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The Attenuation of Idiosyncratic Risk under Alternative Portfolio Weighting Strategies: Recent Evidence from the UK Equity Market

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Abstract

In this study, we investigate the attenuation of idiosyncratic risk and corresponding benefits of diversification for equally weighted and market capitalisation weighted portfolios in the UK Equity Market over 2002 - 2012. We analyse the absolute benefits of risk reduction by testing the homogeneity of variances of portfolios of different sizes using Levene's Test. Next, we perform a cost-benefit analysis to determine the return benefit of diversification from a practical perspective. We find that the absolute benefits of diversification for an equally weighted portfolio are greater in the 'crisis' than 'pre-crisis' period, but when we analyse the results from a practical perspective the benefits fall dramatically and the results are reversed. When comparing the benefits of market capitalisation weighted and equally weighted portfolios, we note that the benefits of diversification tend to be greater for an equally weighted portfolio for small portfolios but that a crossover occurs as the size of the portfolio increases. The relative benefits of diversification under these different weighting strategies are thus highly dependent upon the state of the market and further study is needed to determine why the diversification benefits for the alternative weighting strategies decay at varying rates.

Keywords: portfolio diversification, idiosyncratic risk, index funds, weighting methodology

JEL Classification: C15, G01, G11, G17

1. Introduction

The benefits of employing a portfolio approach to investing plays a central role within modern finance theory. The arguments for this approach has its roots in the seminal paper by Markowitz (1957) that laid the theoretical framework for what has now evolved to become Modern Portfolio Theory. One key implication and oft quoted result from this theory is that increasing the size of one's portfolio helps to reduce idiosyncratic risk, and it is hence possible to achieve superior risk-adjusted performance through the use of a portfolio approach to investing. However, what is the optimal number of securities that one should hold to reap the maximum benefits of diversification?

This is a key question that academics grappled with in the wake of Modern Portfolio Theory. The early literature looked at the issue from 2 different perspectives. The first approach investigates the benefits of diversification by analysing the results from the simulation of numerous random portfolios and is credited to the early work of Evans and Archer (1968). The second approach seeks to find an exact solution to quantify the benefits of diversification and is credited to the analytical approach first espoused by Elton and Gruber (1977). While the ability to mathematically quantify the benefits of diversification in an exact manner is intuitively appealing, it comes at the cost of over simplification as it employs the use of many assumptions to reduce the problem to something that is mathematically tractable but not necessarily operationally useful. Hence, we have adopted a methodology in line with the first approach as it gives us greater flexibility in the crafting of our methodology and yields results that will be of interest to both academics and practitioners.

In this paper, we investigate the benefits of diversification in the UK equity market through the use of a modified methodology that incorporates elements from both of these approaches. In addition, we present a more realistic model of diversification by constructing market capitalisation weighted portfolios in addition to equally-weighted portfolios that are traditionally the focus of studies on diversification.

2. Background

2.1 Objectives and Significance of Paper

While the study of the benefits of diversification is by no means a novel topic, we propose to contribute to existing literature by suggesting improvements on the best way to quantify it. In this paper, we employ 3 changes that we believe allows us to add to the existing literature on the topic.

Firstly, we conduct the experiment on the UK Equity Market using the FTSE All-Share Index as a benchmark and present the empirical results for diversification on a previously untested market over a recent time period.

Next, while many studies have adopted an ex-ante approach to their investigation, we have adopted an ex-post approach in this study. Instead of asking the question what are the likely benefits in the future, we have asked the question what were the benefits during the 'pre-crisis' and 'crisis' period. This allows us to present empirical results on how the benefits from diversification and optimal number of securities to hold to reap that benefit may have changed during a period of high volatility and market uncertainty.

Finally, we consider an alternative weighting scheme that allows for results that are more realistic and representative. While the traditional approach looks at equally weighted portfolios, we include in our analysis the benefits from diversification of both an equally weighted portfolio and a market capitalisation weighted portfolio. Studying the benefits of diversification for a market capitalisation weighted portfolio is more appropriate as the de facto benchmark for full diversification with the lowest possible cost would be that offered by an Exchange-Traded Index Fund, which tends to be a market capitalisation weighted investment vehicle In addition, the market capitalisation weighted portfolio is a better resemblance of a mean-variance efficient portfolio than an equally weighted one and more reflective of an approach that might be employed in practice. Hence, if we compare the cost of full diversification using an ETF with an equally weighted portfolio or use an alternative benchmark such as a mutual fund we would overstate the cost of diversification and hence lead to a misleading conclusion not representative of the decisions that would be made in reality.

2.2 Traditional Approaches to Testing the Benefits of Diversification

There are 2 general approaches that have been employed in tests on diversification using simulated portfolios. The first approach pioneered by Evans and Archer (1968) focuses on the absolute benefits of diversification. This approach attempts to find the level beyond which holding more securities in a portfolio has a negligible impact on the reduction of risk. Statistical tests such as the T-Test and F-Test are often employed in these types of studies to find the point at which increasing the size of a portfolio no longer has a statistically significant impact on the reduction of risk as well as the level at which standard deviation tends to converge, or the asymptote for the graph of portfolio size vs. standard deviation. This approach has also been adopted by a number of contemporary studies on diversification and is the methodology often referenced in finance textbooks (Newbould & Poon, 1993, 1996). Lai and Seiler (2001) use this methodology to study diversification within industry groups and Benjelloun (2010) uses this approach to study the benefits of diversification from a terminal wealth perspective.

The second approach pioneered by Statman (1987, 2004) takes a more practical view of the issue and seeks to find the number of securities beyond which the benefits of diversification are lower than the holding costs from an increased number of securities. This approach converts the risk of a simulated portfolio of n securities into a comparable return figure by combining the simulated portfolio with a risk-free asset to generate portfolio combinations with the same level of risk. The cost of a collective investment scheme such as a mutual fund or exchange traded fund is often used as a proxy for the cost of full diversification and is compared to the return benefit from increasing the number of securities held to obtain the optimal number of securities that one should hold in a well-diversified portfolio. This approach has also been used to study the benefits of diversification in other asset classes and markets. Gupta and Khoon (2001) adopt this approach to study the number of securities needed to form a diversified portfolio in Malaysia while Lee (2005) studies the benefits of diversification in commercial real estate portfolios.

In this study, we employ both of these approaches to present the benefits of diversification from both an absolute and practical perspective. We use these approaches on equally weighted random portfolios as employed in the original methodologies and extend that methodology to test the benefits of diversification using market capitalisation weighted random portfolios.

2.3 Time Period of Investigation

The time period employed is likely to have a material impact on the benefits of diversification. For this paper, we split our analysis into 2 time period, a 5 year period from 1 July 2002 to 30 June 2007 that we have called the

'pre-crisis period' and a 5 year period from 1 July 2007 to 30 June 2012 that we have called the 'crisis period'. By using these 2 particular periods in time, we hope to present results on the benefits of diversification during a normal period of time and during a period of crisis, as well as provide a comparison on how the optimal number of securities to hold from a diversification perspective might have changed during this period of market stress.

2.4 Weighting Strategies

The manner in which portfolios are constructed will have a tangible impact on the risk and return profile of the portfolio. In particular, alternative weighting strategies are likely to have a material influence on the risk and return characteristics of a portfolio and hence the effectiveness of a diversification strategy. In this study we consider 2 alternative weighting strategies, equally weighted portfolios and market capitalisation weighted portfolios.

An equally weighted portfolio refers to a construction technique in which an equal dollar amount is invested in each holding, regardless of any differences in the fundamental characteristics of component securities. When applied to a large universe of stocks of different sizes such as in our study of the FTSE all-share index, the return profile of such portfolios will inevitably have an implicit tilt towards stocks with a small market capitalisation and may not be reflective of a portfolio that can be achieved in reality. However, equally weighted portfolios have traditionally been the focus of diversification studies as it is computationally easier to work with equally weighted portfolios when employing analytical approaches. As we are conducting our analysis using a simulation approach instead of an analytical one, the added complexity of portfolios with unequal weights is of a smaller concern. Beyond the fundamental tilt of an equally weighted portfolio, the larger problem of such a weighting strategy is the lack of a representative low-cost benchmark for full diversification. Furthermore, the correlation between stocks with a small market capitalisation and stocks with a large market capitalisation compared to stocks with similar market capitalisation tends to be lower (Huang, Eun & Lai, 2006), thus when combined into a portfolio this will exhibit lower levels of standard deviation. Hence, using an equally weighted portfolio is likely to overstate the benefits of diversification and present conclusions that may not be operationally meaningful.

In order to address some of these problems, we have considered an alternative weighting strategy, that of a market capitalisation weighted portfolio. When constructing market capitalisation weighted portfolios, the proportion of each security held is according to the size of its market capitalisation. The benefit of this approach is that our benchmark, the FTSE All-Share index is by construction a capitalisation-weighted index and hence there are viable low cost options for full diversification based on the index. Results based on market capitalisation weighted portfolios are closer to the type of decisions made in reality and are likely to have more meaningful operational implications.

3. Methodology

3.1 Creating Random Portfolios of n Securities by Simulation

The aim of this study is to investigate the empirical benefits of diversification by increasing the number of securities held in a portfolio under alternative weighting strategies. In the first step of this process, we create random portfolios of *n* securities by simulation. The *n* securities are selected at random based on a uniform distribution.

For each run, we calculated the daily return of the portfolio at time *i* (R_i^d) with the following equations.

For equally weighted portfolios:

$$R_i^d = \frac{1}{n} \sum_{k=1}^{n} R_i^k \quad (1)$$

For n = 1 to 250

Where n is the number of securities in the portfolio.

For market capitalisation weighted portfolios:

$$R_i^d = \sum_{k=1}^{n} w_k R_i^k \quad (2)$$

$$w_k = \frac{m_k}{\sum_{k=1}^{n} m_k} \quad (3)$$

Where

w_k : Weight of security *k* in the *n* security portfolio

m_k : Market capitalisation of security *k* at the start of the time period.

We also calculate the geometric mean return for the entire period considered (R_p) using the following equation:

$$R_p = \exp\left(\frac{1}{L}\sum_{i=1}^{n}\log_e R_i^d\right) \quad (4)$$

For *L* = 1265 for pre-crisis and *L* = 1262 for crisis, where *L* is the number of daily return data points.

Finally, the portfolio standard deviation (s_p) is computed:

$$s_p = \sqrt{\frac{1}{L-1}\sum_{i=1}^{L}\left(\log_e R_p - \log_e R_d^i\right)^2} \quad (5)$$

We conduct 20,000 runs for each portfolio of size *n* for each of the 2 time periods (10,000 runs for equally weighted portfolios and 10,000 runs for market capitalisation weighted portfolios), which yields a total of 10,000,000 simulated portfolios. To increase the robustness of our results, the simulations were run with replacement.

3.2 Absolute Benefits of Diversification

In this section, we evaluate the absolute benefits of diversification by finding the level at which further increases in the number of securities held in a portfolio does not lead to a reduction in variance that is statistically significant. The traditional approach employed for tests of the homogeneity of variance between 2 samples, in this case portfolios with a different number of securities, is the F-Test. However, the F-Test has been shown to be extremely sensitive to the normality assumption (Box, 1953; C. Markowski & E. Markowski, 1990) while financial data series often exhibit characteristics that are not consistent with a normal distribution. An alternative test, Levene's test (Levene, 1960), uses the average of the absolute deviations instead of the mean square of deviations and this adjustment makes the test criterion much less sensitive to non-normal distributions (Snedecor and Cochran, 1976). Hence, we employ Levene's Test instead to test the equality of variances between successive portfolios. The results from this test are reported in Table 3.

3.2.1 Levene's Test

We conduct Levene's Test on successive portfolios with different numbers of securities. The test is conducted with the following hypotheses:

H_0: The 2 samples have the same variance

H_1: The 2 samples have different variances

The test statistic, *W*, is defined as follows:

$$W = \frac{N-k}{k-1}\frac{\sum_{n=1}^{k}N_n(Z_{n\cdot}-Z_{\cdot\cdot})^2}{\sum_{n=1}^{k}\sum_{j=1}^{N_i}(Z_{nj}-Z_{n\cdot})^2} \quad (6)$$

$$Z_{nj} = \left|Y_{nj} - \overline{Y_{n\cdot}}\right| \quad (7)$$

$$Z_{n\cdot} = \frac{1}{N_i}\sum_{j=1}^{N_i}Z_{nj} \quad (8)$$

$$Z_{\cdot\cdot} = \frac{1}{N}\sum_{n=1}^{k}\sum_{j=1}^{N_i}Z_{nj} \quad (9)$$

Where

W : Test statistic

k : Number of groups to which the samples belong

N : Total number of runs

N_i : Number of runs in the n-security portfolio simulation

Y_{nj} : Value of the j-th run from the n-security portfolio simulation

$\overline{Y_{l.}}$: Mean for the n-security portfolio simulation

The significance of *W* is tested against F(0.05, 1, 19998) where F is a quantile of the F-test distribution. We conduct this test for portfolios of successive sizes to determine the number of securities that must be added to each portfolio of *n* securities such that there is a statistically significant change in variance and hence benefit to diversification.

3.3 Cost-benefit Analysis

While measuring the absolute benefit of diversification is important, such an approach does not take into account the fact that holding more securities comes with an added cost as well. In reality the decision of how many securities to hold is likely to be contingent upon some form of cost-benefit analysis, where the number of securities held will be increased up until the point where the marginal benefit of diversification exceeds the marginal cost of holding more securities. In this section, we approach the issue of diversification form a more practical perspective by making that explicit cost-benefit analysis.

3.3.1 Measuring the Benefit of Full Diversification

We quantify the benefit of fully diversifying each *n*-security portfolio to the index portfolio by converting the associated reduction in standard deviation into a return figure. This is done by levering down all *n*-security portfolios such that its standard deviation is equal to that of the *m*-security population portfolio.

In effect, the process transforms all *n*-security portfolios into ones where a portion $\sigma_m/\sigma_{p(n)}$ of the portfolio remains invested in *n*-securities, while the remaining (1 - $\sigma_m/\sigma_{p(n)}$) is invested at the risk free rate. The net result is that the levered down portfolios will have a standard deviation equal to that of the *m*-security population portfolio. With all portfolios having the same standard deviation, differences in returns can therefore be attributed to diversification effects.

The benefit from diversification is calculated using the following equation:

$$D_{p(n)} = R_m - [(R_{p(n)} - R_f)\ \frac{\sigma_{p(n)}}{\sigma_m} + R_f] \tag{10}$$

Where

$D_{p(n)}$: return benefit of diversifying an n-stock portfolio to an m = 498 stock portfolio

$R_{p(n)}$: geometric mean return of the n-stock portfolio

R_m : geometric mean return of the index portfolio

R_f : risk free rate obtained from rolling 3 month government bills over each 5 year period

$\sigma_{p(n)}$: standard deviation of returns of the n-stock portfolio

σ_m : standard deviation of returns of the population of m = 498 stocks

We first deduct the relevant risk free rate from each *n*-security portfolio's geometric mean return to find its market risk premium, $R_{p(n)} - R_f$. This risk premium is then multiplied by the ratio of the M-security population standard deviation to the *n*-security portfolio standard deviation, $\sigma_m/\sigma_{p(n)}$, in order to lever down the portfolios' risk premium. The risk free rate is then added back to the market risk premium of each levered down portfolio. Finally, the difference between the *m*-security population portfolio return and the last calculated figure is the benefit from full diversification.

All values above are annualised and $D_{p(n)}$ is calculated for *n* ranging from 1 to 250.

Digressing slightly from explaining the above calculation, it is of significance that the relevant risks free rate in this study is that of the annualised 5 year internal rate of return obtained by rolling 1-year UK governments securities over each 4 year period under study. Such is consistent with minimising the price and reinvestment risk present in longer dated generic government rates, and is consistent with the interpretation of the risk free rate in modern literature (Mukherji, 2011; Damodaran, 2010).

3.3.2 Measuring the Cost of Full Diversification

Diversifying fully from an *n*-security portfolio to an *m*-security portfolio incurs a cost equal to the difference in cost between holding each of the above portfolios. Given the simple, one-time transaction buy-and-hold strategy of constructing each *n*-security portfolio, price spread costs are negligible when spread over the entire 5 year

period. Further, transaction fees are negligible vis-à-vis returns in our study given institutional-sized portfolios. We hence assume that the cost of constructing and holding the *n*-security portfolio is zero.

This leaves us with the cost of full diversification being equal to the cost of holding the *m*-security population portfolio. Much like existing literature (Statman, 1987), we take the total expense ratio of a representative ETF as a proxy for the cost of constructing and maintaining the said *m*-security population portfolio.

The cost of full diversification is hence the total expense ratio of a representative ETF, and in this case, the relevant ETFs – db x-trackers FTSE All-Share and the Lyxor ETF FTSE All Share ETFs – both have an expense ratio of 0.40%. This will be the cost of full diversification in our study.

Finally, we find the values of *n* for each period and weighting methodology that best equates the benefit of full diversification with its cost – such is the point at which the marginal benefit of diversification is outweighed by the cost.

4. Results

4.1 Data

Daily closing price and market capitalisation data were extracted from the Bloomberg Professional service for each of the FTSE All-Share Index's constituents. In order to best reflect the ex-post return and volatility experienced by a buy-and-hold investor over each of the two periods under study, price data was extracted for the equities that constituted the index on each of the period's start date. The relevant market capitalisation weights used in constructing the market-cap weighted portfolio were then those on each period's start date, reflecting the proportions of each stock an investor will include in a market-cap weighted portfolio constructed at the beginning of each period.

Also in line with ensuring representativeness of a buy-and-hold portfolio investment, daily price data was adjusted for normal cash dividends (regular cash, interim, income, estimated, partnership distribution, final, interest on capital, distributed and prorated), abnormal cash dividends (special cash, liquidation, capital gains, memorial, return of capital, rights redemptions, return premium, preferred rights redemption, proceeds/rights, proceeds/shares, proceeds/warrants) and capital changes (spin-offs, stocks splits/consolidations, stock dividend/bonus, rights offerings/entitlement).

The price data was then screened for equities which lacked a complete dataset over each five year period under study. These equities were removed from the dataset. Eventually, what remained were 498 equities out of 703 and 698 index constituents for the pre-crisis and crisis periods respectively. These 498 equities were then inputs into our portfolio simulations for both periods.

4.2 Simulation Summary

Table 1 below displays the portfolio standard deviations for both the pre-crisis and crisis period for an equally weighted and market capitalisation weighted portfolio of *n* equities, with *n* ranging from 1 to 250 and $n = 498$ representing the population of equities under consideration, which is a proxy for all the constituents in the FTSE All-Share Index. While we are using the model generated standard deviation figures for all *n* between 1 and 250, for the interest of brevity, only steps of 10 are displayed beyond $n = 50$.

Table 1. Annualised Daily Standard Deviation of Returns

Portfolio Size (n)	Pre-Crisis Period 1 July 2002 to 30 June 2007		Crisis Period 1 July 2007 to 30 June 2012	
	Equally Weighted Portfolio	Market-Cap Weighted Portfolio	Equally Weighted Portfolio	Market-Cap Weighted Portfolio
1	30.195%	30.195%	42.673%	42.662%
2	22.652%	25.117%	34.038%	37.967%
3	19.696%	23.274%	30.291%	35.926%
4	17.953%	22.288%	28.129%	34.768%
5	16.825%	21.590%	26.734%	34.010%
6	16.027%	21.142%	25.741%	33.422%
7	15.410%	20.785%	24.993%	33.084%
8	14.932%	20.503%	24.410%	32.748%
9	14.543%	20.247%	23.968%	32.493%
10	14.216%	20.041%	23.592%	32.265%
11	13.946%	19.873%	23.280%	32.134%
12	13.722%	19.727%	23.021%	32.070%
13	13.519%	19.588%	22.795%	31.951%
14	13.343%	19.465%	22.607%	31.805%
15	13.193%	19.360%	22.432%	31.656%
16	13.058%	19.241%	22.271%	31.568%
17	12.946%	19.156%	22.128%	31.407%
18	12.842%	19.079%	22.010%	31.294%
19	12.744%	19.000%	21.897%	31.182%
20	12.655%	18.924%	21.800%	31.088%
21	12.573%	18.841%	21.707%	30.982%
22	12.499%	18.786%	21.624%	30.907%
23	12.431%	18.724%	21.549%	30.827%
24	12.369%	18.665%	21.479%	30.707%
25	12.310%	18.617%	21.417%	30.643%
26	12.257%	18.568%	21.360%	30.567%
27	12.205%	18.523%	21.307%	30.513%
28	12.160%	18.480%	21.255%	30.469%
29	12.115%	18.439%	21.207%	30.434%
30	12.077%	18.396%	21.160%	30.357%
31	12.036%	18.357%	21.118%	30.282%
32	11.999%	18.313%	21.081%	30.241%
33	11.964%	18.274%	21.044%	30.177%
34	11.931%	18.241%	21.006%	30.123%
35	11.900%	18.206%	20.976%	30.080%
36	11.873%	18.171%	20.947%	30.038%
37	11.845%	18.137%	20.917%	30.000%
38	11.818%	18.101%	20.890%	29.946%
39	11.793%	18.076%	20.865%	29.887%
40	11.771%	18.048%	20.840%	29.833%
41	11.746%	18.014%	20.816%	29.783%
42	11.725%	17.982%	20.791%	29.748%
43	11.705%	17.957%	20.767%	29.696%
44	11.684%	17.924%	20.744%	29.674%
45	11.667%	17.902%	20.723%	29.613%
46	11.649%	17.874%	20.703%	29.570%
47	11.631%	17.845%	20.686%	29.532%
48	11.616%	17.820%	20.667%	29.500%
49	11.601%	17.798%	20.648%	29.465%
50	11.585%	17.777%	20.630%	29.429%
60	11.460%	17.585%	20.499%	29.108%
70	11.368%	17.407%	20.403%	28.800%
80	11.298%	17.266%	20.329%	28.577%
90	11.243%	17.154%	20.272%	28.343%
100	11.201%	17.056%	20.228%	28.178%
110	11.168%	16.973%	20.189%	28.057%
120	11.139%	16.902%	20.156%	27.945%
130	11.113%	16.831%	20.131%	27.871%
140	11.092%	16.782%	20.110%	27.800%
150	11.073%	16.727%	20.090%	27.710%
160	11.058%	16.681%	20.071%	27.634%
170	11.044%	16.644%	20.058%	27.581%
180	11.032%	16.609%	20.046%	27.518%
190	11.021%	16.578%	20.032%	27.472%
200	11.011%	16.547%	20.023%	27.432%
210	11.001%	16.519%	20.012%	27.383%
220	10.992%	16.496%	20.001%	27.341%
230	10.985%	16.472%	19.993%	27.309%
240	10.978%	16.448%	19.986%	27.280%
250	10.972%	16.428%	19.980%	27.252%
⋮	⋮	⋮	⋮	⋮
498	10.813%	15.904%	19.814%	26.498%

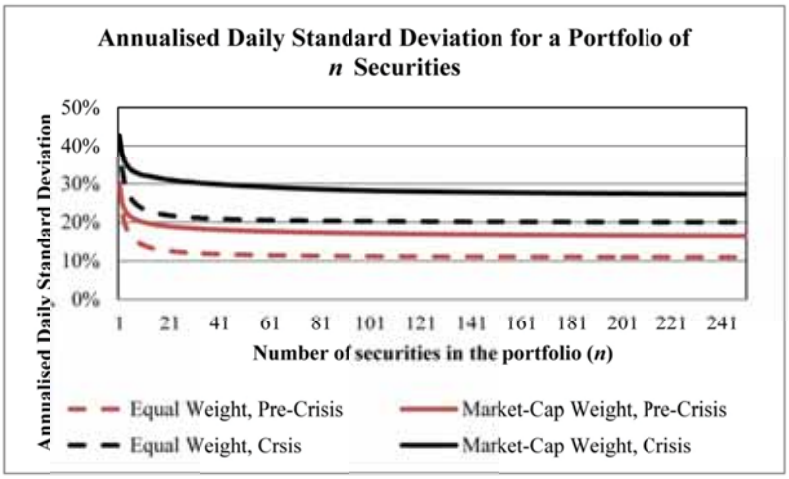

Figure 1. Annualised Daily Standard Deviation of Returns vs. *n*

As is apparent from both the Figure 1 and Table 1, portfolio standard deviation decreases monotonically with an increase in *n*. Further, portfolio standard deviation was larger during the crisis vis-à-vis the pre-crisis period for both the weighting methodologies, and market-cap weighting led to larger standard deviations than equal weighting. Such results are consistent with present literature which investigates recent equity market behavior during the last decade (Hjalmarsson & Manchev, 2012; Abhyankar & Ho, 2007).

Moving on to the other summary statistic central to the inputs of our absolute diversification benefit and cost-benefit analysis, the geometric mean return of the portfolios converged to the population geometric mean returns as stated in the table 2. The figures represent the expected geometric mean return of a portfolio of size *n*, for all *n* ranging from 1 to 250.

Table 2. Annualised Daily Geometric Mean Returns

	Pre-Crisis Period 1 July 2002 to 30 June 2007	Crisis Period 1 July 2007 to 30 June 2012
Equally Weighted Portfolio	18.488%	2.568%
Market-Cap Weighted Portfolio	13.021%	2.274%

These return and standard deviation data are utilised as set out in the methodology to derive the results in sections 4.3 and 4.4 below.

4.3 Absolute Benefits of Diversification

Table 3. Test Statistic from Levene's Test on the Homogenity of Variances

Run (Note 1)	Test Statistic from Levene's Test on the Homogeneity of Variances (Note 2)			
	Equally Weighted [02 – 07]	Market Capitalisation Weighted [02 – 07]	Equally Weighted [07 – 12]	Market capitalisation Weighted [07– 12]
1	197.264	131.110	248.069	107.892
2	105.538	73.192	113.915	32.825
3	51.107	30.620	61.738	14.900
4	29.859	18.349	47.718	10.836
5	31.020	10.462	25.842	7.139
6	16.940	4.991	26.674	4.513
7	15.848	5.667	17.475	3.571
8	11.889	5.772	14.273	1.842
9	9.891	2.658	13.662	1.891
10	7.458	2.339	7.256	0.551

11	5.372	2.010	7.773	0.439
12	5.228	0.967	6.001	0.483
13	6.204	1.910	5.808	0.625
14	3.285	0.706	3.934	0.381
15	4.218	0.960	5.093	0.531
16	3.170	0.638	3.312	0.957
17	2.140	0.547	3.003	0.218
18	2.665	0.879	3.155	0.341
19	2.514	0.472	3.266	0.262
20	1.789	0.340	2.971	0.483
21	2.014	0.756	2.528	0.177
22	1.647	0.440	2.632	0.188
23	1.975	0.296	2.435	0.324
24	1.783	1.038	1.409	0.178
25	1.807	0.384	1.306	0.096
26	1.281	0.809	1.969	0.081
27	1.327	0.486	1.866	0.144
28	0.693	0.253	1.236	0.189
29	1.027	0.520	0.708	0.358
30	1.022	0.245	1.198	0.298
31	0.941	0.298	1.262	0.019
32	1.140	0.450	1.150	0.142
33	0.563	0.452	1.074	0.161
34	0.678	0.426	0.768	0.134
35	0.622	0.381	0.688	0.122
36	0.694	0.239	0.806	0.043
37	0.609	0.168	1.330	0.177
38	0.678	0.239	1.107	0.165
39	0.768	0.356	1.144	0.253
40	0.516	0.196	0.868	0.141
41	0.523	0.446	0.731	0.071
42	0.779	0.387	0.557	0.151
43	0.604	0.367	0.531	0.036
44	0.554	0.389	0.899	0.290
45	0.506	0.174	0.588	0.086
46	0.823	0.286	0.386	0.049
47	0.326	0.438	0.310	0.099
48	0.621	0.573	0.677	0.072
49	0.308	0.167	0.592	0.189
50	0.586	0.497	0.306	0.083
⋮	⋮	⋮	⋮	⋮
246	0.011	0.014	0.012	0.021
247	0.021	0.010	0.007	0.045
248	0.007	0.029	0.013	0.018
249	0.024	0.038	0.026	0.001

Table 3 shows the results from Levene's test. Levene's test compares 2 samples and tests for equality of variances. The benefit of Levene's test compared to other tests on the equality of variances such as the F-test is that it is robust for samples that are not normally distributed. From a diversification perspective, this section shows whether further successive increases in portfolio size results in a statistically significant change in variance. For equally weighted portfolios, increasing the portfolio size from 33 to 34 during the 'pre-crisis' period and increasing the portfolio size from 41 to 42 during the 'crisis period' no longer leads to a change in risk that is statistically significant. For market capitalisation weighted portfolios, increasing the portfolio size from 16 to 17 during the 'pre-crisis' period and increasing the portfolio size from 10 to 11 during the 'crisis period' no longer leads to a change in risk that is statistically significant. From the results, we also see that the market

capitalisation weighted portfolios demonstrated less benefit from diversification compared to the equally weighted portfolios over both time periods.

4.4 Cost-benefit Analysis

The table 4 below displays the benefit of full diversification for both the pre-crisis and crisis period for an equally weighted and market capitalisation weighted portfolio of *n* equities, with *n* ranging from 1 to 250 and *n* = 498.

Table 4. Benefit of Full Diversification (Annualised % Return)

	Pre-Crisis Period 1 July 2002 to 30 June 2007		Crisis Period 1 July 2007 to 30 June 2012			Pre-Crisis Period 1 July 2002 to 30 June 2007		Crisis Period 1 July 2007 to 30 June 2012	
Portfolio Size (N)	Equally Weighted Portfolio	Market-Cap Weighted Portfolio	Equally Weighted Portfolio	Market-Cap Weighted Portfolio	Portfolio Size (N)	Equally Weighted Portfolio	Market-Cap Weighted Portfolio	Equally Weighted Portfolio	Market-Cap Weighted Portfolio
1	9.31083%	4.21277%	0.58619%	0.30285%	37	1.30872%	1.11120%	0.05789%	0.09341%
2	7.63792%	3.27864%	0.45757%	0.24153%	38	1.27723%	1.09563%	0.05652%	0.09213%
3	6.62091%	2.83606%	0.37889%	0.20986%	39	1.24835%	1.08468%	0.05527%	0.09073%
4	5.85808%	2.56841%	0.32390%	0.19024%	40	1.22284%	1.07235%	0.05401%	0.08944%
5	5.27667%	2.36371%	0.28368%	0.17666%	41	1.19373%	1.05742%	0.05286%	0.08826%
6	4.81389%	2.22497%	0.25239%	0.16570%	42	1.16894%	1.04325%	0.05156%	0.08741%
7	4.42153%	2.11027%	0.22718%	0.15923%	43	1.14539%	1.03218%	0.05036%	0.08617%
8	4.09456%	2.01648%	0.20644%	0.15265%	44	1.12135%	1.01779%	0.04919%	0.08565%
9	3.81151%	1.92895%	0.19003%	0.14759%	45	1.10055%	1.00780%	0.04816%	0.08416%
10	3.56128%	1.85691%	0.17559%	0.14298%	46	1.07900%	0.99541%	0.04712%	0.08313%
11	3.34519%	1.79716%	0.16329%	0.14031%	47	1.05765%	0.98240%	0.04627%	0.08221%
12	3.15981%	1.74434%	0.15278%	0.13898%	48	1.03961%	0.97095%	0.04529%	0.08142%
13	2.98562%	1.69304%	0.14344%	0.13653%	49	1.02217%	0.96136%	0.04432%	0.08057%
14	2.83026%	1.64733%	0.13552%	0.13349%	50	1.00289%	0.95179%	0.04342%	0.07970%
15	2.69346%	1.60775%	0.12803%	0.13036%	60	0.84925%	0.86380%	0.03668%	0.07175%
16	2.56921%	1.56241%	0.12100%	0.12848%	70	0.73513%	0.78071%	0.03171%	0.06396%
17	2.46269%	1.52944%	0.11472%	0.12504%	80	0.64700%	0.71340%	0.02782%	0.05822%
18	2.36227%	1.49936%	0.10945%	0.12260%	90	0.57679%	0.65900%	0.02481%	0.05208%
19	2.26726%	1.46831%	0.10438%	0.12018%	100	0.52282%	0.61094%	0.02250%	0.04771%
20	2.17800%	1.43833%	0.09993%	0.11813%	110	0.47870%	0.56966%	0.02043%	0.04448%
21	2.09539%	1.40502%	0.09568%	0.11579%	120	0.44152%	0.53447%	0.01866%	0.04143%
22	2.01971%	1.38312%	0.09182%	0.11412%	130	0.40772%	0.49846%	0.01731%	0.03942%
23	1.94959%	1.35770%	0.08836%	0.11234%	140	0.37932%	0.47337%	0.01616%	0.03748%
24	1.88534%	1.33398%	0.08504%	0.10965%	150	0.35438%	0.44561%	0.01510%	0.03500%
25	1.82236%	1.31402%	0.08213%	0.10823%	160	0.33475%	0.42180%	0.01409%	0.03291%
26	1.76609%	1.29377%	0.07940%	0.10651%	170	0.31583%	0.40258%	0.01338%	0.03142%
27	1.71031%	1.27507%	0.07691%	0.10528%	180	0.29989%	0.38423%	0.01270%	0.02966%
28	1.66139%	1.25713%	0.07441%	0.10426%	190	0.28474%	0.36822%	0.01199%	0.02837%
29	1.61263%	1.24037%	0.07206%	0.10347%	200	0.27076%	0.35186%	0.01146%	0.02725%
30	1.57021%	1.22188%	0.06982%	0.10171%	210	0.25785%	0.33719%	0.01088%	0.02588%
31	1.52529%	1.20568%	0.06776%	0.09999%	220	0.24621%	0.32478%	0.01028%	0.02469%
32	1.48399%	1.18696%	0.06593%	0.09904%	230	0.23578%	0.31211%	0.00987%	0.02376%
33	1.44417%	1.17037%	0.06413%	0.09755%	240	0.22695%	0.29967%	0.00948%	0.02293%
34	1.40723%	1.15635%	0.06229%	0.09629%	250	0.21927%	0.28912%	0.00913%	0.02215%
35	1.37232%	1.14117%	0.06079%	0.09528%	⋮	⋮	⋮	⋮	⋮
36	1.34094%	1.12609%	0.05938%	0.09430%	498	0.00000%	0.00000%	0.00000%	0.00000%

Data from Table 4 is also presented in Figure 2 and Figure 3. Figure 2 shows how the benefit of full diversification decreases monotonically with *n*, and it was markedly lower during the crisis period as is

consistent with the findings of the Levene's Test. Figure 3 is a rescaled version of Figure 2 that includes a horizontal line that represents the cost of diversification, equal to 0.40% as set out in the section 3.3.2.

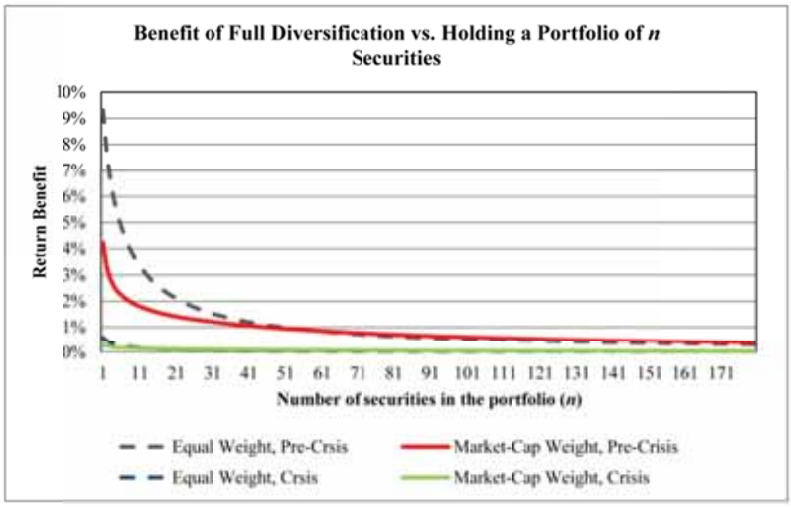

Figure 2. Benefit of Full Diversification (Annualised % Return) vs. N

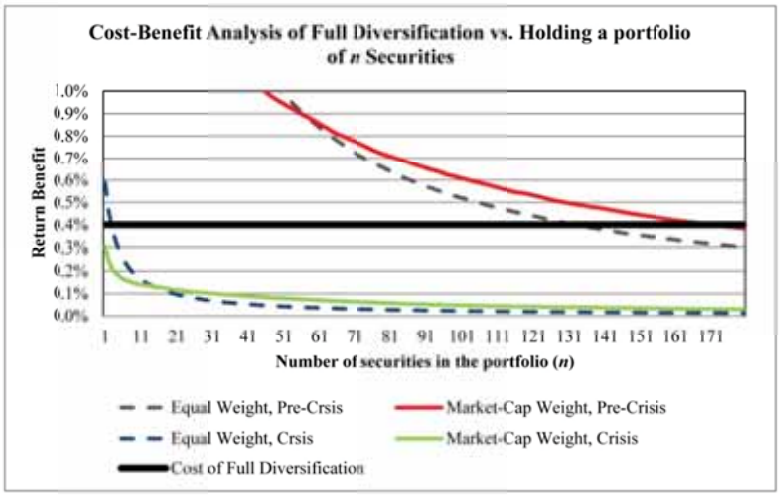

Figure 3. Cost-Benefit Analysis of Full Diversification (Annualised % Return) vs. N

As seen from Figure 2 and Figure 3, the marginal cost of diversification exceeds the marginal benefit for $n = 133$ and $n = 172$ for an equally weighted and market capitalisation weighted portfolio respectively during the pre-crisis period. On the other hand, the crisis period saw starkly dissimilar results, namely $n = 3$ and $n = 1$ for an equally weighted and market capitalisation weighted portfolio respectively.

5. Discussion

5.1 Time Period

The crisis period showed markedly lower absolute benefits via the cost-benefit analysis due to diversification compared to the pre-crisis period. The statistical significance of such a result is strengthened by our results from the Levene's Test – the relative change in diversification benefit was significant at relatively high values of *n*.

Such adverse sensitivity of absolute diversification benefits to the trading and economic regime is consistent with the empirical findings of present literature and the prevalent belief that correlations increase in periods of market stress and left-tail events (Hwang & Min, 2012). This leads to important implications for market practitioners, chiefly being that equity diversification benefits and the asset allocation decision is highly sensitive

to ex-ante predictions of trading regime. Such sensitivity should be recognised in the cost-benefit analysis of any portfolio construction process, and while beyond the scope of this study, we postulate that the said margin of error can be lessened if the investor includes international equity or other asset classes that could attenuate the rise in correlation between portfolio constituents during market stress and tail events. Also beyond this study, an interesting topic for investigation is how the benefits of diversification have evolved with time and how they might evolve in the future. Such will build on studies such as that of Christoffersen et al. (2010), which considers the evolution of international diversification benefits; there is scope, however, for studies to be performed on the national level and across asset classes.

5.2 Absolute vs. Practical Benefits

In our study, the Levene's Test showed how increasing the number of securities n in a portfolio led to statistically significant *relative* gains in diversification benefit. Such results should be interpreted with caution, however. Any form of practical portfolio construction would not be based upon the statistical significance of adding the marginal security, as set out in the seminal Evans and Archer (1968) and Benjelloun (2010), but on a cost-benefit analysis similar to that which we have performed in this paper.

To stress on the importance of utilising such a cost-benefit analysis in practical applications, contrary to the Levene's test, the cost-benefit analysis suggested a diversification extent far short of that suggested by Levene's Test during the crisis period. This does not come as a surprise given the highly correlated trading observed during the period, and hence the lesson learnt is that practitioners should be weary of outputs from models based on relative benefits of diversification, as opposed to ones that weigh the absolute benefits and costs of diversification.

5.3 Alternative Weighting Strategies

As is apparent from Figure 2 and Figure 3, the benefit of diversification for a market capitalization weighted portfolio is lower than that for equally weighted portfolios for small values of n, but becomes higher for larger values of n. Based on these observations, we can only conclude that the strategies considered are not systematically different in their relation to diversification benefit. The profile of benefits of diversification for equally weighted and market-cap weighted portfolios differ. The choice of weighting strategy in practical applications at the cost-benefit equivalence point is determined by whether the crossing over of the pair of lines in each period occurs above or below the cost benchmark. From this, we know that the choice between investing in a market capitalization weighted portfolio and an equally weighted portfolio is highly sensitive to the trading regime in consideration. Explaining the factors which affect the relative position between the cost benchmark and the crossover point, however, is beyond the scope of this paper, though we postulate that the cause of the crossover could be due to diversification benefits being insignificant for a small portfolio that is heavily tilted towards a few large cap stocks, and is significant only when the portfolio is larger, more evenly weighted and increasingly granular. There is certainly scope for further econometric analysis in this topic of study.

6. Conclusion

In this study, we investigate the benefits of diversification using alternative weighting strategies. We simulate random portfolios of different sizes and analyse the volatility of these simulated portfolios to determine the risk reduction benefits of holding a larger number of securities. These portfolios were constructed on an equally weighted and market capitalisation weighted basis which we contend is a better approach to obtain more realistic results. We investigate the absolute benefits of risk reduction using Levene's Test and the practical benefits by performing an explicit cost-benefit comparison. We conduct this analysis on the UK equity market over the 'pre-crisis' and 'crisis' period and find that the absolute benefits of diversification for a market capitalisation weighted portfolio are smaller than the absolute benefits of diversification for an equally-weighted portfolio. When we investigate the benefits to diversification over the 2 time periods, we find that the benefits to diversification of an equally weighted portfolio are greater in the 'crisis' than 'pre-crisis' period, but when we look at it from a practical perspective the benefits fall dramatically and the results are reversed. This lends weight to the need to consider not just the absolute benefits but also the achievable benefits of diversification. When comparing the benefits of market capitalisation weighted and equally weighted portfolios, we note that the benefits of diversification tend to be greater for an equally weighted portfolio for small portfolios but that a crossover occurs as the size of the portfolio increases.

While analysing the causal factors that lead to differences in values of n between the two periods and weighting methodologies is not within the scope of this paper, there was evidence during the investigation that suggested why the model might have recommended virtually zero diversification during the crisis period. Most significantly, the geometric mean annual return of the m-security population portfolio, at 2.57%, stood just 1.73

times above the annual risk free rate of 1.48%. The poor market returns sharply reduced the benefit of diversification, given the accompanying cost – the average stock gave a meager if not negative return. Further still, it was apparent from the raw data and summary statistics (which showed that returns were weaker –2.27% vs. 2.57% – and standard deviation higher –26.50% vs. 19.81% – for the market-cap weighted portfolio as opposed to the equally weighted portfolio) that large market capitalisation stocks underperformed the index while having higher standard deviations. Such would further decrease the benefit of diversifying into the index, given that these poor-performing large cap stocks will be over-weighted in the portfolio. Lastly, we hypothesise that the heightened correlation between large-cap financials during the global financial crisis, exacerbated by their sizeable presence in the index and their overweighting in a portfolio would have further reduced the marginal benefit of diversification for each *n*-security portfolio. Further investigation will be required to determine if this is the case.

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Notes

Note 1. This refers to the W statistic that tests the equality of variances between successive securities. Run 1, for example, tests the equality of variances between a portfolio of 1 security and a portfolio of 2 securities.

Note 2. Critical Value of F-Statistic for this test is 0.8323066.

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Cyclical Variations in the Performance of Exchange-traded Funds

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Abstract

This paper investigates the link between exchange-traded funds (ETFs) and the macroeconomy. Using a nonlinear approach, we find that the one-month T-bill rate, default risk premium, change in the money supply, growth of industrial production, and dividend yield have predictive power with regards to the return on ETFs. Moreover, the predictive power of these macro variables depends both on the underlying volatility state as well as the focus of the ETF. Additionally, our evidence suggests that ETFs have asymmetric risk exposure across expansion and recession states.

Keywords: business fluctuations, cycles, exchange-traded funds, Markov regime-switching, financial forecasting

JEL Classification Code: G10, G14, E32, E37

1. Introduction

Exchange-traded funds, or ETFs, are investment instruments that trade like stocks on a stock exchange. Over the past decade they have gained increasing popularity due to the fact they offer investors a number of benefits such as lower costs, trading flexibility, tax efficiency, transparency, and exposure to a variety of markets. Although ETFs are currently a sought-after instrument for investors, they do not receive enough attention from academia. In particular, there are few studies that focus on how changes in the macroeconomy impact the performance of ETFs. In this study, we examine the time variation of ETF performance using a two-regime Markov-switching model incorporating time varying regime-switching probabilities. This framework is helpful in that it allows for the intercept, coefficients, and residual volatility to change with our state variable in a latent approach. Empirical results suggest that when there are high conditional volatilities, the performance of ETFs is more sensitive to changes in the factors that have predictive power of future economic conditions and that ETFs have asymmetric risk exposure across expansion and recession states.

The remainder of this study is structured as follow. Section 2 reviews past literature. Section 3 examines our basic econometric framework. Section 4 looks at data and variables used for the paper and Section 5 presents the model specifications and empirical results. The last section concludes the study and makes suggestions for future research.

2. Past Literature and Motivation

Although there is a growing body of literature on ETFs, most studies tend to focus on pricing (Ackert and Tian, 2008; Engle and Sarkar, 2002; Lin, Chan, and Hsu, 2006; Jares and Lavin, 2004), market efficiency and overreaction (Madura and Richie, 2004; Cherry, 2004), tax efficiency (Poterba and Shoven, 2002), or performance and trading characteristics (Dellva, 2001; Kostovetsky, 2003; Gallagher and Segara, 2005). Rarely are there studies looking at the link between the returns of ETFs and the state of economy. This is somewhat surprising since the performance of ETFs has been greatly impacted both by the 2000 Dot-com Bubble and the 2008 Financial Crisis. It is these recent changes to the economy that motivate us to study whether variables related to the macroeconomy can predict the performance of ETFs. Therefore, our study can be said to differentiate from past literature in that it is the first to focus on the variations of the predictive power macro variables have on the performance of ETFs across expansions and recessions. To capture different aspects of the underlying economy, the following variables are chosen: the one-month T-bill rate, default risk premium, change in the money supply, growth of industrial production, and dividend yield. Since changes in the underlying economic conditions may have different impacts on ETFs with different focuses we therefore study the

following five representative groups of ETFs: finance, health, real estate, technology, and utilities. This allows us to extract different reactions to changes in the economy from ETFs with different foci.

Our goal is to develop a nonlinear model that investigates the relation between the previously listed macro factors and the performance of ETFs. By incorporating the one-month T-bill rate into the regime switching probabilities, we are able to extract the cyclical variations in the predictive power of these macro variables. Our work mostly follows Gulen, Xing, and Zhang (2011) (Note 1) Perez-Quiros and Timmermann (2000) (Note 2). Our results indicate that the one-month T-bill rate, default risk premium, change in the money supply, growth of industrial production, and dividend yield have predictive power for the return on exchange-traded funds. The predictive power of these macro variables depends both on the underlying volatility state and the focus of the ETF. Additionally, our evidence suggests that ETFs have asymmetric risk exposure across expansion and recession states.

3. General Framework

A potentially useful approach to modeling nonlinearities in time series is to assume different behavior in different regimes. If the dates in which the regime switches have taken place are known, then modeling can be estimated simply by using dummy variables. However, since the prevailing regime is not always directly observable a Markov-switching framework is preferable. It is a latent state approach that does not require the conditioning on predefined state indicators. The state transition probability obtained through this estimation reveals valuable information regarding the movements of changes in the conditional distribution of the ETFs returns. Following Gulen, Xing and Zhang (2011) and Perez-Quiros and Timmermann (2000), we adopt the following econometric framework.

Let r_t denote ETF excess return in month t (in excess of one month T-bill rate) and X_t denote a set of conditioning factors used to explain the excess return r_t. The regime-switching specification follows a generalized framework and allows the intercept, coefficients, and variance to depend on a latent state variable , S_t :

$$r_t = \alpha_{S_t} + \beta_{S_t}^{'} X_t + \varepsilon_t \qquad with \qquad \varepsilon_t \sim N(0, \sigma_{S_t}^2), \tag{1}$$

in which $N(0, \sigma_S^2)$ is normally distributed with zero mean and a variance of σ_S^2. We allow the parameters to differ across two states. This methodology allows for the interpretation of the nature of the state from the data without presumption or restrictions. The regression coefficients and variance are either $(\alpha_1, \beta_1', \sigma_1^2)$ or$(\alpha_2, \beta_2', \sigma_{21}^2)$, depending on the state.

Next, we specify the state transition probabilities as following:

$$p_t = P(S_t = 1 \mid S_{t-1} = 1, Y_{t-1}) = p(Y_{t-1}) \tag{2}$$

$$1 - p_t = P(S_t = 2 \mid S_{t-1} = 1, Y_{t-1}) = 1 - p(Y_{t-1}) \tag{3}$$

$$q_t = P(S_t = 2 \mid S_{t-1} = 2, Y_{t-1}) = q(Y_{t-1}) \tag{4}$$

$$1 - q_t = P(S_t = 1 \mid S_{t-1} = 2, Y_{t-1}) = 1 - q(Y_{t-1}) \tag{5}$$

in which Y_{t-1} is a vector of variables containing information that is available to public at *t-1* and affects the regime-switching probabilities between *t-1*and *t*. Traditional formulations of Markov-switching models generally make assumptions that there are constant state transition probabilities. However, recent literature suggests that the these transition probabilities are time varying and are based on prior information such as interest rates (Gray, (1996), and Gulen et al, (2004)) or some other macro factors variables. By incorporating time-varying transition probabilities, one is able to observe important economic behavior that may be neglected by assuming transition probabilities are constant

We obtain these parameters from the model through MLE (Note 3), with some assumptions made regarding the conditional density function of the innovation ε_t $\varepsilon_t \sim N(0, \sigma_{S_t}^2)$. The vector of parameters joining the likelihood function from the sample data is represented by θ . Assume that the density of the of the innovations, ε_t that conditional on state j, $f(r_t \mid S_t = j, X_t; \theta)$, is Gaussian:

$$f(r_t \mid \Omega_{t-1}, S_t = j, X_t; \theta) = \frac{1}{\sqrt{2\pi\sigma_j}} \exp\left(\frac{-\left(r_t - \alpha_j - \beta_j' X_t\right)^2}{2\sigma_j} \right) \quad (6)$$

for j=1,2, Ω_{t-1}, denotes the information set $X_{t-1}, r_{t-1}, Y_{t-1}$, and also their lagged value. We assume that the relationship between, X_t and r_t is constant within every state, but allow for these coefficients varying between the states. Therefore, our log-likelihood function is given by:

$$L\left(r_t \mid \Omega_{t-1}; \theta\right) = \sum_{t=1}^{T} \log\left(\phi\left(r_t \mid \Omega_{t-1}; \theta\right)\right), \quad (7)$$

where the density, $\phi(r_t|\Omega_{t-1}; \theta)$, is calculated as the sum of the probability-weighted state densities, $f(\bullet)$ across two potential states:

$$\phi\left(r_t \mid \Omega_{t-1}; \theta\right) = \sum_{j=1}^{2} f\left(r_t \mid \Omega_{t-1},\ S_t = j; \theta\right) P\left(S_t = j \mid \Omega_{t-1}; \theta\right), \quad (8)$$

and $P(S_t = j|\Omega_{t-1}; \theta)$ is the conditional probability of state j at time t given information at time $t-1$. The conditional transition probabilities reflect the investors' beliefs of the following period being the high volatility state.

We then obtain the conditional state probabilities recursively based on the total probability theorem:

$$P\left(S_t = i \mid \Omega_{t-1}; \theta\right) = \sum_{j=1}^{2} P\left(S_t = i \mid S_{t-1} = j,\ \Omega_{t-1}; \theta\right) P\left(S_{t-1} = j \mid \Omega_{t-1}; \theta\right), \quad (9)$$

Then, using Bayes' rule, we obtain the conditional state probabilities as following:

$$P\left(S_{t-1} = j \mid \Omega_{t-1}; \theta\right) = P(S_{t-1} = j \mid r_{t-1}, X_{t-1}, Y_{t-1}, \Omega_{t-2}; \theta)$$

$$= \frac{f\left(r_{t-1} \mid S_{t-1} = j, X_{t-1}, Y_{t-1}, \Omega_{t-2}; \theta\right) P\left(S_{t-1} = j \mid X_{t-1}, Y_{t-1}, \Omega_{t-2}; \theta\right)}{\sum_{j=1}^{2} f\left(r_{t-1} \mid S_{t-1} = j, X_{t-1}, Y_{t-1}, \Omega_{t-2}; \theta\right) P\left(S_{t-1} = j \mid X_{t-1}, Y_{t-1}, \Omega_{t-2}; \theta\right)}. \quad (10)$$

We then iterate the last two equations recursively to obtain the state transition probabilities and derive the parameter estimates of the likelihood function. Therefore, the variation in the distribution of excess returns conditional on the included regressors drives the inferred state probabilities.

4. Data

The return data for the exchange-traded funds spans from January 2001 to December 2010 covering ETFs with an investment focus on the financial industry, the health industry, real estate industry, technology industry, and utility industry. We then create five equally weighted portfolios containing all the ETFs with the same investment focus. To be included in our sample, the ETFs have to satisfy the following criterion: (1) listed on NYSE Arca, (2) have at least two years of data and (3) have an investment focus from one of the five previously listed industries. The data is collected from the Yahoo Finance ETF Center (Note 4).

Table 1. Summary Statistics

	Finance ETFs	Health ETFs	Real Estate ETFs	Technology ETFs	Utilities ETFs
Mean	-0.0019	0.0023	0.0022	0.0027	0.0026
Median	0.0080	0.0041	0.0067	0.0062	0.0114
Standard Deviation	0.0814	0.0457	0.0695	0.0868	0.0450
Minimum	-0.3193	-0.1516	-0.3021	-0.2624	-0.1393
Maximum	0.2371	0.1063	0.2812	0.2314	0.1027
Kurtosis	3.6145	0.7702	5.3336	0.7026	1.0517
Skewness	-1.0384	-0.4450	-0.8389	-0.2534	-0.8980

This table contains the descriptive statistics for the returns on the five groups of ETFs.

The summary statistics of the returns for the five groups of ETFs are provided in Table 1. The average return for ETFs with a focus on the financial industry is the lowest among the five groups with monthly average return of -0.19% and a standard deviation of 8.4%. In contrast, the average return for ETFs with a focus on the technology industry is the highest among the five groups. Its monthly average return is 0.27% with a standard deviation of 8.68%. The low average return for finance ETFs is likely due to how hard the financial industry was hit during the 2008 Financial Crisis. However, the relatively high return for the technology ETFs is likely due to the rapid growth the technology industry experienced after the 2000 Dot-com Bubble. The average return for ETFs with a focus on the health industry, real estate industry, and utility industry are 0.22%, 0.23%, and 0.26% per month, respectively. Figure 1 plots the average returns for the five groups of ETFs. We also overlay these returns with historical NBER recession dates.

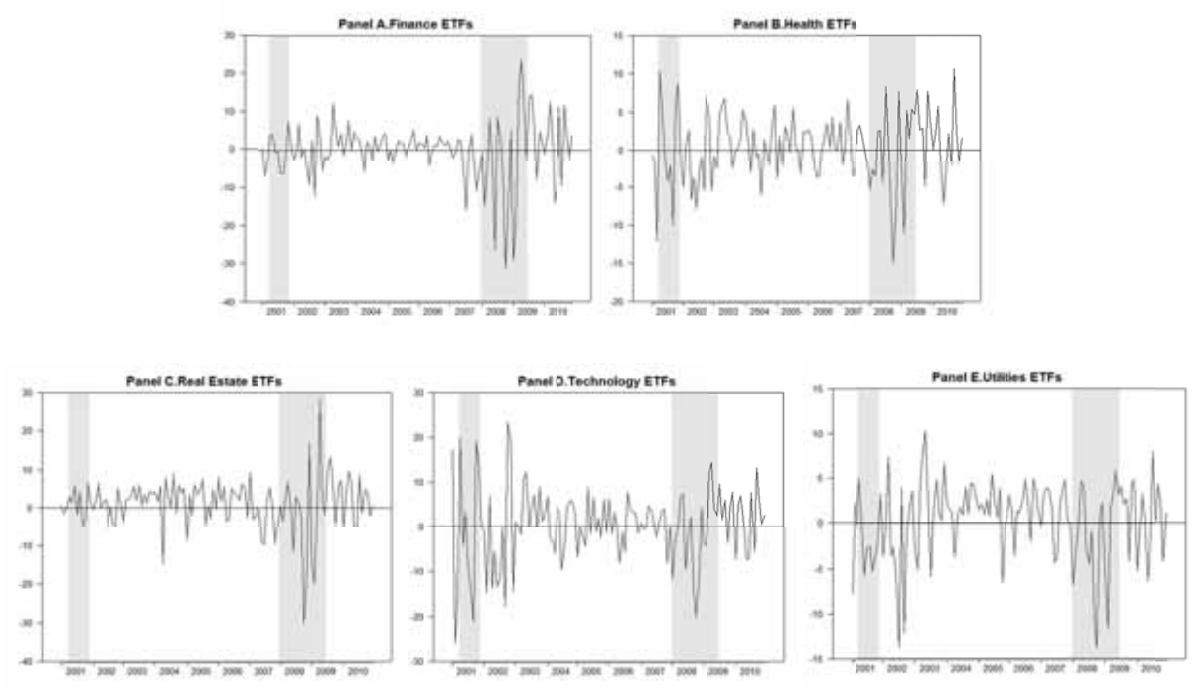

Figure 1. Returns of ETFs

This figure contains time series plots of monthly average returns for ETFs with focus in financial industry, health industry, Real Estate, Technology, and Utilities. Shadows are NBER recessions.

Table 2 analyses the correlations of the returns for the five groups of ETFs. Among the five groups the correlation between ETFs with a focus on the financial industry and ETFs with a focus on the real estate industry is the highest – 0.80. The higher correlation is largely consistent with what we see for the 2007-2008 Financial Crisis. During that time period the housing market and the financial industry go through decline and collapse. The housing bubble in the U.S. burst in 2007 causing the value of securities backed by real estate assets to plummet, thus resulting in heavy damage to financial institutions. In contrast, ETFs with a focus on technology and ETFs with a focus on utilities have the least correlation with each other – 0.43.

Table 2. Correlation Matrix

	Finance ETFs	Health ETFs	Real Estate ETFs	Technology ETFs	Utilities ETFs
Finance ETFs	1.0000	0.6668	0.7972	0.6129	0.5620
Health ETFs		1.0000	0.5559	0.7160	0.5815
Real Estate ETFs			1.0000	0.4602	0.5278
Technology ETFs				1.0000	0.4346
Utilities ETFs					1.0000

This table lists the correlation matrix of the five groups of ETFs.

We then model the excess return of ETFs using the following lagged variables: one-month T-bill rate, the default risk premium, the change in the money supply, the change in the growth rate of industrial production, as well as the dividend yield. The one-month T-bill rate is a variable commonly used to predict stock market returns as discussed in previous literature. The default risk premium is the difference of two corporate bonds yields: Moody's Baa and Aaa. Past literature shows that the default spread is a strong indicator in the forecasting of business cycles. Fama and French (1989) also use the default spread as an important conditional variable to predict stock returns. We capture changes in aggregate liquidity by using the change in the money supply, which is calculated as the twelve-month log difference in the money stock. This variable can also capture shocks from monetary policy that impact underlying macroeconomy. Our fourth variable is the change in industrial production growth rate, which is calculated as the twelve-month log difference of the Industrial Production index. Last, the dividend yield is calculated as the dividends on the CRSP (Note 5) value-weighted market portfolio from the past twelve-months divided by the price of the stock at the end of the month. This variable is also standard in past literature because it reflects mean reversion in expected returns. The economic intuition is that a large dividend yield implies that a higher rate is used to discount dividends. The data for the five variables is obtained through the Federal Reserve, except for dividend yield which is calculated from CRSP data.

5. Model Specification and Empirical Results

In this section, we first provide specification in extension to a general econometric framework. Then we provide empirical analysis of this specified model.

5.1 Model Specification

For each group of ETFs, denoted by i , we estimate model below:

$$r_t^i = \beta_{0,S_t} + \beta_{1,S_t} TB_{t-1} + \beta_{2,S_t} DEF_{t-1} + \beta_{3,S_t} \Delta M_{t-2} + \beta_{4,S_t} \Delta IP_{t-1} + + \beta_{5,S_t} DIV_{t-1} + \varepsilon_t^i \quad (11)$$

$$\varepsilon_t^i \sim N\left(0, \sigma_{i,S_t}^2\right), \quad S_t = \{1,2\}$$

where r_t^i is equally weighted excess return (monthly) for the ith group of ETFs, *TB, DEF, ΔM, ΔIP, and DIV* which denote the one-month T-bill rate, the default risk premium, the changes in the money supply, the change in the industrial production growth rate, as well as the dividend yield, respectively. Following Perez-Quiros and Timmermann (2000) and Gulen et el (2011) framework, , we choose a lag of one month for the change in industrial production growth rate, the dividend yield , the one-month T-bill rate, and the default spread, but a lag of two months for the growth in money supply. The two month lag allows for the publication delay of the money supply data.

We allow the state dependence for the conditional variance, $\sigma_{S_t}^2$. To model investors' conditional beliefs, we follow Gray (1996) and Gulen, Xing and Zheng (2011) and incorporate the regime-switching probabilities as a linear function of one-month T-bill rate. In this manner, we are able to extract the information currently known to the public regarding conditions of macroeconomy in the future. To be specific, these probabilities are denoted as:

$$p_t^i = P\left(S_t^i = 1 \mid S_{t-1}^i = 1, Y_{t-1}\right) = \Phi\left(\mu_0^i + \mu_1^i TB_{t-1}\right); \quad (12)$$

$$1 - p_t^i = P\left(S_t^i = 2 \mid S_{t-1}^i = 1\right); \quad (13)$$

$$q_t^i = P\left(S_t^i = 2 \mid S_{t-1}^i = 2, Y_{t-1}\right) = \Phi\left(\mu_0^i + \mu_2^i TB_{t-1}\right); \quad (14)$$

$$1 - q_t^i = P\left(S_t^i = 2 \mid S_{t-1}^i = 2\right); \quad (15)$$

in which S_t^i indicates the state for ith fund and Φ denotes the cumulative density function of a standard normal variable. This specification is similar to Gray (1996). We extract investors' information on regime-switching probabilities parsimoniously by using risk free rate. The model is estimated using maximum likelihood estimation.

5.2 Empirical Results

Table 3 suggests that high conditional volatilities often occur in state 1 and low conditional volatilities often occur in state 2. Therefore, state 1 is identified as the high volatility regime/state and state 2 is identified as the

low volatility regime/state. For the five groups of ETFs the differences in volatilities across states 1 and 2 are similar in magnitude.

Table 3. Regime-Switching Regressions of Macro Variables

	Finance ETFs		**Health ETFs**		**Real Estate ETFs**		**Technology ETFs**		**Utility ETFS**	
Intercept, St=1	0.13***	(0.03)	0.006	(0.01)	0.09	(0.47)	-0.06	(0.09)	0.04	(0.03)
Intercept, St=2	-0.10***	(0.01)	-0.17***	(0.00)	0.03***	(0.01)	-0.08	(0.05)	0.02***	(0.00)
TB, St=1	-26.21***	(8.78)	-18.38***	(3.10)	-20.55	(4.42)	-16.37	(7.42)	-11.39**	(4.76)
TB, St=2	-1.63	(2.47)	-11.17***	(1.39)	-4.64	(3.13)	-4.01	(4.22)	-1.41	(1.23)
DEF, St=1	9.68***	(1.50)	4.67***	(0.43)	8.19***	(8.61)	8.010*	(4.79)	4.19***	(0.56)
DEF, St=2	3.82**	(1.58)	8.3***	(0.45)	-2.42	(1.97)	2.66*	(2.82)	1.19***	(1.05)
ΔM, St=1	-0.02	(0.15)	0.10**	(0.05)	7.89***	(0.53)	-0.07	(0.38)	-0.03	(0.10)
ΔM, St=2	0.11	(0.08)	-1.69***	(0.23)	0.18**	(0.09)	-0.15**	(0.16)	-0.03	(0.04)
ΔIP, St=1	-5.93*	(2.61)	-2.32*	(1.20)	-6.81	(9.89)	0.76	(4.46)	-0.86	(1.72)
ΔIP,St=2	1.13	(1.52)	-1.16	(1.28)	0.29	(1.62)	-2.20	(2.47)	0.93	(1.14)
DIV, St=1	-0.22	(1.15)	2.87***	(0.32)	-11.44	(14.64)	9.52***	(1.43)	0.80***	(1.27)
DIV, St=2	4.21***	(0.51)	9.23***	(0.22)	0.60	(0.78)	4.43***	(3.33)	-0.04	(0.43)
Trans. Prob. Parameters										
Constant	0.70**	(0.35)	2.05***	(0.38)	1.56***	(0.43)	1.37**	(0.56)	0.50	(0.43)
TB, St=1	3.40	(2.57)	1.63	(4.07)	0.13	(0.40)	4.40	(3.73)	0.24	(1.57)
TB, St=2	2.91**	(1.37)	-0.32	(1.26)	5.44	(4.74)	1.93	(2.14)	0.83	(1.42)
Stand. Dev.										
σ, St=1	0.09***	(0.01)	0.05***	(0.01)	0.08***	(0.02)	0.11***	(0.01)	0.05	(0.01)
σ, St=1	0.03***	(0.00)	0.03***	(0.00)	0.05***	(0.00)	0.05***	(0.01)	0.02	(0.00)
Log-Likelihood	177.04		213.44		182.77		148.14		219.88	

This table reports the estimation results for equation (11)-(15) with *, **, *** denoting the 10%, 5% and 1% significance levels.

Figure 2 shows conditional transition probabilities of the five groups of ETFs to be in state 1 (high volatility) at t based on the set of information at time $t = 1, P(S_t = 1|\Omega_{t-1}; \theta)$, respectively. We also overlay these probabilities together with NBER business cycles. These probabilities are determined by the lagged values of conditioning information; therefore, they are reflections of investors' belief on the conditional likelihood of being in the high volatility state in the following period. In particular we see that during the 2000 Dot-com Bubble, ETFs with a focus on the technology industry stay in state 1 (high volatility) for a relatively long time. Also, for the 2008 Financial Crisis, ETFs with a focus on the financial industry suffer a big loss and persistently remain in state 1 (high volatility) until the end of sample period. From these evidences we can also identify the high volatility state as recession and the low volatility state as expansion.

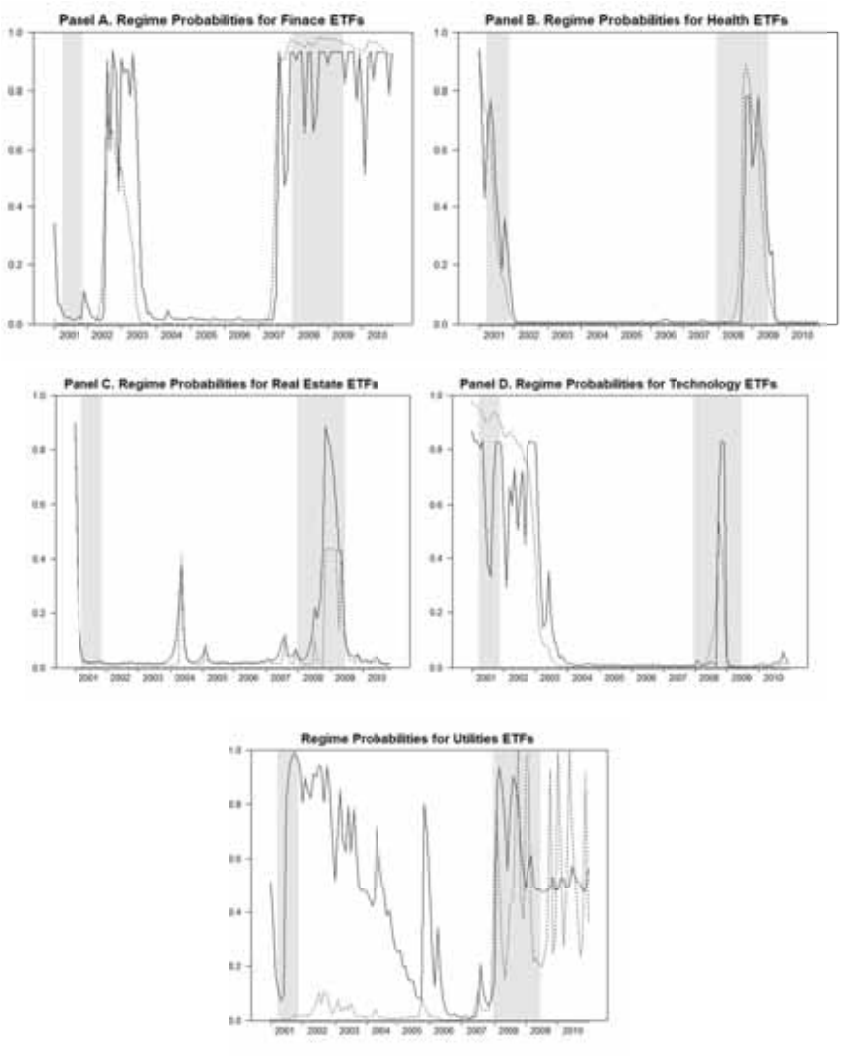

Figure 2. Regime Transition Probabilities

This figure shows regime –switching probabilities for each group of ETFs. The ex-ante probabilities are denoted is solid lines while smoothed probabilities are denoted by dotted one. Shadows are NBER recessions.

Table 3 suggests that for the five groups of ETFs the coefficients of the T-bill rate are all negative for state 1(high volatility). In particular, T-bill rate coefficients for ETFs with a focus on the financial industry and the health industry have a statistical significance of 1%, while the coefficients for utility ETFs has a statistical significance of 5%. In state 2 (low volatility) the T-bill rate coefficients remain negative for all five groups of ETFs, but much smaller in magnitude. This suggests that in state 1 (high volatility), the shocks of interest rates have larger impact on the performance of ETFs; however, in state 2 (low volatility) the performance of ETFs are not heavily impacted by these shocks. There are also systematic variations in the coefficients of the default risk premium. In state 1(high volatility), the five groups of ETFs all have positive coefficients on the default risk premium at the 1% significance level, except technology ETFs which are positive at the 10% level. These coefficients in our low volatility state are much smaller in magnitude. This indicates that the performances of ETFs are more affected by the default risk premium during volatile times. In particular, we see this effect is most pronounced for the group of ETFs with a focus on the financial industry, but less so for the utilities group. The coefficient for finance ETFs in state 1 is 9.68 with a standard deviation of 1.50 and the coefficient of utility ETFs is 4.18 with a standard deviation of 0.56.

The coefficients for the change in money supply are only significant in state 1 for real estate and health ETFs. The positive sign of these coefficients suggests that better expected performance of ETFs focusing on real estate is associated with higher growth in the money supply. This makes sense since the Federal Reserve is more likely

to increase money supply in bad economic conditions. The predictive power for the changes in the growth of industrial production, however, is limited under our specification. Lastly, the coefficient on the dividend yield is significant for ETFs with a focus in the health and technology industries in both the high and low volatility states. In addition they are positive and significant for finance ETFs in the low volatility state and positive and significant for utility ETFs in the high volatility state.

Our results so far indicate that the predictive power of these macro variables depends both on the underlying volatility state and the focus of the ETF. Moreover, ETFs have asymmetric risk exposure across expansion and recession states. However, these results do not prove that the asymmetries are significant statistically. Therefore, a series of statistical tests are performed regarding the existence of the two states in the conditional mean and variance for each group of ETFs. When testing for asymmetry of the coefficients across the two states, one has to take consideration that regime-switching probabilities may not be well identified in the standard likelihood ratio test, as Hansen (1992) discusses. Therefore, the regression coefficients from the Markov regime-switching model are restricted by setting the coefficients equal to one another across the two states. The test statistic from this specification is a standard chi-squared distribution. Specifically, the following null hypotheses are tested: the regression coefficients for the T-bill rate, default risk premium, change in the money stock, growth of industrial production, as well as dividend yield are the same in magnitude across the two states for each group of ETFs. More formally, $\beta^i_{k,S_t=1} = \beta^i_{k,S_t=2}, for\ k = 1,...,5$. Table 4 reports the results of the tests. The differences are statistically significant for ETFs with a focus on the financial industry, health industry and utilities industry, indicating that we reject the null hypothesis for these ETFs.

Table 4. Likelihood Ratio Test

	Finance ETFs	**Health ETFs**	**Real Estate ETFs**	**Technology ETFs**	**Utilities ETFs**
Unrestricted Log-likelihood	177.04	213.44	182.77	148.14	219.88
Restricted Log-likelihood with $\beta^i_{k,S_t=1} = \beta^i_{k,S_t=2}, for\ k = 1,...,5$	166.96	207.50	178.70	143.96	215.22
p-value	0.00	0.04	0.15	0.14	0.09

We conduct the likelihood ratio test for each group of ETFs. The null hypothesis is that regression coefficients are equal across regimes

6. Conclusion

This paper investigates the link between exchange-traded funds and the macro economy. Using a nonlinear approach, we find that the T-bill rate, default risk premium, change in the money supply, growth of industrial production, and dividend yield have predictive power for the return on exchange-traded funds. Moreover, the predictive power of these macro variables depends both on the underlying volatility state and the focus of the ETF. Additionally, our evidence suggests that ETFs have asymmetric risk exposure across expansion and recession states. The framework we use is flexible enough to be applied to the study of a variety of topics within financial economics. By incorporating regime-switching one may examine the time-varying nature of financial markets, making this a beneficial tool for empirical studies.

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Notes

Note 1. Gulen, Xing and Zhang (2011) study time variations of the expected value premium using a two-state Markov-switching model. They find that when conditional volatilities are high the expected excess returns of value stocks are more sensitive to aggregate economic conditions than the expected excess returns of growth stocks. As a result, the expected value premium is time varying, with the value premium tending to spike upward in the high volatility state only to decline more gradually in subsequent periods.

Note 2. Perez-Quiros and Timmermann (2000) adopt a flexible two-state regime-switching model to analyze the presence of asymmetries in the variation of small and large firm risk over the economic cycle. Their model shows that small firms display the highest degree of asymmetry in their risk across recession and expansion states. This translates into a higher sensitivity of these firms' expected stock returns with respect to variables that measure credit market conditions.

Note 3. Maximum Likelihood Estimation

Note 4. A complete list of the ETFs that are included in our sample is available upon request.

Note 5. The Center for Research in Security Prices

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Private Health Care and Drug Quality in Germany – A Game-Theoretical Approach

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Abstract

Quality of medical treatment is a major goal of Germany's statutory health insurance system. According to our game theoretical approach, existing price-discrimination between statutory and private health insurance leads to a higher quality of innovative drugs. Hence, a move into the direction of a single payer health care (so-called citizens' insurance) should result in a reduction of innovative drugs' quality. Moreover, and in the case of citizens insurance's implementation, innovative drugs' price level should increase for patients with statutory health insurance. Furthermore, a similar effect is caused by the Act on the Reform of the Market for Medicinal Products (AMNOG) which leads to reduced prospects for price discriminations between the statutory and private health insurance system. In summary, the existence of private health insurance in Germany does not cause unfavourable cream-skimming. Rather the division of the German health care sector (statutory vs. private health insurance) results in higher drug quality at lower prices for patients with statutory health insurance.

Keywords: private health insurance, statutory health insurance, health reform, price discrimination, drug quality

JEL-Classification: H40, I11, I13, I18, K20, K32

1. Introduction

Universality and access to good quality care are the overreaching values of European Health care systems (Council of the European Union, 2006). Additionally, the German legal framework states that statutory health insurance's (GKV) health care provision for the people has to be fulfilled to the generally accepted state of medical knowledge. Those insured by statutory health care insurance are entitled to receive medically necessary treatment of high quality. The goals of Germany's health care systems are access as well as quality. The GKV insures 70 million people in Germany, about 90 % of German citizens, additionally 10% of German citizens decided to use a private health insurance company (PKV). PKV's and GKV's legal frameworks are different: the GKV is dovetailed closely with the state and takes over governmental tasks. Instead of GKV, PKV is based on private autonomy and entrepreneurial freedom. The PKV's market is restricted to the area in which the GKV's administrative monopoly does not exist. Either PKV and GKV are differentiated, or they converge. On the one hand, the PKV is legally drawn near the GKV through the introduction of an obligation to contract, a prohibition of dismissal or the introduction of a base rate, on the other hand the GKV is legally drawn close to the PKV through possible deductibles, premium refunds or optional tariffs. This legislative act and the extension of membership in the statutory health insurance lead to a single-payer health care system, the so-called citizens insurance.

The existence of a full, private health insurance system in the future is questionable. It is not clear, whether the PKV's existence helps reaching the PKV's goal of good quality care, or if the GKV will be able to grant access to good quality care. A special purpose in this context is the access to innovative drugs, because increasing prices of innovative drugs will raise financial problems for statutory health insurance. High prices for innovative drugs are a result of the fact that pharmaceutical corporations get a monopoly for in-patent drugs. Contrarily, incentives to innovate justify an unrestricted monopoly on manufacturer prices. Monopoly prices allow producers to earn back research and development costs before prices decline through generic competition (Kifmann & Neelsen, 2010).

Drug prices in Germany are relatively high compared to other countries (Heuer, Mejer & Neuhaus, 2007) and price differences for identical drugs between private and statutory health funds are a consequence of German legal drug price regulation (Arzneimittelpreisverordnung – AMPreisV). Drug expenses account for a fifth of statutory health funds' budgets and are their fastest growing expense (Kifmann & Neelsen, 2010). High drug prices are also criticised by the PKV, for example the "absurd" price differences between PKV and GKV for identical drugs. Price differences had been borne by manufacturers' legal rebates to statutory health insurance funds and by a pricing treaty between the Federal Association of Statutory Health Insurance Fund and the Federal Union of German Associations of Pharmacists (Bundesvereinigung Deutscher Apothekerverbände – ABDA). Negotiations between the Federal Union of German Associations of Pharmacists and the association of private health insurance funds did not result in a pricing treaty. In general, private health insurance funds seemed to have less power negotiating sufficient discount agreements. By the Act on the Reform of the Market for Medicinal Products (AMNOG), a new drug price regulation is set into law (Deutscher Bundestag, 2010). Manufacturers' legal rebates to GKV had been widened to PKV, additionally the PKV takes part in the introduced price negotiations between manufacturer and GKV. Therefore, drug prices between GKV and PKV should converge.

This paper focuses on the introduction of a single-payer health care in Germany. More precisely we analyze the impact of the PKV's existence on the GKV's drug price and the drug quality for innovative drugs. Additionally, our analysis enables us to give a brief prediction about the AMNOG's effect on drug quality and prices. Our analysis starts with a brief summary of the German drug pricing after the introduction of AMNOG. Afterwards, we introduce a game theoretic approach widely drawn from Acharyya and García-Alonso (2008, 2009). Based on our model, we show that a single-payer health care is derogatory especially to PKV's members. They are affected by increasing drug prices and decreasing drug quality. In spite of this, members of the PKV are also affected by decreasing drug quality but benefit from decreasing drug prices.

Our analysis also shows that the introduction of a new drug pricing legal framework leads to decreasing price discrimination between PKV and GKV, decreasing PKV drug prices and a decreasing drug quality. The German legal framework grants further latitude for the individual health insurance funds to formulate their own contracts with the pharmaceutical corporation, the prediction of these contracts will be important for innovative drugs' quality.

2. Drug Pricing in Germany

The Federal Institute for Drugs and Medical Devices (Bundesinstitut für Arzneimittel und Medizinprodukte – BfArM) is the medical regulatory body in charge of the testing and authorisation of medicines in Germany. After authorisation and market-introduction, all members of the GKV are generally entitled to receive the new drug. Evaluation of the benefits and harms was introduced in Germany in 2004 as a consequence of health reform (GKV-Modernisierungsgesetz – GMG). Other countries had used the therapeutic value already to negotiate prices (Heuer et al., 2007). A novelty had been the standards that the Institute for Quality and Efficiency in Health Care (Institut für Qualität und Wirtschaftlichkeit im Gesundheitswesen – IQWiG) and the Federal Joint Committee (Gemeinsamer Bundesausschuss – G-BA) had set.

With the introduction of AMNOG in 2011, the evaluation of benefits and harms takes place after market introduction of new drugs with a new active ingredient. Depending on the existence of an added benefit, price negotiations between the Federal Association of Statutory Health Insurance Funds (GKV-Spitzenverband), PKV and the manufacturer begin after six months. Health insurance and manufacturers have six months to agree on a new drug price in the form of a discount on the original price. If price negotiations fail, an arbitral process is introduced and an award is made up to three months after the failure of price negotiations. Independent health insurance funds are able to negotiate additional individual discounts with the manufacturer on their own after pricing.

The drug becomes part of a reference price cluster, if no added benefit is proven. In the latter case the new drug is not an innovative drug we are focussing on. The G-BA published several definitions of added benefits in 2011:

- A lasting significant improvement of the therapy-relevant benefit that is not reached with the appropriate comparable therapy is called a "major" added benefit.
- A clear improvement of the therapy-relevant benefit that is not reached with the appropriate comparable therapy is called a "considerable" added benefit.
- A moderate improvement of the therapy-relevant benefit that is not reached with the appropriate comparable therapy is called a "minor" added benefit.

- If data does not allow quantifying the added benefit, it is called a non-quantifiable added benefit.

In other cases there is no added benefit. § 35a (1) SGB V states that if the pharmaceutical corporation does not submit fully objective evidence, an added benefit is not mentioned. The added benefit of orphan drugs are always proven with authorisation [§ 35a (1) SGB V]. In addition to the definitions of the added benefit, the IQWiG defines several cases of evidence:

- If there are two or more studies with mostly high certainty of results and consistent results, IQWiG labels it a "Proof".
- If there are two or more studies with consistent results but mostly moderate certainty of results, IQiG labels it an "Indication". An indication is also stated if there is only one study with high certainty of results and statistically significant effects.
- If there are two or more studies with mostly low certainty of results and consistent results, IQWiG states a "Hint". A hint is also stated if there is only one study with moderate certainty of results and statistically significant effects.

	Proof	Indication	Hint	Orphan	Objective Evidence Not Fully Submitted
Major added benefit					
Considarable added benefit	Ticagrelor	Abirateronacetat			
Minor added benefit		Cabazitaxel	Eribulin		
			Fingolimod		
Non-quantifiable added benefit		Boceprevir		Pirfenidon	
		Telaprevir			
No added benefit					Aliskiren/Amlodipin
					Azilsartan Medoxomil (calcium salt)
					Bromfenac
					Linagliptin
					microbial Collagenase from Clostridium histolyticum
					Pitavastatin
					Regadenoson
					Retigabin

Figure 1. Results of the Active Ingredients' Evaluation of Benefits and Harms since 2011

Figure 1 represents results of the active ingredients' evaluation of benefits and harms since 2011 Our definition of innovative drugs is based on Acemoglu and Lynn (2004) they defined radical innovations as drugs with new introduced active ingredient. Because drugs with new active ingredient but no added benefit become part of a price cluster we exclude these drugs, further orphan drugs are not innovative drugs in our definition. Related to German legal framework we focus only on drugs with new marketed active ingredients that have a proof, indication or hint of their added benefits.

3. The Model

Our model is based on Acharayya and García-Alonso (2009). They showed that asymmetric health care systems can arise even if countries are ex-ante symmetric when international price discrimination is possible. It is also shown that regardless of any intra-country income differences, parallel imports result in a lower level of health-care innovation. Earlier findings about product quality and monopoly are related to Mussa and Rosen (1978), who found out that product quality is generally lower in a monopoly than in competitive situation. Later Kim and Kim (1996) introduced spill-over effects in costs and demonstrate that higher marginal willingness to pay does not necessarily imply higher quality being offered. A different approach is chosen by Bardey, Brommier and Jullien (2010). They found that reference pricing negatively affects the intensity of research, especially small innovations using time as an independent variable.

Our model focuses on two countries deciding independently about aspects of their health care systems,

especially subsidizing access to universal health care. In Germany solidarity-based funding within the GKV is indeed subsidizing the poorer members. Access to new medicines is legally granted automatically after approval [§ 31 SGB V]. These subsidies are taken into account by suppliers, especially profit maximizing pharmaceutical corporations as drug manufacturers deciding about price and quality of new drugs within their systematic R&D process (DiMasi, Hansen, Grabowski & Lasagna, 1991; DiMasi, Hansen, & Grabowski, 2003). These subsidies increase pharmaceutical firms' marginal revenues and should result in positive effects on pharmaceutical innovation (Sloan & Hsieh, 2008). After market introduction, patients decide about buying the medicine. Their decision depends only on utility aspects.

Countries are independent in their subsidy decision; manufacturers take the countries' decisions into account when deciding about quality and price of the new drugs. Patients' decisions also depend on price and quality of the new drug as well as the subsidy decision of their country. Figure 1: Sequential structure of the decision game in a two-country model illustrates the model structure like an extensive form in game theory. Players are country 1 (*C 1*) and 2 (*C 2*), a multinational pharmaceutical corporation (*MNC*) and Patients (*Pa*). Their payoffs are wealth (W_1, W_2), profit (π) and utility (U).

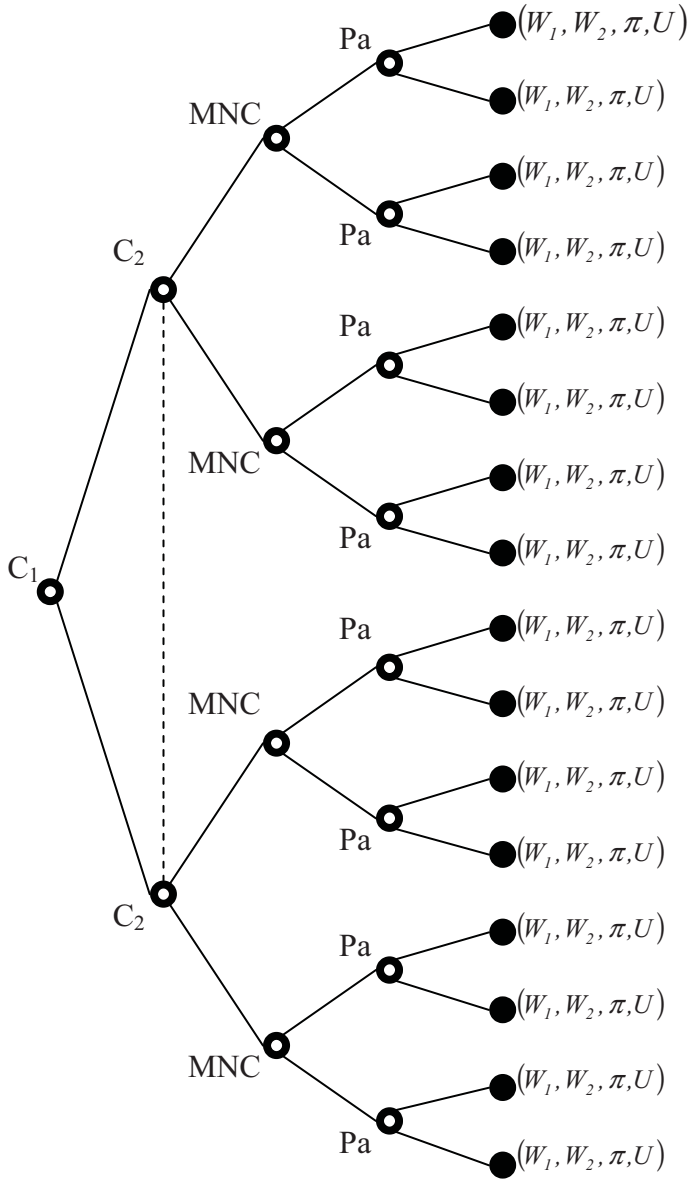

Figure 2. Sequential structure of the decision game in a two-country-model

We consider two types of citizens in the countries; one type earns ordinary wages (*U*) and the other type is high wage earners (*O*). Incomes are y_U and y_O with $y_U < y_O$. Let the number of citizens or consumers with a high wage in country 1 be n_{1O} and n_{1U} with an ordinary wage. Respectively, country 2 consists of citizens n_{2O} and n_{2U}. Different incomes and the population of the countries can be modelled by varying the number of income brackets. Securing for a higher absolute and relative number of high wage earners implies $n_{1O} > n_{2O}$ and $n_{1O}/n_{1U} > n_{2O}/n_{2U}$.

Reducing health inequalities of different population groups is the goal of different policies. These inequalities are mainly driven by general living conditions, social behaviour and income as a requirement for access to health care (European Parliament, 2011). Health inequalities are not only a consequence of economic and ecological factors but mainly a consequence of access factors. Following this argumentation, it is not illness probability that differs across income groups but possibly their access to health care. To simplify, each citizen should be affected by a widespread disease and could be treated with a drug for one year.

The new drug's quality is denoted as *s*. The law of diminishing marginal returns holds true for drug quality, for increasing R&D expenses (*C*) quality increases at decreasing rates:

$$\frac{\partial s}{\partial C} > 0, \frac{\partial^2 s}{\partial C^2} \leq 0 .$$

A simple function for drug quality related to R&D effort would be:

$$s(C) = \sqrt{2 \cdot C} .$$

Following the related literature (Acharyya et al., 2008, 2009; Bardey et al., 2010; Brekke et al., 2007), we assume no other costs except the (sunk) R&D expenses which lead to the cost function:

$$C = \frac{1}{2} s^2 \tag{1}$$

To calculate the MNCs profits, information about revenues are necessary. Revenues depend on sales volume and price. Sales volume itself depends on the coverage decisions in both countries, i.e. only high wage earners buy the drug (partial coverage) or high and ordinary wage earners buy the drug (universal coverage).

In general, consumers decide to buy a product if their individual utility is equal or exceeds the price – or in our case the subsidized price. Each consumer has an identical valuation for a particular product quality (Mussa & Rosen, 1978; Kim & Kim, 1996; Acharyya, 1998, 2005). The consumer's valuation should be linearly related to the income level and a representative consumer *k*, *k = O, U*, derives utility from buying a drug:

$$U_k = u(y_k, s).$$

Related to *Gossen*'s law, utility increases at a decreasing rate with the higher quality of the drug:

$$\frac{\partial U}{\partial s} > 0, \frac{\partial^2 U}{\partial s^2} \leq 0 .$$

Since $y_O > y_U$, so,

$$u(y_O, s) > u(y_U, s) \forall s .$$

Thus, a high wage earner derives greater utility than an ordinary wage earner from the same quality drug. Following *Grossman*'s model, additional time available for work or leisure, i.e. time not been taken over by illness, increases the individuals' utility directly and indirectly through market and non-market activity (Grossman, 1972). A high wage earner has a greater addition to his utility and hence, would be willing to pay more at the margin for a better quality that is created:

$$\frac{\partial u(y_O, s)}{\partial s} > \frac{\partial u(y_U, s)}{\partial s} \forall s .$$

We assume a linear utility function that satisfies all three conditions, letting the reservation utility be zero the individuals buy the drug, if its (subsidized) price is below the utility:

$$U_k = y_k \cdot s \geq P_i - \gamma_{ik} . \tag{2}$$

A subsidy to the high income earners would not make any sense, so γ_i denotes the subsidy to the ordinary wage earners. Price discrimination between countries are possible but not within countries.

The MNC is free to choose its location and the MNC's profits are not taken into account for calculating welfare. According to the literature our wealth function is:

$$W_i = n_{iO}\left(y_O \cdot s - P_i\right) + n_{iU}\left(y_U \cdot s - P_i\right). \tag{3}$$

Obviously a subsidy only makes sense if income differs sufficiently. If not, universal coverage is preferred by MNC even without a subsidy. This income difference in terms of the high wage earner's income is denoted as $\overline{y_O^{\min}}$ and will be investigated later. If subsidies are too high, a welfare loss occurs and we assume an additional income boarder. This income boarder is denoted as $\overline{y_O^{\max}}$ and will also be investigated later. For subsidies within the model the following condition is necessary:

$$\overline{y_O^{\min}} \geq y_O \geq \overline{y_O^{\max}} . \tag{4}$$

4. Drug Quality and Subsidies

4.1 Game Reduction and Drug Quality

The consumer's decision is stated in (2). Consumers will buy the drug if the following conditions holds true

$$P_i \leq y_U \cdot s + \gamma_i ,$$

respectively

$$P_i \leq y_O \cdot s ,$$

Otherwise consumers will not buy the medicine. Regarding utility maximization, other consumption decisions do not make sense and the consumer's decisions can be predicted directly.

The MNC will not offer a price below the price stated in the conditions above, because it would negatively affect revenues and profits. Prices will be:

$$P_i = y_U \cdot s + \gamma_i ,$$

or as the case may be,

$$P_i = y_U \cdot s + \gamma_i .$$

For being determined in price setting, the MNC's only possibility for profit maximization is varying the drug quality. The MNC's drug quality decision refers to the surrounding conditions. That is to say, drug quality is influenced by the countries' covering decisions. Regarding the framework there are three possible alternatives:

1st Both countries provide full coverage, i.e. subsidizing the drug consumption.

2nd Only one country provides full coverage, i.e. only in country 1 or 2 the drug consumption is subsidized.

3rd both countries provide partial coverage, i.e. no country subsidizes the drug consumption.

These alternatives will be further analyzed. The MNC maximizes its profits in choosing the drug quality depending on the countries' subsidy γ_i. If both countries provide full coverage, subsidizing the drug consumption in the high of γ_i^C, the resulting price is $P_i = y_U \cdot s + \gamma_i^C$ in both countries. Calculating the MNC's revenue leads to:

$$R_{FC}^D(s) = \sum_{i=1}^{2} \left(n_{iO} + n_{iU}\right)\left(y_U s + \gamma_i^C\right)^2 .$$

Drug price, numbers of high and ordinary wage earners in the countries and subsidies are given and the MNC's only possibility to maximize profits is to vary drug quality. Revenues increase with increasing drug quality and vice versa. (1) states that the MNC's costs depend only on drug quality and also the MNC's profits π_{FC}^D

depend only on drug quality:

$$\pi_{FC}^{D}(s) = \sum_{i=1}^{2}\left(n_{iO} + n_{iU}\right)\left(y_U s + \gamma_i^C\right) - \frac{1}{2}s^2 \ . \tag{5}$$

Maximizing the MNC's profits for universal coverage in both countries leads to the drug quality:

$$s_{FC}^{D} = y_U \sum_{i=1}^{2}\left(n_{iO} + n_{iU}\right).$$

Universal coverage in only one country subsidizing their consumers' drug consumption with the subsidy γ_i^D and no subsidy in the other country results in the prices $P_i = y_U \cdot s + \gamma_i^D$ and $P_j = y_O \cdot s$ respectively. The MNC's profit is:

$$\pi_{FCi}^{D} = \left(n_{iO} + n_{iU}\right)\left(y_U s + \gamma_i^D\right) + n_{jO} s - \frac{1}{2}s^2 \quad (i \neq j). \tag{6}$$

Resulting in a quality level equal to:

$$s_{FCi}^{D} = y_U\left(n_{iO} + n_{iU}\right) + n_{jO} y_O \ . \tag{7}$$

Partial coverage in both countries results in price $P_i = y_O \cdot s$ in both countries and profits:

$$\pi_{PC}^{D}(s) = y_O s \sum_{i=1}^{2} n_{iO} - \frac{1}{2}s^2 . \tag{8}$$

Thus,

$$s_{PC}^{D} = y_O \sum_{i=1}^{2} n_{iO} \ .$$

Notably, all drug qualities are independent of the height of the subsidies. Given the surrounding conditions there is only one possible combination of drug quality and price being offered by the MNC and the MNC's decision can be predicted without any game theoretic approach. Wealth, drug quality and coverage level depends only on the countries' subsidy decision (see figure 3).

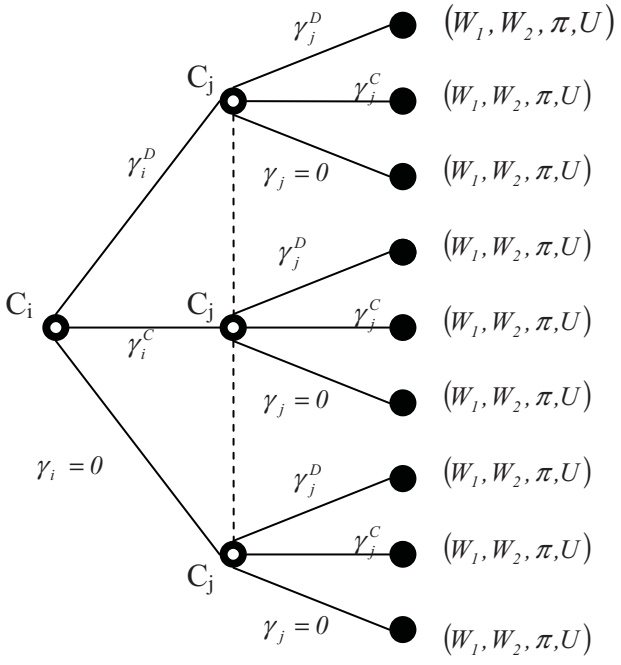

Figure 3. Reduced Game Matrix

4.2 Optimal Subsidy Level

The MNC's optimal drug quality choice under the assumption of profit maximization has been analyzed above. To provide full coverage, the MNC's profits have to be higher with a consumer's subsidy than without a subsidy. To provide full coverage in country *i* – and partial coverage in country j – the following condition has to be fulfilled:

$$\pi_{FC_i}^{D}(s) \geq \pi_{PC}^{D}(s).$$

The quality level is induced by the subsidy decision. Country *i* provides universal coverage subsidizing drug consumption at an appropriate level. And the MNC prefers full coverage in country *i* and partial coverage in country *j*, i.e. (6) > (8). Thus,

$$\gamma_i^D \geq \frac{\frac{1}{2}\left[\sum_{i=1}^{2} n_{iO} \cdot y_O\right]^2 - \frac{1}{2}\left[y_U\left(n_{iO} + n_{iU}\right) + n_{jO} y_O\right]^2}{n_{iO} + n_{iU}}. \tag{9}$$

Full coverage in both countries is preferred by the MNC, if (5) > (8). Thus,

$$\gamma_i^C = \frac{\frac{1}{2}\left[y_O \sum_{i=1}^{2} n_{iO}\right]^2 - \frac{1}{2}\left[y_U \sum_{i=1}^{2}\left(n_{iO} + n_{iU}\right)\right]^2 - \gamma_j^C\left(n_{jO} + n_{jU}\right)}{n_{iO} + n_{iU}} \quad (i \neq j). \tag{10}$$

In spite of γ_i^D γ_i^C is dependent of the other country's subsidy decision. Nevertheless, it is necessary that the MNC prefers full coverage in both countries to full coverage in only one country: (5) > (6). Thus,

$$\gamma_i^{\min} = \frac{\frac{1}{2}\left[y_O \sum_{i=1}^{2} n_{iO}\right]^2 - \frac{1}{2}\left[y_U \sum_{i=1}^{2}\left(n_{iO} + n_{iU}\right)\right]^2 - \gamma_j^{\min}\left(n_{jO} + n_{jU}\right)}{n_{iO} + n_{iU}} \quad (i \neq j). \tag{11}$$

$\gamma_i^{\min} = \gamma_i^C$ resulting from $\gamma_j^{\min} = \gamma_j^C$ and (10) is identical to (11). If both countries decide to provide full coverage, a simple solution could be offering the same subsidy level $\gamma_1^{\min} = \gamma_2^{\min}$ and (11) yields:

$$\gamma_1^{ident} = \gamma_2^{ident} = \frac{\left[y_O\left(n_{1O} + n_{2O}\right)\right]^2}{2\left(n_{1O} + n_{1U} + n_{2O} + n_{2U}\right)} - \frac{1}{2} \cdot y_U^2\left(n_{1O} + n_{1U} + n_{2O} + n_{2U}\right). \tag{12}$$

5. Income Differences and Subsidy Level

5.1 Minimum Income Difference

Equation (4) implies that a subsidy is only necessary, if income differs sufficiently. This condition implies a positive subsidy. Thus, (9) > 0 in the case o

f unilateral full coverage:

$$y_O \geq \frac{n_{iO} + n_{iU}}{n_{iO}} \cdot y_U.$$

And the income difference from (4) can be specified as:

$$y_O \geq \frac{n_{iO} + n_{iU}}{n_{iO}} \cdot y_U = y_O^{\min}. \tag{13}$$

The condition of a positive subsidy has to hold true also in the case of bilateral universal coverage and income distribution results from (12) > 0:

$$y_O > \frac{n_{1O} + n_{1U} + n_{2O} + n_{2U}}{n_{1O} + n_{2O}} \cdot y_U = y_O^{\min}.$$

Given the assumptions about income and population structure in both countries the condition is always fulfilled, if (13) holds true. From equation (13) it can be verified that drug quality decreases with increasing coverage:

$$s_{PC} \geq s_{FCi} \geq s_{FC}.$$

Obviously the monopolistic MNC reduces quality not quantity, if subsidies are granted. With a decrease in the new drug's quality there is a shift from breakthrough to incremental innovations. DiMasi and Paquette (2004) estimates that marketing exclusivity of the breakthrough drug has fallen dramatically. This states also a shift to incremental innovations over time. It might be interesting to additionally investigate the link between coverage and marketing exclusivity over time. Notably, a stream of incremental innovations can often exceed the effect of breakthroughs. By (13) we obtain for (9)

$$\gamma_i^D \geq \frac{\frac{1}{2}\left[\sum_{i=1}^{2} n_{iO} \cdot y_O\right]^2 - \frac{1}{2}\left[y_U \cdot \sum_{i=1}^{2}\left(n_{iO} + n_{iU}\right)\right]^2}{n_{iO} + n_{iU}}.$$

Taking (11) into account it is straightforward that:

$$\gamma_i^{\min} \geq \gamma_i^D - \frac{n_{jO} + n_{jU}}{n_{iO} + n_{iU}} \cdot \gamma_j^{\min}. \tag{11a}$$

The subsidy levels γ_i^D and $\gamma_i^{\min}$ differ about the weighted foreign subsidy level and for every non-negative foreign subsidy:

$$\gamma_i^D \geq \gamma_i^{\min}$$

holds true. (11a) states also that a marginal subsidy has to be granted in order to provide bilateral full coverage, because of $\gamma_j^{\min} = 0 \Rightarrow \gamma_i^{\min} = \gamma_i^D$ and vice versa. Any country's marginal subsidy has to be greater than zero but depends on the other country's subsidy. Transforming (11a) reveals that:

$$\left(n_{iO} + n_{iU}\right) \cdot \gamma_i^{\min} + \left(n_{jO} + n_{jU}\right) \cdot \gamma_j^{\min} \geq \left(n_{iO} + n_{iU}\right) \cdot \gamma_i^D.$$

The level of subsidy does not only depend on the other country's subsidy but also on the countries' population. The marginal subsidy (bilateral universal full coverage) increases with increasing population but will not exceed

the level for unilateral full coverage. By (9) we obtain for (11):

$$\gamma_i^{\min} = \frac{\frac{1}{2}\left[y_U\left(n_{jO} + n_{jU}\right) + n_{iO}y_O\right]^2 - \frac{1}{2}\left[y_U\left(n_{iO} + n_{iU} + n_{jO} + n_{jU}\right)\right]^2}{n_{iO} + n_{iU}}.$$

Because of (13) $\gamma_i^{\min}$ is positive and the absolute minimum subsidy for universal coverage in country *i*. The absolute minimum subsidy increases with increasing income difference. This holds true for (9) also. For (11) and (9) we obtain also:

$$\gamma_i^D = \frac{1}{2} \cdot y_U \cdot \left(n_{iO} + n_{iU}\right) \cdot \frac{n_{jO}}{n_{iO}}.$$

The necessary subsidy to persuade unilateral full coverage increases with increasing population and decreasing relative number of high wage earners. That is to say providing full coverage is more difficult for larger countries with lower per capita income than for smaller ones with higher income.

5.2 Maximum Income Difference

In addition to the minimum level of income inequality, the maximum level of income inequality stated in (4) has to be taken into account. To make sense, a subsidy has to fulfil two conditions: first it must ensure full coverage; second a subsidy has to increase wealth. The first condition is fulfilled by (13). The second condition will be investigated now. In the case of partial coverage, only the high wage earners will be provided with the new drug and by (3) and (2) we obtain:

$$W_i = n_{iO} \cdot \left(y_O \cdot s - P_i\right) = n_{iO} \cdot \left(y_O \cdot s - y_O \cdot s\right) = 0.$$

The wealth improvement condition is:

$$W_i = n_{iO} \cdot s \cdot \left(y_O - y_U\right) - \gamma_i \cdot \left(n_{iO} + n_{iU}\right) \geq 0.$$

Thus, the maximum subsidy is:

$$\gamma_i^{\max} \equiv s\frac{n_{iO}}{n_{iO} + n_{iU}}\left(y_O - y_U\right) \geq \gamma_i. \tag{14}$$

The maximum subsidy increases with increasing drug quality and increasing income range ($y_O - y_U$). It decreases with an increasing number of normal wage earners. It is easier for relatively rich countries to subsidize their lower number of normal wage earners than the other way round.

For subsidizing unilateral full coverage (14) ≥ (9) has to hold true, to be more precise:

$$\gamma_i^{\max} = \frac{n_{iO} \cdot s_{FCi} \cdot \left(y_O - y_U\right)}{n_{iO} + n_{iU}} \geq \gamma_i^D.$$

And the maximum level of income inequality is straightforward:

$$\overline{y_O^{\max}} = \frac{n_{iO}^2 + n_{iO}n_{iU} + n_{iU}n_{jO} + \sqrt{\left(n_{iO}^2 + n_{iO}n_{iU} + n_{iU}n_{jO}\right)^2 + n_{iO}^2 n_{iU}^2 - n_{iO}^4}}{n_{iO}^2} y_U, \qquad (15)$$

respectively

$$\overline{y_O^{\max}} = \left[1 + \frac{n_{iU}}{n_{iO}} + \frac{n_{iU}n_{jO}}{n_{iO}^2} + \sqrt{\frac{2n_{iU}}{n_{iO}} + \frac{2n_{iU}n_{jO}}{n_{iO}^2} + \frac{2n_{iU}^2 + 2n_{iU}^2 n_{jO}}{n_{iO}^3} + \frac{n_{iU}^2 n_{jO}^2}{n_{iO}^4}}\right] \cdot y_U .$$

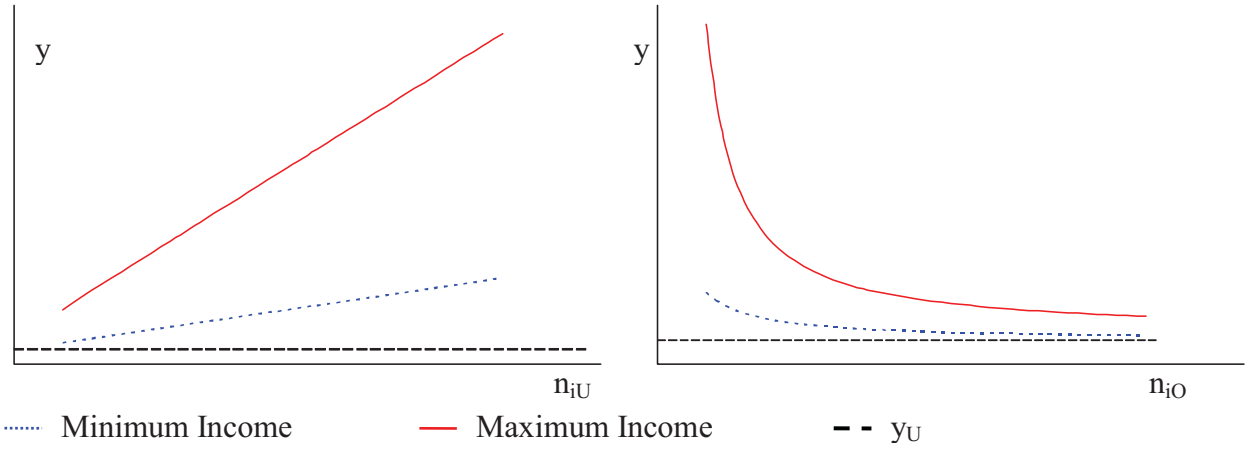

Figure 4. Income Range

The maximum level of income inequality decreases with an increasing number of high wage earners asymptotical to the ordinary wage and increases with an increasing number of ordinary wage earners and foreign high wage earners respectively. It has already been shown that (9) > (11) and (14) ≥ (11) is fulfilled, if (15) holds true.

Figure 4 summarizes the income analysis. Therefore maximum and minimum income disparities – (13) and (15) – are plotted depending on n_{iU} and n_{iO} respectively. As an orientation, the ordinary income is plotted. For an increasing number of ordinary wage earners the income range increases, also the minimum income disparity increases. That is to say income disparity has to be larger in relatively poorer countries in order to make sense of a subsidy. In spite of this result, the income range decreases asymptotical to the ordinary wage with an increasing number of high wage earners. That is to say, in relatively rich countries welfare decreases are implied by a subsidy shortage.

5.3 Subsidy Setting

A subsidy is necessary if the income range (4) holds true. The possible subsidies are between $\gamma_i^D \geq \gamma_i \geq 0$. No subsidy induces bilateral partial coverage and welfare levels of $W_{i,j_{PC}}^D = 0$. In the case of unilateral full coverage with subsidy γ_i^D country *i*'s welfare is:

$$W_{i_{FCi}}^D = \frac{1}{2} y_O^2 \left(-n_{iO}^2\right) + y_O y_U \left(n_{iO}^2 + n_{iO}n_{iU} + n_{iU}n_{jO}\right) + \frac{1}{2} y_U^2 \left(n_{iU}^2 - n_{iO}^2\right)$$

Because of (14) > (9), $W_{i_{FCi}}^D \geq 0$ holds true. The other countries' welfare is zero. If the non-subsidizing country decides to provide full coverage subsidizing the marginal subsidy, (Note 1) drug quality decreases and country *i*'s welfare decreases to:

$$W_{i_{FC}}^{D,\gamma_i^D} = -\frac{1}{2} y_O \left(n_{iO}^2 + 2n_{iO}n_{jO}\right) + y_O y_U \left(n_{iO}^2 + n_{iO}n_{iU} + 2n_{iO}n_{jO} + n_{iO}n_{jU} + n_{iU}n_{jO}\right)$$

$$-\frac{1}{2} y_U^2 \left(n_{iO}^2 + 2n_{iO} n_{jO} + 2n_{iO} n_{jU} - n_{iU}^2 \right)$$

And welfare in country *j* increases. By (13) the welfare is equal to:

$$W_{j_{FC}}^{D,\gamma_i^D} \geq n_{jU} y_U^2 \left(n_{iO} + n_{iU} + n_{jO} + n_{jU} \right) - \left(n_{jO} + n_{jU} \right) \gamma_j^{\min}.$$

For $\gamma_j^{\min}$ being slightly greater than zero welfare is approximately:

$$W_{j_{FC}}^{D,\gamma_i^D} \geq n_{jU} y_U^2 \left(n_{iO} + n_{iU} + n_{jO} + n_{jU} \right).$$

And the welfare gain depends on population structure. The welfare in country *i* remains unchanged, if country *j* decides for a higher subsidy than the marginal one. A higher γ_j would only affect country *j*. The subsidy γ_j^{ident} would result in the welfare:

$$W_{j_{FC}}^{D,\gamma_j^{ident}} = y_U^2 \frac{n_{jO}^2 3n_{jU} + n_{jO} n_{iO} + n_{iU} + n_{jO} + n_{jO}^2 - n_{jO} + n_{jU}^3 n_{iO} + n_{jO}^2}{2n_{jO}^2 n_{iO} + n_{iU} + n_{jO} + n_{jU}}.$$

Welfare is zero, if the subsidies are not high enough. Summing up these findings results in the game matrix:

		Country *j*					
		0	$\gamma_j^{\min}$	…	γ_j^{ident}	…	γ_j^{D}
Country *i*	0	0/0	0/0	…	0/0	…	$0 / W_{j_{FCj}}^{D}$
	$\gamma_i^{\min}$	0/0	0/0	…	0/0	…	$W_{i_{FC}}^{D,\gamma_j^D} / W_{j_{FC}}^{D,\gamma_j^D}$
	⋮	⋮	⋮		⋮		⋮
	γ_i^{ident}	0/0	0/0	…	$W_{i_{FC}}^{D,\gamma_i^{ident}} / W_{j_{FC}}^{D,\gamma_j^{ident}}$	…	$W_{i_{FC}}^{D,\gamma_i^{ident}} / W_{j_{FC}}^{D,\gamma_j^D}$
	⋮	⋮	⋮		⋮		⋮
	γ_i^{D}	$W_{i_{FC}}^{D,\gamma_i^D} /0$	$W_{i_{FC}}^{D,\gamma_i^D} / W_{j_{FC}}^{D,\gamma_i^D}$	…	$W_{i_{FC}}^{D,\gamma_i^D} / W_{j_{FC}}^{D,\gamma_j^{ident}}$	…	$W_{i_{FC}}^{D,\gamma_i^D} / W_{j_{FC}}^{D,\gamma_j^D}$

Figure 5. Game Matrix for Two Countries

Country *i*'s best response for $\gamma_j = 0$ is subsidy γ_i^D. This is also the best response for country *j*'s marginal subsidy. Country *i*'s best response for the identical subsidy in country *j* is γ_i^{ident}. In the case of the unilateral full coverage subsidy in country *j*, country *i*'s best response is the marginal subsidy. Country *j*'s best response

are analogues.

Although a final analysis is not possible without information about income and population structure, it can be stated that the first-mover has an advantage over the other country. Because the first-mover is able to determine the second mover's strategy choice, he is able to increase his own welfare choosing the marginal subsidy. Figure 6 illustrates the countries' best response function:

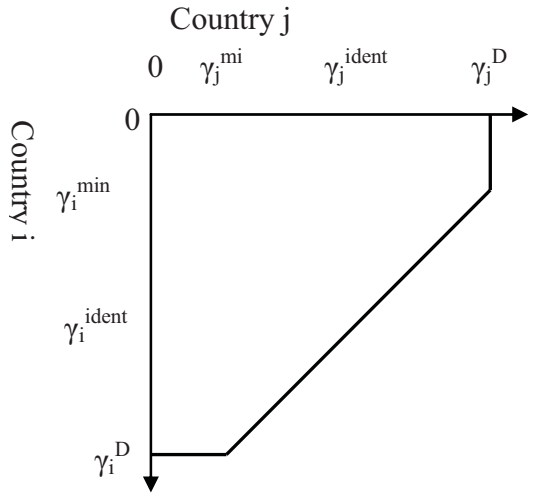

Figure 6. Best Response Functions

6. Importance of Private Health Insurance in Germany

Our model enables us to analyze the PKV's importance for drug price and quality. Therefore we model the two theoretic countries "PKV-country" and "GKV-country". In general because of the German legal framework, it is assumed that especially high income young citizens are members of the PKV in Germany. And the PKV-country is the richer country. According to the annual income threshold, letting the number of ordinary wage earners in a PKV-country be zero is an appropriate simplification: $n_{PU}=0$.

Without any ordinary income earners a subsidy within a PKV-country is not necessary and universal coverage is given automatically. Basing the insurance premium on the principle of equivalence is a logical consequence. A GKV-country consists of high and average income earners: $n_{GO}\geq 0$ und $n_{GU}\geq 0$. To provide universal coverage within a GKV-country (FCG) results in subsidy γ_G^D according to (9). This equals the solidarity-based funding of the GKV. Taking the subsidy strategies into account, the drug quality is analogous to (7):

$$s_{FCG}^{D} = y_U \left(n_{GO} + n_{GU}\right) + n_{PO} y_O .$$

The unification of GKV and PKV to a so-called citizens insurance results in a profit function

$$\pi_{FC}^{B} = \left(n_{GO} + n_{GU} + n_{PO}\right) \cdot \left(y_U \cdot s_{FC}^{B} + \gamma^{B}\right) - \tfrac{1}{2} \cdot \left[s_{FC}^{B}\right]^2$$

and drug quality:

$$s_{FC}^{B} = y_U \cdot \left(n_{GO} + n_{GU} + n_{PO}\right) < s_{FCG}^{D} .$$

By the solidarity-based funding of GKV (13) is given and by (13) we obtain: $s_{FC}^{B} < s_{FCG}^{D}$. Introducing a citizens' insurance will negatively affect the quality of new drugs, i.e. the PKV's existence is strengthened by the good quality of care.

Given a GKV-country's population structure the resulting the subsidy is analogous to (9):

$$\gamma_G^D = \frac{\left[y_O\left(n_{GO} + n_{PO}\right)\right]^2 - \left[y_U\left(n_{GO} + n_{GU}\right) + y_O \cdot n_{PO}\right]^2}{2\left(n_{GO} + n_{GU}\right)}$$

Introduction of a citizen insurance leads to the following subsidy:

$$\gamma^B = \frac{\left[y_O\left(n_{GO} + n_{PO}\right)\right]^2 - \left[y_U\left(n_{GO} + n_{GU} + n_{PO}\right)\right]^2}{2\left(n_{GO} + n_{GU} + n_{PO}\right)}.$$

Thus,

$$y_O > \frac{n_{GO} + n_{GU} + n_{PO}}{n_{GO} + n_{PO}} \cdot y_U \equiv y_O^{\overline{\overline{\min}}} < y_O^{\overline{\min}},$$

is the necessary income disparity. The citizen insurance's minimum income disparity is below the existing GKV minimum income disparity. That is to say, universal coverage without any subsidies is reached at a further step of income convergence in the existing system of GKV and PKV, because of the MNC's ability to discriminate prices. Furthermore, by (13) we obtain:

$$\gamma^B \geq \gamma_G^D.$$

Unifying GKV and PKV to citizens' insurance leads to higher subsidies being necessary to persuade full coverage. The full sums of subsidies are $n_{GU}\gamma_G^D$ in the bipartite system and $n_{GU}\gamma^B$ in the case of a citizens' insurance. Therefore the introduction of a citizens' insurance leads to a higher degree of redistribution. On the one hand the citizen insurance's drug price is negatively affected by the decreasing drug quality; on the other hand the higher degree of redistribution affects the citizens insurance's drug price positively.

In general, it is assumed that a convergence of GKV's und PKV's compensation – a vital requirement for the introduction of a citizen insurance – leads to higher GKV compensations. Lower PKV's compensations put the care provider's economic existence at risk. In our model the existing prices are:

$$P_P = y_O \cdot s_{FCG}^D = y_O y_U\left(n_{GO} + n_{GU}\right) + y_O^2 n_{PO}$$

respectively

$$P_G = y_U \cdot s_{FCG}^D + \gamma_G^D.$$

By (9) and (13) it is straight forward that $P_P > P_G$ and the PKV member's drug prices are higher than the GKV member's drug prices. The PKV's importance for the drug quality is now obvious: together with their financial power, their higher valuation for quality affects the drug quality positively. The citizen insurance's drug price is:

$$P_B = y_U \cdot s_{FC}^B + \gamma^B.$$

By the citizen insurance's minimum income disparity we obtain that the PKV member's drug price exceeds the drug price within a citizen insurance ($P_P > P_B$). Members of the PKV would on the one hand face a decreasing drug quality; on the other hand they have to pay less for new, innovative drugs. From equation (13), we obtain $P_G < P_B$, i.e. if a citizens' insurance is introduced, former GKV member's face increasing drug prices as well as decreasing drug quality. From this point of view the introduction of a citizens' insurance negatively affects prior members of GKV. The bipartite German health system advantages especially members of the GKV through higher drug quality and lower drug prices. Because of the pharmaceutical corporations' possibility to

discriminate prices between GKV and PKV, the latter supports the first's goals of qualitative high coverage and efficiency. At least the analysis of the regarding welfare functions reveals that welfare decreases with the introduction of a citizens' insurance.

With the introduction of AMNOG, price negotiations between Federal Association of Statutory Health Insurance Funds and manufacturers of innovative drugs are introduced involving at least the PKV. Drug price convergence between PKV and GKV is a consequence. Further discount agreements between individual funds and manufacturers are possible. Considering the results of our analysis these individual discount agreements are vital for reaching the GKV's goals of qualitative high coverage and the efficiency principle. The possible individual discount agreements had not been sufficient from the PKV's point of view. From the GKV member's point of view, the importance of individual discount agreements should be enhanced, if the PKV's disability to negotiate individual discounts continues.

7. Conclusion

Access to health care, the efficiency principle and treatments of high quality are goals of the German Statutory Health Insurance. The existing German health care system consists of the statutory health insurance and private health insurance; these parts converge more and more. The legal framework puts pressure on this convergence to citizens' insurance. With our game theoretic approach we have shown that especially members of the statutory health insurance suffer from the introduction of citizens insurance via decreasing drug quality and increasing prices. Those insured by private health care also suffer from decreasing drug quality but benefit from decreasing drug prices.

The introduction of AMNOG results in price negotiations for innovative drugs between manufacturers and the Federal Association of Health Insurance Funds involving the PKV. Afterwards, individual discount agreements between manufacturers and funds are possible. According to this procedure, price discrimination is less likely and the PKV member's drug prices should decline. Based on the findings with citizens insurance, we assume a decreasing drug quality resulting from AMNOG. The innovative drug quality's decrease is substantially dependent on the possibility of price discrimination resulting from the individual discount agreements. The statutory health insurance would profit from the private health insurance's inability to negotiate sufficient discounts. This disability would also induce a lower reduction of drug quality.

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Note

Note 1. It is stated in (11a) that $\gamma_i^{\min}$ has to be slightly above zero in the case of γ_i^D.

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Economic Growth, Regional Savings and FDI in Sub-Saharan Africa: Trivariate Causality and Error Correction Modeling Approach

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Abstract

Empirical studies examining the dynamic causal relationship between key macroeconomic variables using varied forms of bivariate causality methodology abound in the macroeconomic and finance literature. Causal inference based on such bivariate causality approach however, has been criticized for its inherent likelihood to draw causal inference or attribute causation to variables in scenarios where an omitted variable might have a better claim; Lutkephol (1982), Umberto Triacca (1998). This study is modeled to reduce this inherent weakness by employing trivariate causality methodology through error correction approach. Using aggregate data on Sub-Sahara Africa spanning the period 1977 to 2010, this study finds joint uni-directional causal relationship running from FDI and Gross Regional Savings growth to regional GDP growth. Empirical results further document additional uni-directional joint causal relationship stemming from GDP growth and Gross Regional Savings to growth in FDI inflow into the sub-region.

Keywords: trivariate causality test, FDI, GDP growth, Error Correction Model, Sub-Saharan Africa

JEL Classification: O40, O55, C01, C87.

1. Introduction

The dynamic relationship between foreign direct investment (FDI) and economic growth among developing economies and regional economic blocks such as Sub-Saharan Africa (SSA), continue to receive significant empirical attention in the ever growing literature focusing on economic growth. A review of the literature show that most studies focusing on the FDI-GDP growth nexus, especially those centering on less developed economies, tend to concentrate on three main traditional benefits often attributed to FDI inflow. These traditional benefits centers on: 1) additional capital infusion into recipient economies, 2) the potential to generate auxiliary small scale domestic firms whose operations complements major firms and industries resulting directly from FDI, and, 3) the ultimate impact of FDI on domestic or regional economic growth. Empirical evidence (to be reviewed shortly) so far, overwhelmingly supports integral role of these FDI induced benefits on GDP growth in most economies in sub-Saharan Africa. The evidence show that, with limited regionally generated investment capital and technological knowhow, coupled with weak institutional structures to spur and self-sustain regional growth, economic blocks such as SSA have come to depend significantly on the volume of FDI inflow for economic growth. This reliance on FDI as the main catalyst for growth for most economies in the sub-region has been persistent over the years due to legion of socio-economic and geo-political factors; prominent among these being the region's deficit in growth augmenting technologies and access to capital. Recent regional growth data published by the United Nations Conference on Trade and Development (UNCTAD) for instance, show that the sub-region's dependence on external financial capital infusion and technological know-how continue to experience substantial growth despite inroads made in harnessing regional resources for growth. Key macroeconomic indicators further suggest that FDI inflow into the sub-region has gone through a transitional period; from an earlier phase of raw material extraction oriented form of FDI, to the present phase where the sub-region is now able to attract huge capital inflows into areas beyond the traditional phase which focused on raw material extraction. Available data show that significant portion of FDI inflows into the sub-region in recent years are channeled into production of finished goods for export and regional consumption, as well as investment in the services sectors of the various economies (e.g. banking services, wholesaling and retailing etc.). Regional macroeconomic data further show that significant percentage FDI inflow into the sub-region in recent years has come from emerging Asian economies such as China and India with former trading partners such as the United

Kingdom playing a limited role. There is thus, enough data evidence in support of the view that appreciable growth conditions in the sub-region in recent years could be attributed in part, to increased volume of FDI inflow into the sub-region.

This growing interest in the sub-region from both developed and emerging economies around the world, coupled with designed policies aimed at attracting such external investments from most economies in the sub-region, has to a greater extent led to over-reliance on FDI as the press button for sustained growth SSA. GDP growth in the sub-region now depends heavily on the volume of FDI and FDI related activities. For instance, for most oil producing economies such as Nigeria, Ghana etc, GDP growth rates have come to depend extensively on FDI related operations in the energy (oil production) sector of the economy. Available data for instance show that proportion of FDI as a percentage of regional GDP growth for most economies in the sub-region continues to soar even as the sub-region as a whole struggles to find its place in the ever changing global market economy. Most private sector investments (considered as the engine for economic growth) found in the sub-region are dominated by auxiliaries of multinational firms or foreign private investments in partnership with local firms. Activities of these firms are mostly oriented to take advantage of the region's natural resources for export or to supply parent companies in developed economies. The case of Cadbury Company Limited, UK, and its investments in cocoa producing economies in the sub-region are examples of this form of FDI orientation. Growing importance of FDI to regional economic growth is also readily evident from the legion of regional macroeconomic economic policies geared towards attracting such investments into the region; most economies in the sub-region for instance, are involve in vigorous campaign aimed promoting extensive incentive laden FDI oriented policies designed to attract additional investments to complement domestic productivity. Programs such as free already developed industrial zones, tax holidays for specified operational period, accommodating profit repatriation laws etc. are some of the policy initiatives specifically designed to attract FDI into the sub-region.

Although existing literature provide verified evidence in support of the positive role of FDI in economic growth among developing economies and regional economic blocks such as SSA, critical review of the literature further suggests the extraordinary role often attributed to FDI in the economic growth process might be overstated. This study also hinges on the view that the role of FDI in domestic or regional growth may be limited compared to what most bivariate causality analysis tend to suggest. This study further projects that effects of FDI on economic growth may not be automatic as often portrayed existing empirical work, in that, such effects are often contingent on other socio-economic and geo-political factors. For instance, strands of dissenting literature exist to the effect that FDI alone cannot be the panacea for constrained growth in in most developing economies such as those in SSA. Empirical evidence (to be reviewed in subsequent sections) further suggest that FDI inflow is only a necessary condition for regional growth; since it's impacts on economic growth depend significantly on other core growth augmenting regional socio-economic factors. Regional benefits such as substantial infrastructure development, infusion of hitherto unavailable technologies and capital, and potential employment growth for host economies associated with FDI are not in dispute; however, this study is among limited studies in the evolving FDI-Economic Growth literature questioning the singular role often accorded to FDI in the economic growth process espercially among developing economies.

This study undoubtedly subscribe to empirically verified condition that FDI inflow is crucial for GDP growth in SSA; however, it is also of the view that FDI inflow fundamentally functions as an auxiliary condition in the economic growth process and not the core or the principal variable around which regional growth revolve. This position stems from projected condition suggesting that, given the proportion of domestic or regional investments needed to significantly impact economic growth, FDI inflow alone, devoid of thriving auxiliary regional or domestic private sector investments, might not be enough to generate required impetus for significant economic growth. Thus, FDI inflow into SSA alone might not be enough to fuel expected economic growth in the Sub-region. Consequently, FDI inflow in this study is viewed as a marginal investment flow which requires some form of regional or domestic support to significantly impact regional economic growth. What constitutes critical regional supporting factors however, differ significantly among researchers. Zhang (2001) for instance, argued in favor of institutional quality, political stability, and significant infrastructure development base. Zhang's work further showed that FDI inflow tend to promotes economic growth in economies where domestic infrastructures are well developed and trade and FDI policies are more liberal. This study however, subscribe to the view that regional savings conditions – [regionally generated financial resource crucial for creating auxiliary financial base for regional investors]- constitute a key regional factor needed to augment FDI inflow to ensure sustained investment-led regional economic growth. Gross regional savings is deemed as the needed regional supporting factor in this study because of its unique potential to foster domestic private sector investments crucial for long term economic growth.

Available literature (Note 1) on the nexus between FDI and GDP Growth show that significant number of present studies employed bivariate causality estimation approach in their effort to unravel potential dynamic causal relationship between the variables. Dominant among these bivariate causality methodologies found in the literature include bivariate Granger Causality tests formally propounded by Granger (1969), and a projected robust variant of the approach by Toda Yamamoto, Toda, H.Y. and Yamamoto T. (1995). These approaches to causal inference estimation have become prevalent among researchers partly because of their intuitive nature and simplicity. Growing popularity of these bivariate causality methodologies further highlights evolving trends in empirical methodology geared towards isolation of critical variables in a quest to ascertain potential causal relationships among core variables of interest. Unlike bivariate causality methods which dominate the literature, this study opts for trivariate causality error correction approach (multivariate approach) to verify joint causal relationships among key macroeconomic variables of interest from SSA. Trivariate causality approach adopted in this study test causal effect of two key macroeconomic variables on a specific macroeconomic variable of interest from SSA instead of causal effect of just one variable as done in a bivariate framework. The goal is to verify the presence long run joint causal relationships among key macroeconomic variables of interest for SSA via trivariate causality methodology. This approach will afford this study the opportunity to identify direction of causal relationships due to joint effects of two key variables from the sub-region instead of single variable approach which dominates the literature.

The rest of the study is structured as follows: section 2 reviews data on FDI, GDP growth and Savings growth trends in SSA. This is followed by a review of the literature focusing on the dynamic relationships between combinations of key variables employed in this study in section 3. FDI-GDP growth nexus is first review, followed by verified causal relationship between GDP growth and savings rates in that order. This section then concludes with empirical review of the relationship between FDI and growth rate in savings conditions. Sources of data and empirical methodology used in this study's empirical estimations are reviewed in section 4. Section 5 report empirical results and findings as well as conclusion and possible policy implications of verified causal relationships.

2. FDI, GDP Growth and Regional Savings Trends

2.1 FDI as a Percentage of GDP in SSA

FDI growth in SSA continues to be a key macroeconomic trend influencing socio-economic conditions in the sub-region. GDP growth conditions associated with a number of economies in the sub-region, and the region as a whole, have over the years come to revolve to some degree, around the rate and volume of FDI inflows. Available data (UNCTAD DATA) show that the rate of FDI flow into the sub-region differ markedly among individual economies due to country specific factors such as differences in resource endowment which influence the form and volume of FDI inflow and prevailing socio-political environment. This notwithstanding, the data shows aggregate growth in FDI attracted into the region as a whole has experience significant growth in the past two decades. Like most macroeconomic indicators in the region, FDI growth over the years has been fraught with periods of significant fluctuations. Figure 1 illustrates FDI growth as a percentage of GDP growth conditions for SSA; with significant positive growth trend variability. Figure 1 indicates between 1980 and later part of the 1990s, FDI as a percentage of GDP growth experienced relatively minimal but sustained growth. The early part of the year 2000 however witnessed substantial growth in FDI for the sub-region, with FDI as a percentage of GDP growth peaking around 4.5%. This sharp growth in FDI over the period however, was short-lived; the trend then declined substantially afterwards and fluctuated until another episode of growth burst was recorded between 2006 and later part of 2008. This mild growth condition persisted until the trend succumbed to the effects of the 2008 global recession evidenced by marked decline in 2009. Figure 1 illustrates FDI growth for SSA between 1977 and 2010.

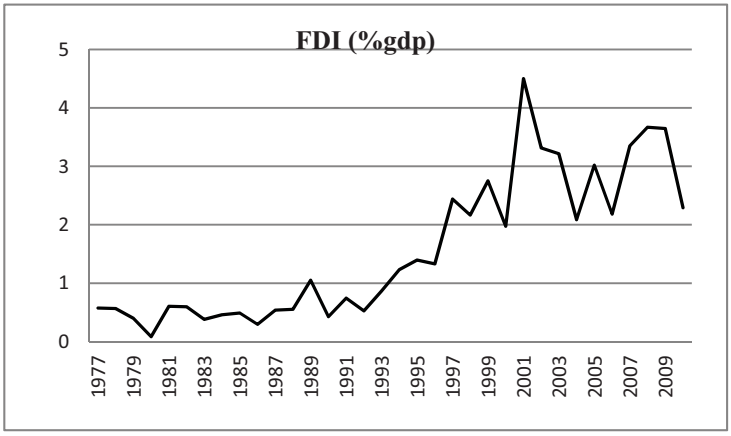

Figure 1. FDI as a percentage of GDP in SSA

Data Source: UNCTAD

2.2 Structure of GDP in SSA

GDP growth in the sub-region exhibits extreme trend variability over the period under study. Periods of significant growth are short-lived, often interrupted by substantial declining trend. Figure 2 show that between 1977 to date, the SSA region has experienced two major episodes of substantial decline in GDP growth in addition to the recent decline following the 2008 recession. The first major decline in GDP growth over the period occurred in the early part of the 1980s, and the second in the early part of the 1990s. According to available data, these two periods recorded the only conditions of negative GDP growth over the period under study for the sub-region. Apart from mostly socio-economic and political conditions which often constrain GDP growth conditions in the sub-region according to available literature, there is also some evidence that GDP growth trend in the sub-region has also been shaped to some degree by global macroeconomic conditions. For instance, the data show that sharp decline in GDP growth recorded in the later part of 2008 and early 2009 were in responds to the 2008 global financial crisis. Figure 2 charts annual regional GDP growth conditions in SSA over the study period.

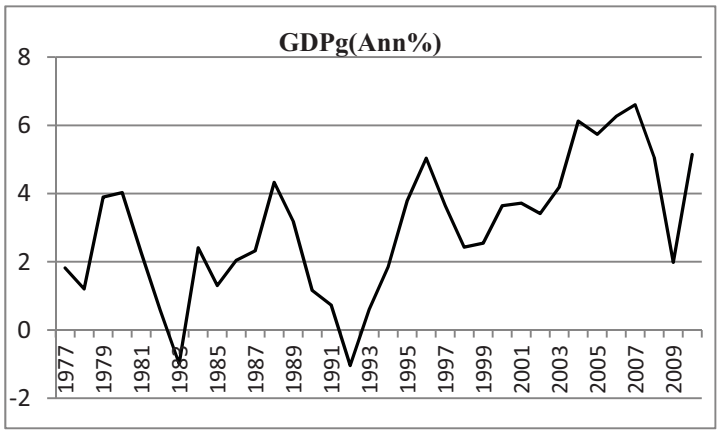

Figure 2. Annual GDP growth in SSA

Data Source: UNCTAD

2.3 Gross National Savings as a Percentage of GDP Growth in SSA

Among macroeconomic variables employed in this study, gross regional savings as a percentage of GDP growth is the only variable with fairly sustained negatively sloped growth trend. This condition suggest that, over the period under study, gross national savings as a percentage of GDP for SSA witnessed persistent decline despite fairly sustained growth in FDI and appreciable GDP growth among most economies in the sub-region. From a peak of about 24% of GDP growth in the late 1970s, regional savings have declined persistently; and now hovers

around 16% of GDP growth on the average. Although this decline in gross regional savings over the period is not as drastic as variability associated with other key indicators such as regional GDP growth, it suggest a diverging trend between FDI growth and savings rate in the sub-region over the past decades. Figure 3 captures historical trend in regional gross savings as a percentage of GDP growth between 1977 and 2010.

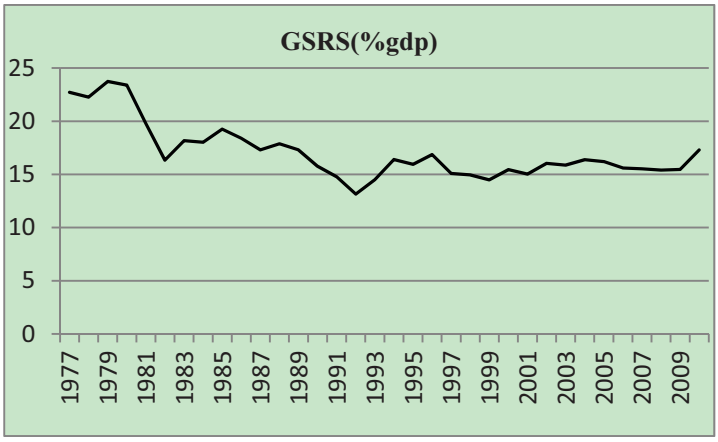

Figure 3. Gross National Savings as a percentage of GDP growth in SSA

Data Source: UNCTAD

3. Empirical Literature: FDI, GDP Growth and Domestic Savings Rate

3.1 FDI and GDP Growth

Empirical literature focusing on the FDI-GDP growth nexus is quite extensive; and captures conditions prevailing in both developing and developed economies around the world. Reviewed evidence suggests evolving trends in globalization, and the effects of the phenomenon on recent FDI flows continue to drive the quest to understand the dynamic relationship between key macroeconomic variables and FDI flows around the world. Using co-integration and an error-correction framework, Chakraborty and Basu (2002) for instance, examined the relationship between FDI and economic growth in India; contrary to most empirical findings in existing literature, this study found uni-directional causal relationship with direction of causality running from GDP growth to FDI growth with no feedback effect. Hsiao and Shen (2003) further documented bi-directional causal relationship between FDI and growth in China; an indication of feedback effect relationship between FDI and GDP. Additionally, in a study focusing on 23 developing economies around the world, Basu, Chakraborty and Reagle (2003) also found bi-directional causal relationship between FDI and GDP growth in more open economies, and a uni-directional causal relationship running from GDP growth to FDI in more closed economies. Trevino and Upadhyaya (2003) further documented comparable results in a study of five developing economies in Asia; the study showed that FDI tend to have significant positive influence on economic growth in more open economies - further supporting causal relationship stemming from FDI to GDP growth among open economies. Additionally, in a study verifying the dynamic relationship between FDI and economic growth in Indonesia, Thailand, Philippines and Malaysia, Marwah and Tavakoli (2004) also found evidence in support of positive correlation between FDI and economic growth for all the economies studied.

Li and Liu (2005) who studied endogenous relationship between FDI and economic growth using a panel of 84 countries over the period 1970-1999; additionally concluded that FDI has positive impact on economic growth. Li and Liu (2005) further pointed out that this verified positive relationship is significantly moderated by human capital availability in the various developing economies studied. In the same study however, the researchers also found negative relationship between FDI and economic growth in the presence of significant technology gap. Choe (2003) adopted panel vector auto regressive model to evaluate the relationship between FDI and economic growth in eight countries over the period 1971 and 1995; Choe's work also documented evidence of bi-directional causal relationship between FDI and economic growth; with relatively stronger causal effects emanating from economic growth to FDI rather than the reverse condition. Alfaro et al (2002) additionally argued that effect of FDI on economic growth depends to some extent, on the degree of domestic financial sector development; and submitted that economies with well-developed financial markets tend to gain significantly

from FDI inflows than those with underdeveloped financial markets. In a special case focusing on the same nexus among Latin American economies, Bengoa et al. (2003) also verified this nature of relationship using a panel of eighteen Latin American countries. This study again overwhelmingly supported prevailing empirical evidence suggesting that FDI has significant positive impact on economic growth; this positive relationship was verified among all economies in the study.

However, these conclusive empirical findings notwithstanding, there also exist significant strands of existing literature suggesting that FDI inflow alone has minor, weak or no significant effect on economic growth. Segments of existing literature further contend that FDI's impact on economic growth is conditional or depends on other auxiliary domestic/regional factors or enabling conditions. For instance, Campos and Kinoshita (2002) showed that FDI inflows will have positive and significant effect on economic growth only if it is in the form of pure technology transfer which has the potential to impact other key sectors of the economy. Similarly, utilizing General Method of Moment approach in a similar FDI-economic growth nexus study, Carkovic and Levine (2005) submitted that FDI inflows do not exert influence on economic growth directly, nor through its effect on human capital as has been suggested in some studies; this conclusion was based on the fact that, most studies reporting positive causal relationship between FDI and economic growth often fails to control for simultaneity bias and country-specific effects in their analysis. Additionally, studies such as Akinlo (2004) and Aynwale (2007) have found FDI to have insignificant effect on economic growth all things being equal. Hermes and Lensink (2003) and Sylwester (2005) even suggest that FDI tend to have negative effects on host economies under certain conditions.

3.2 GDP Growth and Domestic/Regional Savings

Empirical submissions on the causal relationship between GDP growth and regional or domestic Savings rate differ significantly among researchers; however, the view that some form of causal relationship exists between the two variables is largely supported by the literature. A review of existing studies however show that most findings reported are in conflict with projections of the Solow growth framework; a well referenced growth economic model which suggest that domestic savings rate temporary causes growth in the level of output per capita; a condition which imply savings rate growth precedes economic growth all things being equal. For instance, Christopher et al. (1994) who examined the association between saving rate and economic growth using a sample of 64 economies concluded that economic growth autoregressively predicts future saving rates, without feedback effects. In other words, this study found conclusive evidence in support of the condition that economic growth precedes domestic savings rates contrary to reverse condition suggested by the Solow growth framework. Again, focusing on the savings rate-economic growth nexus in Latin America, Gavin et al. (1997), further showed that sustained economic growth precedes higher savings rather than the reverse condition; another conclusion suggesting causality running from economic growth to savings rate with no feedback effect. Similarly, Sinha and Sinha (1998), and Agarwal (2001) also confirmed that economic growth precedes and Granger cause higher savings rate all things being equal. In an estimation focusing on a similar causal relationship in the case of Nigeria, Nurudeen Abu (2010) also submitted that economic growth Granger cause savings growth in the Nigerian economy; further supporting evolving view that economic growth precedes or Granger cause growth in domestic savings.

In a related study examining the long-run relationship between real gross domestic product and real gross domestic savings in Morocco and Tunisia, Bassam AbuAl-Foul (2010), found bi-directional causal relationships between the variables in the case of Morocco. The study however, found uni-directional Granger causality between real gross domestic product and real gross domestic savings for the Tunisian economy- with direction of causality running from savings rate to economic growth. Sajid and Sarfraz (2008) who investigated causal relationship between savings and output growth in Pakistan using co-integration and vector error correction techniques further supported significant bi-directional long run causal relationship between domestic savings and output growth. In another study which focused on verifying similar relationship among seven African economies, Anoruo and Ahmad (2001) also submitted that economic growth Granger cause growth rate in domestic savings for all the countries treated in the study with the exception of Congo. Narayan and Narayan (2006), additionally provided evidence in support of the fact that that GDP growth stimulates savings growth in Fijian economy – thus further supporting uni-directional causal relationship all things being equal. These empirical findings suggest that the exact direction of causal relationship between these two macroeconomic indicators deviates somehow from earlier projections.

3.3 FDI and Domestic Savings

FDI inflows have also been credited with significant positive impact on regional/domestic savings among

developing and emerging economies. This study projects that the dynamic relationship between FDI and domestic savings will depend on how FDI impacts regional GDP growth. In other words, effect of FDI on savings rate is projected to be channeled through GDP growth all things being equal. This projection presumes that any verified causal relationship between the two variables might stem from FDI inflows to domestic savings and not the reverse condition. Bashier and Bataineh (2007) investigated this dynamic relationship, FDI-savings nexus, and showed that the variables are co-integrated or has a long run relationship; the study further submitted that FDI significantly complement national savings; suggesting some form of positive causal relationship stemming from FDI to national savings. In another study focusing on a similar relationship in the case of Pakistan, Shahbaz et al. (2008) also showed that foreign direct investment and domestic savings are complementary; augmenting each other in a dynamic relationship pertaining to growth. Additionally, in a relatively recent study, Salahuddin, Shahbaz, Irfan Chani (2010) also confirmed bi-directional causal relationship between foreign direct investment and gross domestic savings in Bangladesh using Johansen cointegration and error correction techniques; the study further showed that, causal influence between the variables tend to be stronger from domestic savings to foreign direct investment than the reverse condition.

3.4 Data and Test Variables

This study employs aggregate data for SSA between the period 1977 and 2010. Key data variables used in this study are GDP growth, FDI growth and Gross Regional Savings rate. Gross regional savings is chosen over regional investment growth in a trivariate framework due to difficulty in isolating absolute regional investments from component strictly due to FDI inflow from available data. These data points have been sourced from the International Monetary Fund (IMF) data base and United Nations Conference on Trade and Development data base **(**UNCTAD) respectively.

4. Empirical Methodology

4.1 Empirical Model and Stationarity Test

This study recognizes that in a dynamic macroeconomic economic environment, a number of factors are often responsible in explaining observed variability in a macroeconomic variable or indicator. However, trivariate causality test approach adopted in this study presumes that variability in a specific macroeconomic variable of interest could be explained to some degree by happenings of two critical (related/unrelated) variables instead of one key variable of interest often used in bivariate causality analysis; consequently three equations modeling trivariate causal relationship approach are stated after pre-estimation data analysis. Stationary conditions of individual time series variables in this study are tested using unit root testing methodology proposed by Phillips P.C.B and P. Perron (1988). Equation 1 models unit roots test approach and table 1 report results from pperron estimation procedure using Stata Statistical software package. Initial unit root test using specific lag order and related first difference results are reported. Results reported in table 1 show that, using specific lag order determined by Akaike Information Criterion (AIC) and Bayes-Schwartz Information Criterion (BSIC) procedures, the null hypothesis of unit root cannot be rejected for the three variables tested; the first difference of the three variables however, are stationary. Unit root tests for individual variables are modeled as follows:

$$\Delta y_t = \beta' \Pi_t + \pi y_{t-1} + u_t \quad (1)$$

Where u_t is *I(0)* and may be heteroskedastic. Philips Perron tests modeled in equation 1 corrects for serial correlation and heteroskedasticity in the errors (u_t) of regressions by directly modifying associated test statistics. Table 1 reports results of Philips-Perron Unit root test for study variables.

Table 1. Unit Root Test: *Phillips-Perron Test for Unit Roots*

Variables	Pperron-Stats	Lag	Results	First Difference	Pperron-Stats	Results
FDI(%GDP)	- 4.678	2	I(1)	ΔFDI(%GDP)	-49.083	1(0)
GDP	-11.382	2	I(1)	ΔGDP	-32.121	1(0)
GRS(%GDP)	- 6.360	2	I(1)	ΔGRS(%GDP)	-28.378	1(0)

Significant at 1% Critical Values.

Pperron statistics reported in table 1 are based on a lag order of 2 selected by AIC and BSIC respectively; first part of the result indicates the three variables are not stationary. First difference of the variables however, was found to be stationary. Non-stationary condition found in the first test show the variables satisfy the first

condition in a test for long run relationship using co-integration procedure. Co-integration methodology in this context tests the assumption that, although variables in the study exhibit non-stationary individual trends, such trends might not be a 'random walk'; in that, a combination of the variables may have long run relationships. In this co-integration estimation using error correction framework, (approach adopted in this study) if time series data for the three variables are found to share equilibrium relationship with an error correction mechanism, then the stochastic trends of the time series data will correlate with one another- thus, implying co-integration or long run relationship.

4.2 Trivariate Causality Test – An Error Correction Approach

As alluded to earlier, significant number of empirical studies verifying the nexus between combinations of any the three variables employed in this study (as evidenced in the literature review) is based on bivariate causality framework. Although this framework continue to be an effective tool in verifying causal relationships between key variables of interest, empirical evidence also suggest that the approach has inherent flaw in how it identifies the source or direction of causal influence between variables. For instance, the approach has been criticized for its narrow focus on only a source or variable as the causal agent of an occurrence or changes in another variable. Critics suggest that in an environment devoid of potential causal agents or variables, bivariate framework might erroneously attribute causation to the only known agent or variable in treatment. Granger (1969) and Lutkephol (1982) for instance, suggested a highly plausible scenario where an omitted variable could be responsible for a verified causal relationship between two variables of interest in a bivariate framework. In other words, their work allowed for the chance that an omitted variable or one outside the test environment could be responsible for verified causal relationship between two treatment variables. Umberto Triacca (1998) additionally offered empirical evidence on how omitted variables could have a better claim in a higher-order system causality analysis than a purported causal agent or variable in treatment. Critics of bivariate causality approach further point out that if omitted variables in a treatment correlates with variables included in a test, bivariate approach may attribute causation to a variable included in a treatment or test when in fact an omitted variable which correlates with the variable in treatment may be responsible or have a better claim as the causal agent. For instance, if variable δ is known to correlates with variable μ, and it could further be shown that variable μ granger cause changes in variable Ω in a hypothesized bivariate causality framework; critics then argue that, the omitted variable in this scenario, δ could have a better claim as the causal agent instead of variable μ. This position is based on the view that bivariate approach in this example might have erroneously attributed causality to variable μ because of its association with variable δ or just because variable δ happen to be omitted from the test. To minimize this possibility, this study estimates joint influence of two macroeconomic variables on a macroeconomic variable of interest in a trivariate causality framework. Trivariate or multivariate causal analysis has been suggested as a means to reduce the chance of erroneously attributing causality to test variables in cases when other variables could have a better claim. Lutkephol (1982) for instance, suggested that multivariate system having more than two variables may be more useful in causality analysis than a bivariate framework. Trivariate causality model using error correction approach is consequently modeled as follows:

$$\Delta GDPg_t = c_1 + \sum_{j=1}^{p-1} \beta_t \Delta GDPg_{t-i} + \sum_{j=1}^{p-1} \gamma_t \Delta FDIg_{t-i} + \sum_{j=1}^{p-1} \psi_t \Delta GRSg_{t-i} + \omega EC_{t-i} + u_1 \quad (2)$$

$$\Delta FDIg_t = k_1 + \sum_{j=1}^{p-1} \delta_t \Delta FDIgv_{t-i} + \sum_{j=1}^{p-1} \lambda_t \Delta GDPg_{t-i} + \sum_{j=1}^{p-1} \eta_t \Delta GRSg_{t-i} + \omega EC_{t-i} + e_1 \quad (3)$$

$$\Delta GRSg_t = j_1 + \sum_{j=1}^{p-1} \alpha_t \Delta GRSg_{t-i} + \sum_{j=1}^{p-1} \rho_t \Delta GDPg_{t-i} + \sum_{j=1}^{p-1} \sigma_t \Delta FDIg_{t-i} + \omega EC_{t-i} + \varepsilon_1 \quad (4)$$

In equations 1, 2, and 3, *GDPg, FDIg* and *GRSg* represent GDP growth, FDI growth and Gross Regional Saving rate in Sub-Saharan Africa respectively. *EC* is the error correction term and u_1, e_1 *and* ε_1 are errors terms for individual equations. Equation 1, 2 and 3 models joint causal effects of two macroeconomic variables on specific variable of interest in a trivariate causality framework. Equation 1 for instance, hypothesize that gross regional savings and FDI growth jointly granger cause GDP growth in SSA if: H_0: $\gamma t = \psi t = 0$ is rejected. Equations 2 and 3 follow similar procedures and are modeled in the following section.

To test associated hypothesis of trivariate causal relationships based on equations 1, 2 and 3, let ***Y*** represent GDPg, ***F*** for *FDIg* and ***S*** for *GRSg* respectively. Using these notations this study tests the following trivariate causal relationships:

(a) ***F*** and ***S*** jointly Granger cause ***Y*** if the null hypothesis of $\gamma_t = \psi_t = 0$ is rejected.

(b) ***Y*** and ***S*** jointly Granger cause ***F*** if the null hypothesis of $\lambda_t = \eta_t = 0$ is rejected.

(c) ***Y*** and ***F*** jointly Granger cause ***S*** if the null hypothesis of $\rho_t = \sigma_t = 0$ is rejected

(d) Feedback effects exist if hypothesis (a), (b), and (c) are shown to hold simultaneously

5. Empirical Results

Table 2 .Trivariate Causality Results (Error Correction Approach)

Independent Variables	Dependent Variables		
	GDPg	*FDIg*	*GRSg*
GDPg	-	0.2575	-0.4868
	-	(0.080)**	(0.156)**
FDIg	0.6047	-	0.3890
	(0.222)*	-	(0.375)
GRSg	0.5272	-1.2182	-
	(0.195)*	(0.705)*	-
EC_t	-0.8460*	-0.4543*	0.7404

Standard errors in parenthesis, *Denote level of significant

Reported results in table 2 indicate two out of three error correction terms (EC_t) are significant. The first error correction term which test for co-integrating equation with gross domestic product (GDPg) as the dependent variable is significant; a condition which suggest existence of long run joint causal relationship emanating from foreign direct investment and gross regional savings to economic growth in SSA. The condition further highlights short run causal relationships between *FDIg* and *GDPg,* and *GRSg* and *GDPg* respectively; with causal influence stemming from *FDIg* and *GRSg* respectively. Additionally, the coefficient of error correction term with foreign direct investments (FDIg) as the dependent variable is also statistically significant, further suggesting existence of joint long run causal relationship running from economic growth and gross regional savings to foreign direct investments. This outcome also implies another short-run uni-directional causal relationship between *GDPg* and *FDIg,* and *GRSg* and *FDIg,* with the direction of causality running from *GDPg* and *GRSg* respectively. The error correction term estimating trivariate joint causal relationship with GRSg as the dependent variable is however found to be insignificant; an outcome which suggesting failure to verify this specific joint causal relationship. Table 3 further present results of hypothesis tests verifying similar joint causal relationships among the three macroeconomic indicators in this study; this hypothesis tests are meant to further verify conclusions already reported in table 2.

Table 3. Hypothesis Testing for Joint Causal Relationships

Null Hypothesis (H_0)	Test Stat (F)	Causal Inference
FDIg and GRSg do not jointly Granger cause variability in GDPg	4.79**	Reject H_0
GDPg and GRSg do not jointly Granger cause variability in FDIg	7.22**	Reject H_0
GDPg AND FDIg do not jointly Granger cause variability in GRSg	0.43	Failed to Reject

**significant at 5% level

Table 3 report results of trivariate causality hypothesis test. Test results in this instance are consistent with test results reported in table 2. For instance, table 3 also show that the null hypothesis of no joint causal relationship stemming from *FDIg* and *GRSg* to *GDPg* is rejected; implying significant joint causal relationship running from *FDIg* and *GRSg* to *GDPg.* Similar outcome is further found in the case of joint causal relationship stemming from *GDPg* and *GRSg* to *FDIg*; further supporting the second case reported in table 2. This result also shows significant rejection of the null hypothesis of no joint causal relationship emanating from *GDPg* and *GRSg* to

FDIg. Reported test results in table 3 however, failed to find significant evidence in support of a joint causal relationship stemming from *GDPg* and *FDIg* to *GRSg*; another condition consistent with findings reported in table 2. Test results in this case failed to reject the null hypothesis of no joint causal relationship. These results provide significant empirical evidence in support of augmenting role played by regional savings in FDI-led growth in SSA. Altogether, these findings support initial projections that effects of FDI inflow on economic growth in SSA is significantly influenced by or depend on other key macroeconomic variables or conditions.

6. Concluding Remarks and Policy Implications

This study verified joint causal relationships between selected macroeconomic variables and specific macroeconomic indicators for SSA using a trivariate causality error correction approach. Empirical findings suggest that FDI and gross regional savings in SSA, jointly Granger cause GDP growth all things being equal. In other words, FDI and gross regional savings jointly explains to some degree, GDP growth dynamics in the sub-region. This outcome supports the view that there is a regional/domestic dimension to the extent to which FDI inflow impacts regional economic growth. The outcome further suggest that, policies geared towards promoting sustainable regional economic growth should not be oriented solely towards attracting FDI as most economies in the sub-region are known for; such policies should also incorporate a means of mobilizing regional savings to support local investments to augment economic boost generated by FDI inflow. This study further finds that all things being equal, economic growth and regional savings rate jointly Granger cause FDI growth in SSA. This result further suggests that foreign direct investments into SSA to some extent depend on regional economic growth dynamics and savings conditions. This finding shows regional/domestic macroeconomic conditions play significant role in attracting foreign direct investments into the sub-region. These results ultimately call for recalibration of existing regional macroeconomic policies which are often structured purposely and solely to attract FDI with little emphasis on improving regional/domestic macroeconomic conditions. Such restructured policies which take into consideration the role of regional macroeconomic performance will help the sub-region nurture long term growth defined by regional performance indicators with FDI inflow serving as auxiliary condition.

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Note

Note 1. Details to be reviewed in section 3

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Market Share and Cash Policy: Evidence from Western European Companies

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Abstract

This study analyses the impact of market share on corporate cash policy in a static as well as a dynamic framework. Using a panel data set of large firms in 14 European countries, we show that firms with high market share tend to have lower cash holdings. This relationship between market share and cash policy is most apparent when predation risk, measured using either the similarity of a firm's technology with its industry rivals or market concentration, is high. These findings are robust for different estimation methods, different variables definitions, and for controlling for possible endogeneity between cash holdings and market share.

Keywords: competition, corporate finance, financing policy, market structure, cash holdings

JEL classification: D43, G31, G32, L11

1. Introduction

Recent studies show that corporations hold significant amounts of cash in Europe (Ferreira & Vilela, 2004) as well as in the United States (Bates, Kahle, & Stulz, 2009). The literature puts forward several motives that could explain the level of cash holdings. First, the transaction motive posits that firms can save on transaction costs by using cash reserves to make payments instead of having to liquidate assets. A second explanation for cash holdings by firms is based on the agency perspective. Managers have a preference for cash because it reduces firm risk and increases their discretion. Despite some empirical evidence supporting the transaction and agency motives for holding cash, the recent increase in cash holdings around the world has mostly been attributed to a hedging or precautionary motive (e.g., Bates et al., 2009). Firms tend to hedge against a possible shortfall of financial resources in the future by maintaining a cash buffer. Moreover, an important driver of these hedging needs has been shown to be an increase in industry competitiveness (e.g., Morellec & Nikolov, 2008; Gaspar & Massa, 2006). Since firms want to avoid underinvestment, increased competitive risk results in an increase in cash holdings for hedging purposes (Opler et al., 1999; Mikkelson & Partch, 2003; Frésard, 2010). Elaborating on this latter issue, a recent strand of literature highlights the link between corporate cash holdings -as a hedging tool against competition- and product market dynamics. Research shows that firms tend to hold more cash when they are exposed to more intensive product market competition (Haushalter, Klasa, & Maxwell, 2007; Morellec & Nikolov, 2008). Firms take into account the risk that rivals may prey on them, which in turn leads to a positive relationship between cash balances and predation risk within an industry. Next to this impact of product market dynamics on optimal cash levels, it has also been shown that cash policy itself can significantly influence competitive outcomes. Frésard (2010) for example, shows that cash rich firms outperform their more financially

fragile rivals. Although the empirical evidence supports the notion that holding cash is beneficial for the firm, the implications of this hedging motive for the design of a firms' cash policy is much less understood.

Preceding studies do not take into account that the competitive pressure that a firm is subjected to, depends upon its position in its industry, i.e. its market share. In this study, we evaluate how the predation risk in an industry can influence the relationship between a firm's market share and its cash policy. To test this, we examine the cash holdings of large European firms from 14 countries over the 1998 to 2008 period in a static as well as a dynamic framework. Our sample has the advantage that extensive yearly financial statement information is available for listed as well as non listed firms, so that competitive measures can be calculated on a yearly basis including these non listed firms (Note 1). We find that corporate cash holdings are related to market share and predatory risk. Specifically, our results show that a firm is more likely to hold cash reserves when its market share is low. Furthermore, we find that the association between market share and cash holdings is most important when the risk of predation is high. This predatory risk can be proxied using firm specific measures, as the interdependence of firms' investment opportunities with rivals, or industry specific measures, as market concentration. Our results hold after controlling for profitability, size, growth, leverage and several other cash determinants, and after controlling for possible endogeneity between cash holdings and the explanatory variables.

Our study contributes to the literature is three distinct ways. First, by focusing on the impact of a firm's market share on its cash policy, we explore a new direction in the causal relationship between product market behavior and financing policy. The findings of Frésard (2010) that cash rich firms are able to increase market share at the cost of their rivals, lead to the expectation that market share itself should play an important role in a firm's optimal cash policy. Although previous studies have identified a significant impact of the market position of a firm on its capital structure decisions (e.g., Kovenock & Phillips, 1997; MacKay & Phillips, 2005; Campello, 2006), the impact on cash holdings is far less understood. Second, by showing that market share does in fact not only influence cash policy but that this influence depends upon the competitive environment (i.e., predatory risk), this study contributes to our understanding of the cash-competition dynamics. Similarly, our study also complements the work of Akdogu and Mackay (2008) who establish a link between the predatory risk caused by industry competitiveness and strategic investment behavior. Finally, this paper adds to studies like Haushalter et al. (2007) by showing that firms not only take into account the competitive intensity of their industry or the similarity of their technology but also their competitive position relative to rivals within this industry (i.e., market share), when they select their optimal cash position.

The next section provides a brief review of prior literature on the determinants of corporate cash holdings as well as an overview of prior findings on the relationship between product market competition and corporate liquidity. Section 3 outlines the empirical methodology. Section 4 describes the data while Section 5 presents and discusses the findings. The final section concludes.

2. Literature Review and Hypotheses

2.1 Cash Policy Motives

One of the classical explanations in corporate finance why firms build up liquidities, is the transaction motive. Firms retain a certain level of cash holdings in order to avoid transaction costs associated with converting a noncash financial asset into liquidities when cash outlays arise. Firms are expected to hold more cash when the cost of raising extra financing is higher (Baumol, 1952). A second motive for cash policy is related to agency costs. As argued by Jensen (1986), entrenched managers would rather retain cash than increase payouts to shareholders when the firm has poor investment opportunities (Dittmar, Mahrt-Smith, & Servaes, 2003; Pinkowitz, Stulz, & Williamson, 2006; Dittmar & Marht-Smith, 2007).

However, since the seminal work of Opler et al. (1999), many papers show the importance of a precautionary build up of cash reserves to hedge against underinvestment (Almeida, Campello, & Weisbach, 2004; Han & Qui, 2007; Bates et al., 2009; among others). A quickly growing body of research shows that important drivers of precautionary cash holdings include income uncertainty due to riskier cash flows (Riddick & Whited, 2009), financing constraints due to poor access to external capital (Han & Qui, 2007; Pal & Ferrando, 2010) or higher financing costs due to informational asymmetries between investors and managers (Almeida et al., 2004). This strand of research also suggests that firms with better investment opportunities hold more cash because adverse shocks and financial distress are more costly for them (Opler et al., 1999). Finally, Acharya, Almeida, and Campello (2007) develop a model showing that firms accumulate cash instead of reducing debt when the risk of an income shortfall is high due to low correlation between operating income and investment opportunities.

2.2 Interaction between Cash Policy, Market Share and Product Market Competition

A recent debate that has emerged from the general cash literature, concerns the relation between cash policy and product market competition. Based primarily on the hedging logic of the precautionary motive, several studies look at the impact of the competitive environment on corporate cash policy. Haushalter et al. (2007) for example, study the influence of product market dynamics on cash policy. They argue that, when deciding on their optimal amount of cash, firms take into account the risk of losing investment opportunities to rivals. Haushalter et al. (2007) show that this predation risk is positively associated with the level of cash holdings. Using similar arguments, Morellec and Nikolov (2008) suggest that the recent findings of Bates et al. (2009) that US firms hold more cash than they used to, can be partly attributed to a rise in industry competitiveness over the last decade. In a similar vein, Gaspar and Massa (2006) investigate the link between the competitive environment and stock market performance, and attribute the rise in idiosyncratic volatility of stocks to the increase in industry competitiveness. Consistent with the relation between cash holdings and income uncertainty induced by increasing product market competition, Frésard (2010) provides evidence that a cash buffer protects firms against predator behavior of competitors while allowing them to better survive exogenous shocks in the product market. Finally, Bolton and Scharfstein (1990) argue that the ability to finance investments with internally generated funds is a key to success in the product markets.

Although cash holdings offer firms protection against predation by rivals as well as the opportunity to prey upon rivals themselves, preceding evidence raises the question whether firms that have a large market share should be less concerned about predation and therefore reduce their cash savings. The hedging logic from the literature discussed above suggests that this would indeed be the case in an equilibrium setting. Hay and Liu (1997) show that within an industry, market share increases with firm efficiency. The theoretical foundation of the hypothesis that market dominance is driven by higher efficiency that generates greater profitability can be found in the industrial organization literature (e.g., Demsetz, 1974; Schmalensee, 1989). As a result, firms with an important market share are less likely to invite predation, as forcing an efficient competitor out of the market is likely to be excessively costly. Furthermore, Bolton and Scharfstein (1990) argue that rivals prey more aggressively on more vulnerable firms. In sum, because they are better placed to fend off predatory attacks, the more dominant firms in an industry should be less concerned about inducing predation than the non-dominant firms. This leads to our main hypothesis:

Hypothesis 1: Firms with higher market share hold less cash.

If market share is helpful in shielding a firm from predation, it should have more impact on cash holdings in industries where predation risk is high. For in such a situation, firms experience a need to hedge against this risk by increasing cash holdings. However if a firm can better shield itself against predators as its market share increases, its need for more cash holdings diminishes, ceteris paribus. Froot, Scharfstein, and Stein (1993) and Haushalter et al. (2007) argue that a firm's exposure to predation risk depends on the interdependence of its investment opportunities with product market rivals. This leads to our second testable hypothesis:

Hypothesis 2: The relationship between market share and cash holdings is stronger when interdependence of investment opportunities between rivals is high

Next to the interdependence of investment opportunities, also industry characteristics can influence rival to rival behavior. Haushalter et al. (2007) argue that as market concentration increases within an industry, predation risk increases. Supporting this notion, Akdogu and MacKay (2008) show that competition forces firms to invest more quickly as competitors may take away the investment option. However, Akdogu and MacKay (2008) also show that strategic corporate investment aimed at deterrence, pre-emption, or predation is highest in oligopolistic industries. In perfectly competitive markets, predator behavior is unlikely to be effective because prices are equal to marginal costs and there is no gain from destroying one rival in a market with many players. In monopolistic markets, predator behavior is unlikely to happen because of collusion. Therefore, if market share shields a company from predation risk, its impact on cash policy should be most important in moderately concentrated industries where predation risk is substantial (Kovenock & Phillips, 1997; Zingales, 1998). Preceding arguments suggest our final hypothesis:

Hypothesis 3: The relationship between market share and cash holdings is stronger in moderately concentrated industries as compared to industries where concentration is either very low or very high.

3. Empirical Framework

We test our hypotheses concerning the impact of market share on cash holdings in a static as well as a dynamic framework using panel data. The panel data setting makes it possible to test the role of the cash policy

determinants while controlling for firm specific heterogeneity. It also enables to elaborate the static framework and determine whether changes in the firms' cash ratios follow a partial adjustment model. This dynamic setting assumes that firms pursue a target level when making their cash holdings decision. This way, the levels of cash at any time are also explained by the decisions taken in previous periods. As discussed below, this approach has therefore the additional advantage that we can control for possible reverse causality between cash holdings and the explanatory variables.

3.1 Traditional Determinants of Cash Holdings

In the static framework, we estimate fixed effect models of the relationship between cash holdings and market share. Similarly to other studies like Ozkan and Ozkan (2004) and Garcıa-Teruel and Martınez-Solano (2008), our measure of cash holdings (CASH) is calculated as the ratio of cash and marketable securities to total assets (Note 2). The control variables in our cash models are similar to those in previous empirical studies. These determinants and their expected influence on cash holdings are briefly summarized below. An overview of all variable definitions can be found in Table 1.

Growth (GROWTH) is expected to positively affect cash levels (Opler et al., 1999; Ferreira & Vilela, 2004; Ozkan & Ozkan, 2004). Firms with more investment opportunities are likely to keep higher liquidity levels in order to limit the probability of cash shortfalls, which could jeopardize their profitable investment projects. In this study we measure growth opportunities (GROWTH) as the median industry sales growth in a particular year based on a triple digit industry classification (i.e., SIC codes).

Size (SIZE) is often found to affect cash holdings due to the economies of scale that larger firms can realize in the cash levels required to finance day-to-day operations (Opler et al., 1999). Therefore, we expect a negative relation between firm size, measured as the natural logarithm of total assets, and cash holdings.

Leverage (LEV) likely also affects a firm's cash holdings. Empirical evidence (Opler et al., 1999; Ferreira & Vilela, 2004; Ozkan & Ozkan, 2004) suggests a negative relationship between financial leverage and cash. The argument is that leverage and cash can be considered substitutes since firms can always issue debt when cash shortfalls occur. However, both Ozkan and Ozkan (2004) and Ferreira and Vilela (2004) argue that the predicted relationship between leverage and cash is ambiguous. Since high debt levels increase the probability of financial distress, high levered firms could also increase cash holdings to counter this risk. They find, however, no evidence for the positive relationship between leverage and cash holdings. Leverage is defined as the ratio of total debt to total assets.

Cash flow (CF) is also a determinant of a firm's cash holdings. Due to the hierarchy of financing sources (Myers & Majluf, 1984), firms with large cash flows are expected to keep higher cash levels, as is confirmed by Opler et al. (1999) and Ozkan and Ozkan (2004) for the US and British markets respectively, or by Ferreira and Vilela (2004), for European Monetary Union countries. We define cash flow (CF) as the ratio of EBITDA over total assets in our empirical analysis.

Other liquid assets (LIQ), apart from cash and marketable securities, are expected to reduce cash holdings, since these assets can be considered substitutes for cash. In line with Garcıa-Teruel and Martınez-Solano (2008), we define other liquid assets (LIQ) as net working capital minus cash and marketable securities divided by total assets.

Cash flow uncertainty (RISK) increases the probability of cash shortfalls, ceteris paribus (Opler et al., 1999). Hence, risky firms should increase cash holdings in order to avoid cash shortfalls. We measure RISK as the standard deviation of the cash flow ratio defined above over the last three years.

Table 1. Definitions of variables

Variable names	Definitions
Dependent variable	
Cash holdings (CASH)	Cash + Marketable securities/ Total assets
Explanatory variables	
Growth opportunities (GROWTH)	$(Ind.Sales_t - Ind.Sales_{t-1})/Ind.Sales_{t-1}$
Size (SIZE)	Ln(Total assets)
Leverage (LEV)	Total debt/ Total assets
Cash flow (CF)	Ebitda/ Total assets
Other liquid assets (LIQ)	(Net working capital - (Cash + Marketable securities))/ Total assets
Cash flow volatility (RISK)	Standard deviation of the cash flow ratio (CF) over the last three years
Market share (MSHARE1)	Company sales divided by total sales in 3 digit SIC code industry
Market schare (MSHARE2)	Company sales divided by total sales in 4 digit SIC code industry

3.2 Market Share and Predation Risk

In line with Gaspar and Massa (2006), we estimate market share (MSHARE1) as the annual sales of the firm divided by total industry sales. In order to proxy the total sales of the industry in a given year, we add up the sales of all firms with the relevant industry specification code. This gives us a time variant measure of the market share for a particular firm relative to its industry. The selection of the relevant industry specification deserves further attention. In line with Morellec and Nikolov (2008), we base our industry specification on industry codes. More specifically, we include all firms with consolidated financial statements of 14 European countries in our data set. We define industries on the basis of 3-digit European-wide SIC codes. All firms with the same industry codes are considered likely competitors. By using consolidated statements to calculate market share we reduce the risk of double counting sales due to pyramidal ownership structures. By incorporating several European countries, we also avoid possible biases by measuring market share at the country level. Especially the large firms in our dataset can be expected to compete far beyond country borders. As a robustness check however, we will also use alternative proxies of market share either by changing the industry classification to 4-digit SIC codes (MSHARE2) or by defining industries on the country level.

In order to differentiate firms and industries based on predatory risk, we use either interdependence of a firm's investment opportunities with rivals, or market concentration. Following Mackay and Phillips (2005), we proxy this interdependence by measuring the similarity of the technology used by a firm with that of its rivals. This similarity measure is the absolute value of the difference between a firm's ratio of net plant and equipment per employee and the median ratio in its industry. Analogue to Haushalter et al. (2007), we scale the absolute difference with the standard deviation of all capital-to-labor ratios in a particular industry, in order to make the similarity measure comparable across industries. Firms with smaller values of this similarity measure will be faced with higher predation risk because their technology, and thus also their investment opportunities, are more similar to rivals. In contrast to Haushalter et al. (2007), the similarity measure is not used as a continuous variable for predation risk in the cash models. As we wish to estimate the impact of predation risk on the relationship between market share and cash holdings, subsamples of firms that are very similar to their rivals (i.e., high predation risk) are compared to subsamples of firms with low similarity, based on the median value of the similarity measure.

A potential problem with the similarity measure in a multi-country empirical setting, is that it could be biased due to possible institutional differences in the capital-to-labor ratio (Dew-Becker & Gordon, 2008). Therefore, our alternative country corrected measure for similarity uses the absolute value of the residuals of an auxiliary regression where the firm specific capital-to-labor ratio is the dependent variable explained by the industry median value of this ratio and country fixed effects. The country corrected similarity measure represents the scaled distance between a firm's observed and forecasted ratio of capital-to-labor. The basis of the forecast is the company's industry while controlling for country specific effects. Again, smaller values of this measure indicate a greater similarity of a firm's technology with industry rivals and therefore more interdependence of investment opportunities.

As a second proxy for predation risk, we measure market concentration based on the same industry classification (3-digit SIC codes) used in the market share variable. Following Gaspar and Massa (2006) and Hou and Robinson (2006), market concentration is measured by the Herfindahl Hirschman Index (HHI), which is the sum

of squared market shares over all companies in an industry in a particular year. As in Haushalter et al. (2007), we expect predation risk to be higher when industry concentration increases. However, in the most concentrated (i.e., monopolistic) industries, the predation risk should drop as the probability of collusion increases (Kovenock & Phillips, 1997; Zingales, 1998; Akdogu & Mackay, 2008). For this reason we divide the total sample in three groups of market concentration based on the 33rd and 67th percentiles of the HHI variable thus creating a middle group (mid HHI) of moderately concentrated (i.e., oligopolistic) industries between low concentrated (low HHI) and highly concentrated markets (high HHI). Using the arguments leading up to our hypothesis 3, we expect the predation risk in this middle group of moderately concentrated industries to be the highest.

3.3 The Static and Dynamic Estimation Model of Cash Holdings

The static cash model frequently used in previous research implicitly assumes that firms can instantaneously adjust towards the target cash level following changes in firm-specific characteristics and/or random shocks. The dynamic framework allows for an adjustment process involving a lag in the adjustment to changes in the target cash structure (Ozkan & Ozkan, 2004). In fact, by adding a lagged cash ratio in the model, we turn the static model into a dynamic one. Hence, when we include the lagged cash ratio we estimate the following dynamic panel data specification:

$$CASH_{it} = \alpha + \delta_0 CASH_{it-1} + \delta_1 GROWTH_{it} + \delta_2 SIZE_{it} + \delta_3 LEV_{it} + \delta_4 CF_{it} + \delta_5 LIQ_{it} + \delta_6 RISK_{it} + \delta_7 MSHARE_{it} + \eta_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where η_i and λ_t represent firm-specific effects and time-effects respectively. It is assumed that firm-specific effects are unobservable but have a significant impact on cash holdings. They differ across firms but are fixed for a given firm through time. In contrast, time-effects vary through time but are the same for all firms in a given year, capturing mainly economy-wide factors that are outside the firms' control. The inclusion of the lagged cash variable has important consequences for the estimation methodology. Models can no longer be tested with fixed effect OLS estimation due to correlation between the lagged cash level and the time invariant firm specific effect. The coefficient of the lagged cash variable δ_0 can be interpreted as an inverse measure of the adjustment speed. A firm's ability to reach the target level of cash holdings in a certain year can be represented by (1- δ_0). If δ_0 equals 0, the speed of adjustment equals 1 and the firm adjusts instantaneously towards the optimal cash target level. A low speed of adjustment (i.e., δ_0 reaching 1) would indicate that modification of the cash level is very costly (see e.g., Ozkan and Ozkan (2004) and Garcia-Teruel and Martinez-Solano (2008), for an elaborate discussion of the properties of the partial adjustment model of cash holdings).

We estimate the dynamic cash model by applying GMM according to the Arellano and Bond (1991) method. The technique consists of taking the first differences of the model and then applying the generalized method of moments (GMM) using the lagged levels of the endogenous variables as instrumental variables. Taking first differences also controls for the non observable fixed firm effect (η_i). The consistency of estimates is obviously subject to an optimal choice of instruments where the validity of instruments depends on the absence of higher-order serial correlation in the idiosyncratic component of the error term. Therefore, a test for the second-order serial correlation is performed. We also apply the Sargan test of over-identifying restrictions to test whether the instruments and residuals are independent.

4. Data Collection and Descriptive Statistics

For our empirical investigation we use an unbalanced sample of non-financial listed as well as unlisted European companies from 14 countries over the period 1998-2008. We include all firms with consolidated financial statements available in the Amadeus Database of Bureau Van Dijk. Bureau Van Dijk standardizes balance sheet information with the objective of achieving cross-border uniformity. Even after the enlargement of the European Union the 14 EU countries in our sample (i.e., Belgium, Germany, Denmark, Spain, Finland, France, UK, Ireland, Italy, Netherlands, Portugal, Sweden) represent about 90% of total EU GDP (based on Eurostat statistics for 2010). Norway and Switzerland are included because of their major trade relationship with the European Union with import and export representing between 75% and 70% of their trade volume respectively (based on Eurostat statistics for 2010). Some countries from the pre enlargement members (e.g., Luxembourg, Greece and Austria) are not included due to the lack of consolidated statements in the Amadeus database.

The data set consists of 126 509 available firm year observations corresponding to 22 239 firms. Due to the extensive use of lagged values both in the variable definitions and estimation methodology, the effective sample in the reported univariate and multivariate results is somewhat smaller. To minimize the influence of outliers in the analysis, we replace extreme observations of all ratio variables with missing values. Extreme observations include values in the 99th percentile and, for variables with negative values, also those in the 1st percentile.

In order to characterize the firms of the sample, we report the descriptive statistics of the variables used in Table 2. The summary statistics for the cash variable are similar to other studies using European data in the same time period. Companies are holding roughly 10% of their assets in cash or cash equivalents. Growth opportunities measured as the industry sales growth is around 5%. The average company in our data set has total assets of about 40 million euro. Firms are on average highly leveraged, with total debt to total assets (LEV) amounting to 63%. The cash flow variable (CF) and other liquid assets (LIQ) are very similar to the statistics in other empirical studies. The EBITDA of our firms amounts to 11% of total assets on average while they hold about 16% of total assets in net working capital other than cash. The average cash flow uncertainty of 4% is relatively high compared to the average cash flow measure. Finally, our main measure of market share MSHARE1) varies between a minimum of virtually 0 to a maximum of almost 1. However, our average firm does not dominate the market as it owns 1% of the (3 digit) industry sales. This increases to 2% on average when we reduce the industry size by adopting the more detailed 4-digit SIC code (MSHARE2) as industry classification. These low average market shares are not surprising in view of the large number of firms - listed as well as unlisted - that we consider to be rivals in our relatively broad industry classifications.

Table 2. Summary statistics

Variable	Mean	Median	Minimum	Maximum	Std. dev.
CASH	0.10	0.06	0.00	0.50	0.10
GROWTH	0.05	0.06	-0.40	0.78	0.06
SIZE	10.58	10.50	2.77	19.44	2.12
LEV	0.63	0.65	0.00	1.00	0.20
CF	0.11	0.10	-0.98	0.99	0.10
LIQ	0.16	0.16	-0.99	0.99	0.25
MSHARE1	0.01	0.00	0.00	1.00	0.06
MSHARE2	0.02	0.00	0.00	1.00	0.09
RISK	0.04	0.03	0.00	0.99	0.05

5. Empirical Findings

5.1 Market Share and Cash Holdings

Table 3 reports the results from the static fixed effect models as well as the dynamic GMM models of cash holdings (Note 3). We first assess the relevance of the dynamic framework by checking the GMM models with the lagged dependent variable $CASH_{t-1}$. The Sargan test of over-identifying restrictions as well as the direct tests of serial correlation in the residuals never rejects the validity of the lagged values of endogenous regressors as instruments. The significantly positive coefficients for the lagged cash variable amounting to 0.180 in both GMM model estimations correspond to a speed of adjustment of 82%. Consistent with other findings in the literature for large firms (e.g., Guney et al., 2003; Ozkan & Ozkan, 2004; among others) this result suggests that our sample companies pursue a target level of cash holdings that balances the costs and benefits of keeping cash while maintaining a high adjustment speed. For the remainder, the findings for the static and dynamic models are quite similar.

The static fixed effects models as well as the dynamic GMM models of Table 3 show a significant negative impact of market share, both MSHARE1 and MSHARE2, on cash holdings. In line with our first hypothesis concerning hedging against predation risk, higher market share leads to lower cash holdings. This result suggests that one of the advantages of having a higher market share is that one can afford to keep lower cash holdings and hence reduce the opportunity costs associated with maintaining a cash buffer. It is also consistent with earlier findings of Frésard (2010) that indicate that market share is an important determinant of corporate policy.

For the remainder, the models in Table 3 show that the other determinants of cash holdings are mostly significant with the expected sign. Larger and highly levered firms tend to hold less cash while cash flow generation leads to an increase in cash holdings. When alternative sources of liquidity are abundant however, firms lower their cash reserves. By contrast, risky firms increase their cash buffer in order to reduce the chances of a possible cash shortage in low income years. The only determinant that does not follow the expectations is growth opportunities. Better growth opportunities should increase cash holdings but the variable GROWTH is never significant (Note 4).

5.2 Industry Dynamics and Predation Risk

If hedging against predation risk is an important driver of the relationship between market share and cash holdings, the impact of market share on cash policy should increase when predation risk mounts. In order to test this, we re-estimate our cash models in subsamples based on firm-specific (i.e., similarity) as well as industry-specific (i.e., market concentration) proxies for predation risk.

Table 3. The impact of market share in static and dynamic cash models

	Fixed effects	GMM	Fixed effects	GMM
Explanatory var (expected sign)	(1)	(2)	(3)	(4)
Intercept	0.247***		0.248***	
	(28.02)		(28.08)	
$CASH_{t-1}$		0.179***		0.180***
		(20.37)		(20.28)
GROWTH (+)	0.003	0.004	0.004	0.004
	(0.48)	(1.24)	(0.77)	(1.26)
SIZE (-)	-0.011***	-0.006***	-0.011***	-0.006***
	(-13.39)	(-7.56)	(-13.46)	(-7.48)
LEV (+/-)	-0.035***	-0.035***	-0.035***	-0.034***
	(-13.37)	(-12.28)	(-13.46)	(-12.26)
CF (+)	0.017***	0.089***	0.017***	0.089***
	(3.89)	(28.90)	(3.88)	(28.93)
LIQ (-)	-0.089***	-0.422***	-0.089***	-0.422***
	(-35.42)	(-181.86)	(-35.21)	(-181.81)
RISK (+)	0.036***	0.011***	0.036***	0.011***
	(5.20)	(4.15)	(5.21)	(4.15)
MSHARE1	-0.014*	-0.013*		
	(-1.82)	(-1.88)		
MSHARE2			-0.011*	-0.015*
			(-1.67)	(-1.88)
Obs.	98,586	79,166	98,586	79,166
Adjusted R^2	0.6948		0.6949	
Sargan		n.s.		n.s.
m1		***		***
m2		n.s.		n.s.

This table reports the results for the static (i.e., Fixed effects) as well as the dynamic (i.e., GMM) cash models (White's heteroskedasticity consistent t-statistics in parentheses). The dependent variable in all models is the CASH variable measured as cash and cash equivalents divided by total assets. The Sargan test is χ^2 distributed, its significance is reported in the Table. Level of significance: ***1%; **5%; *10%; n.s. indicates non significance.

5.2.1 Firm Specific Proxies for Predation Risk

Tables 4 and 5 report the results of the static and the dynamic cash models respectively, estimated on subsamples based on interdependence of investment opportunities between rivals. Using either the similarity of technology measure analogue to Haushalter et al. (2007) or a country corrected similarity measure, we divide the full sample in subsamples of firms with technologies that are similar to their industry rivals or not. For, as argued in Haushalter et al. (2007), firms with similar technologies (i.e., investment opportunities) face higher predation risk. In the first two models of Table 4, subsamples are formed based on the median value of the main similarity measure, while the two models on the right hand side of the table compare the most and least similar firms according to the country corrected similarity measure (Note 5).

In line with our second hypothesis, the impact of market share changes as a function of the interdependence of investment opportunities (i.e., similarity of technology) with rivals. When rivals use a similar technology, predation risk likely is higher, which in turn leads to an increased importance of market share. This result holds

for both similarity measures in Table 4. When firms are less similar to rivals, market share seems to have no significant influence on the level of cash holdings. This result also relates to Mackay and Phillips (2005) who show that financing decisions depend not only on firm specific characteristics but also on the firm's position within its industry. For the remainder, Table 4 shows that the control variables in the static models do not differ much between the similarity subsamples, suggesting that subdividing according to interdependence of investment opportunities has little impact on the relationship of other determinants with cash holdings.

Table 4. The impact of market share depending on firm specific proxies for predation risk in a static model

	Similarity		Country corrected similarity	
Explanatory var (expected sign)	(similar)	(not similar)	(similar)	(not similar)
Intercept	0.220***	0.254***	0.245***	0.228***
	(15.28)	(19.31)	(17.22)	(16.43)
GROWTH (+)	0.005	0.004	0.002	-0.004
	(0.52)	(0.66)	(0.23)	(-0.47)
SIZE (-)	-0.008***	-0.013***	-0.011***	-0.010***
	(-6.03)	(-10.14)	(-8.47)	(-7.32)
LEV (+/-)	-0.038***	-0.026***	-0.037***	-0.037***
	(-9.00)	(-6.92)	(-8.39)	(-7.92)
CF (+)	0.010**	0.018***	0.051***	0.040***
	(2.02)	(3.14)	(7.92)	(6.79)
LIQ (-)	-0.083***	-0.094***	-0.095***	-0.067***
	(-21.40)	(-23.95)	(-23.12)	(-16.62)
RISK (+)	0.036***	0.021*	0.017	0.034***
	(3.01)	(1.98)	(1.49)	(3.15)
MSHARE1	-0.050***	0.001	-0.037***	0.028
	(-3.07)	(0.07)	(-3.91)	(1.60)
Obs.	44,410	44,937	44,254	44,031
Adjusted R^2	0.7059	0.7106	0.7079	0.7001

This table reports the results for the static (i.e., Fixed effects) cash models (White's heteroskedasticity consistent t-statistics in parentheses) tested on subsamples of firms that are either using similar technologies compared with rivals or not. The dependent variable in all models is the CASH variable measured as cash and cash equivalents divided by total assets. Level of significance: ***1%; **5%; *10%.

Table 5, which estimates the dynamic models on the same subsamples as those of Table 4, shows similar results. Again, and in line with our second hypothesis, market share influences cash policy only for firms that face higher predation risk. For both similarity measures, the coefficient estimate for market share is significantly negative only when the interdependence of investment opportunities is high. As in Table 4, the coefficients of the other control variables vary little between subsamples.

Table 5. The impact of market share depending on firm specific proxies for predation risk in a dynamic model

	Similarity		Country corrected similarity	
Explanatory var (expected sign)	(similar)	(not similar)	(similar)	(not similar)
$CASH_{t-1}$	0.133***	0.151***	0.153***	0.127***
	(11.56)	(13.23)	(12.12)	(12.07)
GROWTH (+)	0.005	0.005	0.002	0.004
	(0.82)	(1.29)	(0.49)	(0.88)
SIZE (-)	-0.003***	-0.005***	-0.002**	-0.007***
	(-3.00)	(-4.52)	(-1.98)	(-5.89)
LEV (+/-)	-0.051***	-0.028***	-0.035***	-0.042***
	(-12.30)	(-7.64)	(-9.16)	(-10.68)
CF (+)	0.074***	0.083***	0.074***	0.083***
	(16.50)	(18.59)	(16.19)	(19.54)
LIQ (-)	-0.398***	-0.417***	-0.405***	-0.406***
	(-127.30)	(-127.52)	(-126.50)	(-127.46)
RISK (+)	0.007***	0.011***	0.004	0.010***
	(3.00)	(3.19)	(0.84)	(4.11)
MSHARE1	-0.030*	-0.009	-0.030***	0.011
	(-1.82)	(-1.09)	(-3.10)	(0.88)
Obs.	34,774	35,442	34,853	34,680
Sargan	n.s.	n.s.	n.s.	n.s.
m1	***	***	***	***
m2	n.s.	n.s.	n.s.	n.s.

This table reports the results for the dynamic (i.e., GMM) cash models (White's heteroskedasticity consistent t-statistics in parentheses) tested on subsamples of firms that are either using similar technologies compared with rivals or not. The dependent variable in all models is the CASH variable measured as cash and cash equivalents divided by total assets. Models are tested with GMM, estimated in first differences using the Arellano and Bond (1991) method. The validity of using lagged values of endogenous regressors as instruments was evaluated with the Sargan test of over-identifying restrictions and direct tests of serial correlation in the residuals m1 and m2. The Sargan test is χ^2 distributed, its significance is reported in the Table. Level of significance: ***1%; **5%; *10%; n.s. indicates non significance.

5.2.2 Industry Specific Proxies for Predation Risk

By separating firms in our sample on the basis of similarity between rivals, we implicitly assume that predatory risk only depends on the interdependence of investment opportunities, regardless of industry characteristics. However, Kovenock and Phillips (1997) and Zingales (1998) show that strategic behavior (e.g., predation) is more likely to occur in oligopolistic industries.

In order to test whether the relationship between market share and cash holdings differs between low concentrated, oligopolistic and monopolistic markets, we introduce market concentration as an industry specific proxy of predation risk. Analogue to Akdogu and Mackay (2008), we subdivide our sample in three groups based on our measure of market concentration (HHI) and using the 33rd and 66th percentile respectively (Note 6). We re-estimate the static as well as the dynamic cash models in the low, middle and high market concentration subsample. Hypothesis 3 predicts that as predation risk from product market competition is highest in the middle group (i.e., oligopolistic competition), the impact of market share should be more important in this group. Table 6 reports the results for these tests. In line with our hypothesis, the coefficient estimate of the market share variable (MSHARE1) is only significantly negative in the middle segment of market concentration. This implies that firms counter the threat of having a low market share with a cash buffer, only when strategic actions against rivals likely are effective. As argued above, when market concentration becomes very low or very high, the threat of predation decreases and hence also the importance of market share for cash policy. The coefficients of the other control variables are qualitatively similar between subsamples, indicating that the impact of the other cash determinants is not strongly influenced by industry dynamics.

In sum, our results support the notion that characteristics of the competitive environment influence the relationship between market share and cash policy. When predation risk increases, hedging through

precautionary cash holdings becomes more important. In that kind of environment, market share becomes a significant determinant of cash policy as it reduces the risk of being preyed on.

Table 6. The impact of market share depending on industry specific proxies for predation risk

	Fixed effects			GMM		
Explanatory variables (expected sign)	(low HHI)	(mid HHI)	(high HHI)	(low HHI)	(mid HHI)	(high HHI)
Intercept	0.230***	0.261***	0.245***			
	(14.18)	(16.28)	(14.59)			
$CASH_{t-1}$				0.192***	0.158***	0.186***
				(11.27)	(11.62)	(10.76)
GROWTH (+)	-0.023	-0.011	0.001	0.004	0.001	-0.005
	(-1.74)	(-0.82)	(0.10)	(0.47)	(0.21)	(-0.84)
SIZE (-)	-0.011***	-0.012***	-0.011***	-0.006***	-0.007***	-0.006***
	(-6.95)	(-8.02)	(-7.08)	(-2.70)	(-5.16)	(-3.37)
LEV (+/-)	-0.030***	-0.035***	-0.031***	-0.050***	-0.045***	-0.022***
	(-5.65)	(-6.98)	(-7.24)	(-7.14)	(-9.70)	(-4.01)
CF (+)	0.037***	0.010**	0.008**	0.083***	0.079***	0.086***
	(6.45)	(1.99)	(1.95)	(11.55)	(16.63)	(14.53)
LIQ (-)	-0.043***	-0.069***	-0.100***	-0.423***	-0.401***	-0.449***
	(-9.24)	(-14.86)	(-20.66)	(-73.91)	(-104.42)	(-76.82)
RISK (+)	0.059***	0.026**	0.003	0.025**	0.005	0.010***
	(4.52)	(2.19)	(0.26)	(2.61)	(0.72)	(2.73)
MSHARE1	-0.020	-0.106***	0.015	-0.048	-0.089**	0.013
	(-1.34)	(-2.91)	(0.97)	(-1.59)	(-1.97)	(0.94)
Obs.	31,004	31,916	32,360	25,893	25,534	26,044
Adjusted R^2	0.7296	0.7001	0.6976			
Sargan				n.s.	n.s.	n.s.
m1				***	***	***
m2				n.s.	n.s.	n.s.

This table reports the results for the static (i.e., Fixed effects) as well as the dynamic (i.e., GMM) cash models (White's heteroskedasticity consistent t-statistics in parentheses) tested on subsamples of firms depending on low, medium or high market concentration. The dependent variable in all models is the CASH variable measured as cash and cash equivalents divided by total assets. The first three models are tested using fixed firm and fixed period effects. All explanatory variables are lagged one year to avoid possible endogeneity problems. The three models on the right hand side are tested with GMM, estimated in first differences using the Arellano and Bond (1991) method. The validity of using lagged values of endogenous regressors as instruments was evaluated with the Sargan test of over-identifying restrictions and direct tests of serial correlation in the residuals m1 and m2. The Sargan test is χ^2 distributed, its significance is reported in the Table. Level of significance: ***1%; **5%; *10%; n.s. indicates non significance.

5.3 Alternative Measures of Market Power

In order to assess the robustness of our conclusions, we re-estimate our models using either a country based measure of market share, or the price cost margin as an ex post measure of market power. For in the literature on industrial organization market share and price cost margins are both considered to be measures of market power (e.g., Schmalensee, 1989; Hay & Liu, 1997). Results from these robustness tests can be found in Table 7 (Note 7).

Table 7. The impact of market power using alternative measures

	Country based market share		Excess price cost margin	
Explanatory variables (expected sign)	Fixed effects	GMM	Fixed effects	GMM
Intercept	0.249***		0.242***	
	(26.82)		(25.50)	
$CASH_{t-1}$		0.183***		0.175***
		(17.55)		(17.49)
GROWTH (+)	0.001	0.002	-0.002	0.003
	(0.13)	(0.27)	(-0.28)	(0.77)
SIZE (-)	-0.012***	-0.007***	-0.011***	-0.007***
	(-13.41)	(-6.33)	(-12.87)	(-6.31)
LEV (+/-)	-0.029***	-0.031***	-0.031***	-0.035***
	(-10.88)	(-9.83)	(-11.09)	(-8.94)
CF (+)	0.045***	0.084***	0.062***	0.094***
	(11.79)	(27.51)	(11.34)	(20.34)
LIQ (-)	-0.089***	-0.419***	-0.087***	-0.419***
	(-34.62)	(-147.42)	(-33.57)	(-130.28)
RISK (+)	0.045***	0.012***	0.043***	0.010***
	(6.10)	(4.15)	(5.75)	(2.59)
MSHARE	-0.004*	-0.006*		
	(-1.76)	(-1.67)		
EPCM			-0.017***	-0.016***
			(-3.02)	(-3.31)
Obs.	99,720	79,749	98,037	78,762
Adjusted R^2	0.6947		0.6976	
Sargan		n.s.		n.s.
m1		***		***
m2		n.s.		n.s.

This table reports the results for the static (i.e., Fixed effects) as well as the dynamic (i.e., GMM) cash models (White's heteroskedasticity consistent t-statistics in parentheses). The dependent variable in all models is the CASH variable measured as cash and cash equivalents divided by total assets. Models (1) and (3) are tested using fixed firm and fixed period effects. All explanatory variables are lagged one year to avoid possible endogeneity problems. Models (2) and (4) are tested with GMM, estimated in first differences using the Arellano and Bond (1991) method. The validity of using lagged values of endogenous regressors as instruments was evaluated with the Sargan test of over-identifying restrictions and direct tests of serial correlation in the residuals m1 and m2. The Sargan test is χ^2 distributed, its significance is reported in the Table. Level of significance: ***1%; **5%; *10%; n.s. indicates non significance.

In defining the main proxy for market share, we assumed that the every European firm in our sample competes in the same European wide product market. Although this may be accurate for most firms, some firms may compete on a smaller scale. Therefore, as an alternative measure for market share, we recalculate the market share variable based on country specific product markets only. Using the 3-digit industry SIC codes as industry classification, the market share of a firm is then measured by dividing the sales in a certain year by the total sales in the corresponding home country industry. Evidently, market shares become somewhat larger on average. The first two models in Table 7 show the results for the country based market share in the static and dynamic setting respectively. The coefficient estimate for the alternative market share variable is negative and significant which confirms that our main conclusions about the influence of market share on cash policy are robust to different specifications of market share.

Finally, we test whether other proxies for market power, like the price cost margin, have a similar relationship with cash policy. In contrast to market share, price cost margin is a more ex post measure of market power. As in Drakos and Goulas (2006), we define the price cost margin (PCM) as operating income (before depreciation) over sales. The excess price cost margin (EPCM) is then calculated as the difference between the firm specific PCM and the industry median based on the 3-digit SIC code industry classification. We use EPCM rather than PCM in order to control for industry specific effects. Firms that are able to exceed their industry in terms of PCM have higher market power. Table 7 shows that consistent with our main conclusions on market share, the

excess price cost margin also has a negative and significant impact on cash holdings. This confirms the main hypothesis that firms with higher market power worry less about predation risk and are therefore able to lower the precautionary cash buffer. Other determinants of cash holdings are not qualitatively altered by this replacement of market share with the excess price cost margin in the static as well as the dynamic cash model.

6. Concluding Remarks

Using a large sample of consolidated statements from European companies in 14 countries, we examine the impact of market share on cash policy. Our key conclusions are that a firm is more likely to hold cash reserves when its market share is low and that this relation between market share and cash holdings is most important when the risk of predation is high. This confirms our main hypothesis that firms with high market shares are expected to worry less about predation risk resulting in lower precautionary cash buffers.

Our results hold in static as well as dynamic cash models and are robust to different specifications of market share, predation risk, and for controlling for possible endogeneity. These findings show that one of the advantages of maintaining a sufficiently important market share in a competitive environment is that it adds to the efficiency of the use of assets as less cash reserves are needed. In this way it offers another motive to explain the observed phenomenon that many firms consider market share to be important, strive to increase it or at least take action to maintain their position in their industry.

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Notes

Note 1. In the US such calculation is only possible for years for which Census data are available. However, including non listed firms is important for the accuracy of the calculated competition measures (e.g., Haushalter

et al., 2007). In Europe this seems to be especially important as 90% of the large firms in our sample are not listed. This latter finding is comparable to Claessens and Tzioumis (2006) who construct a database of all large firms of 19 European countries. They report that about 87% of these companies are unlisted.

Note 2. As an alternative measure of cash holdings we subtract cash and marketable securities from total assets in the denominator which gives us cash levels scaled by net assets (Opler et al., 1999). Results remain qualitatively similar if this alternative measure of cash holdings is used.

Note 3. Gaspar and Massa (2006) show that market share has an influence on idiosyncratic volatility, which indicates that market share could influence income risk as well. Although in our sample market share and risk are negatively correlated (about 3%), the correlation seems too small to cause any problems. As a robustness check however we re-estimated our cash models without the risk variable. Results remain qualitatively the same.

Note 4. Different definitions of growth opportunities like firms specific sales growth or other industry classifications yield the same result.

Note 5. Haushalter et al. (2007) incorporate their similarity measure as a continuous variable in the cash model. In a (not reported) robustness test, we also find a significantly negative coefficient for the continuous similarity variable in our static and dynamic cash models.

Note 6. Our results are qualitatively similar if we use alternative percentile cutoffs in market concentration to subdivide the sample in three groups.

Note 7. To limit the number of Tables we report only the tests for our main hypothesis, i.e. hypothesis 1. The results for the other hypothesis remain qualitatively similar to those reported in Table 4 and 5, i.e. also for the other measures of market share discussed below and for the price cost margin it remains the case that when predation risk is high, market share or the price cost margin has a significant effect upon cash holdings, while this is not the case when predation risk is low. These findings can be obtained upon request.

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ASEAN Economic Cooperation: Trade Liberalization Impacts on the National Economy

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Abstract

This study aims to analyse the impact of trade liberalization by focusing on twelve priority industrial sectors in the ASEAN-5 (Singapore, Thailand, Indonesia, Malaysia and the Philippines). The General Equilibrium Model based on Multi-country Input Output Data as provided by the GTAP is used to measure potential economic benefits of reducing tariffs on output, trade balance, welfare gain, and competitiveness. We compare the outcome of the CGE approach with the Cost Benefit Analysis (CBA) based on the Analytical Hierarchy Process (AHP). The results show that the outcomes of the CGE Model does not match those suggested by the AHP. However, they do support the findings of Falianty (2005), Achsani and Siregar (2010), Achsani and Partisiwi (2010), Nugroho and Yanfitri (2011). Our results suggest that taking non-economic but relevant factors from public opinion into account affects the robustness of CGE studies based purely on economic factors.

Keywords: ASEAN-5, economic integration, tariff liberalization, welfare

1. Introduction

After the year 2000, rapid movement towards the conclusion of the Free Trade Area (FTA) in East Asia has been a subject of intensive investigation among researchers. In particular, there is a need to understand the distribution of the potential economic benefits resulting from trade liberalization under economic integration (see: Urata and Kiyota, 2003; Francois and Wignaraja,2008; Pardo-Calvo, Freund, C.L and, Omelas, L,2009; Mukopadhyay and Thomassin, 2010). In a similar spirit, see Falianty (2006); Achsani and Siregar (2010); Achsani and Partisiwi (2010); and Nugroho and Yanfitri (2011).

Francois and Wignaraja (2008) examined three core scenarios – ASEAN+3, ASEAN+3 and India, and ASEAN+3 and South Asia. The analysis concluded that China, Japan, and Korea were countries that drove most of the income and trade effects in the East Asia region across all scenarios. Pardo *et.al* (2009) studied the effects of preferential and external tariff reductions on import growth from ASEAN and non-ASEAN. They found no evidence that preferential liberalization has led to lower import growth from non-members.

Falianty (2006) used data from the ASEAN-5 countries (Singapore, Malaysia, Thailand, Indonesia and the Philippines) to analyze the readiness of these countries to implement the idea of single currency. Her findings show that not all countries are ready to joint, particularly Indonesia and the Philippines. Using a different approach, Achsani and Siregar (2010) extended the number of countries under their study and came to a similar conclusion. In line with this, Achsani and Siregar (2010) analyzed potential economic benefits by classifying countries according to the limitation and among member countries of the ASEAN+3. Nugroho and Yanfitri (2011) assessed the implication of the agreement of ASEAN Economic Cooperation toward establishment of a single market in the year 2015 for the Indonesian economy. The study used quantitative and qualitative data from the ASEAN+3. The findings indicate that Indonesia still needs to enhance commitment among stakeholders in order to achieve optimal potential economic benefits from the program. The findings are also consistent with previous studies, as the data support the hypothesis of the existence of disparity of potential economic benefits among ASEAN member countries.

In January 2007, under the ASEAN Economic Cooperation framework, at the 12th ASEAN Summit, the ASEAN Country Leaders affirmed their strong commitments to accelerating the establishment of an ASEAN Community by 2015. As part of the agreement, tariffs on all intra-ASEAN goods will be eliminated in accordance with the schedules and commitments set out in the CEPT-AFTA Agreement and other relevant Agreements. Progress achieved with respect to the removal of tariffs is as follow:

- All tariffs on eight sectors and sub-sector (agro-based, fisheries, healthcare, electronic, rubber based, wood based, textiles, and automotive) were eliminated by Singapore (since 2002), Malaysia and Thailand (since 2009)
- Indonesia and the Philippines have eliminated all tariffs on six sector and sub-sector, namely health care, electronic, rubber, textiles (since 2008), wood based, and automotive (since 2009),
- Indonesia and the Philippines are still collecting taxes 0-3% two sub-sectors which are agro-based sub-sector (code 7.14 and 10.5) and fisheries sub-sector (code 3.01 and 3.04). (The ASEAN Secretariat, 2010).

With respect to the distribution of the gains from trade (Deardorff, 1984), there has been no sufficient policy evaluation, particularly in identifying who is the winners as well as the losers. Clarification on this issue is very important to the country members as well as to the stakeholder of the AEC to decide what should be done to achieve maximum benefits from such agreement.

Our study ties in with a number of recent studies, including a study by Mukopadhyay and Thomassin (2010) that analyzes tariff reduction using various scenarios and regionalism (clustering) of trade agreement (i.e. ASEAN and non-ASEAN Countries). It was unclear whether tariff reduction would create equal potential beneficial effects to all members. Our approach extends Mukopadhyay and Thomassin's study by providing different clustering alternatives based on more recent data. The gist of our approach is to compare the relative impact of tariff reduction of priority integration sector (PIS) on country's welfare and competitiveness among the ASEAN-5 (Indonesia, Singapore, Thailand, the Philippines, and Malaysia).

The remainder of this paper is organized as follows. Section 2 explains data and research methodology. Results and discussion will be presented in section 3. The final section of the paper gives a conclusion and policy recommendation.

2. Data and Methodology

2.1 Data Aggregation

We used the GTAP version 7 database to analyze the impact of tariff liberalization on 12 priority sectors for integration on national economy of each country. The GTAP database is a global database that contains bilateral trade patterns, transport, production data, and consumption, intermediate use of commodities and services, protection data characterizing economic linkages among region, together with individual-country input-output data bases that account for inter-sector linkages within each region. The advantage of using a multi-country model is to take into account the impact of a changing world environment, as well as the possible feedback associated with the bilateral trade liberalization.

The GTAP database of this version comprises 113 countries, 57 sectors. Our study focuses on the ASEAN-5 and the 12 priority sectors whose tariffs will be eliminated in accordance to the schedule and commitments of the governments of the ASEAN countries. Before analyzing, the first step is to aggregate the 113 countries into seven regions: (a) Indonesia; (b) Singapore; (c) Thailand; (d) Philippines; (e) Malaysia; (f) the rest of ASEAN, and (g) the rest of the world. We then aggregate the 57 sectors into twelve priority sectors: (i) agro-based product; (ii) air transport; (iii) automotive; (iv) E-ASEAN; (v) electronic goods; (vi) fisheries; (vii) health product; (viii) rubber; (ix) textile and clothing; (x) tourism; (xi) wood; and (xii) logistic. Table 1 depicts products included in each of the aggregated sector.

2.2 General Equilibrium

The impact of tariff reduction on the performance of national economic is analyzed within the framework of *Walrasian general equilibrium* (WGE), originally developed by Walras (1874). The advantage of this approach is its ability to measure policies' ultimate impact on aggregate welfare in an economy.

According to this theories, whole economy (W^e) can be viewed as an interconnected of single market (consumer). Suppose that $W^e = \left\{\left[u^i, x^{0^i}\right]\right\}_1^n$ denotes an economy where $\left[u^1, x^{0^1}\right], \ldots \left[e^n, x^{0^n}\right]$ is a pair of consumer choices. n is number of consumer. *Walrasian Equilibrium* is a pair $(p^*, x^*) \in R_+^l \times R_+^{nl}$ that satisfies the following two conditions: Firstly, $\forall_{1i} \in \{1,2,3,\ldots,n\} : x^{*i}$ maximizes u^i on the budget constraint, $B(p^*, x^{*i}) := \left\{x^i \in R_+^l \mid p^*.x^i \leq p^*.x^{0^i}\right\}$. where $\{x^{*1}, x^{*2}, x^{*3}, \ldots, x^{*n}\}$ is bundles of individual consumer's demand and $\{p^{*1}, p^{*2}, p^{*3}, \ldots, p^{*n}\}$ is set of prices. Secondly, $\forall_k \in \{1,2,3,\ldots,l\} : \sum_{i=1}^n \left[x_k^{*i} - x_k^{oi}\right] \leq 0$ and $\sum_{i=1}^n \left[x_k^{*i} - x_k^{o1}\right] \leq 0$ if $p_k^* \geq 0$.

The second condition is for market clearing. In this definition, the price plays the role of equilibrating demand and supply. In modern economics literature, the concept of Walrasian general equilibrium has been intensively studied (see Arrow and Debreu (1959)). In Arrow and Debreu (1959), the abstract of computable general

equilibrium structure (CGE) is formalized to solve numerically for the levels of supply and demand, and prices that support equilibrium across a specified set of markets.

In a number of empirical studies (Shield and Francois (1994), Gunning and Keyzer (1995), Wing (2004)), the CGE has been used as a standard tool to analyze the aggregate welfare as well as the impact of policies whose effects may be transmitted through multiple markets or region. The policies can be a price-based (e.g. taxes and subsidies) or quantity based (e.g. demand and /or supply constraint and whose values are exogenously determined by the researcher). Under this approach, the impact of policies can be evaluated by comparing the pre-and the post change equilibrium vector of prices, demand and income level.

2.3 GTAP

GTAP (Global Trade Analysis Project) is a quantitative model developed based on the General Equilibrium Theory. The model has been widely used by researchers and policy makers to conduct quantitative analysis of international policy issues. We use the GTAP model to analyze the impact of tariff liberalization on national economy. The basic setup of this multi-country model assumes that representative agents in the economy comprise household, and firm[1]. Each regional household or country has representative consumers that maximize their utility function, dependent on private consumption of good, savings and government expenditures. According to Hertel (1997), the aggregate utility is governed by the Cobb Douglas function. Solving this problem yields three forms of representative agent's demand functions respectively for: (1) government; (2) household; (3) and saving.

a. Household Expenditure :

$$INCOME(r) + u(r) = PRIEX(r) + up(r) + GOVEX(r) + [ug(r) - pop(r)] + SAVE(r)[qsaver(r) - pop(r)] \quad (1)$$

b. Regional Saving :

$$qsaver(r) = y(r) - psaver(r) - saveslack(r) \quad (2)$$

c. Government Purchases :

$$Ug(r) = y(r) - pgov(r) + govslack(r) \quad (3)$$

Each industry of each country or region assumes a nested Constant Elasticity of Substitution (CES). It combines the input factors of production (land, capital, skilled labor, unskilled labor and intermediate goods. Their quantities are denoted as $QFE = (i, j, s)$. Firms also purchase intermediate inputs, some of which are produced domestically $afds(i, j, s)$ and some of which are imported $qfm(i, j, s)$. This specification is known as "Armington approach". The firms combine their individual input factors to produce output, $QO(i, s)$, under the assumption of separability in production.

The model assumes that firms choose their optimal mix of primary factors, independent of the price of intermediate inputs. The degree of substitution between any individual primary factors and intermediate input is equal and is given by the elasticity of substitution parameter. Prices of goods and production factors are determined through interaction between demand and supply in the markets. Prices are determined in the goods market simultaneously.

2.4 AHP

The Analytic Hierarchy Process (AHP) was originally developed by Saaty (1987). The AHP methodology has gained popularity in many area of empirical studies since it provides not only a framework for decision m, but making also takes into account all the relevant quantitative and qualitative relevant information in achieving the stated objective. In general, this approach allows the researcher/policy maker to analyse multi-criteria decision problems which are decomposed in a hierarchy of criteria, sub-criteria, attributes and alternatives.

The main purpose of this study is to use the result of the AHP to examine the robustness of the results based on the CGE model. As documented in Saaty (1990), the first step to implement this approach is to identify a hierarchy or network structure to represent a decision problem. Secondly, using the hierarchy to develop priorities for the alternatives based on the expert's judgments throughout the system. In ideal case of exact measurement, the quantified judgment are recorded in pairs and presented in matrix form so called a pairwise comparison matrix, A. Suppose that $C_1, C_2, .., C_n$ be *n* the element of activities. The quantified judgments on pair of activities C_i and C_j are represented by an *n*-by-n matrix. A= (a_{ij}), *(i,j=1,2,3,..,n)*. Thus the matrix A has the following form:

$$A=\begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}$$

The two conditions must be hold are : (1) $a_{11} = a_{22} = \cdots = a_{nn} = 1$

(2) if $a_{ij} = \theta$ then $a_{ji} = 1/\theta,\ \theta \neq 0$

According to Saaty (1990), a set of numerical weights $w_1, w_2, w_3 \dots, w_n$ reflects the recorded judgment. Hence, the pairwise comparison matrix can be represented as follow :

$$A=\begin{bmatrix} w_1/w_1 & w_1/w_2 & . & . & . & w_1/w_n \\ w_2/w_1 & w_2/w_2 & . & . & . & w_2/w_n \\ . & . & & & & . \\ . & . & & & & . \\ . & . & & & & . \\ w_n/w_1 & w_n/w_2 & . & . & . & w_n/w_n \end{bmatrix}$$

Where $w_i/w_j = a_{ij}$ for $i, j = 1,2,3, \dots n$

Once all weights in matrix A have been estimated, the next step is to synthesize the judgment by calculating the priority of each criterion in terms of its contribution to the overall goal through a normalization process of the pairwise comparison matrix. The final step is to check the consistency of entire hierarchy which is evaluated based on the consistency Index (CI) and the consistency ratio of hierarchy (CRH) developed in Saaty (1990).

There have been a number of empirical studies that have used the framework of AHP as an alternative approach to consider a non-economic variables in to the analysis, such as cost benefit analysis (CBA) (Azis, 1990, Clayton et al.1993; Wedley *et al.,* 2001; Handfield et al., 2002). In this study, we adopt their approach to analyze the costs and benefits of trade liberalization on the national economy. Suppose a country wants to evaluate three alternatives of trade liberalization policy: (i) tariff reduction of zero per cent; (ii) tariff reduction of five per cent; and (iii) tariff reduction of ten per cent. The evaluation is conducted based on the benefits and costs of these policies.

The benefits can be classified as the following:

1. Economic benefits (i.e. benefit aimed at achieving economic growth), including:
   (a) wider opportunities for people and business
   (b) increased intra-regional trade
   (c) improved efficiency (capacity building)
   (d) higher valued-added job for the skilled labor and professionals (e.g. engineers, lawyers, economists)
   (e) provisions of technical assistance & financial support for domestic reform
   (f) establishment of a single-integrated market (mobility skilled labor, less bureaucracy, free of flow goods)
2. Social and cultural benefits (i.e. benefits that satisfy social and cultural needs of the entire society), including:
   (a) stronger social cohesiveness
   (b) deeper mutual understanding
   (c) political and social stability
   3. Other benefits (i.e. benefits aimed at satisfying basic human needs), including:
   (a) smaller development gap
   (b) safer and more reliable communication
   (c) more access to the environment (environment accessibility)

(d) higher capacity to design emergency social safety net

The above breakdown leads to the following hierarchy of benefits among the three alternatives of tariff liberalization policy. The application of AHP to the benefit hierarchy provides weighting for each policy scenarios. The weight indicates the relative importance of each tariff liberalization policy alternative (see Figure 1)

By similar framework, the costs criteria can be classified as:

1. Economic costs (i.e. costs that reduces a country's independence in policy making), including:
   (a) commercialization and privatization of social services
   (b) rights and control over economic and social benefits
   (c) foreign corporate control versus domestic corporations
   (d) phased approach / corporate control
   (e) necessary conditions/ requirements for proper coordination
2. Social costs, including
   (a) job losses and livelihood of workers losing jobs under AFTA
   (b) violations of economic, social, and cultural rights
   (c) deprivation of rights to livelihood, jobs, health access
   (d) massive de-industrialization/devastated industries and agriculture
   (e) massive contractualization
3. Others costs (i.e. costs that reduce social status of a society), including:
   (a) change in life style and traditional values
   (b) erosion of policy space
   (c) weakening of labor unions

Figure 2 presented in the appendix shows the cost hierarchy for the three alternatives of tariff liberalization policy. Again, we use the AHP framework to construct the cost hierarchy and to generate weight for each policy scenarios. The weight indicates the relative importance of the each tariff liberalization policy alternative.

Once the benefit and cost priorities generated, the next step is to compare the ratios of benefit priorities over the cost priorities, and evaluate the alternatives of tariff liberalization policy based on the ratios. These ratios are used to analyze the impact of tariff liberalization policy on the priority sectors in each country.

3. Results and Discussion

As discussed earlier, the tariff liberalization of the 12 priority sectors are the focus of our investigation. We simulate the GTAP model by employing three different scenarios of tariff reduction on agro-based, fisheries, healthcare, electronic, rubber based, wood based, textiles, and automotive sector. The three scenarios are:

(1) all the ASEAN-5 member countries reduce the import tariff to zero per cent,

(2) all the ASEAN-5 member countries reduce the import tariff to 5 per cent and

(3) all the ASEAN-5 member countries reduce the import tariff to 10 per cent.

The model was run to evaluate the possible economic impacts of tariff liberalization on national economic performances of the six individual countries (Indonesia, Singapore, Malaysia, Philippines and Thailand). Simulation results of the first scenario (reduction of tariffs to zero per cent) are depicted in Figure 3,4 and 5 (see appendix).

Figure 3 shows that the percentage of changes in output in all ASEAN-5 countries (Indonesia, Singapore, Thailand, and Philippines) has increased except for Malaysia. The percentage of increase in output for Singapore appears to be the highest (1.29%), while Malaysia has the lowest (-0.27%). It means that removing import tariff for the 12 priority sectors will decrease Malaysia's output by 0.27%. These findings show that Singapore will get the highest "benefit" from trade liberalization, followed by Thailand, Philippines, Malaysia and Indonesia.

Similar findings are also shown in simulation results of the second scenario (reduction of import tariffs to five per cent), where Singapore receives the highest increase in output, while Malaysia gets the least. Surprisingly, when the tariffs are only cut to ten per cent, Singapore has the worst outcome compared to the other ASEAN-5

countries (its output contracted by 2.1%), while Indonesia has the least negative outcome (-0.4%).

The next step is to analyze of the impact of tariff reduction on welfare gain and competitiveness, particularly on whether the tariff agreement generates equal potential economic benefits for all countries. This study adopts the "equivalent variation (EV)" concept. The "equivalent variation" concept is defined as the change in income that would allow a consumer to purchase the same quantities of all goods as before without remainder, after prices have changed. This definition also refers to the higher part of income that consumer would pay to prevent the price from changing (see Hick (1941) Meanwhile, the "terms of trade" measures a change in the export price relatively to the import price. A positive change in the value of term of trade in a country indicates that there is an improvement in term of its capital accumulation (i.e. more money is coming in from exports). The results of estimating welfare gain and competitiveness are shown in Figures 4 and 5. It is clear from Figures 4 and 5 that reducing tariff to zero per cent for all countries increases both welfare and competitiveness for all the ASEAN-5 member countries. Singapore and Thailand receive the highest welfare gains compared other country members, although Malaysia experiences losses in term of trade.

Notice that the scenario under which impact tariffs are reduced to zero is the only scenario that yields a net benefit (i.e. a benefit/cost ratio ≥ 1) for all ASEAN-5 countries except Singapore. This is in contrast with our previous results obtained under the CGE approach. The latter, however, are consistent with the findings of Achsani and Partisiwi (2010), Falianty (2010), Nugroho and Yanfitri (2011) pertaining to the gains achieved by countries participating in various agreements and the fact that there still is inequality of distributions of potential economic benefit from trade liberalization under economic integration.

Table 2 presents a summary of the results obtained under the two approaches under the various tariff liberalization senarios. Under the zero percent tariff reduction scenario, CGE and AHP results diverge entirely for all five countries. However, under the five percent tariff reduction scenarios. CGE and AHP results are somewhat similar in their respective ranking for Singapore (1) and Thailand (2). Furthermore, under the ten percent scenario, the two approaches again provide somewhat similar results in term of the ranking of Thailand (2) and Indonesia (1).

Notwithstanding these similarities, the two approaches by and large appear to yield different results. This suggests that ranking is sensitive to the inclusion of non-economic factors in the analysis. Hence, our study shows that the results of previous studies that only considered economic factors should be considered with some cautions.

4. Conclusion and Policy Implications

This study provides additional evidence on the impact of tariff liberalization on the national economy. We analyze 12 priority sectors under the ASEAN Economic Integration (AEC) framework. The three different scenarios from the two approaches (CGE and AHP) show that overall, removing all tariffs in all-intra ASEAN of the priority sector increases output, and earn to welfare gains. Nonetheless, the distribution of economic benefits to the member countries tends to be unequal. Our results indicate that Singapore and Thailand consistently appear as countries that receive the highest gain from liberalization under the CGE approach. When we do incorporate other aspects (non-economic variables) into the analysis using the Analytical Hierarchy Process, our results show that the distribution of benefits (economic and non-economic) to member countries is again unequal. Overall, the results indicate that Indonesia and Malaysia appear to be the countries that receive the highest gain from liberalization under the AHP approach.

The results of our study based on the CGE approach are consistent with those obatined by Falianty (2006), Achsani and Siregar (2010), Achsani and Partisiwi (2010), Nugroho and Yanfitri (2011) pertaining to the gains achieved by countries participating in various agreements and the fact that inequality of distribution of potential economic benefits from trade liberalization under economic integration still exists. The results under AHP approach suggest that ranking is sensitive to the inclusion of non-economic factors in the analysis so that the findings of previous studies that only considered economic factors should be considered with a degree of caution.

Overall, our findings suggest that it is essential for members as well as stakeholders of the AEC to properly understand how to achieve maximum benefits, both in economic and non-economic terms, from economic integration.

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Appendix

Table 1. Sector Aggregation

No	Aggregated Sector	Product
1.	Agro based product	Paddy rice; wheat; cereal grain nec; vegetable, fruit, nut; sugar cane, sugar beat; plant base fibers; crops nec; forestry; rice; sugar; beverage and tobacco product
2.	Air Transport	Air transport
3.	Automotive	Motor vehicle product; transport equipment
4.	E-ASEAN	Financial services; insurance; business services
5.	Electronic goods	Electronic equipment; machinery equipment; electricity
6.	Fisheries	Fishing
7.	Health Product	Public administration, health, defences /education
8.	Rubber	Chemical, plastic product, rubber
9.	Texting and clothing	Wool, silk worm cocoons; textiles; wearing apparel; leather product
10	Tourism	Trade; communication; recreation and other services
11.	Wood	Wood products, paper product; publishing
12	Logistic	Trans nec, sea transport

Source: GTAP Version 7 database

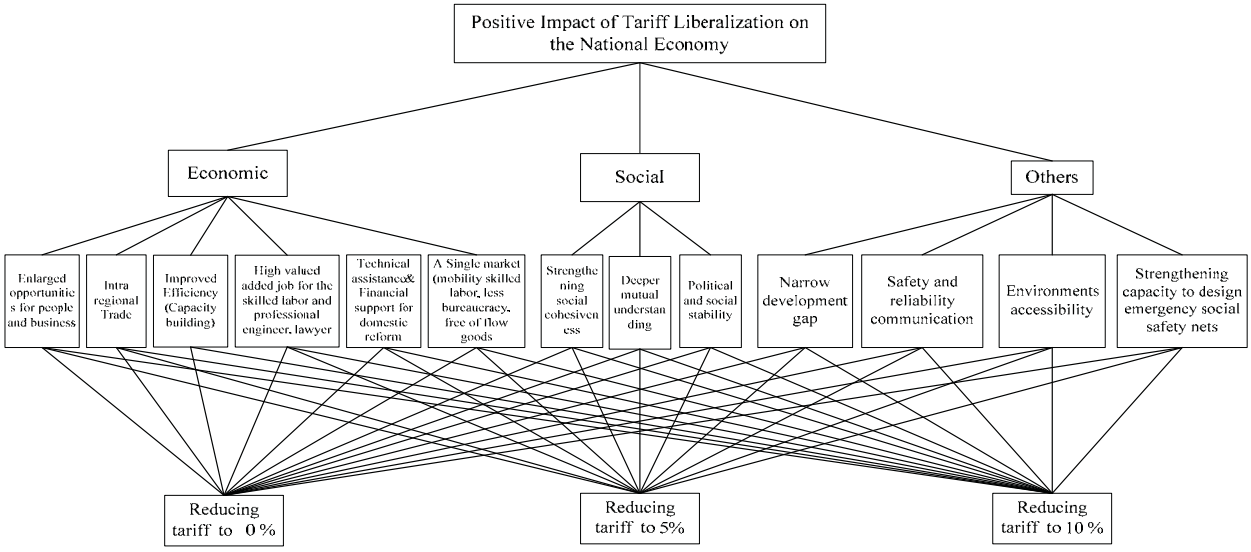

Figure 1. Hierarchy for Positive Impact of Tariff Liberalization on the National Economy

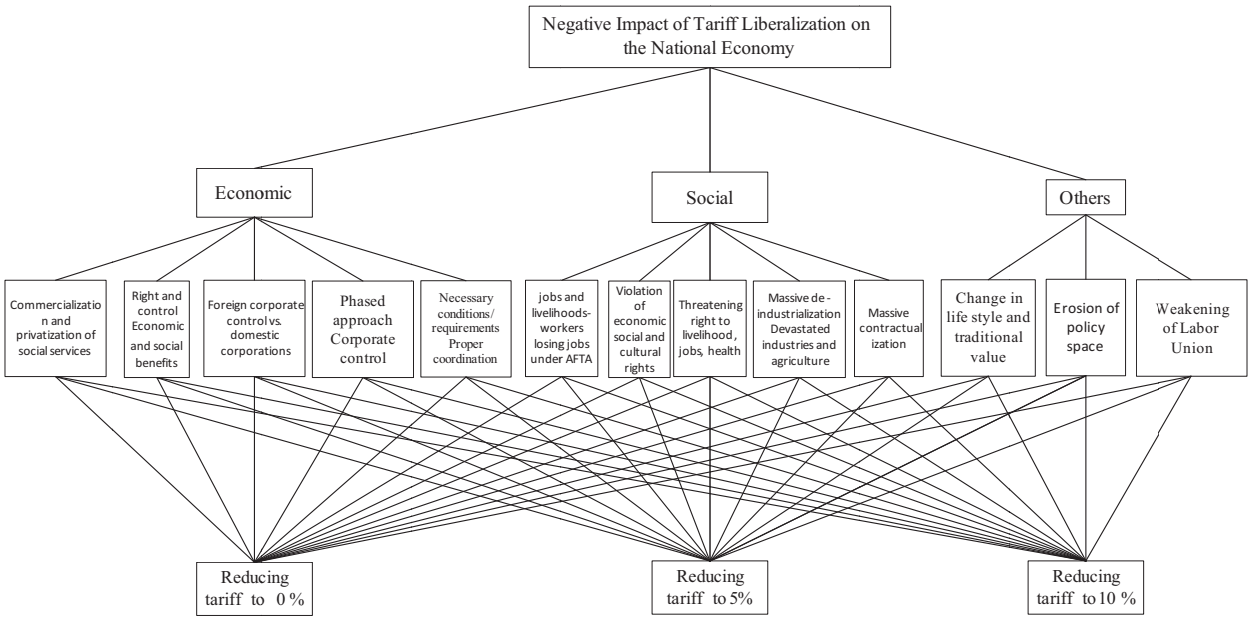

Figure 2. Hierarchy for Negative Impact of Tariff Liberalization on the National Economy

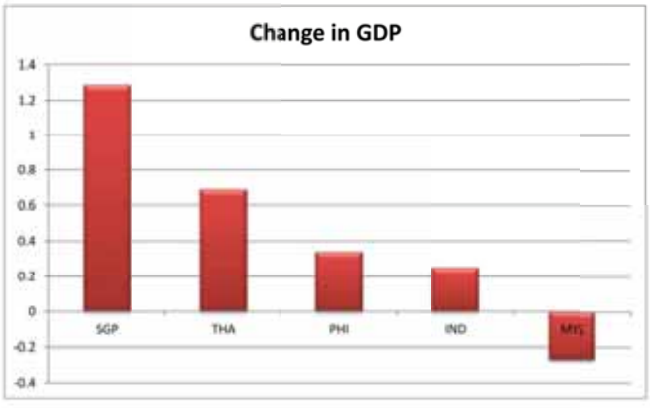

Figure 3. Percentage change in the GDP and Import value under zero per cent of tariff liberalization scenario

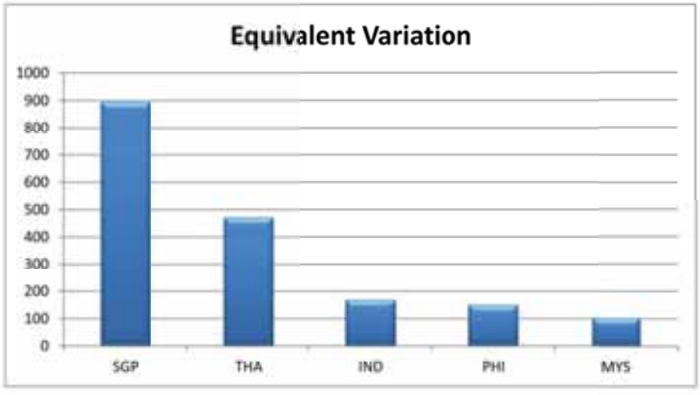

Figure 4. Percentage change in the Equivalence of Variation under zero per cent of tariff liberalization scenario

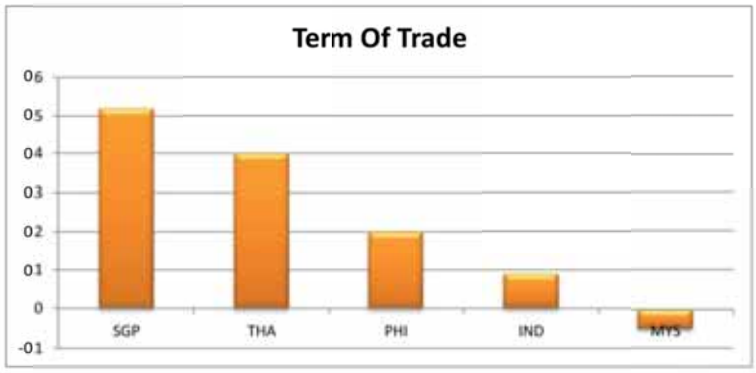

Figure 5. Percentage change in the Term of Trade under zero per cent of tariff liberalization scenario

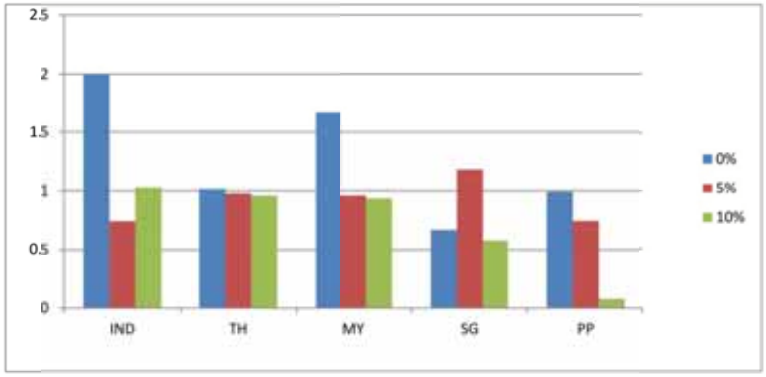

Figure 6. Chart of the benefit-cost ratio of three possible scenarios for each of the ASEAN-5 country members

Table 2. Summary results of the CGE and AHP under various tariff liberalization scenarios

scenarios	CGE			AHP
	Δ% GDP	EV	TOT	B/C
0%	Singapore (1)	Singapore (1)	Singapore (1)	Singapore (5)
	Thailand (2)	Thailand (2)	Thailand (2)	Thailand (3)
	Indonesia (4)	Indonesia (3)	Indonesia (4)	Indonesia (1)
	Malaysia (5)	Malaysia (5)	Malaysia (5)	Malaysia (2)
	Philippine (3)	Philippines (4)	Philippines (3)	Philippines (4)
5%	Singapore (1)	Singapore (1)	Singapore (2)	Singapore (1)
	Thailand (4)	Thailand (5)	Thailand (3)	Thailand (2)
	Indonesia (3)	Indonesia (2)	Indonesia (4)	Indonesia (5)
	Malaysia (5)	Malaysia (4)	Malaysia (5)	Malaysia (3)
	Philippines (2)	Philippines (3)	Philippines (1)	Philippines (4)
10%	Singapore (5)	Singapore (1)	Singapore (3)	Singapore (4)
	Thailand (3)	Thailand (5)	Thailand (2)	Thailand (2)
	Indonesia (1)	Indonesia (2)	Indonesia (1)	Indonesia (1)
	Malaysia (2)	Malaysia (4)	Malaysia (5)	Malaysia (3)
	Philippines (4)	Philippines (3)	Philippines (2)	Philippines (5)

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The Impact of M&A Announcement and Financing Strategy on Stock Returns: Evidence from BRICKS Markets

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Abstract

In this paper, we examine if M&A announcements and methods of financing these deals affect stock returns. Data is used for BRICKS from the period 2005-2009 and standard event study methodology is used for this purpose. We find significant pre-event returns for 5 out of 6 sample countries. This indicates possible leakages in the information system, which may not be surprising, given the emerging nature of these markets. Three of the BRICKS countries, i.e. India, South Korea and China provide significantly negative post-event returns while strong positive returns are observed in case of South Africa. The extra normal post-event returns defy semi-strong efficiency for majority of sample markets. We further find that M&A announcements do not significantly alter the trading liquidity and pricing efficiency of the sample stocks. However, return volatility does decline on post event basis. It is also observed that while stock financed mergers are value creating, cash financed mergers seem to be value destroying in the short run. The study is extremely relevant for common shareholders, global fund managers as well as financial regulators. The present research contributes to corporate restructuring as well as market efficiency literature, especially for emerging markets.

Keywords: mergers and acquisitions, market model, event study analysis, emerging markets, investment financing strategy

JEL Codes: G14, C12, C13

1. Introduction

Corporate restructuring refers to a broad array of activities that expand or contract a company's operations or substantially modify its financial structure or bring about a significant change in its organizational structure and internal financing. It includes activities such as merger, acquisition, de merger, divestiture, slump sale, spin off, equity carve outs etc. However, for the purpose of this study a *Corporate Restructuring Event* is operationally defined as a merger or an acquisition (hereinafter referred to as M&As).

Globally, BRICKS nations hold a preeminent position amongst emerging economies. The acronym 'BRIC economies' was coined in a Goldman Sachs report titled "The World Needs Better Economic BRICs" by Jim O'Neill. It highlighted the growing importance of Brazil, Russia, India and China in the world economy, they being the new frontiers of capitalism. The popularity of the Goldman Sachs thesis "BRIC" which even helped inflows of foreign investment into these markets, has led to its extension. "BRICK"(K for South Korea), "BRIMC"(M for Mexico) are some other commonly discussed groups. South Africa expressed a keen interest in being part of the BRIC club and subsequently got an invitation to join the 2011 BRIC nations' summit in China. Hence, we feel that BRICKS (including South Korea and South Africa) becomes an important and diverse group, to necessitate a study that will interest global investors.

A major research approach assessing corporate restructuring events is the value effect (short and long term) of the announcement of restructuring. Typical findings from early studies suggest that M&As did not enhance firm value, either in the short-run (Dodd, 1980; Asquith, 1983; Malatesta, 1983; Jarrell &Poulsen, 1989) or in the long-run (Asquith, 1983; Agrawal, Jaffe, &Mandelker, 1992; Loderer& Martin, 1992). More specifically, acquisitions were often found to erode acquiring firm value (Chatterjee, 1992; Datta, Pinches, & Narayanan,

1992; Seth, Song, & Pettit, 2002; King, Dalton, Daily, &Covin, 2004; Moeller, Schlingemann, &Stulz, 2004) and produce highly volatile stock returns (Langetieg, Haugen, &Wichern, 1980; Pablo, Sitkin, & Jemison, 1996).As limited work is available regarding corporate restructuring events in India and other BRICKS nations, and their effects on shareholders' value, there is a felt need for a comprehensive study on the subject for these countries. Moreover, corporate restructuring is an interdisciplinary area of study due to its linkages with corporate finance, investment management as well as behavioral aspects particularly in the context of M&As.

The present study attempts to fill this important void in M&A literature. We specifically examine the following propositions for acquirer/ parent companies: 1) Corporate restructuring event generates significantly abnormal returns around the announcement date (i.e. in the short run). 2) Corporate restructuring event significantly changes stock trading volume, volatility of returns and pricing efficiency, from pre to post event periods around the announcement date. 3) Mode of financing M&A deals substantially affects the post event abnormal stock returns. The outcome of the study will be useful to policy makers for regulation, companies planning restructuring event, corporate finance managers, consultants as well as existing and prospective shareholders.

We find significant pre-event returns for 5 out of 6 sample countries, which may be caused by possible leakages in information. Three of the BRICKS countries, i.e. India, South Korea and China exhibit significantly negative post-event returns while strong positive returns are observed in case of South Africa. The extra normal post-event returns defy semi-strong efficiency for majority of sample markets. It is further found that M&A announcements do not significantly alter the trading liquidity and pricing efficiency of the sample stocks. However, return volatility does decline on post event basis, which can possibly be explained by arguments provided by Bharath and Wu (2005). We also find that while stock financed mergers are value creating, cash financed mergers seem to be value destroying in the short run.

The paper is organized into 6 sections, including the present one. Section 2 provides a survey of literature on the subject. Section 3 describes data and their sources, while section 4 deals with methodological issues. In section 5, we discuss empirical results while summary and concluding remarks are contained in the last section.

2. Review of Literature

In this section, we provide a survey of literature for both developed and emerging markets.

2.1 Developed Markets

A large number of studies, especially in US and UK, have examined the effects of corporate restructuring events on stock returns in the short run, value creation effect in the long run, changes in company characteristics such as stock liquidity and volatility, pre and post restructuring performance and financing aspects relating to M&As. Some important studies are reviewed in this section.

Keown and Pinkerton (1981) document strong evidence of excess returns earned by investors in target companies prior to the public announcement of mergers. They argued that abnormal price movement can be construed as evidence that the market reacted to the information ahead of its public announcement.

Travlos (1987) explores the role of the method of payment in explaining common stock returns of bidding firms at the announcement of takeover bids. The results reveal significant differences in the abnormal returns between common stock offers and cash offers. The results are independent of the type of takeover bid, i.e., merger or tender offer, and of bid outcomes. These findings, supported by analysis of nonconvertible bonds, are attributed mainly to signaling effects and imply that the inconclusive evidence of earlier studies on takeovers may be due to their failure to control for the method of payment.

Franks, Harris and Titman (1991) investigate share-price performance following corporate takeovers. They use multifactor benchmarks from the portfolio evaluation literature that overcome some of the known mean-variance inefficiencies of more traditional single-factor benchmarks. Studying 399 U.S. takeovers consummated in the 1975–1984 period, they conclude that previous findings of poor performance after takeover are likely due to benchmark errors rather than mispricing at the time of the takeover.

Schaik and Steenbeek (2004) study 136 domestic mergers between non-financial companies in Japan between 1993 and 2003. Consistent with other findings, and in contrast to US evidence, bidders show a positive abnormal return around the announcement date of approximately 1.4%. The largest return is being realized in the 2 days *before* the announcement, but gains are quickly lost thereafter. Interestingly, trading volume appears to increase *after* the announcement. Announcement returns are found to be related to the presence of a common shareholder holding shares in both the bidder and the target company and whether the deal took place after 1997. They further find relationship between the size of the target company relative to the bidder company and the volume effect.

Alexandridis, Petmezas and Travlos (2010) use observations from US, UK and Canadian firms relating public acquisitions and find that they generate, at best, zero abnormal returns, and their stock financed subset negative abnormal returns for acquiring firms around the deal announcement. However, in other markets, which are deemed to be less competitive, the acquirers pay lower premia and realize gains, while share-for-share offers are at least non-value destroying for their shareholders.

2.2 Emerging Markets

Anson Wong, Kui Yin Cheung (2009) study the effects of corporate restructuring announcements on the pricing behavior of the Asian acquirer and target firms using the Bloomberg Database and Reuters Business Database. The markets studied were Hong Kong, China, Taiwan, Singapore, South Korea and Japan over the period from 1 January 2000 to 31 December 2007. Their results indicate that bidding firms see upside whereas target firms suffer from the downsides. Moreover, they find that the abnormal return for the shareholders of bidding firms during the post-announcement period depends on the type of acquisition.

Ma, Jianyu,Pagán, José A,Chu, Yun (2009) investigate the abnormal stock price returns of bidder firms around the day of M&A announcement for 10 emerging Asian markets: China, India, Hong Kong, Indonesia, Malaysia, the Philippines, Singapore, South Korea, Taiwan and Thailand. With a sample of 1,477 M&A deals, they found expected positive cumulative abnormal returns in 3 different event windows: a two-day (0, 1) window, a three-day (-1, +1) window, and a five-day (-2, +2) window. Valuation effects of information leakage about M&A deals were concluded to be statistically significant.

In India the empirical literature on the subject is limited and of recent origin.

Pandey (2001) examines the issue of takeover announcements, open offers and their impact on shareholders' value in the Indian corporate sector. Based on an empirical investigation of 14 large takeover related open offers, using event study methodology, he documented significant announcement effect (10 %) associated with the takeovers in the Indian capital market. He also found that target firm valuations increase in the short run up to announcement.

Dash (2004) examines the economic consequences of mergers with a view of resolving the conflict. It is found that modern mergers are primarily motivated by the firms with above industry-average performance and this trend continues to persist over the time. The event study methodology employed to assess the extent of value creation by mergers during 1994-96, indicates that on an average, mergers lead to value destruction and destruction of value is greater in case of unrelated mergers.

Sehgal, Sangh and Choudhary (2005) examined the data from 31 Indian corporate restructuring events and found the existence of pre-event extra normal profits and leakage of information. In the post-event phase, the evidence was mixed, with only 'Change in Management' type events leading to significant gains.

Suresh, Thenmozhi and Vijayaraghavan (2006) conducted a study to see the stock market's impact to 25 public announcements of both internal and external strategic decisions of Indian companies during January1, 2004 to May 31, 2005. The study concluded that the market penalized merger announcements substantially as the abnormal returns were negative, though not significantly different from zero on the days surrounding the event. The group means of the post announcement period were substantially lower than the means of the pre-announcement period, reflecting erosion in the firm value.

Anand and Singh (2008) analyzed short term shareholder wealth effects of the Indian bank mergers during the period 1999 to 2005. Event study methodology has been used to assess the impact on the firm's stock prices. The results document positive and significant increase in value to the shareholders of bidder banks, target banks and their combined portfolio.

3. Data

We consider the M&As completed during the period January 01, 2005 to December 31, 2009. The Thomson One online databases, along with the Thomson Reuters Spreadsheet Link (TRSL), were used for acquiring the data. The list of M&As were extracted from the online Thomson One database. Names and SEDOLs of acquirers were searched and matching Thomson Tickers were found, so that daily data could be extracted from TRSL. This gave us a complete dataset for 237 out of the initial 458 companies, from which again duplicates (a single day's transaction listed multiple times due to purchase in tranches) were removed to arrive at the final list of 214 companies.

For the 214 acquirer companies studied, both the acquirer and target companies were publicly listed in Brazil, Russia, India, China, South Korea and South Africa. Cross border M&A cases were not included. Only

transactions where the percentage of shares acquired was more than 15% were considered. This was to ensure that the effects of substantial acquisitions were studied. Other criterion for company selection was the availability of daily stock prices for 141 days, involving a 100 day estimation window (T0-120-T0-21 days), 20 days pre-event window (T0-20-T0-1 days), event date (Day T0) and 20 day post event window (T0+1-T0+20 days). We obtain this information by screening the companies over T0-150 to T0+50 observation window, owing to missing price observations. Data details for the sample countries are given in table 1.Our data set looks skewed with South Korea and India accounting for about 50% and 20% respectively of the sample companies. The missing data is the reason for the variation in the number of companies studied from each country. We used an internationally acceptable financial database and hence, have to adhere with data limitations. However, one has to be extremely careful while drawing general interpretations, given the unbalanced nature of our dataset.

For the next part of the study that deals with the impact of M&A announcement on stock characteristics, daily trading volumes 20 days prior and post the M&A announcement were additionally obtained. Volume data could be obtained for a list of 211 out of the 214 sample companies described previously. A screening window of T0-50 to T0+50 days was used to get data on account of missing observations, from which 20 pre and post data points were extracted. For the final part of the study, we obtain details of mode of financing (Cash, Debt and Stock considerations) for these M&A deals. Such information is available for only 116 out of the 214 sample companies. Owing to this relatively small sample size, we do not perform country specific analysis while evaluating the relationship between mode of financing and post event stock returns.

For finding the abnormal returns, we benchmark the returns on sample companies against stock indices from the same sample countries. The indices used are: IBOVESPA Brazil Index, RUSSIA RTS, BSE National 500, Shanghai SE Composite Index, KOSPI Composite Index, FTSE/JSE Allshare. The list of indices and their details are given in table 2. Daily data is collected for each of the stock market indices for the corresponding periods.

We also classify the sample companies based on Standard Industry Classification system, obtained from Thomson Reuters Spreadsheet Link (TRSL). SIC is a classification system that employs four-digit code and is extensively used this purpose in contemporary research.

4. Methodology

Event study methodology, as developed by Fama, Fisher, Jensen and Roll (1969)and Brown and Warner (1985), is ideal for discerning the influence of particular events on shareholder wealth.The event date labeled 'T0' is the date of announcement of the corporate restructuring. We use the daily closing stock prices for the period T0-120 days to T0+120 days. This daily price series is converted into daily return series using the formula:

$$R_{i,t} = log_e (P_{i,t} / P_{i,t-1}) \quad (1)$$

where $R_{i,t}$ is the return on Day t for the stock i, $P_{i,t}$ and $P_{i,t-1}$ are the closing prices on days t and t-1 respectively of the stock i.Daily returns were found for the various country specific indices described in the previous section for the same period. Next, we use the market model (Sharpe, 1963) which relates the return of a security to the return of the market index as shown:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (2)$$

(where $E[\varepsilon_{i,t}] = 0$ and $Var[\varepsilon_{i,t}] = \sigma^2_{\varepsilon i}$)

where $R_{i,t}$ and $R_{m,t}$ are the Day t returns on security i and the market index, (e.g. BSE 500), respectively. $\varepsilon_{i,t}$ is the zero mean error term and α_i, β_i and $\sigma^2_{\varepsilon i}$ are the estimated parameters of the market model.

The market model is estimated using Ordinary least squares (OLS) regression. The estimation window is a rolling window comprising of 100 days immediately before the day t, on which the return $R_{i,t}$ is to be computed. This procedure helps us in obtaining dynamic values of α_i and β_i, which change for each day of our event window (-20 to +20 days) and allow us to obtain more precise values of expected returns for each day of event window.1st order autocorrelation is checked for in the error term using Ljung-Box-Pierce Q-test. In case autocorrelation is detected at 5% significance level, the GLS estimation procedure is adopted to ensure efficiency of the estimated parameters. The period consisting of day T0-120 to day T0-21 was used to obtain the initial estimates of α_i,β_i and the process is repeated by skipping one day at a time.

Next, we define abnormal return as:

$$AR_{i,t} = (Actual\ Return)_{i,t} - (Expected\ Return)_{i,t} \quad (3)$$

where (Actual Return)$_{i,t}$ is the realized return of the security i on day t and (Expected Return)$_{i,t}$ is calculated according to equation 2 for $R_{i,t}$.

We find the daily abnormal returns for the pre-event window, days T0-20 to T0-1 and the process is continued for the post event window, i.e. days T0 to T0+20. For drawing inferences about the event impact, the abnormal return observations must be aggregated. The aggregation is studied along 2 dimensions: through time and across securities.

We define Cumulative Abnormal Returns for the stocks as:

$$CAR_i = \sum_{t=T0-20}^{T0-1} AR_{i,t} \quad (4)$$

$$CAR_j = \sum_{t=0}^{T0+20} AR_{i,t} \quad (5)$$

where$CAR_i$and CAR_j are the pre-event and post-event Cumulative Abnormal Returns, respectively.The CAR values are standardized as follows:

$$\text{Standardized CAR (SCAR)} = CAR/\ SE_{CAR} \quad (6)$$

where SE_{CAR} is the standard error of CAR calculated as:

$$SE_{CAR} = \sqrt{n/(n-2)}\sigma \quad (7)$$

σs are the standard deviations of the ARs, for the T0-20 to T0-1 and T0 to T0+20 periods. n=20 and 21 for the pre-event and post-event windows respectively.

The SCAR values follow t-distribution and hence, compared to t-statistic, at 5% confidence level, 2-tailed with (n-2) degrees of freedom. This allows us to find which of the sample companies have significant abnormal returns in the pre-event and post-event windows.

For country analysis, we take the average of Abnormal Returns, day-wise (i.e. T0-20, T0-19,….,T0+20) for all the companies in each country and label this Average Abnormal Return (AAR). The AARs are cumulated for the pre-event and post-event windows to obtain $CAAR_i$and $CAAR_j$respectively. The CAARs are standardized as follows:

$$CAAR_i = \sum_{t=T0-20}^{T0-1} AAR_{i,t} \quad (8)$$

$$CAAR_j = \sum_{t=T0}^{T0+20} AAR_{i,t} \quad (9)$$

$$\text{Standardized CAAR} = CAAR\ /\ SE_{CAAR} \quad (10)$$

where SE_{CAAR} is the standard error of CAAR:

$$SE_{CAAR} = \sqrt{n/(n-2)}\sigma_p \quad (11)$$

σ_p is given by the Markowitz Portfolio formula:

$$\sigma_p^2 = \sum_{i=1}^{N} x_i^2 \sigma_i^2 + \sum_{i=1}^{N} \sum_{j \neq i} \sigma_i \sigma_j \rho_{i,j} x_i x_j \quad (12)$$

where ρ_{ij} is the correlation coefficient between the returns on assets *i* and *j*. In our case, $x_i=x_j=1/n$ (equally weighted), where n=number of sample companies, in the country being considered. The correlation coefficient is taken to be 0 if there is no overlap in the event windows of the I and jthcompanies. This accounts for any cross-correlations between the securities.

The SCAAR values follow t-distribution and now compared to t-statistic, at 5% confidence level, 2-tailed with (n-2) degrees of freedom. This allows us to find significant average abnormal returns in the pre-event and post-event windows. We also perform aggregate market analysis using CAAR methodology. However, in this case, we take the average daily abnormal returns for all the sample companies before proceeding with further estimation. We also calculate the 3 day (T0-1 to T0+1) CAAR, aggregated by country, to see if there are different patterns between a very short term (3 day) and a short term (41 days) event windows. Specifically, we intend to verify if abnormal returns are more pronounced very close to the event date, which cannot be evaluated using the standard 41 days event window.

Next, we examine the impact of M&A announcement on stock characteristics. We verify if the knowledge of

event alters the trading activity, return volatility and pricing efficiency of the sample stocks. For testing any changes in trading activity, we consider the data in the event window, T0-20 to T0-1 days and T0 to T0+20 days. For these periods, we calculate the daily average of logarithm of trading volume, standard deviation of daily returns and 1st order autocorrelation of daily returns for each of the 211 sample companies.

For evaluating the significance of change in trading volume, we use the two-sample pooled t-test, equal variances, at 5% significance level.

$$t = (\bar{x}_1 - \bar{x}_2) / s_p\sqrt{(\frac{1}{n1} + \frac{1}{n2})} \quad (13)$$

$$s_p^2 = [(n_1-1)s_1^2 + (n_2-1)s_2^2] / (n_1+n_2-2) \quad (14)$$

$$df=(n_1+n_2-2) \quad (15)$$

Here the assumptions are that of normal populations (or $n_1 + n_2 > 40$) and independent observations and that population standard deviations, $\sigma_1 = \sigma_2$ where σ_1 and σ_2 are unknown.

- n_1 = sample 1 size.
- n_2 = sample 2 size
- s_1 = sample 1 standard deviation
- s_2 = sample 2 standard deviation

For discovering changes in standard deviation of daily returns, we use the two-sample F test for equality of variances, at 5% significance level.

$$F= (s_1 / s_2), \text{ with } s_1^2 \geq s_2^2 \quad (16)$$

The null hypothesis (H_0) that there is no significant change in pre-event and post-event standard deviations of average daily returns is rejected for $F > F(\alpha / 2, n_1 - 1, n_2 - 1)$.

For discerning changes in the lag 1 autocorrelation, which signifies pricing efficiency, we compute the t-statistic for the differences between pre and post event autocorrelation coefficients.

$$t = (ACF_i - ACF_j) / \sqrt{(\frac{1}{n1} + \frac{1}{n2})} \quad (17)$$

where ACF_i and $ACF_j$are the pre-event and post-event autocorrelation of daily returns for a 20 days and 21 days periods.

Finally, we evaluate if the mode of financing strategy significantly impacts stock returns. We estimate CAARs after segregating the companies on the basis of investment financing i.e. 1) cash, 2) stock and 3) cash, stock and other modes of financing. We estimate a 20 and 21 days CAARs as well as 3 day CAARs (centered on announcement date). The later shall help us in a better understanding of market reaction very close to the event date, when intensity of trading action is expected to be the highest. The final analysis is performed on aggregate basis, and not on country basis, owing to data limitations discussed in previous section.

5. Empirical Results

5.1 Pre and Post Event Returns

The pre and post event CAAR values for BRICKS, both on country as well as aggregate basis, are provided in table 3 and depicted in figures 1 a -1 g. Four out of six sample countries namely Russia, India, China and South Korea report significantly positive abnormal returns on pre-event basis, while pre-event CAAR for Brazil, though positive, is statistically not distinguishable from zero. South African market seems to be an exception, as it provides significantly negative returns for the pre-event period.The CAAR results are also statistically significantly positive on aggregate basis i.e. after accounting for all sample markets.

Extra-normal returns prior to an event maybe caused by 1) superior investment analysis by some of the market participants and/or 2) leakages in information, resulting in insider-trading. Given the pervasiveness of abnormal returns across sample markets and the fact that financial regulation is still evolving in emerging economies, the first argument is relatively less plausible. Hence, our pre-event results possibly point at information leakages and their exploitation by more well informed market traders. These conclusions may not be that farfetched; insider

trading seems to be prevalent even in mature markets like US, leading to recent investigations by SEC on this issue.

On post event basis, India, China and South Korea provide negative abnormal returns, while positive returns are reported for South Africa. There seems to be a reversal of signs of abnormal returns for these countries while comparing results for pre and post event periods. This clearly points to a change in market sentiment. Pre-announcement, the markets react positively (negatively) to the upcoming M&A, anticipating it to be value creating (value destroying) for the buyer firms' shareholders. But as the details of the M&A deal seep in, markets reverse, sensing chances of overpayment (underpayment), which will lead to value destruction (creation) for acquirer firms' shareholders.

Our findings support the overreaction hypothesis and imply that while investors are overoptimistic in India, China and South Korea during the pre-event period, they seem to be over-pessimistic in case of South Africa and correct their behavior after the event. Brazil and Russia do not report any significant post-event CAAR values. On overall basis, strong negative post event abnormal returns are observed for BRICKS. Thus, four out of six sample markets do not seem to be efficient on post-return basis to M&A announcement. Negative post event CAARs for the acquirers maybe an outcome of market fears of overestimation of synergies by the buyer firms' management and/or overpayment to the seller due to competitive bidding amongst potential acquirers, leaving negative value for the buyer firms' shareholders.

Our results for Chinese and South Korean economies are in contrast with those of *Ma, Jianyu, Pagán, José A, & Chu, Yun (2009)*. These contradictions may be an outcome of different time periods used by the two studies. It may be recalled that while Ma, *et al* use a 2000-2007 time period, we employ data from 2005 till 2009. Further, we use a 41 day event window, compared to shorter event windows used by them (Ma, et al use 3 different event windows: a two-day (0, 1) window, a three-day (-1, +1) window, and a five-day (-2, +2) window while we primarily study a 41 day (-20-+20) event window). The difference in results point out at significant changes in investor behavior over time in these markets.

We next focus on 3 day CAAR centered at the event date. It can be clearly seen that the 3 day CAAR values account for a major part of abnormal returns, reported over 41 days event window. This confirms that the market reaction is most intense immediately around the event date and most returns (positive or negative) are booked in the immediate vicinity of the event.

Our findings suggest that M&A announcement information can be exploited by market traders to generate superior profits by aligning their trading strategies for each market i.e. buying for countries that experience post-event positive returns and short-selling for those which report negative return. In case of any short-selling restrictions, they can take trading positions using stock futures. Our results provide support to the M&A arbitrage strategies used by hedge funds, at least for our emerging market basket.

Next, we perform CAR analysis for individual companies in BRICKS, which is reported in table 4. About 49% of CAR values are statistically significant both for pre and post event periods on overall basis. 51% of the significant pre-event CAR values are positive which declines to 44% for post event analysis. The CAR findings confirm strong abnormal returns prior to the event as well as on post event basis for a large number of cases. South Africa is an exception from the average as 83% of the significant post event CAR values tend to be positive. In contrast, 70% of significant post event CAR values in India are negative. Our results suggest possible leakages of M&A information which is exploited by the market traders on pre event basis for the BRICKS basket. On post event basis, M&A announcement is relevant for developing trading strategies in general. Specifically, for South Africa and India, long and short positions, respectively may provide abnormal returns.

We also classify individual companies in each country using Standard Industry Classification code discern if there are any sector patterns in post-event returns relating to M&A announcements. We could not find any clustering of statistically significant CAR values for any specific sector. This implies that abnormal returns are not sector specific and hence knowledge of industry classification may not aid in developing more profitable trading strategies.

5.2 M&A Announcement and Stock Characteristics

We analyze the impact of M&A announcement on stock characteristics, namely trading liquidity, return volatility and pricing efficiency, the results of which are shown in table 5.

We find that trading liquidity does not change significantly for pre and post event periods for the sample companies. Our results may be justified by the price overreaction hypothesis.We had seen in previous section

thatstrong positive (negative) pre event CAARs,implying continuation, are followed by significantly negative (positive) post event CAARs, implying reversal. Both continuation and reversal patterns may be supported by trading volumes, which is reflected ininsignificant changes in trading activity for our study. Our findings are in contrast Copeland (1976), Morse (1980 and 1982b), and Verrecchia (1981) who argue that pre-event trading volume should be generally higher owing to asymmetrically distributed information, which creates differences in investors' beliefs.

Next, we examine the volatility of acquirer firms' stock returns around the event date. There are at least three factors that may determine the level of post-merger volatility of the acquirer firms' stock (see SreedharBharath and Guojun Wu, 2005). First, mergers could be a response to industry shocks faced by firms. Thus, a successful merger may lead to a post-merger decline/stabilization in volatility. Second, one of the most crucial aspects that determines the success or failure of the merger is the ability of acquirer management to unify both the target and acquirer into a single entity after the merger. Thus post-merger integration risk is an important issue that has to be factored in by the financial markets. Based on this argument, we should expect declines/no further increases in volatility with the successful integration of the acquirer and the target, at least in the long run. However, there may be observable short term aberrations in terms of higher post event trading volatility till the time the two companies are fully integrated. Third, the cash flows of the acquirer and the target are imperfectly correlated. Based on the principle of diversification and portfolio theory, we expect acquirers to have declines in volatility immediately after the merger. This decline is likely to be greater for mergers across industries (inter-industry mergers). We find that post event volatility significantly declines compared to pre-event volatility for almost allthe companies in the sample data as shown in table 5. A short-run decrease in price volatility suggests that the diversification benefits outweigh any increase in integration related risks in the short run.

Finally, we check the pricing efficiency of the acquirer firms' stocks around the M&A announcement date. We observe that most pre and post event abnormal returns are not having autocorrelation at lag 1, implying that there are no pricing inefficiencies. We further confirm that there is no difference in price discovery levels, by comparing the pre and post period autocorrelation values as shown in table 5. This is not surprising given the statistical insignificance of the pre and post event autocorrelation coefficients for the sample companies in the first instance.

5.3 Mode of Financing and Stock Returns

In this subsection, we examine the impact of M&A financing strategy on post announcement stock returns. Previous research agrees that the method of payment plays an important role in explaining acquiring firms' stock returns. However, there are contradictory views as to which mode of financing is value creating (destroying).

Two hypotheses offer a theoretical rationale why the stock financed M&As should be treated unfavorably by investors: (1) The "information content" hypothesis by Myers and Majluf (1984), predicting that an offer to pay in shares for an acquisition will be seen by market participants as a signal that the stocks are overvalued and (2) the "free cash flow" hypothesis by Jensen (1986), showing that acquisitions being paid for in cash reduce the agency costs of free cash flows. The conclusions of both hypotheses are that stock transactions should lead to negative abnormal returns around the announcement date, whereas cash transactions should result in positive abnormal returns.

Alternative arguments are provided in the literature, that suggest that stock financing should be taken as good news by market traders. There have emerged two alternative hypotheses for explaining acquiring companies' stock return: The Investment Opportunity Hypothesis and the Risk Sharing Hypothesis.

The Investment Opportunity Hypothesis links the existence of growth opportunities with the method of payment for corporate acquisitions. Myers (1977) shows that firms with excellent future investment opportunities are less likely to issue debt than companies with poor future investment opportunities. The reason is that the first group of firms tries to preserve the cash flows to take advantage of the investment opportunities, whereas the second group of firms can use the cash flows for debt service payments without giving away investment opportunities. Similarly, Jung, Kim and Stulz (1996) argue that managers with growth perspectives prefer to raise capital with equity rather than with debt because it gives them more discretion with regard to the future use of the firm's cash flows. The similarities in the decision between how to raise capital and how to pay for corporate acquisitions led Martin (1996) to assume that firms with good investment opportunities prefer to pay in stock for their corporate acquisitions, whereas other firms prefer payment in cash. The Investment Opportunity Hypothesis has been tested by Martin (1996) and the results show that acquiring firms with good future investment opportunities are more likely to offer stock for corporate acquisitions than firms with poor investment opportunities. These results are consistent with the results of the study by Jung/Kim/Stulz (1996), who not only report that firms with

valuable investment opportunities are more likely to issue equity, but also state that the stock-price reaction to equity issues is more favorable for firms with valuable investment opportunities.

The second hypothesis is the Risk Sharing Hypothesis, and goes back to Hansen (1987). It is strongly related to the asymmetric information problem mentioned by Myers/Majluf (1984), but this time the information asymmetry is not in favor of the acquiring firm. In most acquisitions, the true value of the target firm is difficult to assess and remains controversial even after carefully executed due diligence. Furthermore, it is not necessarily clear to what extent the expected synergies will materialize in the post-acquisition period. The target firm, however, is in most cases fully aware of its true firm value. Hansen (1987) models this situation of asymmetric information between the acquiring firm and the target firm. He concludes that if the bidder is unsure about the true value of the target firm, he will rather offer to pay in stock so that the target firm's shareholder can be forced to share inany post-acquisition revaluation effects. Martin (1996), based on Hansen (1987), also argues that if there is high uncertainty in acquisition outcome, the bidder should rather use stock. Rappaport/Sirower (1999) argue that from a shareholder value point of view, the risk sharing hypothesis should receive high attention: in the case of a pure cash transaction, the post-merger operating risk will exclusively be taken on by the acquiring shareholders. If a risk-adjusted change in shareholder value due to the transaction were to be calculated, this would probably lead to a lower value than compared to a mixed or pure stock transaction.

Thus, the first hypothesis states that firms with excellent future investment opportunities should not pay in cash for acquisitions. Cash transactions often have to be financed with new debt. Cash flows, however, should not be used for debt service payments since this reduces the amount of discretionary cash flows available in the future. The second hypothesis states that, particularly for high-risk transactions, it could be advantageous to pay in stock because in this case, the target company will have an incentive to make a success of the takeover transaction. Both hypotheses predict that stock transactions have no longer to be seen as a negative signal by the market participants and therefore stand in sharp contrast to the hypotheses by Myers/Majluf (1984) and Jensen (1986).

Pre and posts event CAARs of financing strategy based portfolios are provided in table 6 and their graphical depictions are given in figures 2a -2c. We do not perform event study analysis separately for each sample country as the matching information for mode of financing and stock returns are available for only a subset of sample companies, i.e., 109 out of 214 firms. Hence, country analysis could suffer from small sample biases in financing strategy based portfolios. On pre event basis, CAARs for cash financed M&A deals are close to zero, while it is statistically significantly positive for stock and hybrid financing strategies. This may imply possible leakages in information and exploited by inside traders. However our primary focus is on post event performance owing to behavioral implications. We find that while cash based M&As provide strongly negative CAARs, stock based deals results in significantly positive CAAR values. Our results suggest that choice of payment does affect post-event stock returns and that stock financed deals are perceived to be value creating while cash financed deals are seen as value destroying. These finding are consistent with discussed above.

BRICKS are prominent emerging markets, which exhibit high economic growth rates over the last two decades, generating a plethora of investment opportunity in different sectors. Hence, these companies in the BRICKS basket may prefer to conserve cash for investing in these high growth opportunities by using stock financing as a means for funding inorganic growth through M&As. Additionally, these emerging markets are still going through economic and financial transition, making them riskier investments. Further, these markets are not fully information efficient and hence, may not generate fair corporate valuations, which may induce the buyer firms to prefer the stock financing mode as this will result in risk sharing with acquired firms' shareholders. Cash based mergers are seen as value destroying by the market as there is a fear of overpayment due to competitive bidding. The payments could be more than the value created by the M&A. There is a case of asymmetric information between the management of the companies and the external market participants. Hence, the acquirer firm stockholders may fear less value left for them from the merger, with most value accruing to the acquired firm shareholders. This drives the acquirer prices downward. Stock financing mitigates the effect of overvaluation or undervaluation of either firm. With a stock offer, the impending unfavorable news about the acquired firm's value will fall partly on the shoulders of the acquired firm's shareholders. So, the acquiring firm shareholders perceive decreased risk viz.-a-viz. cash acquisitions and react positively. Our results may not be surprising, given the nature of these emerging markets.

Our findings suggest that market traders should pay attention to the choice of payment for M&A deals, as it has a significant impact on post event returns. Arbitrage strategies can be created by taking long and short positions in the buyers firms in stock and cash financed M&As respectively.

6. Summary and Conclusion

To conclude, we find significant pre-event abnormal returns for five out of six sample countries. While these pre-event abnormal returns are significantly positive for India, China, Russia and South Korea, they are strongly negative for South Africa. This may point at possible information leakages in the system which has policy implications for financial regulators. On post-event basis, there is reversal in signs of abnormal returns, i.e. India, China and South Korea provide negative profits, while South Africa experiences strong positive returns. Our findings support the overreaction hypothesis and imply that while investors are overoptimistic in India, China and South Korea during the pre-event period, they seem to be over-pessimistic in case of South Africa and correct their behavior after the event.

We further examine the impact of M&A announcement on stock characteristics. It is found that corporate restructuring event does not significantly alter the trading liquidity of the sample stocks. Our findings are in contrast with Copeland (1976), Morse (1980 and 1982b), and Verrecchia (1981), who argue that pre-event trading volume should be generally higher owing to asymmetrically distributed information, which creates differences in investors' beliefs. It is further shown that return volatility significantly declines for sample stocks when one compares the pre and post event periods. A short-run decrease in price volatility suggests that the diversification benefits from merger outweigh any increase in integration related risks in the short run [For volatility related argument, see Bharath and Wu, (2005)]. We also find that pricing efficiency of sample stocks does not alter owing to M&A announcement.

Finally, we evaluate if mode of M&A financing affect post event stock returns for buyer companies in the sample countries. It is observed that while stock financed mergers are value creating, cash financed mergers seem to be value destroying in the short run. Our findings are consistent with Investment Opportunity Hypothesis as well as Risk Sharing Hypothesis proposed by Martin (1996).

The study has strong implications for global fund managers. The results suggest that they should pay attention to M&A announcements and the method of financing deals in emerging markets as such information can be used for developing profitable trading strategies. There are also implications for policy makers. The financial regulators should be concerned about insider trading and price manipulation, and tighten regulations to discourage them.

For future research, we recommend that event study analysis could be performed for target firms from BRICKS nations so that one gets a complete picture. Also, other type of corporate restructuring events, namely spinoffs and divestitures may be looked at as well. Multifactor models like Fama-French (1993) could be used to see if a pattern can be discerned regarding information leakage and any of the factors like market cap or PE valuations.

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Appendix

Table 1. Criteria for data selection

Countries from	Brazil, Russia, India, China, South Korea, South Africa
Acquirer and acquired status	Public
Date of Announcement	01/01/2005 to 12/31/2009
% of Shares Acquired in Transaction	15%-100%
Deal Status	Completed
Data window used	-150 days-+150 days data used to get -120-+120 days data points around event date, accounting for missing data
Number of companies	214 (Phase 1), 211 (Phase 2), 116 (Phase 3)

Table 2. Summary of Stock Market Indices used in the study for the sample countries

Index Name	**IBOVESPA Brazil Index**	**RUSSIA RTS**	**BSE National 500**	**Shanghai SE Composite Index**	**KOSPI Composite Index**	**FTSE/JSE Allshare**
Country	Brazil	Russia	India	China	S Korea	South Africa
Data available since	1/3/1972	9/1/1995	2/1/1999	1/2/1991	12/31/1974	6/1/1995
Number of index constituent	68	50	500	915	760	620

Table 3. Pre-event and post-event CAARs for BRICKS

	S Korea	India	Brazil	China	Russia	S Africa	All
-20-+20 days event window:							
CAARi	0.0270	0.0128	0.0024	0.1054	0.0218	-0.0370	0.0207
CAARj	-0.0185	-0.0427	0.0040	-0.0152	0.0144	0.0162	-0.0172
SCAARi	6.8605	2.8772	0.5249	11.2736	2.6653	-6.2005	9.5379
SCAARj	-4.8482	-10.3331	0.7806	-1.6589	1.3147	2.6656	-7.6558
-1-+1 days event window:							
AAR-1	0.0145	-0.0071	0.0158	0.0247	0.0162	0.0084	0.0103
AAR0	0.0108	-0.0054	0.0206	0.0084	0.0158	0.0092	0.0086
AAR+1	-0.0039	0.0022	0.0047	0.0187	-0.0068	0.0063	0.0006
CAAR (3)	0.0215	-0.0104	0.0412	0.0518	0.0252	0.0239	0.0195

Table 4. Pre and post event CAR results for the sample companies in BRICKS

Countries	Total number of companies	Abnormal Pre-event Return	% Abnormal Pre-event Return	Abnormal Post-event Return	% Abnormal Post-event Return	Positive Pre-event Abnormal Return	% Positive Pre-event Abnormal Return	Positive Post-event Abnormal Return	% Positive Post-event Abnormal Return
Brazil	26	14	53.85	13	50.00	6	42.85	5	38.45
Russia	6	2	33.33	3	50.00	1	50	2	66.67
India	44	24	54.55	20	45.45	12	50	6	30
China	11	6	54.55	9	81.82	6	100	5	55.55
South Korea	113	52	46.02	55	48.67	26	50	24	43.63
South Africa	14	7	50.00	6	42.86	3	42.85	5	83.33
Total	214	105	49.07	106	49.53	54	51.42	47	44.33

Table 5. Pre and post event stock characteristics for sample companies in BRICKS

Country/Change	Number of companies showing significant changes in Daily Trading Volumes	Number of companies showing significant changes in Daily Returns volatility	Number of companies showing decrease in Daily Returns volatility	Number of companies exhibiting significantly different ACFs
Brazil (26)	0	26	26	0
Russia (6)	0	6	6	0
India (42)	0	37	35	4
China (11)	0	11	11	0
South Korea (112)	0	108	108	2
South Africa (14)	0	14	14	0

Table 6. Impact of mode of M&A financing on pre and post event CAAR values for BRICKS

	Cash	Stock	Cash, Stock &Others
CAARi	-0.0035	0.0181	0.0682
CAARj	-0.0159	0.0122	0.0018
SCAARi	-0.8585	3.9033	4.8160
SCAARj	-3.8249	3.0451	0.1268
AAR0	0.0166	0.0080	0.0575
AAR+1	-0.0052	0.0088	-0.0075
CAAR(3)	0.0305	0.0238	0.0994

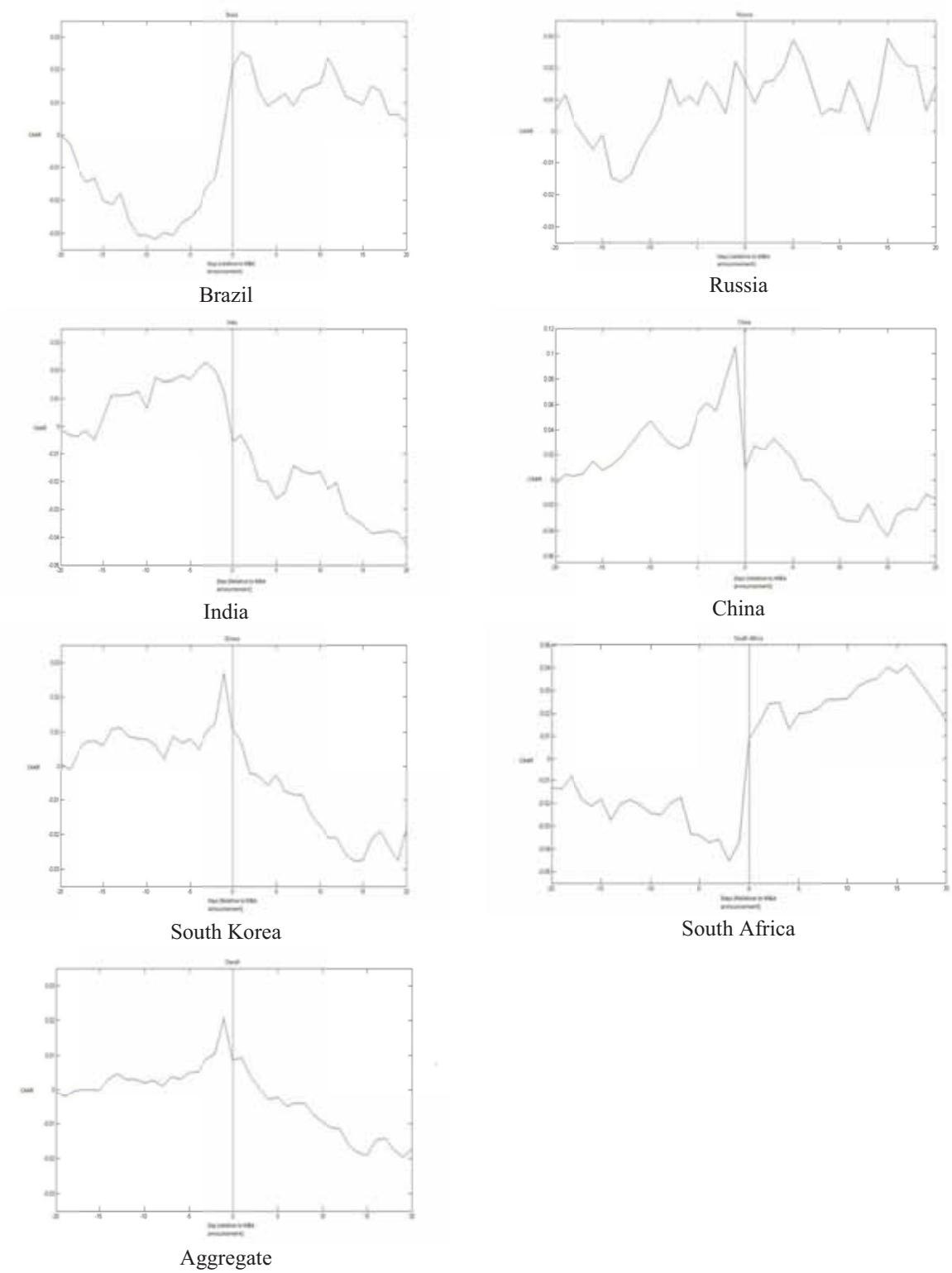
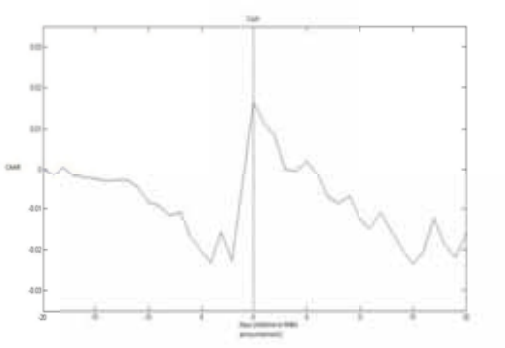
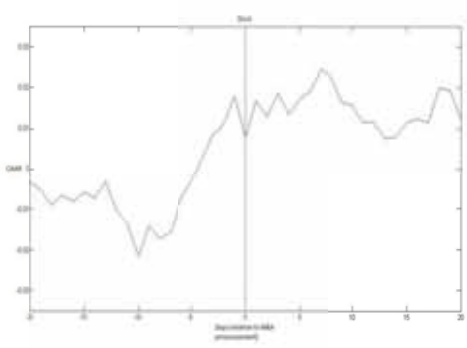


Figure 1. Graphical depiction of CAAR values for sample countries as well as on aggregate basis

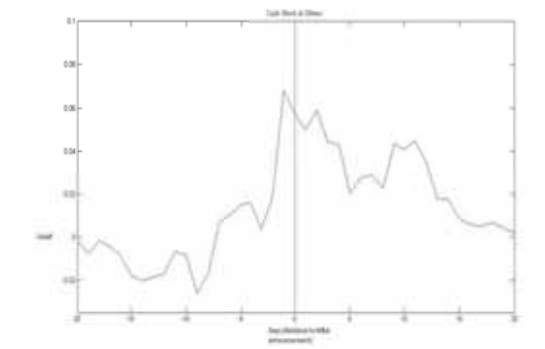
Note: The days relative to the M&A date are represented on the X-axis while CAAR values are depicted on the Y-axis.



Cash financed



Stock financed



Financed through cash, stock and others

Figure 2. Graphical depiction at aggregate level of CAAR results for portfolios formed on basis of method of payment

Note: The days relative to the M&A date are represented on the X-axis while CAAR values are depicted on the Y-axis.

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The Impact of Stocks Index Adjustments Announcement on Earnings Management

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Abstract

This study considers the situation of Morgan Stanley Capital International (MSCI) Taiwan Index adjustment announcement to examine the behavior of manager earnings management during the period 1999-2010. Survey whether the changes by declaring, in turn convey the manager's use of discretionary accruals. It is to explore whether the manager earnings management degree is high (low) when firms deleted from (added to) MSCI Taiwan index. The empirical and analytical results show that the discretionary accrual changes degree of added firms is not significantly smaller than that of deleted firms and the result implies that there seems no information effect in MSCI Taiwan index adjustment announcement.

Keywords: earnings management, MSCI Taiwan index, adjustment announcement, discretionary accruals

1. Introduction

Since the end of 2001, the U.S. went through a succession of business crisis storm. Enron made the forged account, WorldCom hide the losses, AOL TIME Warner reported the false advertising revenue, Johnson & Johnson was accused the concealment product error and other major events all caused investors' confidence falling, and investors had suffered huge losses, and the confidence of corporate financial reports were also a serious setback.

All events above, earnings management became an issue of high priority and a variety of accounting reforms were under consideration. When information asymmetry is high, stakeholders do not have sufficient resources, incentives, or access to relevant information to monitor manager's actions, which gives rise to the practice of earnings management (Schipper, 1989). Lobo and Zhou (2001) and Hunton, Libby and Mazza (2006) indicate that there is a statistically significant negative relationship between corporate disclosure and earnings management. Firms that disclose less tend to engage more in earnings management and vice versa. Jo and Kim (2007) supports the notion that greater disclosure frequency helps reduce information asymmetry, enhances the transparency of earnings, improves SEO pricing, and reduces post-issue SEO underperformance.

Therefore, this study investigates 130 added firms and 91 deletion firms during the period 1999- 2010 to explore whether the manager earnings management degree is high when firms deleted from MSCI Taiwan index and whether the manager earnings management degree is low when firms added to MSCI Taiwan index. Unlike some prior studies investigating firms' earnings management of S&P 500, the analytical results show that the discretionary accrual changes degree of added firms is not significantly smaller than that of deleted firms and the result implies that there seems no information effect in MSCI Taiwan index adjustment announcement. This study is the first study to examine the relationship between MSCI Taiwan Index adjustments announcement and earnings management. Investors should find some information content embedded in the index adjustments announcement.

2. Literature Review

Earnings, sometimes called the "bottom line" or "net income," are the single most important item in financial statements. They indicate the extent to which a company has engaged in value-added activities. They are a signal that helps direct resource allocation in capital markets. In fact, the theoretical value of a company's stock is the present value of its future earnings. Increased earnings represent an increase in company value, while decreased earnings signal a decrease in that value (Lev, 1989). Given the importance of earnings, it is no surprise that company management has a vital interest in how they are reported. That is why every executive needs to

understand the effect of their accounting choices so they can make the best possible decisions for the company. They must, in other words, learn to manage earnings (Note 1). News that a firm has fallen short of earnings expectations can immediately send its stock price plummeting; firms that beat expectations, on the other hand, are handsomely rewarded by investors (K. Chan, L. Chan, Jegadeesh, & Lakonishok, 2006).

Watts and Zimmerman (1978) suggested that the managers might engage in different accounting policies to manipulate earnings of accounting and in turn affected cash flows. Healy (1985) considered that the managers would use the components of discretionary accruals to manipulate earnings. Schipper (1989) also found that the manager would use the discretionary accruals to control the result of earnings. Jones (1991) and Teoh, Welch and Wong (1998) noted the managers might adjust time and places of profit and loss to achieve earnings management purposes. In addition, McNichols (2000) indicated that accruals are positively related to analysts' forecasts of future earnings growth even after controlling for contemporaneous growth.

Bernstein and Siegel (1979) and Bricker, Previts, Robinson and Young (1995) found that the fluctuations of the net income would affect the earnings quality. The smaller the fluctuations of the net income, the better for analysts to predict the future net income, and the greater of earnings quality. Sloan (1996) documented an intriguing return anomaly associated with accruals. He found that companies with high accruals earned lower abnormal returns than companies with low accruals. Collins and Hribar (2000) confirm this finding with quarterly accruals. Beneish and Vargus (2002) analyzed accruals, insider trading, and subsequent earnings quality. They found that the stocks trading for internal parties would affect the earnings quality. Following internal parties' trading, changes in total accruals and current accruals occurred. Penman and Zhang (2002) found that earnings quality would be affected by changes in accounting principles and investment decisions, which further affected the returns of accounting. Chan et al. (2006) found that there is a reliable, negative association between accruals and future stock returns.

Jo and Kim (2007) examined the relation between disclosure frequency and earnings management, and the impact of this relation on post-issue performance, for a sample of seasoned equity offerings (SEOs). They found that disclosure frequency is inversely related to earnings management and positively associated with post-issue performance. Platikanova (2008) examined the relationship between earnings quality and the long-term price effect of addition to the S&P 500. The trading-based explanations showed the positive abnormal returns following index addition. He also found that discretionary accruals significantly decrease is the conclusive cause, which greatly improves earnings quality. Chang and Sun (2010) investigate whether Sarbanes-Oxley Act (SOX)'s recently mandated disclosure of corporate governance structures affects the market's perception of earnings informativeness and firms' earnings management. They found that the quality of accounting earnings is increased after the SOX's mandated disclosure, which strengthens the link between financial reporting and corporate governance functions. Boon, Chan and Lee (2011) investigate whether Internet firms have a higher tendency to engage in earnings management than the brick-and-mortar firms. They use discretionary current accruals as the proxy for earnings management and find Internet firms have a greater tendency to manage their earnings.

Based on the foregoing literature review show when the companies have higher information transparency, the manager earnings management's behavior will be less. By the same token when the company is paid attention to by investors, the earnings management behavior is easier to be found, therefore the manager will reduce the motivation for earnings management. Otherwise, when the company is neglected by the investors, the manager will carry on more earnings management. Inference from here, this study predicts firms experience a lower earnings management degree on inclusion (addition to) in the MSCI Taiwan index and a higher earnings management degree on deletion from the MSCI Taiwan index. This leads to the following hypothesis:

Hypothesis 1a:

Compared to the deleted firm, the newly added firm its manager management degree is lower, discretionary accrual changes should reduce.

It also has the possibility that the added and deleted firms already have received investor's attention before index adjusted announcement. That means the investors will not reduce their attention because of company's situation change. Hence, company managers have been engaged in a very weak motivation for earnings management since then. Therefore, this leads to the following hypothesis:

Hypothesis 1b:

Compared to the deleted firm, the newly added firm its manager management degree is unchange, discretionary accrual changes have no markedly difference.

3. Research Methodology

3.1 Earnings Management Test Method

There are many ways common used in manipulate the earnings management, including changes in accounting methods, changes in business operations, and adjusts the accruals. The accruals are easier to manipulate in practice and with lower cost. There are many scholars' research focus on the accruals, the results all show that for firms with higher level of accruals, the managers should be more likely to manipulate earnings. Healy (1985) and Schipper (1989) found that the managers would use the components of discretionary accruals to manipulate earnings. Therefore, this study uses discretionary accruals to measure earnings management.

The discretionary accruals will be estimated using the Modified Jones Model suggested by Dechow, Sloan and Sweeney (1995) as an improvement of the original Jones model (Jones, 1991). The model is as:

$$\frac{TA_{it}}{A_{it-1}} = \alpha_0(\frac{1}{A_{it-1}}) + \alpha_1(\frac{\Delta REV_{it}}{A_{it-1}}) + \alpha_2(\frac{PPE_{it}}{A_{it-1}}) + \varepsilon_{it} \quad (1)$$

where

TA_{it} is the total accruals of firm *i* in year *t*；

A_{it-1} is the total assets of firm *i* at the end of year *t-1*；

ΔREV_{it} is the change in revenues of firm *i* between years *t* and *t-1*；

PPE_{it} is the gross property plant and equipment of firm *i* in year *t*.

The parameters of Eq. (1) are estimated using ordinary least squares, and take them into Eq. (2) calculate the nondiscretionary accruals.

$$NDA_{it} = \hat{\alpha}_0(\frac{1}{A_{it-1}}) + \hat{\alpha}_1(\frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}}) + \hat{\alpha}_2(\frac{PPE_{it}}{A_{it-1}}) \quad (2)$$

where ΔREC_{it} is the change in receivables of firm *i* between years *t* and *t-1*. Finally, discretionary accruals (DA) equal total accruals (TA) minus nondiscretionary accruals (NDA).

$$DA_{it} = \frac{TA_{it}}{A_{it-1}} - NDA_{it} \quad (3)$$

3.2 Research Model Establishment

This study is to explore whether the manager earnings management degree is high when firms deleted from MSCI Taiwan index and whether the manager earnings management degree is low when firms added to MSCI Taiwan index. It is to examine whether the discretionary accrual changes (ΔDA) degree of the added firms smaller than that of the deletion firms. This study adopts a dummy variable INC_{it} to represent the added firms and the deletion firms. INC_{it} is taking a value of 1 for firm *i* adding to MSCI Taiwan index in year *t* and 0 for firm *i* deleting from MSCI Taiwan index in year *t*. Then, a multiple regression approach is used to identify the important factors that relate to discretionary accrual changes (ΔDA). The seven most commonly cited variables are firm size (SIZE), debt ratios (LEV), operating cash flow (OCF), absolute values of total accruals (ABSTA), return of asset (ROA), growth opportunity (GROWTH), and the discretionary accrual changes at *t-1* (ΔDA_{t-1}). OCF and ΔDA_{t-1} are hypothesized to have a negative relationship to the discretionary accruals change. ABSTA and ROA are hypothesized to have a positive relationship to the discretionary accruals change. Therefore, this study can set up a regression model as follow:

$$\begin{aligned}\Delta DA_{it} = {} & \beta_0 + \beta_1 INC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 OCF_{it} + \beta_5 ROA_{it} + \\ & \beta_6 GROWTH_{it} + \beta_7 ABSTA_{it} + \beta_8 \Delta DA_{it-1}\end{aligned} \quad (4)$$

ΔDA_{it} is the discretionary accrual changes of firm *i* in year *t* and equals $DA_t - DA_{t-1}$.

INC_{it} is a dummy variable taking a value of 1 for firms *i* adding to MSCI Taiwan index in year *t* and 0 for firms *i* deleting from MSCI Taiwan index in year *t*.

$SIZE_{it}$ is the natural logarithm of the total assets of firm *i* in year *t*.

LEV_{it} is the total debt to total assets ratio of firm *i* in year *t*.

OCF_{it} is the operating cash flow scaled by the total assets of firm *i* in year *t*.

ROA_{it} is the return of asset of firm *i* in year *t*.

$GROWTH_{it}$ is the net sales change growth rate of firm *i* in year *t*.

$ABSTA_{it}$ is absolute values of total accruals of firm *i* in year *t*.

$\Delta DA_{i\ t-1}$ is the discretionary accrual changes of firm *i* in year *t-1* and equals $DA_{t-1} - DA_{t-2}$.

3.3 Data Source

This study uses stocks either added to or deleted from the MSCI Taiwan Index to examine the information effect during the periods from 1999 to 2010. Excluding finance and insurance industries and insufficient data firms during the event periods, the final samples comprised 130 firms added to and 91 firms deleted from the MSCI Taiwan Index. Table 1 summarizes the information of the sample. The firm-year observations with financial statements information are obtained from the TEJ (Taiwan Economic Journal). Furthermore, announcement date information for MSCI Taiwan Index adjustment is obtained from the UDN (United Daily News) data.

4. Empirical Results Analysis

4.1 Descriptive Statistics and Univariate Analysis

The descriptive statistics for the variables are shown in Table 2. The mean of discretionary accrual changes in year *t* (ΔDA_{it}) is -0.0087 (median=0.0001). The mean firm size ($SIZE_{it}$) is 16.9237 (median=16.8878), and the mean debt ratios (LEV_{it}) is 0.3876 (median=0.3950). Sample firms have a mean operating cash flow (OCF_{it}) of 0.1016 (median=0.0702), a mean net sales change growth rate ($GROWTH_{it}$) of 0.1137 (median=0.0721), and a mean absolute values of total accruals ($ABSTA_{it}$) of 0.0863 (median=0.0547). The ratio of return of asset (ROA_{it}) ranges from -62.39% to 53.1%, with a mean (median) of 7.33% (6.32%). The mean of discretionary accrual changes in year *t-1* (ΔDA_{it-1}) is -0.0103 (median= -0.0064).

Table 3 presents the results of descriptive statistics and univariate analyses of firms adding to MSCI Taiwan index (INC_{it} =1) and firms deleting from MSCI Taiwan index (INC_{it} =0). The results indicate that the mean discretionary accrual changes in year *t* of additions is 0.000 higher than that of deletions (mean = -0.021), but the *t*-test and Wilcoxon two-sample test are not significantly greater than 0 (p=0.255; p=0.327). These results seem that the manager earnings management degree is no difference when firms added to or deleted from MSCI Taiwan index. The result tends to support hypothesis 1b and shows MSCI Taiwan index adjustment is an information-free event. As for other variables, firm size ($SIZE_{it}$), operating cash flow (OCF_{it}), return of asset (ROA_{it}) and net sales change growth rate ($GROWTH_{it}$) for additions are significantly greater than those for deletions. The debt ratio (LEV_{it}) for additions is significantly smaller than that for deletions. This can be seen added firms' size and financial condition are better than deleted firms.

Table 1. Changes in the MSCI Taiwan Index

	MSCI Taiwan Index	
Year	Additions	Deletions
1999	11	13
2000	3	15
2001	27	6
2002	2	1
2003	11	7
2004	8	0
2005	7	6
2006	8	4
2007	26	3
2008	3	26
2009	23	7
2010	1	3
Total	130	91

This table describes the number of firms added to or deleted from the MSCI Taiwan Index from 1999 to 2010. Excluding finance and insurance industries and insufficient data firms, the final samples comprised 130 firms added to and 91 firms deleted from the MSCI Taiwan Index.

Table 2. Descriptive statistics for the variables

Variables	Number	Mean	S.D.	Minimum	Q1	Median	Q3	Maximum
ΔDA_{it}	221	-0.0087	0.1378	-0.9080	-0.0703	0.0001	0.0614	0.3828
INC_{it}	221	0.5882	0.4933	0	0	1	1	1
$SIZE_{it}$	221	16.9237	0.8926	14.8884	16.2568	16.8878	17.4446	19.9485
LEV_{it}	221	0.3876	0.1665	0.0474	0.2694	0.3950	0.4900	1.1141
OCF_{it}	221	0.1016	0.1226	-0.1757	0.0250	0.0702	0.1562	0.5679
ROA_{it}	221	7.3291	13.5194	-62.39	1.35	6.32	14.92	53.1
$GROWTH_{it}$	221	0.1137	0.3495	-0.8997	-0.1052	0.0721	0.2811	1.5076
$ABSTA_{it}$	221	0.0863	0.0882	0.0005	0.0258	0.0547	0.1205	0.4570
ΔDA_{it-1}	221	-0.0103	0.1657	-1.5166	-0.0582	-0.0064	0.0461	0.4584

As shown in Table 2, ΔDA_{it} is the discretionary accrual changes of firm *i* in year *t* and equals $DA_t - DA_{t-1}$. INC_{it} is a dummy variable taking a value of 1 for firms *i* adding to MSCI Taiwan. index in year *t* and 0 for firms *i* deleting from MSCI Taiwan index in year *t*. $SIZE_{it}$ is the natural logarithm of the total assets of firm *i* in year *t*. LEV_{it} is the total debt to total assets ratio of firm *i* in year *t*. OCF_{it} is the operating cash flow scaled by the total assets of firm *i* in year *t*. ROA_{it} is the return of asset of firm *i* in year *t* (unit: %). $GROWTH_{it}$ is the net sales change growth rate of firm *i* in year *t*. $ABSTA_{it}$ is absolute values of total accruals of firm *i* in year *t*. ΔDA_{it-1} is the discretionary accrual changes of firm *i* in year *t-1* and equals $DA_{t-1} - DA_{t-2}$.

4.2 Regression Results Analysis

This study reports a Pearson correlation matrix in Table 4. If only alone observes the relationship between discretionary accrual changes in year *t* (ΔDA_{it}) and added firms (INC_{it}), and it shows no significant correlation. Results from the table indicates ΔDA_{it} is positively associated with return of asset (ROA_{it}) and negative associated with operating cash flow (OCF_{it}) and discretionary accrual changes of firm *i* in year *t-1* (ΔDA_{it-1}). These results exhibit the higher return of asset, the discretionary accrual changes are also higher. The more operating cash flow, the discretionary accrual changes are lower. In addition, ΔDA_{it} has no significant correlation with firm size ($SIZE_{it}$), debt ratios (LEV_{it}), net sales change growth rate ($GROWTH_{it}$) and absolute values of total accruals ($ABSTA_{it}$). In the table the correlation coefficients are almost all less than 0.5, indicating that among independent variables seem without higher correlations. If further testing VIF among the independent variables, all values are less than 10. Therefore, this study of colinearity among independent variables should be little doubt.

The multiple-regression results are reported in Table 5. The regression results reveal that the additions (INC_{it}) are slight negatively associated the discretionary accrual changes (ΔDA_{it}). The discretionary accrual changes degree of added firms is not significantly smaller than that of deleted firms. The results also tend to support hypothesis 1b show MSCI Taiwan index adjustment is an information-free event. The result is consistent with Tu and Chang (2012) who find that there is no significant information effect from MSCI Taiwan Index additions. The effects of control variables, the firm size ($SIZE_{it}$) and absolute values of total accruals ($ABSTA_{it}$) are slightly positively related with the ΔDA_{it}. The net sales change growth rate ($GROWTH_{it}$) is slightly negatively related with the ΔDA_{it}. The coefficient estimate of debt ratio (LEV_{it}) is 0.120 and significantly positively related with the ΔDA_{it}, with a t-statistic of 2.423. The positive effect is consistent with Duke and Hunt (1990). The discretionary accrual changes (ΔDA_{it}) are significantly positively associated with return on assets (ROA_{it}). The coefficient estimate is 0.008, with a t-statistic of 10.566. This result is consistent with Dechow et al. (1995), Kasznik (1999) and McNichols (2000).The result also indicates that consistent with Dechow et al. (1995) and Becker, Defond, Jiambalvo and Subramanyam (1998) ΔDA_{it} is negatively associated with OCF_{it}, operating cash flow, with a coefficient of -0.636 and a t-statistic of -5.898.

Table 3. Univariate analysis

	Additions			Deletions			t-test	Wilcoxon test
	INC=1			INC=0			difference	Z-value
variables	number	mean	S.D.	number	mean	S.D.	(p-value)	(p-value)
ΔDA_{it}	130	0.000	0.151	91	-0.021	0.117	0.021(0.255)	-0.980(0.327)
$SIZE_{it}$	130	17.084	0.967	91	16.695	0.720	0.388**(0.001)**	2.977**(0.003)**
LEV_{it}	130	0.354	0.143	91	0.435	0.186	-0.081**(0.000)**	-3.026**(0.002)**
OCF_{it}	130	0.140	0.139	91	0.046	0.060	0.094**(0.000)**	-5.976**(0.000)**
ROA_{it}	130	12.813	11.681	91	-0.505	12.071	13.317**(0.000)**	-8.224**(0.000)**
$GROWTH_{it}$	130	0.191	0.363	91	0.003	0.297	0.189**(0.000)**	-4.150**(0.000)**
$ABSTA_{it}$	130	0.092	0.090	91	0.078	0.085	0.015(0.228)	-1.555(0.120)
ΔDA_{it-1}	130	-0.010	0.195	91	-0.010	0.112	0.000(0.989)	-0.739(0.460)

The variable definitions are the same with Table 2.

Table 4. Pearson Correlation Coefficients

	ΔDA_{it}	INC_{it}	$SIZE_{it}$	LEV_{it}	OCF_{it}	ROA_{it}	$GROWTH_{it}$	$ABSTA_{it}$	ΔDA_{it-1}
ΔDA_{it}	1								
	.								
INC_{it}	0.077	1							
	(0.255)	.							
$SIZE_{it}$	-0.028	0.215	1						
	(0.680)	**(0.001)**	.						
LEV_{it}	0.000	-0.240	0.319	1					
	(0.996)	**(0.000)**	**(0.000)**	.					
OCF_{it}	-0.125	0.379	-0.067	-0.347	1				
	(0.063)	**(0.000)**	(0.322)	**(0.000)**	.				
ROA_{it}	0.282	0.486	-0.159	-0.485	0.608	1			
	(0.000)	**(0.000)**	**(0.018)**	**(0.000)**	**(0.000)**	.			
$GROWTH_{it}$	0.053	0.267	0.114	-0.094	0.277	0.394	1		
	(0.431)	**(0.000)**	(0.092)	(0.163)	**(0.000)**	**(0.000)**	.		
$ABSTA_{it}$	-0.008	0.081	0.094	0.106	-0.166	-0.163	0.025	1	
	(0.909)	(0.228)	(0.163)	(0.115)	**(0.014)**	**(0.016)**	(0.716)	.	
ΔDA_{it-1}	-0.420	0.001	0.022	-0.018	-0.092	0.078	0.072	0.014	1
	(0.000)	(0.989)	(0.745)	(0.785)	(0.171)	(0.249)	(0.287)	(0.841)	.

Figures in brackets are p-values (two-tailed). The variable definitions are the same with Table 2.

Table 5. Regression analysis result

Variables	Coefficient	Standard deviation	t-value	VIF
Constant	-0.153	0.138	-1.109	
INC_{it}	-0.016	0.014	-1.167	1.571
$SIZE_{it}$	0.006	0.008	0.752	1.303
LEV_{it}	0.120	0.049	2.423**	1.454
OCF_{it}	-0.636	0.108	-5.898***	1.695
ROA_{it}	0.008	0.001	10.566***	2.415
$GROWTH_{it}$	-0.016	0.025	-0.621	1.253
$ABSTA_{it}$	0.032	0.086	0.377	1.086
ΔDA_{it-1}	-0.440	0.089	-4.927***	1.045
F value 27.40***				
Adjusted R-square 0.4898				
N = 221				

$$\Delta DA_{it} = \beta_0 + \beta_1 INC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 OCF_{it} + \beta_5 ROA_{it} + \beta_6 GROWTH_{it} + \beta_7 ABSTA_{it} + \beta_8 \Delta DA_{it-1}$$

The variable definitions are the same with Table 2. ***: significant at 1% level, **: significant at 5% Level, *: significant at 10 % level.

5. Conclusions

This study investigates 130 added firms and 91 deletion firms during the period 1999- 2010 to explore whether the manager earnings management degree is high when firms deleted from MSCI Taiwan index and whether the manager earnings management degree is low when firms added to MSCI Taiwan index. Unlike some prior studies investigating firms' earnings management of S&P 500, the analytical results show that the discretionary accrual changes degree of added firms is not significantly smaller than that of deleted firms and the result implies that there seems no information effect in MSCI Taiwan index adjustment announcement. This study regresses the discretionary accrual changes (ΔDA) on some variable to identify the factors that drive firms' earnings management changes. The regression analysis reveals that return of asset (ROA), operating cash flow (OCF) and debt ratios (LEV) are the major determinants for earnings management changes. It is the first study to examine the relationship between MSCI Taiwan Index adjustments announcement and earnings management. Investors should find some information content embedded in the index adjustments announcement.

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Note

Note 1. Data retrieved from http://www.swlearning.com/pdfs/chapter/0324223250_1.PDF

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Testing the Cointegrating Relationship between Health Care Expenditure and Economic Growth in Nigeria

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Abstract

This paper examined the relationship between health care expenditure and economic growth in Nigeria for the period 1970-2009. We employed the multivariate cointegration technique proposed by Johansen and found the existence of at least one cointegrating vector describing a long run relationship among economic growth, foreign aids, health expenditure, total saving and population. This is further confirmed by the Hassen Parameter instability test. The cointegrating equation however shows some deviations in terms of the signs of the coefficients of foreign aids and health expenditure which partly may be attributed to some diversification of foreign aids to other uses or that the allocation to health services is grossly inadequate. It is therefore suggested that an appreciable proportion of the national budget be allocated to the health care services to have a more robust health care programmes capable of fostering economic growth in Nigeria.

Keywords: health care expenditure, economic growth, co-integration

JEL classifications: C32, I15

1. Introduction and the Background

The significance of health especially to human capital has been well documented. The World Health Organization (WHO, 2005) attributed the fifty per cent differentials in economic growth between developed and developing nations to Health Care and this is a pointer to the fact that there is a positive correlation between health care and economic growth. Health outcomes are affected by a wide range of factors, pertaining to the individual, social and environmental context. In addition, preventive and curative health services are direct inputs that affect an individual's health status and the ability to cope with ill health (Benefo and Schulz, 1994).

Given the importance of health services, policy makers in Nigeria have been giving considerable attention to the issue of how public expenditure on health can be increased so as to ameliorate health care problems. And in line with this, expenditure on health care has been on the increase since independence. The health care recurrent expenditure was ₦12.48 million in 1970, it increased to ₦52.78 million in 1980 (322.9%) and further rose to ₦132.02 million in 1985 (150.13%). In 1989 and 1991 it was ₦5785.3 million and ₦668.40 million respectively. The budgeted expenditure rose to ₦1.27 billion in 2008.This shows that expenditure on health has been increasing on a yearly basis. Despite this however, there is no correlation between the Health Care expenditure and Nigerian Health Status. Statistical evidence from the National Bureau of Statistics (NBS) (Various issues) reveals one hospital bed per 1,806 people in 2005, compare with one per 1,651.6 in 2001. The population per doctor and nurse ratios deteriorated from 3376:1 to 3059:1 and from 1082:1 to 714:1 respectively over the same period.

In addition, life expectancy has been the most common indicator of health conditions in a country, and Nigeria's was just 44.9 years in 2003, down from 47.5 years below those of Ghana (54.4 years) and Cameroun (48.0 years). The high rates of HIV/AIDS infection has contributed significantly to Nigeria's low life expectancy (USAID, 2010). The 2003 HIV/AIDS infection rate of 5.4 per cent remained almost unchanged in 2011. It is above the LI-SSA average (4.4 per cent) and Ghana's rate (3.1 per cent), but below that of Cameroun (6.9 per cent). On the aggregate, 3.5 million people in Nigeria are affected which translates to 10 per cent of the world's total infected population (USAID, 2010).

Infant mortality rate (IMR) fell from 78.8 per 1,000 life births in 2002 to 76.0 in 2006. About 52% of under five deaths are associated with malnutrition. The maternal mortality rate (MMR) is another troubling indicator, an estimated 800 deaths per 100,000 live births in 2000 and has remained almost unchanged in 2011. This rate is worse than Ghana (540 deaths) or Cameroun (730 deaths), yet slightly below the LI-SSA average of 880. This statistics highlights Nigeria's low score on another health indicator, the percentage of births attended by a skilled health professional 35 percent in Nigeria which is low relative to the LI-SSA average of 50 percent and Cameroun's 60 percent (USAID, 2010). According to USAID (2010) the provision of basic health service is a major form of human capital investment and a significant determinant of growth and poverty reduction. Therefore, an understanding of health conditions can influence the design of economic growth and poverty reduction. USAID therefore notes that, health problems cannot be addressed in a sustainable way without more funding and initiatives on the part of government.

One of the main objectives of the World Bank's Country Partnership strategy and Nigeria's National Economic Empowerment Development Strategies Programme according to USAID (2010) is to improve these conditions to meet Millennium Development Goals (MDG), but the allocation of Nigerian government to health spending in recent years is only 0.66 percent of GDP. This expenditure is less than one-third of the regional average and also below the spending in Ghana and Cameroun.

The inadequate allocation of the national budget to the health sector is being worrisome and as such this study attempts to find answers to the following questions. How has government expenditure on health transmitted to the Nigerian economy? What is the relationship between health care expenditure and economic growth in Nigeria? The remaining parts of this paper is organised as follows. Section II examines health care financing in Nigeria while Section III is on review of related literature. Section IV presents the methodology and section V presents and analyses the results. Section VI concludes and offers some useful policy recommendations.

2. Health Care Financing in Nigeria

The structure of the Nigerian health system and mechanisms for its financing draw their origins from the colonial medical system. During colonial times, health services were primarily public services involving preventive health care mainly in the form of hygiene and sanitation, provided to the general populace. Financing public sector health service delivery derived largely from undertakings of and funded by the missionaries, who established Federal Budget Office (FBO) service delivery units, many of them outside the capital territory and other areas.

Figure 1 shows the government funding flows to the health care system. Within this arrangement, however, funding and referral linkages have never been clearly defined. National policies were developed not only to clarify the roles and responsibilities for the delivery of health care but also to expand options for health care financing. In spite of overall increase in resource availability in the government budget, overall allocations to the health sector decreased between 2000 and 2006. Federal government expenditure on health as a percentage of total government expenditure fell from 4.2% (2000) to 3.5% (2004) and has not increased beyond 4.5% since 2004. As well, the total expenditure on health as a percentage of Gross Domestic Product (GDP) fell slightly between 2000-2006 (from 4:3% to 4.1%)

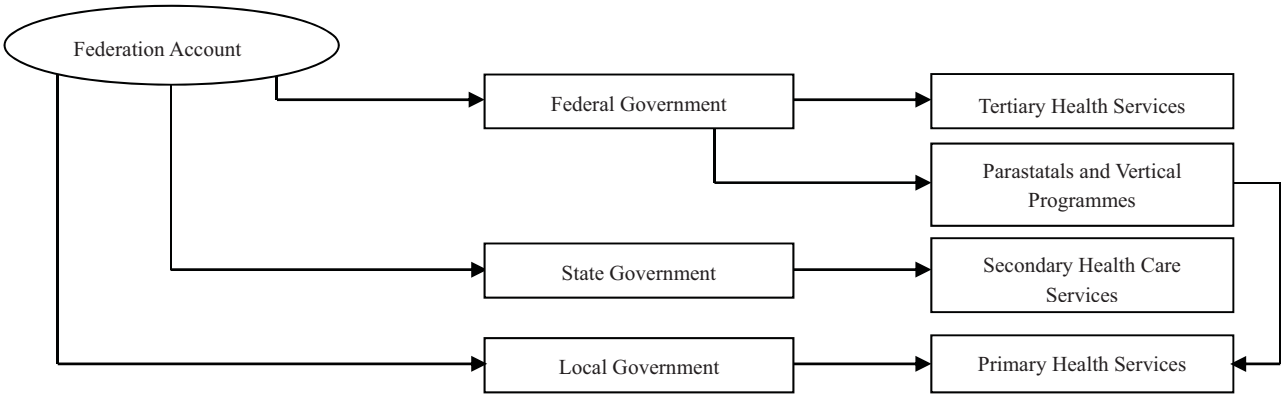

Figure 1. Government funding in health care system

Sources: Federal Ministry of Health, 2008

Nigeria obtained relief from her group of creditors in 2005. This effort has expanded the overall fiscal space for health in Nigeria. Twenty-one per cent of its 2006 round of allocation from debt relief went to the Health Sector. In 2007 the allocation fell to 13.5%, but provided further support for conditional grants and safety nets to assist both states and local governments support expansion of social service delivery, particularly primary health care (office of the Special Assistant to the President on the Millennium Development Goals, 2006, 2007).

Assessing financial flows and accountability of funds for health in Nigeria remains a dilemma because the data required for tracking resource flows, budgets and expenditure are often not easily available. The findings of Nigeria's first National Health Accounts (NHA), published in 2006 (WHO, 2006), provide important insights into the sources of health care financing in Nigeria. According to this report, household out-of-pocket expenditures remain the single largest source of health care financing constituting 65.9% of total health expenditures. This is followed by the government at 26.1% (federal 12.4%, state 7.4% and local government 6.4%),firms at 6.1% and development partners at 1.8%. Per capita expenditure on health was US$ 50.00 by 2006 (WHO, 2006).

As a part of efforts to strengthen the National Health system, the revised National Health Policy has been developed and adopted by the Federal Executive Council. The key thrusts of the policy are to expand financial options for health care and strengthen the contribution of the private sector and pre-payment based approaches for financing (Dare, 2008). It also seeks to engage communities and households in community-based schemes for the financing of primary care services. Public – Private – Partnerships (PPPs) is also presented as a strategic approach for the expansion of health financing options at all operational levels.

3. Literature Review

The correlation between government expenditure on health care and economic growth in Nigeria has continued to generate series of debate among scholars. According to Abdullah (2000) governments all over world are expected to perform two functions, which are protection (security) and provisions of certain public goods. In terms of protection, government is expected to enforce the rule of law, while under the provision of public goods; government is expected to provide roads, education, and health care, just to mention a few.

There have been divergent opinions on the expected relationship between government expenditure and economic growth. Some schools of thought believed that increase in government expenditure promotes economic growth (Al-Yousif, 2000; Coorcy, 2009; Barro, 1991) while other schools of thought believed that higher or increasing government expenditure may slowdown overall performance of the economy. According to them, higher expenditure might lead to increase in taxes or borrowing, whereas higher income tax discourages individual from working for long hours or even searching for jobs. The multiplier effect of this is reduction in income and aggregate demand. On the production side, higher profit tax tends to increase the cost of production which will in-turn reduce investment expenditure, therefore large government expenditure will have negative impact on economic growth (Laudau, 1983; Barro, 1991; Engen and Skinner, 1992; Folster and Henrekson, 2001).

Issues relating to the quantity of resources a country devotes to medical care have continued to get attention from researchers and policy makers. Many studies have found a strong and positive correlation between GDP of a country and the national expenditure on health care. Most studies employed a demand function approach to specify their model. In this case, the real per capita health care expenditure is expressed as a function of real per capita GDP and other selected variables

The above notwithstanding, Odior (2011) using computable general equilibrium (CGE) model found that government expenditure on health in Nigeria is significant in explaining economic growth in Nigeria and that moving resources from other sectors to provide quality health will stimulate economic growth.

Growth literature has adequately recognised the role of human capital in stimulating economic growth. The early take-off of most developed nations has largely been attributed to investment in human capital and not physical capital, thus, human capital is a key determinant of growth (Barro, 1996; Solow, 1956 and Swan, 1956).

Using infant mortality or child mortality a lot of studies found that the contribution of health care spending to health status is either small or statistically insignificant (Odior, 2011; Musgrave, 1996; Filmer and Pritchett, 1977). However, other studies have found a positive correlation between expenditure on health care and health status of the poor (Gupta et al., 2003). A micro-study by Grossman (1972), Muurinen (1982) and Wagstatt (1986) observed slight correlation between income and utilization of expenditure on health care. On the contrary, Newhouse (1977) found that over 90 per cent of the variance in per capita medical expenditure is explained by variation in per capita GDP. It was found that the income elasticity for health care spending is greater than one indicating that medical care is a luxury.

Halil et al. (2006) in their study on tests of stationarity and cointegration of health care expenditure and gross domestic product for Turkey employed cointegration analysis to examine the long run relationship between health care expenditure, GDP and population growth .The results suggest that there exists at least one cointegrating vector especially for the total health care expenditure model.

4. Empirical Model and Data

The methodology here analyzes the relationship between health care expenditure and economic growth using Keynesian modelling framework which postulates that any expansion in government expenditure has positive impact on economic growth; hence the level of government expenditure on health remains an important determinant of economic growth. Based on this and following Solow (1956), an economic growth model is specified as

$$Y_t = f(K_t, A_t, L_t) = K_t^{\alpha}(A_t L_t)^{1-\alpha} \tag{1}$$

where Y_t = aggregate real output, K_t = Capital stock, A_t = Efficiency factor, L_t = Labour force, $\beta = 1-\alpha$. Since human capital contributes positively to economic growth and following Odusola (2002) and as adopted in Olubokun and Bakare (2011), a re-specification of the model is

$$Y_t = K_t^{\alpha} H_t^{\beta}(A_t L_t)^{\sigma} \tag{2}$$

where H_t = human capital. Again, an improvement in health care programmes through adequate financing schemes enhances physical and mental capabilities and thus improves productivity. Therefore, it is logical to proxy the human capital variable with health care expenditure. The natural log linear transformation of equation (2) is

$$\ln Y_t = \alpha \ln K_t + \beta \ln H_t + \sigma \ln(A_t L_t). \tag{3}$$

In these equations, α, β and σ are taken as constants and are interpreted as elasticities in equation (3).

This study employed the co-integration in analyzing the relationship between health care expenditure and economic growth as adopted by Halil et al. (2006).

Based on Engle and Granger principle, there is an underlying long run relationship between two cointegrated variables. If the two variables X_t and Y_t are non-stationary in their first differences, then they are I(1) variables so that their linear combination would be

$$Z_t = X_t - \lambda Y_t \tag{4}$$

If λ exists such that Z_t is I(0), then their linear combination is stationary and are therefore cointegrated even though they may drift apart in the short run. As a first step in cointegration analysis, the Philip-Perron (P-P) unit root test can be employed but we adopted the Augmented Dickey Fuller (ADF) test statistic since both techniques can approximate each other.

The ADF is

$$\Delta y_t = a_0 + \delta y_{t-1} + a_2 t + \sum_{i=1}^{P} \beta i \Delta y_{t-i} + \mu_t \tag{5}$$

where y_t is the variable under consideration and the error term μ_t is such that

$$\varepsilon(\mu_t) = 0 \tag{6}$$

The Johansen's procedure is the main technique adopted for the test of cointegration. This avoids Engle and Granger's two step estimating and testing for the presence of multiple cointegrating vectors. It thus avoids carrying the error term introduced in the first-step estimation into the error correction mechanism. The Johansen approach relies on the relationship between the rank of matrix and its characteristic roots and estimates long-run relationship between non-stationary variables using maximum- likelihood procedure. This approach based on the rank of the coefficient matrix Π of the equation. The test equation is of the form

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Delta X_{t-2} + ... + \Gamma_{k-1} \Delta X_{t-1+1} + \Pi X_{t-k} + \mu + \varepsilon_t \tag{7}$$

The null hypothesis for r cointegrating vector in this case is that Π has a reduced rank, $r < k$ where X_t = $kx1$ vector of I(1) variables of $\Gamma_1, \Gamma_2 ..... \Gamma_{k-1}$. Π is kxk matrices of unknown parameters and contains

information about the cointegrating relationship. The reduced rank condition has an implication that the process ΔX_t is stationary and X_t is non-stationary. If Π is of full rank, all elements of X are stationary, if the rank of Π=0, there is absence of stationary combinations and so no cointegrating vectors and if Π is between r and k, the X variables are cointegrated and there exists r cointegrating vectors. The trace and maximum Eigen test statistics in the Johansen's approach are respectively given by

$$\lambda_{trace} = -N\sum \ln(1-\lambda_i) \tag{8}$$

$$\text{and } \lambda_{\max}(r, r+1) = -N\sum \ln(1-\lambda_{i+1}) \tag{9}$$

where λ_i =estimated values of the characteristics roots generated from the π matrix, r =the number of cointegrating vectors and N = the number of observations

For the present case of the interaction between health care expenditure and economic growth, a measure of economic growth using the real GDP which serves as the dependent variable is adopted. This seems to have controlled for inflation uncertainty thereby explaining the real value of money. Our key independent variable is the health expenditure variable obtained as a proportion of the real GDP and which is believed to have some impact on growth. Other control variables used are population, saving and foreign aid.

The rationale for including the population variable lies on the fact that age structure is of prime importance in determining the levels of health care expenditure as the demand for medical services fluctuates with age structure. Population less than 15 years and above 65 years of age tend to utilize medical services more than the rest of the population. In between these age structures, there are the physically active population who carry the burden of the inactive populace. This amounts to stress which may affect productivity vis-a-vis growth. Our investment variable is the total saving following the classicists assumption of equality between saving and investment. If what is saved is invested under the conventional circular flow of income, then saving may determine the amount invested.

Data on foreign aid to health sector is often not readily available in most developing countries, Nigeria is no exception. An inflow of foreign capital in form of aid accentuates the rate of investment in many sectors through the provision of the foreign exchange component of investment. Aside from the salaries of health personnel, some part of health care expenditure such as the purchase of medical supplies such as imported drugs, equipment and spare parts requires foreign exchange.

On the basis of equation (3), that is, $\ln Y_t = \alpha \ln K_t + \beta \ln H_t + \sigma \ln(A_t L_t)$, we derive our estimating equation. In principle, we can write

$$\ln y_t = \phi + \alpha \ln K_t + \beta \ln H_t + \delta_1 \ln A_t + \delta_2 \ln L_t + \varepsilon_t \tag{10}$$

We have earlier taken A_t to be the efficiency factor. In our case since foreign aid may tend to facilitate health care through provision of the required health facilities as earlier discussed, it thus serves as an efficiency factor and then may represent the A. On the final note, our empirical model is defined as

$$\ln RGDP = \beta_0 + \beta_1 \ln K_t + \beta_2 L_t + \beta_3 H_t + \beta_4 AD + \varepsilon_t \tag{11}$$

where $RGDP$ is real gross domestic product capturing economic growth. The variable K_t is proxied using total saving on the assumption that saving equal investment L_t is proxied using the population variable serving as the labour force. The H_t is the health care expenditure as defined earlier. We take the natural log of these variables to control for the variability among the observations and this is represented by the "$\ln$". AD = foreign aid although in U$ million but is converted into Nigerian Naira to have uniformity, ε is the stochastic term and $\beta_0, \ldots\ldots\ldots\ldots, \beta_4$ are elasticity coefficients. It is expected that β_1>0, β_2>0, β_3>0 and β_4>0.

5. Empirical Results and Discussion

As indicated in table 1, all the variables are stationary at various levels of integration. Variables RGDP, AD and TS are stationary in their first differences as evident from the critical values test statistics (CV) being less that the ADF test statistics in absolute terms. Only the HE, our key variable, is however stationary in its level form. This results support the claim that most economic variables are often stationary at their first differences. However, the stationarity status of the POP deviates completely from those of the rest variables as it is non-stationary even in

its second difference. One reason that may account for this is the degree of variability among the population observations and as a result may have led to the wide spread variance.

Table 1. Unit root test results

Var	CV test stat	ADF test stat	Order of integration
RGDP	-2.941	-5.754	I(1)
AD	-3.537	-5.210	I(1)
HE	-3.530	-5.210	I(0)
POP	-2.951	0.752	Not even I(2)
TS	-3.533	-4.348	I(1)

Table 2. The outcome of Johansen cointegration approach

Hyp.n(CEs)	Eigen value	Trace stat	5% CV
$r = 0$	0.565	74.233	68.52
$r \leq 1$	0.425	43.47	47.21
$r \leq 2$	0.320	23.016	29.68
$r \leq 3$	0.200	8.735	15.41
$r \leq 4$	0.012	0.464	3.76

Table 3. Cointegration result of Hansen parameter instability approach

Lc stat	Stochastic Trends(m)	Deterministic Trends(k)	Excluded Trends(p_2)	Prob*
0.4347	4	0	0	>0.2

The linear combination of the variables may however be stationary. This claim is being supported by the cointegrating relationships explored using 5% critical value. The Johansen approach in table 2 under the trace statistics indicates only one cointegrating equation testifying to the long run relationship among the variables with RGDP as the dependent variable. The parameter instability approach in table 3 further confirms this claim of long run relationship among the variables with probability value greater than 0.2 thereby accepting the null hypothesis of existence of cointegrating relationship. This finding is in line with Halil et al. (2006) on the tests of stationarity and cointegration of health care expenditure and gross domestic product for Turkey although their analysis incorporates a disaggregation of private and public expenditure on health.

On theoretical ground, we explain the long run relationship among these variables following some possible transmission mechanisms. Development assistance through provision of foreign aids would help to meet more medical needs. This would improve the health status of people all things being equal and thus enhance productivity. This is a growth enhancing channel. The cointegrating relationship motivated the existence of the error correction mechanism. As shown in table 4, the error correction coefficient has an expected negative value though not significant. It follows that about 59% of the deviation from the long run RGDP path is corrected for per period.

Table 4. Cointegrating regression and Vector Error Correction MechanismMethod: Fully Modified Least Squares(FMOLS) Dep.var Δ RGDP VECM

Var.	Coeff.	t-stat	Prob	Var.	Coeff.	t-stat	Prob
AD	-0.209	-2.299	0.028	Δ AD	0.147	0.780	0.452
HE	-0.472	-2.864	0.007	Δ HE	-0.130	-0.555	0.590
POP	0.296	2.197	0.035	Δ POP	0.167	0.145	0.888
TS	1.246	2.119	0.000	Δ TS	0.039	0.183	0.858
C	1.999	1.723	0.094	ECM_{-1}	-0.589	-0.589	0.568
				C	8.782	5.988	0.000

R^2: 0.843, DW: 1.12, R^2:0.103, DW: 2.44, Long run var: 0.405

In the cointegrating regression using the fully modified least squares approach, all the explanatory variables are significantly related to the dependent variable RGDP at 5% level. The variables POP and TS are negatively related to the RGDP. A 1% per cent increase in the amount sent as foreign aid tends to decrease the RGDP by about 21%. This explains the fact that such aid might not have been diverted to the channels that would foster growth and development processes and of course may also depend on priorities. The opportunity cost of diverting such aid to sectors that may not speedily facilitate growth is the appropriate diversion to the growth enhancing sectors which tends to boosts the economy. The presumed inappropriate diversion of the foreign aid might have also determined the behaviour of the health expenditure variable (HE). As the HE is increased by 1%, there is a decline of about 47.2% in growth just about twice the decline in growth for a 1% increase in foreign aid. The POP and TS variables have positive impact on the RGDP. This explains the notion that a substantial numbers of active populations enhance productivity and thus growth. If saving is sufficiently translated to investment, then it adds more value to growth.

The coefficient of determination shows that the independent variables have a higher explanatory power of about 84%. The DW value (1.12) demonstrates that autocorrelation is obvious among the residuals in the model. This is further confirmed by the LM test in table 5 demonstrating that serial autocorrelation is present at lag 7 (prob.=0.068)

Table 5. VAR residual serial correlation LM test

Lags	LM-stat	Prob.	Lags	LM stat	Prob	Lags	LM stat	Prob
1	2.494	0.646	5	3.182	0.528	9	2.304	0.680
2	3.303	0.508	6	1.983	0.739	10	0.490	0.975
3	3.318	0.506	7	8.736	0.068	11	0.518	0.972
4	2.034	0.730	8	2.384	0.665	12	1.471	0.832

Prob.from Chi-Square with n=4 where n is the degree of freedom.

Table 6. VAR residual normality test

component	Skewness	Chi-sq	Df	Prob	component	Kurtosis	Chi-sq	Df	Prob
1	2.766	47.187	1	0.000	1	13.775	179.001	1	0.000
2	-0.551	1.870	1	0.171	2	2.904	0.014	1	0.905
Joint		49.057	2	0.000	Joint		179.016	2	0.000
	Jarque-Bera								
1	226.188		2	0.000					
2	1.885		2	0.390					
Joint	228.073		4	0.000					

The residual test for normality in table 6 indicates that it is non-normal thereby rejecting the hypothesis that residuals are multivariate normal. This increases the chance of the residuals having unit roots.

6. Conclusion

The paper has examined the relationship between government expenditure on health and economic growth in Nigeria. The existence of long run relationship among real gross domestic product, foreign aid, health expenditure, population and total saving is a demonstration that each of these variables is connected through some transmission mechanism.

A significant finding is that the foreign aids which tend to be supportive of the domestic investment on health facilities have not performed to expectation. The possible reason attributed to this may be the diversion of the aids to some other uses depending on the policy frame work. A very important policy option is to ensure some levels of coherence between the foreign aids and the health expenditure plans through some appreciable proportion of the budget devoted to health care services. This would pave way for better plans in health expenditure programmes thereby improving health outcomes vis-a-vis promotion of economic growth in Nigeria.

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The Sources of Stock Market Volatility in Jordan

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Abstract

This study examines the sources of the Amman Stock Exchange (ASE) price index volatility, using monthly data between 1991 and 2010. The volatility returns of the ASE are estimated through utilizing the ARCH /GARCH model with /without dummy variable, and to measure the shocks of each variable, the Impulse Response Function (IRFs) is applied. The results of the study revealed that the ARCH (1) performs well. It also indicated that RMS2, CPI, E1, WAIR and the dummy variable have an adverse impact on the ASE returns volatility, while RGDP played a positive effect. The volatility equation shows that the mean (ω) is smaller than that of the parameter of lagged squared error term (γ). ARCH (1) (represented by γ) is positive and statistically significant at 1% level, while GARCH (1, 1), represented by δ, is negative with the dummy variable but not statistically significant. The sum of (γ +δ) is greater than unity, demonstrating that the volatility increases over time. The dummy variable (η) has an inverse influence on the ASE index returns volatility and is statistically significant at 1%. The results from the (IRFs) support the significance of dynamic association between the monthly return index and the macroeconomic variables. The findings of this study can assist policy makers in curbing the outflows of financial capital, investors in assessing the asset returns predictability during the financial crisis, financial regulators, business executives, and stock market analysts.

Keywords: Jordan stock market, macroeconomic variables, stock market return, volatility

1. Introduction

Over the last three decades, many studies have looked into the connection between asset prices and different economic variables both theoretically and empirically, and the relations between stock market volatility and macroeconomic variables have been widely studied in financial economics.

The subject of the effects of macroeconomic variables on stock returns can be dated back to the late 1970's (i.e. Ross (1976). Numerous other studies have also analyzed the sources of volatility, such as (Fama, 1981, 1990); Chen et al., (1986) , Ferson and Harvey, 1991, 1993); and Kwon and Bacon (1997).

Schwert (1989) conducted a great number of investigations on the sources of macroeconomic effect on the volatility of stock market in the United States. It was hypothesized that the volatility of stock returns increase during economic contractions and decrease during recoveries.

Bekaert and Harvey (1995) tackled the relative importance of local and world information over the change of time in both anticipated returns and conditional variance processes. Liljeblom & Stenius (1997) analyzed the impact of macroeconomic volatility on conditional stock market volatility, using GARCH estimations. Kearney and Daly (1998) analyzed the sources of stock market volatility in Australia. Morelli (2002) constructed a study regarding the causes of stock market volatility and conditional macroeconomic volatility using (ARCH) & (GARCH) models.

Rousan and Al-Khouri (2005) performed a study about the ASE volatility in Jordan using ARCH and GARCH models. Yusof and Majid (2007) employed the (GARCH)-Mean model, and GARCH (1, 1) framework jointly with VAR analysis, in order to explore the volatility which represented by the conditional variance of the error in the conventional &Islamic stock markets in Malaysia.

Al Rjoub (2011) examined the effect of the financial crisis event on the ASE returns volatility in Jordan, using the GARCH-M model and introduced dummy variables to measure the behaviour of the ASE returns volatility during the crises episode.

This study investigates the dynamic relationship between the sources of volatility returns in the ASE and macro economic variables, using a monthly data between 1991 and 2010.

This study differs from other empirical studies in at least three aspects: First, it examines the macroeconomic determinants and their effect on the stock market returns in Jordan by using different macroeconomic variables and definitions. Secondly, it conducts the (IRFs) in order to measure the dynamic interaction and the importance among macroeconomic variable and ASE return volatility. Thirdly, the study incorporates a longer time period of the latest monthly data for Jordan, in order to capture long-term movements of returns and to reduce the probability of high degree of multicollinearity. It also measures the effect of financial crisis on ASE return volatility.

The monthly data is obtained from Amman Stock Exchange (ASE) , the Central Bank(CBJ) statistical database, (IMF), (IFS) (various issues), and Department Of Statistics (DOS) (various issues) over the period 1991–2010.

This paper is divided into seven sections. Firstly: Introduction. Secondly: literature reviews. Thirdly: the methodology, econometric model and data. Fourthly: the macroeconomic variables and their definitions. Fifthly: the Descriptive Statistics. Sixthly: empirical results and its interpretation, and finally: conclusions and recommendations.

2. Literature Review

Earlier studies regarding the effect of macroeconomic factors on the returns of stock markets were initiated in the second half of 1970s. Several other researchers have concentrated on the reasons behind stock market return volatility.

Ross (1976) developed the Arbitrage Pricing Theory (APT) and links stock returns to several macroeconomic variables, and determines the nature of income volatility sources.

In the same line of research, Fama and Schwert (1977) investigated the link amongst stock market return volatility, macroeconomic and financial variables. The results showed a positive link between stock market volatility and macroeconomic volatility. At the same time, there is a dual causality between them.

An additional study carried out by Fama (1981) assured that an inverse relationship exists between stock returns and inflation, while a positive relationship is existed between stocks returns & real activity. He also argued that an increase in real activity encourages the demand for money, which in turn creates an upward relationship between stock returns & money supply.

Utilizing a multivariate (APT), Chen, Roll and Ross (1986) confirmed a strong systematic relation among the returns in stock market and the macroeconomic factors.

In the line of this, a study constructed by Schwert (1989) indicated that macroeconomic volatility partially explains the movements in stock volatility whereas financial asset volatility strongly explains the prediction of future macroeconomic volatility.

Utilizing the GARCH model, Liljeblom and Stenius (1997) presented a study about Finland's stock market volatility. Results revealed that a linkage existed between aggregate stock volatility & macroeconomic volatility. They also found an inverse link between stock market volatility and foreign trading volume growth.

Kearney and Daly (1998) investigated the causes of volatility for Australia's stock market returns. The findings showed that inflation and interest rates were positively related to the volatility of the stock market, whereas money supply, industrial production, and current account deficit were indirectly affected by the stock market volatility. The money supply is considered the strongest variable that affects the conditional volatility of the stock market.

Using ARCH/ GARCH models, Morelli (2002) presented a study about the UK stock market volatility. The results confirmed that conditional macroeconomic variables volatility do not explain the conditional stock market volatility.

Employing the (VECM), a dynamic study of the ASE market and macroeconomic variables in Jordan was conducted by Al-Sharkas (2004). The results indicated that stock prices and macroeconomics variables have a long-term equilibrium relationship.

An additional study carried out by Rousan and Al-Khouri (2005) investigated the ASE market volatility for the period between 1992 and 2004. Using ARCH/ GARCH models, empirical results indicate symmetry in volatility. This means that good or bad news have a similar degree of influence on the ASE market volatility level. Adding to this, the volatility continues in the stock market for a long period of time.

Chowdhury, Mollik and Akhter (2006) employed both the GARCH and VAR models, and showed that a significant unidirectional causality exists, namely from industrial production volatility to market return volatility and from market return volatility to inflation volatility.

In the same line of research, Yusof and Majid (2007) utilized GARCH-M and GARCH (1,1) frameworks and (VAR) analysis in order to investigate the volatilities in stock markets of Malaysia .The findings showed that the volatility of interest rate influences the traditional stock market volatility except the volatility in the Islamic stock market. However, the exchange rate has more influences on Islamic stock market volatility.

Chinzara (2010) examined the volatility of stock market in South Africa, using (GARCH), (AR-GARCH) and (VAR) models. He confirmed that insecure phenomenon in macroeconomic factors considerably affects the volatility of the stock market. Moreover, it was found that interest rates and exchange rates volatility in the short term are more important than that of inflation, gold price and oil prices. The results also indicated that financial crises raise stock market volatility.

Al Rjoub (2011) considered the impact of dummy variables on the stock returns volatility in Jordan during the financial crises, by utilizing the GARCH-M model. The results confirmed that there is an inverse link between stock returns volatility and the financial crisis. Amazingly, the findings indicated that volatility of stock returns was positively related throughout the 2004 Iraq war. Furthermore, it was concluded that the extreme fluctuates in the volatility (negative and positive shifts) may be due to the effect of news and general public expectations about the Jordanian market.

3. The Methodology and Econometric Model

This paper inspects the influences of macroeconomic factors on stock returns volatility in Jordan using different methods of estimation such as the (ARCH) and (GARCH) model.

Many empirical search papers have examined the relationship between macroeconomic variables and stock market returns volatility. Schwert (1989), Karolyi (1995), Liljeblom &Stenius (1997), Kearney & Daly (1998), Muradoglu et al. (1999), Morelli (2002), Rousan and Al-Khouri (2005), and Chowdhury et al., (2006) studied the factors that influence the volatility of stock market returns through utilizing the GARCH and Vector Autoregressive models.

The (ARCH) model was initially pioneered by Engle (1982, 1983) and Cragg and Malkiel (1982), and has now become widely used in modeling the behavior of financial time series and is commonly used for modeling the association between stock market volatility and macroeconomic variables for various markets (i.e. stocks, bonds, indices, currencies, derivative prices volatility). The main advantage of ARCH models is its ability to capture the non-linearity and volatility clustering in stock return data. Also, ARCH models study the second moment (Conditional and non-conditional) of the time series, and thus allow the variance of a series to depend on the available information set.

However, Heteroskedasticity has also been observed in time series, and can be considered a reflection of the way in which the volatility of the dependent variable varies systematically during time. Therefore, Heteroskedasticity can be considered a time varying variance (i.e. volatility). The variance of the error term (ε_t) at time (t) represents the uncertainty at that point in time. Moreover, it has been found useful in some models to treat the variance of (ε_t), as a function of prior errors.

The Autoregressive Conditional Heteroscedastic (ARCH) model can be written as follows:

$$Y_t = \beta X_t + \varepsilon_t \quad (1)$$

In this model, the mean equation is specified by an AR (p) process; the return series is regressed on its previous values. Moreover, the conditional variance is regressed on constant and lagged values of the squared error term acquired from the mean equation.

Engle and Bollerslev (1986) extended this model to the generalized version of the ARCH model, better known as the (GARCH) model, which includes the lagged values of conditional variance. The GARCH) model is therefore capable of taking the leptokurtosis, skewness, and volatility clustering in data time series. Also, GARCH is a method that takes into account past variances in explaining future variances. So, when data suffers from Heteroskedasticity, it means that the expected value of the error term is not constant.

ARCH/ GARCH models and the stochastic volatility models are of great significance for forecasting volatility, as they explain the importance of the degree of persistence of shocks to volatility in returns and macroeconomic variables. In describing the behavior of ARCH/GARCH models, we focus on the error process. In particular, we assume that the conditional mean of the errors equals zero.

The general GARCH (p, q) model for stock return (SR_t) at time (t) is represented as follows:

$$Y_t = \beta X_t + \varepsilon_t \quad (2)$$

$$SR_t = \beta_0 + \sum_{i=1}^{t} \beta_i SR_{t-i} + \varepsilon_t, \varepsilon_t / \psi_{t-1} \sim N(0, SR_t) \quad (3)$$

The conditional variance of the error (${CV_t}^2$) is represented as follows:

$${CV_t}^2 = \omega + \sum_{i=1}^{p} \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \delta_j {CV_t}^2_{t-j} \quad (4)$$

Where $p \geq 0$, $q \geq 0$

$\gamma_0 \geq 0, \gamma_i \geq 0$ i = 1,…, p

$\delta_j \geq 0$ j = 1,…, q

The first number between the brackets (1, 1) in the above GARCH (1, 1) model refers to the number of autoregressive lags (or ARCH terms), whereas the next number refers to the number of moving average lags which is often identified as the number of GARCH terms. Moreover, (ε_t) is characterized by a zero mean, serially uncorrelated error term, and with a normal distribution conditional on past information. As for (${CV_t}^2$), it depends on the mean (ω), news regarding volatility from the prior period measured by the lag squared residual from the mean equation (ε_{t-1}), the ARCH term, and last periods forecast variance, (${CV_t}^2_{t-1}$) (the GARCH term). Also, the estimate of (γ_i) shows the influence of current news on the conditional variance process, and the estimate of (δ_i) demonstrates the influence of old news on volatility (the persistence of volatility to a shock).

Furthermore, Engle and Bollerslev (1986) clarify the importance of the degree of persistence in shocks to volatility in determining the relationship between stock market returns and macroeconomic factors. In the case of the GARCH model process, shock persistence is measured as the sum (Σ) of the $(\gamma_i + \delta_i)$, which must be equal to or less than one in order for stability to hold. Moreover, in order for the sum to have a stationary variance, it should be less than 1. However, if the sum is greater than the unity, then volatility increases over time. Therefore, for non-stationarity in the variance, the conditional variance forecasts will not meet on their unconditional value as the horizon increases.

However, the differences between the ARCH and GARCH models is that the latter is more flexible in its lag structure, as it permits all lags to exert an influence through including the previous value of the conditional variance itself $({CV_t}^2_{t-1})$, (referred as GARCH term), and the previous values of the squared errors (ε_{t-i}^2) (referred to as the ARCH term), as pointed out in the above equations.

Additionally, we added the dummy variable (D) to capture the effect of the financial crisis on the stock returns volatility. (D) takes the value of one throughout the following periods: 11 September, 2001 in the US, the Iraqi war in 2003, world financial crisis in 2008 and recent political events in 2010.

Otherwise, (D) takes the value of zero.

Moreover, the conditional variance equation will be utilized as follows:

$${CV_t}^2 = \omega + \sum_{i=1}^{p} \gamma_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \delta_j {CV_t}^2_{t-j} + \eta D \quad (5)$$

Also, a number of macroeconomic variables are incorporated into the mean and the conditional variance equation to evaluate the predictive power of macroeconomic variables volatility on stock market volatility. These variables are: $\mathrm{RMS2}, \mathrm{RGDP}, \mathrm{CPI}, \mathrm{E1}, \mathrm{WAIR}$.

In equation (5), if the sign of the coefficient of the dummy variable (η) is negative, then the effect of the recent financial crisis will probably affect the stock returns in a negative way. Otherwise, it suggests a positive impact.

The estimation of GARCH models in this study will be based on the Akiake's Information Criterion (AIC) and Schwarz's order Information Criterion (SIC). The AIC and SIC are functions of the maximum log-likelihood values L (θ) as well as to the numbers of the free parameters in the estimation. Moreover, the (AIC) and the (SIC) are a compute of the goodness of fit of an estimated statistical model and thus, they give us a bias towards more economical specifications due to the fact that they incorporate a penalty for a large number of parameters. Consistent with that, these criteria should provide the lowest value to fit the data.

The hypothesized model is as follows:

$$ASE = f\{RMS2, RGDP, CPI, E1, WAIR, Dum\} \quad (6)$$

To explore whether the above proceeded macroeconomic variables affect the ASE index returns volatility, the following model is carried out in the following form:

$$ASE_t = \beta_0 + \beta_1 RMS2_t + \beta_2 RGDP_t + \beta_3 CPI_t + \beta_4 E1_t + \beta_5 WAIR_t + Dum + \varepsilon_t \quad (7)$$

In the proceeded equation, β_0 is constant and β is the coefficient of the variables, whereas ε_t is the residual error of the regression. In the light of the literature review, the coefficient of variables; β_1, β_3, β_4 and β_5 are anticipated to be negative, while β_2 is anticipated to be positive.

In order to be able to perform a partial elasticity analysis, we take the logs of the variables in the above equation, enabling us to assess the impact of a change in the independent variables on the dependent variable while other variables remaining constant.

$$lnASE_t = \beta_0 + \beta_1 lnRMS2_t + \beta_2 lnRGDP_t + \beta_3 lnCPI_t + \beta_4 lnE1_t + \beta_5 lnWAIR_t + Dum + \varepsilon_t \quad (8)$$

This study hypothesizes that the Amman Stock Exchange price index (ASE) is employed as a proxy for the performance of the Jordanian stock market. The ASE is an open market and known as one of the most open markets in the Middle East, and offers a suitable investment environment for the non –Jordanian investors. This openness affects the volatility of the ASE returns.

It also hypothesizes that the returns of the (ASE) are affected by macroeconomic variables namely; Real money supply (RMS2), real gross domestic product (RGDP), consumer price index (CPI), real exchange rate (E1), weighted average interest rates on loans and advances (WAIR) and a dummy variable (DUM). The study uses monthly data rather than quarterly data covering the period of 1991-2010, to maximize the number of observations, and capture the long-term movements in the ASE returns, by employing ARCH /GARCH model.

4. Macroeconomic Variables Descriptions, Definitions and Transformation

ASE_t is the monthly General Price Index of Amman Stock Exchange Market.

The index is the market value weighted average of month-end closing prices for All-stock shares listed on Amman Stock Exchange markets for the period from January, 1991 to December, 2010.

$rtr_t = (ASE_t/CPI_t)x100$, where rtr_t is the real general price indices of the Amman stock exchange at the current month (t) and the CPI_t is the consumer price index at the current month (t).

$$LRTR_t = ln(rtr_t/rtr_{t-1})x100$$

Where: $LRTR_t$ is the monthly rate of return of real General Price Indices of Amman stock exchange at the current month (t). Hence, in the sequel, the term "returns" loosely means continuously compounded returns.

rtr_t and rtr_{t-1} represent the real general price indices of Amman stock exchange at the current month (t) and previous month $(t-1)$ respectively, whereas ln is the natural logarithm. Therefore, the use of natural logarithm, rather than levels and percentage changes, is to mitigate the correlations among the variables and to smooth the data of all variables.

$RMS2_t$ is the month-end Real money supply (RMS2) (broad definition) =Nominal money supply, in JDs millions divided by CPI,

$$LRMS2_t = ln(RMS2_t/RMS2_{t-1})x100$$

Where: $LRMS2_t$ is the monthly growth rate of $RMS2_t$. $RMS2_t$ and $RMS2_{t-1}$ represent the monthly real money supply at the current month (t) and previous month $(t-1)$ respectively, while ln is the natural logarithm. GDP_t is the monthly-end gross domestic product, in JDs millions).

The month-end real gross domestic product (in JDs millions) = nominal gross domestic product, in JDs millions) divided by CPI.

$$LRGDP_t = ln(RGDP_t/RGDP_{t-1})x100$$

Where: $LRGDP_t$ is the monthly growth rate of $RGDP_t$. $RGDP_t$ and $RGDP_{t-1}$ denote the monthly real gross domestic product at the current month (t) and previous month $(t-1)$ respectively, whereas ln is the natural logarithm. However, many macroeconomic series such as GDP are normally available on annual or quarterly basis. The monthly gross domestic product series was generated using the software program EViews.6.

In order to reduce the high degree of multicollinearity, real GDP is employed in this empirical work. The choice of this variables is almost similar to Chen, Roll and Ross (1986), Darrat and Mukherjee (1987), Lee (1992), and Mukherjee and Naka (1995).

$\mathrm{CPI_t}$ is the month-end consumer price index.

$$LCPI_t = ln(CPI_t/CPI_{t-1})x100$$

Where: $LCPI_t$ is the monthly growth rate of CPI_t at current time (t). CPI_t and CPI_{t-1} represents the month-end of CPI at the current month (t) and previous month $(t-1)$ respectively, whereas ln is the natural logarithm.

Ex_t is the month-end exchange rate of U.S. dollar per Jordanian dinar.

$\mathrm{ex1_t} = \frac{1}{\mathrm{ex_t}}$ (Exchange rate of Dinar per U.S. Dollar). In general, researchers use the nominal exchange rate as a measure of the exchange rate variable. The nominal exchange rate is defined as domestic currency units per unit of US dollar. While, The authors used the real exchange rate;

$\mathrm{e1_t} = (\mathrm{ex1_t})\mathrm{x}\left(\frac{\mathrm{CPI_t}}{\mathrm{wpim_t}}\right)$, which is defined as the nominal exchange rate in terms of JDs per USD times by the ratio of domestic price level to foreign prices $(\mathrm{P_d}/\mathrm{P_f})$.

$$Le1_t = ln(e1_t/e1_{t-1})x100$$

Where: The $Le1_t$ is the monthly growth rate of real exchange rate at current time(t). $e1_t$ and $e1_{t-1}$ represent the month-end exchange rate of the JDs to US$ at the current month (t) and previous month $(t-1)$ respectively, whereas ln is the natural logarithm.

$WAIR_t$ is the monthly return on weighted average interest rates on loans and advances.

$$LWAIR_t = ln(WAIR_t/WAIR_{t-1})x100$$

Where: $LWAIR_t$ is the monthly growth rate of $(WAIR_t)$ at current time(t). $WAIR_t$ and $WAIR_{t-1}$ represent the weighted average interest rates on loans and advances at the current month time (t) and previous month $(t-1)$ respectively. ln denotes the natural logarithm.

Using an interest rate may cause problems since the interest rate is highly correlated with other macro-variables. Owing to the correlation problem between interest rates and other macroeconomic variables, the weighted average interest rates on loans and advances is used instead of the short interest rate, and because, short interest is mostly unregulated. However, the study uses the nominal interest rate rather than the real rate of interest as Gjerde et al. (1999) employed.

Dum is the dummy variable (Dum) .The purpose is to capture the effect of the recent non-macroeconomic forces on the stock returns. (Dum) takes the value of one during the following periods: 11 September, 2001 in the US, the Iraqi war in 2003, world financial crisis in 2008 and recent political events in 2010.Otherwise, (Dum) takes the value of zero.

$\boldsymbol{\varepsilon_t}$ represents the disturbance term

5. Descriptive Statistics of the Study Variables

In this section, the relationship between the rate of return of the (ASE) index and selected macroeconomic variables has been examined through various descriptive statistics analysis. It starts by analyzing whether the time series data is normally distributed, by finding the determinants of the sample normality through the skewness, and kurtosis statistics. Table (1) presents the descriptive statistics of the data. Also, the probabilities (p-values) are used in order to provide evidence whether to reject the null hypothesis of the normality for the unconditional distribution of the monthly rate of return.

Table 1. Statistics for Amman stock Price Index and macroeconomic variables namely $RMS2_t$, $RGDP_t$, CPI_t, EXR_t, and $WAIR_t$.

	ASE_t (RTR_t)	$RMS2_t$ ($RMS2_t$)	$RGDP_t$ (RYX_t)	CPI_t (CPI_t)	EXR_t ($E1_t$)	$WAIR_t$ ($WAIR_t$)
Mean	2103.770	4.965714	452.0521	136.8767	1.395773	10.98733
Median	1376.681	4.981162	395.7913	130.6677	1.460323	11.22000
Maximum	6012.092	5.922678	825.7001	199.8447	2.068295	13.97000
Minimum	1000.000	3.842361	212.2633	100.0000	0.738877	7.580000
Std. Dev.	1297.813	0.542207	158.6230	26.74066	0.327844	1.710810
Skewness	1.281083	-0.261175	0.957551	0.726740	-0.210054	-0.119641
Kurtosis	3.406914	2.493428	2.805582	2.649288	2.353304	1.737654
Jarque-Bera	67.30271	5.294641	37.05413	22.35602	5.947072	16.50772
Probability	0.000000	0.070841	0.000000	0.000014	0.051122	0.000260
Sum	504904.9	1191.771	108492.5	32850.40	334.9856	2636.960
Sum Sq. Dev.	4.03E+08	70.26331	6013541.	170900.0	25.68810	699.5219
Observations	240	240	240	240	240	240

Sources: 1. Central Bank of Jordan. 2. Amman Stock Exchange.

As shown in Table (1), the variables are normally distributed and highly skewed, excluding the Amman stock price index (ASE) which is significantly skewed to the right and has an excess kurtosis (deviated from 3), and the series are leptokurtic (for more details, ***see M.G. Bulmer, 1965)***. RMS2, EXR, and WAIR are skewed to the left and the less kurtosis and the series are platykurtic.

Furthermore, the normality test is applied to the data through using, the Jarque-Bera test (1980) which measures the goodness of fit that depart from normality, and take into account the sample kurtosis and skewness. However, the computed Jarque-Bera statistics and corresponding p-values are employed to check for the normality assumption. In the light of this assumption, all variables are rejected at 1% level of significance, with the only two exceptions in EXR and RMS2, at 5% and 10% respectively.

Subsequently, the descriptive statistics show mixed results regarding the normality distribution. We can see from the data that there is no randomness and the data can be heavily exposed to speculation and shows periodic change. This indicates that an investor can earn a noticeably superior profit rate from the Amman Stock Exchange Market.

In order to check the stationarity of the time series, a unit root tests is carried out. Hence, the non-stationary data produces normal properties problem. In this case, the value of Durbin-Watson (DW), t-statistics and the R^2 break down. Running regressions with such data produces questionable, invalid and spurious results. So, to remove this problem, stationarity tests must be carried out.

Before utilizing the ARCH/GARCH models, it is essential to inspect the properties of the factors by employing unit root tests. There have been many proposed techniques for implementing stationarity tests (for example, The Augmented Dickey-Fuller (ADF) ***(Dickey and Fuller, 1979; 1981)*** and Phillips-Perron (PP) ***(Phillips and Perron, 1988)***.The ADF & PP unit root tests results are presented in Table (2). The ADF test is based on the Akaike Information Criterion (AIC), to measure the goodness-of-fit of an estimated statistical model and thus, it gives us a bias towards more economical specifications due to the fact that they incorporate a penalty for a large number of parameters. Consistent with that, these criteria should provide the lowest value to fit the data. As for the PP test, it is based on the automatic selection procedure of Newey-West (1994) for Bartlett Kernel (Lag truncation: 4).

Table 2. The Results of Unit Root Test for Amman Stock Price Index and Macroeconomic Variables)

Variables	The Augmented Dickey-Fuller test **(ADF Unit Root Test)**	The Phillips-Perron test **(PP Unit Root Test)**	**Akaike Information Criterion (AIC)**	**Durbin-Watson Stat**
ASE	-5.191*	-12.725*	(-2.97)	2.0
M2	-7.389*	-19.617*	(-5.35)	2.00
GDP	-5.59*	-16.947*	(-5.10)	2.03
CPI	-5.906*	-12.859*	(-6.70)	2.00
EXR	-3.659*	-12.33*	(-4.60)	2.02
WAIR	-6.767*	-21.078*	(-4.75)	2.03

Notes: 1. Asterisk (*) shows the rejection of the null hypothesis of non-stationary at the 1% level.

2. MacKinnon (1996) critical values of ADF and PP tests Variables are at first difference in natural logarithm without Intercept and Trend. The 1%, 5% and 10% critical value for the ADF and PP tests is -2.5742 and -1.9410and -1.6164 respectively.

As shown in Table (2), the results of both tests indicate that the null hypothesis of the existence of a unit root is rejected at 1% significance level, meaning all of the series are accepted not to include unit root. In other words, the hull hypothesis of a unit root can be rejected in both the ADF and PP tests, since the values of test are more negative than the critical values, and thus the t-statistics are located in the rejection of the null area. Moreover, the Durbin-Watson statistics indicates there is no evidence of autocorrelation.

Since we deduced that all of the series are stationary, now we can proceed to modeling the effect of macroeconomic variables and their volatility on the Amman Stock Price Index, through employing the ARCH/GARCH models.

6. Empirical Results and Interpretations

The empirical outcomes show a mixture of results, which depend on the scope of the research and how the cross-market dynamics in volatility are modeled. Some of those variables could be common for all stock exchange markets. Anyhow, it is hard to generalize the outcomes because of the different conditions that surround each stock market background. Each market has its own rules and regulations, location of the country, sort of investors, and other features that offers the basis of its uniqueness.

With regards to this study; all variables indicate that they are stationary, lending continuity in the modeling process (Gujarati 2003). Therefore, the influence of macroeconomic factors on the (ASE) returns volatility is estimated using ARCH/GARCH estimation models respectively as shown in the following table. All estimations have been carried out using EViews program 6, and for the ordinary calculations Excel also used.

Table 3. The impact of macroeconomic variables on the rate of return of stock exchange price index is examined by Method: ML - ARCH (Marquardt) ARCH1/ GARCH (1) estimation for the period: (1991:01- 2010:12). Dependent Variable: LRTR

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	15.72163	0.006760	2325.782	0.0000
LRMS2	-1.811843	0.056694	-31.95847	0.0000
LRYX	0.129717	0.002401	54.03616	0.0000
LCPI	-0.494647	0.022188	-22.29302	0.0000
LE1	-0.516599	0.046878	-11.02000	0.0000
LWAIR	-1.439426	0.067902	-21.19867	0.0000
DUM	-0.218608	0.010999	-19.87506	0.0000
		Variance Equation		
C	0.002279	0.000419	5.438414	0.0000
ARCH(1)	1.064035	0.241522	4.405541	0.0000
GARCH(1)	-0.017565	0.076746	-0.228871	0.8190
R-squared	0.899979	Mean dependent var		7.497781
Adjusted R-squared	0.896065	S.D. dependent var		0.525384
S.E. of regression	0.169379	Akaike info criterion		-1.437581
Sum squared resid	6.598501	Schwarz criterion		-1.292554
Log likelihood	182.5097	F-statistic		229.9452
Durbin-Watson stat	0.198219	Prob(F-statistic)		0.000000

Table 4. The effect of macroeconomic variables on the rate of return of stock exchange price index is examined by Method: ML - ARCH (Marquardt): ARCH1 estimation for the period: (1991:01- 2010:12). Dependent Variable: LRTR

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	14.60040	0.016283	896.6577	0.0000
LRMS2	-1.755744	0.049483	-35.48165	0.0000
LRYX	0.378007	0.009253	40.85069	0.0000
LCPI	-0.712028	0.017324	-41.10109	0.0000
LE1	-0.462680	0.040720	-11.36240	0.0000
LWAIR	-1.194532	0.054655	-21.85597	0.0000
DUM	-0.228514	0.011639	-19.63270	0.0000
		Variance Equation		
C	0.001542	0.000101	15.32398	0.0000
ARCH(1)	1.161338	0.223361	5.199373	0.0000
R-squared	0.889289	Mean dependent var		7.497781
Adjusted R-squared	0.885455	S.D. dependent var		0.525384
S.E. of regression	0.177814	Akaike info criterion		-1.553006
Sum squared resid	7.303714	Schwarz criterion		-1.422482
Log likelihood	195.3607	F-statistic		231.9387
Durbin-Watson stat	0.161401	Prob(F-statistic)		0.000000

The estimated results of the effect of macroeconomic variables on the rate of return of the stock exchange price index, using ARCH/ GARCH were performed. The value related to the lagged squared error term is positive and significant at 1% level, which satisfies the specification requirement of the model. On the other hand, GARCH (1, 1) which incorporates the coefficient of the lagged variance term is found to be negative but not statistically significant. Because of the insignificancy of the coefficient of the previous variance term, the extension to a GARCH (1, 1) does not seem necessary. Therefore, the ARCH (1) does perfectly well.

However, the results of this study based on the ARCH (1) estimation as showed in table (4) indicate that money supply (M2 either in real terms) has an inverse impact on the ASE return .The negative value of the coefficient is (-1.755744) and is highly significant.

With regards to real economic activity, such as industrial production (IP) or Gross Domestic Product (GDP), the findings showed a positive relationship between Amman stock prices index and RGDP, and the coefficient is (0.378007) and highly significant.

The findings confirmed an inverse link between Amman stock prices index and inflation, where the coefficient is (-0.712028) and highly significant.

Adding to this, the findings showed a negative relationship between real exchange rate and Amman stock prices index returns, and the coefficient is (-0.462680) and highly significant.

Moreover, the study indicates that there is an inverse relationship between weighted average interest rates on loans and advances and Amman stock prices index returns and the coefficient is found to be highly significant with a magnitude of (-1.194532).

Finally, the results indicated a negative direction between Dummy Variable and Amman stock prices index returns and the coefficient is found to be important and its magnitude is (-0.228514) and is highly significant.

6.1 The Volatility of Returns in the ASE

This section examines the volatility returns of the ASE. In order to do that, we employ GARCH (1, 1), as well as ARCH (1). Moreover, a dummy variable will be incorporated, between the periods (from January, 1991 to December, 2010).

Table 5. Presents the volatility in the returns of the ASE using ARCH (1) and GARCH (1, 1) models (with/ without a dummy variable), for the period from 1991:1 to 2010:12

model	ω	γ	δ	γ + δ	η	AIC¤	SIC¤
GARCH (1, 1)	0.001598*	0.956303*	0.075695	1.032	----------	-1.366927	-1.236403
GARCH (1, 1)						-1.437581	
With Dummy	.002279*	1.064035*	-0.017565	1.046	-0.218608*		-1.292554
ARCH (1)	0.000953*	1.169210*	----------		----------	-1.483657	-1.367636
ARCH (1)							
With Dummy	0.001542*	1.161338*	----------		-0.228514	-1.553006	-1.422482

¤AIC is the Akiake Information Criterion, and SIC is the Schwarz's order Information Criterion. The model with the lowest criterion is considered optimal, whereas the number of optimal lag-structure of the conditional variance equations is used, and is determined according to values of (SIC, AIC).

*correspond to a claim of a statistically significant at 1% level.

In general, the value of the term (ω) relates to the mean (constant). The (γ) value relates to the lagged squared error term. In this study, the previous error is linked to the change in returns in the previous month. Assuming that the market operates efficiently (i.e. demand and supply curves are at equilibrium), the changes in returns are due to the responding to the coming of information. Therefore, (γ) can be displayed as 'current news' arrival, that recent news has a greater impact on prices changes. The coefficient (δ) reflects the impact of 'old news' on volatility. (δ) is the coefficient on the previous variance term, and captures the impact of the return changes related to the previous months.

Furthermore, the volatility equation, contains the constant term (ω) which is the time independent component of volatility; it shows evidence of the volatility measure if no ARCH (1) or GARCH (1, 1), or conditional variables are significant ($\omega = \gamma = \delta = 0$).

The impact of macroeconomic factors on the rate of return of stock exchange price index, results of volatility in the returns of (ASE) index show that the magnitude of (ω) is less than the parameter (γ), which embodies the impact of preceding surprises. ARCH (1) (represented by γ) is positive and claimed a statistically significant at 1% level, and therefore satisfies the specification requirement of the model. On the other hand, GARCH (1, 1) (represented by δ) is found to be negative with Dummy but not statistically significant. The sum of ($\gamma + \delta$) measures the volatility persistence as outlined by (Engle & Bollerslev 1986). Our results show that the sum of (γ +δ) is equal to (1.046); which is greater than unity, signifying that the models are second order stationary, and volatility increases over time. Therefore, for non- stationarity in variance, the conditional variance forecasts will not meet on their unconditional value as the horizon increases. However, due to the insignificancy of (δ), the extension to a GARCH (1, 1) does not seem necessary. The ARCH (1) does perfectly well.

To catch up the consequence of the financial crisis on the ASE index returns volatility, a dummy variable is added to the conditional variance equation. The results of the dummy variable (η) indicated a negative sign and is statistically significant at 1% level in the ARCH (1) or GARCH (1, 1) models. This suggests that the financial crisis has a negative impact on the ASE index returns volatility. However, the value of (δ) has remained insignificant and its sign changed to negative after adding the dummy variable (η) and thus, the financial crisis affect on the volatility of ASE returns was manifested in the magnitude of (γ). Consequently, this suggests that the response of the ASE volatility in returns has slightly decreased. In other words, the volatility shocks will show a sign of a long memory within the financial crisis.

6.2 Impulse Response Function

Given that the individual coefficients in the Vector Autoregressive models estimation are frequently hard to figure out, practitioners of this technique normally conduct the impulse response function (IRF). The IRF traces out the shocks reaction of the dependent variable in the Vector Autoregressive system to shocks in the error terms. Suppose error term in the $LRTR_t$ equation increases by a value of one standard deviation. Such a shock or change will change $LRTR_t$ in the present as well as future periods. But since $LRTR_t$ appears in the R regression, the change in error term will also have an impact on R regression. The IRF traces out the impact of such shocks for several periods in the future. Although the utility of such IRF analysis has been questioned by researchers, it is the centerpiece of VAR analysis (Gujarati, 2003).

In order to obtain added perception into the short-run transmission mechanisms between the monthly return index and macroeconomic variables; the IRFs are calculated. The paper utilizes Choleski's decomposition which requires that variables in the VAR must be ordered in a particular fashion.

However, this study employs the following ordering schemes:

$$\mathrm{LRTR_t}, \mathrm{LRMS2_t}, \mathrm{LWAIR_t}, \ \mathrm{Le1_t}, \ \mathrm{LCPI_t}, \ \mathrm{LRYX} \text{ and } \mathrm{Dum}.$$

The dynamic relationship between the monthly return indexes to changes in macroeconomic variables is presented in Figures 1A-5A. However, the study ordering systems appear normal in the light of the existed information lags and the deployment of monthly data. It is also in harmony with the main goal of our assessment.

The IRFs (24 periods) from shocks of each factor are mark out by means of the simulated response of the calculated Vector Autoregressive system. Looking at impulse response graphs, it can be viewed that Monthly return index, on average, fully accommodate shocks to the other variable after 6 periods.

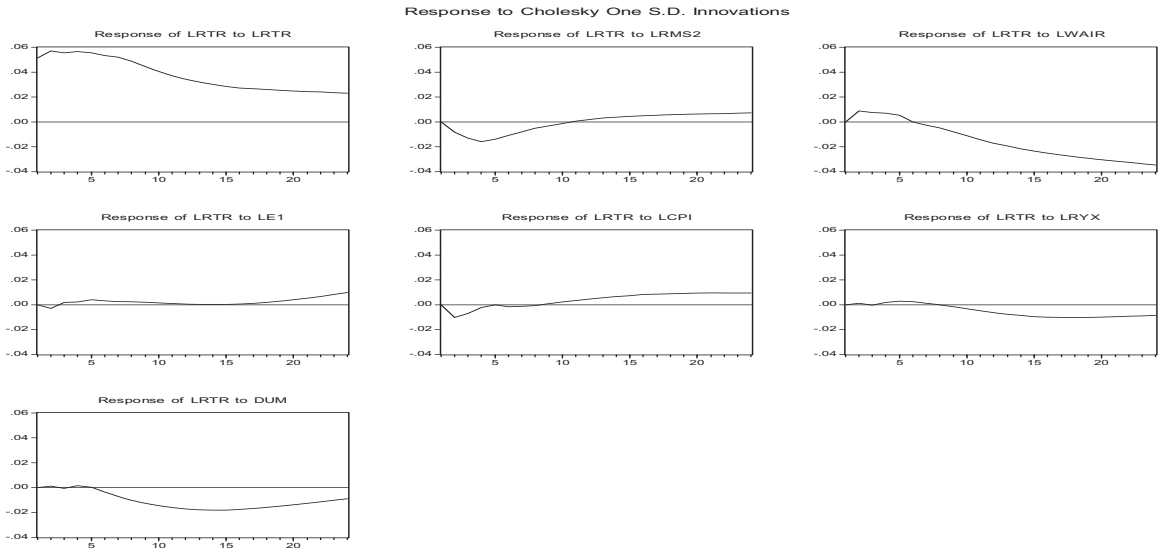

Figure 1.

From the results, we notice that the impulse response for $\mathrm{LRTR_t}$,$\mathrm{LRMS2_t}$ and $\mathrm{LCPI_t}$ appears to have negative shocks during the period (2- 8) but then starts to rise in the positive area after 10 periods. As for $\mathrm{LWAIR_t}$, it has a positive but non-significant effect at the first period but then moves into the negative region. The effect of $\mathrm{Le1_t}$ is not significant during the period. With respect to the effect of LRYX and Dum, both were negative following the periods of 8 and 4 respectively. The results from the impulse response functions support the presence of a significant dynamic relationship between monthly return index and macroeconomic variables.

7. Conclusion and Implications

This paper examines the impact of macroeconomic variables on the volatility of ASE returns in Jordan, using monthly data between 1991 and 2010. The normality test is applied to the data and unit root tests were performed for stationary purposes. As a result, all the variables proved to be stationary, lending continuity in the modeling process.

The ARCH model shows strong linkages between the stock returns and macroeconomic factors and is considered a suitable in examining the simultaneous relationships between stock returns volatility and changes in the macroeconomic factors.

The results of the ARCH (1) estimation confirmed that real money supply (RMS2), inflation, real exchange rate, change in nominal interest rates, and the dummy variable all have a negative impact on the ASE returns volatility.

In this study, the negative and positive role of macroeconomic factors on stock prices has several practical implications. The RMS2 plays a negative impact on stock returns, whereas the increase in the economic

activities (RGDP) has a positive impact on ASE return. Therefore, the monetary policy should be guided to influence the stock market, and weighing up the positive impact of the economic activities.

The results also indicate that the ASE returns are inversely linked to inflation. This means that the stock returns diminish and curtail capital formation. Therefore, policy makers should pay more attention to the changes in inflation. As for the exchange rate, a negative relationship is found with the stock returns. Therefore, this implication depends on whether the economy is export dominant or import dominant. For an export leading economy, (exports companies listed on the ASE), the currency appreciation has a negative influence on ASE returns. On the contrary, the currency appreciation boosts the stock market for an import leading economy (imports companies listed in the ASE).

The stock returns react negatively to rising interest rates. Therefore, high interest rates would affect the stock market returns and subsequently causing stock prices to fall. Whenever returns on treasury securities increase, investors are likely to change out of stocks and causing a decrease in stock prices. This can be explained through the behavior of the weighted average interest rates on loans and advances

Finally, the Dummy Variable has a negative impact on the ASE return. In the light of these results, policy makers should pay more attention to the macroeconomic, non-macroeconomic and financial variables that affect stock market return.

Furthermore, with regards to the volatility, the effect of macroeconomic variables on the volatility of the ASE returns showed that the magnitude of the mean (ω) is smaller than that of the parameter of lagged squared error term (γ). ARCH (1), represented by (γ) is positive and significant at 1% level, which satisfies the specification requirement of the model. On the other hand, GARCH (1, 1), represented by (δ) is found to be negative with Dummy but not statistically significant. Our results show that the sum of ($\gamma + \delta$) is equal to (1.046); which is greater than unity, indicating that the models are second order stationary, and volatility increases over time

However, due to the insignificancy of (δ), the extension to a GARCH (1, 1) does not seem necessary, as the ARCH (1) does perfectly well.

We add a dummy variable (η) to the conditional variance equation, and the estimation of ARCH (1) or GARCH (1, 1) model is found to have a negative value and statistically significant at 1%. This suggests that the financial crisis has a negative impact on the volatility of the ASE index returns.

Finally, the results of (IRFs) indicated that impulse response of $LRTR_t$, $LRMS2_t$ and $LCPI_t$ have negative shocks during the period (2- 8) and then after start to rise in the positive area after 10 periods. The $LWAIR_t$ has a positive effect but not significant at the first period but starts to move into the negative region thereafter. The effect of $Le1_t$ is not significant during the period. With respect to the effect of LRYX and Dum, both were negative following the periods of 8 and 4 respectively. The results from the impulse response functions support the presence of significant dynamic relationship between Monthly return index and macro economic variables.

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Monetary Policy and the Transmission Mechanism: Evidence from Nigeria

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Abstract

This paper is an attempt aimed at investigating the empirical relationship between measures of monetary policy and the bank asset (BKA) channel of the monetary transmission mechanism as well as the direction of causality between them. The impulse response function of the monetary variables to shocks in the monetary system were also examined. Using data for the period 1970-2010 and employing co-integration, error correction mechanism and variance decomposition techniques, the study found a positive and significant long run relationship between BKA, money supply (MNS), cash reserve ratio (CRR) and Minimum Rediscount Rate (MRR) as well as a uni-directional Granger causality from BKA and CRR to MNS respectively. The results of the variance decomposition of BKA to shocks emanating from CRR, MRR and MNS show that own shocks remain the dominant source of total variations in the forecast error of the variables. The authors recommend that monetary policies should be properly fashioned to accomplish their target objectives in the economy.

Keywords: monetary policy, transmission mechanism, granger causality, ECM and variance decomposition

1. Introduction

Monetary policy constitutes the major policy thrust of the government in any economy especially in the realization of target macroeconomic objectives. This is so because monetary policy as a key tool in government financial management involves three elements; the policy environment or macroeconomic framework which sets the preconditions for effective monetary management and stability and ultimately determines the optimal policy targets to pursue; the policy instruments designed and applied to chart the course of movement through a defined path; and the transmission mechanism which depicts the system of administration of monetary policy instruments through the indicator variables in order to hit the target(s) of the policy.

Monetary policy efficiency is achieved when the appropriate instruments are selected or a combination of instruments is directed at the indicator and target variables through the transmission mechanism and the intended macroeconomic goals are achieved in the economy. As long as there are policy targets to pursue and policy instruments designed to apply, then it is the role of the transmission mechanism to continue to ensure that changes in the behavior of the monetary sector influence various monetary variables or aggregates, affect the level of money supply either by expanding or contracting it, or influence the level and structure of interest rates and thus the cost of funds in the markets, and also affect the non-bank public's holding of real and financial assets and the relative quantities of financial assets in the financial system of the economy (Nzotta, 2004).

Monetary policy has far-reaching influence on financing conditions in the economy, not just the cost, but also availability of credit, banks' willingness to assume specific risks, asset prices, exchange rates as well as consumption and investment. The economy will feel the effect of the transmission activities more positively when bank liabilities and assets and money supply are controlled. Thus indicator and target variables form the transmission paths of monetary policy instruments. Indicator variables are linked on one side to the monetary policy instruments or to a set of monetary policy instruments and on the other side to a monetary policy target; and the target itself is linked to the corresponding policy goal which closes the transmission path of the monetary policy instruments in question (Onoh, 2007).

To perform its transmission function optimally, the indicators and targets must respond appropriately to the dictates of the monetary policy instruments. Two monetary policy instruments: cash reserve ratio and minimum rediscount rates are cardinal for our purpose. The manner of the response is a function of the degree of intensity of the impact of monetary policy instruments on the indicator and target variables in these transmission paths.

For the purpose of this paper, we concern ourselves with the actions, forces and stimulations originating from the monetary policy instruments that bring about corresponding responses by the indicator and target variables that make up the transmission mechanism. By definition, *Monetary Policy* refers to *any conscious action undertaken by the monetary authorities to change or regulate the availability, quantity, cost or direction of credit in any economy in order to attain stated economic objectives.*(Nzotta,2004). Also in this context, transmission mechanism interconnects monetary policy instruments, indicator variables, targets of policies and macroeconomic objectives or goals. (Onoh, 2007).

In order to chart future policy paths for transmission mechanism's response to monetary policy instruments, it is necessary to investigate the behavior of the indicator variables such as bank liabilities and assets and interest rates as well as the target variables such as money supply and domestic credits in the light of the effect of monetary policy instruments that roost in the economy.

According to Onoh (2007), the extent to which the goals of monetary policy can be achieved will depend on the strength and size of the monetary policy instruments. The strength and size of an instrument determines the strength and size of the impact to be unleashed on the indicator variables and which is further transmitted proportionately to the target variable which finally produces the desired results or goals in proportion to the impact initially generated by the instruments. The target variables are reflections of their related indicator variables and as such, the size, direction and strength of the indicator variables reflect the size, direction and strength of the target variables.

There are so many transmission paths of monetary policy as there are monetary policy instruments, indicator variables, targets and goals. Based on the behavioral pattern displayed by the indicators, appropriate monetary policy instruments should be chosen and the strength, directions and the timing of the application of the instruments be determined to ensure that the target goals are achieved. (Onoh, 2007).

Previous studies have attempted to demonstrate that monetary policy instruments indeed influence the activities of the economy. While they seem to agree on the significant effect of these monetary policy instruments on the economy, there appear to be disagreements in respect of the direction of causality between monetary policy and indicator variables and also between monetary policy measures and target variables of the transmission paths.

Unlike earlier studies by other authors, this paper attempts to bring to light the bank asset channel of the transmission mechanism in response to stimuli provided by the various monetary policies in Nigeria as well as determine the direction of causality among the monetary policy instruments, the indicator variables and the target variables of the transmission mechanism.

2. Literature Review

Certain general behavioral patterns are decipherable from the empirical evidence of how to understand the transmission mechanism of monetary policy. Notable among these is Keynesians structural model evidence. According to the Keynesians structural model, evidence of the transmission mechanism of monetary policy shows that money supply affects interest rates which in turn affect investment spending, which in turn affects aggregate output or aggregate spending in the economy. The Keynesians examine the relationship between money supply and aggregate output or spending by looking at empirical evidence on the specific channels of monetary influence such as the link between interest rate and investment spending. (Mishkin, 1997).

The above suggests that monetary policy through its transmission path has far reaching impact on financing conditions in the economy. Not just the cost, but also the availability of credit. Banks' willingness to assume specific risks also influences public expectations about the future direction of economic activity and inflation thus affecting asset prices, exchange rates as well as consumption and investment.

Another behavioral pattern identified with the transmission mechanism relates to the monetarists approach. The monetarists reduced-form evidence do not describe specific ways in which money supply affects aggregate spending. Instead, they examine the effect of monetary policy on economic activities by looking at whether movements in aggregate output or spending are tightly linked to or have a high correlation with movements in money supply. Using the reduced-form model, the monetarists analyze the effect of monetary policy on aggregate output or spending as if the economy where a Black box whose working conditions cannot be seen. (Mishkin, 1997).

The Keynesian structural model approach offers the opportunity to evaluate each transmission mechanism separately to see whether it is plausible to help one predict the effect of money supply on aggregate output or spending more accurately and enable analysts to predict how institutional changes in the economy might affect the relationship between money supply and output level. It can easily be seen that the monetarists reduced form evidence and the Keynesian structural model evidence are basically theories of transmission behavior of monetary policies, which phenomenon are the building blocks of modern transmission mechanism.

Onoh (2007) observed that in their transmission path, monetary policy instruments do not directly hit the target(s) of policy but indirectly through the indicator variables. The target variables are a reflection of their related indicator variables. Onoh (2007) stated that for every macroeconomic goal or monetary policy objective, there is a target variable standing between the goal and indicator variable and behind every indicator variable, there is an array of appropriate monetary policy instruments waiting to be activated. This implies that appropriate policy instruments should be activated and directed at the relevant indicator variables after which the related target variable reacts sympathetically in line with the new position of the indicator variable. This target variable will enhance the achievement of the policy goal. As such, each policy instrument or combination of instruments in any policy package has to be carefully chosen to ensure that the desired impact is adequately felt by the offending target variable via the corresponding indicator variables.

In the context of monetary policy in Nigeria, an indicator variable relays to the monetary authorities the relative size and strength of the target variable to be encountered so that the authorities can determine the type or combination of instruments as well as the level of empowerment for the instruments to achieve the intended goal(s). For our purpose, we adopt Onoh's (2007) indicator and target variables. The indicator variable is bank assets while our target variable is money supply. According to Onoh (2007), a target variable is most time an obstacle or an impediment standing on the way to achieve a chosen goal. A question that this paper addresses remains: How do the Nigerian indicator and target variables behave when confronted with the adverse or favorable stimuli provided by the monetary policy instrument? Do their behaviors reflect any of these patterns? What is the direction of causality between these variables? The criteria for choosing variables include measurability, controllability and ability to predictably affect goals in a desired manner.

Apart from those already identified, other related studies have been conducted to address the impact of respective monetary policy measures on both indicator and target variables. Ezenwa (2009) for instance, studied the impact of monetary policy on inflation and growth of domestic output and found a significant relationship between monetary policy and money supply as operating target or indicator variable, broad money supply (M2) as intermediate or target variable and inflation as the final target. Inflation remains at moderate level accompanied by high growth of domestic output.

The significant effects of both monetary and fiscal policies on economic growth were underscored in the work of Olawunmi and Ayinla (2007). The study employed Johansen maximum likelihood co-integration procedure to show the long-run relationship between economic growth, degree of openness, government expenditure and money supply (M2). In another study, Ubogu (1985) found a relatively greater and more reliable, stable, strong and effective monetary actions unimpaired by fiscal operations in Nigeria.

In addition, Bernanke and Gertler (2000), in their work examined the implications of asset price volatility for the management of monetary policy. By employing a comparative analysis of U.S. and Japanese data on monetary policy as well as simulation of different policy rules in a small scale macro model, the authors conclude that asset prices become relevant only to the extent that they may signal potential inflationary or deflationary forces. In much the same manner, Tymoigne (2006), in his paper claims that central banks should focus their attention on maintaining financial stability and leave other problems to public institutions better suited for the task. For Tymoigne, the notion of bubble does not matter for policy purposes.

In another related study, Alfaro, et. al (2003), investigated the bank lending channel of monetary policy transmission in Chile between the period 1990-2002. Using data from both the banking sector and the corporate sector, the authors employed the VAR technique to test whether or not the bank lending channel exacerbates the effect of a monetary policy shock over macroeconomic activity. The paper concludes that the bank lending channel has operated as a monetary policy transmission mechanism in Chile during the sample period having an independent and significant effect in terms of macroeconomic activity.

Further investigations employing more sophisticated models attempt to determine the direction of causality using Granger-causality test. Using Nigeria data, Adefeso and Mobolaji (2010), observed that in the pre and post reform periods, treasury bill rate, exchange rate and lending rate do not Granger-cause real growth in the Nigerian economy. The deregulation of interest and exchange rates in the post reform period also has no

significant impact on the growth of the economy. In addition, the sale of treasury bills has no positive impact on the growth of the economy. In the post-reform periods, their findings reveal that the causality between monetary base and economic growth were in the nature of both supply- leading and demand- following hypothesis. During the post reform periods, CPI causes M2 and when M1 is used as a monetary aggregate, a bi-directional causality between money and price was observed. The study further shows that more of the variability in prices and output is explained by shocks to money aggregates, the exchange rate and currency ratio of the transmission mechanism.

Familoni (1989) argued that before monetary policy can produce the desired results as maintained by the classical economists, a highly integrated and monetized economy and regular information network system are indispensable. However, he lamented that the Nigerian economy lacks the fundamental flexibilities which could have aided a more effective use of monetary policy instruments.

3. Methodology

This paper constructs two monetary policy transmission models patterned after the Keynesian structural model using multivariate regression analysis as well as the Granger- causality technique within the context of co-integration and ECM. We are content with these types of models in the study since they appear to capture the prevailing circumstances observable in the country of study. For estimation purposes, we applied the two estimable models to time-series annual Nigerian data from 1970 through 2010 using Econometric View (E-View: 3.1) statistical package.

The relevant data are obtained from the Statistical Bulletin of the Central Bank of Nigeria (CBN). Analysis of the estimated models are in two parts: one directed to determining the utility of the models and the other directed to determining the relative impacts of the variables and the direction of causality between the monetary policy measures and the indicator variables (bank assets), as well as the direction of causality between the monetary policy variables and the target variables (money supply). As pointed out by Onoh (2007) each indicator variable supplies vital answers to questions on the behavior of the associated target variable to enable monetary authorities determine the appropriate monetary policy instrument(s) to employ. He added that the target variable is a function of the indicator variable. For one thing, the models constructed are derived greatly from both previous empirical studies and the theoretical foundations that characterize Onoh's (2007) argument.

3.1 Model Specification

Following the opinion in Onoh (2007) as well as the theoretical underpinnings and empirical review earlier made in this paper, we can hypothesize that bank assets (BKA) which is an indicator variable and money supply (MNS) which is a target variable, are positive functions of the monetary policy instruments. Given the above consideration, we can specify a two- variable predictor model of monetary policy transmission mechanism in a log-linear form as follows:

BKA = f(CRR, MRR).That is,

$$BKA = a_0 + a_1CRR + a_2DRR + \mu_t \quad (1)$$

Recasting equation (1) into log-linear variety using logarithmic transformation procedure, we have:

$$LOG(BKA) = a_0 + a_1LOG\ CRR + a_2LOG\ MRR + \mu_t \quad (2)$$

On a priori, $a_1, a_2 < 0$

The above model is for the indicator variable of monetary policy transmission mechanism and for the target variable of the monetary policy transmission mechanism, we postulate the model:

$$MNS = f(CRR, MRR)$$

$$MNS = b_0 + b_1CRR + b_2MRR + \mu_t \quad (3)$$

Again, recastingequation (3) into log-linear variety using logarithmic transformation procedure we have:

$$LOG\ MNS = b_0 + b_1LOG\ CRR + b_2LOG\ MRR + \mu_t \quad (4)$$

On a priori, $b_1, b_2 < 0$;

where:

BKA= Bank Assets (Dependent indicator variable)

MNS = Money Supply (Dependent target variable)

CRR = Cash Reserves Ratio

MRR =Minimum Rediscount Rate

μ_t = Stochastic Variable (Error term)

a_0 and b_0 are **i**ntercepts while a_1, a_2 and b_1, b_2, are the regression parameter coefficients.

Hence, combining equations (2) and (4) above, we generate a three-predictor model of monetary transmission mechanism from money supply to bank assets as given in equation (5) below. Equation (5) is the model to be estimated in this paper.

$$LOG(BKA)=\pi_0+\pi_1 LOG(MNS)+\pi_2 LOG(CRR)+\pi_3 LOG(MRR)+\mu \quad (5)$$

Where on a priori basis $\pi_1 > 0$ while π_2 and $\pi_3 < 0$.

4. Data Analysis and Interpretation

Table 1 shows data on the variables of our model expressed in equation (5) for the period 1970-2010 for the Nigerian economy. Bank Assets (BKA) and Money Supply (MNS) are measured in Millions of Naira while Cash Reserve Ratio (CRR) and Minimum Rediscount Rate (MRR) are measured in percentages.We start our empirical analysis by examining the time-varying characteristics of our level series data in Table 1 using the Augmented Dickey Fuller (ADF) unit root tests.

Table 1. Aggregate Monetary Data for Nigeria (1970-2010)

Year	BKA(N'm)	CRR(%)	MNS(N'm)	MRR(%)	Year	BKA(N'm)	CRR(%)	MNS(N'm)	MRR(%)
1970	1151.800	5.20	641.5000	4.50	1991	117511.9	2.90	50071.70	14.50
1971	1276.200	5.20	670.0000	4.50	1992	159190.8	4.40	75970.30	17.50
1972	1449.800	5.40	747.4000	4.50	1993	226162.8	6.00	118753.4	26.00
1973	1769.700	5.40	325.8000	4.50	1994	295033.2	5.70	169391.5	13.50
1974	2811.100	11.50	1357.200	4.50	1995	385141.8	5.80	201414.5	13.50
1975	4308.000	26.30	2605.400	3.50	1996	458777.5	7.50	227464.4	13.50
1976	6371.100	32.00	3864.100	3.50	1997	584375.0	7.80	268622.9	13.50
1977	8531.000	16.10	5557.800	4.00	1998	694615.1	8.30	318576.0	14.31
1978	9105.800	8.10	5260.700	5.00	1999	1070020.0	11.70	393078.8	18.00
1979	11238.60	12.40	6351.500	5.00	2000	1568839.0	9.80	637731.1	13.50
1980	16340.40	10.60	9650.700	6.00	2001	2247040.0	10.80	816707.6	14.31
1981	19477.50	9.50	9915.300	6.00	2002	2766880.0	10.60	946253.4	19.00
1982	22661.90	10.70	10291.80	8.00	2003	3047856.0	10.00	1225559.0	15.75
1983	26701.50	7.10	11517.80	8.00	2004	3753278.0	8.60	1330658.0	15.00
1984	30066.70	4.70	12497.10	10.00	2005	4515118.0	9.70	1725396.0	13.00
1985	31997.90	1.80	13878.00	10.00	2006	7172932.0	2.60	2280649.0	12.25
1986	39678.80	1.70	13560.40	10.00	2007	10981694.0	2.80	3116272.0	8.75
1987	49828.40	1.40	15195.70	12.75	2008	15919560.0	3.00	4857544.0	9.81
1988	58027.20	2.10	22232.10	12.75	2009	17522858.0	1.30	5017116.0	7.44
1989	64874.00	2.90	26268.80	18.50	2010	17331559.0	1.00	5571270.0	6.13
1990	82957.80	2.90	39156.20	18.50					

Source: CBN Statistical Bulletin (2010)

4.1 Unit Root Tests

The Augmented Dickey Fuller (ADF) unit root test was conducted for all the time series variables used in this study. The ADF results show that all the variables were non-stationary at their levels but became stationary after the first differencing.Hence the series are all integrated series of order I (1). In addition, the residual series of the level series regression (Table 3) of our model in equation (5) are integrated of order zero, that is, 1(0) thus confirming the existence of co-integration and long run relationship among the variables in equation (5). The results of the ADF tests are shown in Table 2.

Table 2. ADF Unit Root Test Results (1970-2010)

Variable	ADF Test Statistic 1st Diff	Order of Integration
LOG(BKA)	-4.195871	1(1)
LOG(MNS)	-4.732386	1(1)
LOG(CRR)	-3.918658	1(1)
LOG(MRR)	-4.694026	1(1)
RESID01	-3.470730	1(0)

Critical Values: 1% -3.6117; 5% -2.9399; 10% -2.6080.

Table 3. Level Series OLS Regression Results

Dependent Variable: LOG(BKA)
Method: Least Squares
Date: 06/29/12 Time**: 14:55**
Sample: 19702010
included observations: 41

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.845547	0.199176	4.245232	0.0001
LOG(MNS)	1.032951	0.015763	65.53063	0.0000
LOG(CRR)	-0.154044	0.044865	-3.433509	0.0015
LOG(MRR)	-0.038487	0.079730	-0.482719	0.6321
R-squared	0.994856	Mean dependent var		11.77843
Adjusted R-squared	0.994439	S.D. dependent var		2.903476
S.E. of regression	0.216516	Akaike info criterion		-0.129839
Sum squared resid	1.734525	Schwarz criterion		0.037338
Log likelihood	6.661708	F-statistic		2385.375
Durbin-Watson stat	1.414301	Prob(F-statistic)		0.000000

Source: Author's Computation

The econometric properties of the estimated equation are remarkable, as the overall goodness of fit is high with an F-stat of 2385.375 and p-value of 0.0000. From the regression result, R^2 is 0.9949 or 99.49% and an adjusted R^2 of 99.44%. This implies that 99.44% of the total variations in the level of bank assets is explained by the independent variables- MNS, CRR and MRR. In addition, the estimated model shows that both MNS and CRR have significant impact on Bank Assets (BKA) while MRR is not significant. The signs of the parameters are in consonance with a priori expectation. Be that as it may, the Durbin-Watson statistic value of 1.41 indicates the presence of positive autocorrelation in the level series regression which means that our regression results should be accepted with some caution and provides a firm justification for the ADF tests that were carried out and reported in Table 2.

4.2 Co-integration Test

Having established that the level series data are 1(1) series and the residuals are 1(0), we now apply the Johansen co-integration technique to determine the long run co-integrating properties of the model. Table 4 shows the results of the Johansen co-integration test. The test assumes linear deterministic trend in the data and a lag interval of 1 to 3.

Table 4. Johansen Cointegration Test Results

Johansen Cointegration Test
Date: 06/29/12 Time: 15:00
Sample: 19702010
Included observations: 37
Test assumption: Linear deterministic trend in the data
Series: LOG(BKA) LOG(MNS) LOG(CRR) LOG(MRR)
Lags interval: 1 to 3

Eigenvalue	**Likelihood Ratio**	**5 Percent Critical Value**	**1 Percent Critical Value**	**Hypothesized No. of CE(s)s**
0.649262	59.19578	47.21	54.46	None **
0.296572	20.43030	29.68	35.65	At most 1
0.144414	7.414102	15.41	20.04	At most 2
0.043440	1.643241	3.76	6.65	At most 3

*(**) denotes rejection of the hypothesis at 5%(1%) significance level L.R. test indicates I cointegrating equation(s) at 5% significance level

UnnormalizedCointegrating Coefficients:

LOG(BKA)	LOG(MNS)	LOG(CRR)	LOG(MRR)
-0.822493	0.893783	0.011519	0.035332
-0.737273	0.686082	-0.251707	0.155398
0.420177	-0.391213	-0.110230	0.037850
-0.722615	0.909500	-0.359059	-0.851999

Source: Author's Computation

Given the likelihood ratios and the critical values for the hypothesized number of co-integrating equations, the test indicates the existence of only one co-integrating equation at 5% level of significance as seen in Table 4. This confirms the existence of a long run stable relationship between Bank Assets and the other independent variables (MNS, CRR and MRR).

4.3 Error Correction Model Estimation

Continuing our analysis, we now employ the Error Correction Mechanism (ECM) which was first used by Sargan (1984) and later by Engle and Granger (1987). The ECM corrects for equilibrium by incorporating both the short run and long run effects in a dynamic setting given that the variables are co-integrated. Table 5 presents the results of the parsimonious error correction model incorporating a three-period lagged values of the explanatory variables and one-period lagged value of the error term (ECM) and adopting the general to specific approach.

Table 5. Parsimonious ECM Test Results

Dependent Variable: D(LOG(BKA))				
Method: Least Squares				
Date: 06/29/12 Time: 15:41				
Sample(adjusted): 1974 2010				
Included observations: 37 after adjusting endpoints				
Variable	**Coefficient**	**Std.Error**	**t-Statistic**	**Prob.**
C	0.179885	0.069110	2.602867	0.0162
D(LOG(BKA(-1)))	0.320322	0.211668	1.513326	0.1444
D(LQG(BKA(-2)))	-0.311510	0.252704	-1.232709	0.2307
D(LOG(BKA(-3)))	-0.198746	0.178774	-1.111716	0.2783
D(LOG(MNS))	0.363324	0.127877	2.841194	0.0095
D(LOG(MNS(-1)))	0.044206	0.110033	0.401755	0.6917
D(LOG(MNS(-2)))	0.055458	0.085753	0.646718	0.5245
D(LOG(CRR))	-0.033916	0.043252	-0.784132	0.4413
D(LOG(CRR(-1)))	0.017321	0.049904	0.347077	0.7318
D(LOG(CRR(-2)))	-0.042634	0.045330	-0.940525	0.3572
D(LOG(CRR(-3)))	0.030583	0.043959	0.695723	0.4939
D(LOG(MRR))	0.012621	0.095400	0.132298	0.8960
D(LOG(MRR(-1)))	-0.089974	0.082239	-1.094063	0.2858
D(LOG(MRR(-3)))	-0.081568	0.090094	-0.905362	0.3751
ECMO1(-1)	-0.166492	0.128564	-1.295010	0.2087
R-squared	0.677604	**Mean dependent var**		0.248364
Adjusted R-squared	0.472442	**S.D. dependent var**		0.125455
S.E. of regression	0.091122	**Akaike info criterion**		-1.662304
Sum squared resid	0.182670	**Schwarz criterion**		-1.009230
Log likelihood	45.75263	**F-statistic**		3.302785
Durbin-Watson stat	2.029749	**Prob(F-statistic)**		0.006034

Source: Author's Computation

The estimated results of the ECM are illuminating. Money supply (MNS) has a positive and significant relationship with Bank Assets in line with our theoretical expectation though the one and two- period lagged values of MNS are not significant. Cash Reserve Ratio (CRR) has a negative but insignificant relationship with Bank Assets while its lagged values show alternating signs. Minimum Rediscount Rate (MRR) as well as its lagged values is insignificant with the lagged values having the correct signs.

The adjusted R^2 is 47.24% indicating that the model explains only 47.24% of the total variation in Bank Assets while the D-W statistics of approximately 2.03 is very good and confirms the absence of any autocorrelation in the model.

The error correction term with a value of-0.1665 approximately is appropriately signed but not significant. The ECM value provides an insight on the speed of adjustment of the model from its long run equilibrium on account of any short run shock. Thus, the value of -0.1665 indicates that a short run disequilibrium in the long run monetary transmission relationship will be corrected at a speed of 16.65% per annum.

4.4 Granger Causality Test

Granger causality test is used to examine the direction of causality between two variables. (Granger, 1969). In Table 6, we report the empirical results of the Granger causality test.

Table 6. Pairwise Granger Causality Test Results

Pairwise Granger Causality Tests			
Date: 07/08/12 Time: 16:38			
Sample: 1970 2010			
Lags: 3			
Null Hypothesis:	**Obs**	**F-Statistic**	**Probability**
D(LOG(CRR)) does not Granger Cause D(LO	37	1.88687	0.15310
D(LOG(BKA)) does not Granger Cause D(LOG	(CRR)	101088	0.40159
D(LOG(MNS)) does not Granger Cause D(LO	37	0.36803	0.77658
D(LOG(BKA)) does not Granger Cause D(LOG	(MNS)	4.28501	0.01245*
D(LOG(MRR)) does not Granger Cause D(LO	37	0.88991	0.45761
D(LOG(BKA)) does not Granger Cause D(LOG	(MRR)	2.81537	0.05600
D(LOG(MNS)) does not Granger Cause D(LO	37	2.10278	0.12080
D(LOG(CRR)) does not Granger Cause D(LOG	(MNS	4.11537	0.01472*
D(LOG(MRR)) does not Granger Cause D(LO	37	0.25619	0.85631
D(LOG(CRR)) does not Granger Cause D(LOG	(MRR	1.73951	0.18009
D(LOG(MRR)) does not Granger Cause D(LO	37	0.34273	0.79459
D(LOG(MNS)) does not Granger Cause D(LOG	(MRR	0.51994	0.67181

Source: Author's Computation

The results of the pair wise test conducted with a maximum lag of 3 on the first difference of the log transforms of the variables show that Granger causality runs uni-directionally from Bank Assets (BKA) to Money supply(MNS) and again uni-directionally from cash reserve ratio (CRR) to Money supply (MNS).

4.5 Impulse Response and Variance Decomposition Analysis

Tables 7 and 8 extend our analysis of the monetary transmission mechanism by employing the impulse response function and the variance decomposition techniques. Specifically, the two methods allow us to examine the dynamic effects of cash reserve ratio (CRR), minimum rediscount rate (MRR), and money supply (MNS) on bank assets (BKA) over the long run period. (Cheng and Vijverberg, 2012). The impulse response function (IRF), according to Runkle (1987) as well as Gujarati and Porter (2009), traces out the response of the dependent variable in the VAR system to shocks in the error terms both in the current and future periods.

Table 7. Impulse Response to One S.D. Innovations

Response of LOG(BKA)				
Period	LOG(BKA)	LOG(CRR)	LOG(MNS)	LOG(MRR)
1	0.086213	0.013336	0.031976	-0.010337
	(0.00976)	(0.01489)	(0.01427)	(0.01477)
2	0.135974	0.038971	0.014729	-0.032671
	(0.02099)	(0.02701)	(0.02604)	(0.02623)
3	0.161356	0.053936	-0.000545	-0.023604
	(0.03190)	(0.03618)	(0.03708)	(0.03398)
4	0.171515	0.069650	-0.019269	-0.004527
	(0.04022)	(0.04490)	(0.04658)	(0.04124)
5	0.169033	0.082156	-0.029588	0.019082
	(0.04561)	(0.05492)	(0.05261)	(0.04939)
6	0.160229	0.092110	-0.033928	0.045406
	(0.04840)	(0.06560)	(0.05593)	(0.05877)
7	0.147786	0.099617	-0.033939	0.071770
	(0.04990)	(0.07606)	(0.05751)	(0.06968)
8	0.133336	0.104561	-0.030888	0.097544
	(0.05122)	(0.08560)	(0.05837)	(0.08187)
9	0.117778	0.107136	-0.025995	0.122187
	(0.05319)	(0.09394)	(0.05922)	(0.09491)
10	0.101555	0.107495	-0.019896	0.145347
	(0.05638)	(0.10105)	(0.06032)	(0.10841)

Source: Author's Computation

In Table 7, we report the results of the impulse response estimates to one standard deviation innovations in each of the four variables in the VAR system for a ten-year period into the future. The figures in parenthesis are the standard errors and the ordering of the variables is as shown in the table. That is, log(CRR)→ LOG(MRR)→ LOG(MNS)→ LOG(BKA). For example, Table 7 shows that the impulse response of Bank Assets to own shock is a positive 8.62% in the first year, 16.9% in the 5th year and 10.16% in the long term (10th year) while the impulse response of Bank Assets to shocks emanating from CRR, MNS and MRR in the first year are 1.33%, 3.2% and -1.03% respectively and with respect to CRR increases from a positive 3.9% in the 2nd year to 10.75% in the 10th year; for MNS, it is a positive 1.47% in the 2nd year and falling to -2.96% in the 5th year and -1.99% in the 10th year and for MRR, the responsiveness of BKA is -3.27% in the 2nd year, positive 1.91% in the 5th year and increasing to 14.53% in the 10th year showing a mixture of contraction and expansion. The other panels in Table 7 clearly show the impulse response of CRR, MNS and MRR respectively to own shocks and to shocks emanating from the other variables.

Table 8 presents the empirical results of the variance decomposition of the four variables in the VAR model of monetary transmission also for a ten- year period into the future as with the impulse response function. The variance decomposition helps to determine the total proportion of forecast error attributed to own innovation and to innovations in the other variables.(Iyeli,2010).

Table 8. Variance Decomposition

Variance Decomposition of LOG(BKA):					
Period	**SE.**	**LOG(BKA)**	**LOG(CRR)**	**LOG(MNS)**	**LOG(MRR)**
1	0.093487	85.04364	2.035052	11.69865	1.222650
2	0.173297	86.31380	5.649309	4.126919	3.909975
3	0.243997	87.27328	7.736165	2.082310	2.908243
4	0.306911	86.39024	10.03963	1.710263	1.859870
5	0.361602	84.08571	12.39443	1.901566	1.618290
6	0.410032	80.66582	14.68576	2.163559	2.484860
7	0.454085	76.36581	16.78724	2.322740	4.524211
8	0.495352	71.41744	18.56240	2.340681	7.679482
9	0.535097	66.04688	19.91600	2.241881	11.79524
10	0.574211	60.48324	20.79966	2.066911	16.65019

Source: Author's Computation

A cursory look at Table 8 indicates that own innovation represents the dominant source of variation in the forecast errors of the variables. In the variance decomposition of Bank Assets (LOG(BKA)) for instance, own shock constitutes 85.04% in the first year with the other variables contributing 2.04%, 11.70% and 1.22% respectively. However, from the fourth year, own shock gradually reduces from 86.39% to 60.48% in the 10th year while CRR, MNS and MRR contributed 20.80%, 2.07% and 16.65% respectively in the 10th year.

5. Summary and Conclusion

This paper set out to investigate the Bank Asset channel of monetary transmission in Nigeria as well as examine the pattern and magnitude of policy response to shocks in our monetary transmission model over a ten-year period into the future. In addition, the paper employed the Granger causality test to evaluate the direction of causality between Bank Assets on the one hand and the monetary policy tools- Cash Reserve Ratio, Money Supply and Minimum Rediscount Rate- in the model.

Using the ADF test and the Johansen co-integration test, our findings show that there is one co-integrating long run relationship between BKA, CRR, MNS and MRR.

The parsimonious error correction model results (Table 5) indicate a significant and positive relationship between BKA and MNS in consonance with theoretical expectation. The relationship between BKA and CRR is negative in line with apriori expectation but not significant while the empirical findings show that MRR has a positive and insignificant relationship with BKA which does not agree with theoretical expectation. However, both the one and two-period lagged values of MRR, though not significant, have the expected negative sign. Thus, given the values of the F-statistic and the D-W statistic, we conclude that the monetary policy variables- MNS, CRR and MRR- significantly influence Bank Assets in the monetary transmission channel. This result

corroborates the empirical findings of Bernanke and Blinder (1992), Onoh (2007), Olawunmi and Ayinla (2007) as well as that of Alfaro, et al (2003) and Cheng and Vijverberg (2012).

The Granger causality test results reveal a uni-directional causality from Bank Assets to Money Supply and also uni-directionally from Cash Reserve Ratio to Money Supply at the 5% level of significance.

The analysis of the impulse response function (IRF) and the variance decomposition of the VAR model shows that the impulse response of Bank Assets to shocks emanating from MNS, CRR and MRR exhibit a mixture of contraction and expansion over the ten-year forecast period. With respect to the variance decomposition of Bank Assets to innovations from MNS, CRR and MRR, it is apparent that own shocks remain the dominant source of the total variations in the forecast error of the variables in our monetary transmission model over the ten-year period.

5.1 Concluding Remarks

From our empirical results, both the cash reserve ratio and the Minimum Rediscount Rate seem not to have any significant impact on Bank Assets- the indicator variable of the transmission path of monetary policies in the economy. This may be due to poor banking habits exhibited by the public and the dominance of the informal financial sector which allow most people to save, lend and borrow money in the informal financial sector or perhaps, it may be a pointer to the interest-insensitive nature of financial intermediation in an emerging economy like Nigeria.

Thus, this paper has examined the nature of the impact of monetary policy variables on Bank Assets as a channel of the monetary transmission mechanism in Nigeria as well as the responsiveness of Bank Assets to shocks emanating from the monetary variables

The empirical results confirm the position of Onoh (2007) that monetary policy influences the indicator variables and also supplies vital answers to the questions on the behavior of the target variables of the transmission paths of monetary policies in Nigeria.

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Causality between Economic Growth, Export, and External Debt Servicing: The Case of Lebanon

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Abstract

The econometric relationship between external public debt, exports and economic growth in Lebanon has been rarely examined. This study empirically investigates the relationship between economic growth, exports and external debt of Lebanon through an econometric analysis over the period 1970-2010 with the inclusion of a fourth macroeconomic variable that is the exchange rate. The exports were introduced in the model to test the export-led growth hypothesis for Lebanon. We explore this relationship using the vector error correction models (VECM) and we employ Granger causality technique in order to investigate the presence of causality among these variables. The results show that both short run and long run relationships exist among these variables. Moreover, the finding suggests, *i*) bidirectional Granger causality between GDP and external debt servicing, *ii*) unidirectional Granger causality that runs from external debt to exports, *iii*) unidirectional causality running from exports to economic growth, and *iv*) unidirectional causality running from exchange rate to economic growth.

Keywords: economic growth, exports, external debt, cointegration analysis, causality

1. Introduction

The relationship between economic growth and exports in developing countries has drawn the attention of researchers theoretically and empirically. A host of empirical studies have been conducted to investigate the role of exports on economic growth or the export-led growth hypothesis. This latter stipulates that export is an engine to promote economic growth and hence increases the rewards of factors of production. Moreover, it opens opportunities for investments in the economies as a result of the higher level of income and saving, which leads in return to sectoral growth. The importance of export and its impact on economic growth raises the question about the nature of the relationship between these two macroeconomic variables. In other words, it is useful to investigate whether the co-movement between exports and GDP is in line with the export-led hypothesis or whether a causal relationship exists between the two variables.

Bivariate causality analysis leaves out some other relevant variables such as external debt, exchange rate, inflation, external debt servicing, etc. that could have significant relationship with the two variables in question. For that reason we find many empirical studies that improved the export-led growth strategy by including in their models one or more relevant macroeconomic variables. For instance, Sheehey (1990), Jones (1989) provided studies which test the causal relationship among economic growth, exports and external debt servicing. Others introduced different variables such as imports (Din, 2004), world income (Afzal, 2006), and external debt (Amoateng and Adu, 1996), etc.

Bivariate causality studies provided conflicting empirical results. This situation may be due to the misspecification of the causal model used in these studies because of the omission of an important third variable such as foreign debt, among others. Therefore, the omission of external debt servicing variable, for instance, could seriously bias the empirical causality results between export and economic growth in the case of Lebanon since foreign debt servicing is a major disbursement item.

The economic situation in Lebanon has undergone many difficulties due to several economic and political events which unexpectedly have been occurring at internal and external levels since 1975.

Lebanon's external and internal debts are seen to be the cause of the major problems that causes troubles to the economy since 1993. Moreover, in all fiscal years since 1964, the government's revenue has been less than its expenditure, which causes fiscal deficits that are covered by borrowing from both internal and external sources.

External debt may have a positive or a negative impact on economic growth depending on its uses. It could affect the economy positively when the government uses it for investment-oriented projects such as infrastructure, power, and the agriculture sector. However, it could have a negative impact when it is employed for private and public consumption. In general a lower level of the external debt affects positively the economic growth. This impact becomes negative at a higher level. The specific turning points are 35-40% of the debt-gross domestic product (GDP) ratio and 160-170% of the export-debt ratio (Note 1). The lower is the first ratio (the higher the second ratio) the better is the impact on economic growth.

In Lebanon, the external debt was at low levels till 1992. The external debt-GDP ratio started to grow steadily from 5.7% in 1993 to reach 90.6% in 2007 and then declined to 52% in 2010. As to export-external debt ratio, it was very high before 1986. It started to decrease from 339% in 1986 to arrive at its lower level 20.8% in 2002 and then increased to 40.8% in 2010 (see table 1).

Table 1. External debt as percentage of GDP and export as percentage of external debt

Year	1986	1987	1992	1993	2002	2006	2007	2010
External debt-GDP ratio	7.7	26.6	4.7	5.7	77.9	90.6	84.7	52
Export-external debt ratio	339	153	186	150	20.8	23.4	27.2	40.8

In light of the above discussion, the objective of this study is to investigate the impact of exports in shaping the economic growth in the case of Lebanon with the inclusion of two economic variables that are external debt servicing and exchange rate. A cointegration analysis based on Johansen procedure is used for this purpose. Moreover, the causality between these variables is explored using Granger causality test. The data used in this study cover the period from 1970 to 2010.

The study is organized as follows, in section II, we analyze the economic situation in Lebanon. Section III presents the literature review of causality relations among GDP, export, and other macroeconomic variables in a country or a group of countries. Section IV explains the methodology used in this research. Section V presents the data and variable description. In section VI, we present the obtained results regarding the cointegration analysis and the Granger causality tests. The last section concludes the main findings.

2. The Economy of Lebanon: A Background

This study attempts to establish the relationship between economic growth, export, exchange rate, and foreign debt servicing in Lebanon during the period from 1970 to 2010. The main objective of this research is to examine the effect between these four macroeconomic variables and the specific aim is to identify the causality between them.

2.1 The Lebanese GDP

The economic situation in Lebanon has undergone many difficulties due to several economic and political events which unexpectedly have been occurring at internal and external levels since 1975. The Lebanese economy performed well in the era of 1990 to 2010 in which economic growth was growing at an average rate of 7 percent annually (see fig. 1). However, the period between 1975 and 1990 witnessed a lot of fluctuations due the civil war that took place during that time.

After 1992 the country witnessed a period of economic recovery that is characterized by security stability in most regions of Lebanon (except for the areas under occupation and some major political events in 1996, 2005, and 2006) and strong local currency. The government started to apply a wide rehabilitation policy based on the rebuilding of the infrastructure and the launching of new projects in order to enhance the economy. However, the expenditures exceeded significantly the revenues, forcing the government to seek for domestic and external borrowing in order to finance the public deficits.

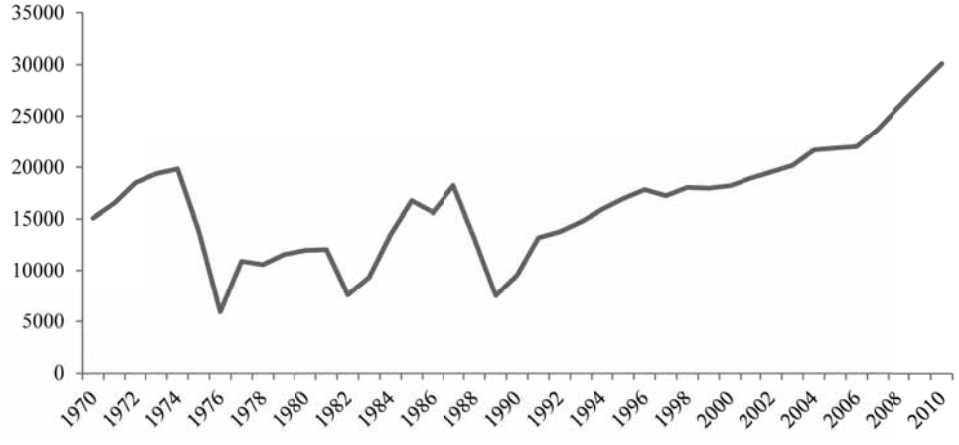

Figure 1. Real GDP in Lebanon (in millions of US$) from 1970 to 2010

Source: United Nations Statistics.

The country has been exposed to slowing economic growth since mid-1995 as a result of inappropriate regional atmosphere, not investing in productive projects, the escalation of debt service remarkably, and finally the widespread of the corruption in the public administrations and institutions.

2.2 The Lebanese Exports

The exports in Lebanon witnessed significant developments in the period before 1975 which was the start date of the Lebanese civil war. The value of exports grew from 351 million dollars in 1970 to reach 2214 million dollars in 1975. The reason for that lies in the fact that the structure of the Lebanese exports does not depend on the export of one commodity as is the case in most developing countries. For instance, more than 90% of the exports of the Gulf countries are based on oil. However, the export performance of Lebanon was exposed to a period of fluctuations during the civil war that took place from 1975 to 1990 (see fig. 2). Lebanese exports were dramatically affected by the Lebanese events and it was noticed that whenever the security situation improved, the better the exports were. In 1976 exports dropped to a lower level to reach about 300 million dollars, which was a decline of about 86% compared to 1975. Afterward, the value of exports knew periods of ups and downs till 1992. The decline in some periods was the result of partial or total destruction of national production companies and the disabling of the port of Beirut, which was the main artery for the import of raw materials and equipment necessary for the production processes. This port was also the main gate to export Lebanese product abroad. However, in the period between 1993 and 2010 exports grew steadily at an average rate of 13% annually. It is important to mention that the main importers of the Lebanese production are Arab countries.

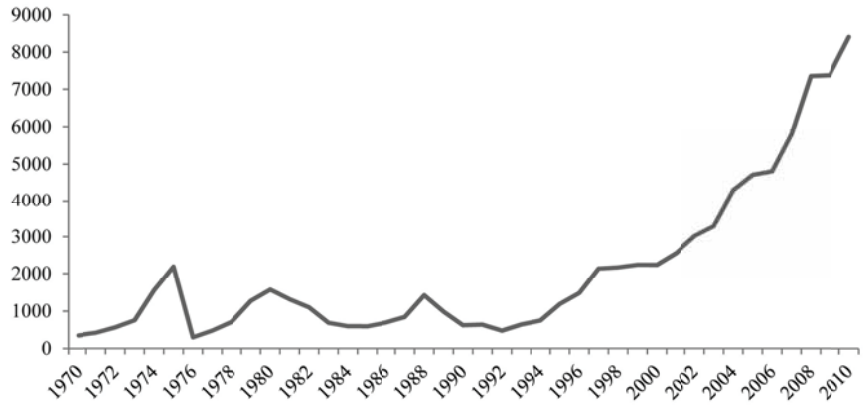

Figure 2. Exports of goods and services in Lebanon from 1975 to 2010. (Current US$)

Source: United Nations Statistics.

2.3 Lebanon's Foreign Debt

Before 1975, the level of foreign debt was minimal. From 1976, following the break out of civil war in 1975, which exerted remarkable pressure on government finances, it became necessary to borrow for balance of payments support and project financing.

Till 1975 the ratio of public debt to GDP was very low but soon this debt was accumulated very quickly with the continuation of Lebanese events and the escalation of its intensity and duration to rise from about $67 million dollars in 1975 to about $4 billion in 1982, only 6% of this latter was attributed to external debt.

The debt was accumulated due to the decline in revenues and the growing expenses imposed by the events and the indulgence of governments in public spending. However, the continued confidence in the state and the influx of capital on Lebanon limited the deterioration of the exchange rate of pound (3.8 pounds to one dollar in 1982 compared to 2.5 pounds in 1975).

Figure (3) indicates that Lebanon's external debt remained at very low levels till 1992. Afterward, external debt increased from $429 million in 1993 to $21.221 billion in 2007 and then declined to $20.590 billion by 2010.

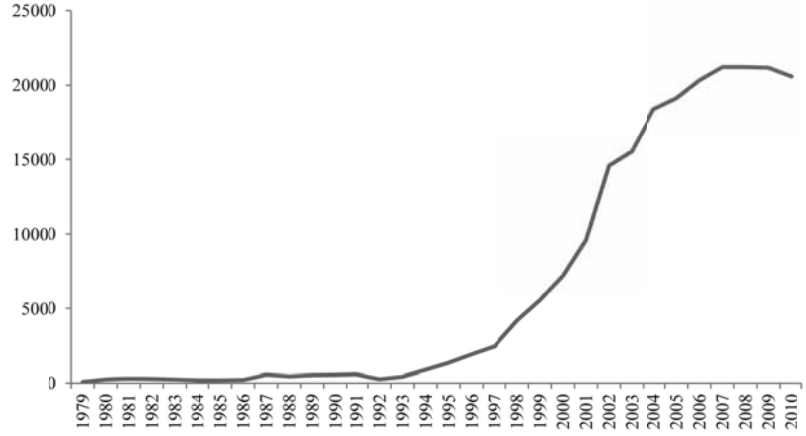

Figure 3. Lebanon's external debt from 1975 to 2010. (Current US$)

Source: United Nations Statistics.

External debt constituted 4.7% of the gross domestic product in 1992. However, this ratio rose considerably to its highest level 90.6% in 2006, but it started to decline since that date to reach 52% in 2010 (see table 2).

Table 2. Total debt as percentage of GDP and external debt as percentage of GDP and total debt

Year	1979	1987	1992	1993	2002	2006	2007	2010
Total debt as percentage of GDP	23.5	19.2	50.7	13.4	167.7	179.9	167.2	134
External debt as percentage of GDP	2.7	26.6	4.7	5.7	77.9	90.6	84.7	52
External debt as percentage of total debt	11.3	13.9	11.2	13.4	46.5	50.3	50.48	39.1

The accumulation of this debt was the result of financing the rehabilitation projects for boosting the economy after the end of the Lebanese civil war in 1990. But the subsequent period has seen a lot of leniency in spending as well as the expansion in employment and the establishment of several futile institutions. As you notice in table (2) the total public debt increased tremendously since 1992 and constituted 179.9% of the GDP in 2006. This ratio slightly declined to 134% in 2010.

2.4 Exchange Rate

The exchange rate of the Lebanese currency witnessed great stability until 1980. During that period exchange rate maintained a very narrow margin for exchange rate of the dollar ranged between 3.43 and 22.3 pounds. This

matter continued till 1980, and then the exchange rate of foreign currencies jumped in a way that it hadn't seen before. The exchange rate of the dollar doubled in 1982 to become about 4.72 after it was about 2.33 in 1974. After that it tripled in the year 1984 and became 176 times more in 1988 and about 378 more in the year 1990 compared to what it was in 1974. As a result, the Lebanese pound lost the confidence of depositors and people refrained from its acquisition. Moreover, prices of goods and services increased dramatically and hence, the economy suffered from a huge phenomenon of inflation. This situation was aggravated after the 1990 Gulf War and the Lebanese pound deteriorated more and more to reach 605 Lebanese pounds for every dollar exchange rate in 1990 and 1750 in 1992. But it started to have some improvements and stability since that date due to the government adoption of a fixed exchange rate.

3. Literature Review

A host of empirical studies have attempted to investigate whether exports and economic growth are correlated and determine the direction of this causation. The empirical analysis, based on the export-led economic growth hypothesis, has provided mixed results in a bivariate causality analysis. In most studies, this latter was investigated using Granger causality. In addition, the long and short run equations were estimated using vector autoregressive models. For instance, there are Awokuse (2005) who examined this relationship for Korea, Lee and Pan (2000) who investigated this link for eight East Asian countries. Moreover, Mah (2005) found bidirectional causality in China. Similarly, Hatemi (2002) examined the bi-directional causal relationship in Japan. Demirhan and Akcay (2005) found that exports cause economic growth in Morocco and Jordan.

Some studies also used causality analysis at trivariate level between exports, economic growth, and a third relevant macroeconomic variable such as imports, external debt, external debt servicing, income, etc. For instance, Eita and Jordaan (2007) supported the export-led growth hypothesis in Namibia by finding that export Granger causes GDP and per capita income. Baharumshah and Rashid (1999) investigated long run causal relationship between exports, GDP, and imports of Malaysian economy. Similarly Khalid and Cheng (1997) also found long-run relationship among the three variables. Shirazi and Manap (2004) found strong long-run relationship among the three variables. Moreover, Ahmed et al (2000) examined the trivariate causality between export, external debt and economic growth for South and South-East Asian countries and reached the result that there is no joint feedback among them. Moreover, Amoateng and Amoako-adu (1996) examined the causality relationship among exports, external debt and economic growth in African countries, their results indicated bidirectional causality between external debt, economic growth and exports. Awokuse (2007) studied the impact of export and import on economic growth in three transition economies and found a bidirectional causal relationship between exports and growth in Bulgaria and causality from import and export to economic growth in the Czech Republic and only a unidirectional causality between import and growth in Poland. Tang and Lai (2011) investigated the validity of export-led growth hypothesis for Asia's four little dragons by using bivariate (exports and GDP) and trivariate (exports, GDP, and exchange rate) models. Their results showed that growth led export hypothesis is valid only for the case of Hong Kong and Singapore in the bivariate model but valid for all four economies in the trivariate model. Cetintas and Barisik (2009) analyzed the relationship between export, import and economic growth for the 13 transition economies by using a panel vector error correction model. Their results indicated that the export-led growth hypothesis is supported in those countries. However, some studies found no causal relationship among the variables in question such as Ribeiro (2001) in Portugal economy and Hsiao (1987) in four Asian economies.

4. Methodology

This study uses cointegration analysis and error-correction models to explore the relationship among the GDP, exports, exchange rate, and external debt serviving. Moreover the causality between each pair of variables is investigated using Granger causality.

In fact, most of the economic series are non-stationary at their levels. The use of such series in regression analyses lead to spurious regression (Granger and Newbold, 1974). For this reason, to explore the order of integration of the series in question we will use two tests: Augmented Dickey-Fuller test (1979) test and Phillips-Perron test (1988) test. The ADF test is employed using the ordinary least square (OLS) estimation of model (1):

$$\Delta y_t = a_0 + a_1 y_{t-1} + \sum_{i=1}^{p} \emptyset_i \Delta y_{t-i} + u_t \quad (1)$$

where y_t is the time series, Δ is the first difference operator, u_t is the error term with zero mean and constant variance, and a_0, a_1, $\emptyset_i$ (i = 1, …, p) are parameters to be estimated. The non rejection of the null hypothesis H_0: $a_1 = 0$ implies that y_t is nonstationary series. In this case differences are necessary to reach stationarity.

Once the order of integration is determined, cointegration test is implemented using Johansen procedure (1988) and Johansen and Juselius technique (1990). These researchers have developed two tests to detect the number of cointegrating vectors: the maximum-likelihood test and the trace test. Once the variables are proved to be cointegrated, two different kinds of equations can be derived:

a) The long-run equation:

$$LRGDP_t = \alpha_0 + \alpha_1 LREXP_t + \alpha_2 LRDEBT_t + \alpha_3 EXCHR_t + u_t \quad (2)$$

where *LRGDP*, *LREXP*, and *LRDEBT* represent the natural logarithms of real GDP, real exports, and real external debt servicing respectively. *EXCHR* is the exchange rate. In addition, u_t is the stochastic error term with mean zero and a constant variance.

b) The short-run model or the vector error-correction representations:

$$\Delta LRGDP_t = \alpha_1 + \sum_{i=1}^{p} \theta_{1i} \Delta LREXP_{t-i} + \sum_{i=1}^{p} \delta_{1i} \Delta LRDEBT_{t-i} + \sum_{i=1}^{p} \rho_{1i} \Delta EXCHR_{t-i} + \beta_1 ETC_{t-1} + e_{1t} \quad (3)$$

$$\Delta LREXP_t = \alpha_2 + \sum_{i=1}^{p} \theta_{2i} \Delta LREXP_{t-i} + \sum_{i=1}^{p} \delta_{2i} \Delta LRDEBT_{t-i} + \sum_{i=1}^{p} \rho_{2i} \Delta EXCHR_{t-i} + \beta_2 ETC_{t-1} + e_{2t} \quad (4)$$

$$LRDEBT_t = \alpha_3 + \sum_{i=1}^{p} \theta_{3i} \Delta LREXP_{t-i} + \sum_{i=1}^{p} \delta_{3i} \Delta LRDEBT_{t-i} + \sum_{i=1}^{p} \rho_{3i} \Delta EXCHR_{t-i} + \beta_3 ETC_{t-1} + e_{3t} \quad (5)$$

$$EXCHR_t = \alpha_4 + \sum_{i=1}^{p} \theta_{4i} \Delta LREXP_{t-i} + \sum_{i=1}^{p} \delta_{4i} \Delta LRDEBT_{t-i} + \sum_{i=1}^{p} \rho_{4i} \Delta EXCHR_{t-i} + \beta_4 ETC_{t-1} + e_{4t} \quad (6)$$

where Δ represents the difference operator, p is the number of lags, *ETC* is referred to the error terms derived from the long run relationship, and e_{it} (i =1, 2, 3, 4) is the stochastic error term with mean zero and a constant variance.

In order to check the causal relationship between the variables we will use Granger causality test that was developed by Granger (1969). According to Granger (1988), causality tests are valid only if there exists cointegration among the involved variables. Thus a necessary precondition to causality testing is to check the cointegrationg properties of the variables of interest. We apply the standard Granger causality test on the equations (3), (4), (5), and (6).

5. Data and Variables Description

This study employs annual series of gross domestic product (GDP), export, exchange rate, and foreign debt servicing in Lebanon over the period 1970-2010. The data on exports and GDP are drawn from the United Nations Statistics (UNSTATISTICS) and the external debt servicing values were taken from UNICTAD for the same period. Moreover, the external debt values were taken from the Central Bank of Lebanon for the period 1979-1992 and the Ministry of finance for the period 1993-2010. The nominal figures of these variables (except the exchange rate) were deflated by the GDP deflator (2005=100) in order to express them in real terms. Afterward, all variables (except exchange rate) are expressed in the natural logarithmic form of the real values.

6. Results and Discussions

The aim of this study is twofold. First, establish the causal relationship between exports (external debt servicing and exchange rate) and economic growth. Second, if such a relationship exists, find the direction of the causation. Annual time-series on exchange rate and the logarithms of real GDP, exports, and external debt servicing from 1970 to 2010 are employed.

In the light of the econometric methodology presented previously, the cointegration properties of the variables in question are examined. Hence, all variables in this study are tested for stationarity using Augmented

Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The results of the unit roots tests are reported in Table (3) and indicate that all variables are nonstationary in their levels, but stationary in their first difference level at 1% level of significance. Therefore, all the variables of interest are integrated of order one I(1).

Table 3. Results of ADF and PP tests

Variables	Augmented Dickey-Fuller Test		Phillips-Perron Test	
	Level	First Difference	Level	First Difference
LRGDP	0.3601	-4.1773***	-0.6255	-6.1628***
LREXP	0.3740	-3.9937***	0.3740	-3.9937***
LREDS	-2.1724	-6.3189***	-2.4306	-6.3139***
EXCHR	-0.9647	-4.1304***	-0.8309	-4.1304***

Note: *, **, and *** show the statistical significance at the 10%, 5%, and 1% level of significance respectively.

After stationarizing the variables, their optimal lag length is determined using Akaike's Information Criterion (AIC). The optimum lag length of the variables in questions is found to be 3. The next step consists of testing whether these variables are cointegrated or not by applying Johansen-Juselius cointegration procedure. Two tests are used for this purpose: Trace test and Maximum Eigen Value test. The results are reported in Table (4) and show the existence one cointegrating equation for economic growth, exports, exchange rate, and external debt servicing at 1% level of significance.

Table 4. Results of cointegration tests

Null Hypothesis	Alternative Hypothesis		0.05 Critical Value	Probability
		λ_{trace}value		
$r = 0$	$r = 0$	76.85043	47.85613	0.0000
$r \leq 1$	$r > 1$	26.94771	29.79707	0.1029
$r \leq 2$	$r > 2$	11.82515	15.49471	0.1655
$r \leq 3$	$r > 3$	3.416629	3.841466	0.0645
		λ_{max} tests		
$r = 0$	$r = 1$	49.90273	27.58434	0.0000
$r = 1$	$r = 2$	15.12256	21.13162	0.2804
$r = 2$	$r = 3$	8.408522	14.26460	0.3387
$r = 3$	$r = 4$	3.416629	3.841466	0.0645

Notes: Trace and max-eigenvalue tests indicate 1 cointegrating equation at the 0.01 level of significance. r indicates the number of cointegrating vector and λ_{trace} and λ_{max} are tests statistic of trace and maximum eigenvalue tests respectively.

These results imply that a long-run association exists among the exchange rate and the logarithms of real GDP, real exports, and real external debt servicing. Then, the long-run estimated coefficients are reported in table (5).

The statistically significant positive long-run coefficient of *LREXP* indicates that exports have positive effects on economic growth. Furthermore, exchange rate (*EXCHR*) has a statistically positive coefficient that reveals a positive effect on economic growth. However, the long-run coefficient of *LREDS* is insignificant even at 10% significance level. Therefore, we conclude that foreign debt servicing has no effect on economic growth in the long-run.

Table 5. Estimated long-run model

Dependent Variable *LRGDP*			
Variable	Coefficient	Standard Error	*t*-value
Constant	8.42206	0.2791	30.3517***
LREXP	0.1505	0.0435	3.4580***
LREDS	0.0188	0.0210	-0.8928
EXCHR	9.45E-05	3.7E-05	2.5245**

Note: *, **, and *** indicate the rejection of the null hypothesis at the 10%, 5%, and 1% level of significance respectively.

Since there exists one cointegrating vector in the four variables involved in the cointegrating tests, it is convenient to perform multivariate Granger causality tests based on vector error correction models (VECM). These latter include an error correction term (ETC) that captures the short-run dynamics. The results of these tests from VECM specification, χ^2-statistics, probability (in parentheses), and the error correction term (ETC) coefficient from each four equations are reported in table (6).

Table 6. Results of Granger causality tests built on VECM

Dependent Variable	Short-run lagged differences				
	ΔLRGDP	*ΔLREXP*	*ΔLREDS*	*ΔEXCHR*	ETC_{t-1}
ΔLRGDP	-	28.21426***	8.584848**	9.43783**	-0.82582***
		(0.000)	(0.0354)	(0.0240)	(-3.12986)
ΔLREXP	2.24016	-	1.308360	0.861229	0.58869
	(0.5241)		(0.7271)	(0.8348)	(0.85566)
ΔLREDS	34.52563***	6.442964*	-	15.50800***	-2.71223***
	(0.0000)	(0.0919)		(0.0014)	(-5.69149)
ΔEXCHR	4.308169	2.026306	1.594139	-	-147.9639
	(0.2301)	(0.5670)	(0.6607)		(-0.63633)

Notes: values presented in the last column are the *ECT* estimated coefficients and values in parenthesis the t-values. All other values are the asymptotic Granger χ2-statistics. *, **, and *** indicate the statistical significance at the 10%, 5%, and 1% level of significance respectively and values in parentheses are the *p*-values.

Our results indicate the validity of export-led growth hypothesis in the long run. Exports are considered as engine for the process of growth since they engender scare foreign exchange reserves that are required to finance imports of goods such as energy and investment goods. These latter are essential for the formation of capital and economic growth. Exports diminish the weight on the balance of payments and engender employment opportunities (Eita and Jordaan, 2007). Moreover, exports can lower the effect of external shocks on the domestic economy. The essential role for exports as a key to economic growth was also stressed by Senhadji and Montenegro (1999). Barro (1991, 1997) and Gemmell (1996) argued also that exports are an important determinant of economic growth. They assumed that a higher level of exports enhances productivity, which results in an increase in production of high value added goods. This situation leads in return to an overall improvement in economic growth.

The results of Granger causality tests show that a bidirectional causality between external debt servicing and GDP exists at 1% level of significance and there is a unidirectional Granger causality going from *i*) export to GDP at 5% level of significance, *ii*) exchange rate to GDP at 5% level of significance, *iii*) export to external debt servicing at 10% level of significance, and *iv*) exchange rate to external debt servicing at 5% level of significance. Moreover, the statistically significant *ECT* coefficients at 1% for GDP and external debt servicing indicate that these obtained causalities are also accompanied with short run dynamics. On the other hand, *ECT* coefficients for exchange rate and exports are insignificant with the absence of any causal effect. As a result, the findings imply that both exports and exchange rate matter in the economic growth in the short-run in Lebanon. Moreover, exports have also an impact on external debt servicing in the short-run.

Based on the achieved results, we notice that if a large proportion of the export earnings is being employed to service foreign debt than we would expect a positive relationship between export revenue growth and debt servicing. This is because countries with promising export potential are likely to obtain more foreign loans and, therefore, to bear larger external debt and, consequently, a larger foreign debt servicing burden [Feder (1982)]. Since the resources from exports could be directed to foreign debt servicing instead of being used in the investment, the relationship between exports and economic growth may not be significant in the short run.

It is surprising that there is not any causality between export and exchange rate. This can be referred to the fact that exchange rate has been stabilized for a long time by adopting the policy of fixed exchange rate since 1992.

7. Conclusion

This study analyses empirically the causal relations among economic growth, export, exchange rate, and foreign debt servicing in Lebanon, over a period of 40 years from 1970 to 2010.

Public debt has become an increasingly serious problem for Lebanon due mainly to its crowding out public finances because of the huge debt-service charges. In 2010 the total debt was $52.6 billion, of which 39.1% is attributed to external debt. According to the World Bank, when the external debt of a country reaches to 80% of its GNP, it becomes unsustainable. Although the external debt of Lebanon did not become unbearable in the period of analysis, we can say that the country does not feel at ease when it external debt equals or exceeds 53.5% of its GNP.

Furthermore, the ratio of exports to gross domestic product (GDP) experienced ups and downs over the period from 1970 to 2010. The ratio was 37.38% in 1979, arrived to its lowest level 8.56% in 1993, and then increased to reach 21.42% in 2010. These fluctuations are due to internal and external political events.

In order to clarify whether exports, exchange rate, and external debt servicing cause economic growth or vice versa, a vector autoregressive model is developed. Moreover, Granger causality technique is used to assess the direction of causation.

The results showed bidirectional causality between economic growth and external debt servicing, unidirectional causality running from exports to economic growth, unidirectional Granger causality running from exports to external debt, and unidirectional causality flowing from exchange rate to economic growth. The presence of a causal link between exports and growth has implications of great consequence on development strategies for developing countries. If export causes economic growth, then the achievement of a certain degree of development may be a prerequisite for the country to expand its exports. Our findings provide evidence to support the export-led growth hypothesis. Thus, exports are important in fueling economic growth.

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Owner Risk Averse and Enterprise Technological Innovation Mode: Focus on Major Equipment Manufacturing Industry

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Abstract

Major equipment manufacturing industry is the strategic industry of national defense construction. In the 1990s, China began implementing the "market for technology" strategy, but the strategy did not achieve the desired results, for the important technology and equipment is still highly dependent on imports. The paper analyses the risk aversion characteristics of the owners to purchase, and points out that the risk aversion characteristics comes from the product attributes of important equipment manufacturing industry and asymmetric information. Then it elaborates a dynamic game model to study on the choices of the enterprise's technological innovation modes in the major equipment manufacturing industry. Finally, the paper concludes that under the strong risk aversion constraints, rational companies will choose collaborative innovation instead of independent innovation.

Keywords: risk aversion, major equipment manufacturing, technology innovation, mode

1. Introduction

The major equipment manufacturing industry is a pillar industry in China and a strategic industry for national economic development and military security. It is particularly important to strengthen the study on the model selection of major equipment manufacturing technological innovation.

With respect to the influence of owner risk averse on the market, Eeckhoudtetal concerned the effect of owner risk averse on the decision variable of newspaper boy model (Eeckhoudtetal, 1995). He promoted a comparative static analysis under different prices and costs. Tsay studied that under the circumstances which both supplier and retailer have the character of owner risk averse, buy-back strategy could be used to embed to the arbitrage model (Tsay, 2002). Gan obtained the coordinated contract among parts with owner risk averse in the way of Pareto Optimality (Gan, 2004). Bouakiz.M.and M. J. Sobel considered the issues of inventory collaborations with risk averse (Bouakiz & Sobel, 1992).

The purchaser of major equipment manufacturing products has obvious risk aversion characteristics. The reason is that the product has a long production cycle and large inputs. Once it fails after the owner's purchase, the owner will suffer losses much greater than the inputs' costs of the purchasing products. In the economic sense, Liu Yingzong, Pan Pengcheng, and Xu jiang (2006) think that risk preference is used to explain the behavior of consumers and investors in the case of asymmetric information, showing the reluctant level of individuals to accept high-risk transactions relative to the low-risk but low expected return transactions(Liu Yingzong, Pan Pengcheng, & Xu jiang. 2006). Zhang Guobao, Wang Qianyuan and Zhang Xinjian argued that the technology spillover from transnational corporations helped experience accumulation for self-dependent innovation, and the manufacturing and research of major technological equipment has got a substantive progress (Zhang Guobao, 2006). Wu Weili, Liu Jinshan and Dong Shuli pointed out that technology spillover had low-side and internality characters (Wu Weili, 2006). Because of substitution and squeeze-out effect, most of Chinese major equipment manufacturing corporations barely mastered the core technology and were entrapped into vicious circle of independent R&D.

Considering the costs and benefits of risk reduction, risk aversion purchaser is more inclined to make a low-risk preference. In this case, domestic owners who purchase the major equipment manufacturing products will generally consider past "market performance" as the access condition of the product purchase and purchasing preferences become important factors in deciding technological innovation model. This paper uses owner's risk

aversion characteristics as the starting point to analyze the impact of selection of the major equipment manufacturing innovation model, and tries to build a technological innovation model suitable to the development of Chinese major equipment manufacturing industry, promoting the development of China's equipment manufacturing industry, technological innovation, especially independent innovation.

2. Purchasing Characteristics of Owners under the Constraints of Risk Aversion

The product characteristics of major equipment manufacturing industry and market information asymmetry are two main reasons that form the purchasing characteristics of the owners.

Firstly, the products of major equipment manufacturing industry have the following characteristics: First, major equipment manufacturing products require high development costs and have high development risks. Major equipment manufacturing industry is a strategic industry that matters national livelihood and national security, whose technological relevance and technological requirements are also high. Most links, including design, experiment debugging, production & sales, and maintenance require enterprises to complete independently, with the equipment manufacturing companies bearing all costs and risks in product development and manufacturing. Second, risk is a major factor in purchasing products of equipment manufacturing industry. For buyers, the purchase of major equipment manufacturing products is a major infrastructure investment for the enterprise. Once the product has problems or defects, the company will suffer huge losses. So when the owners purchase major equipment manufacturing products, risk factors have huge impact on their decision. Third, on the demand side, Qiu Ruozhen and Huang Xiaoyuan (2006) show that the number of owners is limited, which results in monopoly, owners and companies' behaviors vary greatly from other industries(Qiu Ruozhen & Huang Xiaoyuan, 2006). Fourth, from the technological structure's perspective, equipment products belong to typical complex product system, the breadth and depth of product innovation and technology required are larger than that of other products, which has the features of technological complexity, small batches, and product customization.

Secondly, for the owners, before making a purchasing decision, due to the asymmetry of information, all kinds of information of equipment products acquired through the information search is limited: First, equipment products are "completely uncertain" products. Product availability and particular functions cannot be foreseen to the transaction parties prior to the transactions; the owners cannot learn them from the appearance and image of the product to determine the quality. Second, the cost for the owners to obtain product information is high, because the environment of production and use of the equipment products cannot be simulated; product practicability can only be verified through on-site operation; besides, the purchase and manufacture are both one-off huge investment, with long production cycle and high costs. If the owners want to get full product information, they need to pay a huge cost. Due to the asymmetry of information, the practicality and reliability are unpredictable to the buyers and sellers before the transactions, so the two sides face huge transaction risks, and asymmetric information causes the market's ineffective allocation of resources, which cannot meet with the utility maximization in economics.

Based on the above two points, the owners have high risk aversion characteristics when purchasing major equipment manufacturing products

(1) The owners do not trust the products manufactured by domestic equipment companies. Currently, many domestic products in equipment manufacturing industry are comparable with foreign products, and even beat foreign products in some parts such as performance, but because the owners do not trust the products of domestic equipment companies, a phenomenon exists in the purchase process: If the imported products have defects, due to the fact that multinational corporations are not subject to the control of our administrative mechanism, the government has no power in the accountability of multinational corporations; if you choose domestic products, the problem will be accountable, various reasons cause domestic equipment products to fall into disadvantage in the procurement bid.

(2) Localization of "the first set" lacks recognition of the owners. Equipment manufacturing industry has features of long construction period, wide work span, heavy capital investment, and high experience requirements, making the recognization and adoption of "the first set" an important part. However, due to fact that domestic enterprises' performances are in a blank in "the first set" market, Sun Xiaohua and Yuan Jijun (2008) show that owners highly value "the first set" so much that to avoid the use of risky products, they develop a variety of harsh conditions, or carefully design tender eligibility threshold in orders and the bidding process to "accurately" shut out domestic enterprises and domestic-brand products with potential innovation capability(Sun Xiaohua & Yuan Jijun, 2008). Not only will domestic enterprises lose market opportunities, but also feel a serious blow to the confidence. Domestic enterprises can only be committed to the reproduction of the sales

cycle for foreign enterprises, and gradually lose their patience on the innovation of products, and their products being eliminated out of the market due to risk aversion characteristics of the owners, further weakening the strength of the domestic equipment companies.

(3) Repeated introduction multi-introduction phenomena still exist. Due to the lack of macro-control in the major equipment manufacturing market, the owners multi-introduce and repeatedly introduce the complete set of equipment, falling into a vicious cycle of introduction - backwardness - the introduction again. Because of the information asymmetry between foreign equipment manufacturing enterprises and domestic enterprises, foreign enterprises maintain the confidentiality of the specific data and equipment parameters of the introduced product, so that domestic enterprises' equipment lags far behind the quota and requirements of owners' needs, not to mention should be market opportunities, the less accumulated experience, the more inadequate innovation power, only to make them become the subsidiary of foreign companies.

(4) Qin Ying, Lei Jiaxiao and Han Miao (2009) think that the owner just pursuit of the advanced nature of the equipment, ignoring the matching of equipment. Major equipment manufacturing industry requires high matching of equipment and environmental adaptability(Qin Ying, Lei Jiaxiao & Han Miao, 2009). Some equipment must be attached to the original machine, and the most advanced equipment may not necessarily achieve the best results, only the most closely matched and most appropriate equipment can achieve the best results. The owners only consider the advanced nature of the equipment, not the best matching, resulting in a waste of product purchasing, and exceed the digestion and absorption capacity of the domestic technical staff.

Although some of the domestic major equipment manufacturing industries have achieved or even surpass foreign products through technological and capital accumulation, the owners still choose products of foreign key equipment manufacturing industry, ignoring the domestic independent innovative product. The key issues in owners' purchase do not lie in the quality and technical level of domestic products' independent device, but in the external factors like "historical performance" and "first set ", which leads to extreme risk aversion caused. This makes some domestic equipment, which has achieved critical progress in key product quality and performance, not recognized by the owners due to the lack of running practical environment. Unable to cross "the first set" condition limitations, the new products cannot get the market's positive affirmation, which seriously impede the technological level of equipment manufacturing industry and development of innovation capability.

3. The Impact of Owners' Risk Aversion on Enterprise Technological Innovation Model Selection

3.1 Basic Assumptions

Currently, typical industry represented by the major technological equipment remains highly dependent on imports; multinational monopoly power has been formed. Domestic enterprises are eager to get rid of dependence on foreign technology through improving technological innovation model and relying on our own strength to carry out the technical innovation.

Assuming there is duopoly in the equipment manufacturing market, domestic equipment manufacturing enterprise A and foreign equipment manufacturing enterprise B. Domestic buyer of major equipment manufacturing industry is made up by a limited number of owners, forming approximate purchasing monopoly, so the decisions of the owners have a huge impact on the product suppliers.

To facilitate the analysis of the model, this paper makes the following assumptions when building a dynamic game model of enterprises' technological innovation model selection:

(1) Interests driving force is the main motivation of enterprises' technological innovation, under which, the enterprises have self-conscious requirement of technological innovation. The primary determinant of what kind of technological innovation model to choose is the utility that innovation brings to the enterprise. When the utility brought by the technological innovation is negative, the enterprises have no motives to carry out technological innovation; different models of technological innovation can bring different utilities, so companies will make a rational choice based on the principle of utility maximization.

(2) In order to secure the comprehensiveness of model's strategic content analysis, we assume that in the current market, influenced by historical performance and technical ability, foreign firm B has value P on local market, but needs further development on key technologies. Estimate that successful development can bring π revenue for enterprise B. Company A does not have this technology, in order to gain a competitive advantage and profit increase, needs this technology, so they have the possibility of cooperation and innovation.

(3) Assume that company A is the first decision-makers, firm B know the decision-making action of company A, while company A knows that their own actions will be observed, so both sides mutually understand and benefit.

3.2 Game Process of Technological Innovation Model Selection

In a game model, the two companies constitute a sequential game tree model. Domestic equipment manufacturing company A wants to change the unfavorable situation of the existing market through technological innovation model. To carry out technological innovation, there are three technological innovation strategy: independent innovation model, a model that cooperates with foreign enterprise B in innovation, through the introduction of absorbing foreign enterprise B's technology to imitate the innovation model.

In this game model, A as the first policy-maker, if chooses the independent innovation, then game ends; if company A selects to cooperate with enterprise B in innovation, in this case, if firm B agrees, the two sides will cooperate and allocate the profit of innovation pro rata, if firm B disagrees, then company A will conduct independent innovation: if firm A chooses to imitate the innovation, foreign enterprise B will decide whether to sell its technology to company A to allow it to imitate the innovation, if it agrees, then both sides will negotiate through the introduction of technological prices, if not, then company A will use independent innovation to get the technology, which put an end to the game. As is shown in Figure 1.

When domestic enterprise A carries out independent innovation, its probability of success is p_1, which represents its own innovation ability and gains profit π. Assume that domestic enterprise Podolny, J (1998) show that A's independent innovation success can successfully break the technological monopoly of foreign manufacturers(Podolny, 1998), while both cooperative innovation and imitative innovation can't, according to Podolny's theory on independent innovation, independent innovation's success can bring in an additional market share profit V. If assume that without taking the risk aversion factor of the owners into account, there is $V = \pi$, considering the impact of owners' purchasing decision, introduce the owners 'risk aversion parameter number $\rho(0 < \rho < 1)$ in additional market profit share, the greater the ρ, the stronger the owners' risk aversion characteristics, the more inclined to buy good "market performance" products. Under the given condition of successful technological innovation, the higher the risk aversion of the owners, the less additional profit acquired by enterprise A due to lack of good market performance. From the analytical framework by Suzanne Fogel (2004) the revenue function of enterprise A after successfully achieved independent innovation is(Suzanne Fogel, 2004):

$$\pi_1 = p_1\pi + V \tag{1}$$

Here, V depends on whether to consider the owner's risk aversion characteristics.

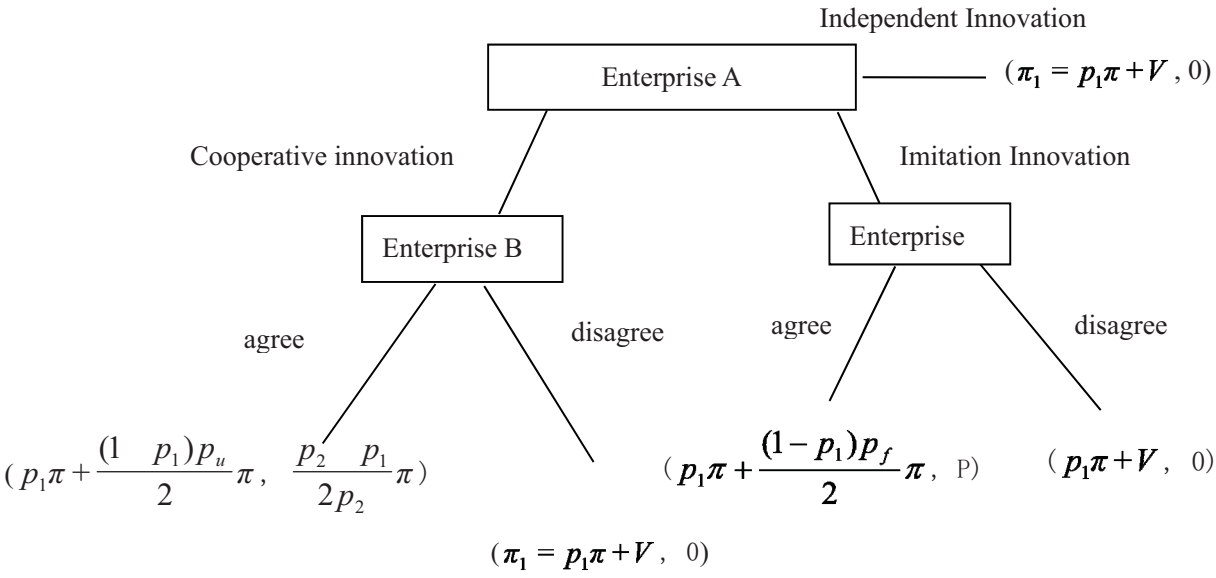

Figure 1. The game chart of the enterprise technological innovation model selection

When enterprise A chooses enterprise B for cooperative innovation, if enterprise B agrees, assuming that enterprise B innovates independently and the probability of its success is p_u, so the probability of enterprise A's

cooperative innovation is:

$$p_2 = p_1 + p_u - p_1 p_u \tag{2}$$

Through university-industry collaboration, enterprise can accumulate more technical resources, so cooperative innovation is more likely to succeed than independent innovation, obviously $p_2 \geq p_1$, the benefit allocation proportion after cooperative innovation succeeds is α. The process of benefit allocation is affected by enterprise A's own innovative ability, that is, is threatened by enterprise A's own innovative ability.

When enterprise A chooses enterprise B for imitate innovation, if enterprise B agrees, enterprise A have to pay technology introduction fee P. Suppose enterprise A goes on a secondary development based on foreign technology and the probability of success is p_f, besides, foreign enterprise B have market share and other advantages, so $p_f \leq p_u$. So the probability of imitate innovation for enterprise A is:

$$p_3 = p_1 + p_f - p_1 p_f \tag{3}$$

Enterprise purchases foreign advanced technology, greatly improves the success rate of innovation, so $p_3 \geq p_1$.

To solve the problems of benefit allocation and technology introduction fee, we use comparative Nash negotiations solution, the result is $\alpha = \frac{p_1 + p_2}{2p_2}$, $P = \frac{(p_3 - p_1)\pi}{2}$.

This shows:

When enterprise A chooses to innovate independently, their benefits are($p_1\pi$,0); When enterprise A chooses cooperative innovation, and enterprise B agrees, the benefit allocation proportion after cooperative innovation succeeds is α, their benefits($p_1\pi + \frac{(1-p_1)p_u}{2}\pi$, $\frac{p_2 + p_1}{2p_2}\pi$); When enterprise A chooses imitate innovation, if enterprise B agrees, and enterprise A pays the technology introduction fee P, their benefits are($p_1\pi + \frac{(1-p_1)p_f}{2}\pi$, P).

We can get the benefits brought by the comparative advantage of independent innovation and cooperative innovation, that is:

$$\pi_1 - \pi_2 = V - \frac{(1 - p_1)p_u}{2}\pi \tag{4}$$

And the benefits brought by the comparative advantage of independent innovation and imitate innovation is:

$$\pi_1 - \pi_2 = V - \frac{(1 - p_1)p_f}{2}\pi \tag{5}$$

So, the benefits brought by the comparative advantage of cooperative innovation and imitate innovation is:

$$\pi_2 - \pi_3 = \frac{(1 - p_1)(p_u - p_f)}{2}\pi \tag{6}$$

We get conclusions as follows, when domestic enterprises choose technological innovation model, they will consider the value of V, $\frac{(1 - p_1)p_u}{2}\pi$ and $\frac{(1 - p_1)p_f}{2}\pi$.

When we don't consider the purchase decision of owner and enterprise B's benefits, $V = \pi$, because $p_1, p_u \leq 1$, we can get that: $\frac{(1 - p_1)p_u}{2} \leq 1$, so $V > \frac{(1 - p_1)p_u}{2}\pi$. Independent innovation can bring more benefits than cooperative innovation: Domestic enterprise A owns new products and technology depending on its own strength, or uses technology in universities for technology integration, thus builds its own core technical ability and technology advantage. And it seizes the market, forms its own advantages in competition, changes the adverse situation of present market.

In this game, the enterprise A is the first decision maker, the decision-making power is in the enterprise A's hand, the enterprise A's best choice is independent innovation. By selecting the independent innovation pattern,

enterprise A can optimize the industrial structure of the equipment manufacturing industry, promote the center part of industrial upgrading, get rid of the independence on foreign technology by technology import and imitation, break the technology monopoly of foreign enterprises, grasp the initiative of innovation core link, grasp the ownership of core technology, and improve international competitiveness of the products, rely on independent innovation to form his own first-class brand and product, change current negative situation of the equipment manufacturing industry, further change the export trade structure of domestic equipment manufacturing industry.

3.3 Technological Innovation Model Choice under Owner Risk Averse

When considering the demand, the owner's purchase choice has close relationship with its risk aversion characteristics. When the domestic enterprise innovates successfully, the profit function of enterprise A after independent innovation is $V = \pi - \rho\pi$ (here, ρ is the risk aversion parameter of owner). As mentioned above, the owner will have an influence on market share through his purchase decision, the risk aversion makes enterprise A's innovation may have two situations:

(1) When the owner's risk aversion degree is low, the owner only considers the price and performance of the products in equipment manufacturing industry at home and abroad, but doesn't consider product "performance" and other brand effects. Economically speaking, in order to realize the resource allocation optimization, the owner will act as a rational economic man and only compare the price with the benefits brought by buying the product, previous purchase experience and the product evaluation will not have a great effect on the next product purchase decision.

After independent innovation succeeds, enterprise A will get $V = \pi - \rho\pi$, when the owner risk aversion degree ρ is low, $1-\rho$ will get higher, we can get $1-\rho > \frac{(1-p_1)p_u}{2}$, and $\pi_1 - \pi_2 = V - \frac{(1-p_1)p_u}{2}\pi$, so $V > \frac{(1-p_1)p_f}{2}\pi$, $\pi_1 > \pi_2$; and $\frac{(1-p_1)p_u}{2} > \frac{(1-p_1)p_f}{2}$, so $\pi_1 > \pi_3$. When domestic enterprise A compares the benefits of independent innovation with cooperative innovation and imitation innovation, if enterprise has the inherent demand of technological innovation, it will choose independent innovation model. Choosing this kind of innovation model, the domestic enterprise with excellent independent design innovation ability, is expected to break foreign technology blockade, and forms his own first-class products and brands, changes the current domestic adverse equipment manufacturing industry market.

(2) When the owner's risk aversion degree is high, he takes the brand effects and other previous purchasing factors into consideration first, such as the performance of the products, while purchasing the products in equipment manufacturing industry, largely because the products from major equipment manufacturing industry are one-off purchased and consumed. Under the high risk aversion, the risk aversion parameter ρ becomes larger, and $1-\rho$ smaller, resulting in $1-\rho < \frac{(1-p_1)p_u}{2}$. As $\pi_1 - \pi_2 = V - \frac{(1-p_1)p_u}{2}\pi$, we can draw that $V < \frac{(1-p_1)p_f}{2}\pi$, $\pi_1 < \pi_2$. The extra benefits from company A's independent innovation are fewer than that from company A's cooperative innovation. Based on "rational agent" decision, company A will choose cooperative innovation model rather than the independent innovation model. Even when the owner is highly risk averse, the risk aversion parameter ρ becomes large enough, and $1-\rho$ extremely small, resulting in $V < \frac{(1-p_1)p_u}{2}\pi$. The benefits from independent innovation are even fewer than that from imitation innovation. Based on "rational agent" decision, Chinese companies have no motivation to choose the independent innovation, and probably they will just take advantages of foreign companies' technological advantages and choose cooperative innovation model. But this cooperative innovation model cannot change Chinese companies' independent innovation capabilities, because foreign companies still possess the core technology and key technology of the equipments, and Chinese enterprises are only involved in some peripheral technological work. At the same time, foreign countries exert the monopoly power to export the low-end equipments without advanced technology, making the technological gap between Chinese enterprises and foreign companies even wider. Thus, Chinese enterprises in equipment manufacturing industry have never changed the disadvantaged position even if they choose the cooperative innovation model.

In conclusion, the choice of innovation model by the owner is influenced by his risk aversion. When the owner's risk aversion degree is low, ρ is small and $1-\rho$ is large, resulting in extra benefits V from independent innovation larger than that from cooperative innovation and imitation innovation. Driven by the interests, company A has the demand for independent innovation. However, the reality is the owner is highly risk-averse, ρ is large enough, and $1-\rho$ extremely small, resulting in $V < \frac{(1-p_1)p_u}{2}\pi$, so company A will choose the cooperative innovation model. Independent innovation will increase company A's benefits in theory, and change its current market share, But even if Chinese company A succeeds in independent innovation, and possesses new products whose performance is better than that of foreign companies' products and the price is lower, purchasing risk is still the most important factor that the owner takes into consideration. Balancing the reduction in risks and increase in benefits, if a Chinese company hasn't good performance before, the owner will show on interest in the new products developed through innovation. Based on the "rational person" decision, Chinese company A first considers the loss resulted from the risk aversion to the new products, and then chooses the cooperative innovation model. Although the benefits from cooperative innovation are fewer than that from independent innovation in theory, and foreign countries want a share in the total profit. But only with the foreign advanced technology, foreign companies' performance and brand effects, Chinese products are marketable.

4. Conclusion and Policy Recommendations

Currently, the technological level in Chinese equipment manufacturing industry still remains low, Chinese companies imitate a lot, depend greatly on foreign technology and equipments, and haven't developed their own independent innovation capabilities. To change the situation where Chinese major equipment manufacturing market is monopolized by foreign companies, Chinese companies must innovate independently. The priority is to reduce the owner's risk aversion degree, and on the demand side, to create more practice and innovation opportunities for Chinese enterprises. If the owner's risk aversion degree cannot be reduced, on one hand, the owner will choose the products manufactured by multinational companies at first, which will influence his purchasing decision continually in a period; on the other hand, even if Chinese companies succeed in independent innovation, no one buy their products, so without the benefits from the independent innovation, the host country's technological development will be blocked, leading to that Chinese companies and research institutes have no initiative to innovate independently.

When resources cannot be allocated effectively through market mechanism, government is needed to be involved in, becoming the third body. Government can reduce the owner's risk aversion degree through government purchasing and taxation system.

Through government purchasing, "the first set" can be easily sold out. On one hand, government purchasing requires the owner enterprise to purchase domestic technology and equipment first, solving the "first product selling" problem. On the other hand, the risks of manufacturing equipments in major equipment manufacturing industry are shared by the government, reducing the owner's risk aversion degree. The labs and engineering practice opportunities provided by the government create a convenient environment for companies' independent innovation. On the demand side, it guides the way for companies' independent innovation: performance and standard of purchased products are specified in the purchasing process, and general conditions like performance-to-price ratio are emphasized. Auxiliary measures are also needed to give full play of the government's role.

Taxation system is another way to reduce the owner's risk aversion degree. Taxation, as a safeguard for independent innovation strategy should focus on reform and improvement of taxation system, thus laying a financial foundation for independent innovation. To the owners in major equipment manufacturing industry, preferential policies for importing foreign equipments need adjusting, which accelerates technological equipments' depreciation, accelerates the pace the technological progress and promotes the product updating and technological upgrading in equipment manufacturing industry.

From the macroeconomic level, government purchasing and taxation system adjustment act as policy orientation and innovation incentives, reducing the owner's risk to the largest degree with the other auxiliary measures. The implementation of two means also changes the previous purchasing decisions dependent on "performance" and "the first set", enhances the Chinese companies' motivation to innovate independently, promotes the product updating and technological upgrading in equipment manufacturing industry and boosts the development of this industry.

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The Determinants of Systematic Risk in the Italian Banking System: A Cross-Sectional Time Series Analysis

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Abstract

This research provides an insight to the main determinants behind the systematic risk of banks. For this purpose, we use a number of regression models to test the statistical significance of a wide range of bank-specific risk factors. The results indicate that bank equity beta correlates positively with bank size and with the relative volume of loans and intangible assets, and negatively with bank profitability, liquidity levels and loan loss provisions. We find no evidence supporting the traditional hypothesis that lower leveraged banks may be exposed to lower systematic risk. The study refers to the Italian banking system. Our findings are of significance both to bank managers as well as investors, since they will enable them to fully assess the effects of different strategic choices on a bank's risk profile. We also discuss potential policy implications regarding the impact of the new capital requirements imposed by Basel III in light of the observed risk-leverage relationship.

Keywords: systematic risk, market beta, bank leverage, Modigliani-Miller, accounting indicators, Basel III

JEL Classification: C33; G12; G21; G32

1. Introduction

This paper analyzes the fundamental determinants of risk in the Italian banking sector. We refer to the most well known measure of risk, that is the systematic risk measured by equity beta. The equity beta, also known as "stock beta" or "market risk", is a measure of the sensitivity of a stock's returns to the returns of the overall financial market.

Systematic risk and its determinants have been widely discussed in financial literature and are considered one of the most interesting issues in banking studies. The classical Capital Asset Pricing Model (CAPM) suggests a positive linear relationship between the required rate of return of any stock and its beta (Sharpe, 1964). Since a stock required rate of return from the point of view of a company also constitutes the cost of equity capital, those factors which affect a firm's systematic risk at the same time indirectly influence the funding costs of the firm, as well as its market value. The importance of beta is also evident from the investor's point of view. Systematic risk estimation is useful for investors in order to analyze the nature of risk associated with different investment options and to recognize risk-return relationships within portfolio investment strategies. Given the importance of CAPM and beta in financial analysis, it is not surprising that the determinants of a company's systematic risk have been widely studied.

The current research aims at expanding the evidence arising from the existing literature by exploring the main accounting determinants of systematic risk in the banking sector. Our findings pertain to the Italian context. More specifically, our estimates are based on accounting and market panel data on Italian banks that were publicly traded on the Milan Stock Exchange from 1992 to 2011.

Seven financial indicators are explored as possible determinants of the systematic risk of banks: (1) book value of total assets, (2) book leverage, (3) loan to asset ratio, (4) liquidity ratio, (5) intangibles to assets ratio, (6) loan loss ratio and (7) earnings per share. In order to investigate their statistical significance in determining banks' systematic risk exposure, we tested five different regression approaches, so as to examine the best combination of bank and time specific effects. Through a sequence of statistical specification tests, we then isolated the two-way fixed effects model as the one which best fits our data.

Our results suggest that Italian banks' systematic risk is positively correlated with a bank's size and with the relative volume of loans and intangible assets in a bank's balance sheet. Also, we conclude that banks with high profitability and liquidity levels, as well as those with high relative levels of loan loss provisions, tend to have lower equity betas. Finally, contrary to most of the previous literature, our estimates do not support the traditional hypothesis that systematic risk exposure is negatively correlated with financial leverage.

We believe our findings provide a significant contribution to the understanding of the fundamental determinants behind the systematic risk of banks. Their empirical value is twofold. First, our estimates allow equity capital investors and bank managers to better assess the consequences of different strategic options on the risk profile of banks under their control (e.g. with regard to bank leverage, liquidity levels and revenue diversification). Second, this study may be of use to financial authorities, providing them with insights of the effects of their regulatory choices on bank risk profiles. This point is particularly noteworthy in light of the new capital requirements reform (Basel III). Policy implications of our findings will be discussed in the conclusion.

The structure of the paper is as follows: section 2 provides the literature review; in section 3 we introduce data and empirical methodology; in section 4 we evaluate the impact of accounting indicators on Italian banks' systematic risk; finally, section 5 summarizes the main results of the study.

2. Literature Review

Systematic risk and its determinants have been widely discussed in previous studies. The Capital Asset Pricing Model, developed by William Sharp in 1964, constituted a historic milestone in modern financial theory, being the first theoretical model to introduce a security's sensitivity to market risk, that is the systematic risk or beta, as a main determinant of its required rate of return in a well-diversified investment portfolio context.

A few years earlier, Modigliani and Miller (1958) had developed their general equilibrium model on corporate capital structure, which still affects modern financial thinking. The Modigliani and Miller (M-M) model states that, under idealized conditions, the market value of a company is determined by its earning power and the risk inherent in its underlying assets, while it is unaffected by how a company is financed. In other words, the debt-equity ratio does not affect a company's overall cost of funds (WACC - Weighted Average Cost of Capital) or its market value ("Capital structure irrelevance principle").

In 1972, Robert S. Hamada combined the M-M theorem with the CAPM to develop a general model relating the beta of a company to its financial leverage (Hamada, 1972). Following Hamada's work, a number of studies have used the M-M proposition to establish the theoretical relationship between leverage and beta (Rubinstein, 1973; Bowman, 1979; Conine, 1980; Mandelker & Rhee, 1984, Fernandez, 2003), while several studies have extended and empirically investigated the validity of the theoretical model on leverage adjustments to market beta (Lev, 1974; Hill & Stone, 1980; Bhandari, 1988; Butler, Mohr, & Simmonds, 1991; Darrat & Mukherjee, 1995). Most of these studies support the theoretical leverage-beta relationship, while also observing the joint effects of operating and financial leverage on a company's systematic risk.

A different body of literature, mainly dating from the 70's, relates clusters of accounting variables to market measures of systematic risk (Beaver, Kettler, & Scholes, 1970; Rosenberg & McKibben, 1973; Lev & Kunitzky, 1974; Bildersee, 1975; Beaver & Manegold, 1975; Martikainen, 1991; Hong & Sarkar, 2007; Iqbal & Shah, 2012). Similarly, a number of researches explore the relationship between fundamental accounting indicators and stock returns (Chan, Hamao, & Lakonishok, 1991; Haugen, & Baker, 1996; Asl, Karimi, & Eghbali, 2012; Aldin, Dehnavi, Hajighasemi, & Hajighasemi, 2012). Most of these publications greatly differ in their selection of explanatory variables as well as in statistical model results. What these studies all seem to conclude is that accounting measures appear to be useful in predicting both market risk and stock performance.

In reference specifically to the banking industry, a considerable amount of studies have examined systematic risk and its determinants. Rosenberg and Perry (1981), based on data on U.S. bank holding companies (BHCs) between 1969 and 1977, build a large empirical model which relates both bank systematic and specific risk to a wide range of accounting variables. Their results show that the most important predictors of bank beta are size, dividend yield, equity capitalization and the asset to long-term liability ratio. In a similar study, Lee and Brewer (1985) confirm that bank market risk relates to leverage and dividend pay-out ratio. The dividend pay-out ratio also plays a role in the study of Jahankhani and Lynge (1980). The authors analyze the relationship between commonly used accounting ratios and market-based measures of risk for a sample of U.S. commercial banks and bank holding companies over the period from 1972 to 1976. Their results indicate that bank market beta is statistically related with the dividend pay-out ratio, the coefficient of variation of deposits, and the loan to deposits ratio.

Another strand of U.S. banking literature supports the view that systematic risk is strongly correlated with a bank's diversification level and/or with the composition of bank assets and liabilities. Templeton and Severiens (1992) find that diversification in non-bank activities has no effect on BHCs (Bank Holding Companies) systematic risk, although it can reduce risk as measured by stock return variance. Similar results are shown by Demsetz and Strahan (1997), who use data on the BHCs publicly traded over the period from 1980 to 1993 to investigate the relationship between size, diversification and risk. Their analysis indicates that BHCs assets size is positively correlated with bank systematic risk, although larger banks are more diversified than smaller ones. That is to say that for large BHCs the potential of diversification does not translate into reductions in risk. By analyzing bank-specific attributes to explain the positive size-risk relationship, the authors report that large BHCs engage in more commercial and industrial lending (C&I loans), are more active in derivatives and are more leveraged than small BHCs, thus offsetting their diversification advantage.

In the wake of the significant rise in defaults on mortgage lending post 2007, Bhattacharyya and Purnanandam (2011) analyze the evolution of U.S. commercial banks' risk profiles in the years leading up to the crisis. Their study shows, for the period from 2000 to 2006, a significant increase in the banking sector's systematic risk profile, which seems to be driven mostly by the effects of residential mortgage loans on both idiosyncratic and systematic risk levels. They conclude that the U.S. stock market was able to perceive increased mortgage lending activity (and securitizing of mortgages) as enhancing the systematic risk of banks' asset portfolios.

Although most existing literature has an overwhelming U.S. focus, a number of studies examined the determinants of bank systematic risk outside the United States. Vander Vennet, Baele and De Jonghe (2005) analyze the determinants of both systematic and idiosyncratic risk for European banking institutions. They provide evidence showing that capital levels and the proportion of loans and core deposits in total assets are negatively correlated with bank systematic risk, while higher levels of diversification and loan loss provisions tend to increase the market beta. Using empirical evidence on U.K. banking institutions, Miles, Yang and Marcheggiano (2011) explore the link between beta and a measure of leverage which is affected by regulatory rules on bank capital, that is a bank's total assets over its Tier 1 capital. Their estimates reveal a negative impact of leverage upon bank equity beta, although the results do not fully conform to the conditions implied by the joint hypothesis of M-M effects and the CAPM. In a recent inquiry, Yang and Tsatsaronis (2012) analyze the return-risk profile of bank stocks using data on 50 actively traded global banks located in 11 OECD countries from 1990 to 2009. They show that bank market beta is positively correlated with leverage and the ratio of book to market value of equity, while correlating negatively with bank profitability. They also find that the systematic risk of bank stocks differs across the stages of the business cycle: it is higher during recessions (when default rates on loans tend to decline, thus raising bank earnings) and lower in periods of economic expansion (when both loan values and bank earnings decrease). Agusman, Monroe, Gasbarro and Zumwalt (2008) investigate the relation between bank accounting and market measures of risk for a sample of 46 listed Asian banks during the period from 1998 to 2003. Their results show that the standard deviation of the return on assets (ROA) and the ratio of loan loss reserve to gross loans correlates significantly with total risk, while gross loans to total assets ratio and loan loss reserve to gross loans ratio are significantly related to specific risk. Eldomiaty, Al Dhahery and Al Shukri (2009) analyze the financial ratios that are statistically associated with market beta for different categories of companies - banking, insurance and nonfinancial institutions - in the Dubai financial market. With regard to banking companies, their results indicate that the fundamental determinants of systematic risk are financial leverage, measured by the assets to equity ratio, and the book value per share. More precisely, both the ratios exhibit a negative relationship with banks' market beta.

3. Data and Methodology

3.1 Data and Variable Definitions

As already observed, the present study explores bank-specific accounting measures which correlate significantly with stocks' market risk (*i.e.* equity beta) in the Italian banking sector. For this purpose, we collected from the Capital IQ database annual accounting and market data for Italian commercial banks and bank-holding companies which were listed on the Milan Stock Exchange from 1992 to 2011. We considered all kinds of banking institutions, from relatively small commercial banks to larger financial conglomerates.

For each bank, key accounting ratios are obtained from the annually consolidated income statements and balance sheets, while equity betas are estimated by regressing banks' daily stock returns on the daily returns of the FTSE MIB index over discrete periods of one year.

A number of banks have been excluded due to the lack of data. We also imposed a minimum limit of at least three years available data in order to include banks in the study. Our final sample consists of 38 companies and 350 bank-year observations. Table 1 shows our final sample composition.

Table 1. Sample composition

N.	Bank	Obs.	N.	Bank	Obs.
1	Banca Antonveneta	3	20	Banca Popolare di Spoleto	10
2	Banca Carige	14	21	Banca Popolare Italiana	7
3	Banca Commerciale Italiana	6	22	Banca Profilo	8
4	Banca CR Firenze	7	23	Banca Toscana	4
5	Banca Fideuram	11	24	Banco di Desio e della Brianza	12
6	Banca Finnat Euramerica	14	25	Banco Popolare	8
7	Banca Generali	5	26	Capitalia	8
8	Banca Ifis	10	27	Credito Artigiano	12
9	Banca Lombarda e Piemontese	8	28	Credito Bergamasco	18
10	Banca Monte dei Paschi di Siena	12	29	Credito Emiliano	11
11	Banca Nazionale del Lavoro	6	30	Credito Valtellinese	12
12	Banca Popolare Commercio e Industria	3	31	Fineco Group	4
13	Banca Popolare dell'Etruria e del Lazio	10	32	Intesa Sanpaolo	18
14	Banca Popolare dell'Emilia Romagna	10	33	IW Bank	3
15	Banca Popolare di Cremona	5	34	Mediobanca	8
16	Banca Popolare di Intra	8	35	Meliorbanca	6
17	Banca Popolare di Milano	14	36	SanPaolo IMI	8
18	Banca Popolare di Novara	8	37	UniCredit	18
19	Banca Popolare di Sondrio	13	38	Unione di Banche Italiane	8

Based on theory and previous banking literature evidence, we tested a wide range of accounting predictors as possible determinants of Italian banks' systematic risk. Through a stepwise regression process, we finally limited our analysis to the following seven indicators: (1) book value of total assets, (2) leverage ratio, (3) loan to asset ratio, (4) liquidity ratio, (5) intangibles ratio, (6) loan loss ratio, and (7) earnings per share.

Each indicator serves as a proxy for a bank-specific attribute which we expect affects market risk exposure. Those attributes are: (1) size, (2) financial leverage, (3) degree of diversification, (4) liquidity, (5) volume of intangible resources, (6) loan portfolio quality and (7) profitability. Table 2 presents the explanatory variables used in our regression analysis and their measurement.

Table 2. Explanatory variables tested in the study

Symbol	Indicator	Measurement
SIZE	Total Assets	Book value of total assets (in billions of euro)
LEV	Leverage ratio	Book value of debt / Book value of equity
LTA	Loan to asset ratio	Gross loans / Total assets
LIQ	Liquidity ratio	Cash / Total Assets
INTA	Intangibles ratio	Intangibles / Total assets
LLR	Loan Loss Ratio	Provision for Loan Losses / Gross Loans
EPS	Earnings per Share	Net Income / Nr. of shares outstanding

The first accounting predictor is the book value of a bank's total assets, which we use as a proxy for bank size. Although previous studies show that firm size is a key determinant of market risk, the theoretical size-risk relationship is somehow ambiguous. On the one hand, a negative relationship is to be expected since larger banking institutions have a scale competitive advantage over smaller ones, are more diversified and benefit from the implicit government guarantees provided by the too-big-to-fail (TBTF) principle. On the other hand, the size effect may have a positive impact on a bank's risk assessment given that larger institutions are often more exposed to certain bank-specific risk profiles, such as credit and operating risk, exchange rate risk and systematic risk resulting from common shocks to the financial system (Rosenberg & Perry, 1981; Vander Vennet et al.,

2005). Thus, the sign of correlation between bank size and equity beta in the case of Italian banks remains an empirical question.

In line with classical theory, our second predictor of systematic risk is financial leverage (*LEV*). According to the joint hypothesis of the M-M theory and CAPM, we expect a positive relationship between equity beta and leverage. That is to say that highly-leveraged banks should exhibit greater systematic risk given that, as leverage intensifies (decreases), earnings volatility and default probability increase (decrease) as well and, as a consequence, equity becomes more (less) risky. Here, we estimate the leverage ratio as the ratio of book value of debt to book value of equity (book leverage).

The third explanatory variable included in our model is the loan to assets ratio (*LTA*), that is the ratio of gross loans to total assets. *LTA* is assumed as a proxy for a bank's degree of diversification in activities beyond traditional intermediation. Theoretically, to the extent that the cash flows generated by different bank activities are not perfectly correlated, diversification should increase revenue stability, thus reducing bank systematic risk exposure. However, banking empirical literature shows that the impact of diversification on bank risk profile is somewhat uncertain. A number of studies show that diversification in non-bank activities does not affect bank systematic risk exposure (Templeton & Severiens, 1992; Demsetz & Strahan, 1997), while others show that the effect of diversification on banks' market beta, contrary to what one might expect, is predominantly positive (Vander Vennet et al., 2005).

We also investigate whether the liquidity ratio (*LIQ*), that is the ratio of cash and equivalents to total assets, acts as a proxy for bank systematic risk. We suppose that the higher the liquidity of a bank the lower the risk of financial distress should be, which implies a negative effect of the liquidity ratio on the market risk of a bank.

The fifth explanatory variable is the intangibles ratio (*INTA*), *i.e.* the ratio of intangible assets to bank total assets. We suspect that goodwill and other intangible assets may have a critical role in explaining banks' risk exposure, given their relatively low loss-absorbing capacity, their link with bank growth opportunities and their effect on transparency of banks' balance sheets.

In addition, bank betas are likely to vary with the overall quality of the loan portfolio, here expressed by the loan loss ratio (*LLR*), *i.e.* the ratio of provisions for loan losses to gross loans. Given the pivotal role played by interest margin in Italian banks' income statements, we expect to find a negative relationship between the bank loan portfolio quality and bank equity beta.

Finally, we investigated whether or not high profitability levels provide banks with a structural hedge against deterioration in financial market conditions. Specifically, we assume a negative relationship between a bank's overall profitability and its systematic risk, since banks with higher margin capacity should have less volatile profits. Profitability is here measured by the earnings per share indicator (*EPS*).

Table 3 provides summary statistics for the explanatory variables. Banks' mean equity beta is 0.674 (*i.e.* bank stocks are less volatile than the market index), while the mean value of total assets is about 67.3 billion Euros. The sample displays considerable cross-section heterogeneity: the largest bank is more than 29,000 times the size of the smallest one. Debt to equity ratio has a mean value of about 13.5 and loans are roughly 64.2% of total assets, which confirms that Italian banks are typically focused on more traditional forms of intermediation, where both the lending portfolio and the interest margin play a key role. On average, cash and intangible assets are, respectively, 1% and 1.1% of total assets, while annual loan loss provisions are 0.6% of gross loans. Finally, mean value of banks' earnings is about 0.4 euro per share.

Table 3. Summary statistics of the explanatory variables

Variable	Mean	Min	Max	Std. Dev.
BETA	0.674	-0.547	1.767	0.408
SIZE	67.285	0.036	1,045.61	145.51
LEV	13.520	0.235	48.311	5.866
LTA	0.642	0.033	0.965	0.174
LIQ	0.010	0.000	0.130	0.014
INTA	0.011	0.000	0.056	0.012
LLR	0.006	-0.004	0.064	0.008
EPS	0.434	-2.923	4.451	0.714

Table 4 presents pair-wise correlations among the variables involved in the study. Equity beta is positively correlated with size, leverage, intangibles ratio and earnings per share, while correlating negatively with loan to asset ratio, liquidity ratio and loan loss ratio. The correlation matrix provides a first indication of possible multicollinearity issues: correlation values between two explanatory variables close to +/- 1 indicate that the given couple of predictors is multicollinear. Table 4 shows that there is no problem of multicollinearity, given that the higher correlation value is 0.354 (size-earning per shares correlation). However, the pair-wise correlation method is not able to detect more complex linear relationships between more than two variables at a time. For this reason, we also used the Variance Inflation Factor (VIF) to better assess potential multicollinearity problems in our estimations[1].

Table 4. Correlation matrix

	BETA	SIZE	LEV	LTA	LIQ	INTA	LLR	EPS
BETA	1							
SIZE	0.529	1						
LEV	0.208	0.151	1					
LTA	-0.036	0.040	-0.075	1				
LIQ	-0.034	-0.033	0.035	0.043	1			
INTA	0.250	0.255	-0.251	-0.012	-0.103	1		
LLR	-0.119	-0.023	0.016	-0.185	-0.138	0.127	1	
EPS	0.076	0.354	-0.082	0.089	-0.091	-0.047	-0.348	1

3.2 Regression Models

The methodology presented in this study compares five different regression models between the selected financial fundamentals (the predictor variables) and bank systematic risk (the response variable): (1) a simple pooled OLS model (POLS), (2) a one-way fixed effect model (FE1), (3) a one-way random effect model (RE1), (4) a two-way fixed effect model (FE2), and (5) a two-way random effect model (RE2).

In the simple pooled OLS regression we do not consider unobserved heterogeneity across units (banks) or time (years). Under this assumption, each observation is viewed as independent and the regression model takes the following form:

$$\beta_{i,t} = a + x'_{i,t-1}\, b + \varepsilon_{i,t} \quad (1)$$

where β (that is the equity beta) is the dependent variable, a is the intercept, x' is the row vector of (lagged) explanatory variables, b is the column vector of parameters (regression coefficients), ε is the random error term, i and t are indices for observation units (banks) and time (years). Since the POLS estimator ignores the panel structure of the data, it provides consistent and efficient estimates only if there is no unit-specific and time-specific heterogeneity across observations (*i.e.* the error term is uncorrelated with regressors).

If this is not the case, a one-way fixed or random effects transformation may be a better choice, since it allows the impact of unobserved and time-invariant factors (effects) that are specific to each bank (e.g. effects relating to the geographical localization, management competence, etc.) to be assessed.

In the (one-way) fixed and random effects approach the error term (ε_{it}) is divided into two components: a unit-specific error (λ_i), which does not change over time (*i.e.* the individual effect), and an idiosyncratic error (μ_{it}) which is observation-specific (*i.e.* varies over units and time).

The key difference of the fixed and random effects estimator is in the assumptions about λ_i. In the FE1 model we assume each unit (bank) to have a constant individual-specific effect shifting the dependent variable up or down by a fixed amount; that is, λ_i is now part of the constant term and the regression line turns out to be as follows:

$$\beta_{i,t} = (a + \lambda_i) + x'_{i,t-1}\, b + \mu_{i,t} \quad (2)$$

where the constant term is now the sum of a constant (a) plus an individual effect which varies across banks (λ_i). This way, we permit each unit (bank) to have a different intercept term, though all regression coefficient (slopes) are the same.

While the fixed effects model treats the individual-specific effects (λ_i) as a variable that is allowed to be correlated with the observed regressors, in the RE1 approach we assume any unobserved individual heterogeneity (λ_i) to be a random variable which is distributed independently of the explanatory variables. As a consequence, individual effects are treated as a part of the composite error term and the model can be written as follows:

$$\beta_{i,t} = a + x'_{i,t-1}\, b + (\mu_{i,t} + \lambda_i) \tag{3}$$

Given that the one-way fixed and the random effects specification do not fully eliminate the possibility of omitted-variable bias, we also performed a two-way fixed and random effects model, which allow to estimate both bank-specific and time-specific effects. In the two-ways approach the error term (ε_{it}) is divided into three components: an individual effect (λ_i), which is time-invariant and bank-specific, a time-specific effect (δ_t), which affects all banks in the same way for each time period (e.g. effects relating to the economical cycle, the stock exchange market conditions, etc.), and an observation-specific idiosyncratic error (μ_{it}).

In the FE2 model both individual and time effects are assumed to be constant, respectively, across banks (individual effect) and across years (time effect), and the regression model takes the following form:

$$\beta_{i,t} = (a + \lambda_i + \delta_t) + x'_{i,t-1}\, b + \mu_{i,t} \tag{4}$$

Contrastingly, in the RE2 model the individual and time effects are included in the composite error term, being assumed to be both random and uncorrelated to the regressors. The model can be expressed as follows:

$$\beta_{i,t} = a + x'_{i,t-1}\, b + (\mu_{i,t} + \lambda_i + \delta_t) \tag{5}$$

For each of the regression equations above, we corrected potential heteroskedastic and autocorrelation effects using an HAC (Heteroskedasticity Autocorrelated Consistent) estimator of standard errors, so to improve the significance of estimates.

We also used the Box-Cox technique to identify a suitable power transformation for the data in order to reduce anomalies such as non-normality and heteroscedasticity. In any case, Box-Cox results suggest that, for our panel data, no transformation of the response and predictors is required to improve the fit of regressions.

3.3 Model Selection

Table 5 presents the results of the five different regression models. *SIZE* and *INTA* variables are positively related with equity beta for all the regression equations and their estimated regression coefficients turn out to be statistically significant. *EPS*, *LIQ* and *LLR* predictors exhibit a negative regression coefficient which is highly significant for most of the regression models. *LTA* predictor has a negative but statistically insignificant coefficient in the POLS model; once controlling for differences across banks and years, *LTA* became significant and positively correlated with the dependent variable. Finally, the regression coefficient between leverage and bank systematic risk is positive but statistically significant only for the POLS and the RE2 specifications.

Table 5. Determinants of bank equity beta: regression results

	POLS	FE1	RE1	FE2	RE2
SIZE	0.0014 ***	0.0007 ***	0.0009 ***	0.0005 ***	0.0007 ***
	(5.852)	*(9.062)*	*(5.898)*	*(5.533)*	*(4.802)*
LEV	0.011 *	0.0004	0.006	0.004	0.008 **
	(1.863)	*(0.088)*	*(1.558)*	*(1.038)*	*(2.233)*
LTA	-0.146	0.557 ***	0.313 ***	0.446 ***	0.296 **
	(-1.111)	*(3.84)*	*(2.629)*	*(3.466)*	*(2.511)*
LIQ	-1.241	-3.109 ***	-2.82 ***	-2.919 ***	-3.041 **
	(-0.826)	*(-2.917)*	*(-2.603)*	*(-3.154)*	*(-2.239)*
INTA	5.863 **	3.859 **	4.668 ***	3.407 **	4.088 **
	(2.248)	*(2.197)*	*(2.821)*	*(2.298)*	*(2.531)*
LLR	-10.939 ***	-1.947	-4.274 **	-3.486 **	-5.442 ***
	(-2.889)	*(-0.793)*	*(-1.972)*	*(-2.199)*	*(-2.663)*
EPS	-0.086 ***	-0.057 ***	-0.062 **	-0.066 ***	-0.064 **
	(-2.802)	*(-2.665)*	*(-2.19)*	*(-3.182)*	*(-2.299)*
Constant	0.573 ***	0.289	0.373 ***	0.06	0.177
	(3.775)	*(2.682)*	*(3.39)*	*(0.475)*	*(0.774)*
Standard error	0.329	0.238	0.352	0.216	0.351
R^2 *overall*	0.363	0.705	-	0.770	-
R^2 *between*	-	-	0.049	-	0.049
R^2 *within*	-	-	0.056	-	0.047
Adj R^2	0.350	0.662	-	0.721	-
F-test	27.90	16.53	-	15.53	-
Prob. >F	2.72E-30	7.09E-58	-	3.34E-62	-
B.I.C.	253.87	202	302.96	219.16	387.31
Bank effect	No	Yes	Yes	Yes	Yes
Year effect	No	No	No	Yes	Yes

Notes: (1) * denotes significance at 10% ($p < 0.1$), ** denotes significance at 5% ($p < 0.05$), *** denotes significance at 1% ($p < 0.01$); (2) Numbers in parentheses below each coefficient show t-statistics; (3) B.I.C. = Bayesian Information Criterion.

In order to select the most appropriate estimator, we implemented a sequential choice process which relies on various specification tests (see table 6). First, to choose between the pooled OLS regression and one-way fixed effects model, we used an F-Test, where the null hypothesis implies that the POLS model is the appropriate specification (no significant difference across units).

Second, to examine whether the pooled OLS model is more appropriate than the one-way random effects model, we performed a Breusch-Pagan LM (Lagrange Multiplier) test, where the null hypothesis is that the pooled OLS estimator is adequate against the random effects model (no error variance across units). In our case, the null hypothesis is rejected for both tests and thus the one-way fixed and random effects model turns out to be the optimal specification.

In a third step, to verify whether time dummies are needed when running the fixed and random effects models, we implemented a Wald specification test. Under the null hypothesis all year coefficients are jointly equal to zero (no time effects are needed). For our data, the test goes in favour of the two-way specifications.

Finally, to compare the two-way fixed and random effects estimators, we performed a Hausman test, which investigates the null hypothesis that the random effects estimator is adequate against the fixed effects alternative (no correlation between effects and regressors). Given the results obtained by the Hausman test, the two-way fixed effects model is taken as our central estimate, and the regression equation assumes the following structural form:

$$\beta_{i,t} = (a + \lambda_i + \delta_t) + b_1 SIZE_{i,t-1} + b_2 LEV_{i,t-1} + b_3 LTA_{i,t-1} + b_4 LIQ_{i,t-1} + \\ + b_5 INTA_{i,t-1} + b_6 LLR_{i,t-1} + b_7 EPS_{i,t-1} + \mu_{i,t} \quad (6)$$

Table 6. Results of the model selection process

	Specification Test	Null hypothesis	Alternative hypothesis	Test Statistics	p-value
Test I	F-Test	POLS	FE1	F = 9.51	8.86E-33 ***
Test II	Breusch-Pagan	POLS	RE1	χ^2 = 199.21	3.10E-45 ***
Test III	Wald	FE1	FE2	χ^2 = 233.23	2.06E-39 ***
Test IV	Wald	RE1	RE2	χ^2 = 76.26	3.84E-09 ***
Test V	Hausman	RE2	FE2	χ^2 = 56.73	0.0003 ***

By fully considering the panel structure of the data, the FE2 specification enables us to analyze systematic risk exposures of a bank both over space (cross-sectional analysis) and time (time series analysis), thus allowing to account for unobserved heterogeneity across banks and years that may be related with banks' equity betas.

Furthermore, based on table 5 data, the statistical properties of the FE2 specification meet statistical standards for reliability. The chosen model is also the one associated with the lowest standard error and the highest R-squared (the equation accounts for more than three-quarters of the variability in bank equity betas).

4. Results and Discussion

Some of the evidence for a bank systematic risk drivers shown by the FE2 model fully meet expectations. Both the profitability (*EPS*) and liquidity (*LIQ*) coefficients are negative and statistically significant at 1%, providing evidence that higher profitability and liquidity levels lower a bank's systematic risk. Those results are not surprising since high performing and liquid institutions are generally perceived, ceteris paribus, as less risky than banks with bad economic performance and/or low liquidity level.

We also established a strong positive link, statistically significant at the 1% level, between a bank's equity beta and its loan to asset ratio (*LTA*). The loan to asset ratio is assumed, in the current study, as a proxy for bank diversification level: the larger the loan portfolio relative to total assets (*LTA*), the lower the degree of diversification in non-interest generating activities. Thus, our regression model indirectly confirms a negative relationship between bank systematic risk and the degree of revenue diversification. This evidence, contrary to previous empirical studies (Templeton & Severiens, 1992; Demsetz & Strahan, 1997; Vander Vennet et al., 2005), is consistent with the theoretical model on diversification benefits, according to which a higher degree of diversification reduces revenue and earnings volatility (since earnings from activities beyond intermediation are more stable than loan-based earnings) as well as bankruptcy risk (since non-interest income is less affected by a possible deterioration in credit market conditions), while expanding income sources and cross-selling opportunities.

A positive and highly significant (1% level of statistical significance) correlation is also found between systematic risk and bank size, indicating that, despite the higher diversification opportunities and the implicit public protection against failure, larger banks tend to have higher market risk exposure. A number of factors may explain the observed size-risk relationship. First, as observed, large banks are more exposed to the risk of common shocks because of the higher interconnectivity among large institutions, as recent financial crises have clearly illustrated. They are also more exposed to other bank-specific risk profiles, such as operating risk, exchange rate risk and credit risk. Vander Vennet et al. (2005) find that differences in systematic risk between small and large banking institutions may also reflect a different lending behavior, given that small banks' loan portfolio appears to be, on average, safer than those of large banks[2]. Finally, large and complex banking organizations seem to be harder to evaluate and are likely to be perceived as more opaque, which may result in investors perceiving a higher risk exposure.

Sound and transparent financial accounting information may also have a role in explaining the observed intangible-risk relationship, as well as the association between bank equity beta and loan portfolio quality. The FE2 specification shows, with a level of significance of 5%, that bank equity betas vary with the relative volume of investments in intangibles assets. We suspect that goodwill and other intangibles increase banks' perceived opacity because of the complex accounting rules and the difficulty in auditing the valuation of intangible assets, which makes bank risk profiles harder to quantify. Furthermore, many intangibles have a relatively low loss-absorbing capacity as their book value can hardly be monetized in the event of lack of liquidity and financial distress.

Regarding the loan portfolio quality, our model assumes the loan loss ratio, that is the ratio of loan loss provisions (income statement item) to gross loans (balance sheet item), as a proxy for the overall quality of a

lending portfolio: given a certain level of loans (the denominator of the *LLR*), the higher the allowance a bank sets aside for bad loans (the numerator of the *LLR*), the lower the loan portfolio quality should be. Thus, we would expect to obtain a positively-correlated regressor, while table 5 shows a negative regression coefficient, which is statistically significant at the 5% level.

Discretionary practices over bank loan loss provisioning and opportunistic accounting behavior by bank managers provide a potential explanation for our finding. Indeed, in accordance with sound accounting principles, loan loss provisions should reflect a bank management's assessment of the real quality (that is, inherent credit risk) of the loan portfolio. However, a number of studies find evidence that bank managers use the discretionary component of *LLP* (sometimes, jointly with other discretionary accounting variables) to smooth bank earnings (Kanagaretnam, Lobo, & Mathieu, 2003; Rivard, Bland, & Hatfield Morris, 2003; Taktak, Shabou, & Dumontier, 2010) or to signal their banks' future prospects (Wahlen, 1994). According to these studies, discretional use of loan loss provisions allows bank managers to reduce time variation in reported earnings by saving income for the future (by reducing current income through *LLP*) in times of good current performance, while borrowing income from the future (by increasing current income through *LLP*) in bad times. Also, the signaling hypothesis states that managers may use *LLP* to signal their private information about their banks' current health and future prospects, setting aside a larger provision when current and/or future expected earnings before loan losses are high. The observed *LLR*-risk relationship may results from such opportunistic *LLP* management, since an increase in loan loss provisions (and, as a consequence, in the *LLR*) may be interpreted by investors as a sign of confidence in the bank's future returns, thus reducing the perceived systematic risk.

Finally, one of the main results of our empirical test concerns the correlation between leverage and bank market risk. Our central estimate (FE2 regression) indicates that the regression coefficient of leverage, as predicted, is positive, but the coefficient itself is very low and statistically not significant. Therefore, financial leverage may not be regarded as a key determinant of Italian banks' systematic risk, which contradicts the traditional corporate finance theories.

A number of factors can affect bank capital structure choices, causing a misalignment with the M-M model. Apart from the impact of the debt tax shield[3], leverage-risk relationship is affected by the fact that banks are, by nature, more leveraged than most non-financial institutions, and that banks' capital structure is highly regulated by the capital requirements addressed by the Basel Committee. Furthermore, bank debts benefit from government guarantees. In the case of deposits, an explicit guarantee exists in the form of the deposit insurance system itself. At the same time, a banks' non-deposit liabilities benefit from an implicit government guarantee, since investors assume that the government will not let the banking system default on its debt (especially in the case of large banking institutions). These government guarantees, whether explicit or implicit, make banks' debt (partially) free from systematic risk, thus substantially reducing debt cost and providing bank managers with an incentive to prefer debt funding to equity funding.

5. Conclusion

Our contribution to existing banking literature is the use of a set of statistically robust regression models and an updated data set, to assess the ability of a range of accounting indicators to predict market risk within the Italian banking system.

After running a sequence of specification tests, a regression estimator including both bank and year fixed effects has been selected as our reference model. Evidence from this model indicates that bank equity beta is significantly and positively associated with (1) bank size (book value of total assets) and with the relative volume of (2) loans and (3) intangibles in bank total assets (loan to asset ratio and intangibles to asset ratio, respectively). Also, we find that bank systematic risk is significantly and negatively correlated with (1) a bank's profitability, as measured by earnings per share, (2) liquidity levels, *i.e.* the cash to assets ratio, and (3) loan loss ratio, that is the ratio of provision for loan losses to gross loans.

As discussed, some of these findings, namely the effects of intangibles and loan loss provisions on banks' systematic risk, indirectly outline the role of financial disclosure and opportunistic accounting behavior in explaining the stock market perceptions about a bank's systematic risk. At the same time, the positive association between systematic risk and the loan to asset ratio indirectly confirms diversification benefits. It is also noteworthy that there is a leverage-risk relationship in the Italian banking system. Indeed, we find no statistically robust evidence in favour of the traditional hypothesis that less-leveraged banks are perceived by investors to be less risky. This finding implies the relatively small importance of capital adequacy as a proxy for bank creditworthiness.

This study entails a number of strategic implications at different levels. First, for Italian bank managers it seems advisable, from a systematic risk perspective, to increase revenue diversification and to maintain high levels of liquidity and profitability. Also, Italian listed banks would seem to have significant incentives to increase the level of voluntary disclosures regarding loan loss provisions and intangible assets accounting rules. Indeed, our results indirectly demonstrate that full accounting disclosure may help the financial market to better assess a bank's risk profile.

At the same time, our findings are worthy of particular consideration in light of the new capital requirements imposed under Basel III. By requiring banks to increase their capital ratios, the new capital rules will involve lower levels of financial leverage, since banks are called upon to hold a larger amount of equity for a given amount of assets. Under the M-M framework, if a bank raises equity capital by issuing stock and/or selling debt, the increase in the portion of equity, which is more expensive than debt, is offset by a decrease in the required rate of return on both debt and equity, because of the lower risk premium investors demand. This would happen in such a way that the overall impact of higher equity capital (and less debt) on the funding cost is zero. However, to the extent that lower leverage levels do not affect equity beta, *i.e.* the M-M model does not hold true for banks, an increase of equity capital, which is more expensive than debt, will not be offset by a decrease in the required rate of return on both bank debt and equity. Thus, given that our estimates do not confirm the assumptions underlying the M-M theorem, the Basel III reform could result in potentially higher bank funding costs which might, in turn, lead Italian banks to raise loan prices and/or reduce their lending portfolio.

Given the positive link between the cost of capital and equity beta, our findings also suggest that the increase in funding costs should be, on average, higher for large Italian banks with relatively low performance, liquidity levels and revenue diversification and/or with high volumes of intangible assets. However, this conclusion needs to be further investigated in order to confirm its accuracy.

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Notes

Note 1. We initially tested a wide range of indicators which were likely to affect a bank systemic risk, such as bank market capitalization, market leverage (debt / market value of equity), book value per share, book to market value, operating efficiency indicators (total revenue to total assets ratio and cost/income ratio) and standards profitability indicators (ROA and ROE). Those indicators have not been included in our final regression models because of the multicollinearity problems revealed by the VIF test (VIF >= 5).

Note 2. It is an open question whether small banks tend to have a lower credit risk exposure because they simply require more collateral from each borrower or because their loan decision model benefits from the superior knowledge arising from closer lender-borrower relationships.

Note 3. As a result of their different tax treatment (interest payments are tax-deductible for companies while dividends are not), a higher proportion of equity reduces the impact of the debt tax shield, thereby increasing funding costs. The same Modigliani and Miller made a correction to their original model by incorporating the impact of the tax advantage arising from debt financing into their model (Modigliani and Miller, 1963).

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The Effect of Economic Policy Uncertainty in the US on the Stock Market Performance in Canada and Mexico

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Abstract

This paper investigates the effect of economic policy uncertainty in the United States on stock market performance in Canada and Mexico. Using monthly returns of the Canada S&P/TSX-300 Total Return Index from 1985:2 to 2012:5 and Mexico SE Total Return Index from 1988:1 to 2012:5, this study shows that the increased changes in economic policy uncertainty in the US negatively affect stock market performance in Canada and Mexico. Although the changes in the U.S. trade balance do not influence the effect of the changes in economic policy uncertainty in the US on the stock market performance in Canada and Mexico, the returns on the S&P 500 do have an impact on this effect. The findings suggest that stock market performance in Canada and Mexico is linked to the economic policy conditions and stock performance in the US. The implication of this finding is that market participants in Canada and Mexico do pay attention to the economic policy conditions and stock performance in the US.

Keywords: economic policy uncertainty, stock market performance, USA, Canada, Mexico

JEL Classifications: E60, G12, G14

I. Introduction

In attempts to better understand price and return behaviors of financial assets, macroeconomists have tried to empirically investigate the ability of various macro variables (Cochrane 1991b; Cooper & Priestley 2005; Lamont, 2000; Lettau & Ludvigson, 2001a; Menzly, Santos & Veronesi, 2004; Piazzesi Schneider & Tuzel, 2005) in predicting stock returns to complement the predictability of portfolio-based models. For instance, the predictability of uncertainty in the real economy and various economic policies on financial markets has been empirically studied. Sum (2012a) uses a vector autoregression analysis to analyze U.S. data and show that stock market excess returns negatively respond to the increased changes in economic policy uncertainty. Another study by Sum (2012b) shows that the changes in economic policy uncertainty in Europe negatively affect all stock market returns in the Eurozone, Croatia, Norway, Russia, Switzerland, Turkey and Ukraine, and the effect is statistically significant for all countries except Croatia and seven members (Bulgaria, Estonia, Latvia, Lithuania, Malta, Slovakia and Slovenia) of the European Union. Paster and Veronesi (2012) propose that government policy uncertainty is negatively associated with stock prices. Bansal and Yaron (2004) find that the falling of asset prices is a response to economic uncertainty. Bansal, Khatchatrian and Yaron (2005) find a negative linkage between asset prices and the increase in economic uncertainty. Ozoguz (2009) shows that stock prices are negatively related to higher uncertainty among investors. Dzielinski (2011) provide evidence about the drop of stock returns in the week following a high degree of economic uncertainty.

In recent decades, the world economy has become globally connected more than ever; a disruptive shockwave to an economy can travel to neighboring countries and across the globe instantly. The developments in one country can indirectly and directly affect the economies of neighboring countries and other countries around the world. The effect can be significantly strong when the transmission is originated from one of the world's leading economies; this phenomenon has been well documented in the international economic and financial transmission and spillovers literature. For instance, Forbes and Chinn (2004) report that regional spillovers are determined by trades; the authors also show that the spillovers in a given region are triggered by the largest economy, and the developments in the United States affect all regions. Becker, Finnerty and Friedman (1995) show that US news and information partially explain the spillovers between the US and UK equity markets. In addition, Ehrmann and Fratzscher (2009) analyze 50 stock markets around the world and find that stock market returns negatively

respond to a tightening monetary policy in the United States. Studies conducted by these researchers (Awad & Goodwin, 1998; Chinn & Frankel, 2004; Ehrmann, Fratzscher, & Rigobon, 2011) show significant cross-border spillovers in bond yields among advanced economies including the US. Kim (2001) also shows that monetary policy shocks in the United States have a significant effect on foreign long-term yields and output.

Financial economists have studied the linkage between the international financial markets. For instance, King and Wadhwani (1990) argue that because rational agents observe and rationalize information from price innovations in other financial markets, there exists a correlation between financial markets. A study conducted by Lin, Engle and Ito (1994) shows that returns on the US stock market is interrelated with returns on the Japanese markets. Wongswan (2006) shows that stock markets in Korea and Thailand are affected by macroeconomic announcements in the United States and Japan. Hausmann and Wongswan (2011) show that international equity prices are significantly affected by surprises in Federal Reserve FOMC announcements during 1994-2005; a similar finding is documented in a study conducted by Ehrmann and Fratzscher (2006) and also reported by Ammer, Vega, and Wongswan (2008). Ehrmann, Fratzscher, and Rigobon (2005) find that financial shocks in the Eurozone have a greater effect on bond yields in the US than the reverse. Because the size of the economy and the well-established financial markets in the United States, shocks to economic activities and other macroeconomic variables in the US are likely to affect foreign markets; this claim is supported by various empirical studies (Bayoumi & Swiston, 2007; Ehrmann & Fratzscher, 2005; Goldberg & Leonard, 2003). Therefore, it is the intent of this study to investigate the effect of economic policy uncertainty in the United States on stock market performance of its neighboring countries namely Canada and Mexico.

This study is necessary because it contributes to the further understanding how financial markets of the neighboring countries respond to the shocks of economic policy uncertainty in the US. The results of this study add important information to the global financial transmission and spillovers literature. The findings from this study offer market participants useful information related to investment and risk management in the capital markets.

2. Method and Data

Monthly data on economic policy uncertainty in United States spanning from 1985:1 -2012:5 are obtained from the Economic Policy Uncertainty Index website located at http://www.policyuncertainty.com; this index is constructed by Baker, Bloom, and Davis (2012). Readers are strongly encouraged to read the detailed methodology of how the index is constructed by accessing at the methodology section at the Economic Policy Uncertainty Index website located at http://www.policyuncertainty.com/methodology.html. The data of historical monthly index values of the S&P 500 Total Return Index, Canada S&P/TSX-300 Total Return Index from 1985:1 to 2012:5 and Mexico SE Total Return Index from 1988:1 to 2012:5 are collected from the Global Financial Data database. The monthly data of the U.S trade balance with Canada and Mexico are obtained from the U.S. Census Bureau located at http://www.census.gov/foreign-trade/balance.

For the analysis purpose, the historical monthly returns (period percentage change) on the stock market indices are calculated; the first difference is calculated for the economic policy uncertainty index to take care of the non-stationary issue in the series. The time-varying OLS regression analyses (Equation 1 to 3) are computed for the effect of the changes in economic policy uncertainty in the United States on the stock market performance in the United States, Canada and Mexico, respectively. In order to see if changes in the U.S. trade balance with Canada and Mexico, respectively, influence the effect of changes in economic policy uncertainty in United States on the stock market performance in Canada and Mexico, the time-varying OLS regressions (Equation 4 and 5) are analyzed. Moreover, in order to see if the returns on S&P 500 index influence the effect of the changes in economic policy uncertainty in the United States on the performance of stock markets in Canada and Mexico, respectively, the time-varying OLS regression analyses (equation 6 and 7) are carried out. Finally, to examine if changes in the U.S. trade balance with Canada and Mexico, respectively, and returns on the S&P 500 index influence the effect of changes in economic policy uncertainty in United States on the stock market performance in Canada and Mexico, the last two equations (equation 8 and 9) are computed.

$$R_{s\&p500t} = \alpha + \beta \Delta EPU_t + \varepsilon_t \quad (1)$$

$$R_{cant} = \alpha + \beta \Delta EPU_t + \varepsilon_t \quad (2)$$

$$R_{mext} = \alpha + \beta \Delta EPU_t + \varepsilon_t \quad (3)$$

$$R_{cant} = \alpha + \beta \Delta EPU_t + \theta \Delta TRDCAN_t + \varepsilon_t \quad (4)$$

$$R_{mext} = \alpha + \beta \Delta EPU_t + \theta \Delta TRDMEX_t + \varepsilon_t \quad (5)$$

$$R_{cant} = \alpha + \beta \Delta EPU_t + \gamma R_{s\&P500t} + \varepsilon_t \quad (6)$$

$$R_{mext} = \alpha + \beta\Delta EPU_t + \gamma R_{s\&P500t} + \varepsilon_t \quad (7)$$

$$R_{cant} = \alpha + \beta\Delta EPU_t + \theta\Delta TRDCAN_t + \gamma R_{s\&P500t} + \varepsilon_t \quad (8)$$

$$R_{mext} = \alpha + \beta\Delta EPU_t + \theta\Delta TRDMEX_t + \gamma R_{s\&P500t} + \varepsilon_t \quad (9)$$

Where:

$R_{s\&P500t}$ = return on the S&P 500 total return index in month *t*

R_{cant} = return on the Canada S&P/TSX-300 total return index in month *t*

R_{mext}= return on the Mexico SE total return index in month *t*

ΔEPU_t = change in the index of economic policy uncertainty in the United States by taking the first difference; that is the value of economic policy uncertainty index in month *t* less month *t*-1

$\Delta TRDCAN_t$ = change in the U.S. trade balance (export – import) with Canada by taking the first difference; that is the value (in millions) of trade balance in month *t* less month *t*-1

$\Delta TRDMEX_t$ = change in the U.S. trade balance (export – import) with Mexico by taking the first difference; that is the value (in millions) of trade balance in month *t* less month *t*-1

3. Results

Descriptive statistics are reported in Table 1. The correlations among the variables are reported in Table 2. The time-varying regression results reported in Table 3, 4 and 5 show a statistically significant negative coefficient for the United States (β = -0.076, *t* = -5.14), Canada (β = -0.079, *t* = -5.56) and Mexico (β = -0.078, *t* = -2.81). When changes in the U.S trade balance with Canada and Mexico, respectively, are included in the regression analyses reported in Table 6 and 7, the regression results still show a statistically significant negative coefficient for Canada (β = -0.079, *t* = -5.55) and Mexico (β = -0.078, *t* = -2.81). The changes in the U.S. trade balance with Canada and Mexico, respectively, have no significant effect on the stock market performance in these two countries. When returns on the S&P 500 index included in the regression analyses as shown in Table 8 and 9, the regression coefficient becomes less negative but still significant at the 5% level for Canada (β = -0.023, *t* = -2.44); the regression coefficient for Mexico (β = -0.015, *t* = -0.61) becomes less negative and statistically insignificant at the 5% level. The returns on S&P 500 index fully mediate the effect of the changes in economic policy uncertainty in the United States on the stock market performance in Mexico. When changes in the U.S trade balance with Canada and Mexico, respectively, and returns on the S&P 500 index included in the regression analyses reported in Table 10 and 11, the regression coefficient is still negative and significant at the 5% level for Canada (β = -0.023, *t* = -2.42). The regression coefficient for Mexico (β = -0.015, *t* = -0.61) becomes less negative and still statistically insignificant at the 5% level.

Table 1. Descriptive Statistics

Variables	Mean	Standard Deviation	# of Obs
Return on Canada S&P/TSX-300 Total Return Index	0.766068	4.396819	328
Return on Mexico SE Total Return Index	2.477562	8.013095	293
Return on S&P 500 Total Return Index	0.911767	4.523394	328
Change in U.S. Economic Policy Uncertainty	0.266671	16.3189	328
Change in U.S. Trade Balance with Canada	-1.34116	655.2900	328
Change in U.S. Trade Balance with Mexico	-18.84299	467.6124	328

Table 2. Correlations

R_{can}	R_{can}	R_{mex}	$R_{s\&P500}$	ΔEPU	$\Delta TRDCAN$	$\Delta TRDMEX$
R_{mex}	1.0000					
$R_{s\&P500}$	0.5158	1.0000				
ΔEPU	0.7798	0.5323	1.0000			
$\Delta TRDCAN$	-0.2943	-0.1624	-0.2738	1.0000		
$\Delta TRDMEX$	0.0054	0.0017	-0.0297	-0.0090	1.0000	
	-0.0173	-0.0021	0.0073	-0.0372	-0.1339	1.0000

Table 3. Time-Varying OLS Regression Results: $R_{s\&p500t} = \alpha + \beta\Delta EPU_t + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	0.93200	0.24062	3.87	0.001
β	-0.07590	0.01476	-5.14	0.000
R-Square	0.0750			
Adj. R-Square	0.0721			
F(1, 326)	26.42			0.000

Number of Observation = 328

Table 4. Time-Varying OLS Regression Results: $R_{cant} = \alpha + \beta\Delta EPU_t + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	0.78721	0.01426	3.39	0.001
β	-0.07929	0.23240	-5.56	0.000
R-Square	0.0866			
Adj. R-Square	0.0838			
F(1, 326)	30.91			0.000

Number of Observation = 328

Table 5. Time-Varying OLS Regression Results: $R_{mext} = \alpha + \beta\Delta EPU_t + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	2.49019	0.46273	5.38	0.000
β	-0.07883	0.02808	-2.81	0.005
R-Square	0.0264			
Adj. R-Square	0.0230			
F(1, 291)	7.88			0.000

Number of Observation = 293

Table 6. Time-Varying OLS Regression Results: $R_{cant} = \alpha + \beta\Delta EPU_t + \theta\Delta TRDCAN_t + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	0.78723	0.01426	3.38	0.001
β	-0.07928	0.23240	-5.55	0.000
θ	0.00001	0.00035	0.05	0.958
R-Square	0.0866			
Adj. R-Square	0.0810			
F(2, 325)	15.41			0.000

Number of Observation = 328

Table 7. Time-Varying OLS Regression Results: $R_{mext} = \alpha + \beta\Delta EPU_t + \theta\Delta TRDMEX_t + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	2.48773	0.01426	5.36	0.000
β	-0.07894	0.23240	-2.81	0.005
θ	-0.00012	0.00096	-0.13	0.958
R-Square	0.0264			
Adj. R-Square	0.0197			
F(2, 290)	3.94			0.000

Number of Observation = 293

Table 8. Time-Varying OLS Regression Results: $R_{cant} = \alpha + \beta\Delta EPU_t + \gamma R_{s\&P500t} + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	0.10240	0.15452	0.66	0.508
β	-0.02352	0.00963	-2.44	0.015
γ	0.73476	0.03477	21.13	0.000
R-Square	0.6152			
Adj. R-Square	0.6128			
F(2, 325)	259.77			0.000

Number of Observation = 328

Table 9. Time-Varying OLS Regression Results: $R_{mext} = \alpha + \beta\Delta EPU_t + \gamma R_{s\&P500t} + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	0.10240	0.40586	4.06	0.000
β	-0.01516	0.02490	-0.61	0.543
γ	0.97513	0.09538	10.22	0.000
R-Square	0.2843			
Adj. R-Square	0.2794			
F(2, 290)	57.60			0.000

Number of Observation = 293

Table 10. Time-Varying OLS Regression Results: $R_{cant} = \alpha + \beta\Delta EPU_t + \theta\Delta TRDCAN_t + \gamma R_{s\&P500t} + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	0.10240	0.15461	0.66	0.511
β	-0.02330	0.00964	-2.42	0.016
θ	0.00018	0.00023	0.79	0.431
γ	0.73476	0.03477	21.13	0.000
R-Square	0.6159			
Adj. R-Square	0.6124			
F(3, 324)	173.19			0.000

Number of Observation = 328

Table 11. Time-Varying OLS Regression Results: $R_{mext} = \alpha + \beta\Delta EPU_t + \theta\Delta TRDMEX_t + \gamma R_{s\&P500t} + \varepsilon_t$

	Coefficient	Std. Err.	*t*	Sig.
Constant	1.64866	0.40683	4.05	0.000
β	-0.01510	0.00964	-0.61	0.546
θ	0.00004	0.00023	0.06	0.952
γ	0.97524	0.03477	10.21	0.000
R-Square	0.2843			
Adj. R-Square	0.2769			
F(3, 289)	38.27			0.000

Number of Observation = 293

4. Conclusion

Motivated by a great deal of empirical evidence reported in the international economic and financial transmission and cross-border spillovers literature, this study investigates the effect of economic policy uncertainty in the United States on stock market performance in Canada and Mexico. Using monthly returns of the Canada S&P/TSX-300 Total Return Index from 1985:2 to 2012:5 and Mexico SE Total Return Index from 1988:1 to 2012:5, this study shows that the increased changes in economic policy uncertainty in the US negatively affect stock market performance in Canada and Mexico. Although the changes in the U.S. trade balance do not influence the effect of the changes in economic policy uncertainty in the US on the stock market performance in Canada and Mexico, the returns on the S&P 500 do influence this effect. The findings suggest that stock market performance in Canada and Mexico is linked to the economic policy conditions and stock performance in the US. The implication of this finding is that market participants in Canada and Mexico do pay

attention to the economic policy conditions and stock performance in the US.

This study provides an important implication for equity investment and risk management. During the periods of high economic policy uncertainty in the US, investors can sell or short the stock market indices in Canada and Mexico. In contrast, during times with lower economic policy uncertainty, market participants can expect higher returns from investing in the stock markets in Canada and Mexico. For risk management implication, the findings suggest that it is difficult to diversify by investing in the stock markets in Canada and Mexico when investors are simultaneously investing in the U.S. stock market because not only do the increased changes in economic policy uncertainty in the US affect stock market performance in the US, these changes also affect stock market performance in Canada and Mexico as well.

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Testing the Relationship between Government Revenue and Expenditure: Evidence from Nigeria

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Abstract

The paper examines the revenue-spending hypothesis for Nigeria using macro data from 1970 to 2011. Correlation analysis, granger causality test, regression analysis, lag regression model, vector error correction model and impulse response analysis were the techniques used for analysis. The paper found that revenue and expenditure are highly correlated and that causality runs from revenue to expenditure in Nigeria. The vector error correction model also confirms that there is a significant long run relationship between revenue and expenditure implying that disequilibrium in expenditure can be corrected in the long run through policies that adjust oil and non-oil sector revenues. The lagged regression model showed that the positive relationship between revenue and expenditure reverts to negative at lag five thereby justifying the need for the use of medium term expenditure framework to monitor expenditure patterns in the short to medium term. The paper concludes that short term shocks from crude oil price passes through oil revenue to affect expenditure. This has led to swings in public expenditure pattern with sustained increase of recurrent expenditure over capital that has consequences for economic growth. Putting policies in place to enhance the performance of the non-oil sector and adopting expenditure framework that accounts for possible decline in crude oil prices was conceived as useful in enhancing a healthy revenue-expenditure relationship in Nigeria.

Keywords: revenue, expenditure, time series analysis, Nigeria

1. Introduction

The debate on the relationship between government revenue and spending has been the focus of several studies (e.g. Stoian, 2008; Obioma & Ozughalu, 2010; Mehmood & Sadiq, 2010; Aregbeyen & Ibrahim, 2012). These studies however provide some empirical gaps that can be improved upon. The aim of this paper is to examine the relationship of revenue and public spending in Nigeria from 1970 to 2010. The paper contributes to the literature by updating the data used and improves on the methodological gaps found in related studies. The paper also examines the response of expenditure to revenue shock so as to make policy deductions that would be relevant for Nigeria's expenditure framework.

Stoian (2008) examined the relationship between public revenues and expenditures in Romania. Regression analysis, Correlation and Granger causality analysis where used for the analysis. The results found a significant relationship between the variables. The paper argued that the direction of causality (that runs from revenue to expenditure) implied that some adjustments are required in revenues to achieve desired targets of expenditures. The paper also argued that expenditures could respond to lagged values of revenues but did not provide empirical evidence in that direction. From the granger causality result also, the paper deduced there could be along run equilibrium between revenue and expenditure that could be reached by through short run adjustments in revenue. Empirical evidence that shows such possibility was also not presented in the paper. More so, specific economies are likely to respond to shocks from their major exports, like crude oil for Nigeria. Providing

evidence on expenditure response to major revenue shock channels would therefore be important as well. Obioma and Ozughalu (2010) examined the empirical relationship between government revenue and government expenditure in Nigeria using time series data from 1970 to 2007. The paper used the Engel-Granger two-step cointegration technique, the Johansen cointegration method and the Granger causality test within the Error Correction Modeling (ECM) for analysis. It found that there is a long-run relationship between government revenue and government expenditure in Nigeria and evidence of a unidirectional causality from government revenue to government expenditure. It however did not model expenditure response to shocks from revenue.

Mehmood and Sadiq (2010) examined the short and long run relationship between the fiscal deficits and poverty in Pakistan using time series data from 1976 to 2010. The short run relationship was examined using error correction model while Johansen cointegration analysis was used to examine the long run relationship. The paper found that there is a negative relationship between government expenditure both in short and long run in Pakistan. Though the authors used Johansen cointegration model to estimate the long run relationship, vector error correction model would have been preferred to provide for short run and long run relationship using a single framework. Normality test should also have been added to the stationarity test in order to avoid spurious regression results. Aregbeyen and Ibrahim (2012) examined the long-run relationship and the dynamic interaction between government revenues and expenditures in Nigeria from 1970 to 2008 using Autoregressive Distributed Lag (ARDL) bound test approach. The paper introduced an innovation that examined the relationship of revenue and expenditure but did not test for their direction of influence. Thus, it is not clear why they revenue (or expenditure) was specified as dependent (or independent) variable.

1.1 Revenue and Expenditure Pattern in Nigeria: 1970 To 2011

Revenue and expenditure in Nigeria have behaved in a procyclical nature since 1970. Table 1 shows that expenditure changed by 85% within the period 1970 to 1975. This was attributed to the oil boom that was witnessed within the period and led to the expansion of government involvement in the economy that was characterized by nationalization programmes.

Table 1. Change in Total Government Spending and Revenue in Selected Periods

Items	1970-1975	1975-1980	1979-1984	1985-1990	1995-1997	1997-2000	2000-2003	2003 - 2007	2007 -2011
Change in Expenditure	85%	60.29%	34.04	78.36%	41.91%	38.92%	42.82%	49.98%	45.33%
ΣRecurrent (Nm)	7,767.5	21,161.9	28,923.40	112,542.7	410,684.6	1,247,923.7	2,722,000.0	6,120,171.9	12,653,170.7
ΣCapital (Nm)	5,809.6	31,836.4	36,352.80	67,786.8	603,716.3	1,316,145.8	1,241,213.8	2,424,197.1	5,065,452.8
Average crude oil prices (USD)	24.47	63.15	78.41	31.36	25.91	25.23	32.14	56.24	88.15
Average Inflation Rate (12MMA)	10.8%	18.6%	19.0%	22.4%	37.6%	8.0%	13.2%	12.1%	10.5%
Average Exchange rate (Naira/USD)	0.6619	0.6062	0.6523	4.4831	21.8861	59.6427	116.0938	129.8977	139.4920

Source: Authors' calculation based on National Statistics

From 1975 to 1980, public expenditure fell by 24.71% to 60.29%. This was due to the creation of new states in February 1976 and the decline in the level of oil production during the 1975/76 fiscal year. The focus of the third development plan from 1975-1980 to finance water supply, health, agriculture and co-operative projects also necessitated the rise of capital expenditure above recurrent expenditure. The decline in the level of oil production saw global crude oil price rising from an average of USD24.47 within 1970-1975 to USD63.15 in 1975-1980; which helped to close the deficit spending gap. Average inflation rate within this period however had gone up by 7.8% while exchange rate appreciated against the dollar 8.42% implying low value for money and higher real project costs/higher cost of living.

Within 1979-1984, public expenditure had further dropped by 26.25% to 34.04% compared to 60.29%. A major reason for this was the need for the then administration to address the worsening of economic conditions which led to the introduction of the Economic Stabilization Act of April 1982. The stabilization measures were, to a large extent, implemented through administrative controls such as tightening of import controls, imposition of exchange restrictions on current international transactions, substantial increases in customs tariffs, introduction of an advance import deposit scheme, and ceilings on total central bank foreign exchange disbursements (NCEMA, 2004). The fourth national development plan (1981-1985) therefore re-emphasized the need for

agricultural-based self reliance but, suffered from foreign exchange shortages, which led to widespread scarcity of essential commodities and high food cost.

By the 1985-1990, the administration at the time saw the need to free resources by liberalizing the economy. Thus, Structural Adjustment Programme (SAP) was put in place. The objectives of SAP were among, to position the private sector as the engine of economic growth, to liberalize the economy and to hold back on government involvement in the economy. Government expenditure within the period soared as recurrent expenditure rose above capital expenditure by 59.82%. Average crude oil price fell by more than 47% while inflation rose 3.4% to 22.4%. The naira depreciated by about 85% moving from N0.6523 to the USD within 1979-1984 to N4.4831 within 1985-1990. Economic hardship within this period increased and rolling plans replaced development plans.

From 1990 to 1996, four national rolling plans had already been implemented. By 1995-1997 however, exchange rate further depreciated by 79.53% to N21.88 to the USD and inflation rate rose by 15.2% to 37.6%. The federal government maintained deficit spending which led to increased external and domestic debt to N643,372.50 million and N466,486.86 respectively within 1995-1997. These figures were the highest since Nigeria's independence. By 1997-2000, capital expenditure was slightly higher than recurrent expenditure. With the return to democracy in 1999 there were therefore high expectations on achieving sustainable growth through sound fiscal management.

The creation of new democratic institutions however, saw recurrent expenditure rising over capital expenditure within 2000-2003. The huge debt inherited from the military era made the financing of capital projects difficult and expensive. Though crude oil price had improved by this period from an average of USD32.14 in the previous period to USD 56.24, the devaluation of the naira, made it difficult for Nigeria to reap the gains of rising crude oil price as pipeline vandalism was also the order of the day at the time.

By 2007-2011 the global economy witnessed severe recession and Nigeria was not exempted from its adverse impacts. Declining crude oil price also compounded the impact of the crisis on revenue in Nigeria. This translated into further devaluation of the naira by 6.88% to N139.49 from an average of N129.89 in the previous period and expanded the deficit spending gap.

2. Methods and Techniques

Following Stoian (2008) and Mehmood and Sadiq (2010) paper employed the following techniques for analysis: correlation analysis, Granger causality, regression analysis, lagged regression model and vector error correction model. Real time series data were collected for the following variables for the period 1970-2011 from the Central bank of Nigeria: federally collected public expenditure (EXPN), federally collected revenue (REV), revenue from crude oil (OREV), non-oil revenue (NOREV) and crude oil price in USD (COP) from the web. The variables were also used in Obioma and Ozughalu (2010) and Aregbeyen and Ibrahim (2012). The variables were tested for stationarity and normality before the estimations were done.

The correlation coefficient is computed using:

$$r_{xy} = \Sigma z_x z_y / N \tag{1}$$

where r_{xy} is the correlation coefficient, Z_x is the variables converted in z scores to be correlated with Z_y variables to obtain r, and N is the number of observation (1970-2011) for 42 observations. The *a priori* is that $r > 0$ for all the variables.

The direction of causality among the variables will be examined using Granger causality for expenditure (EXPN) and revenue (REV) is specified as:

$$EXPN_t = \alpha_0 + \alpha_i \sum_{i=1}^{n} EXN_{t-i} + \beta i \sum_{i=1}^{n} REV_{t-I} + e_t \tag{2.1}$$

$$REV_t = \alpha_0 + \alpha_i \sum_{i=1}^{n} REV_{t-i} + \beta i \sum_{i=1}^{n} EXPN_{t-i} + e_t \tag{2.2}$$

Where α_0 and $ß_i$ are coefficients and e_t is the residual. It is expected that EXPN and REV will have a bi-directional relationship i.e. $\alpha_i > 0$ and $ßi > 0$. Revenue is also be broken down into oil revenue (OREV) and non-oil revenue (OREV) and substituted in the model to obtain the direction of causality. Crude oil price (COP) will also be substituted to obtain the direction of causality with expenditure (EXPN).

The regression model is specified as:

$$\Delta EXPN_t = a_o + a_1\Delta REV_t + a_2\Delta OREV_t + a_3\Delta NOREV_t + a_4\Delta COP_t + u_t \quad (3)$$

Where Δ is the differencing sign to correct for unit root and a1-4 are coefficients showing the relationship between the independent variables and the dependent variable. The *a priori* expectation is that $a_1>1$, $a_2>0$, $a_3>0$ and $a_4<0$.

Lagged regression model will also be estimated connecting expenditure and revenue at lag five. It will be expected that coefficient will be negative as revenue in Nigeria is driven by crude oil price which can be difficult to predict beyond 5 years. The model is specified as:

$$\Delta EXPN_t = b_o + b_1\Delta REV_t + b_2\Delta REV_{t-5} + u_t \quad (4)$$

Where $b_1 > 0$; $b_2 < 0$.

The vector error correction model is specified thus:

$$\Delta x_t = \Pi x_{t-1} + \sum_{I=1}^{p-1} \phi i \Delta x_{t-I} + \epsilon_t \quad (5)$$

where ϵ_t is the error term, Π and the Φ are functions of the Φ's. If $\Pi = 0$, then there is no cointegration. Nonstationarity of $I(I)$ type vanishes by taking differences (Δ). The model interprets that there is an adjustment to the 'equilibrium' x^* or long term relation described by the cointegrating relation while Π captures the short run relationship and the adjustment required to arrive at the long run equilibrium. The models will be estimated using Eviews econometric package.

3. Results

3.1 Correlation Analysis

Correlation analysis was conducted on the data to establish the degree of association connecting the variables. It was found that all the variables are positively associated by 99 % except for COP which had a low correlation value of about 30 % with the other variables. The correlation matrix result is presented in Table 2.

Table 2. Correlation Matrix

	EXPN	REV	OREV	NOREV	COP
EXPN	1.000000	0.995498	0.992554	0.992272	0.312008
REV	0.995498	1.000000	0.998226	0.992640	0.326349
OREV	0.992554	0.998226	1.000000	0.985061	0.349530
NOREV	0.992272	0.992640	0.985061	1.000000	0.280679
COP	0.312008	0.326349	0.349530	0.280679	1.000000

Source: Authors Computation

3.2 Granger Causality

Though correlation analysis shows the degree of association between two variables, it does not tell the direction of causality i.e. whether the changes in one of the variables is attributed to changes in the other variable. Granger causality test addresses this short coming. The granger causality result is presented in Table 3:

Table 3. Granger Causality Test

Pairwise Granger Causality Tests
Sample: 1970 2011
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
(1) REV does not Granger Cause EXPN	40	3.21726	0.05216
EXPN does not Granger Cause REV		2.09693	0.13800
(2) OREV does not Granger Cause EXPN	40	3.48308	0.04173
EXPN does not Granger Cause OREV		2.60493	0.08818
(3) NOREV does not Granger Cause EXPN	40	0.41740	0.66199
EXPN does not Granger Cause NOREV		7.16248	0.00247
(4) COP does not Granger Cause EXPN	40	3.58235	0.03842
EXPN does not Granger Cause COP		0.55271	0.58033
(5) COP does not Granger Cause REV	40	5.95284	0.00595
REV does not Granger Cause COP		2.94757	0.06561
(6) COP does not Granger Cause OREV	40	8.13425	0.00126
OREV does not Granger Cause COP		3.99592	0.02735
(7) COP does not Granger Cause NOREV	40	0.67767	0.51433
NOREV does not Granger Cause COP		0.15050	0.86084

Source: Authors Computation

Table 3 show that revenue granger-causes expenditure at 10 % level of significance but expenditure does not granger-cause revenue implying that, there is a unidirectional influence running from revenue to expenditure. The result is shown in line (1) in Table 3.2 above.Breaking revenue into two parts (oil revenue and non-revenue) showed that oil revenue granger-causes expenditure and the result was significant at 5 % critical value. Though expenditure as well was found to granger-cause oil revenue, the result which is presented in line (2) of Table 3.2, was significant at 10 % critical value implying lesser significance compared to the influence oil revenue has on expenditure compared. Non-oil revenue however does not lead to changes in expenditure rather expenditure was found to granger-cause non-oil revenue with significance at 1% critical value. This implies that public expenditure, which is large driven by the oil sector in Nigeria, should be used to develop the non-oil sector in order to get the non-oil sector contribute the growth of public expenditure in Nigeria. The result is presented in line (3) of Table 3.

Fluctuations in crude oil price were also found to granger-cause public expenditure in Nigeria. This is shown in line (4) of Table 3.2 as the probability value of the computed F-statistic was significant 5 % critical value while. This implies that variability in crude oil prices would significantly affect the public expenditure pattern in Nigeria. The channel through which oil revenue affects expenditure however is through revenue. Thus the granger causality result in line (5) shows that crude oil price granger-causes i.e. has a short run influence on total revenue in Nigeria. The result is significant at 1% critical value. When separated into oil and non-oil revenue, crude oil price was found to influence oil revenue at a significant value of 1 % critical value, while there was no causality found running from crude oil price to non-oil revenue. The results are contained in lines (6) and (7) of Table 3 respectively.

In summary, the granger causality test confirms the revenue-spend hypothesis at 10 % critical value while the hypothesis for spend-revenue is rejected. The short coming of the granger causality test is that it does not show the direction of relationship between two variables. Although it is used to show that changes in revenue affects expenditure but it does not tell whether it is positive or negative changes or the size of the impact in terms of a coefficient of determination. The ordinary least square regression technique addresses this short coming.

3.3 Ordinary Least Square Regression Result

This technique requires that the variables should be stationary and normally distributed before estimation is conducted. When tested for stationarity using the augmented dickey fuller unit root test, it was found that all the variables were stationary at first difference therefore requiring that the variables be differenced by one during estimation. The stationarity result is presented in Table 4:

Table 4. STATIONARITY TEST: Augmented Dickey Fuller (ADF) Test

Level test *I*(0)		Critical Values		
ADF Stat	Variables	1%	5%	10%
-0.7711	Expenditure (EXPN)	-3.5973	-2.9339	-2.6048
-1.0022	Revenue (REV)	-3.5973	-2.9339	-2.6048
-1.7473	Oil Revenue (OREV)	-3.5973	-2.9339	-2.6048
-0.2077	Non-Oil Revenue (NOREV)	-3.5973	-2.9339	-2.6048
-2.0491	Crude oil Price (COP)	-3.5973	-2.9339	-2.6048
First Difference Test *I*(1)				
-7.4387	Expenditure (EXPN)	-3.6019	-2.9358	-2.6059
-7.1407	Revenue (REV)	-3.6019	-2.9358	-2.6059
-7.2685	Oil Revenue (OREV)	-3.6019	-2.9358	-2.6059
-8.1661	Non-Oil Revenue (NOREV)	-3.6019	-2.9358	-2.6059
-6.4247	Crude oil Price (COP)	-3.6019	-2.9358	-2.6059

Source: Authors Computation (Eviews)

The Jarque-Bera statistics was used to test for normality in the distribution of the data. Of all the variables, only expenditure (EXPN) and revenue (REV) were found to be normally distributed since their Jarque-Bera statistics values were approximately 3 and the values of their skewness approximately zero. The Jarque-Bera result is presented in Table 5:

Table 5. Jarque-Bera Statistics

	EXPN	REV	OREV	NOREV	COP
Mean	4.900476	5.042857	4.897615	4.443419	1.592187
Median	4.800000	4.995000	4.886990	4.340802	1.570312
Maximum	6.650000	6.950000	6.814955	6.333246	2.056600
Minimum	2.960000	2.800000	2.221675	2.669689	0.997386
Std. Dev.	1.135133	1.262551	1.310474	1.184348	0.264085
Skewness	0.004034	0.052903	-0.051385	0.154457	-0.239057
Kurtosis	1.702095	1.680241	1.837705	1.586509	2.455340
Jarque-Bera	2.948089	3.067680	2.382611	3.663421	0.919183
Probability	0.228997	0.215706	0.303824	0.160139	0.631542
Observations	42	42	42	42	42

Source: Authors Computation using Eviews

The multiple regression result was then estimated using all the variables. The result showed that none of the coefficients were significant by their t-statistics value. The multiple regression result is presented in Table 6.

Table 6. Multiple Regression Results

Dependent Variable: D(EXPN)				
Method: Least Squares				
Date: 07/14/12 Time: 12:46				
Sample(adjusted): 1971 2011				
Included observations: 41 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.045713	0.021673	2.109240	0.0419
D(REV)	0.410448	0.656922	0.624804	0.5360
D(OREV)	0.009425	0.453908	0.020765	0.9835
D(NOREV)	0.084061	0.183019	0.459299	0.6488
D(COP)	-0.225022	0.202428	-1.111615	0.2737
R-squared	0.215308	Mean dependent var		0.090000
Adjusted R-squared	0.128120	S.D. dependent var		0.111826
S.E. of regression	0.104417	Akaike info criterion		-1.567004
Sum squared resid	0.392503	Schwarz criterion		-1.358032
Log likelihood	37.12358	F-statistic		2.469472
Durbin-Watson stat	2.413408	Prob(F-statistic)		0.062031

Source: Authors Computation using Eviews

Looking at the probability values for the individual t-statistic value shows that the coefficients are not significant. All the variables were then dropped at the regression re-estimated taking into account only expenditure and revenue since they were both normally distributed. Expenditure is specified as the dependent variable because of the results from the granger-causality which confirms the revenue-spend hypothesis. The re-estimated result is presented in Table 7.

Table 7. Single Regression Result

Dependent Variable: D(EXPN)				
Method: Least Squares				
Sample(adjusted): 1971 2011				
Included observations: 41 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.058844	0.020086	2.929552	0.0056
D(REV)	0.307811	0.116199	2.648994	0.0116
R-squared	0.152490	Mean dependent var		0.090000
Adjusted R-squared	0.130759	S.D. dependent var		0.111826
S.E. of regression	0.104259	Akaike info criterion		-1.636334
Sum squared resid	0.423924	Schwarz criterion		-1.552745
Log likelihood	35.54485	F-statistic		7.017168
Durbin-Watson stat	2.513903	Prob(F-statistic)		0.011596

Source: Authors Computation using Eviews

The result shows that there is a positive and significant relationship between public expenditure and revenue in Nigeria and supports the revenue-spend hypothesis for Nigeria indicating that increase in revenue implies increase in expenditure for Nigeria and decrease in revenue implies decrease in expenditure for Nigeria.

The implication for Nigeria's short to medium planning can be deduced by introducing lag values of the independent variable in the model. Revenue lagged to maximum period of 10 but the coefficient was only significant at revenue at present value and revenue at lag 5. The implication is that why it makes economic sense for current expenditure to increase due to increase recorded in revenue, it would be important to adopt a framework that allows for expenditure to decline in 5 years when revenue is increasing and increasing when revenue is declining. This would require factoring into Nigeria's medium expenditure framework measures that counteracts the procyclical nature revenue and expenditure in Nigeria. Such measure would be important to help Nigeria weather the storm in periods of dwindling crude oil prices. The lagged revenue model is presented in Table 8.

Table 8. Lagged Revenue Regression Result

Dependent Variable: EXPN				
Method: Least Squares				
Sample(adjusted): 1976 2011				
Included observations: 36 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.073269	0.021356	3.430902	0.0016
REV	0.380920	0.122380	3.112607	0.0038
REV(-5)	-0.246342	0.120385	-2.046278	0.0488
R-squared	0.249937	Mean dependent var		0.080000
Adjusted R-squared	0.204479	S.D. dependent var		0.106207
S.E. of regression	0.094728	Akaike info criterion		-1.795950
Sum squared resid	0.296125	Schwarz criterion		-1.663990
Log likelihood	35.32709	F-statistic		5.498159
Durbin-Watson stat	2.499310	Prob(F-statistic)		0.008692

Source: Authors Computation using Eviews

3.4 Test Results for Cointegration

Understanding the long run relationship between government revenue and spending would also be important to understand how revenue and spending behave in the long run. To do this, vector error correction model was used. The variables considered were expenditure, total revenue, oil revenue, non-oil revenue and crude oil price. The result shows that there are three cointegrating relationship i.e. revenue on expenditure (at 1% critical value), oil revenue on expenditure (at 1 % critical value) and non-oil revenue on expenditure (at 5% critical value). The cointegration and the vector error correction model is presented in Table 9.

Table 9. Vector Error Correction Result

Sample(adjusted): 1972 2011					
Included observations: 40 after adjusting endpoints					
Standard errors & t-statistics in parentheses					
Cointegrating Eq:	CointEq1				
EXPN(-1)	1.000000				
REV(-1)	-9.062512				
	(3.11028)				
	(-2.91373)				
OREV(-1)	6.758237				
	(2.45830)				
	(2.74915)				
NOREV(-1)	1.410752				
	(0.69008)				
	(2.04433)				
COP(-1)	0.228127				
	(0.14407)				
	(1.58345)				
C	1.006701				
Error Correction:	D(EXPN)	D(REV)	D(OREV)	D(NOREV)	D(COP)
CointEq1	-0.077362	-0.074529	-0.224102	0.145358	-0.205569
	(0.08846)	(0.11728)	(0.14224)	(0.11697)	(0.10809)
	(-0.87456)	(-0.63547)	(-1.57556)	(1.24272)	(-1.90185)
R-squared	0.198735	0.096563	0.153563	0.220488	0.164115
Adj. R-squared	0.053051	-0.067698	-0.000335	0.078759	0.012136
Sum sq. resids	0.398739	0.700922	1.030967	0.697190	0.595361

Source: Authors Estimation using Eviews

The impulse response function was derived from the vector error correction model. Expenditure was shocked with one standard innovation around its standard error. The trend reveals that a positive shock in total revenue raises expenditure in the first two years and then stabilizes in the subsequent years. A negative shock in revenue however, pulls down expenditure in the immediate years and falls even faster in the subsequent years. When separated into oil and non-oil revenue, public expenditure however, happens to maintain a stable and rising trend despite the direction of the shock. This suggests that, designing policies to be used for stabilization of oil and non-oil revenue would be useful in stabilizing public expenditure in periods of domestic and external shock. Lastly, a shock in crude oil price however, was found to have a drastic effect on expenditure. A positive shock in crude oil price was found to increase expenditure slightly above the line of origin which in this case is synonymous to the balanced budget line, but quickly goes below the line of origin signaling a budget deficit regime. A negative shock in crude oil price however, drags expenditure down immediately and widens over time. This implies that the fluctuation of crude oil price is also a major factor that determines the size of public expenditure in Nigeria thus, a stable bench mark should be used in forecasting revenue from crude oil that takes into account possibility of a negative oil price shock. Further actions to improve revenue from non-oil sources would also be important to enhance sustainable growth and development in Nigeria. The impulse response trend is shown in Figure 1.

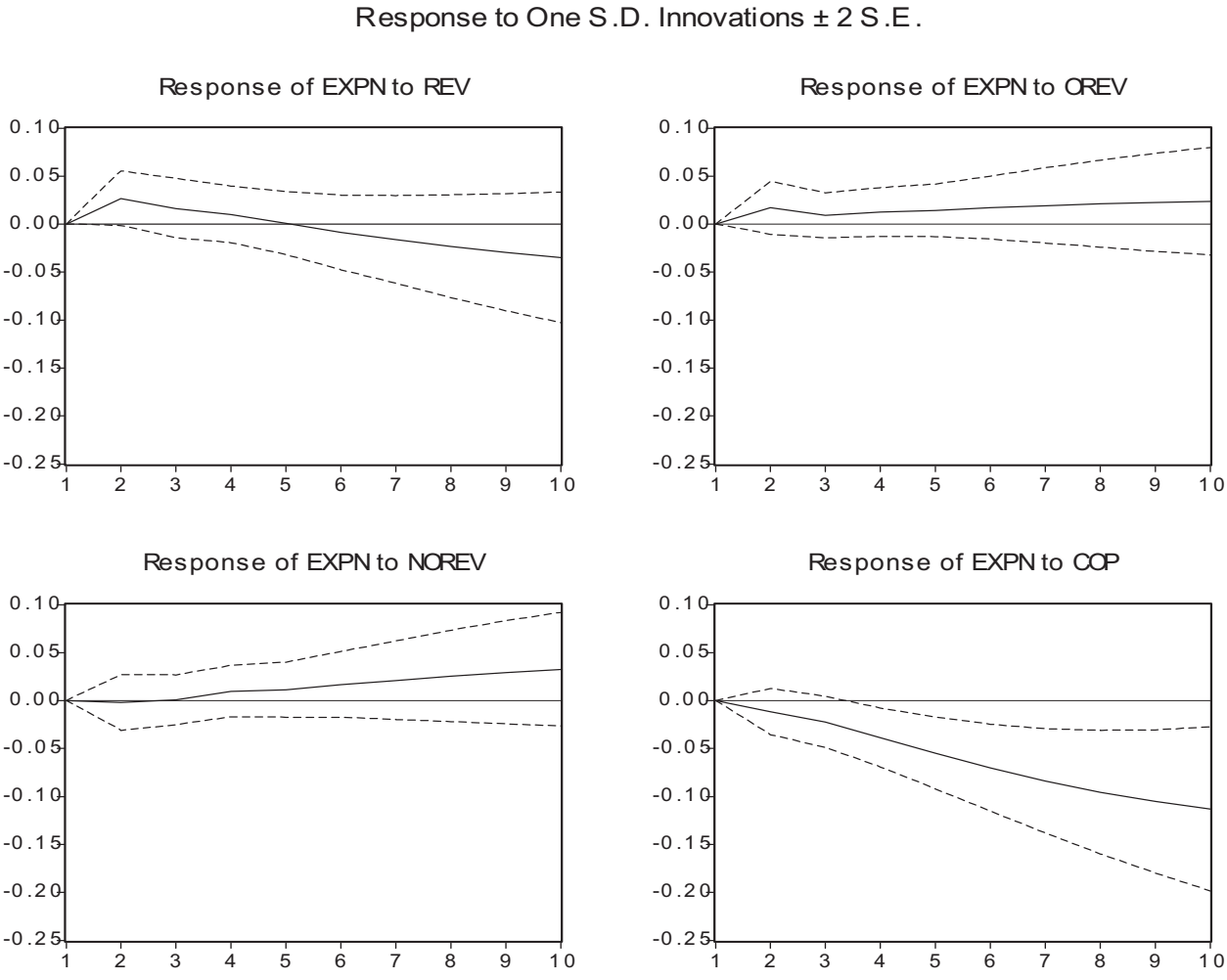

Figure 1. Nigeria: Impulse Response Function of Expenditure to Revenue

Source: Authors Presentation using Eviews

4. Discussions

Several studies have examined the relationship between total government expenditure and revenue for various countries. The literature for Nigeria however still offers some methodological gaps and useful tips for policy on expenditure management. This paper tests the revenue-spend hypothesis for Nigeria. Total public expenditure was used as proxy for expenditure while revenue, oil revenue, non-oil revenue and crude oil prices were used to represent the revenue side. Correlation analysis was used to establish the degree of association among the variables while granger-causality test was used to test for the direction of influence between revenue and expenditure. The static direction of impact was then established using ordinary least square technique while the dynamic direction of impact was estimated using lagged regression model. The cointegration relationship was tested using vector error correction model and finally the response of expenditure to a shock in total revenue, oil revenue, non-oil revenue and crude oil price was tested using impulse response functions obtained from the vector error correction model. It was found that revenue and expenditure are highly correlated at about 90 % and that the direction of causality between revenue and expenditure is positive and unidirectional running from revenue to expenditure. The vector error correction model found that there are three cointegrating relationship connecting expenditure to revenue, oil revenue and non-oil revenue implying that a shock in revenue has consequences for public spending. The impulse response function showed that a positive shock in revenue through crude oil price raises expenditure and narrows the deficit spending gap. A negative shock on the other hand, steepens public expenditure and widens the deficit spending gap. Though the shock from oil revenue and non-oil revenue on public expenditure seem to have the same spread effect, but negative shock from non-oil revenue drags expenditure down by a much lesser extent compared to a negative shock from oil revenue.

The policy implication is that while positive shocks from the international crude oil market could boost revenue in Nigeria hence translating into higher revenue, a negative shock would however, decrease oil-revenue and translate into widening spending deficit. The benchmark for crude oil price should therefore be kept at a level that recognizes possibility of international crude oil price decline. The need to move towards clean energy by de-emphasizing use of non-renewable energy in the face of climate change is another factor that could accelerate the rate of decline in the future. Furthermore; efforts should be made to boost non-oil revenue as a negative shock from this source of revenue was found to have a lesser impact on expenditure. One way to do this would be to commit part of the excess crude revenue account to boosting the performance of non-oil sector.

5. Conclusion

The paper examines the revenue-spending hypothesis for Nigeria using macro data from 1970 to 2011. Correlation analysis, granger causality test, regression analysis, lag regression model, vector error correction model and impulse response analysis were the techniques used for analysis. The paper found that revenue and expenditure are highly correlated and that causality runs from revenue to expenditure in Nigeria. The vector error correction model also confirms that there is a significant long run relationship between revenue and expenditure implying that disequilibrium in expenditure can be corrected in the long run through policies that adjust oil and non-oil sector revenues. The lagged regression model showed that the positive relationship between revenue and expenditure reverts to negative at lag five thereby justifying the need for the use of medium term expenditure framework to monitor expenditure patterns in the short to medium term. The paper concludes that short term shocks from crude oil price passes through oil revenue to affect expenditure. This has led to swings in public expenditure pattern with sustained increase of recurrent expenditure over capital that has consequences for economic growth. However, there are some areas for further studies. There would be need to test for structural breaks over the period studied to support the conclusions obtained from the impulse response shocks. There would also be need to carry out a cross country study for the correlation between government expenditures and revenues for oil-exporting countries in other to provide cross country evidence on the relationship between public expenditure and revenue.

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Estimation of Exchange Rate Volatility via GARCH Model Case Study Sudan (1978 – 2009)

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Abstract

This paper aims to estimate volatility of exchange rate that was caused by inconsistent economic policies adopted by consecutive governments who failed to realize realistic exchange rate of the Sudanese pound. The consequences were mutual influence of high inflation rate, deterioration of the productive sectors, continuous internal and external deficits and depreciation of the exchange rate. To estimate the volatility of the exchange rate EGARCH (1,1) was used**.** The leverage effect term is negative and statistically different from zero, indicating the existence of the leverage effect (negative correlation between past returns and future volatility. As the past few years prove highly leveraged financial systems can have crises that increase the volatility of asset prices. These results indicate the possibility of a simultaneous feedback between the exchange rate and uncertainty and the response of the exchange rate to news about general price level (CPI)l, money stock, and current account which are the main determinants..

Keywords: current account, GARCH, money supply, prices, risk, leverage, volatility

1. Introduction

International currency is demanded for buying and selling of goods and services. The exchange rate is the rate at which one currency will exchange for other units of international currency. This rate will vary over time depending on many factors. The uncertainty of exchange rates has been studied extensively in developed and developing countries. Long-run and short-run fluctuations may have negative effects on macroeconomic level therefore; exchange-rate fluctuation is usually treated as a risk. A higher risk will lead to a higher cost for risk-averse investors, therefore, result in fewer jobs created. Exchange rate itself is considered a financial asset, so the need for accurate forecasting of volatility in financial markets is critical with regard to "investment, financial risk management and monetary policy making" (Poon & Granger (2003)). Sudan experienced two exchange rate regimes. In 1957 IMF set a fixed exchange rate of one Sudanese pound to 2.87 US dollar. In September 1978 IMF devaluated the Sudanese pound was devaluated for the first time by 43 per cent, and introduced two rates i.e. the fixed (official) and floating (free) rate. This scenario continued up to February 1992 when Economic liberalization Policies (ELP) were introduced devaluating the official and free rate by 496 per cent, and 197 per cent respectively. State control and restriction on citizen for holding certain amount of foreign currency were lifted. Since the application of ELP the exchange rate fluctuated sharply in the next four years. In 1996 new comprehensive reform polices were introduced reducing devaluation rate from 75% to 27% in 1998 and to only 2 per cent in 1999, and to negative figures up to 2007. Many academics and professionals studied the behavior of the Sudanese exchange rate using conventional techniques such as OLS, descriptive statistics and statistical inference, but no one (to my knowledge) has attempted to estimate the volatility via GARCH models. The purpose of this paper is to estimate variability via GARCH models due to its suitability to such type of data. GARCH (1,1) model outperforms other models in estimating volatility of foreign exchange rate. For the ARCH model, the conditional variance changes over time as a function of past squared deviations from the mean. The GARCH processes variance changes over time as a function of past squared deviations from the mean and past variances (Johnston and Scott 2000).

2. Empirical Literature Review

AUWAL (2010) used 354 bi – weekly data points (from July 22, 2002 to March 27, 2006) of Retail Dutch Auction System (RDAS) sessions' period in Nigeria to show that RDAS as an institutional arrangement for foreign exchange does not bring about better stability in the exchange rate in the long – run. The short – run relationship is

modeled by the GARCH while the long – run relationship is modeled through the ARDL. The study revealed that volatility is persistent in demand for foreign exchange and the rate of exchange. There is evidence of long run relationship between demand for foreign exchange, marginal rate of exchange and the rate of success of bids under RDAS. Therefore, exchange rate and the effect of RDAS have significant influence towards the determination of demand for exchange rate both in the short run and in the long run. The study concluded that, RDAS, as an institutional arrangement for conducting a flexible exchange, cannot bring about better result in the long run than it can offers in the short run. The study suggests further studies on the recent phase Wholesale Dutch Auction System (WDAS).

Hung-Chung et al. (2009) have shown that a GARCH model with an underlying leptokurtic asymmetric distribution outperforms one with an underlying Normal distribution, for modeling volatility of the Chinese Stock Market.

Shiyi (2008) presented support vector regression (SVR), a novel neural network (NN) technique, which has been successfully used for financial forecasting. He dealt with the application of SVR in volatility forecasting. Based on a recurrent SVR, a GARCH method is proposed and is compared with a moving average (MA), a recurrent NN and a parametric GACH in terms of their ability to forecast financial markets volatility. The real data in this study uses British Pound-US Dollar (GBP) daily exchange rates from July 2, 2003 to June 30, 2005 and New York Stock Exchange (NYSE) daily composite index from July 3, 2003 to June 30, 2005. The experiment shows that, under both varying and fixed forecasting schemes, the SVR-based GARCH outperforms the MA, the recurrent NN and the parametric GARCH based on the criteria of mean absolute error (MAE) and directional accuracy (DA). No structured way being available to choose the free parameters of SVR, the sensitivity of performance is also examined to the free parameters.

Shu (2008) estimated the long- and short-run effect between exchange-rate uncertainty and unemployment in South Korea and Taiwan. The exchange-rate uncertainty is measured by using two different measures: moving average standard deviation around the predicted value and GARCH (1,1) model. A long-run equilibrium relationship between exchange-rate uncertainty and unemployment is found to exist in Taiwan and South Korea, when exchange-rate uncertainty is generated by two different measures. The exchange-rate uncertainty has a short-run impact on unemployment and vice versa no matter which measures of uncertainty is used. However, the impacts of exchange-rate uncertainty on unemployment in South Korea and Taiwan are positive and negative, respectively.

Jan (2005) considered Leverage as the evil force that produces excessive volatility in market and economies. They found negative relation between investors and leverage. Leverage is raised when volatility is low and reduced when volatility is high. Thus market volatility lags rater than lead volatility.

Niklas (2005) examined the small sample properties of adaptive tail index estimators under the class of student-t marginal distribution functions including generalized autoregressive conditional heteroscedastic (GARCH) models and propose a model-based bias-corrected estimation approach. The simulation results indicate that bias relates to the underlying model and may be positively as well as negatively signed. The empirical study of daily exchange rate changes reveals substantial differences in measured tail thickness due to small sample bias. Thus, high quantile estimation may lead to a substantial underestimation of tail risk.

Kolawole (2004) investigated the effects of exchange rate volatility on the Nigeria stock markets. It was found that the exchange rate volatility generated via GARCH process exerts a stronger negative impact on the Nigeria stock markets. However the rate of inflation and interest rate did not have long run relationship with stock market capitalization since the major participant in the market is government. Based on this it is recommended that a coordinated monetary and fiscal policy should be put in place to check mate the fluctuation of exchange rate in order to deepen the depth of the Stock Market.

Hassan (2004) studied events that can alter the volatility pattern of financial assets and how unanticipated shocks determine the persistence of volatility over time by detecting time periods of sudden changes in volatility by using the iterated cumulated sums of squares (ICSS) algorithm. Examining five major sectors from January 1992 to August 2003, they found that accounting for volatility shifts in the standard GARCH model considerably reduces the estimated volatility persistence.

Carol (2003) presented a general symmetric presentation for Normal Mixture (NM) GARCH (1,1) models, derived the analytic derivatives for the maximum likelihood estimation of the model parameters and their standard errors and compute the moments of the error term. They also formulated specific conditions on the model parameters to ensure positive, finite conditional second and fourth moments.

CHOO (2002) attempted to study GARCH models with their modifications, in capturing the volatility of the exchange rates. The results indicate that the volatility of the Ringgit Malaysian /Sterling exchange rate is persistent. The within sample estimation results support the usefulness of the GARCH models and reject the constant variance model, at least within-sample.

Devajyoti (2000) established that in situations common in finance, many of the properties of stable models are shared by GARCH models, implying that many of the findings of fat-tailed stable distributions could be caused by temporal clustering of volatility. They applied studied eight financial data series, and concluded that the GARCH model characterizes the data better than the stable Partisan model. This supports the hypothesis that the fat tails in financial data are better described as being caused by volatility clustering than by a stable Partisan data generating process.

3. Data and Methodology

3.1 Data

Nominal exchange rate X, current account balance CAB, interest rate I, international reserves RSV, domestic credit DC, and money supply MS data are provided by the Central Bank of Sudan, while the general price level P, and consumer price index CPI are supplied by Central Bureau of Statistics. Annual data is used and the start date is 1978 when the country shifted from fixed peg to monitored floating exchange rate.

3.2 Methodology

Tests of unit roots and Co integration were carried in addition to the use of ARCH and GARCH models to estimate volatility the exchange rate which is considered a financial asset. Recent Studies of financial markets suggest that the phenomenon is quite common (Greene 1994).

3.3 ARCH

The ARCH model has become a popular one because its variance specification can capture commonly observed features of the time series of financial variables; in particular, it is useful for modeling volatility and especially changes in volatility over time (Hill etal 2008) The basic idea of ARCH models is that (a) the mean a_t is serially uncorrelated, but dependent and (b) the dependence of a_t can be described by a simple quadratic function of its lagged values Ruey (2002). Specifically, an ARCH (m) model assumes that

$$a_t = \sigma_t \varepsilon_t;\ \varepsilon_t \sim iid(0,1);\ a_0 > 0 \tag{1}$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \cdots + \alpha_m a_{t-m}^2;\ \alpha_0 > 0; \alpha_i \geq 0; i > 0 \tag{2}$$

These models suffer from many weaknesses) Ruey 2002): first they assume that positive and negative shocks have the same effects on volatility because it depends on the square of the previous shocks. Second they are rather restrictive e.g. α_2 of an ARCH (1) model must be in the interval [0, 0.333]. Third they do not provide any new insight for understanding the source of variations of a financial time series. They only provide a mechanical way to describe the behavior of the conditional variance. It gives no indication about what causes such behavior to occur. Finally they are likely to over-predict the volatility because they respond slowly to large isolated shocks to the return series.

3.4 GARCH

GARCH (m,s) is the Generalized ARCH by Bollerslev (1986) models are widely used in various branches of econometrics, especially in financial time series analysis.

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{m} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{s} \beta_j \sigma_{t-j}^2;\ \varepsilon_t \sim N(0.1); \alpha_0 > 0; \alpha_i \geq 0; \beta_j \geq 0 \tag{3}$$

The variance equation σ_t^2 is composed of three terms: the mean (long term average) α_0 news about volatility from the previous period (the ARCH term) a_{t-i}^2 and the GARCH term σ_{t-j}^2. It is a weighted average of the variance a (the constant), the ARCH term and the GARCH term. If there was unexpectedly large move in either the upward or the downward direction, then the forecaster will increase the estimate of the variance for the next period. If the asset return was unexpectedly large in either the upward or the downward direction, then the trader will increase the estimate of the variance for the next period. This model is also consistent with the volatility clustering often seen in financial returns data, where large changes in returns are likely to be followed by further large changes **ω**.

3.5 EGARCH

EGRACH model or Exponential GARCH was proposed by Nelson (1991). The specification for the conditional variance is as follows:

$$ln(\sigma_t^2) = \omega + \left|\frac{(\sigma_t|\xi_{t-1})}{\sigma_{t-1}}\right| + \sqrt{\frac{2}{\pi}} + \frac{\gamma\xi_{t-1}}{\sigma_{t-1}} + \beta ln(\sigma_{t-1}^2) \quad (4)$$

The left-hand side is the log of the conditional variance. This implies that the leverage effect γ is exponential, rather than quadratic, and that forecasts of the conditional variance are guaranteed to be nonnegative. Exchange rate is considered as a financial asset. The price of a financial asset is set as the present value of the cash flows expected from the asset. Asset prices change when the expectations of future cash flows change, the uncertainty around them or the rate at which cash flows are discounted changes. Price change by larger amount or more frequently i.e. become more volatile, the greater the number of reasons for investors to alter their views on future cash flows the greater the fluctuation in the discount rate. This requires news (surprises) or unexpected events. CPI (surprises) news affects inflation uncertainty (the vulnerability or sensitivity of prices to the surprise). In many financial and macro variables volatility responds asymmetrically to past negative and positive return shocks, with negative returns resulting in larger future volatilities i.e. leverage effect (Jan 2005). The presence of leverage effects can be tested by the hypothesis that $\gamma < 0$ otherwise the impact is asymmetric if $\gamma \neq 0$.

3.6 Determinants of Exchange Rate

Exchange rate as a policy instrument plays an important role in macroeconomic policies. The systematic patterns of exchange rate behavior are explained by many theories before 1970's (during the dominance of gold standard) exchange rate was considered financial asset affected mainly by the balance of payment and flows of international reserves. This monetary approach MA assumes that the exchange rate for any two currencies is determined by relative money demand and money supply between the two countries. Relative supplies of domestic and foreign bonds are unimportant (domestic and foreign bonds are perfect substitutes). Monetary policymakers found that exchange rates were influenced by changes in monetary policy. The rise of the home interest rate is usually followed by the appreciation of the home currency, and a fall in the home interest rate is followed by a depreciation of the home currency. This indicates that the price of assets plays a role in exchange rate variations. The theory also has two forms: covered interest rate parity (CIRP) and uncovered interest rate parity (UCIRP).

CIRP describes the relationship of the spot market and forward market exchange rates with interest rates on bonds in two economies.

UCIRP describes the relationship of the spot and expected exchange rate with nominal interest rates on bonds in two economies. i.e. equates the difference between the internal rate of interest and the external one to the difference between current exchange rate and long-run exchange rate i.e. $r - r^* = \phi(e - e^*)$, where r is the internal rate of interest, r^* is the external rate of interest, ϕ is an adjustment factor, e is the current exchange rate, and e^* is the expected exchange rate. PPP and CIRP (and UCIRP) only express forms of partial equilibriums and do not clearly relate producer behavior and consumer behavior.

The portfolio-balance approach PB allows relative bond supplies and demands as well as relative money-market conditions to determine the exchange rate (domestic and foreign bonds are imperfect substitutes). In the basic floating exchange rate MA equation equates the percentage change in the exchange rate, to sum of foreign inflation rate and percentage change in domestic income, minus the percentage change in domestic credit. PB equation equates the percentage change in the exchange rate, to sum of foreign inflation rate and percentage change in domestic income, and foreign bonds supplies minus domestic credit minus domestic bonds supplies.

Asset models for exchange rate determination could not make CAPM assumptions i.e. fixed stock of assets and there are many securities each of is small, since the supply of foreign currency and official government assets dominated in foreign currency not fixed, and there are only six currencies dominates 90% of world financial wealth Empirical work demonstrated that the nominal exchange rate is a function of both nominal variables (e.g. current and anticipated values of money supply and inflation) and real variables (e.g. real income and current account balance) (Richard 1983). Inconsistencies may arise between the exchange rate regime and other macroeconomic policy instruments. On the other hand theoretical and empirical studies have emphasized the pervasive effect that devaluation's may exert on output, even when they lead to an improvement in the trade balance. Two main regimes are usually followed i.e. the fixed peg and floating regime. Industrial countries followed managed floating exchange rate in the 1970's and 1980's in which the exchange rate is determined by market forces accompanied with frequent central bank intervention. By contrast, most of the developing countries set exchange rate as policy instrument through fixed peg and crawl over time. The former approach includes pegs

to a single currency and a basket of currencies. The latter has been against a single and basket of currencies following either discretionary or non-discretionary feedback rule.

Quantity Theory of Money specifies exchange rate as a function of the change in the stock of money (MS) or the velocity of circulation (V). An increase in money stock or velocity leads to a rise in domestic prices which in turn cause a considerable change in terms of trade since some countries stop buying the goods and services from the country. Foreign goods become cheaper which leads to capital outflow and a rise of the price of foreign currency. The rise in exchange causes a rise in the prices of foreign goods and services eventually leads to a reduction in the domestic price and more exports.

The theory of purchasing power parity PPP is also known as Inflation Theory of Exchange Rates. According to this theory the price of one good should be equal to the price of the same good in another country, exchanged at the current rate and this is known as Law of One Price. The PPP theory in Currency Exchange rate determination has two different versions: the absolute version and the relative version.

Absolute PPP theory first dealt with the price relationship of goods in different currencies. Very strong preconditions are required by this theory. According to the absolute version, the exchange rates are equal to the ratio of the two countries and general price levels, which is the weighted average of all goods produced in a country. However, this version can work only if two countries produce or consume the same goods. Also according to the Currency exchange theory with absolute version the transportation costs and trade barriers are insignificant. However, transportation costs are significant and always different across the globe. Also under this theory the brand names were disregarded. The absolute PPP is considered as a partial equilibrium theory and not the general one because it doesn't deal with the money markets and the balance international payments. The success of this theory depends on: (1) free trade without barriers (2) free movements of currency form one country to another (3) remittance and profits and dividends have been neglected and capital movement is minimal

Relative PPP was developed as a more general version of the absolute PPP. It describes the relationship of prices with the exchange rate different economies. It had been assumed that the transactional costs are related proportionately to price level in order to generate the relative PPP. According to the relative version, the percentage change in the currency exchange rate in a given time period should be equal to the difference between the change in the domestic and the foreign price level. The relative PPP has its shortcomings too because of the fact that the currency exchange rates move independently of the changes in the domestic prices and the foreign prices.

Sterilization refers to central banks offsetting international reserve flows to follow an independent monetary policy i.e. the central bank must be able to neutralize, or sterilize, any reserve flows induced by monetary policy if the policy is to achieve the central bank's money-supply goals. This is done by decreasing domestic credit by an amount equal to the growth of international reserves, thus keeping base money and the money supply constant.

Currency Substitution: it has been long argued that one of the advantages of flexible exchange rates is that countries become independent in terms of their ability to formulate domestic monetary policy. This independence of domestic policy under flexible exchange rates may be reduced if there is an international demand for monies. If currencies were perfect substitutes to money demanders, then all currencies would have to have the same inflation rates, or demand for the high-inflation currency would fall to zero perfectly substitutable monies indicates that demanders are indifferent between the use of one currency or another.

Balance of Trade: if balance-of-trade deficits are financed by depleting domestic stocks of foreign currency, and trade surpluses are associated with increases in domestic holdings of foreign money, we can see the role for the trade account. If the exchange rate adjusts so that the stocks of domestic and foreign money are willingly held, then the country with a trade surplus will be accumulating foreign currency. Spot exchange rates are affected by international trade flows and expectations concerning future trade flows.

The Role of News: The real world is characterized by unpredictable shocks or surprises. Then some unexpected event takes place, it is referred to as news. Since interest rates, prices, and incomes are often affected by news, it follows that exchange rates too will be affected by news. By definition, the exchange rate changes linked to news will be expected.

Market Microstructure: As news related to money supplies, trade balances, or fiscal policies is received by the market, exchange rates will change to reflect this news. Such news affects the entire economy and other prices change along with exchange rates. However, there is also a micro level, at which exchange rates are determined by interactions among traders. There also exists private information from which some traders know more than others about the current state of the market.

Mundell-Fleming model considers a small open economy exerts weak influence on the international economy

adopts floating the exchange rate regime in general equilibrium of goods and money market. Hence the exchange rate is determined by the competitiveness, internal and foreign interest rate.

Dornbush model postulates that the exchange rate is determined by interaction of output, money supply, internal interest rate, and foreign interest rate. The nominal exchange rate is a function of nominal variables current account balance, money stock, and general price level.

Theory of Discount Rate first defines discount rate as a deduction allowed on a financial obligation. It takes many forms the most important is the bank discount which may be regarded as an interest paid in advance. Weichsel says that a rise in discount rate of a country will lead to an increase in the interest rate, which in turn attract foreign capital and hence foreign demand for local currency and eventually raises the exchange rate. On the contrary, a reduction in discount at a time of high interest rates will lead to capital outflow, deficit in the balance of payments, and an increase in money supply. This theory depended on the experience of central banks that raise discount rate to improve the situation of local currency.

4. Empirical Evidence

Annex (1) shows results of unit root tests based on the ADF where the exchange rate and general price level are found to be stationary containing no intercept and trend, money supply is stationary with an intercept while current account balance is integrated of order one without intercept or trend. Annex (2) indicates the presence of four co integrating equations among these variables at 5% significance level i.e. Exchange rate (X), Money Supply (MS), General Price Level (P) or interchangeably Consumer Price Index (CPI), and Current Account Balance (CAB) which means that there is long-run relationship. Current Account Balance is used as a proxy for BOP for two reasons: first economic sanctions imposed on Sudan lowered the inflow of foreign capital, second BOP showed poor results. Due to the application of Islamic Laws in the Sudan interest rate is prohibited so it was dropped from the analysis.

4.1 EGARCH Estimation Output

Annex (6) presents: first the mean equation

$$\hat{X}_t = 0.0086CPI_t - 0.000156MS_t - 0.000003CAB_t + [AR = 0.75]$$

$$z - stat = 34.7 \; -22.29 \; -17.09 \; 20.5$$

Second the Variance equation

$$ln(\hat{\sigma}_t^2) = 2.12 + 3.67\left|\frac{(\sigma_t|\xi_{t-1})}{\sigma_{t-1}}\right| - 2.66707\frac{\xi_{t-1}}{\sigma_{t-1}} + 0.436ln(\sigma_{t-1}^2)$$

$$\text{z} - \text{stat} = \; 2.86 \; 2.84 \; -3.08 \; 3.98$$

$$R^2 = 0.985 \; \bar{R}^2 = 0.98 \; DW = 1.64 \; ARCH\big(F(Prob)\big) = 0.89 \; ARCH\big(\chi^2(Prob)\big) = 0.88$$

The estimated coefficients of the mean equation are highly significant. The sign of money supply, prices and current account are as expected. An increase in money supply leads to a rise in domestic prices which in turn cause a considerable change in terms of trade since some countries stop buying the goods and services from the country. Foreign goods become cheaper which leads to capital outflow and a rise of the price of foreign currency. Current account deficits are financed by depleting domestic stocks of foreign currency. The role of news is shown by the variance equation. The leverage effect term (-2.66), denoted as RES/SQR [GARCH](1) in the output, is negative and statistically different from zero, indicating the existence of the leverage effect (negative correlation between past returns and future volatility. As the past few years proves highly leveraged financial systems can have crises that increase the volatility of asset prices. If the previously constant volatility of A moves E toward zero, the leveraged entity must sell assets to deleverage. If prices on the asset are not perfectly elastic, the sale of the asset results in a further decline in asset prices which can trigger subsequent sales of the asset by the original entity or other highly leveraged entities that hold similar assets (i.e., trigger much higher volatility). Of course, it gets worse because not only does volatility grow under the influence of inelastic asset prices, but inelasticity increases as credit disappears from the overleveraged system. That is, no one has spare risk capital and asset prices become even more inelastic to create a deflationary cycle which triggers much higher volatility.

4.2 Discussion

The devaluation of the exchange rate in 1978 by 43% lead to a series of devaluations but the most influential was in 1992 by 496% which has had profound effects on major economic variables and triggered large fluctuation and depreciation of the exchange rate. As said before exchange rate is treated as a risk. It is well known that about 80% of manufacturing inputs are imported; the same is true for the input of agriculture and other productive sectors. The

mean ratios of total imports to total exports in the period before ELP and the period after are 206% and 219% respectively which means a loss of potential foreign currency earnings and in turn a cause for depreciating the exchange rate. Descriptive statistics in Annex (1) and (2) show sharp increase in the means, medians and standard deviation of exchange rate, money supply, general price level, consumer price index and current account balance respectively from the pre ELP period to the period after. Inflation has been rising continuously specially in the period after to reach the height of 160% increases the costs of exports and decreases their competitiveness and flow of foreign currency. Besides economic sanctions there are inherited problem of the external debt that caused by the failure of development projects and the prevalence of public expenditure on consumption rather than production. Drought and famine, civil wars in the southern, eastern and western Sudan and economic embargo aggravated the situation and depleted the meager stock of foreign currency causing excess demand for foreign currency and hence more devaluations. To set an optimal exchange rate was the goal of the consecutive governments and to attain that goal many policies were formulated and applied but ended in a continuous depreciation and volatility of the Sudanese pound. There is a possibility of a simultaneous feedback relationship between exchange rate and uncertainty. The main determinants of the exchange rate are money supply, current account balance and prices. News related to money supplies, trade balances, or fiscal policies is received by the market; exchange rates will change to reflect this news as apparent in empirical evidence. The money supply as an indicator of monetary policy with its various tools and components can be used to stabilize foreign exchange market. For instance the domestic credit is an effective tool for sterilization .An increase in money stock leads to a rise in domestic prices which in turn cause a considerable change in terms of trade since some countries stop buying the goods and services from the Sudan. Current Account was negative all along the period of study which means an increasing demand for foreign currency and a reduction of external value of local currency. Since 1996 the government was concentrating in producing oil, so it imported the required equipments and inputs which widen the external gap coupled with negative effects of liberalization policies on agricultural production knowing that 90% of Sudan exports are agricultural products. Moreover, manufacturing sector is based mainly on agro-industries, it was affected too. Oil cake and edible oil have been exported mainly to Europe were affected by the adverse relations and ineffective economic polices. To reverse the sign the government should adopt different reform policies.

5. Conclusion

The main characteristic of the foreign exchange market of Sudan at present is its permanent leaning towards instability. This can be traced from the start of the year 1978. The failure of the consecutive governments to set a realistic exchange rate had negative effects on major economic variable for instance the inflation, and unemployment rates reached a height of 160% and 19% respectively. EGARCH model was used to estimate exchange rate volatility, the mean equations were found to be determined by consumer price index (CPI), money stock and current account balance. So the conditional variance (risk) indicates the existence of the leverage effect in future exchange returns during the sample period.

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Annex 1. Descriptive Statistics

1979 – 1991	X	P	MS	CAB	CPI
Mean	3.376923	939.5521	12010.87	-1635.285	688.6000
Median	2.500000	316.3725	5274.000	-1282.800	254.1000
Maximum	15.10000	5028.664	52696.00	-190.3000	3913.400
Minimum	0.500000	69.99107	936.5100	-7397.800	50.70000
Std. Dev.	3.869142	1411.197	15376.54	1853.754	1088.401
Skewness	2.284723	2.123808	1.659772	-2.511953	2.251967
Kurtosis	7.704201	6.566895	4.791789	8.512646	7.099781
Jarque-Bera	23.29673	16.66437	7.707851	30.13232	20.09238
Probability	0.000009	0.000241	0.021196	0.000000	0.000043

Annex 2. Descriptive statistics

	X	MS	CPI	CUR
Mean	1893.239	7794054.	335773.5	-1679879.
Median	2248.000	3533975.	351715.0	-1209924.
Maximum	2637.000	28314500	738046.1	571000.0
Minimum	132.0000	141595.0	8581.800	-7537000.
Std. Dev.	897.4950	8889129.	224288.2	2123218.
Skewness	-1.071228	1.069171	0.040705	-1.766046
Kurtosis	2.571183	2.792854	1.988072	5.270023
Jarque-Bera	3.580502	3.461563	0.772969	13.22151
Probability	0.166918	0.177146	0.679441	0.001346

Annex 3. Unit Roots Test

General Price Level (none) I(0)			
ADF Test Statistic	1.815114	1% Critical Value*	-2.6522
		5% Critical Value	-1.954
		10% Critical Value	-1.6223
Consumer Price Index I(1)			
ADF Test Statistic	1.873423	1% Critical Value*	-3.6289
		5% Critical Value	-2.9472
		10% Critical Value	-2.6118
Money Supply (intercept) I(0)			
ADF Test Statistic	3.9537	1% Critical Value*	-3.6959
		5% Critical Value	-2.975
		10% Critical Value	-2.6265
Exchange Rate (none) I(0)			
ADF Test Statistic	2.012518	1% Critical Value*	-2.6486
		5% Critical Value	-1.9535
		10% Critical Value	-1.6221
Current Account Balance (none) I(1)			
ADF Test Statistic	-1.82024	1% Critical Value*	-2.6649
		5% Critical Value	-1.9559
		10% Critical Value	-1.6231

Annex 4. Devaluation of Official and Free Rate

Month/Year	Official	Devaluation rate	Free	Devaluation rate	free/Official	Duration
Sep-78	0.5	43%	0.8	129%	160%	
Mar-83	1.3	160%	1.8	125%	138%	54
Oct-84	1.3	0%	2.1	17%	162%	18
Feb-85	2.5	92%	3.03	44%	121%	4
Mar-86	2.5	0%	4.1	35%	164%	12
Oct-87	4.5	80%	12.3	200%	273%	18
Oct-91	15.1	236%	30.3	146%	201%	12
Feb-92	90	496%	90	197%	100%	4
Dec-92	216	140%	333	270%	154%	22
Mar-94	216	0%	404	21%	187%	17

Annex 5. Co integration Results

Date: 06/30/12 Time: 22:55

Sample: 1978 2010

Included observations: 32

Test assumption: Linear deterministic trend in the data

Series: X MS CPI CUR

Lags interval: 1 to 1

Eigen value	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.799592	113.9517	47.21	54.46	None **
0.677705	62.51482	29.68	35.65	At most 1 **
0.533736	26.28161	15.41	20.04	At most 2 **
0.056631	1.865521	3.76	6.65	At most 3

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

L.R. test indicates 3 cointegrating equation(s) at 5% significance level

Annex 6. EGARCH Output

Dependent Variable: X				
Method: ML – ARCH				
Date: 06/30/12 Time: 21:52				
Sample(adjusted): 1978 2009				
Included observations: 32 after adjusting endpoints				
Convergence achieved after 23 iterations				
	Coefficient	Std. Error	z-Statistic	Prob.
MS	-0.000165	7.41E-06	-22.28574	0.0000
CPI	0.008594	0.000247	34.73906	0.0000
CUR	-3.78E-05	2.21E-06	-17.08565	0.0000
AR(1)	0.749184	0.036548	20.49880	0.0000
Variance Equation				
C	2.120171	0.741013	2.861179	0.0042
|RES|/SQR[GARCH](1)	3.669384	1.290521	2.843335	0.0045
RES/SQR[GARCH](1)	-2.655470	0.861560	-3.082164	0.0021
EGARCH(1)	0.435693	0.109415	3.982035	0.0001
R-squared	0.985071	Mean dependent var		1066.331
Adjusted R-squared	0.980716	S.D. dependent var		1161.564
S.E. of regression	161.3013	Akaike info criterion		10.47309
Sum squared resid	624434.6	Schwarz criterion		10.83953
Log likelihood	-159.5695	Durbin-Watson stat		1.640248
Inverted AR Roots	.75			

Annex 7. ARCH Test

ARCH Test:			
F-statistic	0.019758	Probability	0.889187
Obs*R-squared	0.021106	Probability	0.884490

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Modelling Volatility of the BDT/USD Exchange Rate with GARCH Model

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Abstract

The key objective of the study is to explore the application of GARCH type models, like GARCH; EGARCH; TARCH; and PARCH; when applied to task for modelling the BDT/USD exchange rate using the daily foreign exchange rate series fixed up by Bangladesh Bank. This study is conducted by benchmarking their results with AR and ARMA models.The BDT/USD time series from July 03, 2006 to April 30, 2012 are used for the study purpose out of which in-sample and out-of-sample date set cover from July 03, 2006 to May 13, 2010 and May 14, 2010 to April 30, 2012 respectively.The major finding of this study is that all GARCH type models demonstrate that past volatility of exchange rate significantly influence current volatility. Both the AR and ARMA models are found as the best model as per in-sample statistical performance results, whereas according to out-of-sample, GARCH model is the best model with transaction costs. Moreover, Both the ARMA and AR models are nominated as the best model as per in-sample statistical performance results, whereas according to out-of-sample, the TARCH model is nominated as the best model without transaction costs. The EGARCH and TARCH models outperform all the other models as per to in-sample and out-of-sample trading performance outcomes respectively including transaction costs.

Keywords: exchange rate, GARCH, EGARCH, TARCH, PARCH, volatility

1. Introduction

Volatility of exchange rate can be defined as the variation of price at which two different countries currencies are traded. Volatility models are important to the policy makers, since they use to observe the effect of economic factors on foreign exchange rate as well as to formulate the policies related to the money supply in the economy and the policies associated with the government expenditures and incomes. Corporate policy formulators also employ exchange rate variation models as instruments for constructing portfolio, risk management as well as an input for derivate assets pricing. International transactions oriented countries call attention to more emphasis on the foreign exchange rate variation in formulating various economic policies since their economic growth is affected by the foreign exchange dealings significantly (Kamal et al.,2012). From the view point of extent of government control on exchange rates, foreign exchange rates system may be either fixed foreign exchange rate, freely floating foreign exchange rate, managed floating, or pegged foreign exchange rate system. Fixed foreign exchange rate system is either remains stable or permitted to be changed merely in slight range; market forces solely determine the foreign exchange rate in freely floating foreign exchange rate system; in managed float foreign exchange rate system, foreign exchange rates are permittedto be changedwithout restraint on regular basis and there are no official limitations; whereas the local currency value is attachedwith the foreign currency, and changes in the direction of that currency against other currencies in pegged exchange rate system(Madhura, 2006). Taylor (2005) mentions that foreign exchange rate volatility inputs are helpful in certain financial decisions associated with portfolio optimization, hedging, risk management, pricing of financial derivatives. Kemal (2005) states that foreign exchange rate volatility influences the long-term decision unfavorably by thrilling the volume of worldwide marketing and decisions to allocate resources for investment, and government's sales and procurement policies. Sengupta (2002) states that foreign exchange market has no geographical boundaries and it opens round the clock. There is an inverse relationship between an investor's

confidence to make investment in a specific country and high volatilities in the foreign exchange rate. For this reason, volatility models are applied for explaining the stable and vital instances of variation in foreign exchange rate.

Modelling volatility of the foreign exchange rate plays an important role in case of portfolio choice, risk management and pricing of assets (Hooper et al., 2009).The present study may be the first initiations in Bangladesh to measure the volatility of BDT/USD exchange rate. Modelling of the volatility of BDT against USD is in fact crucial and important to many diverse groups, like market participants and decision makers. The outcomes of this study render all of the mentioned rationales. The main motive of the study is to estimate the time varying variation in the BDT/USD exchange rate with GARCH type models.

2. Literature Review

Modelling and forecasting foreign exchange rate has a lot of realistic application in the field of economics and finance along with extensive discussion in the literature. The basic ARCH/GARCH models are recurrently used and quoted to explain the volatility in financial markets, like, stock exchanges and foreign exchange markets (Kamal et al., 2011).

Mckenzie& Mitchell (2002) state that the GARCH (1,1) model is preferred in case of symmetric reactions to the improvement of market.. Ellahi (2011) empirically investigates and finds that exchange rate volatility has negative impact on FDI inflow in short run while this impact is positive in the long run. And also finds that adjustment and liberalization program has favorable outcomes in the short run for Pakistan. Hasan (2005) mentions that the real exchange rate volatility has a significant negative impact on real exports.Ngouana (2012) observes that the nominal effective exchange rate of the union was twice as volatile under the hard peg to the euro as it would have been under a hypothetical basket peg over the past decade, driven by the substantial shifts that occurred in WAEMU trade patterns—away from euro area countries and toward the “BICs” (Brazil, India, and China). Balg& Metcalf (2010*)* reveals that the volatility of the money supply is a unique determinant in variation of foreign exchange rate. So et al. (1999) conducts a study by highlighting the ARV model as a substitute of GARCH model for forecasting exchange rate volatility and finds that the ARV method gives a noteworthy development in this regard. The outstanding performance seems to be related to the "volatility of volatility', i.e. the volatility changes from day to day.Narayan et al. (2009) conducts a study by using EGARCH and find thatforeign exchange rate volatility is positively affected by conditional shock’s evidence. Chong et al. (2004) conducts a research with GARCH model and find that the RM/Sterling exchange rate’s volatility is constant and refuse stable variance model sample. The Q statistic as well as LM tests recommends that long memory GARCH models are supposed to be applied as a replacement for a short-range memory as well as high order ARCH model. Neely & Weller (2009) state that models are inconsistent marginal edge over the genetic program as perMSE and R^2 and the genetic program constantly generatesless MAE at all spheres. Kun (2011) conducts a study on modelling volatility of S&P 500 Index to make comparison between models based forecast and implied volatility and investigated the predictability or model based forecast and the VIX index on forecasting future volatility of S&P 500 index daily returns by using a variety of time series models, including random walk model, GARCH, GJR, and, EGARCH. He finds thatencompassing regression in favor of squared return shocks recommended that the joint use of GJR (1, 1) and RiskMetrics were produced the finest forecasts and also investigated that the implied volatility is inferior for future volatility forecasting, and the model based forecasts have more explanatory power for future volatility.Minkah (2007) reveals that precise forecasting of volatility is indispensable in favor of asset as well as derivative pricing models.Kamal et al. (2011) conducts a study in order to examine the performance of GARCH model including symmetric GARCH-M, asymmetric EGARCH and TARCH models in forecasting the vitality of Pakistani foreign exchange market by using daily foreign exchange rates. The outcomes of the study are the first order autoregressive behavior of the FOREX rate is evidenced in GARCH-M and E-GARCH models, whereas the GARCH-M model supports that previous day foreign exchange rate is affected the current day exchange rate. They also find that the EGARCH-based evaluation of FOREX rates show asymmetric behavior of volatility, where TARCH model shows insignificance but detailed exploratory analysis of the FOREX rate behavior requires prolonged study by applying advance models.

3. Methodology

3.1 Data

The study is based only the secondary data. The required data,the BDT/USD exchange rate,is collected from data base Reuters Xtra 3000. The study period is from July 03, 2006 to April 30, 2012 which comprise 1513 trading days.The total data set is broken – down into in-sample and out-of-sample data set. The in-sample data set covers

from July 03, 2006 to May 13, 2010, includes 1009 observations, whereas out-of-sample covers from May 14, 2010 to April 30, 2012 and contains 504 observations.

3.2 Jarque-Bera Statistics

Jarque-Bera statistics is used to test the non-normality of the BDT/USD exchange rate.

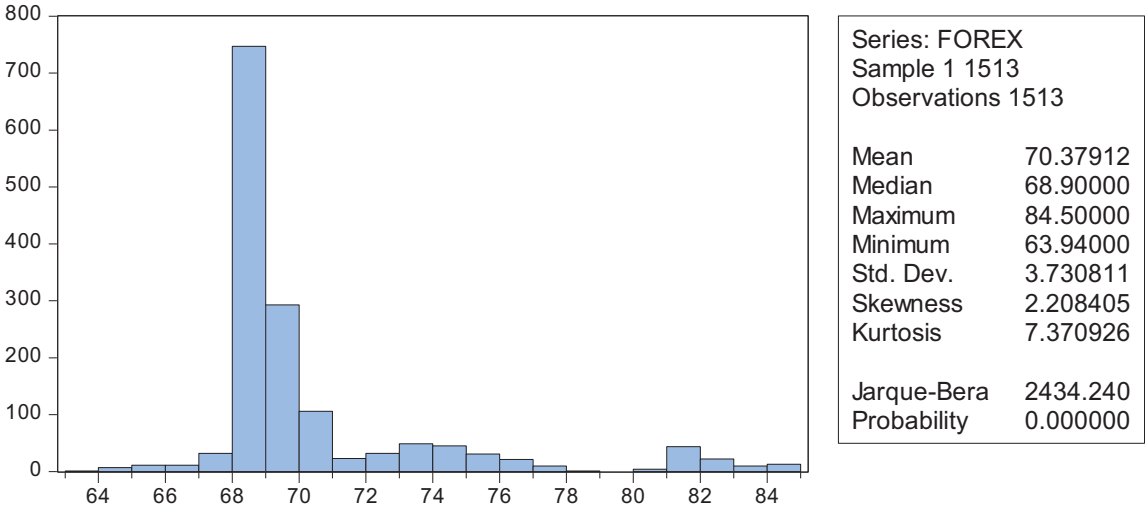

Figure 1. BDT/USD Exchange Rate Summary Statistics

Figure 1 depicts that the positive skewness is 2.208405 and a high positive kurtosis is 7.370926. According to the Jarque-Bera statistics, the BDT/USD exchange rate return is non-normal at 99% confidence interval, since probability is 0.0000 which is less than 0.01. So, it is required to convert the BDT/USD exchange rate series into the return series.

3.3 Transformation of the BDT/USD Exchange Rate Series

Generally, the movements of the foreign exchange rates are usuallynon-stationary as well as quite random and not suitable for the study purpose. The series of BDT/USD exchange rates is converted into returns by using the following equation:

$$R_t = \frac{P_t}{P_{t-1}} - 1 \quad (1)$$

Where,

R_t = return at time t

P_t = exchange rate at time t

P_{t-1} =exchange rate just preceding of the time t

3.4 ADF Test andPP Test

ADF test as well as PP test are used to get confirmation regarding whether BDT/USD exchange rates return series is stationary or not.

Table 1.BDT/USD Exchange Rate Returns ADF TEST

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-24.92981	0.0000
	1% level	-3.964137	
	5% level	-3.412791	
Test critical values:	10% level	-3.128375	

*MacKinnon (1996) one-sided p-values.

Table 1 presents the findings of ADF test and formally confirms that the BDT/USD exchange rate returns series is stationary, since the values of ADF test statistic, -24.92981, is less than its test critical value,-3.964137, at the level of significance of 1%.

Table 2. BDT/USD Exchange Rate Returns PP Test

		Adj. t-Stat	Prob.*
Augmented Dickey-Fuller test statistic		-53.21143	0.0000
	1% level	-3.964125	
	5% level	-3.412785	
Test critical values:	10% level	-3.128372	

*MacKinnon (1996) one-sided p-values.

Table 2 demonstrates the findings of the PP test and properly proves that the BDT/USD exchange rate returns series is stationary, since the values of PP test statistic, -53.21143, less than its test critical value, -3.964125, at the level of significance of 1%. Therefore, it can be mentioned that the BDT/USD exchange rates returns series is stationary as per both the ADF test as well as PP test.

3.5 Summary Statistics of the BDT/USD Exchange Rate Returns

Summary statistics of the BDT/USD exchange rate returns is used to test whether BDT/USD exchange rate returns series is non-normal at 99% confidence level or not.

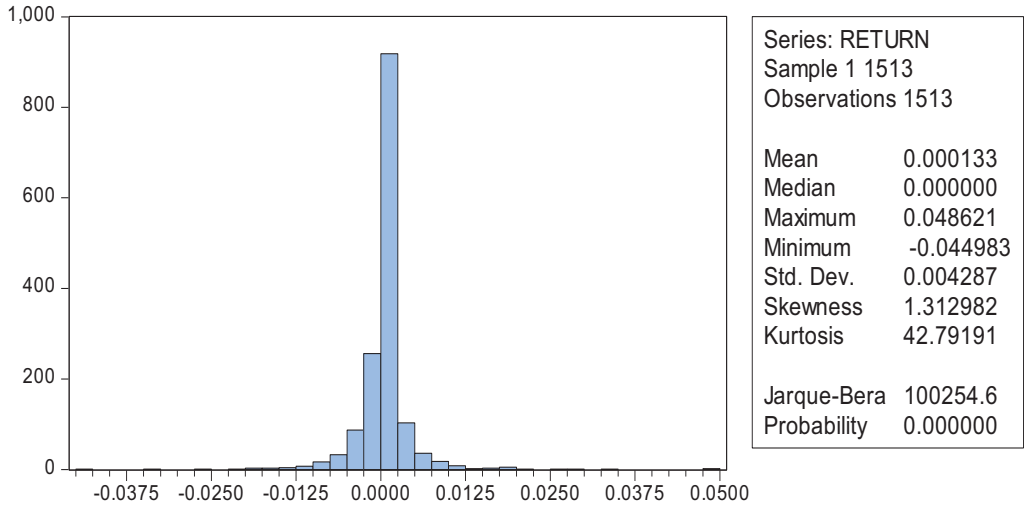

Figure 2. BDT/USD Exchange Rates Returns Summary Statistics

Figure 2 further discloses a slight positive skewness which is 1.312982 and a higher positive kurtosis which is 42.79191. According to the Jarque-Bera statistics, the BDT/USD returns series is non-normal at the confidence interval of 99%, since probability is 0.0000 which is less than 0.01.

3.6 Specification of the Model

3.6.1 Benchmark Models

GARCH, EGARCH, PARCH and TARCH models are benchmarked with an autoregressive (AR) model, and an autoregressive moving average (ARMA) model in the study.

3.6.1.1 AR Model

According to AR model,forecasting is a function of previous values ofatime series (Hanke&Wichern, 2009) and it takes the following equation:

$$y_t = \mu + \varphi_1 y_{t-1} + \varphi_2 y_{t-2} + \cdots + \varphi_p y_{t-p} + u_t \quad (2)$$

3.6.1.2 ARMA Model

This model indicates that the present value of a time series depends upon it past values (Sermpinis, Dunis and Laws, 2010).This model takes the following equation:

$$Yt = \varphi_0 + \varphi_1 Y_{t-1} + \varphi_2 Y_{t-2} + \cdots + \varphi_p Y_{t-p} + \varepsilon_t - w_1\varepsilon_{t-1} - w_2\varepsilon_{t-2} - \cdots - w_q\varepsilon_{t-q} \quad (3)$$

3.6.2 GARCH Model

Bollerslev (1986) & Taylor (1986) develops GARCH model independently and this model permits the conditional variance to be dependent upon previous own lags, and GARCH (1,1) takes the following equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta\sigma_{t-1}^2 \quad (4)$$

σ_t^2 is the conditional variance and this model can interpret the current fitted variance, *ht,* as a weighted function of a long-term average value which is dependent on α_0, information about volatility during the previous period$\alpha_1 u_{t-1}^2$and the fitted variance from the model during the previous period , $\beta\sigma_{t-1}^2$,(Brooks, 2008).

3.6.3 PARCH Model

The PARCH model is an extension of GARCH with an extra term added to account for possible asymmetries and it takes the following form:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma u_{t-1}^2 I_{t-1} \quad (5)$$

3.6.4 EGARCH Model

Nelson (1991) develops exponential GARCH (EGARCH) model. The conditional variance equation can be expressed in the following way:

$$\ln\sigma_t^2 = \omega + \beta \ln\sigma_{t-1}^2 + \gamma\frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha\left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}}\right] \quad (6)$$

This model more advantageous compared to the pure GARCH specification. Firstly, as the $\log(\sigma_t^2)$is modeled, then even if the parameters are negative, σ_t^2 would be positive. Therefore, artificially imposition of non-negativity constraints on the model parameters is not required. Secondly, asymmetries are allowed for under the EGARCH formulation, as if the association between volatility and returns is negative, γ, will be negative ((Brooks, 2008).

3.6.5 TARCH Model

Zakoïan (1994) &Glosten et al. (1993) use the TARCH model with an intention of independence than for the asymmetric effect of the "news". The TARCH takes the following form:

$$\sigma_t^2 = \omega + \sum_{j=1}^{p}\beta_j\,\sigma_{t-j}^2 + \sum_{i=1}^{q}\alpha_i\,u_{t-i}^2 + \sum_{k=1}^{r}\gamma_k\,u_{t-k}^2\overline{I_{t-k}} \quad (7)$$

3.7 Statistical and Trading Performance of the Model

3.7.1 Measures of the Statistical Performance of the Model

The statistical performance measures are, namely mean absolute error (MAE); mean absolute percentage error (MAPE); root mean squared error (RMSE); and theil-u, arecalculated to indentify the best model in case of in-sample as well as the out-of-sample case individually in this study. Lower the values of RMSE, MAE, MAPE and Theil-U better the forecasting accuracy of a given model.

3.7.2 Measures of the Trading Performance of the Model

The trading performance measures, like annualized return (R^A); annualized volatility(σ^A); information ratio (SR); and maximum drawdown (MD),are used to select the best model. That model's trading performance would be the best whose annualized return, cumulative return, ratio information is the highest, and on the other hand whose annualized volatility and maximum drawdown would be the lowest.

3.8 Transaction Cost

In this study, the transaction cost is 2 spread per round trip. The trading performance measures are used to select the best model with transaction cost in the in-sample case and the out-of-sample case individually in this study.

4. Empirical Results

4.1 AR(1) Model

The table below shows the output of the AR (1) BDT/USD returns estimation:

Table 3. Output of the AR (1) BDT/USD Returns Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000029	0.000107	0.271749	0.7859
AR(1)	-0.283417	0.030235	-9.373657	0.0000

The estimated AR (1) model takes the following form:

$$R_t = 0.000029 - 0.283663R_{t-1} \quad (8)$$

The coefficient (with the exception of the constant) of the estimated AR (1) is significant at the confidence interval of 95%, since the probability of its coefficient (except the constant) is less than 0.05.

4.2 ARMA (1, 1) Model

The following table shows output ofARMA (1,1) BDT/USD returns estimation:

Table 4. ARMA (1,1) BDT/USD Returns Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0000178	0.0000823	0.216817	0.8284
AR(1)	0.185505	0.086423	2.146480	0.0321
MA(1)	-0.505836	0.075954	-6.659750	0.0000

The estimated ARMA (1,1)model is as follows:

$$R_t = 0.0000178 + 0.185505Y_{t-1} - 0.505836Y_{t-2} \quad (9)$$

The all coefficients (with the exception of constant) of the estimated ARMA (1, 1) model are statistically significant at 95% confidence interval, since the probability of its each coefficient (except the constant) is less than 0.05.

4.3 GARCH Model

Table 5. Output of GARCH Model Estimation

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.0000826	0.0000248	3.331119	0.0009
		Variance Equation		
C	0.000000347	0.0000000166	20.82415	0.0000
RESID(-1)^2	0.266450	0.012782	20.84645	0.0000
GARCH(-1)	0.748788	0.008688	86.18310	0.0000

Table 5 reveals that in the mean equation, the constant C is also significant at 1% since its probability is less than 0.01. In the variance equation, the coefficient of the terms, RESID(-1)^2 is significant at 1% in the GARCH model showing that the volatility of risk is affected, significantly, by past square residual terms. The GARCH(-1) is also significant at 1% level, which shows that past volatility of exchange rate is significantly, influencing current volatility.

4.4 TARCH Model

Table 6. Output of TARCH Model Estimation

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.0000504	0.0000296	1.704388	0.0883
		Variance Equation		
C	0.000000345	0.0000000161	21.36237	0.0000
RESID(-1)^2	0.176019	0.016684	10.55046	0.0000
RESID(-1)^2*(RESID(-1)<0)	0.207446	0.030388	6.826507	0.0000
GARCH(-1)	0.748205	0.008476	88.27506	0.0000

Table 6 depicts that in the mean equation, the constant C is not significant at 1% since its probability is greater than 0.01, whereas in the variance equation, the constant C is significant at 1% since its probability is less than 0.01. In the variance equation, all the coefficients of the terms, RESID(-1)^2, RESID(-1)^2*(RESID(-1)<0), and GARCH(-1), are statistically significant at 1% in the TARCH model, since their probabilities are less than 0.01 which indicates that past volatility of exchange rate is significantly, influencing current volatility.

4.5 PARCH Model

Table 7. Output of PARCH Model Estimation

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	5.14E-05	3.07E-05	1.674610	0.0940
		Variance Equation		
C(4)	1.05E-08	1.23E-08	0.856799	0.3916
C(5)	0.269774	0.017487	15.42752	0.0000
C(6)	0.191263	0.025298	7.560265	0.0000
C(7)	0.708489	0.015815	44.79890	0.0000
C(8)	2.559976	0.183877	13.92225	0.0000

Table 7 depicts that both in the mean as well as variance equations, the constant C is not significant at 1% since their probabilities are greater than 0.01. In the variance equation, all the coefficients of the terms, (ABS(RESID(-1)),RESID(-1))^C(6), and @SQRT(GARCH(-1))^C(8)are statistically significant at 1% in the PARCH model, since their probabilities are less than 0.01 which indicates that past volatility of exchange rate is significantly, influencing current volatility.

4.6 EGARCH Model

Table 8. Output of EGARCH Model Estimation

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000182	0.000016	11.36593	0.0000
		Variance Equation		
C(4)	-0.976753	0.043536	-22.43573	0.0000
C(5)	0.425092	0.013219	32.15794	0.0000
C(6)	-0.049511	0.013178	-3.757123	0.0002
C(7)	0.940384	0.003327	282.6224	0.0000

Table 8 reveals that both in the mean as well as variance equations, the constant C is significant at 1% since their probabilities are less than 0.01. In the variance equation, all the coefficients of the terms, ABS(RESID(-1)/@SQRT(GARCH(-1))), RESID(-1)/@SQRT(GARCH(-1)), and LOG(GARCH(-1)) are statistically significant at 1% in the EGARCH model, since their probabilities are less than 0.01 which indicates that past volatility of exchange rate is significantly, influencing current volatility. The EGARCH variance equation also indicates that there exists the asymmetric behavior in volatility, which means that positive shocks are effecting, differently, than the negative on volatility.

4.7 Statistical Performance

4.7.1 In -Sample Statistical Performance

Table 9. In -Sample Statistical Performance Results

Particulars	Model					
	AR	ARMA	GARCH	EGARCH	PARCH	TARCH
Mean Absolute Error	0.0024	0.0024	0.0026	0.0026	0.0025	0.0025
Mean Absolute Percentage Error	67.43%	69.32%	73.35%	76.60%	70.99%	71.23%
Root Mean Squared Error	0.0057	0.0057	0.0059	0.0059	0.0058	0.0058
Theil's Inequality Coefficient	0.9817	0.9599	0.9623	0.9609	0.9706	0.9695

Table 9 reveals that both the AR and ARMA models have the same and the lowest mean absolute error (MAE) at 0.0024, whereas AR has the lowest MAPE at 67.43%. Both the AR and ARMA models have the same and the lowest root mean squared error (RMSE) at 0.0057, whereas the ARMA model has the lowest theil's inequality coefficient at 0.7058.It is complex to select the best performing model on the basis of these results, since both the AR and ARMAmodels are nominated as the best model three times, the GARCH modelisnominated as the best model once, whereas the EGARCH, PARCH and TARCH are nominated not a single time.

4.7.2 Out – Of- Sample Statistical Performance

Table 10. Out –of - Sample Statistical Performance Result

Particulars	Model					
	AR	ARMA	GARCH	EGARCH	PARCH	TARCH
Mean Absolute Error	0.0008	0.0008	0.0008	0.0012	0.0009	0.0008
Mean Absolute Percentage Error	33.83%	37.16%	36.97%	57.90%	42.40%	36.02%
Root Mean Squared Error	0.0019	0.0018	0.0018	0.0027	0.0021	0.0018
Theil's Inequality Coefficient	0.7391	0.7191	0.6935	0.7050	0.7799	0.7061

Table 10 depicts that all models have the lowest mean absolute error (MAE) at 0.0008, except the EGRACH and PARCH models, whereas AR model has the lowest MAPE at 33.83%. The ARMA, GARCH, and TARCH models have the same and the lowest root mean squared error (RMSE) at 0.0018, whereas the GARCH model has the minimum theil's inequality coefficient at 0.6935.The GARCH model is selected as the best performing model on the basis of these results, since this model is nominated as the best model three times, whereas the EGARCH and PARCH models are nominated not a single time.

4.8 Trading Performance

4.8.1 In-Sample Trading Performance without Transaction Costs

Table 11. In- Sample Trading Performance Results without Transaction Costs

Particulars	Model					
	AR	ARMA	GARCH	EGARCH	PARCH	TARCH
Annualised Return	-45.27%	**-39.43%**	-40.54%	-39.52%	-41.90%	-41.34%
Annualised Volatility	**6.59%**	6.74%	6.71%	6.73%	6.68%	6.69%
Sharpe Ratio	-6.87	**-5.85**	-6.04	-5.87	-6.27	-6.18
Maximum Drawdown	**-181.66%**	-163.53%	-167.99%	-163.92%	-173.42%	-171.19%

Table 11 depicts that the ARMA model has the highest annualized return at 39.43%, whereas AR model has the lowest annualized volatility at 6.59%. The ARMA model has the highest Sharpe ratio at -5.85.The AR model has the minimum downside risk s measured by maximum drawdown at -181.66%. Therefore, both the ARMA and AR models might be selected as the best model, since they are nominated as the best models the highest times.

4.8.2 Out-Of-Sample Trading Performance without Transaction Costs

Table 12. Validation Trading Performance Results without Transaction Costs

Particulars	Model					
	AR	ARMA	GARCH	EGARCH	PARCH	TARCH
Annualised Return	14.03%	16.62%	19.42%	4.86%	-2.67%	**20.09%**
Annualised Volatility	5.93%	5.90%	5.87%	5.99%	5.99%	**5.86%**
Sharpe Ratio	2.37	2.82	3.31	0.81	-0.45	**3.43**
Maximum Drawdown	-4.76%	-3.52%	-3.55%	-4.43%	**-11.52%**	-3.48%

Table 12 depicts that the TARCH model has the highest annualized return, lowest annualized volatility, and highestat Sharpe ratio at 20.09%, 5.86%, and 3.43 respectively.The PARCH model has the lowest downside risk

as measured by maximum drawdown at -11.52%. Therefore, the TARCH model is selected as the best performing model on the basis of these results, since this model is nominated as the best model the maximum times.

4.8.3 In -Sample Trading Performance with Transaction Costs

The average BDT/USD exchange rate for the in-sample time period is 70.37912, therefore the transaction cost is 0.00028% per transaction.

Table 13. In-Sample Trading Performance Results with Transaction Costs

	Model					
Particulars	AR	ARMA	GARCH	EGARCH	PARCH	TARCH
Transaction Costs	0.110544	0.084116	92352	84864	102336	87584
Annualized Return	-56.32%	-47.84%	-49.41%	**-47.25%**	-51.22%	-50.49%

According to the table 13, it can be stated that after considering transaction costs in case of in-sample trading performance, the EGARCH model does better thanother models in respect of annualized return, since it has the highest annualized return (including transaction costs) at -47.25%.

4.8.4 Out –of- Sample Trading Performance with Transaction Costs

The average BDT/USD exchange rate during the period of out-of-sample is 68.56817641, so transaction costs are 0.00029%per transaction.

Table 14. Out –of- Sample Trading Performance with Transaction Costs

Particulars	Model					
	AR	ARMA	GARCH	EGARCH	PARCH	TARCH
Transaction Costs	0.0691	0.0414	0.0495	0.0317	0.0437	0.0525
Annualized Return	7.12%	12.48%	14.46%	1.68%	-7.05%	**14.84%**

Based onthe table 14, it can be mentioned that after considering transaction costs in case of out-of-sample trading performance, the TARCH model outperforms other models in the light of annualized return, since it has the highest annualized return (including transaction costs) at 14.84%.

5. Conclusion

GARCH, EGARCH, PARCH, and TARCH models are benchmarked with an AR model, and an ARMA model in the study. The data consisted of exchange rates of Bangladeshi Taka (BDT) against the U.S. Dollar (USD) for the period of July 03, 2006 to April 30, 2012.

Both the estimated AR and ARMAmodels showthat their coefficients (with the exception of the constants) aresignificant. GARCH model demonstrates that in the variance equation, the coefficient of the terms, RESID(-1)^2 and GARCH(-1) are significant which indicatethat the volatility of risk is affected, significantly, by past square residual terms andpast volatility of exchange rate is significantly, influencing current volatility respectively. TARCH model shows that in the variance equation, all the coefficients of the terms, RESID(-1)^2, RESID(-1)^2*(RESID(-1)<0), and GARCH(-1), are statistically significant which indicate that past volatility of exchange rate is significantly, influencing current volatility.TARCH model demonstrates thatinthe variance equation, all the coefficients of the terms, (ABS(RESID(-1)),RESID(-1))^C(6), and @SQRT(GARCH(-1))^C(8)are statistically significant which signify that past volatility of exchange rate is significantly, influencing current volatility. EGARCH model depicts that in the variance equation, all the coefficients of the terms, ABS(RESID(-1)/@SQRT(GARCH(-1))),RESID(-1)/@SQRT(GARCH(-1)),and LOG(GARCH(-1)) are statistically significant which indicatethat past volatility of exchange rate is significantly, influencing current volatility. Its variance equation also signifies that there exists the asymmetric behavior in volatility which means that positive shocks are effecting, differently, than the negative on volatility.

The in-sample statistical performance results select both the AR and ARMA models as the best performing model, whereas according to out-of sample statistical performance results, the GARCH model is the best performing model. Both the ARMA and AR models are selected as thebest model as per in –sample trading

performanceoutcomes, whereas, TARCH model is nominated as the best model according to out – of – sample trading performanceoutcomes without transaction costs. As per in-sample and out-of-sample trading performance outcomes, the EGARCH and TARCH models outperformother models respectively with transaction cost.

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Appendices

1. Statistical Performance Measures

$$\text{MAE} = \left(\frac{1}{n}\right) \sum_{\tau=1+t}^{t+n} \text{I}\, \widehat{\sigma_\tau} \; - \; \sigma_\tau \,\text{I} \qquad (1)$$

$$\text{RMSE} = \sqrt{\left(\frac{1}{n}\right)\sum_{\tau=t+1}^{t+n}(\hat{\sigma}_\tau - \sigma_\tau)^2} \quad (2)$$

$$\text{Theil-U} = \frac{\sqrt{\left(\frac{1}{n}\right)\sum_{\tau=t+1}^{t+n}(\hat{\sigma}_\tau - \sigma_\tau)}}{\sqrt{\frac{1}{n}\sum_{\tau=t+1}^{t+n}\widehat{\sigma_\tau^2}} + \sqrt{\frac{1}{n}\sum_{\tau=t+1}^{t+n}\sigma_\tau^2}} \quad (3)$$

2. Trading Performance Measure

$$R^A = 252 * \frac{1}{N}\sum_{t=1}^{N} R_t \quad (4)$$

$$R^C = \sum_{t=1}^{N} R_t \quad (5)$$

$$\sigma^A = \sqrt{252} * \sqrt{\frac{1}{N-1} * \sum_{t=1}^{N}(R_t - \bar{R})^2} \quad (6)$$

$$\text{SR} = \frac{R^A}{\sigma^A} \quad (7)$$

$$\text{MD} = \text{Min}_{i=1,\ldots,t;t=1,\ldots\ldots,N}\sum_{j=i}^{t} R_j) \quad (8)$$

3. Output of AR(1) Model

Dependent Variable: RETURN
Method: Least Squares
Date: 06/20/12Time: 02:33
Sample (adjusted): 2 1009
Included observations: 1008 after adjustments
Convergence achieved after 3 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.90E-05	0.000107	0.271749	0.7859
AR(1)	-0.283417	0.030235	-9.373657	0.0000

R-squared	0.080326	Mean dependent var	2.89E-05
Adjusted R-squared	0.079411	S.D. dependent var	0.004527
S.E. of regression	0.004344	Akaike info criterion	-8.038064
Sum squared resid	0.018983	Schwarz criterion	-8.028310
Log likelihood	4053.184	Hannan-Quinn criter.	-8.034358
F-statistic	87.86545	Durbin-Watson stat	2.019251
Prob(F-statistic)	0.000000		

Inverted AR Roots -.28

4. Output of ARMA(1,1) Model

Dependent Variable: RETURN
Method: Least Squares
Date: 06/20/12Time: 03:16
Sample (adjusted): 2 1009
Included observations: 1008 after adjustments
Convergence achieved after 6 iterations
MA Backcast: 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.78E-05	8.23E-05	0.216817	0.8284
AR(1)	0.185505	0.086423	2.146480	0.0321
MA(1)	-0.505836	0.075954	-6.659750	0.0000

R-squared	0.099718	Mean dependent var	2.89E-05
Adjusted R-squared	0.097926	S.D. dependent var	0.004527
S.E. of regression	0.004300	Akaike info criterion	-8.057391
Sum squared resid	0.018583	Schwarz criterion	-8.042761
Log likelihood	4063.925	Hannan-Quinn criter.	-8.051833
F-statistic	55.65839	Durbin-Watson stat	1.973798
Prob(F-statistic)	0.000000		

Inverted AR Roots	.19
Inverted MA Roots	.51

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Based on ECM Modelling for Daily Turnover and Close Index of Chinese Stock Markets

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Abstract

By making use of test for stationary, Granger, co-integration, we study the daily turnover and daily close index of Chinese stock markets from 1991 to 2011. We strive to find how Shanghai and Shenzhen stock markets interact each other, there really exist a long-run equilibrium equation among the daily close index,daily turnover of Shanghai (Shenzhen) market and daily close index of Shenzhen (Shanghai) market, to establish the two-order bivariate error correction model(ECM)for two Chinese stock markets respectively. We also further analyze the act of the fluctuation of daily close index of the two markets in short-term.

Keywords: turnover, close index, ECM, co-integration, Granger cause

1. Introducation

Shanghai stock market and Shenzhen stock market, both established in the early l990s, sometimes are affected by the western stock markets.Due to Chinese special financial policy, however the development tendency of two Chinese markets has its own character every day, that is when the index of one market goes up, the index of another market not necessarily goes up even goes down in their early period of development.The phenomena of “Shanghai market gets strong and Shenzhen market becomes weak",or vice versa occurred from time to time, one market’s development change is often different from another one’s every day, two stock markets are almost independent of each other.However,as time passes, the interaction between Shanghai stock market and Shenzhen stock market has been becoming more and more obvious. The phenomena of “Shanghai (Shenzhen) market strong and Shenzhen(Shanghai) market weak" is no longer the case nowadays. Two Chinese stock markets seemingly rise up or drop down almost at the same time,

The relation between business volume and price in stock market is of interests to the professional people.In general, increase in business amount causes index climing up, decline in business amount causes index down. There are a lot of literatures that research the relation between the close index and the turnover in the same market. For example,in the recent papers, ZHOU Xiao-yan(2012) studied the volume-price relation in Shenzhen Stock Market by using impulse response function and variance decomposition from 2003 to 2006. ZHAI Ai-mei&ZHOU Tong(2011) analyzed the volume-price relation in stockmarket from 2006 to 2010 by using Behavioral Finance. GUO Liang & ZHOU Weixing (2010) performed an empirical analysis of the volume-price relation in the Chinese stock market at microscopic level using high-frequency data from January to June 2006. TONG Menghua& WU Chengming (2009) studied the dynamic relation between volume and price in Shanghai stock market based on the CARR model from 1999 to 2007 etc.

These papers all have focused on the single stcoket market, they have not considered the interaction between two markets. Moreover, Sample data used in their research is limited, and the time range of sample data is finite. In this paper,we expand the time range of sample data from 1991 to 2011,and consider the interaction between two markets, by the use of mainly bivariate ECM to study the volume- price relation.We noticed that In Chinese stock markets, the index of one market is affected not only by its own turnover but also by another market index, but the index of one market is irrelevant with the turnover of another market, although the close index and turnover appears occurring in a random way every day. There likely exists a long-run equilibrium relation among the daily close index, daily turnover in same market and daily close index of another market. The question

arising is What is their relation in long-term? Furthermore, what does cause the fluctuation of the close index in one market in short-term? These problems are what we are concerned and what we intend to study in this paper, the answer to these problems are very important for investors in the stock markets. Hopefully the findings from this study provide investors some helpful advices to lower risk and improve return.

The reminder paper is organized as follows. Section 2 presents the method used in this paper. Section 3 presents the empirical analysis and modelling. The final section presents conclusions.

2. Methodology

There are lots of papers to introduce how to test the stationary of the variables using the Augmented Dickey-Fuller (ADF), how to test for causality from variable A to variable B (and variable B to variable A) using the Granger and how to test, provided the co-integration has been found, co-integration between variables using the Johansen (or others) technique. In this paper, we mainly introduce bivariate ECM.

Suppose that there is a long-run equilibrium relation among variables Y_t, X_t and Z_t as below

$$Y_t = \alpha_0 + \alpha_1 X_t + \alpha_2 Z_t + u_t \tag{1}$$

However, actually variable Y_t, X_t and Z_t seldom exist the long-run equilibrium relation at t moment.Let $ecm_t = \mu_t = Y_t - \alpha_0 - \alpha_1 X_t - \alpha_2 Z_t$, we then can establish multiple variables two-order error correction model (ECM) as below.

$$\Delta Y_t = \lambda evm_{t-1} + \beta_1 \Delta X_t + \beta_2 \Delta X_{t-1} + \gamma_1 \Delta Z_t + \gamma_2 \Delta Z_{t-1} + \varepsilon_t \tag{2}$$

Where ε_t is white-noise series,and $\alpha_0, \alpha_1, \alpha_2, \lambda, \beta_1, \beta_2, \gamma_1, \gamma_2$ are parameters to be estimated.

3. Empirical Analysis and Modelling

3.1 Data and Variables

The time range of sample data is from 3/4/1991 to 28/11/2011, hence the total size of sample data is 5043, Let $x_{1t}, x_{2t}(t = 1,2,...,5042)$ represent the daily close index, daily turnover of Shanghai market at the $t-th$ day respectively, whilist $y_{1t}, y_{2t}(t = 1,2,...,5042)$ be the daily close index,daily turnover of Shenzhen market at the $t-th$ day respectively. We also set $lx_{1t} = \ln x_{1t}, lx_{2t} = \ln x_{2t}, ly_{1t} = \ln y_{1t}, ly_{2t} = \ln y_{2t}$.

3.2 Test for Stationary and Granger

We find $lx_{it}, ly_{it}(i = 1,2)$ are not stationary by test for unit root, though they are stationary by one-difference, or, $lx_{it}, ly_{it}(i = 1,2)$ are $I(1)$,For $lx_{it}, ly_{it}(i = 1,2)$, according to "AIC",we take lags to include $k = 1$, then we tabulate the test for Granger in table 1 below.

Table 1. Test for Granger

Null	Hypothesis		Obs	F-Statistic	Prob.
Δlx_{2t}	does not Granger Cause	Δlx_{1t}	5040	1.64919	0.1991
Δlx_{1t}	does not Granger Cause	Δlx_{2t}		194.471	2.00E-43
Δly_{2t}	does not Granger Cause	Δly_{1t}		1.03545	0.3089
Δly_{1t}	does not Granger Cause	Δly_{2t}		257.246	2.00E-56
Δly_{1t}	does not Granger Cause	Δlx_{1t}		0.54933	0.4586
Δlx_{1t}	does not Granger Cause	Δly_{1t}		0.10067	0.751

Whether the significance level is 1%,5% or 10%, we accept Δlx_{2t} Granger causes Δlx_{1t}, Δly_{2t} Granger causes Δly_{1t} , Δlx_{1t} Granger causes Δly_{1t} , Δly_{1t} Granger causes Δlx_{1t}.

3.3 Test for Co-integration

We establish the regression equations as below

$$lx_{1t} = 0.11431lx_{2t} + 0.562769ly_{1t} + u_t \quad (3)$$

$$ly_{1t} = 0.060579ly_{2t} + 0.955076lx_{1t} + v_t \quad (4)$$

Where u_t, v_t are random errors, note in (3) R^2=0.917, D.W=0.047, in (4) R^2=0.871, D.W=0.010. We perform unit root test for u_t, then generate some results given in table 2 below

Table 2. Augmented Dickey-Fuller (ADF) test for u_t

			t-Statistic	Prob.
ADF			-5.13745	0.000
	1% level	Test critical values	-2.56542	
significance level	5%		-1.94089	
	10%		-1.61666	

In same way, we can perform unit root test for v_t, and obtain t-Statistic=-5.388414. It is not hard to see u_t $\sim$ $I(0)$, v_t $\sim$ $I(0)$. These observations show that there exists an co-integration relation among lx_{1t}, lx_{2t} and ly_{1t}, an co-integration relation among ly_{1t}, ly_{2t} and lx_{1t},from 3/4/1991 to 28/11/2011, where the co-integration vector are (1,-0.114310, -0.562769),(1,-0.060579, -0.955076), respectively.

3.4 Modeling for ECM

Now in turn, we consider the long-run equilibrium equation among the daily close index lx_{1t}, daily turnover lx_{2t} of Shanghai market and daily close index ly_{1t} of Shenzheng market. Firstly let's establish the equations as below

$$lx_{1t} = 0.54296 + 0.1179761lx_{2t} + 0.4873571ly_{1t} + u_t \quad (5)$$

$$ly_{1t} = 0.678149 + 0.064201ly_{2t} + 0.850619lx_{1t} + v_t \quad (6)$$

Notice that In (5), R^2=0.92, D.W=0.053, in (6), R^2=0.90, D.W=0.02, we take the residual series u_t, v_t to be the error correction term. Accordingly, we establish two-order Error Correction Model (ECM) for lx_{1t} and ly_{1t}, respectively.

$$\Delta lx_{1t} = -0.00761ecm_{t-1} + 0.0085\Delta lx_{2t} + 0.0023\Delta lx_{2t-1} + 0.691\Delta ly_{1t} - 0.0282\Delta ly_{1t-1} + \varepsilon_t \quad (7)$$

$$\Delta ly_{1t} = -0.0038ecm_{t-1} + 0.01\Delta ly_{2t} + 0.0023\Delta ly_{2t-1} + 0.551\Delta lx_{1t} + \varepsilon_t \quad (8)$$

Note In (7), R^2=0.43, D.W=1.983, but In (8), R^2=0.436, D.W=1.98, (7) and (8) show ε_t doesn't exist one-order autocorrelation, coefficient of Autocorrelation and Partial Correlation further show ε_t don't exist high-order autocorrelation..But it shows that the significance test for coefficients in (7), (8) and regression equation (7), (8) can pass whether the significance level is 1%,5% or10%.

4. Conclusion

By Test for stationary,Granger,co-integration, we find that there really exist the long-run equilibrium equation among the daily close index,daily turnover of Shanghai (Shenzhen) market and daily close index of Shenzhen (Shanghai) market.

In the long run, by (5), we noticed that x_{1t} will change 0.1179761% when x_{2t} changes 1% but y_{1t} keeps unchanged, while x_{1t} will change 0.4873571% when y_{1t} changes 1% but x_{2t} keeps unchanged; Similarily by

(6), y_{1t} will change 0.064201% when y_{2t} changes 1% but x_{1t} keeps unchanged, y_{1t} will change 0.850619% when x_{1t} changes 1% but y_{2t} keeps unchanged.

In the short run,by (7) and (8), the fluctuation of the close index of Shanghai(Shenzhen) stock market was caused by two factors.The first one was the effect of the close index deviating from long-run equilibrium.In particular the size of coefficient of term ecm_{t-1} reflects adjusting strength of deviating from long-run equilibrium, the estimation value of coefficient -0.00761(-0.0038) shows that when the short-run fluctuation deviates from the long-run equilibrium,the close index of Shanghai (Shenzhen) market will be pulled back to equilibrium state by adjusting strength 0.00761(0.0038). It is obvious to see the adjusting strength of Shanghai market is more bigger than that of Shenzhen market; the second factor was the total effect of the four (three) term short-run fluctuation, in (7),they include the current, lag-one fluctuation of the turnover of Shanghai; the current, lag-one fluctuation of close index of Shenzhen. Four term coefficients: 0.0085, 0.0023, 0.691,-0.0282 respectively reflect the effect strength size of short-run fluctuation. In (8), they include the current, lag-one fluctuation of the turnover of Shenzhen; the current fluctuation of close index of Shenzhen. Three term coefficients: 0.01, 0.0023, 0.551 respectively reflect the strength size of the effect of short-run fluctuation. In (7), it is obvious to see that the lag-one fluctuation of the close index of Shenzhen, Δly_{1t-1} affects the fluctuation of the close index of Shanghai, coefficient -0.0282 shows the effect is the reverse,however, In (8),on the contrary,the lag-one fluctuation of the close index of Shanghai, Δlx_{1t-1} doesn't affect the fluctuation of the close index of Shenzhen.

In (7) and (8), Δlx_{1t}, Δly_{1t} also represent the daily return rate of Shanghai, Shenzhen stock market respectively, $\Delta lx_{2t}, \Delta ly_{2t}$ stand for the corresponding daily turnover variation rate of two karkets. In (7), Δlx_{1t} will change 0.0085(0.691) unit when Δlx_{2t} (Δly_{1t}) changes 1 unit but another three factors keep unchanged. Δlx_{1t} will change 0.0023 unit when Δlx_{2t-1} changes 1 unit but another three factors keep unchanged. Δlx_{1t} will decrease(increase) 0.0282 unit when Δly_{1t-1} increases(decreases) 1 unit but another three factors keep unchanged. In (8), Δly_{1t} will change 0.01(0.551) unit when Δly_{2t} (Δlx_{1t}) changes 1 unit but another two factors keep unchanged. Δly_{1t} will change 0.0023 unit when Δly_{2t-1} changes 1 unit but another two factors keep unchanged.

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The Leading Role of Industry in The Nakhchivan Autonomous Republic

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Abstract

It is shown that the natural condition of the Nakhchivan Autonomous Republic, its geographical position, geopolitical situation, rich natural resources, existence of enough manpower, high level personnel potential, the existing social and production infrastructure create objective atmosphere in rapid development of the industrial fields. The development inclinations of the industry and its features in the Nakhchivan Autonomous Republic are analyzed, creation of new industrial establishment opportunities on the basis of local raw material, ways of its financial maintenance strengthening and perspective growth directions are stated. It is also indicated that the model of development of economy, in particular, industry in the example of the Nakhchivan Autonomous Republic, Azerbaijan can be applied for the remote regions which are exclaves or locations with difficult access to mainland due to geographical (high mountains, remote islands) or climatic (tundra, permanently frozen polar areas) features.

Keywords: Nakhchivan Autonomous Republic, market economy, industry, local raw material, investment

1. Introduction

The scientific objective or the essential idea behind the presented research work devoted to the investigation of the economy of the Nakhchivan Autonomous Republic which is the integral part of the Republic of Azerbaijan is the concept that regions, which are remote from mainland of the country have their own, specific difficulties and advantages in development of the economy of the region and it is possible to provide the leading role of the industry at the expense of the advantages of the geographical position, natural condition and rich natural resources, existence of enough manpower, high level personnel potential, the existing social and production infrastructure of the region. By remote, we mean not only exclaves (like the Nakhchivan Autonomous Republic, Azerbaijan or the Kaliningrad Region, Russia) but also locations with difficult access to mainland due to geographical (high mountains, remote islands) or climatic (tundra, permanently frozen polar areas) features.

The end of the 20th century long has entered history as a period having fundamental changes of great importance in all political and social directions of Azerbaijan. It bases on the desire state independence achievement of Azerbaijan and passing to the market economy system.

The Nakhchivan Autonomous Republic as a part of the Republic of Azerbaijan also faced with all round crises for valid reasons after gaining the independence of Azerbaijan, the collapse of national economy and before existed division system of labour, loss of sale markets, sharp decrease of industry in all fields of economy and as a result of which it ended with complete stop of major production activity of industrial establishment.

Heydar Aliyev's returning to Nakhchivan in 1990 and his election as a deputy to the parliaments of the Republic Azerbaijan and the Nakhchivan Autonomous Republic by people’s will and at last caused gradual healthy and strong public-political stability after his election to the position of the chairman of the Supreme Majlis of the Nakhchivan Autonomous Republic.

When Heydar Aliyev was elected as the President of the Republic of Azerbaijan a gradual progress in industry became an obvious matter in Azerbaijan wholly, as well as in Nakhchivan Autonomous Republic and a great deal of wide scale reforms were held in the field of industry as well as in other sectors of economy.

Today the development of economy in the Republic of Azerbaijan is held due to special state programs. According to "The State Program on social-economic development of regions" (for 2004-2008) upon the decree was signed on February 11, 2004 by Ilham Aliyev, the President of the Republic of Azerbaijan new industrial fields were established in the Nakhchivan Autonomous Republic and industrial output began to increase dynamically.

During 2004-2008 years 147 industrial establishments were created in the Nakhchivan Autonomous Republic or some of them were reestablished on the bases of new technology.

As a logical continuation of the State Program "Social-economic development State Program of the regions for 2009-2013 of the Republic of Azerbaijan" was confirmed by the decree №80 upon 14 April, 2009 the President of the Republic of Azerbaijan. Along with widening the output of industry and agriculture of the Nakhchivan Autonomous Republic plan of measures consisting of twelve items were determined.

All these stated matters: complex analysis of the problems connected with the development of industry in the Nakhchivan Autonomous Republic, its perspective development and territory forming improvement, joining of the autonomous republic industry to the world economy system, putting forward offers and recommendations in the direction of food safety provision are turned objective necessity.

A number of monographs, books were devoted to the investigation of the economy, in particular, industry of the Nakhchivan Autonomous Republic. The ways of economic development and development features of different branches of economy of the Nakhchivan Autonomous Republic was investigated by N. Ahmadov (N. Ahmadov, 2005; N. Ahmadov, 2008) and other authors. More reliable information on the economy of the Nakhchivan Autonomous Republic can also be found in encyclopaedies devoted to the Nakhchivan Autonomous Republic (Nakhchivan encyclopaedia, 2002; Nakhchivan encyclopaedia, 2005, 1st volume; Nakhchivan encyclopaedia, 2005, 2nd volume). However in the presented work we talk about the leading role of industry of the Nakhchivan Autonomous Republic and discuss the model of development of economy, in particular, industry in the example of the Nakhchivan Autonomous Republic that can be applied for the remote regions which are exclaves or locations with difficult access to mainland due to geographical (high mountains, remote islands) or climatic (tundra, permanently frozen polar areas) features.

2. The Leading Role of Industry in the Economy of The Nakhchivan Autonomous Republic

Rational arrangement of the industry throughout the country is one of the vital means in providing national economy and social perspective as being the main feature of territory arrangement of productive forces. This process as a rule begins from the arrangement of industrial establishments all processes are implemented on the basis of economic productivity. When selecting of the regions to place of this and other establishments and also grounding it one should not satisfy with its expected local productivity. In the same time the role of the very industrial object in new repeated production, its contribution to this process and efficiency entirely in the country should be considered main. Along with this in placing industrial establishments, concretely also non-economic profits, political, national security, defense of country and other factors by all means must be considered. Even Azerbaijan after gaining its independence the actuality of manpower and industrial establishments placement according to the territory not only lost its effect but also earned a very serious form. Together with these common demands in industrial production placement the below stated principles grounded scientifically should be observed:

1. Bringing industrial production nearer raw material sources and consumption regions. By following these principles natural resources can easily be drawn into economy circulation rationally and in its turn puts resistance in carrying raw materials to far distances.

2. Placing of industrial production equally according to the territory of country. Observing these principles in placing industrial production provides the balance of social-economic development of the economic regions of the country and settles the issue of rational use of natural resources and manpower resources respectively and also it prevents non-organized migration of population and so on.

3. Productive labour division among economic regions and complex development of their economy. Guided these principles main determines their directions of specializing according to industrial production together with complex development of economic regions.

4. Internationalizing of economy and its necessity of participation in the international labour division. Realizing of this principle is provided with economic sovereignty, integration to the world economic system in the atmosphere of open economy, creation of establishments and national ownership.

5. Defense of the country from foreign aggression and protection of environment. Observation of this principle has become a very actual question for our republic that newly gained her independence. (T.A. Huseynov, 2000)

As being long complicated process of placement of industry, placement of establishments, forming industrial junctions and centers cover three stages in mutual relations of forming industrial complexes. At present there are various views about the significance of industrial junctions in the economic literatures. As it has been stated by

some foreign economists and geography critics, the base of economic junctions is comprised by natural condition and unity of economy elements. The popular scientists of geography Richard Hartsharn, K. Cons Kloran, Russel Smith, Fransua Rern are included to the supporters of this idea.

Russian-Soviet scientists P. M. Alampiriyev, A. Y. Probst, E. B. Alayev, L. Y. Ziman, Y. Sh. Saushkin and others were intensively busy with the essence of the industrial junctions, investigation of theoretical and methodological basis of them.

Azerbaijani scientists A. A. Nadirov, A. Kh. Nuriyev, S. K. Huseynov and others have shared much place to industrial junctions investigation in their works.

There are common methodological basis in the views of the Azerbaijan economists about the essence of the industrial junctions. According to their views the industrial junctions are industrial fields with a leading role in every territorial- industrial complex (Sumgayit, Mingachevir, Shirvan, Nakhchivan, Ganja, Shaky, Lankaran and so on). Considering this one can find no serious difference in their views.

Forming industrial junctions and its development in modern period has own specific principles. Among them the following items may be called:

1. Planned development and placement of industrial junctions on the basis of scientific-progress and increase of productivity.

2. Social division of labour providing expedient specialization of production, economic relation, cooperation and territory forming.

3. Raw material sources of industry and drawing to products consumers.

4. Placing of industry but considering integration and labour division.

5. Efficient forming of industrial cooperation in the economic development of the regions and so on. (A. A. Nadirov, S. K. Huseynov, 1984)

Science and the factor as a scientific service play an important role in forming of industrial junction and its development. Scientific-technical progress gives an opportunity in intensifying of products output and diminishes of manual labour percentage share, engages new natural resources to the production circulation, creates good atmosphere in settlement of new areas and also reduces technological affects to environment.

State policy plays a great role in securing social-economic development, out of which in providing the promotion of industry.

Current and strategic goals, objectives put ahead by State and also a State policy as a part in realizing them bases on correct directions of social-economic development. The social-economic development policy of State consists of different elements; one of the vital directions of social-economic policy as-finance, monetary-credit, social, agrarian, structural, foreign economic policy, taxes, policy of ecology and etc. comprises regional development policy. (A. Kh. Nuriyev, 2004)

In connection with a successful solution of regional policy a direct state management of economy is implemented more than.

One of the regional policy realization objectives is the method of the purposed program-prognosis.

While preparing the program the current social-economic condition of the region is analyzed and assessed. Social-economic condition of the region and result of this condition for the region are noted and the most priority problems to be solved are selected. The condition of natural resources and environment are assessed. The prognosis model of the program is worked out. Every measure included and considered in the program is valued according to quantitative and qualitative indicators and economic efficiency of it is calculated. (N. I. Larina, A. A. Kselnikov, 1998)

One of the most important forms of the regional policy in the countries passing to market economy is the creation of free economic zones. The free zones of specific geographical areas where customs concessions act in industry, trade, tax play a great role in foreign and local investment, in use of modern technologies, management experience and in cadre choice and above all in opening new work places.

The world practice shows that free economic zones give opportunity to the development of foreign economic relations, generally in investing foreign and local capitals to different regions of the country and also in engaging new technology and management experience, in its turn it impact to economic and social development positively. (A. I. Pogorlensky, 2000)

In a word regional, social-economic policy of state should put perspective goals in front of regions and economy fields development, should determine very urgent objectives in arriving at these aims, should work out management and regulation mechanism capable to fulfill the task from the interest of regions point of view and finally should stimulate its implementation.

According to the "State Program (2004-2008) on social-economic development of the regions" signed by the President of State, Ilham Aliyev on 11 February 2004 new industrial fields have been established in the Nakhchivan Autonomous Republic and the output of industrial production went on increasingly raise.

On the basis of successful implementation of the duties put ahead in the program possible structure innovation was held in the regions, entrepreneurship activity was considerably widened, suitable investment atmosphere was formed and modern type of industrial establishments were created. So that, within 2004-2008 years 147 industrial establishments were created in the autonomous republic or they were reestablished on the basis of new technology.

The rate of industrial product increased 6,4 times in 2008 compared with the result of 2004. All these once again prove the successful implementation of the State Program put in front of the Nakhchivan Autonomous Republic industry development.

According to the economic independent strategy determined by Heydar Aliyev, national leader of the Azerbaijan population and the strategy continued by Ilham Aliyev, head of state, the held structure reforms, integration of economy into international economic relations and economy relations has caused the dynamic growth of social-economy in the Nakhchivan Autonomous Republic too and in its part created a reliable base to the development of all economic fields.

As a result of which the macroeconomic indicators in the autonomous republic developed dynamically by years. All these have been pictured in the below shown table.

Table 1. Macroeconomic indicators of the Nakhchivan Autonomous Republic for 2009-2010

Macroeconomic indicators (in thousand manats)	Years		
	2009	2010	analogical comparison in % (percent)
Gross domestic product	973649,3	1171305,7	116,6*
Gross domestic product per capita, in manat	2434,7	2882,9	118,4
in the USA dollar	3029,4	3591,9	118,6
Total capacity of industrial production	212469,1	318564,8	144,4*
Investments put on main capital	411522,0	501105,5	121,8
Total product of agriculture	185117,2	247126,6	113,3*
Freight transportation in transport sector, one thousand ton	9723,0	11152,7	114,7
Rate of information and communication services	31119,9	36579,3	117,5
Retail goods turnover	484777,5	616454,4	119,9*
Paid service to population	87255,8	107242,3	117,8*
Foreign trade turnover, one thousand USA dollar	220046,5	257933,3	117,2
including			
total rate of export	112287,2	211714,4	188,5
total rate of import	107759,3	46218,9	42,9
Income of population	913371,6	1007483,6	110,3
Incomes per capita, in manat	2284,0	2479,9	108,6
Average monthly salary (wage) calculated per worker, in manat	272,3	302,6	111,1

According to the table report analysis the rate of gross domestic product in the autonomous republic raised 16,6 per cent in 2010 compared with 2009, the total rate of industrial product increased 14,4 per cent, the total product of agriculture uprose 13,3 per cent and the investments put to main capital made up 21,8 per cent rise.

3. The Most Important Strategic Duty of The Nakhchivan Autonomous Republic in the Field of Economy

In general, one can arrive at a conclusion after carried out analysis and investigations that for the purpose to increase industrial potential in the autonomous republic the taken systematic measures are resulted fruitfully

Today the most important strategic duty in front of the autonomous republic must base on the efficient use of natural resources in local production, export of products to foreign market, creation of condition for the competition sustainability

The future perspective of industrial production complex in the Nakhchivan Autonomous Republic must base on local rich mineral excavation reserves either fully and perfectly, dependence of local industry from the delivered raw materials must be reduced maximally.

The territory of the autonomous republic is rich with different minerals and manifestations as: molybdenum, copper, copper-molybdenum, copper-polymetal, spray-arsenic, mercury cobalt, wolfram, titan, gold, lead, manganese, zinc, rock-salt, dolomite, bauxite, phosphorite, sulphur, travertine, black marble, cement raw material, construction materials etc. Also there are more than 200 mineral and termal springs of healing importance as: Sirab, Badamly, Daridagh, Vaykhir, Nahajir, Gahab, Gizilburun, Jahry, Suramly and others. (S. Y. Babayev, 1999)

As a result of geological-exploration works carried out in the territory of the Nakhchivan Autonomous Republic a great deal of building material deposits of mineral origin were discovered and learned. In order to make effective use of different kind of rich minerals of Nakhchivan it is possible to establish small volume metal purifying, metal smelting, cast iron melting on the basis of local raw material and also new establishments connected with steel production.

It is already high time to use of rich chemical raw material reserves (rock salt, dolomit, phosphorite, sulphur etc.) in Nakhchivan AR in developing chemical industry more widely. Thus, natural condition and natural richness of Nakhchivan gives a chance to say that this region is having a great social- economic development possibility after assessing the existing potential from economic points of view.

The world practice shows that regardless of the level of social- economic development and national features the provision of sustainable economic progress not only depends on domestic means but also is possible on the basis of home and foreign factors unanimity. Total social, economic and juridical conditions of investment activity of industrial fields acting in the area of country is specified by the law ”On investment activity” of the Republic of Azerbaijan (On Investment activity The Law of the Republic of Azerbaijan, 1995).

The very law was attributed to all kind of investments focused to the economy of the country, also it was forwarded to the social-economic base of the country and in the same time to reinforcing international economic collaboration and integration promotion and despite of property form it ensures equal rights of all investors.

According to the wide spread world experience several joint cooperation forms are existing in implementing investment activity: such as: consent on profit division regardless of share of participation, service consent, cooperation forms and concession through joint establishment creation.

Classical self finance form in the industrially developed countries of the world is said to be the interest rate of establishment and special allocations formed on the basic funds shares for amortization, money allocation from the sale of securities and bank credits.

No doubt that foreign investments are much more important for the countries who newly gained their independence. Because the reestablishment of economy in these countries and its extension demands a great amount of capital investment. But it is impossible to realize this process in the countries who newly gained independence and in market economy formed regions especially there where there is investment insufficiency by means of domestic opportunities. Considering this, to develop economy by the help of government demands foreign capital investment together with domestic investments. (A. L. Aliyev, 2000)

Thus, in order to develop economy in Nakhchivan Autonomous Republic in the nearest future foreign capital investment is very important side by side with internal investment and for this it is offered to prefer ownership activity together with foreign investors.

To provide the development of industrial fields in Nakhchivan Autonomous Republic and to restore the activity of the industrial establishments existed here before is the question to settle in the perspective. Light and food industry in Nakhchivan economic region occupies a leading place. The total parentage share of them in total industrial product is about 75 %. At present "Gamigaya Barakat Food Products" LTD, "Jahan Holding" Commercial Company Union, "Badamly Mineral Waters Works" LTD, "Sirab" OJS (Open Joint Stock), "Lazzat Food Industry" LTD, "Nakhchivan Brick" OJS, "Underwear knitted goods factory" OJS , "‘Sewing" OJS, "Glass works" OJS, "Carpet" OJS, "Grain and rolls and buns" OJS and other establishments are acting in the Nakhchivan Autonomous Republic. But some of these establishments don’t work due to their project power . Therefore the existing problems solution in this field is said to be more urgent on the agenda. Joint use of home

and foreign investments for the development of the economy of the Nakhchivan Autonomous Republic is necessary to create a good atmosphere in all fields for the foreign businessmen, ownerships, investors to put their capitals on the bases of mutual interest.

In order to supply the demand of the population of the Nakhchivan Autonomous Republic on the basis of local food products completely, we think that, it is important to widen auxiliary economies and with this to lessen the dependence from abroad and to provide the production with local raw material must be on the agenda as the most important question.

For us in the perspective development of industrial complex of the Nakhchivan Autonomous Republic the correct way of usage from agriculture, transport promotion and manpower must be considered without any delay.

For the purpose to provide more efficient use of current potential of the regions a special decree was confirmed on April 14, 2009 by the President on "State Program on social-economic development for 2009-2013 of the regions of the Republic of Azerbaijan". The most advanced priorities connected with the development of the Nakhchivan Autonomous Republic were determined in the new social-economic development program.

The below stated issues were determined in the State Program: construction of new industrial fields in the Nakhchivan Autonomous Republic, restoration of mine-industry establishments activity and creation of new establishments, restoration of new OJS existing in the area of the Nakhchivan Autonomous Republic and their furthermore development, creation of various food products industry, exploration of new construction material beds and investigation, restoration of vineyards, fruit gardens, ploughing areas and widening them, restoration of silkworm breeding and developing, widening poultry farms production, developing of fish industry (Upon the Decree №80 April 14, 2009).

According to the State Program in a short time these below indicated establishments were created and put in use in the Nakhchivan Autonomous Republic. They are: Nakhchivan Cement works, Fishery in Garabaghlar village of Kangarly district, Fishery in Garababa village of Shahbuz district, "Karimbayly" Poultry Farm in Babak district, "Aylis" Poultry Farm in Ordubad district, "Kirna" Poultry Farm in Julfa district and some other establishments. We are hopeful furthermore works according to the State Program will be more scientifically and efficiently in industrial direction in Nakhchivan Autonomous Republic and the gained results will be in power to supply the demands of population successfully.

4. Conclusion

On the basis of the carried investigation we come to the conclusion that the natural condition of the Nakhchivan Autonomous Republic, its geographical position, geopolitical situation, rich natural resources, existence of enough manpower, high level personnel potential, the existing social and production infrastructure create objective atmosphere in rapid development of the industrial fields. The development inclinations of the industry and its features in the Nakhchivan Autonomous Republic are analyzed, creation of new industrial establishment opportunities on the basis of local raw material, ways of its financial maintenance strengthening and perspective growth directions are stated. The analysis show that industry has a leading role in the economy of the Nakhchivan Autonomous Republic.

The model of development of economy, in particular, industry in the example of the Nakhchivan Autonomous Republic can be applied for the remote regions which are exclaves or locations with difficult access to mainland due to geographical (high mountains, remote islands) or climatic (tundra, permanently frozen polar areas) features.

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Debt Policy and Corporate Performance: Empirical Evidence from Tehran Stock Exchange Companies

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Abstract

The ability of companies in determining suitable financial policies to make investment opportunities is one of the most principal factors for the companies' growth and progression. Adopting a debt policy or a capital structure is considered as a momentous decision that influences the companies' value. This paper is aimed to investigate the probable relationship between debt policies (including Current Debt, Non-Current Debt, and Total Debt) and performance of Tehran Stock Exchange Companies. The regression model is applied to investigate the relationship between the performance indicators and debt ratios. In this research, financial performance indicators are considered as Gross Margin Profit, Return on Assets (ROA), Tobin's Q Ratio, and Debt Ratios (Current Debt, Non-Current Debt, and Total Debt). "size" and "growth rate" are considered as control variables. Results show that an increase in current debts, non-current debts, and total debts has a negative influence on the corporate performance. It was also found that companies that merely attempt to create assets through debts, without any attention to the company size and other important factors, are not able to have an excellent performance.

Keywords: performance, debt policy, gross margin profit, Return on Assets (ROA), Tobin's Q Ratio, debt ratios

1. Introduction

The influence of debt policies on the corporate performance is determinant for an appropriate capital structure and is a critical decision for any business. The fast-changing nature of the modern business environment means that planning should be a continuous (Latifi et al, 2010). Businesses have to prepare themselves to react to a wide range of probable futures (Hamidizadeh et al, 2012). As strategic planning is a suitable tool to reach organizational goals (Latifi et al. 2012), results of the current research are very important, not only due to the need to maximize returns to various organizational constitutions in Iran, but also because of its impact on the organization's ability to deal with its competitive environment (Dare Funso David and Sola Olorunfemi). If the firm's capital structure influences its performance, it will be reasonable to expect that the firm's capital structure can influence its health and its likelihood of default.

From both Investors' and creditors' viewpoints, corporate performance evaluation provides a basis to measure the managerial success. Creditors regularly analyze the firm's performance in order to determine the volumes and rates for providing financial resources. Debt ratios help creditors understand the firm's risk management strategies as well as conservative /aggressive approaches toward current and non-current assets and liabilities. The investor's acquired return on equity illustrates management's ability in utilizing investments. The examination of debt policy and corporate performance contributes the management that always attempts to optimize the debt to equity ratio to create sustainable wealth not only for investors but for all stakeholders. While several electronic systems including internet have changed the communication world and given particular opportunities to communication ways, (Hamidizadeh et al, 2012), in this paper, the relationship between debt policy and performance of Tehran Stock Exchange companies are empirically investigated using some performance indicators such as Gross Profit Margin, Return on Assets (ROA), and Tobin's Q Ratio.

2. Literature Review

El-Sayed Ebaid, (2009) investigated the impact of capital structure choice on firm performance in Egypt as one of emerging or transition economies. Using three of accounting-based measures of financial performance (i.e. return on equity (ROE), return on assets (ROA), and gross profit margin), and based on a sample of non-financial Egyptian listed firms from 1997 to 2005 the results revealed that capital structure choice decision, in general terms, has a weak-to-no impact on firm's performance.

Abor, (2005) examined the relationship between capital structure and profitability of listed firms on the Ghana Stock Exchange (GSE) during a five-year period. The results represented a significantly positive relation between the ratio of short-term debt to total assets and ROE. However, a negative relationship between the ratio of long-term debt to total assets and ROE was found.

Qi, Wu and Zhang (2000) investigated whether and how the corporate performance of listed Chinese firms is affected by their shareholding structure. Their findings suggested that the ownership structure composition and relative dominance by various classes of shareholders can affect the performance of state-owned enterprise (SOE)-transformed and listed firms.

Majumdar and Chhibber, (1999) examined the relationship between the levels of debt in the capital structure and performance for a sample of Indian firms. Analysis of the data revealed this relationship for Indian firms to be significantly negative.

Berger and Bonaccorsi di Patti, (2004) examined the impact of leverage on agency costs and thereby the firm performance. In today's economic climate, there is an increasing emphasis on cost reduction and increased efficiency (Latifi et al, 2011). They also proposed a new approach to test the agency theory using profit efficiency. Considering that Investment banking firms are intermediaries that can fund different sectors (Latifi et al, 2012), the results showed that data on the US banking industry are consistent with the theory, and the results are statistically significant, economically significant, and robust.

Gleason, Knowles Mathur and Mathur, (2000) investigated the Interrelationship between Culture, Capital Structure, and Performance for European Retailers. Using both financial and operational measures of performance, it was shown that capital structure influences financial performance, although not exclusively. A negative relationship between capital structure and performance suggested that agency issues may lead to use of higher than appropriate levels of debt in the capital structure, thereby producing lower performance.

Margaritis and Psillaki, (2010), investigated the relationship between capital structure, ownership structure and firm performance across different industries using a sample of French manufacturing firms. They found support for the core prediction of the agency cost hypothesis in that higher leverage is associated with improved efficiency over the entire range of observed data. They also found evidence to support the hypothesis that firms with more concentrated ownership face lower agency costs only in chemicals industry. No statistically significant relationship between ownership structure and firm performance in the computers and textiles industries was observed.

David and Olorunfemi, (2010) examined the impact of capital structure on corporate performance in the Nigerian Petroleum Industry. The study employed panel data analysis by using Fixed-effect estimation, Random-effect estimation and Maximum likelihood estimation. It was found out that there was positive relationship between earnings per share and leverage ratio on one hand and positive relationship between dividend per share and leverage ratio on the other hand.

3. Research Hypotheses

In this study, Gross Profit Margin, Return on Assets (ROA), and Tobin's Q Ratio are applied to measure the corporate performance of Tehran Stock Exchange Companies. If the capital structure influences the firm's performance, the correlation between debt policies and firm's performance can be expected. We argue that debt maturity ratios (current debt, non-current debt, and total debt), as a proxy for firm's debt policies, will influence the corporate performance. Using a gross profit margin as an indicator of a firm's performance, the hypotheses are as follows:

H_1: There is a negative significant relationship between firm's short-term debt policy and its gross profit margin.

H_2: There is a negative significant relationship between the firm's long-term debt policy and its gross profit margin.

H_3: There is a positive significant relationship between the firm's total debt policy and its gross profit

Since the performance measure ROA is widely regarded as the most useful measure to test firm's performance (Reese and Cool, 1978 and Long and Ravenscraft, 1984, Abdel Shahid, 2003, among others), the hypothesis to be tested are as follows:

H_4: There is a negative significant relationship between the firm's short-term debt policy and its return on assets.

H_5: There is a negative significant relationship between the firm's long-term debt policy and its return on assets.

H_6: There is a positive significant relationship between the firm's total debt policy and its return on assets.

Tobin's Q Ratio is used to represent firm's performance in many studies (e.g., Morck, Shleifer, and Vishny, 1988, McConnel and Serveas, 1990, and Zhou, 2001). So, the hypotheses H_7 to H_9 can be introduced as the following:

H_7: There is a negative significant relationship between the firm's short-term debt policy and Tobin's Q Ratio.

H_8: There is a negative significant relationship between the firm's long-term debt policy and Tobin's Q Ratio.

H_9: There is a positive significant relationship between the firm's total debt policy and Tobin's Q Ratio.

4. Methodology

4.1 Data and Sample

In this study, the corporate performance of Tehran Stock Exchange Companies is investigated between the years 2006 to 2011. The sample should have the following characteristics:

1- All companies were required to deliver their financial statements for each year between 2006 and 2011. They were also supposed to give the historical stock price at the end of each year.

2- All financial institutions were excluded from the research population because of their different nature of operations.

3- Selected companies had to have an identical ending of the fiscal year for all years between 2006 and 2011 due to the comparability of analyzed data.

4- We screened some companies because of the lack of the required research data.

A quantitative approach using a co-relational research design is used in this study.

As data are collected using tools such as observation and questionnaire this research is a scientific study which seeks to solve practical problems and as its aim is to develop practical knowledge in investigating debt policy and corporate performance of Tehran Stock Exchange Companies, it can be considered as an applied research. Results of this research can be applied to solve the problems that exist among Iranian managers from the registered corporations in Tehran Stock Exchange. On the other hand, as the current research is designed to provide further insight into the research problem by describing the variables of interest, and typically involves conducting a survey of a sample of population elements at one point in time, it can be considered as a descriptive research. As this study is an intensive study of a single unit with an aim to generalize across a larger set of units, its method is qualitative with small-N, is ethnographic with participant-observation, is “in the field”, and is characterized by process-tracing, it can be considered as a case study research.

5. Data Analysis

Gujarati (2007) states that there are three types of data available for an empirical analysis: time series data, cross-sectional data, and pooled data (i.e., combination of time series and cross-sectional). Since the variables are selected from various companies between 2006 and 2011, the type of data for this study can be considered as pooled. There are two approaches to analyze pooled data which include classical linear regression model and panel data regression model. In order to use the classical linear regression model, all firms’ data should be considered as homogeneous; otherwise the panel data should be applied. F Limer Test is employed to determine which method must be utilized to analyze pooled data. Fisher's F distribution is applied to identify whether the linear regression model between independent and dependent variables is statistically significant. There are two approaches to estimate panel data: The Fixed Effects Model (FEM) and The Error Components Model (ECM). The existence of correlation among error components and explanatory variables determines the right model to be selected. If it is assumed that εi (error component) and the X’s (regressors) are not correlated, ECM may be appropriate, whereas if εi and the X’s are correlated, FEM may be appropriate. In this study, Hausman test would help to choose between FEM and ECM. The null hypothesis underlying the Hausman test is that the FEM and ECM estimators do not differ substantially. If the null hypothesis is rejected, ECM would not be appropriate and that it would be better to use FEM (Gujarati, 2007).

The classical linear regressions model assumes that error terms are dependent over time. In some cases, however, error components are correlated in different time periods and such situation is called autocorrelation or serial correlation. The most popular test for detecting serial correlation is the one developed by Durbin and Watson. It is known as the Durbin–Watson d statistic, which ranges from 0 to 4. The closer d is to 0, the greater the evidence of positive serial correlation; and the closer d is to 4, the greater the evidence of negative serial correlation. If there is no serial correlation, d is expected to be about 2 (Gujarati, 2007). Eventually, the t Statistic is used to evaluate the significance of estimated regression coefficients and the mean of variables.

In this research, descriptive statistics methods are used to summarize and classify the gathered data and inferential statistics methods are applied to analyze them. Table 1 shows the descriptive statistics results of variables.

Table 1. Descriptive statistics of data

Variable	Mean	Std. Deviation	Min.	Max.	Skewness	Kurtosis	Frequency
Short-term Debt Ratio	2.5686	3.360924	-27.79	28.06	-0.61	21.714	515
Long-term Debt Ratio	0.3043	1.608205	-30.84	12.1	-13.88	296.297	488
Total Debt Ratio	2.9855	5.058406	-58.63	46.31	-0.924	62.824	515
Corporation Size	5.4478	0.608189	3.56	7.81	0.98	2.086	515
Sales Growth Rate	0.2238	0.467488	0.9975	7.682	8.338	126.516	515
Gross Profit Margin	0.1506	0.720533	-15.51	1.12	-20.353	442.822	507
Return on Assets	0.1370	0.1407	-0.32	0.59	0.281	0.986	515
Tobin's Q	1.0320	1.177798	0.06	9.46	3.356	14.711	515

The most important measure that shows the balance point and is the exertion center of distribution is arithmetic mean (Azar et al, 2006). As it can be observed in table 1, the mean values of short-term debt ratio, long-term debt ratio, and total debt ratio are 2.5686, 0.3043, and 2.9855 respectively, the mean values for corporation size and sales growth rate are 5.4478 and 0.2238, mean values of gross profit margin and return on assets are 0.1506 and 0.1370, and the mean value for Tobin's Q is 1.0320. The third column in table 1 shows the standard deviation of variables. The value of this parameter for total debt ratio is 5.0584, which is the highest among all variables. The value of a standard deviation for return on assets is 0.1407 which is the lowest of all.

After analyzing descriptive statistics of data, research hypotheses should be tested. Hypotheses have been tested according to data and the model which results are illustrated as table 2.

Table 2. Test of the Modeling Validation

Hypotheses	**Test Type**	**Model's Significance Test**	**Limer's F Test**	**Hoffman Test**	**Durbin-Watson Test**
Hypothesis (1)	Test Statistic	(5.17) F	(1.5) F	(0.912) H	(1.93) DW
	P-value	0.002	0.000	0.31	-
Hypothesis (2)	Test Statistic	(4.049) F	(1.7) F	(0.812) H	(1.932) DW
	P-value	0.007	0.000	0.38	-
Hypothesis (3)	Test Statistic	(5.082) F	(1.62) F	(0.862) H	(1.932) DW
	P-value	0.002	0.000	0.35	-
Hypothesis (4)	Test Statistic	(13.79) F	(1.92) F	(0.9543) H	(2.1242) DW
	P-value	0.000	0.000	0.42	-
Hypothesis (5)	Test Statistic	(10.90) F	(1.6123) F	(0.9125) H	(0.654) DW
	P-value	0.000	0.000	0.41	-
Hypothesis (6)	Test Statistic	(14.256) F	(1.9653) F	(0.9222) H	(0.701) DW
	P-value	0.000	0.000	0.415	-
Hypothesis (7)	Test Statistic	(4.991) F	(1.695) F	(0.8765) H	(0.687) DW
	P-value	0.002	0.000	0.385	-
Hypothesis (8)	Test Statistic	(4.354) F	(1.7654) F	(0.9116) H	(0.701) DW
	P-value	0.005	0.000	0.4012	-
Hypothesis (9)	Test Statistic	(5.149) F	(1.8546) F	(0.8356) H	(0.689) DW
	P-value	0.002	0.000	0.3901	-

As it is observed in table 2, the significant levels of fisher's F test and limer's F test for all variables are under 5% error. Therefore, it can be concluded that there is a regression relationship among variables and panel of data. The significant level of Hoffman test is above 5% for all variables. Therefore, the null hypothesis (fixed effects) is rejected and the random effect is confirmed. Doorbin-Watson statistics show that the model of hypotheses 1 to 4 are not self-correlated, while the model of hypotheses 5 to 9 are self-correlated. With continuous and appropriate conversions, self-correlation will be modified and data will be ready for modeling.

Results of hypotheses 1 to 3 testing has been shown in table 3.

Table 3. Results of Testing the Hypotheses 1,2, and 3

Independent Variable: Gross Profit Margin (Model of Random Effects)									
Variables	Hypothesis 1 Testing Results			Hypothesis 2 Testing Results			Hypothesis 3 Testing Results		
	Coefficients	t Statistic	P-value	Coefficients	t Statistic	P-value	Coefficients	t Statistic	P-value
Y-Intercept	-0.249	2.62	0.001	-0.233	-0.756	0.45	-0.249	2.075	0.021
SDC	-0.07	-7.78	0.000	-	-	-	-	-	-
LDC	-	-	-	0.0004	0.019	0.985	-	-	-
TDC	-	-	-	-	-	-	-0.1121	1.98	0.024
FS	0.067	2.1	0.009	0.062	1.07	0.29	0.0062	0.054	0.225
SG	0.24	3.505	0.000	0.227	3.14	0.002	0.238	3.479	0.001
R^2	0.51	-		0.25	-		0.501	-	

Considering the illustrated results in table 3, research hypotheses can be analyzed as the following:

Hypothesis 1 is significant and has a negative relationship with gross profit margin. This means as the shot-term debt increases, the profit margin will be decreased. In other words, 1 unit increase in a short-term debt will result in 0.07 unit decrease in a profit margin. Therefore, the model of the first hypothesis can be illustrated as the following:

$$Y_1 = -0.249 - 0.07\,SDCit + 0.067\,FSit + 0.24\,SGit$$

Although the results show that the second hypothesis is not significant, the effect of long-term debt is positively related to gross profit margin. This means that long-term debts increase the profit margin of a corporation. As second hypothesis is not significant, a model cannot be presented for it.

The third hypothesis is significant and has a negative relationship with a gross profit margin. This means that an increase in the total debt will result in a decrease in the profit margin of a corporation. In other words, 1 unit increase in total debt will result in 0.1121 unit decrease in a profit margin. Therefore, the model of the third hypothesis can be illustrated as the following:

$$Y_1 = -0.249 - 0.1121\,TDCit + 0.238\,SGit$$

Results of hypotheses 4 to 6 testing has been shown in table 4.

Table 4. Results of Testing the Hypotheses 4, 5, and 6

Independent Variable: Return on Assets Margin (Model of Random Effects)									
Variables	Hypothesis 4 Testing Results			Hypothesis 5 Testing Results			Hypothesis 6 Testing Results		
	Coefficients	t Statistic	P-value	Coefficients	t Statistic	P-value	Coefficients	t Statistic	P-value
Y-Intercept	0.067	2.68	0.001	-0.110	-1.9298	0.029	-0.091	0.686	0.048
SDC	-0.0912	4.537	0.000	-	-	-	-	-	-
LDC	-	-	-	-0.0921	-2.301	0.000	-	-	-
TDC	-	-	-	-	-	-	-0.021	-2.1001	0.007
FS	0.05	1.98	0.021	0.004	0.36	0.72	0.019	1.901	0.034
SG	0.079	6.124	0.000	0.073	3.524	0.000	0.079	6.095	0.000
R^2	0.612	-		0.583	-		0.489	-	

Considering the illustrated results in table 4, research hypotheses can be analyzed as the following:

The fourth hypothesis is significant and has a negative relationship with return on assets. This means that as the short-term debt increases, the corporation's return on assets will be decreased. In other words, 1 unit increase in short-term debt will result in 0.0912 unit decrease in return on assets. Therefore, the model of the fourth hypothesis can be illustrated as the following:

$$Y_2 = 0.067 - 0.0912\,SDCit + 0.05\,FSit + 0.079\,SGit$$

The fifth hypothesis is significant and has a negative relationship with return on assets. This means that as the long-term debt increases, the corporation's return on assets will be decreased. In other words, 1 unit increase in long-term debt will result in 0.0921 unit decrease in return on assets. Therefore, the model of the fifth hypothesis can be illustrated as the following:

$$Y_2 = -0.110 - 0.0921\,LDCit + 0.073\,SGit$$

The sixth hypothesis is significant and has a negative relationship with return on assets. This means that as the total debt increases, the corporation's return on assets will be decreased. In other words, 1 unit increase in total debt will result in 0.021 unit decrease in return on assets. Therefore, the model of the sixth hypothesis can be illustrated as the following:

$$Y_2 = -0.091 - 0.021\,TDCit + 0.019\,FSit + 0.079\,SGit$$

Results of hypotheses 7 to 9 testing has been shown in table 5.

Table 5. Results of Testing the Hypotheses 7, 8, and 9

Independent Variable: Return on Assets Margin (Model of Random Effects)									
Variables	**Hypothesis 7 Testing Results**			**Hypothesis 8 Testing Results**			**Hypothesis 9 Testing Results**		
	Coefficients	**t Statistic**	**P-value**	**Coefficients**	**t Statistic**	**P-value**	**Coefficients**	**t Statistic**	**P-value**
Y-Intercept	2.105	4.529	0.000	2.228	4.504	0.000	-2.106	4.533	0.000
SDC	-0.033	2.1986	0.006	-	-	-	-	-	-
LDC	-	-	-	-0.073	-2.301	0.021	-	-	-
TDC	-	-	-	-	-	-	-0.023	-2.3	0.001
FS	-0.202	-2.354	0.019	-0.229	-2.52	0.012	-0.203	-2.373	0.018
SG	0.338	3.047	0.002	0.32	2.76	0.006	0.333	3	0.003
R^2	0.65	-		0.63	-		0.489	-	

Considering the illustrated results in table 5, research hypotheses can be analyzed as the following:

The seventh hypothesis is significant and has a negative relationship with Tobin's Q. This means that as the short-term debt increases, the corporation's Tobin's Q ratio will be decreased. In other words, 1 unit increase in short-term debt will result in 0.033 unit decrease in Tobin's Q. Therefore, the model of the seventh hypothesis can be illustrated as the following:

$$Y_3 = 2.105 - 0.033\,SDCit - 0.202\,FSit + 0.338\,SGit$$

The eighth hypothesis is significant and has negative relationship with Tobin's Q. This means that as long-term debt increases, the corporation's Tobin's Q ratio will be decreased. In other words, 1 unit increase in long-term debt will result in 0.073 unit decrease in Tobin's Q. Therefore, the model of the eighth hypothesis can be illustrated as the following:

$$Y_3 = 2.228 - 0.073\,LDCit - 0.229\,FSit + 0.32\,SGit$$

The ninth hypothesis is significant and has a negative relationship with Tobin's Q. This means that as total debt increases, the corporation's Tobin's Q ratio will be decreased. In other words, 1 unit increase in long-term debt will result in 0.023 unit decrease in Tobin's Q. Therefore, the model of the ninth hypothesis can be illustrated as the following:

$$Y_3 = 2.106 - 0.023\,TDCit - 0.203\,FSit + 0.333\,SGit$$

6. Discussion and Conclusion

The summary of hypotheses testing results is shown in table 6.

Table 6. Summary of Hypothesizes Results

Hypotheses	Results	Coefficient of the Main Independent Variable	R^2
There is a significant relationship between short-term debt policy and gross profit margin.	Confirmed	- 0.07	51%
There is a significant relationship between long-term debt policy and gross profit margin.	Rejected	-	-
There is a significant relationship between total debt policy and gross profit.	Confirmed	- 0.1121	50%
There is a significant relationship between short-term debt policy and return on assets.	Confirmed	- 0.0912	61%
There is a significant relationship between long-term debt policy and return on assets.	Confirmed	- 0.0921	58%
There is a significant relationship between total debt policy and return on assets.	Confirmed	- 0.021	49%
There is a significant relationship between short-term debt policy and Tobin's Q Ratio.	Confirmed	- 0.033	65%
There is a significant relationship between long-term debt policy and Tobin's Q Ratio.	Confirmed	- 0.073	63%
There is a significant relationship between total debt policy and Tobin's Q Ratio.	Confirmed	- 0.023	64%

Corporations need capital in order to improve and grow. A part of the capital can be provided from internal resources of a corporation such as retained earnings which is obtained from corporation's profit and is not divided among shareholders. The rest of the capital can be borrowed or be provided from capital markets. Managers have to develop efficient debt policies in order to suitably face financial issues. Debt policies are related to the corporation's value and a change in financial leverage will lead to a change in total cost of a capital and the corporation's total value. In brief, the relationship between the capital's structure and the corporations' performance shows that there is a negative relationship between loans' policies and corporations' performance. The capital's structure especially short-term loans and total debt have negative relationships with corporations' performance.

According to statistical results, the claims of this research have been confirmed in a 5% error level. Hence, it can be concluded that an increase in debts (short-term, long-term, and total debts) will result in a decrease in corporations' performance. Of course, it does not mean the corporation should decrease debts as there are other factors which might have affected its performance. Therefore, it seems the amounts of the corporation's debts should be defined with regard to its size and other factors. If corporations provide their assets only from their debts and don't pay any attention to their sizes, their performance will not be improved substantially. Another explanation of the results is that investigated corporations don't have optimized capital structures. In other words, corporations have tried to increase their debt ratio and move toward an optimized ratio of debt to equity. It seems that even this matter has not been accomplished. The results of this study is consistent with studies of Abor (2007), Abu Alsayyed Abid (2009), and Zaitun & Tian (2007). All of these studies express negative influence of debt on corporations' performance.

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