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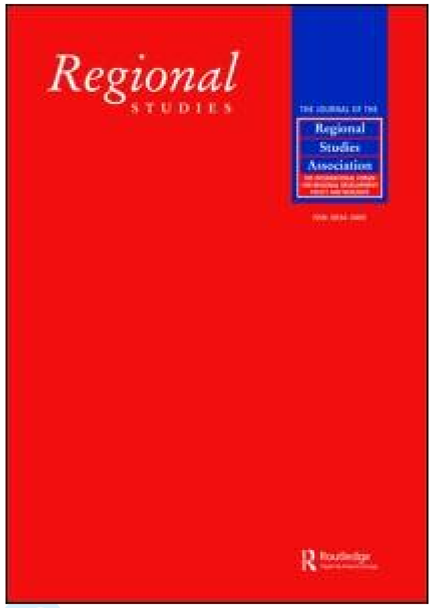


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# FOREIGN DIRECT INVESTMENT AND REGIONAL GROWTH: AN ANALYSIS OF THE SPANISH CASE

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**Abstract**

The massive increase in foreign direct investment (FDI) inflows following the Spanish integration with the now European Union (EU) in 1986, has been one of the most important features shaping the behaviour of the Spanish economy in the last twenty years. In this paper we will try to assess the impact of FDI on regional economic growth following Spain's entry into the EU, using data for the 17 Spanish regions. The results support the important role played by FDI in promoting productivity growth over the period analyzed, which proves to be robust to several alternative specifications.

Key words: Economic growth, Foreign direct investment, Regions

JEL Classification: F21, O40, R58

# Ausländische Direktinvestitionen und regionales Wachstum: eine Analyse des Falls von Spanien

Oscar Bajo-Rubio, Carmen Díaz-Mora and Carmen Díaz-Roldán

## Abstract

Der massive Anstieg ausländischer Direktinvestitionen in Spanien nach der Integration des Landes in die heutige Europäische Union im Jahr 1986 war eines der wichtigsten Merkmale, die das Verhalten der spanischen Wirtschaft in den letzten zwanzig Jahren prägten. In diesem Beitrag versuchen wir, die Auswirkung der ausländischen Direktinvestitionen auf das regionale Wirtschaftswachstum nach dem EU-Beitritt Spaniens anhand von Daten für die 17 spanischen Regionen zu bewerten. Die Ergebnisse bekräftigen die wichtige Rolle der ausländischen Direktinvestitionen bei der Förderung des Produktivitätswachstums über den analysierten Zeitraum – ein Ergebnis, das sich auch in Verbindung mit mehreren alternativen Spezifikationen als robust erweist.

Key words:
Wirtschaftswachstum
Ausländische Direktinvestitionen
Regionen

JEL Classification: F21, O40, R58

Inversión extranjera directa y crecimiento regional: un análisis del caso español

Resumen
El masivo incremento de las entradas de inversión extranjera directa (IED) tras la integración española en la actual Unión Europea (UE) en 1986, ha sido uno de los rasgos más importantes que configuran la evolución de la economía española en los últimos veinte años. En este artículo trataremos de evaluar el impacto de la IED sobre el crecimiento económico regional tras la entrada de España en la UE, utilizando datos para las 17 regiones españolas. Los resultados confirman el importante papel desempeñado por la IED a la hora de favorecer el crecimiento de la productividad a lo largo del periodo analizado, siendo estos resultados robustos a diversas especificaciones alternativas.

Crecimiento económico, Inversión extranjera directa, Regiones

Investissement étranger direct et croissance régional: une analyse du cas espagnol Résumé Le massif accroissement des entrées d'investissement étranger direct (IED) après l'intégration espagnole dans l'actuelle Union Européenne (UE) en 1986, a été l'un des principaux traits configurant l'évolution de l'économie espagnole des vingt dernières années. Dans cet article, nous essayerons d'évaluer l'impact de l'IED sur la croissance économique régionale après l'entrée de l'Espagne dans l'UE, en utilisant des données des 17 régions espagnoles. Les résultats confirment l'important rôle joué par l'IED en favorisant la croissance de la productivité tout au long de la période analysée, ces résultats étant robustes à diverses spécifications alternatives.

Croissance économique, Investissement étranger direct, Régions



## 1. Introduction

As is well known, foreign direct investment (FDI henceforth) has played over the last fifty years an increasing role as a way of internationalization of the economic activity. In fact, FDI is one of the most relevant aspects of the recent wave of globalization, registering higher growth rates than both world trade and output.

On the other hand, FDI has been a crucial factor in the process of intense growth enjoyed by the Spanish economy since the beginning of the 1960s. 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, has been one of the most important features shaping the behaviour of the Spanish economy in the last twenty years. An overview of FDI trends during this period can be found in BAJO-RUBIO and TORRES, 2001.

There are several studies available that investigate the main features of the FDI arrived to the Spanish economy, together with their economic implications. From a long-term perspective, the macroeconomic factors behind the FDI inflows received between 1964 and 1989 were analyzed in BAJO-RUBIO and SOSVILLA-RIVERO, 1994; also, the role of FDI in fostering the favourable effects of the European Single Market was stressed in SOSVILLA-RIVERO and HERCE, 1998. In turn, the sectoral allocation of FDI in manufacturing between 1986 and 1992 (i.e., the period where the affluence of FDI was more intense) has been examined in BAJO-RUBIO and LÓPEZ-PUEYO, 2002. A general survey on the more recent role of FDI in the Spanish economy can be found in FERNÁNDEZ-OTHEO, 2003. However, despite the importance of FDI in the Spanish economy, their regional aspects have been hardly explored. Some exceptions are EGEA-ROMÁN and LÓPEZ-PUEYO, 1991, FERNÁNDEZ-OTHEO, 2000, and PELEGRÍN-SOLÉ, 2002, where the focus is on the description of regional FDI trends in Spain and their explanatory factors, but without analyzing growth effects.

On the other hand, the role of FDI on economic growth has been extensively analyzed in recent years, by means of multivariate regressions of the rates of growth of (mostly) developing countries, over long-time spans, on a series of macroeconomic variables including the ratio FDI-GDP. In general, FDI shows a positive and significant influence on growth, although this effect would be stronger if host countries possess an adequate absorptive capacity to channel FDI flows toward real output expansion; a non-exhaustive listing of papers would include, among others, BLOMSTRÖM et al., 1994, BALASUBRAMANYAM et al., 1996, BORENSZTEIN et al., 1998, DE MELLO, 1999, CAMPOS and KINOSHITA, 2002, DURHAM, 2004, or ALFARO et al., 2004. These results, however, have been criticized by CARKOVIC and LEVINE, 2005, on the grounds that they can be biased on not fully controlling for endogeneity, country-specific effects, and the routine use of lagged dependent variables. These authors propose instead the use of the Generalized Method of Moments (GMM) estimator, and find no robust, independent influence of FDI on growth for a sample of 72 countries, both industrial and developing; similar results were found by LAURETI and POSTIGLIONE, 2005, in this case for 11 developing Mediterranean countries. However, and as far as we know, the relationship between FDI and growth on a regional basis has been hardly explored.We just can quote LEDYAEVA and LINDEN, 2006, or YAO and WEI, 2007 (both of them using also the GMM estimator), who analyze the effects of FDI on growth for the regions of Russia and China, respectively, and find the opposite results about the effects of FDI on growth: non significant for the Russian regions, and positive and significant for the Chinese regions.

In this paper we will try to assess the impact of FDI on regional economic growth in the Spanish case, by estimating an aggregate production function augmented with FDI inflows for the 17 Spanish regions, following the country's entry into the EU. This paper intends to contribute to the available literature on FDI and growth by emphasizing the regional dimension in the context of a developed country. In particular, we present some evidence for a group of relatively homogeneous economies, the Spanish regions, belonging to a developed country that has become integrated with other richer nations. In addition, we make use of an econometric methodology especially well suited for empirical growth work, namely, the system GMM estimator.

On the other hand, choosing the Spanish case might also prove to be a relevant case study. Unlike the cases of Russia and China mentioned above (i.e., two very large and weakly developed countries), Spain would be a medium-size industrialized economy, given the size of her main macroeconomic variables, which has experienced a process of rapid growth in the last forty years, starting from a relatively weak position as compared to the rest of Western European countries. This has been particularly true after her accession to 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. Summarizing, the Spanish experience could be of interest for other medium-size economies following a process of integration with other relatively more advanced countries, as can be the case of the Central and Eastern European countries that have recently joined the EU.

The rest of the paper is organized as follows: the theoretical framework is presented in Section 2, and the main empirical results are shown in Section 3; finally, the main conclusions are summarized in Section 4.

## 2. Theoretical framework

Our starting point will be a simple production function that includes human capital (as in MANKIW, ROMER and WEIL, 1992), written for simplicity in a Cobb-Douglas form:

$$Y_t = A_t K_t^{\alpha} H_t^{\beta} L_t^{\gamma} \qquad (1)$$

where *Y*, *K*, *H*, and *L* denote, respectively, output, physical capital, human capital, and labour; and *A* is an index of the level of technology. Dividing by *L* and taking logs, the above function would become:

$$\log\left(\frac{Y}{L}\right)_t = \log A_t + (\alpha+\beta+\gamma-1)\log L_t + \alpha\log\left(\frac{K}{L}\right)_t + \beta\log\left(\frac{H}{L}\right)_t \qquad (2)$$

where α + β + γ indicates the degree of returns to scale for all production factors. Now, the question would be: how does FDI enter the above equation? The main arguments below are taken from BAJO-RUBIO and DÍAZ-ROLDÁN, 2002, who present a survey on the relationship between FDI, productivity growth, and technological innovation, by the multinational enterprise (MNE).

In the standard neoclassical growth model, FDI would be considered as an addition to the capital stock of the host economy (see, e.g., BREMS, 1970), so that the effect of foreign capital would be indistinguishable from that of domestic capital. Notice that, in this case, the assumption of diminishing returns to capital would imply that FDI would affect growth only in the short run, i.e., during the transition to the steady-state growth path. Such a characterization, however, is unsatisfactory given the recent trends in FDI. In fact, the main role of FDI would seem to be that of transferring assets from less efficient to more efficient owners, so that in practice FDI would consist of offsetting two-way flows that would be hardly related to productive investment (LIPSEY, 2001). In other words, FDI would be less and less "greenfield", i.e., that FDI devoted to enlarge the production capacity of the host economy.

Endogenous growth models allow for a greater impact of FDI on growth. On the one hand, FDI could lead to externalities on the domestic production factors; the effect on growth, however, would be permanent only if the resulting returns to scale over all factors (i.e., including the externality) turn to be increasing. More importantly, the endogenous growth literature has tried to formalize technological innovation, which would emerge as a response to economic incentives, that is, profit opportunities detected by firms that would be influenced by the institutional, legal, and economic environment in which they act (GROSSMAN and HELPMAN, 1994). And, in turn, this would lead to stress the role of FDI and, in general, the degree of economic integration, on influencing technological progress and consequently growth rates.

In this way, higher integration would mean an increase in market size, which would lead to greater incentives to R&D and hence higher growth; and this would facilitate 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 would lead to a higher growth rate in the long run, since it would allow the exploitation at the world level of the increasing returns that would exist in the R&D sector (RIVERA-BATIZ and ROMER, 1991). Even more, both FDI and growth could be the simultaneous result of an increased economic integration, on changing the relative strength of centrifugal and centripetal forces behind manufacturing agglomeration, in a model that combines endogenous growth with elements of economic geography (GAO, 2005).

On the other hand, as mentioned before, FDI has acquired in last years an increasing importance as a way of internationalization of the economic activity in the industrialized countries, enjoying growth rates remarkably above those of world trade. Indeed, the importance of FDI would not be limited to its spectacular growth in merely quantitative grounds, since it would have performed a crucial role in the diffusion of ideas and innovations across borders (ROMER, 1993). In fact, the possibility of gaining access to modern technologies is probably the main reason behind the interest on the side of the less technologically advanced countries to attract FDI. The reason is that MNEs conduct a great part of world R&D, as well as generating and controlling much of the most advanced production techniques. Still, the host countries should possess a minimum social capability in the form of an educated labour force and adequate organizational structures, i.e., the absorptive capacity to get a fully satisfactory transmission of such advanced technologies, in order to reach a higher output growth.

The literature has also analyzed extensively the possible presence of spillovers of the MNEs activities, when establishing a subsidiary leads to productivity or efficiency benefits for the host country's local firms, and the MNEs are not able to internalize the full value of these benefits (BLOMSTRÖM and KOKKO, 1998). That is, the more evolved production methods, organizational and managerial techniques, marketing activities, and the like, of the MNEs, can be spread over the host country's local firms 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).

Notice that the empirical evidence on these spillover effects is far from being unambiguous. In fact, the positive spillover effects would shift downwards the average costs curve of domestic firms; but the increased competition would lead these firms to cut their output and so moving upwards along the new average costs curve, so the net effect on average costs would be ambiguous (AITKEN and HARRISON, 1999). As stressed by GÖRG and GREENAWAY, 2004, not all domestic firms would benefit equally from the 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. Also, in terms of the development of local industry, the positive spillovers related with FDI would dominate when inflows are large, outweighing the negative competition effects associated with FDI (BARRIOS et al., 2005). Finally, backward regions would be more likely to benefit from spillovers from FDI, since the potential productivity gains by domestic firms would be greater due to the scope for technological catch-up (PERI and URBAN, 2006).

In general, a greater opening to FDI coming from the most advanced countries would lead to an increase in the rate of technological progress in the host country, and hence its rate of growth (WANG, 1990). Indeed, the incentive of a MNE to transfer technology would be inversely related to its perceived operation risks in the host country, which would explain that the average age of technologies transferred to their subsidiaries in developed countries is considerably lower than those transferred to developing countries; and technological transfer via FDI would be positively related to the investment in learning made by the host country's firms (WANG and BLOMSTRÖM, 1992).

According to the above theoretical arguments, we will assume that the level of technology $A$ depends on its initial value, $A_0$, and the externalities from accumulated FDI inflows, in relative terms per employee:

$$A_t = A_0 \left( \frac{FDI}{L} \right)_t^{\theta} \qquad (3)$$

where $FDI$ denotes the accumulated sum of FDI inflows, which acts as a proxy of the foreign capital stock.

Finally, replacing (3) in (2):

$$\log\left(\frac{Y}{L}\right)_t = \log A_0 + (\alpha+\beta+\gamma-1)\log L_t + \alpha\log\left(\frac{K}{L}\right)_t + \beta\log\left(\frac{H}{L}\right)_t + \theta\log\left(\frac{FDI}{L}\right)_t \quad (4)$$

or, denoting by *y*, *k*, *h*, and *fdi* the logs of *Y/L*, *K/L*, *H/L*, and *FDI/L*, respectively, we get

$$y_t = \log A_0 + (\alpha+\beta+\gamma-1)\log L_t + \alpha k_t + \beta h_t + \theta fdi_t \quad (5)$$

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



3. Empirical results

Equation (5) has been estimated for the 17 regions ("comunidades autónomas") established after the approval of the current Spanish Constitution in 1978, with the sample period running from 1987 to 2000. The starting and final year of that period is dictated by data availability. So, the regional data on FDI are only available from 1987 on; in turn, the private and public stocks of capital, which are used later in the estimations, are not available after 2000. In addition, a certain change in the traditional location advantages of the Spanish economy seems to have occurred in the last years of the past century, leading to a slowing down of FDI inflows to Spain (FERNÁNDEZ-OTHEO, 2003), so that enlarging the period of analysis much beyond 2000 (even if all data were available) might bias the results. All the variables in real terms are valued at 1986 prices. The data sources and definitions are as follows:

- Gross Domestic Product, from the *Spanish Regional Accounts*, elaborated at the National Institute of Statistics within the framework of the *Spanish National Accounts*.
- Physical capital stock (total, private, and public), from MAS et al., 2005a, which is the result of a joint project between the Instituto Valenciano de Investigaciones Económicas and the Fundación BBVA. The series are elaborated using the method of the permanent inventory, from the accumulation of the series on gross fixed capital formation, following OECD recommendations. Note that the data on public capital we use below,

incorporate only the directly productive items included into the whole government capital stock (i.e., roads, water infrastructures, urban structures, ports, railroads, and airports), hence excluding the non-directly productive items (i.e., education and health); see MAS et al., 2005a, for details.

- Employment and human capital, from MAS et al., 2005b, which is the result of a joint project between the Instituto Valenciano de Investigaciones Económicas and the Fundación Bancaja. This dataset contains a wide range of information on how levels of education in the Spanish population have evolved, separated into several categories (i.e., illiterate, no formal education or primary education, compulsory secondary education, pre-university education, higher education, and total), and its basic source is the *Economically Active Population Survey*, elaborated at the National Institute of Statistics. The particular proxy for human capital we use below is the share of the employed population with two levels of higher education (i.e., pre-university education, and higher education).
- Gross FDI inflows, from the *Foreign Investment Registry*, kept at the Ministry of Industry, Tourism and Trade for statistical purposes. Notice that a stock, rather than a flow, measure of FDI should be used in the estimations, in order to pick the permanent character of FDI, rather than the fluctuations associated to flows. In absence of such a variable, we chose to proxy the foreign capital stock for each year with the accumulated sum of gross FDI inflows from 1987 on to that particular year, as in BAJO-RUBIO and SOSVILLA-RIVERO, 1994.

Table 1 presents summary statistics of the data. As can been, the highest variability corresponds to the FDI variable. Some additional information for this last variable appears in Table 2. Nearly one half (46 per cent) of the accumulated FDI inflows over the period 1987-

2000 came to the Madrid region, and 30 per cent to Catalonia; that is, these two regions account for more than 75 per cent of total in that period. Of the remaining regions, Andalusia attracted 6 per cent, and the Valencian Community and Basque Country around 3 per cent each; which, added up to the figures for Madrid and Catalonia would mean almost 90 per cent of total. In terms of GDP, the relative importance of Madrid and Catalonia is also substantial, since the accumulated FDI inflows amounted to 49 and 26 per cent of GDP, respectively, on average over the whole period. Leaving aside some small regions like Navarre, Rioja, and the Balearic Islands, for the rest of regions accumulated FDI did not exceed 10 per cent of GDP.

[Table 1 here]

[Table 2 here]

In the empirical application, we use a dynamic panel approach where the lagged dependent variable is also included to allow for a dynamic structure of the model. The regression equation would be the following:

$$y_{i,t} = \rho y_{i,t-1} + (\alpha + \beta + \gamma - 1)\log L_{i,t} + \alpha k_{i,t} + \beta h_{i,t} + \theta fdi_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (6)$$

where $\eta_i$ and $\varepsilon_{i,t} \sim N(0,\sigma^2)$ denote, respectively, the unobservable individual specific effects, and a random disturbance.

Equation (6) makes up a dynamic panel data model, where the dependent variable is partly explained by its past value. This model involves two econometric problems. The first one results from the dynamic nature of the data, which can introduce some correlation between the error term and the explanatory variables. So, the application of static panel data estimation methods would lead to biased estimates with dynamic panel data models. The second issue results from the potential endogeneity of the explanatory variables, which can be the case of FDI. We expect that FDI influences GDP growth, but faster GDP growth may lead to more FDI as well; as usual, the other explanatory variables are also treated as endogenous. Therefore, an instrumental variable estimation has to be used to avoid any potential biases induced by simultaneity.

The econometric technique that allows accounting for the problem of error correlation and endogeneity of variables is GMM. An appropriate instrumentation technique for dynamic panel data has been developed by ARELLANO and BOND, 1991, and ARELLANO and BOVER, 1995, which provides unbiased and efficient estimates. These authors suggest first-differencing the model to get rid of the individual specific effects and then using valid instruments (lagged values of the instrumented variables) to deal with the problem of the new error term being correlated with the lagged dependent variable. The use of instruments is also required in order to control for the potential endogeneity of the other explanatory variables. We assume that the right-hand side variables are predetermined (i.e., they are assumed to be correlated with past values of the error term, but uncorrelated with current and future values of the error term). So, at least two lagged values of the dependent variable (i.e., $y_{i,t-2}$ and any further lag $y_{i,t-3}$, $y_{i,t-4}$, etc.) are used as instruments for the equations in first differences. Since it makes use of all the available moment restrictions, the difference GMM estimator suggested by ARELLANO and BOND, 1991, improves significantly estimation efficiency.

A drawback of the difference GMM estimator of ARELLANO and BOND, 1991, is that, when first differences are taken, time invariant variables are wiped out. So, the estimator does not use the cross-sectional information reflected in the differences between regions. Another disadvantage is that lagged levels are often poor instruments for the equation in differences, especially in the case of panels with a small number of time periods with highly persistent data, which can lead to large finite-sample biases and poor precision in the estimators. To reduce this problem associated with the difference GMM estimator, we use a new estimator, namely, the system GMM, developed by ARELLANO and BOVER, 1995, and BLUNDELL and BOND, 1998. This estimator is based on an augmented system that includes the regression in differences in addition to the regression in levels with lagged differences as instruments. The second part of the system requires the additional assumption of no correlation between the variables in differences and the unobserved industry effects, although there may be correlation between the levels of the explanatory variables and the fixed effects. Interestingly, BOND et al., 2001, recommend using the system GMM estimator in empirical growth work. We make use of the one-step robust estimator of the system GMM since simulation studies have suggested very modest efficiency gains from using the two-step estimator, even in the presence of considerable heteroscedasticity (BOND, 2002).

On the other hand, the consistency of the GMM estimator depends on the validity of the instruments, which is examined by means of two specifications tests. First, the Sargan and Hansen test statistics of over-identifying restrictions (the latter, robust to the presence of heteroscedasticity), which test the hypothesis that the instruments are not correlated with the residuals. The validity of the instruments also requires the lack of second-order serial correlation in the first-differenced error term whereas, by construction, first-order correlation is expected even with an uncorrelated original error term. So, an additional test is included to examine the null hypothesis of no second-order correlation in the residuals.

The results of the econometric estimation of equation (6) are shown in Table 3. The two specification tests suggested by ARELLANO and BOND, 1991, to test for the validity of the assumed moment restrictions are also included in Table 3. In all cases, the null hypothesis of no second-order serial correlation cannot be rejected; also, the validity of the instruments used in the estimation is not rejected by Sargan and Hansen's tests. All the estimated equations include time dummies.

[Table 3 here]

As can be seen in column (1), the coefficient on employment would be negative and significantly different from zero, so that the hypothesis of decreasing returns to scale over all inputs would not be rejected. Both the physical capital stock and the human capital variable show a positive and significant effect on the evolution of output per employee. Finally, FDI appears with a positive coefficient, significantly different from zero at the 1 per cent level.

Next, in column (2) we include as an additional variable the product between human capital and FDI, as in BORENSZTEIN et al., 1998. This variable would indicate the existence of complementarities between human capital and FDI, so that the favourable effect of FDI on productivity would depend on the availability of some minimal endowments of human capital, which would proxy in turn the capability of the host country to absorb the new technologies. The coefficient on this variable, however, is negative but not significant, and human capital and FDI lose their significance. In turn, when human capital is dropped in column (3), the multiplicative variable becomes positive and significant at the 10 per cent level, but FDI is not significant; and when FDI is dropped in column (4), the interactive term is positive and significant at the 5 per cent level, but now human capital is not significant.

Finally, the physical capital stock has been split into its two components, private and public, which allows us to assess the separate effect of government capital. The important role played by government capital on regional growth in the Spanish case has been shown elsewhere; see, e.g., BAJO-RUBIO and DÍAZ-ROLDÁN, 2005. As can be seen in columns (5) through (8), the previous results are roughly unchanged. In particular, the coefficient on FDI is positive and significant at the 1 per cent level in column (5); and the interactive term between human capital and FDI is not significant in column (6), unless either human capital or FDI are dropped from the estimated equation in columns (7) and (8), although these variables become then non significant.

We proceed now to assess the robustness of the basic results shown in columns (1) and (5) of Table 3; these new results are presented in Table 4. First, we have included the second lag of the dependent variable in columns (1) and (2), but it did not prove to be significant; the results for the FDI variable are basically unchanged, and human capital loses its significance. On the other hand, note that increasing the number of instruments may weaken the Hansen test to the point that the p-values for this test might become implausibly high (i.e., equal or very close to one). A possible solution would be reducing the number of instruments, even though there is no clear guidance on what is an adequate number of instruments (ROODMAN, 2007). Accordingly, we have experimented using a variety of number of lags as instruments. In columns (3) and (4) we report the estimation results using as instruments lags two to five of all the explanatory variables, but the p-value of the Hansen test does not fall; however, the instruments would be still valid according to the Sargan test, which does not suffer this weakness. The coefficients on the FDI variable, though, are quite the same, and still significant at the 1 per cent level; human capital, in turn, is only significant (at the 10 per cent level) in column (3), but not in column (4).

[Table 4 here]

Still, since the absorptive capacity required to attract FDI inflows is expected to be more prevalent in "richer" countries, we have re-estimated the specifications in columns (1) and (5) of Table 3 allowing for a different coefficient on the FDI variable for those regions with a GDP per employee above and below the Spanish average level over the whole period of analysis; these separate coefficients are denoted by the subscripts 'high' and 'low' in columns (5) and (6) of Table 4. As can be seen, the estimated coefficients on the FDI variable are very similar for both the 'richer' or 'more productive' regions (Rioja, Baleares, Madrid, País Vasco, Navarra, Cataluña, Aragón, Cantabria), and the 'poorer' or 'less productive' regions (Asturias, Comunidad Valenciana, Canarias, Castilla y León, Murcia, Andalucía, Castilla-La Mancha, Extremadura, Galicia). Finally, since most of the FDI received by the Spanish economy is concentrated in Madrid and Catalonia (according to the figures in Table 2, 46 and 30 per cent, respectively, of the accumulated FDI over the whole period of analysis), the specifications in columns (1) and (5) of Table 3 have been re-estimated allowing for a different coefficient on the FDI variable for Madrid, Catalonia, and the rest of regions. Again, the estimated coefficients, denoted by the subscripts 'Madrid', 'Catalonia' and 'rest', and shown in columns (7) and (8) of Table 4, are very similar for these two regions and the rest, and analogous to those found in the basic specification.

## 4. Conclusions

In this paper we have tried to assess the impact of FDI on regional economic growth in the Spanish case. To that end, an aggregate production function augmented with FDI inflows was estimated, using data for the 17 Spanish regions over the period 1987-2000, i.e., following entry into the EU. Along the paper we have emphasized the regional dimension, for a group of developed and relatively homogeneous economies, the Spanish regions, becoming integrated with other richer countries. Finally, we have used an econometric methodology especially well suited for empirical growth work, namely, the system GMM estimator.

Overall, our results support the outstanding role played by FDI as a vehicle for technology transfer, and its relationship with productivity growth. More specifically, accumulated FDI inflows would have played a positive and significant role in the evolution of GDP per employee in the case of the Spanish regions. Even if we have been unable to identify a joint effect of FDI and human capital accumulation, aside the separate impact of both variables simultaneously, the main result has proved to be robust to a number of alternative specifications of the basic equation. In particular, very similar results were found when allowing for a different coefficient on the FDI variable for those regions with a GDP per employee above and below the Spanish average level, or for the regions receiving more than 75 per cent of the accumulated FDI over the period, i.e., Madrid and Catalonia, and the rest.

Summarizing, the results of this paper would confirm (unlike CARKOVIC and LEVINE, 2005) the positive influence of FDI on the evolution of GDP per employee and, eventually, on growth, when using a proper econometric method. In achieving these results it would be crucial that the host economies have an appropriate level of development, and hence the necessary absorptive capacity; and even if the amount of FDI received was deemed in principle as not too high. This in turn would contrast with the conclusions of other papers quoted in the Introduction, which analyze the cases of weakly developed economies; see, e.g., LAURETI and POSTIGLIONE, 2005, or LEDYAEVA and LINDEN, 2006.

On the other hand, recall that policies aimed to increasing R&D expenditures and innovation have been widely used in order to promote regional economic growth in the EU, especially in the peripheral regions (BILBAO-OSORIO and RODRÍGUEZ-POSE, 2004). In this sense, a policy addressed to support FDI could be thought as an indirect way of promoting R&D, given the prominent role of FDI in transferring the most advanced technologies available; and provided that a minimum level of social capability exists in the host regions.

To conclude, it should be stressed that these favourable effects of FDI on growth found for the Spanish regions would be greatly dependent upon their stability and permanent nature. While the huge affluence of FDI to the Spanish economy following her accession to the EU in 1986, would have led to a positive outcome in terms of the evolution of GDP per employee, the picture might be changing since the end of the 1990s (i.e., coinciding with the end of our sample period). In fact, last years have witnessed a process of foreign capital divestment, following recent changes in the strategies of MNEs, which has reached significant levels in the Spanish case (FERNÁNDEZ-OTHEO and MYRO, 2004). Accordingly, it would not be unlikely that the results found in this paper should be qualified in the next future. Also, this fact should be borne in mind by those regions seeking to attract FDI as an engine of technology transfer in order to fostering economic growth.

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Table 1: Summary statistics

| | Mean | Standard deviation | Minimum value | Maximum value |
|---|---|---|---|---|
| y | 4.2958 | 0.0662 | 4.0582 | 4.4365 |
| k | 4.7208 | 0.0660 | 4.4629 | 4.8860 |
| kpr | 4.6603 | 0.0707 | 4.4152 | 4.8603 |
| kpu | 3.8133 | 0.1374 | 3.4800 | 4.0408 |
| h | 1.1255 | 0.1190 | 0.8035 | 1.4519 |
| fdi | 3.0074 | 0.5807 | 0.8894 | 4.2724 |

Source: Own elaboration from National Institute of Statistics; MAS et al., 2005a, 2005b; and Ministry of Industry, Tourism and Trade.

Table 2: Accumulated FDI inflows received by the Spanish regions, 1987-2000
(million euros and percentages)

| | Accumulated FDI inflows | % on total | % on GDP |
|---|---|---|---|
| Andalucía | 34964.14 | 6.10 | 7.40 |
| Aragón | 9715.37 | 1.69 | 8.15 |
| Asturias | 4141.43 | 0.72 | 4.61 |
| Baleares | 8906.63 | 1.55 | 10.36 |
| Canarias | 8743.68 | 1.52 | 6.83 |
| Cantabria | 2012.31 | 0.35 | 4.35 |
| Castilla y León | 5592.81 | 0.98 | 2.66 |
| Castilla-La Mancha | 2468.58 | 0.43 | 1.93 |
| Cataluña | 172149.61 | 30.01 | 25.96 |
| Comunidad Valenciana | 19750.14 | 3.44 | 5.71 |
| Extremadura | 1618.41 | 0.28 | 2.43 |
| Galicia | 6280.56 | 1.09 | 3.27 |
| Madrid | 263516.51 | 45.94 | 49.29 |
| Murcia | 3154.63 | 0.55 | 3.66 |
| Navarra | 9632.27 | 1.68 | 16.81 |
| País Vasco | 17658.54 | 3.08 | 7.98 |
| Rioja | 3312.03 | 0.58 | 11.08 |
| Total | 573617.66 | 100.00 | 16.50 |

Source: Own elaboration from *Foreign Investment Registry*, Ministry of Industry, Tourism and Trade; and *Spanish Regional Accounts*, National Institute of Statistics.

Table 3: Estimation of a production function for the Spanish regions, 1987-2000 (I)
(GMM-system regressions results. Dependent variable: y)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| $y_{-1}$ | 0.7703*** (0.0485) | 0.7672*** (0.0501) | 0.7799*** (0.0468) | 0.7822*** (0.0453) | 0.7664*** (0.0504) | 0.7668*** (0.0523) | 0.7715*** (0.0492) | 0.7790*** (0.0458) |
| log L | –0.0067** (0.0036) | –0.0094** (0.0035) | –0.0094** (0.0037) | –0.0092** (0.0038) | –0.0078** (0.0031) | –0.0078** (0.0030) | –0.0076** (0.0032) | –0.0074** (0.0032) |
| k | 0.1337*** (0.0369) | 0.1338*** (0.0312) | 0.1310*** (0.0288) | 0.1317*** (0.0292) | – | – | – | – |
| kpr | – | – | – | – | 0.1225*** (0.0304) | 0.1225*** (0.0305) | 0.1216*** (0.0293) | 0.1208*** (0.0291) |
| kpu | – | – | – | – | 0.0303*** (0.0080) | 0.0304*** (0.0084) | 0.0316*** (0.0081) | 0.0316*** (0.0087) |
| h | 0.0284** (0.0369) | 0.0437 (0.0357) | – | 0.0001 (0.0167) | 0.0193* (0.0099) | 0.0171 (0.0392) | – | –0.0188 (0.0169) |
| fdi | 0.0113*** (0.0016) | 0.0168 (0.0118) | 0.0027 (0.0063) | – | 0.0140*** (0.0043) | 0.0133 (0.0128) | 0.0081 (0.0056) | – |
| h*fdi | – | –0.0046 (0.0104) | 0.0074* (0.0042) | 0.0087** (0.0034) | – | 0.0006 (0.0110) | 0.0052* (0.0029) | 0.0113*** (0.0037) |
| Observations | 221 | 221 | 221 | 221 | 221 | 221 | 221 | 221 |
| Test p-values: | | | | | | | | |
| AR(1) | 0.009 | 0.010 | 0.007 | 0.007 | 0.009 | 0.010 | 0.008 | 0.007 |
| AR(2) | 0.914 | 0.926 | 0.894 | 0.897 | 0.911 | 0.911 | 0.897 | 0.885 |
| Sargan | 0.279 | 0.528 | 0.323 | 0.354 | 0.509 | 0.742 | 0.560 | 0.559 |
| Hansen | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Notes:

(i) Robust standard errors in parentheses; *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

(ii) AR(1) and AR(2) are tests of first- and second-order serial correlation.

(iii) The instruments are lags two to the earlier available of all the explanatory variables. Sargan and Hansen are tests of the over-identifying restrictions; p-values below 0.05 suggest a rejection of the validity of the instruments at the 5% critical level.

Table 4: Estimation of a production function for the Spanish regions, 1987-2000 (II)
(GMM-system regressions results. Dependent variable: y)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| $y_{-1}$ | 0.7952$^{***}$ (0.0491) | 0.7774$^{***}$ (0.0589) | 0.8027$^{***}$ (0.0397) | 0.7965$^{***}$ (0.0472) | 0.7658$^{***}$ (0.0459) | 0.7614$^{***}$ (0.0475) | 0.7559$^{***}$ (0.0539) | 0.7597$^{***}$ (0.0550) |
| $y_{-2}$ | −0.0019 (0.0499) | 0.0087 (0.0545) | – | – | – | – | – | – |
| log L | −0.0094$^{**}$ (0.0046) | −0.0073$^{*}$ (0.0038) | −0.0085$^{**}$ (0.0033) | −0.0068$^{**}$ (0.0028) | −0.0083$^{**}$ (0.0038) | −0.0062$^{*}$ (0.0032) | −0.0098$^{**}$ (0.0040) | −0.0088$^{**}$ (0.0034) |
| k | 0.1168$^{***}$ (0.0273) | – | 0.1125$^{***}$ (0.2608) | – | 0.1313$^{***}$ (0.0283) | – | 0.1391$^{***}$ (0.0343) | – |
| kpr | – | 0.1075$^{***}$ (0.0293) | – | 0.1050$^{***}$ (0.0288) | – | 0.1198$^{***}$ (0.0284) | – | 0.1239$^{***}$ (0.0322) |
| kpu | – | 0.0327$^{***}$ (0.0107) | – | 0.0279$^{***}$ (0.0076) | – | 0.0313$^{***}$ (0.0071) | – | 0.0274$^{***}$ (0.0083) |
| h | 0.0194 (0.0134) | 0.0073 (0.0126) | 0.0224$^{*}$ (0.0117) | 0.0141 (0.0099) | 0.0274$^{**}$ (0.0127) | 0.0173$^{*}$ (0.0094) | 0.0382$^{***}$ (0.0140) | 0.0268$^{*}$ (0.0149) |
| fdi | 0.0117$^{**}$ (0.0046) | 0.0157$^{***}$ (0.0059) | 0.0101$^{***}$ (0.0035) | 0.0127$^{***}$ (0.0040) | – | – | – | – |
| $fdi_{high}$ | – | – | – | – | 0.0095$^{**}$ (0.0039) | 0.0121$^{***}$ (0.0043) | – | – |
| $fdi_{low}$ | – | – | – | – | 0.0084$^{**}$ (0.0043) | 0.0108$^{**}$ (0.0046) | – | – |
| $fdi_{Madrid}$ | – | – | – | – | – | – | 0.0109$^{**}$ (0.0042) | 0.0129$^{***}$ (0.0044) |
| $fdi_{Catalonia}$ | – | – | – | – | – | – | 0.0131$^{***}$ (0.0045) | 0.0144$^{***}$ (0.0047) |
| $fdi_{rest}$ | – | – | – | – | – | – | 0.0123$^{**}$ (0.0050) | 0.0135$^{***}$ (0.0052) |
| Observations | 204 | 204 | 221 | 221 | 221 | 221 | 221 | 221 |
| Test p-values: | | | | | | | | |
| AR(1) | 0.008 | 0.007 | 0.008 | 0.009 | 0.009 | 0.009 | 0.010 | 0.010 |
| AR(2) | 0.519 | 0.529 | 0.931 | 0.928 | 0.910 | 0.906 | 0.917 | 0.916 |
| Sargan | 0.853 | 0.955 | 0.808 | 0.924 | 0.588 | 0.770 | 0.660 | 0.660 |
| Hansen | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Notes: See Table 3. The instruments in columns (3) and (4) are lags two to five of all the explanatory variables.