

Bajo-Rubio, Oscar

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The role of foreign direct investment in growth: Spain, 1964-2013*

Oscar Bajo-Rubio
(Universidad de Castilla-La Mancha)

Abstract

Foreign direct investment (FDI) has played a major role in the deep process of transformation experienced by the Spanish economy since the first 1960s, which even intensified following the integration with the now European Union (EU) in 1986. In this paper, we analyse the long-run effects of FDI in Spain, by estimating a production function including the foreign capital stock over the period 1964-2013. We find a significant contribution of foreign capital on the accumulated growth of GDP over the period of analysis, which seems however to have been greater during the first years of the period analysed.

Key words: Economic growth, Foreign direct investment

JEL Classification: F21, F43, O40

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1. Introduction

Foreign direct investment (FDI henceforth) has played an increasing role as a way of internationalization of the economic activity since the end of World War II. In fact, FDI is one of the most relevant aspects of the current wave of globalization, recording higher growth rates than both world trade and output.

The role of FDI on economic growth has been extensively analysed in last years, by means of multivariate regressions over long-time spans, where either GDP or its rate growth was made dependent on a series of macroeconomic variables including the ratio of FDI inflows to GDP. A common result of this literature is that FDI shows a positive and significant influence on growth, although this effect would be stronger if host countries possess a minimum absorptive capacity able to channel FDI flows towards an increase in output. Some contributions to this literature would include, among many others, Blomström et al. (1994), Balasubramanyam et al. (1996), Borensztein et al. (1998), de Mello (1999), Campos and Kinoshita (2002), Durham (2004), Alfaro et al. (2004), Laureti and Postiglione (2005), Tang et al. (2008), Adams (2009), Bajo-Rubio et al. (2010), Omri and Kahouli (2014), or Iamsiraroj (2016). A common feature of most of the available studies, though, is that they make use of cross-sections of a set of countries, hence not analysing the case of individual countries. However, given the great heterogeneity of country experiences, such an approach could mean adding together some too dissimilar experiences, so that focusing on specific countries might be a more promising empirical approach.

Accordingly, in this paper we will analyse the relationship between FDI and growth for a particular country, i.e., Spain, over the period 1964-2013. The Spanish economy can provide a relevant case study, given the substantial process of growth she enjoyed starting from the early 1960s. In addition, FDI was a crucial factor in this process of intense growth over the 1960s; and, even more, the massive increase in FDI inflows following the Spanish integration with the now European Union (EU) in 1986, coupled with the prospects about the completion of the Single European Market by 1992, meant one of the most important features shaping the behaviour of the Spanish economy until the start of the Great Recession. An overview of FDI trends following the integration into the EU can be found in Bajo-Rubio and Torres (1992).

The objective of this paper is to analyse the long-run effects of FDI for the case of Spain, by estimating a production function including the foreign capital stock, over the period 1964-2013. In addition to the additional insight that this exercise might provide on the role of FDI in the Spanish economy, the Spanish case might be of interest for other reasons. Spain can be considered a medium-size economy, given the size of her main macroeconomic variables, which has experienced a process of rapid growth since the early 1960s, starting from a relatively weak position as compared to the rest of Western European countries. This has been particularly true after joining the EU in 1986, allowing her an even deeper integration with other more advanced economies, so Spain has been able to join the Economic and Monetary Union from its start. In sum, the Spanish experience could be of interest for other medium-size economies expected to follow a process of integration with other relatively more advanced countries.

There are several studies available that investigate the main features of FDI in the Spanish economy, together with their economic implications. In particular, the macroeconomic factors behind the FDI inflows received between 1964 and 1989 were analysed in Bajo-Rubio and Sosvilla-Rivero (1994); whereas the sectoral allocation of FDI in manufacturing was

examined in Bajo-Rubio and López-Pueyo (2002). A general survey on the role of FDI in the Spanish economy is Fernández-Otheo (2003), and a recent and comprehensive study of the subject can be found in the different contributions included in Myro (2014). However, and despite the importance of FDI in the Spanish economy, their macroeconomic effects have been hardly explored; an exception is Sosvilla-Rivero and Herce (1998), where the role of FDI in fostering the favourable effects of the European Single Market was stressed. Finally, regarding its growth effects, we just can quote Bajo-Rubio et al. (2010), who analysed the impact of FDI on growth at a regional level for the period following the integration within the EU.

The rest of the paper is organised as follows: the theoretical framework is presented in Section 2, the data and empirical results are discussed in Section 3, and the main conclusions are summarised in Section 4.

2. Theoretical framework

Our starting point will be a simple production function including human capital (as in Mankiw, Romer and Weil, 1992), written for simplicity in a Cobb-Douglas form:

$$Y_t = A_t K_t^\alpha N_t^\beta H_t^\gamma \quad (1)$$

where Y , K , N , and H denote, respectively, output, physical capital, labour, and human capital; and A is an index of the level of technology. Taking logs, the above equation becomes:

$$LY_t = LA_t + \alpha LK_t + \beta LN_t + \gamma LH_t \quad (2)$$

where L denotes natural logarithm.

How does FDI enter the above equation? In the next paragraphs, we will review some theoretical arguments on the relationship between FDI, productivity growth, and technological innovation made by the multinational enterprise (MNE).

In the standard neoclassical growth model, FDI is simply assumed to be an addition to the capital stock of the host economy (see, e.g., Brems, 1970), so the effect of foreign capital would be indistinguishable from that of domestic capital. Notice that, in this case, if returns to capital are diminishing, FDI would affect growth only in the short run, i.e., during the transition to the steady-state growth path, which seems to be rather unsatisfactory given the recent trends in FDI. Indeed, the main role of FDI seems to be transferring assets from less efficient to more efficient owners, so in practice FDI consists of offsetting two-way flows that are hardly related to productive investment (Lipsey, 2001). In other words, FDI would be less and less of the “greenfield” type, i.e., that FDI devoted to enlarging the production capacity of the host economy.

Endogenous growth models allow for a greater impact of FDI on growth. In principle, FDI could lead to externalities on the domestic production factors, although its effect on growth would be permanent only in the presence of increasing returns to scale over all factors (i.e., including the externality). Even more, this literature has developed formal models for technological innovation, which emerges as a response to economic incentives, that is, profit opportunities detected by firms that are influenced by the institutional, legal, and economic environment in which they act (Grossman and Helpman, 1994). All this in turn amounts to emphasise the role of FDI and, in general, the degree of economic integration, as an important factor shaping technological progress and hence growth rates.

Thus, higher integration means an increase in market size resulting in greater incentives to R&D and so higher growth; which in turn enables the diffusion of knowledge across countries

and avoid duplication of the research activity (Romer, 1990; Grossman and Helpman, 1991). In particular, integration among relatively similar economies should result in higher growth over the long run, on allowing the exploitation at the world level of the increasing returns present in the R&D sector (Rivera-Batiz and Romer, 1991).

Another issue extensively analysed in the literature is the possible presence of spillovers of the MNEs activities. Specifically, establishing a subsidiary might lead to productivity or efficiency benefits for the host country's local firms, provided that the MNEs are not able to internalize the full value of these benefits (Blomström and Kokko, 1998). In other words, local firms in the host country can benefit from the more evolved production methods, organizational and managerial techniques, marketing activities, and the like, of the MNEs, through several channels such as imitation, the higher competition associated with the presence of the subsidiary, or the mobility of the labour force previously trained and familiar with the more advanced techniques developed by the MNEs (Görg and Greenaway, 2004).

The empirical evidence on these spillover effects is far from being unambiguous, though. As noticed by Aitken and Harrison (1999), the positive spillover effects would shift the average costs curve of domestic firms downwards; but the increased competition would lead these firms to reduce their output and so moving along the new average costs curve upwards, so the net effect on average costs would be ambiguous. On the other hand, not all domestic firms would benefit equally from these spillover effects, but rather those enjoying a higher absorptive capacity of the new technologies, or those located geographically closer to the subsidiary of the MNE (Görg and Greenaway, 2004). Even more, in terms of the development of local industry, the positive spillovers associated with FDI would dominate when inflows are large, outweighing the negative competition effects associated with FDI, as shown in Barrios *et al.* (2005). Most generally, a greater opening to FDI inflows from the most advanced countries would lead to higher rates of both technological progress and growth in the host country (Wang, 1990), and the incentive of an MNE to transfer technologies via FDI would depend negatively on its perceived operation risks in the host country, and positively on the investment in learning made by the host country's firms (Wang and Blomström, 1992).

Therefore, according to the previous theoretical arguments, we will assume that the level of technology A depends on its initial value, A_0 , and the foreign capital stock, FK :

$$A_t = A_0 FK_t^\theta \quad (3)$$

where FK will be proxied by the accumulated sum of FDI inflows; which, in logs, becomes:

$$LA_t = LA_0 + \theta LFK_t \quad (4)$$

And, replacing (4) in (2), we get:

$$LY_t = LA_0 + \alpha LK_t + \beta LN_t + \gamma LH_t + \theta LFK_t \quad (5)$$

which will be the equation to be estimated in the next section.

3. Data and empirical results

In this section, we will present some econometric estimates of the above production function for the Spanish economy, in order to quantify the effects of accumulated FDI inflows on aggregate output. The data are annual for the period 1964-2013, and the variables used and their sources are as follows:

- Gross Domestic Product and its deflator, million €. Source: Eurostat.
- Physical capital stock: net capital stock, million €. Source: Fundación BBVA and Ivie (2019).

- Human capital stock: sum of the employed population with medium (i.e., secondary) and two levels of higher education (i.e., first cycle or shorter courses, and second cycle or full-length courses), thousand persons. Source: Mas et al. (2014).
- Total employed population, thousand persons: Mas et al. (2014).
- Accumulated sum of FDI gross receipts since 1960, net of disinvestments payments, million €. Source: Spanish Balance of Payments, elaborated by the Bank of Spain¹.

where the variables in real terms are valued at 2015 prices. The choice of the sample period is dictated by the data sources. In particular, 1964 is the starting date of a modern and unified system of National Accounts for the Spanish economy; and 2013 is the last year for which the human capital data of Mas et al. (2014) are available.

We begin by examining the time series properties of the series using the tests of Ng and Perron (2001), which try to solve the main problems present in the conventional tests for unit roots. According to the results shown in Table 1, the null hypothesis of a unit root was not rejected in all cases, while the null of a second unit root was always rejected, except for the variable *LFK*. However, since conventional unit root tests are biased toward accepting the null of a unit root when the series is stationary with a structural break, we have performed the modified augmented Dickey-Fuller test of Perron (1989) that allows for a breakpoint on the variable of interest. Two alternative models have been considered, namely, the innovational outlier model (IOM), which assumes that the break occurs gradually, and the additive outlier model (AOM), which assumes that the break occurs immediately. The results, shown in Table 2, allow us to reject the null hypothesis of a second unit root in *LFK* for both models, once we take into account a break at the year 2000.

[Table 1 here]

[Table 2 here]

In Table 3 we present the estimation of the empirical model given by equation (5), i.e., an equation like:

$$LY_t = \kappa + \alpha LK_t + \beta LN_t + \gamma LH_t + \theta LFK_t + \varepsilon_t$$

where κ denotes a constant and ε_t is an error term, using the fully-modified OLS (FM-OLS) method of Phillips and Hansen (1990). This method tries to eliminate the potential biases that could appear when estimating under OLS, by computing a class of Wald tests, modified by semiparametric corrections for serial correlation and endogeneity bias. The long-run covariance matrix has been estimated using the method of Newey and West (1987). Notice that the figures in parentheses are the Phillips and Hansen's fully-modified Wald test statistics on the null hypothesis that the estimated coefficients are equal to zero, asymptotically distributed as a χ^2 with one degree of freedom. We also show the coefficient of determination R^2 , and the two cointegration tests $CR\hat{Z}_t$ and $CR\hat{Z}_\alpha$ proposed by Phillips and Ouliaris (1990). The estimated equation includes a dummy variable for the year 1965.

[Table 3 here]

¹ Notice that, given the policy of autarky followed by the Spanish authorities over the period 1939-1959, FDI inflows would have been negligible before 1960.

As can be seen, all the estimated coefficients are positively signed and statistically significant at the 1% level (except for the coefficient on *LN*, which is significant at the 5% level); in particular, the proxy for the foreign capital stock appears with a small but significant coefficient. Finally, the two cointegration tests allow us to reject the null hypothesis of no cointegration at the 5% and 10% significance levels, respectively.

Now, we proceed to compute the contributions of the different explanatory variables appearing in the equation above (i.e., physical capital, labour, human capital and foreign capital), on the accumulated growth of GDP over the period of analysis. These contributions were obtained as the product of the estimated coefficient in Table 3 and the accumulated growth rate of each variable, and the results are shown in Table 4. First, our estimated equation explains 2.72 points (i.e., 93.6 per cent) of the actual 2.91 points of accumulated growth of GDP over the period. The most important source of growth would have been human capital followed by physical capital, which explain 1.45 and 0.80 points of the actual accumulated GDP growth (i.e., 49.9 and 27.5 per cent of total); whereas labour explains 0.08 points (i.e., 2.6 per cent of total). Finally, we found a sizeable contribution of foreign capital to the accumulated growth of GDP over the period, of 0.39 points (i.e., 13.6 per cent of total).

[Table 4 here]

We have tested for the possible presence of structural change in the previously estimated equation, by means the tests of Bai and Perron (1998, 2003a). These authors have proposed a sequential procedure method to detect endogenously multiple unknown breaks, as well as several test statistics in order to identify the possible break points, namely:

- (i) the *UDmax* and *WDmax* tests of the null hypothesis of no structural break versus the alternative of an unknown number of breaks given some upper bound,
- (ii) an *F*-type test of the null hypothesis of no structural break versus the alternative of a fixed (arbitrary) number of breaks, and
- (iii) a sequential *F*-type test of the null hypothesis of *l* breaks versus the alternative of *l* + 1 breaks.

The results of the Bai and Perron tests appear in Table 5, where we show the *UDmax* and *WDmax* tests, and the *F* statistics scaled by the number of varying regressors (all of them, in our case) for the other tests. We have allowed up to three breaks with a trimming percentage of 20%, so that each regime is restricted to have at least 10 observations. Since the *UDmax* and *WDmax* tests are significant, at least one break is present. The scaled *F*(1), *F*(2) and *F*(3) tests are also significant at the 5% level, which means that there is at least one break. In turn, both the scaled *F*(1|0) and *F*(2|1) tests are significant unlike *F*(3|2), so the procedures detects two breaks, estimated at 1974 and 1984. The first break would be associated with the first oil crisis, which brought to an end the outstanding growth rates enjoyed by the Spanish economy over the 1960s and first 1970s. In turn, the second break would be related to the low growth years following the second oil crisis, until economic growth could return after the Spanish integration into the now EU.

[Table 5 here]

Next, we have re-estimated equation (5) for the three subperiods delimited by the structural breaks found by the tests of Bai and Perron, i.e., 1964-1973, 1974-1983 and 1984-

2013; the estimation results and their related contributions to growth, are shown in Table 6 and Table 7, respectively. Notice that these results should be taken with high doses of scepticism, given the small number of observations available for every subperiod. This problem is particularly serious for the first two subperiods, including just 10 observations each; in turn, the results for the third subperiod (which include a dummy variable for the year 2005) are in line with those found for the whole period. With all these caveats in mind, given explained accumulated growth rates of 5.86, 1.33 and 2.30 for each subperiod, and focusing on our variable of interest, i.e., the foreign capital stock, its contribution to growth would have been 2.81, -0.14 and 0.16 points (i.e., 48.6, -11.4 and 7.2 per cent of total), respectively.

[Table 6 here]

[Table 7 here]

In other words, according to the information shown in Table 7, the role of foreign capital was much greater between 1964 and 1973 (a period in which its accumulated rate of growth reached 18 per cent), fell to negative figures between 1974 and 1983 (a crisis period in which its accumulated rate of growth was hardly 1.5 per cent), and became positive again between 1984 and 2013 (when the growth of the foreign capital stock resumed at an accumulated rate of 10.4 per cent), although at a much slower pace than in the first subperiod. These results, on the other hand, can be confirmed from a different point of view, by computing the recursive estimate of the coefficient on *LFK* from the estimation of equation (5). Such estimates, together with ± 2 standard errors, appear in Figure 1, and show that, after reaching a maximum in 1972, the value of the estimated coefficient falls continuously over the rest of the sample period.

[Figure 1 here]

Finally, for the sake of completeness, and given the possibility of a bi-directional causal relationship between FDI and economic growth, we have performed Granger-causality tests on the variables GDP and foreign capital stock. The tests have been performed in a multivariate setting, i.e., including the other variables utilised in our empirical analysis (physical capital, labour and human capital), in order to avoid possible spurious results due to the omission of those variables. Notice that, if the variables under analysis have a unit root and are cointegrated, as in this case, Granger-causality tests should be performed on the variables in first differences, and including an error-correction term (i.e., the residuals of the cointegrating regression). According to Granger (1988), if there is cointegration between a pair of variables, there must be causality between them in at least one direction, in order to provide these variables with enough dynamics to reach the equilibrium. Hence, we have estimated equations of the form:

$$\Delta LY_t = \kappa + \sum_{i=1}^p \alpha_i \Delta LK_{t-i} + \sum_{j=1}^q \beta_j \Delta LN_{t-j} + \sum_{k=1}^r \gamma_k \Delta LH_{t-k} + \delta ECM_{t-1} + u_t$$

$$\Delta LY_t = \kappa + \sum_{i=1}^p \alpha_i \Delta LK_{t-i} + \sum_{j=1}^q \beta_j \Delta LN_{t-j} + \sum_{k=1}^r \gamma_k \Delta LH_{t-k} + \sum_{l=1}^s \theta_l \Delta LFK_{t-l} + \delta ECM_{t-1} + v_t$$

with an analogous representation holding for ΔLFK_t as dependent variable, where *ECM* denotes the error-correction mechanism, i.e., the residuals of the estimation of equation (5). Accordingly, in order to test for Granger-causality, the null hypotheses would be: (i) $\delta = 0$, for the absence of long-run causality; and (ii) $\theta_j = 0$, for the absence of short-run causality, and the standard *F* test can be used to test for Granger-causality in the short and in the long run.

The results of the Granger-causality tests are shown in Table 8. The number of lags was selected using the Schwarz criterion; up to two lags of the variables were tried, and the best results were obtained with one lag for all variables, except for ΔLK when testing for Granger-causality of ΔLFK on ΔLY , where two lags were chosen. As can be seen, it is possible to reject the null hypothesis of no Granger-causality from foreign capital to GDP in the long run, but not in the short run; whereas the null of no Granger-causality from GDP to foreign capital is not rejected, both in the long run and the short run.

[Table 8 here]

4. Conclusions

The objective of this paper has been to analyse the long-run effects of FDI in Spain, by estimating a production function including the foreign capital stock, over the period 1964-2013. The estimation of the production function for the whole period gave a small, positive but significant coefficient on the foreign capital stock, together with positive and statistically significant coefficients on the rest of variables (i.e., physical capital, labour and human capital); in addition, the estimated relationship was a long-run one, since evidence of cointegration among the variables was found. When computing the contributions of the different explanatory variables on the accumulated growth of GDP over the period of analysis, we obtained that the foreign capital stock would have accounted for 13.6 per cent of the actual accumulated GDP growth, at the same time that human capital, physical capital and labour explained 49.9, 27.5 and 2.6 per cent, respectively, of total accumulated GDP growth.

Next, we tested for the possible presence of structural change in the previously estimated equation, by means the tests of Bai and Perron (1998, 2003a), finding two breaks estimated at 1974 and 1984. When re-estimating the production function for the three subperiods delimited by these structural breaks, i.e., 1964-1973, 1974-1983 and 1984-2013, we found that the contribution of the foreign capital stock on accumulated growth of GDP was much greater between 1964 and 1973, fell to negative figures between 1974 and 1983, and became again positive between 1984 and 2013 but at a much slower pace than in the first subperiod. These results should be taken with care, however, given the small number of observations available for every subperiod, especially for the first two subperiods, although they were confirmed when computing the recursive estimate of the coefficient on the foreign capital stock from the estimation of the production function over the whole sample period.

Finally, given the possibility of a bi-directional causal relationship between FDI and economic growth, we performed Granger-causality tests on the variables GDP and foreign capital stock in a multivariate setting, and including an error-correction term giving the finding of cointegration among the variables under study. According to the results, Granger-causality from foreign capital to GDP appeared in the long run, but not in the short run; whereas no Granger-causality from GDP to foreign capital did not appeared both in the long run and the short run.

In general, the results of this paper suggest that foreign capital can play a positive role on the economic growth of an economy, provided that FDI inflows are stable and permanent enough. Such a favourable effect on growth might be more important in the first stages of a growth process, though. And, in any case, in order to reach a higher GDP growth, the host

countries should possess a minimum social capability in the form of an educated labour force and adequate organizational structures; in other words, the necessary absorptive capacity to incorporate in a satisfactory way the advanced technologies usually associated with FDI.

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Table 1
Ng-Perron tests for unit roots

A) I(2) vs. I(1)

	MZ_{α}	MZ_t	MSB	MP_T
ΔLY	-8.808 ^b	-1.897 ^c	0.215 ^b	3.527 ^c
ΔLK	-9.064 ^b	-1.952 ^c	0.215 ^b	3.364 ^c
ΔLN	-9.176 ^b	-2.074 ^b	0.226 ^b	2.930 ^b
ΔLH	-8.347 ^b	-1.923 ^c	0.230 ^b	3.381 ^c
ΔLFK	-2.803	-1.089	0.388	8.450

B) I(1) vs. I(0)

	MZ_{α}	MZ_t	MSB	MP_T
LY	-0.128	-0.076	0.594	23.56
LK	-1.669	-0.673	0.403	11.11
LN	-6.307	-1.657	0.263	4.269
LH	-2.001	-0.786	0.393	10.19
LFK	1.104	0.946	0.857	53.94

Note: ^b and ^c denote significance at the 5% and 10% levels, respectively. The critical values are taken from Ng and Perron (2001).

Table 2
Perron tests for unit roots with breakpoints

A) I(2) vs. I(1)

	IOM	AOM
	$t_{\tilde{\alpha}}$	$t_{\tilde{\alpha}}$
ΔLFK	-3.995 ^b	-3.984 ^b

B) I(1) vs. I(0)

	IOM	AOM
	$t_{\tilde{\alpha}}$	$t_{\tilde{\alpha}}$
LFK	0.490	0.724

Note: ^b denotes significance at the 5% level. The critical values are taken from Perron (1989).

Table 3
Long-run determinants of GDP, 1964-2013
 (dependent variable: *LY*)

constant	6.465 ^a (353.30)
<i>LK</i>	0.236 ^a (32.76)
<i>LN</i>	0.107 ^b (7.305)
<i>LH</i>	0.243 ^a (60.12)
<i>LFK</i>	0.039 ^a (8.232)
R^2	0.997
$CR\hat{Z}_t$	-5.580 ^b
$CR\hat{Z}_\alpha$	-31.23 ^c

Note: ^a, ^b and ^c denote significance at the 1%, 5% and 10% levels, respectively. The critical values for the Phillips-Ouliaris cointegration tests are taken from MacKinnon (1996).

Table 4
Contributions to economic growth, 1964-2013
 (percentage points)

Variable	Accumulated growth	Estimated coefficient	Contribution
Physical capital	3.388	0.236	0.798
Labour	0.712	0.107	0.076
Human capital	5.973	0.243	1.450
Foreign capital	10.199	0.039	0.394
Total	-	-	2.719

Note: Own elaboration. The actual accumulated growth rate of *Y* over the whole period is 2.906.

Table 5
Bai-Perron tests for structural change

Tests	
<i>UD</i> max	555.54
<i>WD</i> max	635.02
scaled <i>F</i> (1)	555.54
scaled <i>F</i> (2)	521.10
scaled <i>F</i> (3)	447.67
scaled <i>F</i> (1 0)	555.54
scaled <i>F</i> (2 1)	37.352
scaled <i>F</i> (3 2)	14.612*
Number of breaks selected	2

Note: All the test statistics are significant at the 5% level, except the one denoted with *. The critical values are taken from Bai and Perron (2003b).

Table 6
Long-run determinants of GDP over subperiods
(dependent variable: *LY*)

	1964-1973	1974-1983	1984-2013
constant	-7.499 ^b (3.926)	12.41 ^b (4.131)	6.933 ^a (8730.0)
<i>LK</i>	-0.056 (0.195)	-0.043 (0.079)	0.126 ^a (99.02)
<i>LN</i>	1.944 ^a (24.58)	-0.009 (0.000)	0.162 ^a (55.78)
<i>LH</i>	0.178 ^b (6.066)	0.282 ^a (87.40)	0.337 ^a (491.84)
<i>LFK</i>	0.157 ^a (96.97)	-0.093 ^b (4.192)	0.016 ^b (5.329)
<i>R</i> ²	0.997	0.987	0.999
<i>CRZ</i> _{<i>t</i>}	-8.741 ^a	-5.766 ^c	-5.050 ^c
<i>CRZ</i> _{<i>α</i>}	-8.884	-9.769	-26.45 ^c

Note: ^a, ^b and ^c denote significance at the 1%, 5% and 10% levels, respectively. The critical values for the Phillips-Ouliaris cointegration tests are taken from MacKinnon (1996).

Table 7
Contributions to economic growth over subperiods
 (percentage points)

A) 1964-1973

Variable	Accumulated growth	Estimated coefficient	Contribution
Physical capital	4.436	-0.056	-0.247
Labour	0.889	1.944	1.728
Human capital	8.803	0.178	1.568
Foreign capital	17.901	0.157	2.812
Total	-	-	5.862

B) 1974-1983

Variable	Accumulated growth	Estimated coefficient	Contribution
Physical capital	3.428	-0.043	-0.148
Labour	-1.232	-0.009	0.011
Human capital	5.697	0.282	1.609
Foreign capital	1.509	-0.093	-0.140
Total	-	-	1.331

C) 1984-2013

Variable	Accumulated growth	Estimated coefficient	Contribution
Physical capital	2.597	0.126	0.328
Labour	1.382	0.162	0.224
Human capital	4.715	0.337	1.590
Foreign capital	10.358	0.016	0.163
Total	-	-	2.304

Note: Own elaboration. The actual accumulated growth rates of Y over each subperiod are 5.788, 1.231 and 2.275, respectively.

Table 8
Granger-causality tests

A) Null hypothesis: *LFK* does not Granger-cause *LY*

	F-statistic	Probability
Test on <i>ECM</i>	6.692	0.014
Test on lags of ΔLFK	0.812	0.373

B) Null hypothesis: *LY* does not Granger-cause *LFK*

	F-statistic	Probability
Test on <i>ECM</i>	0.953	0.335
Test on lags of ΔLY	0.386	0.538

Figure 1
Recursive estimate of the coefficient on *LFK*

