

A further step into the ELGH and TLGH for Spain and Italy

Isabel Cortés-Jiménez and Manuela Pulina

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Isabel Cortés-Jiménez, *Regional Quantitative Analysis Research Group (AQR) – IREA, Department of Econometrics, Statistics and Spanish Economy Universitat de Barcelona*
Manuela Pulina, *Centre for North South Economic Research (CRENoS), Department of Economics, D.E.I.R. Università di Sassari*

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Summary

Nowadays many developing countries focus on economic policies for promoting international tourism and exports expansion as a potential source of economic growth of the country. However, the understanding of the relationship between exports and economic growth is still ongoing. When treating the relationship between tourism and economic growth, considering tourism as a non-traditional export few studies have been published to date. This paper has the objective to assess if exports and tourism have really promoted growth by means of the export-led growth hypothesis (ELGH) and the tourism-led growth hypothesis (TLGH). The cases under analysis are Spain and Italy, two of the most important countries worldwide regarding the expansion of tourism. Cointegration techniques and the multivariate Granger causality test are applied. Results reveal that exports cause economic growth in the long-term for both countries, whilst only for Spain tourism appears as a factor which influences economic growth in the long-run.

Keywords: Economic Growth, Exports, Tourism, Cointegration, Multivariate Granger Causality, Spain, Italy

JEL Classification: L83, C32, O49

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Address for correspondence:

Isabel Cortés_Jiménez
Department of Econometrics
Statistics and Spanish Economy
Universitat de Barcelona
Avda Diagonal, 690 Torre 4
08034 Barcelona
Spain
Phone: +34 934024319
Fax: +34 934021821
E-mail: icortes@ub.edu

I. INTRODUCTION

The export-led growth hypothesis (ELGH) postulates that the economic growth of countries can be generated not only by increasing the amount of labour and capital within the economy, but also by expanding exports. Actually, exports are generally supposed to contribute positively to economic growth through different means: facilitating the exploitation of economies of scale (Helpman and Krugman, 1985), relieving the foreign exchange constraint (McKinnon, 1964), enhancing efficiency through increased competition (Krueger, 1980), and promoting the diffusion of technical knowledge (Grossman and Helpman, 1991). The ELGH has been widely analysed in the literature¹ and although there is a widely held belief that exports promote economic growth at a theoretical level, empirically evidence is rather mixed². Due to this fact, even today there is a keen interest in these issues especially for developing countries. Recent empirical articles (Panas and Vamvoukas (2002) for Greece, Abual-Foul (2004) for Jordan, Al Mamun and Nath (2005) for Bangladesh and Awokuse (2005a,b) for Japan and Korea, respectively) analyse the causality between exports and economic growth in a bivariate context. Only a few studies employ a multivariate framework; amongst others Islam (1998) and Ghirmay *et al.* (2001).

Directly derived from the ELGH, the tourism-led growth hypothesis (TLGH) has recently appeared in the literature. Balaguer and Cantavella-Jordà (2002) were the first authors to mention this concept. Since then increasing attention has been paid to this issue. Taking into account that international tourism can be considered firstly as a non-

¹ Giles and Williams (2000) provide a comprehensive survey over seventy time series studies.

² For instance, Marin (1992) supports the hypothesis of export-led economic growth in developed countries such as United States, Japan, United Kingdom and Germany whilst Shan and Sun (1998) demonstrate a bidirectional causality between exports and economic growth in China.

traditional export since it implies a source of receipts³ and, secondly, international tourism has experienced such a huge increase that nowadays it is being considered as a potential strategic factor to development and economic growth, it seems straightforward to understand the derivation of the TLGH from the ELGH. To date, only empirical papers can be found and there is a clear lack of theoretical literature about TLGH. In this context, several researchers are interested in demonstrating that tourism can be considered as a main factor of economic growth for developing countries. The current papers on this issue are Balaguer and Cantavella-Jordà (2002) for Spain, Dritsakis (2004) for Greece, Gunduz and Hatemi-J (2005) for Turkey, Oh (2005) for Korea and Kim *et al.* (2006) for Taiwan. Analogously to ELGH, these authors analyse the possible causal relationship between tourism and economic growth in a bivariate context; however, not all of them find evidence of the long-run causality from tourism to economic growth. Therefore, whether tourism growth actually causes the economic growth or, alternatively, economic expansion strongly contribute to tourism growth is a question not well answered at this moment in time.

Amongst the empirical studies on the ELGH and the TLGH hypotheses, we have found an interesting paper by Durbarry (2004). This author mixes both the hypotheses since he uses a production function where the economic growth is explained by physical capital, human capital and exports. The latter variable is included into the model in a disaggregated manner and international tourism is one of the items. This empirical work focuses on the economy of Mauritius.

³ International tourism implies consumption *in situ*, the consumers are who must move rather than the product as happens with exports.

The present paper attempts to go a step further in the ELGH and TLGH. The main objectives of this work are to assess whether the ELGH and the TLGH employed in a multivariate context are valid for two developed countries, namely Spain and Italy.

The main contributions of the present research can be found in the following: the estimated model, the applied methodology and the variables included in the model. Data on exports and GDP, and on international tourism receipts and GDP are employed aimed to analyse the causal interrelationship amongst the variables of interest. Based on Durbarry (2004), a standard production function is estimated including exports as a factor to economic growth when evaluating the ELGH, and international tourism receipts as a further possible factor which influences economic growth when studying the TLGH. In addition to this, and expanding Durbarry's (2004) study, the present paper also investigates the short-run and long-run relationships and Granger causality using a multivariate Granger test.

Regarding previous research on this field for the Italian case, it is worth mentioning that Federici and Marconi (2002) paper is the unique research found. In their work, the ELGH for the Italian economy (1960-98) is tested through a Vector Autoregression (VAR) model with four macroeconomic variables: an index of the GDP of the rest of the world; the Italian real exchange rate; Italian real exports; and the Italian real GDP providing empirical support for the hypothesis. As far as TLGH is concerned, no articles have been found.

With respect to Spain, the papers of Balaguer and Cantavella-Jordà (2002, 2004) support the TLGH and the ELGH, respectively. However, these two works test if international tourism receipts (1975-1997, quarterly data) and exports (1961-2000, annual data) Granger causes GDP, including an exchange rate and the applied test is a

simple Granger test where the error correction term is not considered. According to Granger (1988), the conventional causality tests are valid only if the original time series do not cointegrate. If they do, an error correction model should be used by including the relevant error correction term in the model to check for causality. Therefore, the paper of Balaguer and Cantavella-Jordá while a starting point for later research on TLGH, however, we cannot draw conclusive results from this empirical work. In the present study we avoid this econometric problem by applying appropriate tests in each case.

In this study, firstly, three hypotheses are examined referring the ELGH in Spain and Italy, separately: (a) the ELGH; (b) the economic-driven exports growth hypothesis; (c) the two-way causal hypothesis which combines (a) and (b), where the Granger-causality between exports and economic growth may run in one or both directions. Secondly, regarding TLGH other three hypotheses are evaluated for Spain and Italy, separately: (d) the TLGH; (e) the economic-driven tourism growth hypothesis; (f) the two-way Granger-causal hypothesis which combines (d) and (e), where the causality between tourism and economic growth may run in one or both directions.

Recognition of the existence of a Granger-causal relationship between international tourism/exports and economic growth will have important implications for the development of different tourism marketing/external trade and policy decisions. If a unidirectional Granger-causality from tourism growth to economic expansion is found, then tourism-led economic growth is practical. If results show the opposite causality, then the economic development may be necessary for the expansion of the tourism industry/exports sector. Next, if the causative process is bidirectional, and tourism growth/exports expansion and economic growth have a reciprocal causal relationship, then a push in both areas would be beneficial. Finally, if there is no Granger-causality relation between tourism growth/exports increase and economic development, then

strategies oriented to promote tourism sector/external sector may not be as effective as expected.

This study seeks to go a step further both in the export-led growth hypothesis and in the tourism-led growth hypothesis by testing cointegration, constructing a multivariate VAR model based on a standard production function of economic growth and, lastly, attempting to capture the short-run and long-run effects of the different variables for the Spanish and the Italian economies.

The paper is organised as follows. The previous section gives a brief review of the most important issues on the ELGH and the TLGH, and the objectives of the present research are highlighted. The next section describes the Italian and the Spanish economies and their evolution to provide a general overview on these cases studies. Section 3 describes the data, methodology and results from this empirical analysis. Finally, Section 4 presents the concluding discussion and further comments.

II. SPAIN AND ITALY: A GENERAL OVERVIEW

There is no doubting the importance of tourism for Spain and Italy during the last several decades. Nowadays Spain and Italy are the most important countries in the Mediterranean area regarding international tourism. What is more, in 2005 they ranked second and fourth in the classification of the top ten tourism destinations worldwide as regard to international tourism receipts (UNWTO). The aim of this section is to provide a general overview of the characteristics of the Spanish and the Italian economies. Table 1 provides relevant economic data for these two countries from 1960 to date.

Spain is a widely referenced success case regarding the expansion of tourism and how to take advantage of this activity to develop economic performance. It has been argued that the source of foreign currency receipts generated by tourism during the sixties and the seventies financed the imports of produced goods which were necessary to carry out the industrialisation process (Sinclair and Bote Gómez, 1996). Thus, the international tourism expansion in Spain played a relevant role for becoming a developed country. From Table 1, it can be observed how Spain passes from a developing economy to a developed one. It is worth remarking that exports and international tourism have been significantly more and more important in each period.

Nowadays Italy is a developed country with an important exports and tourism sector as shown in Table 1. Comparing briefly Spain and Italy, it is worth mentioning that Italy has had a bigger exports sector whilst Spain has experienced the highest numbers regarding international tourism. As regards 2003 data, Spain had 27.9% of GDP corresponding to exports of goods and services whereas for Italy it was of 25.4%. When dealing with tourism data, we find that in 2004 Spain had 36376 million euros of international tourism receipts whereas Italy had 28665. It seems clear that Spain continues growing whilst Italy seems to depict a stable pattern.

Thus they offer two potentially valuable cases of study. Due to their economic characteristics and evolution during the last decades, Spain and Italy are suitable countries to assess the ELGH and TLGH.

III. MODEL, METHODOLOGY AND RESULTS

As explained previously, following Ukpolo (1994), Ghatak *et al.* (1995) and Durbarry (2004), we adopt a production function framework that is compatible with the ‘new’ growth theory, where one has the following functions: $Y = f(X, K, H)$ and $Y = f(T, K, H)$. The data are annual Spanish and Italian series on real per capita Gross Domestic Product (Y), exports (X), international tourism receipts (T), physical capital (K), human capital (H). For Spain the sample period is available from 1964 to 2000; for Italy the sample period is from 1954 to 2000. Data definitions and sources are listed in the appendix.

Expressing the previous mentioned functions in a linear logarithmic regression form, the multivariate relationships are investigated:

$$LY_t = \psi_0 + \psi_1 LX_t + \psi_2 LK_t + \psi_3 LH_t + u_t \quad (1)$$

$$LY_t = \varpi_0 + \varpi_1 LT_t + \varpi_2 LK_t + \varpi_3 LH_t + v_t \quad (2)$$

The ELGH will be assessed through expression (1) and the TLGH will be investigated through expression (2).

The methodology employed to investigate the relationship amongst on the one hand, growth, exports, physical capital and human capital and, on the other hand, growth, international tourism, physical capital and human capital, consists of three steps. The first step is to test the order of integration of the natural logarithm of all the variables⁴. Table 2 gives the results of the augmented Dickey-Fuller (ADF) and standard Phillips-Perron (PP) test statistics. These tests are used to detect the presence of a unit root for the individual time series and their first differences. Each of the series appears to be

⁴ Plots of the all series expressed in natural logarithm are also shown in Figures 1 and 2.

integrated of order $I(1)$ in the level form but $I(0)$ in first differences (Engle and Granger, 1987). The PP test is consistent with ADF test.

Given the unit root results, the second step is to use the VAR approach that Johansen (1988) and Johansen and Juselius (1990) employed to investigate the cointegrating properties of a system. The joint F -test and the AIC, SC and HQ Information Criteria⁵ are used to select the number of lags required in each case to assure white-noise residuals; thus, the chosen lag length is accordingly either one or two (Oh and Lee, 2004). The cointegration test results are presented in Table 3. Models 1 and 3 are VARs employing growth, exports, physical capital and human capital for Spain and Italy, respectively. Models 2 and 4 are VARs employing growth, international tourism receipts, physical capital and human capital for Spain and Italy, respectively. A single significant cointegrating vector is identified using the maximum eigenvalue and trace statistic in all cases⁶. Hence, we conclude that all variables are cointegrated, and causally related in each model. It is worthwhile noticing that in the cointegrating vector (Table 3, Model 1) a long-run negative relationship is detected between exports and economic growth. However, the coefficient for LX is not statistically significant; the same conclusion can be reached for LH . In Model 2, LK negatively effects economic growth, nevertheless, the coefficient turns out to be statistically insignificant. A mix result is reached for LH , though showing a statistically significant coefficient at the 5% level, it presents a negative sign. For the Italian case (see Models 3 and 4), LH negatively influences economic growth, however, in both the cases, the coefficient is not statistically significant⁷.

⁵ Akaike, Schwartz and Hannan-Quinn Information criteria, respectively.

⁶ In Model 2 only the trace statistics detects a cointegrating vector (see Table 3).

⁷ It is worthwhile pointing out that in the majority of empirical studies that employ the VEC framework, authors do not report the outcome from the long run analysis obtained using the cointegrating vector.

The third step is to carry out a multivariate Granger causality test (**Granger, 1969; Granger et al., 1998**) augmented with the error-correction mechanism (*ECT*) as derived from the cointegration relationship, as given in equations (3)-(6).

$$\Delta Y_t = \alpha_1 + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + \sum_{i=1}^p \gamma_i \Delta X_{t-i} + \sum_{i=1}^p \delta_i \Delta Z_{t-i} + \sum_{i=1}^p \theta_i \Delta V_{t-i} + \eta_1 ECT_{t-1} + \varepsilon_t \quad (3)$$

$$\Delta X_t = \alpha_2 + \sum_{i=1}^p \sigma_i \Delta Y_{t-i} + \sum_{i=1}^p \phi_i \Delta X_{t-i} + \sum_{i=1}^p \rho_i \Delta Z_{t-i} + \sum_{i=1}^p \lambda_i \Delta V_{t-i} + \eta_2 ECT_{t-1} + \mu_t \quad (4)$$

$$\Delta Z_t = \alpha_3 + \sum_{i=1}^p \omega_i \Delta Y_{t-i} + \sum_{i=1}^p \zeta_i \Delta X_{t-i} + \sum_{i=1}^p \chi_i \Delta Z_{t-i} + \sum_{i=1}^p \xi_i \Delta V_{t-i} + \eta_3 ECT_{t-1} + \nu_t \quad (5)$$

$$\Delta V_t = \alpha_4 + \sum_{i=1}^p \vartheta_i \Delta Y_{t-i} + \sum_{i=1}^p \upsilon_i \Delta X_{t-i} + \sum_{i=1}^p \kappa_i \Delta Z_{t-i} + \sum_{i=1}^p \pi_i \Delta V_{t-i} + \eta_4 ECT_{t-1} + \tau_t \quad (6)$$

The *t*-statistics on *ECT* indicates the existence of long-run Granger-causality, whereas the significance of *F*-statistics indicates the presence of short-run Granger-causality. These tests are provided in Table 4. First, as regards the long-run, in equation (2), if η_1 is statistically different from zero, the null hypothesis can be rejected, and one concludes that the variables *X*, *Z* and *V* Granger cause the variable *Y*. In equation (3) if η_2 is statistically different from zero, one concludes that the independent variables *Y*, *Z* and *V* Granger cause *X*. In equation (4), if η_3 is statistically different from zero, one infers the variables *Y*, *X* and *V* Granger cause the variable *Z*. Finally, in equation (5), if η_4 is statistically different from zero, one infers the variables *Y*, *X* and *Z* Granger causes the variable *V*. Second, referring to the short-run, in equation 2, for example, if γ_i is jointly statistically different from zero, and the null hypothesis cannot be accepted, one finds that *X* Granger causes *Y*. Results are provided in Tables 4 and 5 for Spain and Italy, respectively.

From the first equation the t -statistics, shown in Table 4 for Model 1, indicates that the coefficient of the cointegrating vector is statistically significant at the 1% level, thus a long-run causal relationship exists running from exports (LX) to GDP (LY). A further result is the existence of a long-run Granger causality running from LK and LH to LY . The results from the second equation also show a bidirectional relationship since LY Granger causes LX in the long-run. Additionally, a short-run relationship is found running from LY to LX . In the last equation, once again there is evidence of a long-run Granger causality running from LY to LH as well as a short-run Granger causality running from LY , LX and LK to LH . For Model 2 there is a bidirectional long-run Granger causality between LY and LT as well as a short-run relationship from LT to LY . Furthermore, in the long-term LK and LH Granger cause LY . Finally, LY Granger causes LH in the short-run as shown in the last equation.

For the Italian case, the results are shown in Table 5. Model 3 shows a bidirectional long-run Granger causality relationship between LY and LX . Regarding short-run relationships, LX and LH Granger cause LY , respectively (first equation). In the third equation, a long-run relationship exists running from LY , LX and LH to LK and in the short-term there is also a strong causal relationship from LY , LX , LH to LK . Model 4 shows a unidirectional long-run causal relationship from LT to LY ; in the short-run LH Granger causes LY . From the third and fourth equation, all the explanatory variables on the right hand side of the equation Granger causes LK and LH , respectively, in the long-run.

IV. DISCUSSIONS AND CONCLUSIONS

The main objective of this study is to test if the export-led growth and the tourism-led growth hypotheses hold for Spain and Italy, respectively. The existence of these relationships have been analysed using a cointegration framework. Inspired by Durbarry (2004) paper, instead of analysing only the relationship between exports and GDP and international tourism receipts and GDP, one uses two separate production functions of economic growth where physical capital, human capital are also included. The results of the tests for cointegration indicate that: both exports (LX) and tourist receipts (LT), employed in two separate systems, and economic growth (LY), physical capital (LK) and human capital (LH) are cointegrated, implying that a long-run relationship exists amongst these variables in each of the model.

The multivariate Granger causality results from the VEC (Vector Error Correction) analysis highlight key findings. The evidence suggests that the ELGH hypothesis is confirmed both for Spain and Italy. Specifically, one finds a long-run bidirectional causality from economic growth to exports for both of the countries. In the short-run, economic growth Granger causes exports in the Spanish case, whereas exports Granger cause economic growth in the Italian case.

In the long-run the TLGH is confirmed both for Spain and Italy as one concludes that a bidirectional relationship exists between economic growth and international tourism expansion in the Spanish case and a unidirectional Granger-causality exists in the Italian case, running from international tourism to GDP. Moreover, only for Spain in the short-run evidence appears that tourist activity Granger causes economic growth.

The multivariate Granger causality gives more insight on the relationships amongst all the other variables included in each of the production functions. As far as Spain is concerned, all factors appear as a cause of economic growth in the long-run; hence, tourism is not the essential sector but a complementary sector to take into account in the strategic and promotion policies adopted by governments and policy makers.

In the Italian case, taking into consideration the ELGH hypothesis as presented in Model 3, exports and physical capital appear to be strong Granger-causal factors for the economic growth. Moreover, in Model 4, tourism leads to GDP growth; and, physical capital and human capital cause economic growth in the long-run. Hence, overall, there is empirical evidence that suggests that policies to promote trade expansion, tourism activity, physical and human capital will increase growth.

As Oh (2005) remarks it is commonly believed that tourism has contributed positively to economic growth as exports have strongly triggered economic expansion. Following most of the ELGH papers, here we find evidence that supports the export-led growth hypothesis for both Spain and Italy. Nevertheless, TLGH is also confirmed for Spain and Italy. One must take into account that the present research employs a production function where physical and human capital are also included in a multivariate framework, instead of using only exports and GDP and international tourism receipts and GDP. Therefore, this paper can be regarded as an expansion of the existing empirical works.

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Figure 1 Natural Logarithm of the Economic Series (Spain: 1964 - 2000)

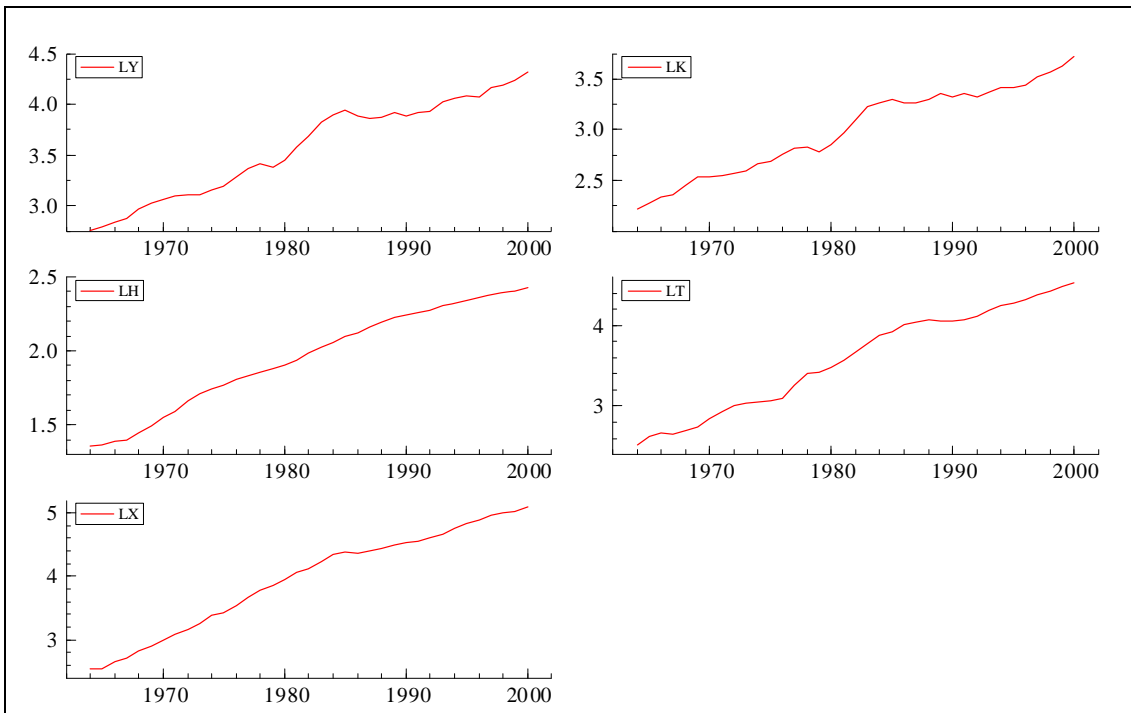


Figure 2 Natural Logarithm of the Economic Series (Italy: 1954 - 2000)

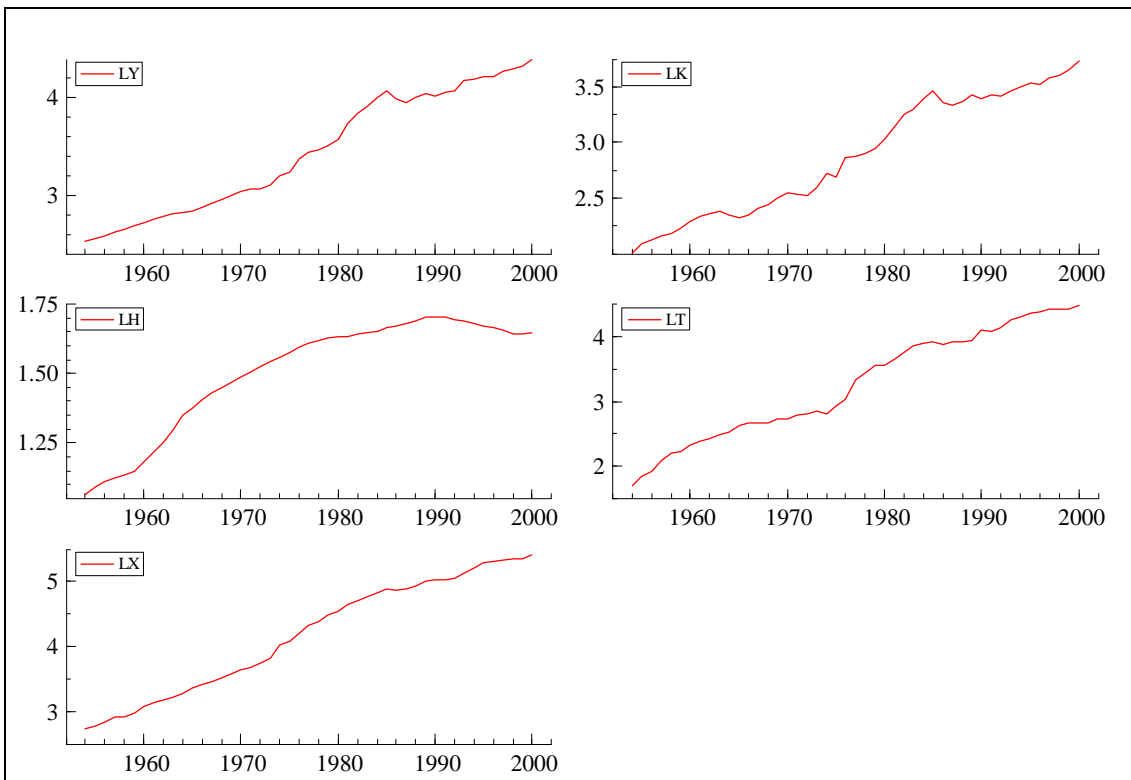


Table 1. Economic features of Spain and Italy

	1960	1970	1980	1990	2000
SPAIN					
Real GDP per capita	1107	2729	6446	12525	19037
GDP growth (annual %)	11.8 (*)	4.2	2.2	3.8	4.2
Labor force	11.7	12.7	13.9	15.7	17.8
Investment Share of Real GDP	22.6	30.2	25.8	27.4	25.5
Exports of goods and services (% of GDP)	8.4	12.6	14.8	16.3	30.1
International Tourism Receipts	107	707	3003	11390	33750
ITALY					
Real GDP per capita	1620	3417	8413	16817	22876
GDP growth (annual %)	8.21(*)	6.10	3.48	1.97	3.03
Labor force	20.8	21.1	22.6	24.4	25.5
Investment Share of Real GDP	37.2	32.2	28.9	23.6	21.7
Exports of goods and services (% of GDP)	12.7	16.1	21.6	19.7	28.3
International Tourism Receipts	207	529	3633	12216	29919

Notes: (1) * this number corresponds to 1961; (2) labor force data is measured in million people; (3) the source for international tourism receipts for Spain is INE and for Italy is ISTAT, these data are measured in million euros; (4) the source of the rest of the data is World Development Indicators (2004).

Table 2. Unit root tests

Variable	ADF	Lags	PP	lags
Spain				
LY	-0.51	0	-1.49	0
Δ LY	-6.47 ***	0	-3.50**	7
LK	-2.45	1	-1.83	0
Δ LK	-4.01**	0	-3.77**	5
LH	-0.73	1	0.21	2
Δ LH	-4.20**	4	-4.72***	9
LX	-0.39	0	-0.53	2
Δ LX	-5.69***	0	-5.68***	2
LT	-1.89	1	-1.07	0
Δ LT	-3.94 **	1	-3.70**	5
Italy				
LY	-2.38	1	-1.75	2
Δ LY	-3.80**	0	-4.81***	2
LK	-1.66	0	-1.81	2
Δ LK	-6.15***	0	-6.15***	1
LH	-0.73	1	0.18	4
Δ LH	-6.53***	4	-3.17*	3
LX	-0.15	0	-0.63	4
Δ LX	-4.65***	0	-5.20***	2
LT	-2.21	2	-2.15	2
Δ LT	-4.78***	0	-5.47***	0

Notes: (1) MacKinnon critical values for rejection of hypothesis of a unit root. (2) *** and ** indicate significance at the 1% and 5% levels, respectively. (3) Δ denotes the first-difference operator. (4) Number of lags set to the first statistically significant lag, testing downwards; number of lags in the ADF test is set upon AIC criterion and PP test upon Newey-West bandwidth. (5) Constant and trend are included in all cases.

Table 3. Tests for cointegration using the Johansen procedure

SPAIN. Sample period: 1964-2000				
Model 1: Y = f(X, K, H)				
Hypothesis	r=0	r≤1	r≤2	r≤3
λ max test	38.28***	14.10	12.34	9.97
Trace test	74.70***	36.42	22.32	9.97
Cointegration equation:				
	LY = -0.67LX + 3.18LK - 0.15LH - 4.02			
	(-0.82)	(3.23)	(-0.09)	(-3.82)
Model 2: Y = f(T, K, H)				
Hypothesis	r=0	r≤1	r≤2	r≤3
λ max test	28.94	20.10	16.74	4.90
Trace test	70.70***	41.76	21.65	4.90
Cointegration equation:				
	LY = 1.07LT - 0.07LK - 0.39LH - 0.004trend			
	(6.75)	(-0.38)	(-2.21)	(-0.86)
ITALY. Sample period 1954-2000				
Model 3: Y = f(X, K, H)				
Hypothesis	r=0	r≤1	r≤2	r≤3
λ max test	34.40***	21.73	10.23	6.92
Trace test	73.27***	38.88	17.15	6.92
Cointegration equation:				
	LY = 0.50LX + 0.34LK - 0.17LH + 0.74			
	(4.09)	(2.14)	(-1.22)	(6.02)
Model 4: Y = f(T, K, H)				
Hypothesis	r=0	r≤1	r≤2	r≤3
λ max test	28.84**	14.73	11.36	5.13
Trace test	60.08**	31.24	16.50	5.13
Cointegration equation:				
	LY = 0.08LT + 0.98LK - 0.01LH + 0.46			
	(1.68)	(15.22)	(-0.25)	(6.08)

Notes: (1) Numbers in parenthesis are t-test, (2) **, *** denote that a test statistics at the 5% and 1 % levels of significance, respectively.

Table 4. Spain: Granger causality results based on vector error-correction model

Model 1. $Y = f(X, K, H)$					
	F-test				t-test
	ΔLY	ΔLX	ΔLK	ΔLH	ECT_{t-1}
ΔLY	-	0.26	0.13	1.40	2.73***
ΔLX	2.86*	-	0.56	0.14	5.46***
ΔLK	0.86	0.70	-	0.29	2.55***
ΔLH	7.85***	8.58***	4.82***	-	4.81***
Model 2. $Y = f(T, K, H)$					
	F-test				t-test
	ΔLY	ΔLT	ΔLK	ΔLH	CI_{t-1}
ΔLY	-	2.92*	0.26	0.11	-2.34**
ΔLT	0.50	-	1.25	0.09	2.33**
ΔLK	1.66	2.22	-	0.36	-2.48***
ΔLH	2.51*	0.89	2.35	-	-1.25

Note: (1) ***, ** and * indicate that a test statistics is significant at the 1%, 5% and 10% levels of significance, respectively.

Table 5. Italy: Granger causality results based on vector error-correction model

Model 3. $Y = f(X, K, H)$					
	F-test				t-test
	ΔLY	ΔLX	ΔLK	ΔLH	CI_{t-1}
ΔLY	-	11.49 ***	1.00	5.63***	-6.63***
ΔLX	2.24	-	0.32	0.07	-4.59***
ΔLK	4.73***	7.72***	-	4.94***	-5.34***
ΔLH	0.15	0.05	0.35	-	-0.73
Model 4. $Y = f(T, K, H)$					
	F-test				t-test
	ΔLY	ΔLT	ΔLK	ΔLH	ECT_{t-1}
ΔLY	-	0.84	2.09	4.31***	-2.75**
ΔLT	2.51	-	0.01	0.03	-0.78
ΔLK	1.38	2.66	-	2.16	-1.67**
ΔLH	0.15	1.65	1.07	-	-3.79**

Note: (1) ***, ** and * indicate that a test statistics is significant at the 1%, 5% and 10% levels of significance, respectively.

APPENDIX

Data description and sources

Common sources for Spain and Italy (million euros)

- Real Gross Domestic Product per capita (Y) was taken from the Penn World Table 6.1.
- Investment share of Y and it was taken from the Penn World Table 6.1. The variable physical capital was built calculating investment data.
- Population data from the Penn World Table 6.1.

For Spain:

- Active population with secondary level of education, this serie was taken from IVIE (Instituto Valenciano de Investigaciones Económicas). The human capital indicator was built dividing the mentioned serie by total population.
- Total exports and international tourism receipts data from INE (Instituto Nacional de Estadística)

For Italy:

- Population with secondary level of education. This serie was taken from the ISTAT (Istituto Nazionale di Statistica). The human capital indicator is the mentioned data divided by total population.
- Total exports and international tourism receipts from ISTAT.

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