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Abstract

This purpose of this paper is to analyze the effect of trade openness on the regional inequality of South Korea. Trade has been the driving force of South Korea's economic growth since the 1960s and it still expands its trade openness through active participation in bilateral and multilateral free trade agreements. With regard to those facts, this study measures the impact of South Korea's trade openness on the country's regional inequality using several sub-national panel datasets covering between 2003 and 2012. All datasets for the 16 regional units (nine provinces and seven metropolitan cities) of South Korea are collected from archival materials of the Korean Statistical Information Service (KOSIS). The dependent variable is the growth rate of GDP per capita from 2000 to 2012, while the explanatory variables include human capital, trade openness, infrastructure, and per capita income. More specifically, human capital is measured by the number of people who have achieved a university level education, and infrastructure is measured by either road density or per capita number of cars, depending on data availability. Unlike other studies, this paper finds that trade openness contributes to a higher level of economic growth for the regions with lower levels of education, implying that trade openness leads to reducing regional inequality in South Korea. In addition, trade benefits the areas with relatively lower per capita income, which also supports the claim that trade contributes to narrowing the regional income discrepancies. However, a seemingly contradictory finding has been made: more trade openness benefits regions that have rich infrastructures, thereby leading to more regional inequality. We argue that the former two effects exceed the latter, thereby leading to the conclusion that trade openness has been playing a positive role in reducing South Korea's regional income gap.

JEL Classification R11 · R12 · R58

Keywords: Regional Inequality, Trade, Openness, Per capita income, Human Capital, Infrastructure, South Korea, Education, FTA.

1. Introduction

Though there are several factors linked to South Korea's noticeable economic growth, however an outward-oriented trade strategy adopted by in the early 1960s is often cited as the main contributor (Nam 1995). With the government's strong trade policy, South Korea achieved noticeable economic growth starting from the 1960s. And until the 1997 Asian financial crisis, South Korea has been one of the leaders in economic growth. Its annual growth of per capital GDP, on average, was almost 6% and that led to a tenfold increase of per capita GDP over the past 40 years (Barro 2003).

Even after the 1997 crisis, the South Korean government has been emphasizing the importance of trade as a driving force of the South Korean economy. Because of that, the role of trade in the South Korean economy has become more crucial. This hypothesis can be confirmed by the data in Table 1, which shows South Korea's trade from 2000 to 2014. According to the data from the IMF, Korea has been the eighth largest trading country in the world, accounting more than 2.9% of world total trade since 2011, compared with its ranking of thirteenth in 2000. Also, from 2008, South Korea shows more than 82% trade dependency, on average. Contrary to such high percentages nowadays, the trade dependency was 59.2% in 2000.

Table 1. Trade of South Korea, 2000-2014.

Unit: USD million dollars

Year	World Trade	Korean Trade	Nominal GDP	Trade Ratio (%)	Rank	Trade Dependency (%)
2000	12,952,021	332,759	561,800	2.6	13	59.2
2001	12,484,608	291,543	533,100	2.3	13	54.7
2002	13,023,633	314,456	608,900	2.4	13	51.7
2003	15,219,138	372,236	680,400	2.5	12	54.8
2004	18,554,407	478,215	765,300	2.6	12	62.5
2005	21,152,188	545,578	898,000	2.6	12	60.8
2006	24,377,706	634,847	1,011,000	2.6	12	62.8

2007	28,150,774	728,463	1,122,700	2.6	11	64.9
2008	32,589,730	857,439	1,001,700	2.6	11	85.6
2009	25,057,804	686,622	902,300	2.7	10	76.1
2010	30,249,100	891,588	1,094,300	3.0	9	81.5
2011	36,131,770	1,079,774	1,202,700	3.0	8	89.8
2012	36,301,610	1,067,445	1,222,400	2.9	8	87.3
2013	36,910,410	1,075,210	1,304,300	2.9	8	82.4
2014	34,273,900	1,004,795	1,449,500	2.9	8	75.8

Sources: Bank of Korea, IMF, K-Stat.

Note: Trade dependency is calculated by total trade volume divided by nominal GDP.

Moreover, the South Korean government is expanding its trade openness through active participation in bilateral and multilateral free trade agreements. It already has 11 FTAs in effect, 4 concluded FTAs, and 6 FTAs under negotiation, and 5 FTAs under consideration.[1] As we can see from the above facts, there is no doubt about the South Korean economy's close relation with trade.

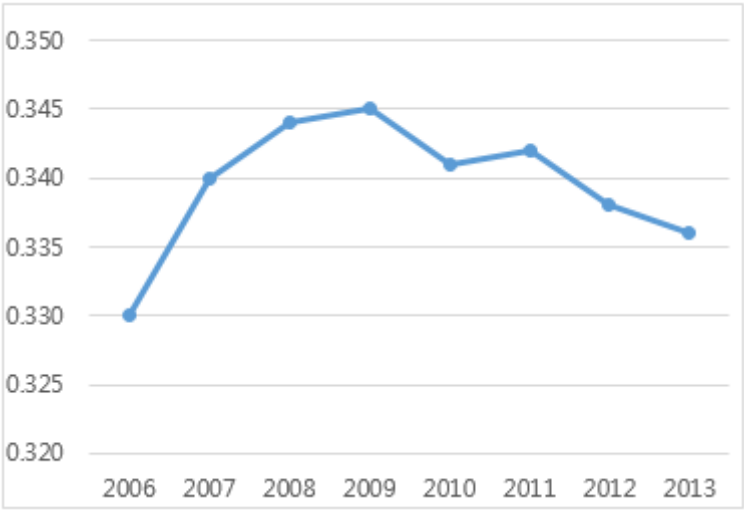
With this information on the role of trade in the South Korean economy, let us move to another issue: economic inequality in South Korean society. Previously, there were many studies that tried to find a relationship between economic growth and the inequality of society. As an example, Kuznets (1955) explained economic inequality changes as it reflects a nation's economic growth, so as with his U-shaped curve. More specifically, when one country experiences a high developing stage, its economic inequality increases. And when the country settles at a maturity stage, its economic inequality decreases. Also, Williamson (1965) found that Kuznets's theory also applied to the regional level.

Recently, South Korea's Gini coefficient shows a downward slope that is contrary to South Korea's increase in trade. Then does this mean trade openness reduces inequality in South Korea? Until now, several scholars conducted empirical studies on the relation between trade openness and regional inequality. First of all, Rivas (2007) conducted her study using the case

[1] FTAs in effect (partner countries): Chile, Singapore, EFTA, ASEAN, India, EU, Peru, USA, Turkey, Australia, and Canada.
Concluded FTAs (partner countries): Colombia, China, New Zealand, and Vietnam.
FTAs under negotiation (partner countries): CJK, RCEP, Indonesia, Japan, Mexico, and GCC.
FTAs under consideration (partner countries): MERCOSUR, Israel, Central America, Malaysia, and Ecuador TA.

of Mexico and found that trade openness increases regional inequality of the country. In line with this, Takeda et al. (2010) has confirmed this using the Japanese Input-Output Table and its corresponding CGE analysis. On the other hand, Daumal (2013) found that trade openness contributes to decreasing the regional inequality of Brazil and to increasing regional inequality of India. Thus, the impact of trade openness on a nation's regional inequality varies, depending on each nation's specific internal situation.

Figure 1. Gini coefficient of South Korea



Source: KOSIS

The aim of this study is to ascertain the impact of trade openness on South Korea's regional inequality based on economic model of Rivas (2007) and using 10-year-data. In her study, she found that trade benefits the area that has less human capital, more infrastructure, and more per capita income. And based on her findings, she concluded that trade openness increases the regional inequality of Mexico. Thus, bearing in mind her study, we set our hypothesis that trade benefits regions with a lower level of education and a high level of income and infrastructure.

This study is composed as follows. The next section will cover data, model, and methodology. Section 3 will explain the findings of the empirical study and section 4 will conclude the study.

2. Data, Model, and Methodology

In order to examine the effect of trade openness on the regional inequality of South Korea, this study uses a panel dataset of 16 regional units (nine provinces and seven metropolitan cities).[2] All datasets are collected from the archival materials at the Korean Statistical Information Service (KOSIS). Generally, most datasets cover from 2000 to 2012. But because of the dearth of information, the dataset related to infrastructure covers less of the period of time than the others.

Figure 2. Map of South Korea

Source: twouptravels.com

With all of these explanations above, we would like to introduce the following regression equations.

$$ln\,(y_{it}) - ln\,(y_{it-1}) = \beta_0 + \beta_1\, ln(Human\ capital_{it}) + \beta_2\, ln(Trade\ Openness_t)*ln(Human\ capital_{it}) + \beta_3\, Infrastructure_{it} + \beta_4\, ln(Trade\ openness_t)*Infrastructure_{it} + \beta 5\, ln(Per\ capita\ income_{it}) + \beta_6\, ln(Trade\ openness_t)*ln(Per\ capita\ income_{it}) + \beta_7\, ln(Population_{it}) + \beta_8\, ln(Trade\ openness_t) + \varepsilon \quad (1)$$

[2] Nine provinces: Gyenggi, Gangwon, Chungnam, Chungbuk, Gyeongbuk, Jeonbuk, Jeonnam, Gyeongnam, and Jeju
Seven metropolitan cities: Seoul, Incheon, Daejeon, Daegu, Gwangju, Ulsan, and Busan.

Where

- $ln\ (y_{it}) - ln\ (y_{it-1})$: The dependent variable. This represents the percent change of the mean income difference of region *i* between year *t* and *t-1*, which is actually the growth rate. This is not directly related with regional inequality, but it still indirectly captures the idea of regional inequality when it is used with interaction terms. That means the following. Suppose β_4 is positive. Since infrastructure is often developed in rich areas, it will be interpreted from this result that increasing trade openness is associated with increasing growth rates in high-income regions. This approach was used by Rivas (2007). In this sense, the difference in the growth rate of a region can be used as a proxy for regional inequality.
- $ln(Human\ capital_{it})$: This represents the number of people who have ever been enrolled in tertiary education. South Korea has highest tertiary education gross enrollment ratio in the world (UNESCO 2010), hence there is not much difference in secondary education enrollment ratio among regions (ibid., 97% have finished at least upper secondary education). Because of that, the enrollment rate of tertiary education is used as measurement of human capital. And like other variables, the logged form is used.
- $ln(Trade\ openness_t)$: This represents the log of South Korea's trade openness (Total volume of trade divided by GDP).
- $Infrastructure_{it}$: This represents the infrastructure of each region. In our study, we use two different indicators that reflect infrastructure. The first one is road density (the total length of a province's road network divided by a province's land area), which is widely used for measuring the infrastructure of a society. However, because of the lack of available data, we used vehicles per capita as a proxy of road density. This relies on the basic assumption that better road conditions will lead to more automobiles. The data of road density are from 2005 to 2012 and the data of car per capita are from 2003 to 2012.
- $ln(Per\ capita\ income_{it})$: This represents the log of GRDP divided by each province's total population.
- $ln(Population_{it})$: This represents the log of each province's population.
- $ln(Trade\ Openness_t)*ln(Human\ capital_{it})$: This represents interaction between logged trade openness and logged human capital.

- *ln(Trade openness$_t$)*Infrastructure$_{it}$*: This represents interaction between logged trade openness and infrastructure.
- *ln(Trade openness$_t$) *ln(Per capita income$_{it}$)*: This represents interaction between logged trade openness and logged per capita income.

Notes: We avoided using the lagged form because of the shortage of available data; and *i* stands for each province, and *t* stands for time.

By using this equation, we have two types of model: the original model which contains all of independent variables and the reduced form model which excludes *ln(Trade openness$_t$) *ln(Per capita income$_{it}$)* and *ln(Trade openness$_t$)* variable. And for each model, both data of road density and car per capita are used separately for the measurement of the infrastructure variable.

3. Results

Table 2. Panel Regression Results.

Concept	Original model		Reduced form model	
	Road density	Car per capita	Road density	Car per capita
Human capital	12.737*** (4.305)	10.372*** (2.624)	17.624*** (3.991)	11.912*** (2.637)
Trade openness* human capital	0.005*** (0.002)	-0.000 (0.001)	-0.001** (0.000)	-0.001*** (0.001)
Infrastructure	0.340 (0.389)	-90.737*** (22.637)	-0.337 (0.376)	-59.644*** (20.612)
Trade openness* infrastructure	-0.001 (0.001)	0.079*** (0.024)	0.000 (0.001)	0.038* (0.020)
Per capita income	-2.162 (4.845)	8.817*** (4.376)	-10.033** (4.663)	0.659 (3.508)
Trade openness*per capita income	-0.007** (0.004)	-0.006** (0.003)		

Population	-34.933***	-30.711***	-27.796***	-26.304***
	(10.181)	(6.480)	(10.715)	(6.241)
Trade openness	-35.152***	-9.469*		
	(12.941)	(4.900)		
Constant	551.958***	376.932**	217.006	254.490**
	(178.124)	(101.533)	(142.573)	(83.995)

Notes: Except for infrastructure variable, all the variables are in logarithmic form. Also, the Hausman Test is conducted and the null hypothesis that random effect models are consistent is rejected, meaning that more attention needs to be paid to the fixed effect models. Because of that, this Table includes fixed effect regression only. For robustness, this paper uses the White heteroskedasticity consistent estimation, whose robust standard errors are provided in parentheses. Significance at the 1%, 5%, and 10% levels is marked as ***, **, and * respectively.

The results of the research are presented on Table 2. The coefficient for the human capital variable is positively significant at the 1% level in both the original model and reduced form model. This means the growth rate of state GDP per capita in a highly educated area (that has more human capital) is higher than the area that has comparatively less educated people live (that has less human capital). However, when the human capital is interacted with trade openness, its results show different results. It is little bit ambiguous but most results show a negative 5% and 10% significance. It means when there is more trade, the area that has lower education level benefits more than the area that has more human capital in their growth rate of state GDP. In other words, trade contributes to relieving the regional inequality by benefiting the area that has less human capital. This result corroborates our hypotheses. Also, these results are in accord with Rivas's analysis on Mexico's regional inequality, which was done in 2007.

The coefficient for the infrastructure (road density) shows there is no meaningful relationship between road density and growth rate. We believe this is caused by the lack of datasets. In contrast, when we uses cars per capita as an index for infrastructure, there are interesting results. The coefficient for the infrastructure (cars per capita) is negatively significant at the 1% level, both in the original model and reduced form model. This means the growth rate of state GDP per capita in the area with an abundant infrastructure is lower than the area where has comparatively less infrastructure. This results confirms the convergence effect theory since a less developed region with less infrastructure tends to have

a high economic growth rate, whereas a developed region that has more infrastructure tends to experience stagnation in its economic growth. However, when we examine the case of the infrastructure interacted with trade openness, there are different results. The coefficient for the infrastructure variable interacted with trade openness is positively significant at the 1% level in the original model and 10% level in the reduced form model. This means when there is more trade, the area that has more infrastructure grows faster than the area that has less infrastructure. In other words, trade accelerates regional inequality when it is combined with infrastructure and decreases the convergence effect of the economy. These results go in the same direction with our prior assumption.

Lastly, the coefficient of per capita income by itself shows ambiguous results. When road density is used as a measurement of infrastructure, both the original and reduced form models show a negative relation with no significance in the original model, and a level of 5% significance in the reduced form model. In this case, we hypothesize that there is a convergence effect since a low growth rate is reported within an area that has a high income level. However, when we examine the case of using cars per capita as a measurement of infrastructure, the results change totally. The results show a positive relation at the level of 5% significance with the original model, whereas there is no significance with the reduced form model. This reflects there is no convergence effect for this case. The difference between these two leaves it unclear about whether the convergence effect has been existing in South Korea during the past 10 years. But contrary to this conundrum, the coefficient of per capita income interacted with trade openness is negatively significant at the 5% level, regardless of what measurement is used for the infrastructure. This means when there is more trade, the area that has a lesser income level grows faster, which clearly shows a convergence effect. In other words, trade openness decreases regional inequality in South Korea, which is different from Rivas's prior study on Mexico.

To sum up the salient results of our empirical study about the case of South Korea: trade openness benefits regions with a lower level of education and a higher level of infrastructure, as we had hypothesized. However, somewhat inconsistent with our hypothesis and the case of Mexico, trade openness in South Korea benefits the areas with relatively lower per capita income, so showing a convergence effect. This means the effect of trade on decreasing regional inequality is larger than its effect of increasing regional inequality. Thus, we conclude that trade openness has been playing a positive role in reducing South Korea's regional income gap.

3. Conclusion

Since the 1960s, with an outward-oriented trade strategy, South Korea achieved noticeable economic growth until the mid-1990s. Yet, even after the high economic growth ceased, the South Korean government still opts for greater trade openness with active participation in bilateral and multilateral free trade agreements. As aforementioned, trade cannot be ignored in understanding the South Korean economy.

With that historical basis in mind, we conducted this study on the relation between trade openness and regional inequality using an empirical model and 10-year-dataeset of South Korea. According to the results of our study, trade openness benefits the region that has less human capital and less per capita income. At the same time, trade contributes more economic growth for an area with abundant infrastructure. Since the impact of the prior two exceeds last one, we believe trade openness contributes to reducing regional income discrepancies, contrary to the cases of other countries. This means the effect of South Korea's trade on local income gap reduction is relatively higher than other countries such as Mexico and Japan. With that basis, we can say that not only the trade policy of South Korea helps boosting its economic growth but also in rectifying regional inequality in South Korea. We believe these results could be a guideline for policy makers in South Korea.

Though the result of this study is interesting, more study should be done on this topic. First of all, we admit the study's limitation caused by a lack of data availability. If more datasets are usable for further study, it would increase the credibility of prior results. In addition to that, a robustness check by using inequality measurement indexes, such as the Theil and Gini indexes, should be done in further studies.

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