Non-chrematistic indicators and growth in the Balearic Islands (Spain), 2000-2015

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ABSTRACT
Our main objective is to offer an interpretation of the economic evolution of a tourist province in Spain that has become a leading region in mass tourism: the Balearic Islands. Environmental data are provided, which complement and even question conventional macroeconomic variables. In this same line of research and through an ecological perspective, the authors connect economics with the environment field. Indicators such as water consumption, the production of solid urban waste, CO2 emissions, and energy consumption, among others, are directly related to up to ten economic, social and environmental indicators. These magnitudes help to point out and to warn that, in a context of climate change, analysing the economy in a different way is necessary. The case of the economy of the Balearic Islands is an appropriate laboratory on this subject.

KEYWORDS

Balearic Islands, economic growth, consumption of natural resources, tourism.

1. Introduction

The Balearic Islands, in the Mediterranean Sea, Spain: more than sixteen million tourists a year; just over a million inhabitants; the most dynamic labour market in Spain (although with precarious occupations); businesses focused on the service sector; environmental saturation and excessive consumption of territory; world leadership in the transnationalisation of investments in the tourism sector. This could be a tight synthesis of the economic growth model of the Balearic Islands since the "tourist boom" of 1970s ([1]; [2]). The spectacular economic expansion of the islands since the seventies is, however, a double-edged sword. On the one hand, in a macroeconomic context, many companies specializing in tourism have been evolving up to the point that some of them have expanded their investment strategies into international markets ([3]; [4]). On the other hand, the great growth of the tourism industry has caused serious consequences on the insular natural capital, which represents the main asset of the Balearic Islands: this is detected in the form of excessive consumption of territory, water resources, and energy resources, together with the creation of urban solid waste. Moreover, these factors are causing demographic implosion ([5], [6]).

Connecting economics with the field of natural sciences is a major challenge for social scientists ([7]; [8]). In this sense, the analysis of economic growth's relationship with nature is based on its dependence on natural resources consumption ([9], [10]; [11]; [12], [13], [14]). In the case of the Balearic Islands, the results of various research approaches have been mainly cultivated in the academic sphere, with relatively few impact on active politics ([15]; [16]; [6]). The aspects that have been under analysis can be grouped into two blocks: the first one affects environmental economics; and the second one is related to ecological economics. Concerning the former block, the applied instruments are generally neoclassical (or marginalist), that is, they are oriented to aspects such as determinations of the environment economic value (marginal utility), and propose political actions aimed at paying a fee to protect and preserve both natural and landscape resources ([17]; [18]). On the contrary, the latter block focuses on a non-chrematistic approach without direct translation to prices [19]. At this point, the distinction between price and value is significant, since indicators like the ecological footprint have become present in the field of social sciences of the Balearic Islands. Investigations ascribed to the field of ecological economics have been barely present in public policies. For this reason, we believe that more specific biophysical variables are needed to facilitate decision-making pathways ([20]; [21]; [22]; [23]). If this were carried out, it would cross the boundaries between investigation and its application in politics [24]; in short, the rise to political economy ([25]; [26]; [27]; [28]).

Based on the conclusion that economic growth causes disorder in all areas and, obviously, in the environment ([29], [30], [31]), [32] defend extending the range and scope in the analysis of economic processes, including methods and theories from natural sciences ([33]; [34]; [35]; [36]; [37]; [38]). The change is substantial. But it contributes to technically and conceptually enrich the analysis of the economy ([39]; [40]; [41]; [42]; [43]). This change moves away from a mechanistic phase, that is, a closed circular flow, to a holistic one, in which the economist is required to dialogue with other disciplines to better understand what happens in his own discipline ([44]; [45], [46]). The temporal vector and the mobility of factors are basic characteristics, which provide a depth and greater rigour to the investigation ([47]; [48]).

This article presents the first results of a case of study in the Balearic Islands. First, based on the previous ideas, and in a similar vein of [49], we present ten economic, social and environmental indicators to analyse the recent evolution of the Balearic economy. We also present the applied methodology, together with the descriptive comments according to the results. Finally, some provisional conclusions and a future line of investigation is offered.

2. Ten economic, social and environmental indicators

Ten indicators have been processed for the period 2000-2015 (Table 1). The series is brief, but it embraces a period of economic expansion followed by the outbreak of the Great Recession in 2007-2008:

1. Water consumption (in cubic hectometres),
2. Energy consumption (in equivalent tons of oil),
3. Production of urban solid waste (USW, in tons),
4. CO2 emissions (in kilotons),
5. Gini Index,

6. GDP deflated at 2010 values,

7. GDP per capita deflated to values of 2010,

8. Wages,

9. Unit labour cost,

10. Demographic evolution.

An essential outcome is revealing in the evolution of these data: two clear stages are detected in the analysed period (2000-2015). A first one that ranges the subperiod 2000-2007, and a second one that starts from the Great Recession on. This distinction, although simple and expected, is important because it entails not only different behaviours of some indicators, but also different readings of the impacts of growth on natural resources consumption. One conclusion arises: economic growth causes disorder—therefore, entropic situations from the environmental point of view—; but such an affirmation, which may seem obvious, hides at the same time different characteristics depending on the analysed specific stage.

Table 1. Basic indicators of the Balearic economy

Years	Gini Index	Water Consumption Cubics Hect.	Energy consumption Equiv.tones of oil	CO2 Emissions KT	Urban Solid Waste (USW) Tones	Nominal GDP €
2000		89	2.551.745	8.994	677.834	16.492.806
2001		95	2.660.509	9.284	709.421	17.789.707
2002		98	2.639.664	9.505	716.262	18.780.108
2003		99	2.789.619	10.779	707.067	19.692.948
2004	29	98	2.871.532	10.401	744.971	20.983.851
2005	30	99	3.023.086	10.513	717.797	22.602.678
2006	28	101	3.106.753	10.724	748.735	24.429.529
2007	30	100	3.135.572	10.773	776.387	26.144.862
2008	27	96	3.078.856	10.897	778.760	27.193.863
2009	32	98	2.951.670	10.565	744.750	26.153.141
2010	33	96	2.919.635	10.516	713.393	26.194.558
2011	34	98	2.833.539	10.040	725.839	26.030.098
2012	33	97	2.742.233	9.515	705.206	25.646.507
2013	32	95	2.675.049	8.577	701.894	25.507.987
2014	33	96	2.769.375	8.187	726.820	26.262.492
2015	33	97	2.711.007	8.402	772.497	27.228.681
2016	32					28.460.988

Years	GDP/Cap €	Population	GDP Index Volum	GDP per capita deflated € constants 2010	Wages Index	Unit Labour costs €
2000	20.030	823.400	89	28.163		
2001	21.256	836.900	91	28.326		19.855
2002	21.684	866.100	91	27.486		20.716
2003	21.914	898.600	92	26.778		21.904
2004	22.710	924.000	94	26.514		23.254
2005	23.677	954.600	97	26.531		24.322
2006	24.746	987.200	100	26.455		25.161
2007	25.502	1.025.200	103	26.356		26.149
2008	25.717	1.057.400	105	25.893		28.013
2009	24.260	1.078.100	100	24.387	98	29.069
2010	24.084	1.087.600	100	24.084	99	29.109
2011	23.762	1.095.500	100	23.850	101	29.302
2012	23.224	1.104.300	98	23.282	100	28.615
2013	22.924	1.112.700	96	22.675	101	28.359
2014	23.439	1.120.500	99	23.074	102	28.754
2015	24.102	1.129.700	101	23.409	102	28.994
2016	24.870	1.144.400	105	23.978	104	

SOURCE: Own elaboration. Gini Index: IBESTAT (Balearic Institute of Statistics); water consumption: Regional Ministry of Environment, Agriculture and Fisheries; energy consumption and CO2 emissions: Regional Ministry of Territory, Energy and Mobility; USW: Island Councils; GDP, GDP per capita and Unit Labour Costs: INE (National Institute of Spanish Statistics; unit labour cost: IBESTAT.

Table 2 shows the indicators reduced to index numbers; while table 3 shows their rate of growth:

Table 2. Reduction of indicators to index numbers

Years	Water Consumption	Energy consumption	CO2 Emissions	Urban Solid Waste	Nominal GDP k€	GDP/Cap €	Population	GDP Index Volum	GDP per capita deflated
2000	100	100	100	100	100	100	100	100	100
2001	106	104	103	105	108	106	102	102	101
2002	110	103	106	106	114	108	105	103	98
2003	111	109	120	104	119	109	109	104	95
2004	110	113	116	110	127	113	112	106	94
2005	111	118	117	106	137	118	116	109	94
2006	114	122	119	110	148	124	120	113	94
2007	113	123	120	115	159	127	125	117	94
2008	107	121	121	115	165	128	128	118	92
2009	110	116	117	110	159	121	131	113	87
2010	107	114	117	105	159	120	132	113	86
2011	110	111	112	107	158	119	133	113	85
2012	109	107	106	104	156	116	134	111	83
2013	107	105	95	104	155	114	135	109	81
2014	108	109	91	107	159	117	136	111	82
2015	109	106	93	114	165	120	137	114	83
2016					173	124	139	118	85

SOURCE: See table 1

Table 3. Indicators growth rate

Years	Water consumption	Energy consumption	CO2 Emissions	USW	Nominal GDP	GDP per capita	Population	GDP Index	Deflated GDP
2000									
2001	6,41	4,26	3,23	4,66	7,86	6,12	1,64	2,23	0,58
2002	3,1	-0,78	2,38	0,96	5,57	2,01	3,49	0,41	-2,97
2003	1,6	5,68	13,41	-1,28	4,86	1,06	3,75	1,09	-2,58
2004	-1,36	2,94	-3,51	5,36	6,56	3,63	2,83	1,81	-0,99
2005	1,31	5,28	1,08	-3,65	7,71	4,26	3,31	3,38	0,07
2006	2,13	2,77	2,01	4,31	8,08	4,51	3,42	3,11	-0,29
2007	-0,72	0,93	0,45	3,69	7,02	3,06	3,85	3,46	-0,37
2008	-4,91	-1,81	1,15	0,31	4,01	0,84	3,14	1,33	-1,76
2009	2,69	-4,13	-3,04	-4,37	-3,83	-5,67	1,96	-3,98	-5,82
2010	-2,53	-1,09	-0,47	-4,21	0,16	-0,73	0,88	-0,36	-1,24
2011	2,15	-2,95	-4,53	1,74	-0,63	-1,34	0,73	-0,26	-0,97
2012	-0,66	-3,22	-5,22	-2,84	-1,47	-2,26	0,8	-1,59	-2,38
2013	-1,98	-2,45	-9,86	-0,47	-0,54	-1,29	0,76	-1,87	-2,61
2014	1,11	3,53	-4,55	3,55	2,96	2,25	0,7	2,47	1,76
2015	0,97	-2,11	2,64	6,28	3,68	2,83	0,82	2,29	1,45
2015/2000	9,18	6,24	-6,58	13,97	65,09	20,33	37,2	14,04	-16,88

SOURCE: See table 1.

The ten indicators and their reciprocal relation are characterised, always considering demographic evolution, by the following:

- They do not present unachievable methodological difficulties for data collection and subsequent calculation, so that they can be reasonably assumed as panel discussion by policy makers;
- Chrematistic variables (GDP, GDP per capita) are intermingled with environmental ones (production of USW, CO2 emissions, energy use, and water consumption);
- They do not put aside the social aspect of the process of growth, since they incorporate data on inequality (Gini index) and consumption capacities (through wage indicators);
- They help identify some ecological effects of economic growth;
- They provide a different reading of the growth process, since they specify and systematize dispersed variables that do not usually appear in the regular diagnoses of public administrations.

One is aware that other variables can be incorporated into this exercise; what is required, though, is that they fulfil at least the five characteristics specified above.

A first look at the evolution of this indicators suggests the following:

1. In 2015 the GDP deflected at 2010 values was 18 percent higher than in 2000; on the contrary, GDP per capita was in 2015 15 percent lower than in 2000. This occurs due to a very relevant growth of population, 39 percent. Hence, the Balearic Islands continue to have the so-called demographic "effect call" that increases production and vice versa; nevertheless, this is clearly insufficient to recover the per capita income in constant values. The economic growth model of the islands, based on the tourism industry and the construction sector, both (but particularly the latter) intensive in the use low skilled labour and in the consumption of natural resources, has not been able to generate a growth rate of GDP above the growth rate of population.

2. The environmental data show some behaviours that, in some cases, surprise. The consumption of water, the use of energy, and the production of USW have increased by 9 percent, 6 percent and 14 percent respectively between 2000-2015; while the CO2 emissions have been reduced by 7 percent (Table 3). Here is an apparent dysfunction:

1) The generation of USW has a greater and closer connection with GDP. As can be seen in Table 4, the correlation between both variables reaches 75 percent. The correlation between USW and population is not high (39 percent), suggesting that the correlation between both variables does not consider the total

population (that is, the residents plus the floating population). It is logical that more population supposes more production of USW; hence, incorporating the tourists would increase the correlation between the two figures (USW and total population).

2) Energy consumption shows a clear growth between 2000 and 2008 (Table 3), while it decreases from 2009 to 2015. Its correlation with CO2 emissions is high (77 percent), and weaker but still relevant with the production of USW (67 percent). Similarly, the correlation between energy consumption and constant GDP is of 71 percent (Table 4).

3) Water consumption is very regular, and its correlation with energy consumption is significant (66 percent), as well as with CO2 emissions (52 percent) and USW production (53 percent). The correlation of these indicators seems obvious: economic growth drives the consumption of resources (water, energy) and generates waste, thus, the correlation coefficients are higher than 50 percent among all these variables.

4) Inequality, measured by the Gini index, has increased since 2008 (with a coefficient of 27,4, after being reduced two points since 2004). The index stabilized in 2016, with a coefficient of 31,7 points (Table 1). Correlations of Inequality with energy consumption, generation of USW and CO2 emissions are positive and relevant, over 50 percent, which implies that the increase of the consumption of natural resources does not contribute to an effective reduction of inequality (Table 4).

Table 4. Correlation Matrices

	Gini Index	Water Consumption	Energy Consumption	CO2 Emissions	USW Production	Nominal GDP	GDP/ capita	Population	GDP Index	GDP/cap. deflated	Wages	Price of work
Gini	1,00											
Water's consump.	-0,41	1,00										
Energy consump.	-0,76	0,67	1,00									
CO2 Emissions	-0,63	0,52	0,77	1,00								
USW	-0,51	0,53	0,68	0,33	1,00							
Nominal GDP	0,34	0,38	0,52	0,07	0,60	1,00						
GDP/per capita	-0,48	0,59	0,84	0,44	0,81	0,88	1,00					
Population	0,69	0,23	0,27	-0,16	0,39	0,96	0,72	1,00				
GDP Index volum	-0,12	0,44	0,72	0,28	0,75	0,95	0,96	0,83	1,00			
Deflacted GDP/cap	-0,84	-0,10	0,00	0,35	-0,13	-0,82	-0,47	-0,94	-0,60	1,00		
Wages	0,18	-0,13	-0,72	-0,82	0,28	0,69	0,23	0,93	0,46	-0,31	1,00	
Price of Work	-0,02	0,01	0,26	0,01	0,13	0,23	0,13	-0,01	0,11	0,07	-0,35	1,00
Laboral cost	0,69	-0,17	0,20	-0,17	0,26	0,96	0,66	0,98	0,80	-0,90	-0,12	0,21

SOURCE: See table 1.

It is important to note that the deflated GDP per capita is 17,45% lower in 2015 than in 2000. It presents negative annual growth rates practically in every year (except for the years 2004, 2013 and 2014). However, water consumption, energy use, CO_2 emissions, and USW production grew at positive rates in practically every year before the Great Recession; and present negative growth rates in practically every year after the Great Recession. Therefore, we see a clearly different pattern of consumption of natural resources before and after the Great Recession that cannot been explained exclusively by the evolution of current output.

3. Consumption of natural resources and GDP per capita

Next, we describe apparent relationships between the four environmental indicators and the deflated GDP per capita. Figures 1-4 show the linear regressions. The results bring new considerations that can complement (and, in some respects, question) the previous ones:

1. During the period 2000-2007, the pair relationships are negative in all cases between 2000 and 2007. All the regressions show negative slope coefficients and statistically significant effects.

2. However, after the Great Recession, the Balearic Islands experience a same sign-relationship between GDP per capita growth and natural resources consumption. From 2008 on, the regression slopes turned positive: the upward or downward variations in the deflated GDP per capita imply same sign-movements in the use of natural resources, except for water consumption (however, in this case the p-value is relatively high, 0,080). This suggests that, contrary to what happened during the subperiod 2000-2007, between 2008 and 2015 the negative growth rates of GDP per capita are accompanied by negative growth rates of consumption of natural resources. We observe statistically significant effects in all the regressions, except in the one between GDP per capita and USW production, with a p-value of 0,48. Therefore, in this latter subperiod apparently there is a more direct relationship between the evolution of GDP per capita and that of the fundamental consumption of natural resources.

Figure 1. Linear Regression between water consumption and GDP per capita

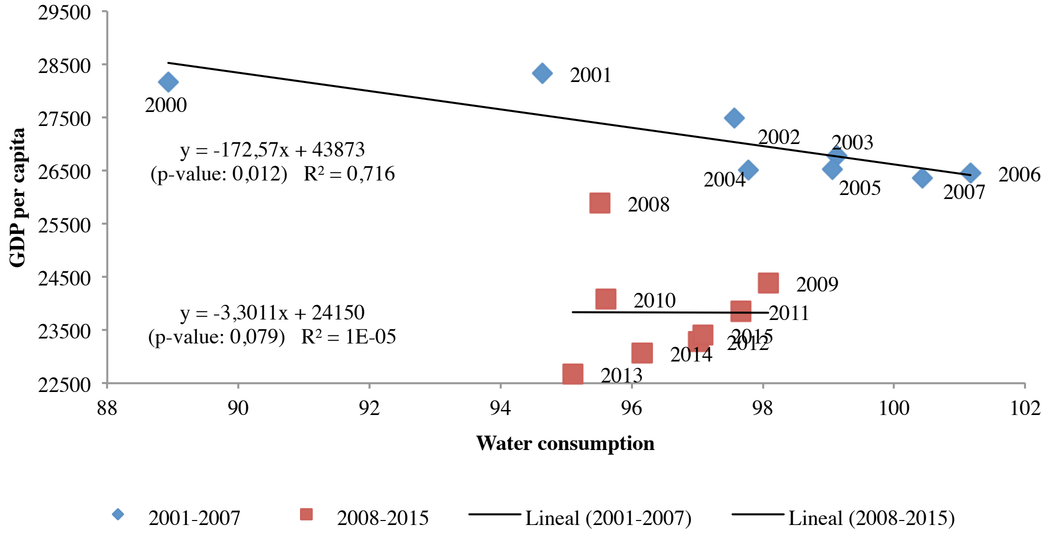


Figure 2. Linear Regression between energy consumption and GDP per capita

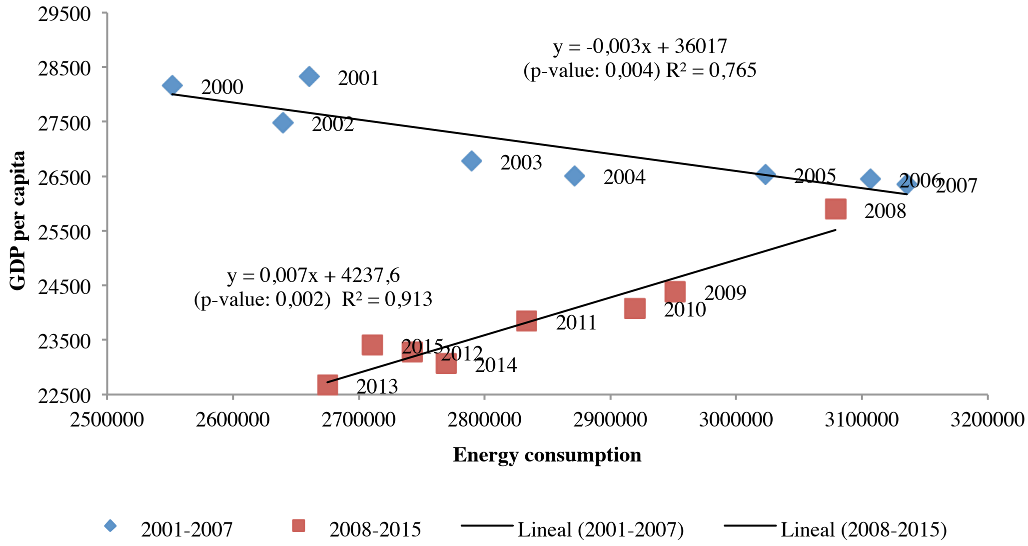


Figure 3. Linear Regression between USW and GDP per capita

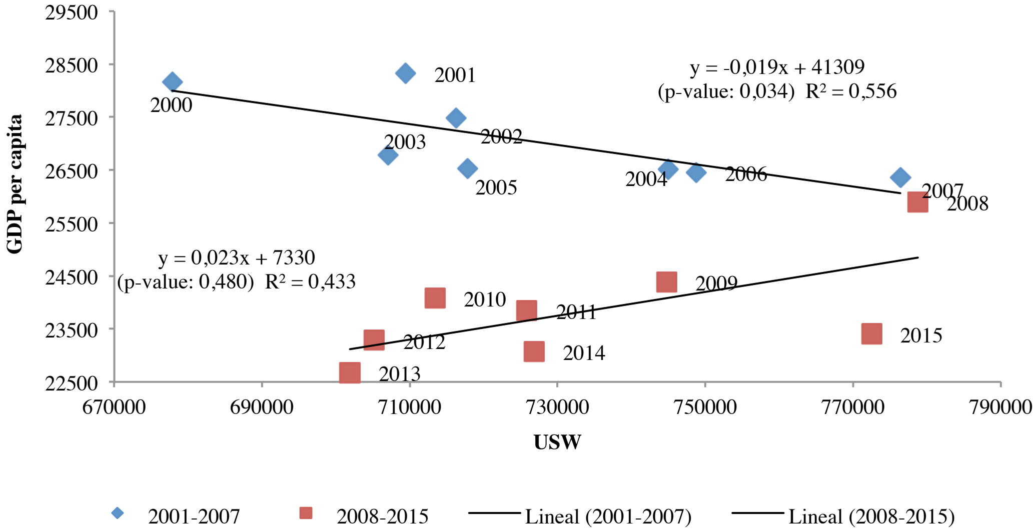
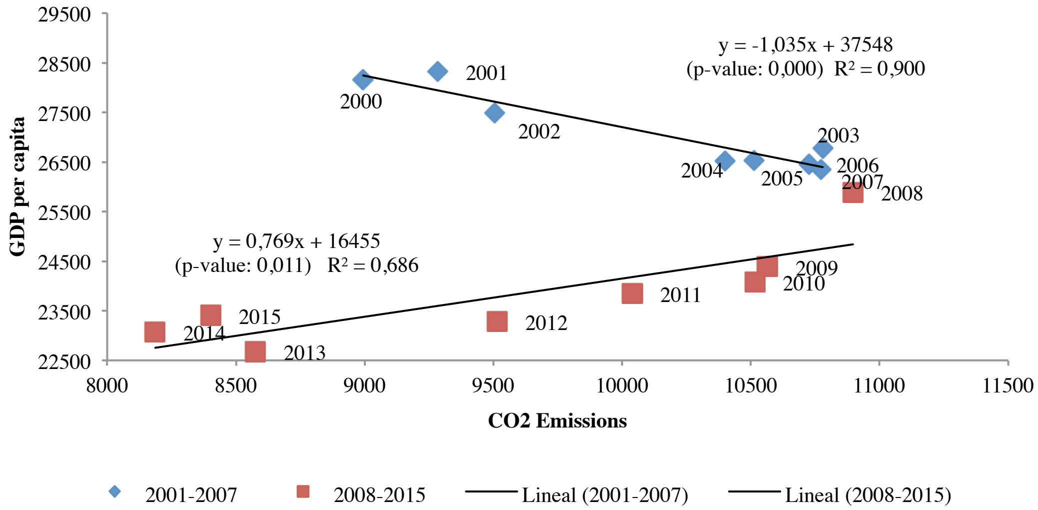


Figure 4. Linear Regression between CO2 emissions and GDP per capita



3. These results suggest three aspects: on the one hand, the improvement in technological efficiency; on the other, the change in consumption patterns. Another key element can be a change in the economic structure of the Islands: the loss of the weight that the construction sector (intensive in the use of natural resources) had on output. Until the Great Recession took place, economic growth was lower than the evolution of energy consumption. The period between 2001 and 2006 was a phase characterised by highs rates of growth of GDP, which needed however, greater expansions of energy consumption (the rates are higher than those of GDP, as detailed in Figure 7). The economy of the Balearic Islands also needed rates of growth of CO_2 emissions and of production of USW higher than those of GDP between the period of 2000 and 2005 (Figure 8). From 2006, the evolution of the USW indicator is below the evolution of GDP (Figure 8). This does not

happen with CO_2 emissions; whose evolution exceeds that of GDP (Figure 8). The Great Recession infers, also here, changes: CO_2 emissions contract while the production of USW increases. In short, between 2000 and 2007, the evolution of the use of natural resources exceeds that of GDP, which suggests that the economic growth model of the Balearic Islands during this period required a high consumption of energy, water and CO_2 emissions. Figures 5-9 show the evolution of the indicators between 2001 and 2015.

Figure 5. Water and GDP deflated

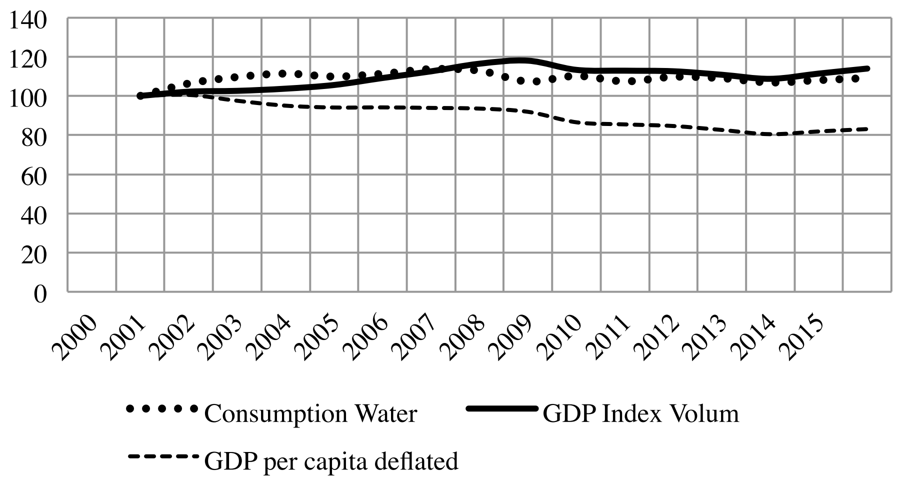


Figure 6. Energy consumption and deflated GDP per capita

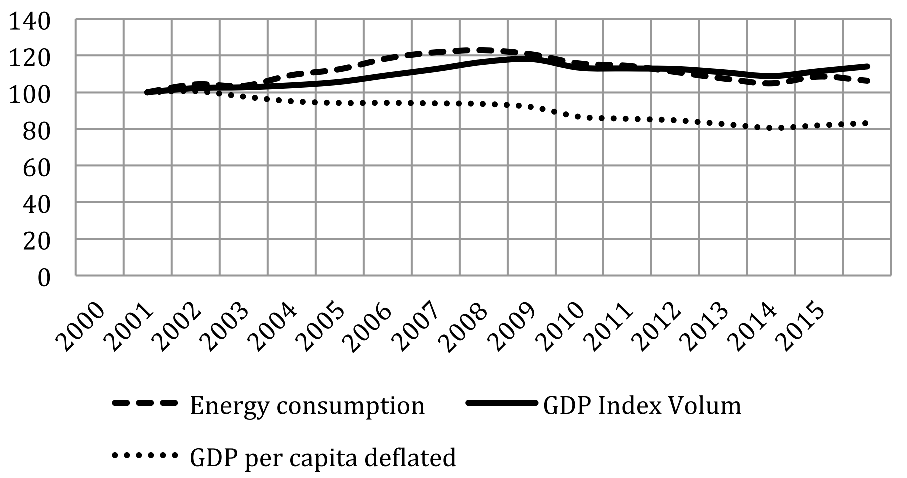


Figure 7. CO2 Emissions, USW, GDP and GDP per capita

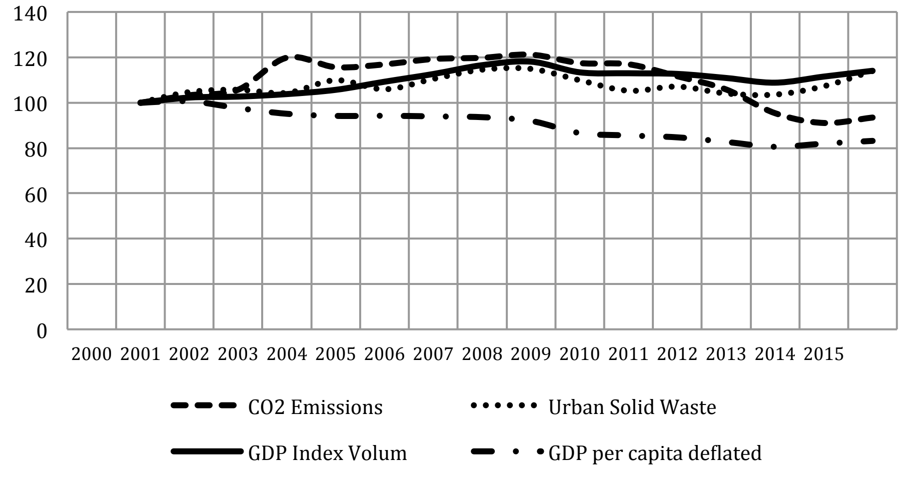
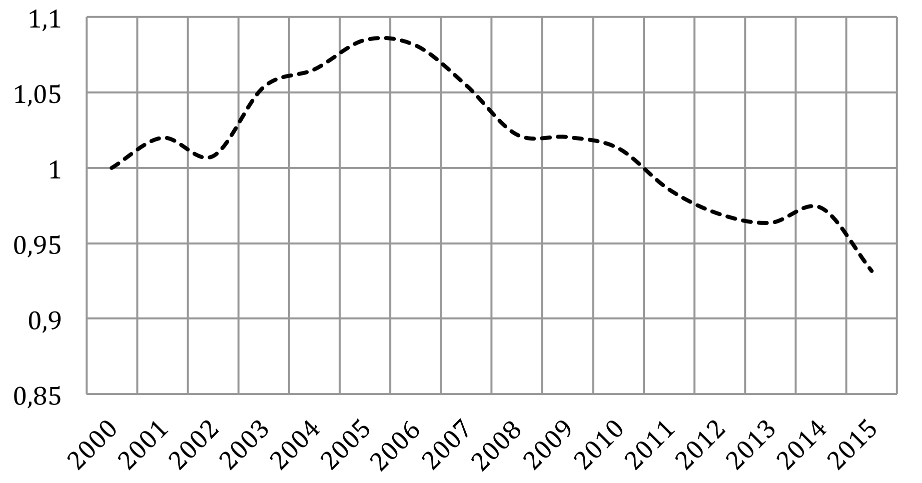


Figure 8. Energy intensity of the Balearic economy



SOURCE: for all figures, see table 1.

Some additional specifications should be noted:

1) From the Great Recession on, the energy consumption per capita is retracted, as well as the production of USW; but, unlike the former, it does it slightly. CO2 emissions per inhabitant fall from 2005 until 2013. As noted above, the incorporation of the population to this analysis suggests that population either controls its consumption more efficiently or, perhaps, that there has been improvements in technological efficiency or a change in the productive structure (due to the fall of the construction sector and the rise of the ICT sector, mainly related to the tourism industry).

2) This last aspect is marked with the calculated intensities. The energy intensity of the economy falls since 2006, after an expansive period (Figure 8).

3) The average growth rate of water consumption, energy use, CO2 emissions and USW production remains at positive levels—although oscillating—between 2000 and 2007 (Table 3). After the Great Recession, the

growth rates are negative, and they change their sign in 2014 with the recovery of the economy (and particularly the recovery of the construction sector).

4) Interestingly, the multiple regression for the period 2008-2015 shows positive and statistically significant (except in the case of water) slope coefficients (Table 5). However, the multiple regression for the period 2000-2007 (Table 6) provides negative slope coefficients (except for water), but none of them is statistically significant. Therefore, we suggest that, as can be seen in Figure 8, the natural resources consumption between 2000 and 2007 follow a totally different trend with respect to the evolution of GDP per capita. Their evolutions diverge so much that the statistical relationship between GDP per capita and natural resources consumption, in a multiple regression framework, vanishes. Thus, we conclude that economic growth during the period 2000-2007 was based on an intensive and disproportionate use of natural resources.

Table 5. Linear regression between GDP per capita and environmental variables between 2008-2015

Variable	Coefficient	Std. Error	t-Statistic	P-value
C	5388.701	3302.877	1.631517	0.2444
CO2	0.313471	0.073899	4.241908	0.0513
ENERGY	0.0024	0.000598	4.012135	0.0569
USW	0.008253	0.001728	4.774646	0.0412
WATER	25.63722	40.32621	0.635746	0.59
R-squared	0.995972	Mean dependent var		23537.29
Adjusted R-squared	0.987915	S.D. dependent var		599.7916
S.E. of regression	65.93631	Akaike info criterion		11.39106
Sum squared resid	8695.195	Schwarz criterion		11.35243
Log likelihood	-34.86872	Hannan-Quinn criter.		10.91354
F-statistic	123.6202	Durbin-Watson stat		2.35016
Prob(F-statistic)	0.00804			

Table 6. Linear regression between GDP per capita and environmental variables between 2000-2007

Variable	Coefficient	Std. Error	t-Statistic	P-value
C	38544.91	4475.121	8.613155	0.0033
CO2	-0.879807	0.464374	-1.89461	0.1545
ENERGY	-0.000382	0.001572	-0.243267	0.8235
USW	-0.00329	0.008845	-0.371964	0.7346
WATER	9.341314	76.04121	0.122845	0.91
R-squared	0.916107	Mean dependent var		27076.13
Adjusted R-squared	0.80425	S.D. dependent var		803.3753
S.E. of regression	355.4425	Akaike info criterion		14.85378
Sum squared resid	379018.2	Schwarz criterion		14.90343

Log likelihood	-54.4151	Hannan-Quinn criter.	14.5189
F-statistic	8.189972	Durbin-Watson stat	2.961732
Prob(F-statistic)	0.05769		

4. Final thoughts

Tertiary economies are experiencing very fast changes in the process of economic globalisation ([50]; [51]). At this point, there exist some challenges that affect the Balearic economy. The dynamic competitiveness of productive systems consists not only in the ability to adapt to changes, but also to do it as quick as possible ([52]; [53]; [54]; [55]). Indeed, the speed with which local actors process and execute information, which can be enhanced through cooperation between the different productive units, is crucial. The agility with which this information is systematised is related, among other factors, to three essential ideas. Firstly, the productive resources of the companies, according to their critical mass or size (tangible plus intangible). Secondly, both human capital and the implementation of regional and local innovation systems could favour new possibilities that would have more efficient productive combinations in order to respond to changes that are in demand. Finally, the active role that the public sector would have to assume in order to develop synergies with the private capital, which until very recently has been prone to investments ([56]). These are indeed difficult challenges, but they are considered by all the regional mature economies. Tourism as a system is consolidated itself as an integral system for the economy in general ([57]; [58]). In this sense, working on alternative indicators, which consider the negative externalities of this integral system, will be a determining factor in improving the adoption of public policies.

The current difficulties that capitalism faces evidence the increasing importance of establishing alternative and complementary indicators that complement the chrematistic ones. This has been a central objective of our research. We believe that the ten presented indicators offer reasonable explanations on the evolution of an economy from the perspective of sustainability. We have argued about environmental aspects, but also about social questions. Both are basic to have more convincing explanations about the trajectory of an economy.

We have combined the behavior of environmental data with the behavior of strictly chrematistic data, which has facilitated the determination of two clear phases, divided by the impact of the Great Recession.

At the same time, an important fact has been observed: tertiary economies, specialized in mass tourism (and its productive linkages, which in the case of the Balearic Islands have led to a spectacular growth in the construction sector), generate negative externalities. Indeed, economic activities of tertiary base are not innocuous towards the environment. This generates derivatives related to economic policy: the possibility of activating fiscal measures that serve to correct these externalities, in the same way that they have been applied in the industrial economies.

Finally, we are aware that our investigation is in a phase that should culminate by stablishing a synthetic indicator of sustainability that will help to better understand the ecological implications of economic growth. This synthetic indicator would go in line with the Human Development Index of the United Nations, but adapted to the regional development with the incorporation of variables related to natural resources.

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