Foreign Direct Investment and Trade: A Causality Analysis

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A CAUSALITY ANALYSIS

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Abstract

In this paper we analyze the relationship between outward FDI and exports, using Spanish quarterly data for the period 1977-1998, by means of Granger-causality tests in a cointegration framework. Our results point to the existence of a relationship of complementarity between both variables, with Granger-causality running in the short run from outward FDI to exports, and bilateral Granger-causality in the long run.
As is well known, recent years have witnessed a growing internationalization of economic activities in the context of a progressive liberalization of international economic relations, which has led to a spectacular increase in both goods and services exchange as well as capital movements. In particular, after 1985 a surge in foreign direct investment (FDI) has occurred, mainly among industrialized nations, with Southern Europe as one of its most important destinations in relative terms (Graham and Krugman, 1993). In this way, according to data from the International Monetary Fund (IMF), during the second half of the eighties world FDI and imports increased at yearly average rates of 41 and 12.6 per cent, respectively, whereas world gross domestic product (GDP) grew by 3.8 per cent.

However, and despite the important growth experienced by both foreign trade and FDI, the relationship between them has not been extensively explored. There is some empirical work, within the industrial organization tradition, which analyses the export behavior of affiliates of multinational firms towards host-country markets. The most common finding of this literature is that of a relationship of complementarity between FDI and exports, a result obtained using data from both industries and individual firms; see, among others, Lipsey and Weiss (1981,1984), Blomström, Lipsey and Kulchycky (1988), Yamawaki (1991), Pfaffermayr (1996) or Bajo and López (1998).

On the other hand, the macroeconomic relationship between FDI and trade flows has hardly been tested. An exception is a paper by Pfaffermayr (1994), who applies Granger-causality analysis to Austrian outward FDI and exports, obtaining a complementary relationship between these variables, with causality running in both directions. An alternative approach is that
of Lin (1995), who estimates export and import equations augmented with several FDI variables for Taiwan vis-à-vis four ASEAN countries (Indonesia, Malaysia, the Philippines and Thailand), finding a positive and significant effect for outward FDI on exports. Working on similar lines, Bajo and Montero (1999b) find a positive effect for accumulated FDI outflows and inflows, respectively, in an estimation of export and import equations for Spain.

Our aim in this paper will be to analyze the empirical relationship between outward FDI and exports from a macroeconomic point of view, using Spanish data for the period 1977-1998, by means of Granger-causality tests in a cointegration framework. The Spanish economy has experienced a growing integration in world markets since the early sixties, strengthened after the restoration of democracy in 1977, and definitively established after joining the then European Community (EC) in 1986. The overall evolution of exports and outward FDI between 1977 and 1998 appears in Figure 1, showing a continuous upward and parallel trend for both variables during the whole period. A broadly similar picture emerges in Figure 2 in terms of GDP shares.

We present some evidence on the sectoral patterns of exports and outward FDI in Table 1, while Table 2 shows their geographical distribution. The entire time span has been divided into three subperiods: 1977-1985, 1986-1992, and 1993-1998, where the breaking dates are the Spanish integration into the EC, and the end of the expansionary period which began in the mid-eighties.
As can be seen in Table 1, around three quarters of Spanish exports are manufacturing goods, with an increasing share throughout the period of machinery and transportation equipment, at the expense of consumer goods. As for outward FDI, although that directed to manufacturing has increased in absolute terms (mainly in the sectors of food and beverages, paper and printing, and electrical material), its relative share has decreased since the bulk of the impressive growth experienced by FDI outflows over the period analysed has fallen on services, such as transport and communications and, especially, financial and insurance activities, and other services.

[Table 1 here]

Regarding geographical distribution (Table 2), the main market for Spanish exports is the EC, a trend reinforced after the Spanish integration in 1986. Within the EC, the main destinations are France and Germany, being especially remarkable the increasing importance of Portugal. Also, the US share is steadily decreasing throughout the period under study, at the same time that Spanish exports to Latin America recover in recent years after the big fall experienced in the second half of the eighties. On the other hand, FDI outflows to the EC show a strong growth after the Spanish accession in 1986 (more than doubling their share on total), which turns to be weaker in last years leading to a lower EC share. Within the EC, the greatest increasing share is again that of Portugal, whereas the figures for the Netherlands are not fully significant, given the fiscal advantages enjoyed by international investment in that country; also, the role of France as a destination of Spanish FDI is quite remarkable. As in the case of exports, the US share has strongly decreased throughout the period. Finally, the impressive growth of Spanish FDI abroad during the last subperiod would have been mainly
explained by that directed to Latin America (especially in the financial and communications sectors), which strongly increases its share following a decrease in relative terms between 1986 and 1992.

We can see how exports and outward FDI share a broad common trend: a higher concentration in the EC following the Spanish integration, as compared to the first subperiod; and a relative shift of outward FDI towards Latin America (and, within the EC, Portugal) in the last subperiod, accompanied with a higher export growth to that area. Therefore, as a very preliminary conclusion, we may guess that the increase in Spanish exports throughout the period of analysis to some destinations, such as Latin America or Portugal, might be related to a higher Spanish FDI in those places.

[Table 2 here]

The analysis in this paper departs from previous studies (e. g., Pfaffermayr, 1994), first, in that we use data on real figures for exports and outward FDI, instead of GDP shares. In addition, we take the accumulated sum of outward FDI over a long period (i. e., a proxy of the foreign capital stock) rather than data on FDI flows, a procedure that could be justified since FDI strategies should be a long-run phenomenon, which might be blurred when looking at the year-to-year evolution of FDI flows. On the other hand, regarding econometric methodology, Granger-causality tests are performed in a cointegration setting, which allows us to distinguish between short-run and long-run Granger-causality. Finally, and given the importance of the choice of lag lengths in Granger-causality tests, these have been selected by means of an
appropriate method, such as Hsiao’s (1981) sequential approach, specifically designed to avoid imposing often false or spurious restrictions on the model.

The rest of the paper is organized as follows. Some theoretical arguments concerning the relationship between FDI and trade are reviewed in Section 1. The econometric methodology is presented in Section 2, and the empirical results are shown in Section 3. Section 4 concludes.

1. Theoretical issues

Initially, the relationship between FDI and trade is far from being unambiguous, from a theoretical point of view. The traditional view (Mundell, 1957) stated, in the context of the (two-good, two-factor, two-country) Heckscher-Ohlin trade model, that goods movements and factor movements were substitutes. Factor mobility induced by differences in factor prices between countries would eliminate price differentials in both goods and factor markets, so removing the basis for trade. Then, trade impediments would enhance factor movements and conversely, so that exports and FDI would be alternative ways of involvement in foreign markets. However, this result would be highly dependent on the specific assumptions made (Schmitz and Helmberger, 1970).

Later contributions showed that trade and foreign investment might be complements rather than substitutes. For instance, once a certain threshold is reached, exports could result in FDI in the destination market, aimed to exploit certain advantages intrinsic to the host country as well as trying to best satisfy the specific requirements of that market. Hence, FDI would be a means of consolidating and expanding export markets (Purvis, 1972).
More generally, Markusen (1983) discusses several models in which factor movements generated by international factor-price differences lead to an increase in the volume of trade. Retaining the assumption of identical relative factor endowments between two countries, several models embodying alternative bases for trade are presented (including differences in production technology, production taxes, imperfect competition, returns to scale, and factor market distortions). In all of these cases, factor mobility leads to differences in factor proportions, which means an additional motive for trade in goods. Therefore, Markusen concludes, Mundell’s result of trade in goods and factors being substitutes would be a special case which is only true if trade is based on differences in relative factor proportions (i.e., for the Heckscher-Ohlin trade model).

On the other hand, and starting from Hymer’s (1976) pioneering contribution, the theories of the multinational enterprise (MNE) state that MNEs must own some particular advantage over domestic firms in the host country. Given such an advantage of ownership, it must be beneficial for the MNE to internalize it within the firm by means of FDI, provided that the foreign country possess a location advantage over the home country making FDI more profitable than exporting. This is the essence of the well-known Dunning’s OLI (ownership-location-internalization) paradigm (Dunning, 1977).

These considerations have been incorporated in formal general equilibrium models in which MNEs arise endogenously. Helpman (1984) and Helpman and Krugman (1985) combine ownership and location advantages in a monopolistic competition model with horizontally differentiated goods, where MNEs develop some specific and highly specialized inputs (such as management, marketing, and product-specific R&D), that are not tradable. So, if differences in factor endowments exist, the firms from the country relatively abundant in headquarter services
become MNEs, and both intra-industry trade in differentiated products and intra-firm trade in such specialized inputs will appear. Ethier (1986) endogeneizes the internalization decision of the MNE. He finds that both a greater uncertainty faced by the firm and (unlike the models by Helpman, and Helpman and Krugman) a greater similarity in factor endowments between countries, make FDI more likely, leading to two-way FDI and a relatively higher intra-industry and intra-firm trade. On similar lines, Barrios (1997) shows that, for a peripheral country engaged in a process of economic integration, both intermediate imports and exports of the final good would be higher as integration deepens.

The previous models refer to “vertical” FDI, i.e., when MNEs locate each stage of the production process in different countries according to relative cost advantages, which results in FDI and trade being complements. However, there are also models for “horizontal” MNEs, trying to gain an easier access to a foreign market (for reasons of transport costs, or being closer to the final customer), which might lead to FDI and trade being substitutes rather than complements.

Brainard (1993) develops a two-sector, two-country model where firms in a differentiated-products sector choose between exporting and FDI as alternative methods of foreign market penetration. This sector is characterized by increasing returns to scale at the firm level due to some specialized input (such as R&D), scale economies at the plant level, and transport costs increasing with distance. From here, an equilibrium with MNEs is more likely, the higher the scale economies at firm level relative to those at plant level, and the higher the transport costs relative to plant-level scale economies. Also, for intermediate ranges of transport costs and firm-level scale economies relative to those at the plant level, there can be an
equilibrium with MNEs and domestic firms in the differentiated sector, with two-way trade in both differentiated products and intangible inputs. Similar results are found by Markusen and Venables (1998), who add an explicit consideration of the role of asymmetries between countries to previous models, so that MNEs become more important relative to trade as countries become more similar in size, relative endowments, and as world income grows.

Notice that the above models, and in particular those on “vertical” FDI, are based on the fact that MNEs own some specific and highly specialized intangible inputs, i.e., services, which can be easily disseminated to different geographical locations. In this way, assuming there is an efficiently operating market for these knowledge-intensive services, several possible configurations may arise: trade in goods, trade in goods and in services, or trade in goods and FDI in services (see van Marrewijk, Stibora and de Vaal, 1996). Notice that the latter case would fit rather well to the Spanish case, as can be seen in the sectoral distribution of exports and FDI outflows shown in Table 1.

Finally, an integrated treatment of “vertical” and “horizontal” models of FDI has been recently provided; see Markusen (1997) and Markusen and Maskus (1999). According to what the authors call the “knowledge-capital model”, the existence of skilled labor-intensive knowledge-based assets that can be easily supplied to geographically separate production facilities would give rise to “vertical” MNEs, locating their single plant and headquarters in different countries depending on factor prices and market sizes. On the other hand, the “public good” character of these knowledge-based assets for these geographically separate production facilities would give rise to “horizontal” MNEs, with plants producing the final good in several countries. In this way, “vertical” MNEs would dominate when countries are very different in
relative factor endowments, and “horizontal” MNEs when countries are similar in both relative factor endowments and size, and trade costs are moderate to high.

To conclude this section, we might guess that most of the recent Spanish outward FDI would roughly follow the pattern hypothesized by “vertical” FDI models (even though the distinction between “horizontal” and “vertical” FDI is not always too clear; see Markusen, 1995). In particular, Spanish outward FDI would be aimed to provide locally some specialized and skill-intensive services activities, in host countries with strong cultural ties with Spain, and relatively less skill-abundant (such as Latin America, or, within the EU, Portugal). All these countries would be characterized by a very high growth potential of their domestic markets, so that outward FDI would be a way of penetration into these markets, acting as a path breaker for Spanish manufacturing exports. This role would be particularly evident in the case of financial services, since the presence of Spanish banks in host countries should be valued as a significant support by potential Spanish exporters. In this way, the availability of these FDI-related services might be used as starting point to promote Spanish exports of manufactures to those countries.

In the rest of the paper we will provide an empirical test of this hypothesis, by means of Granger-causality tests in a cointegration framework. Our econometric methodology is presented in the next section.

2. **Econometric methodology**

As mentioned before, we are going to analyze the empirical relationship between aggregate outward FDI and exports for the Spanish case, by means of Granger-causality tests. As is well known, the results from these tests are highly sensitive to the order of lags in the autoregressive
process. An inadequate choice of the lag length would lead to inconsistent model estimates, so that the inferences drawn from them are likely to be misleading. In this paper, we will identify the order of lags for each variable by means of Hsiao’s (1981) sequential approach, which is based on Granger’s concept of causality and Akaike’s final prediction error criterion, and avoids imposing often false or spurious restrictions on the model.

Suppose two stationary variables, $X_t$ and $Y_t$, on which we would like to test for Granger-causality. Consider the models:

\[
X_t = \alpha + \sum_{i=1}^{p} \beta_i X_{t-i} + u_t \quad (1)
\]

\[
X_t = \alpha + \sum_{i=1}^{p} \beta_i X_{t-i} + \sum_{j=1}^{q} \gamma_j Y_{t-j} + v_t \quad (2)
\]

and then the following steps are used to apply Hsiao’s procedure:

(i) Take $X_t$ to be a univariate autoregressive process as in (1), and compute its final prediction error criterion (FPE hereafter) with the order of lags $i$ varying from 1 to $P$. Choose the lag that yields the smallest FPE, say $p$, and denote the corresponding FPE as FPE$_X(p,0)$.

(ii) Treat $X_t$ as a controlled variable with $p$ lags, add lags of $Y_t$ to (1) as in (2), and compute the FPEs with the order of lags $j$ varying from 1 to $Q$. Choose the lag that yields the smallest FPE, say $q$, and denote the corresponding FPE as FPE$_X(p,q)$. 
(iii) Compare $\text{FPE}_X(p,0)$ with $\text{FPE}_X(p,q)$. If $\text{FPE}_X(p,0) > \text{FPE}_X(p,q)$, then $Y_t$ is said to Granger-cause $X_t$, whereas if $\text{FPE}_X(p,0) < \text{FPE}_X(p,q)$, then $X_t$ would not be Granger-caused by $Y_t$.

Finally, steps (i) to (iii) should be repeated with $Y_t$ as the dependent variable, so that whether or not $X_t$ Granger-causes $Y_t$ would be tested.

Recall that before it was assumed that $X_t$ and $Y_t$ were stationary variables. However, if they are integrated of order one (i.e., first-difference stationary) and are cointegrated, equations (1) and (2) need to be amended to:

$$\Delta X_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta X_{t-i} + \delta z_{t-1} + \epsilon_t$$

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \gamma_i \Delta Y_{t-i} + \sum_{j=1}^{p} \delta \Delta Y_{t-j} + v_t + \delta z_{t-1}$$

where $z_t$ is the error-correction mechanism (ECM) (Engle and Granger, 1987). Notice that if $X_t$ and $Y_t$ are I(1) but are not cointegrated, the coefficient $\delta$ in equations (3) and (4) is assumed to be equal to zero.

Now, the previous definitions of Granger-causality for stationary variables can be applied to the case of I(1) variables from equations (3) and (4). In particular, if $\text{FPE}_{\Delta X}(p,0) > \text{FPE}_{\Delta X}(p,q)$, $Y_t$ is said to Granger-cause $X_t$ in the short run; and if $\delta$ is significantly different from zero, $Y_t$ is said to Granger-cause $X_t$ in the long run. Conversely, if $\text{FPE}_{\Delta X}(p,0) < \text{FPE}_{\Delta X}(p,q)$, $X_t$ would not be Granger-caused by $Y_t$ in the short run; and if $\delta$ is not significantly different from zero, $X_t$ would
not be Granger-caused by $Y_t$ in the long run. As before, the procedure should be repeated with $\Delta Y_t$ as the dependent variable, so that the hypothesis of short-run and long-run Granger-causality from $X_t$ to $Y_t$ would be tested.

3. Empirical results

In this section, the methodology discussed above will be applied to Spanish data on exports and outward FDI. Granger-causality relationships between exports and outward FDI have been evaluated in a multivariate setting, in order to avoid possible spurious results due to the omission of some relevant variables. The additional variables included in the analysis are a proxy of world income and the relative price of exports.

The particular variables used in our empirical exercise are as follows (all of them transformed to logarithms):

- Exports ($LX$): Spanish total exports, valued at 1985 prices.
- Outward FDI ($LINV$): accumulated sum of gross payments, net of disinvestments receipts, for Spanish investment abroad from 1966 on, valued at 1986 prices using the GDP deflator.\(^2\)
- World income ($LY^*$): imports of the industrialized countries, valued at 1985 prices.
- Relative price of exports ($LPRX$): ratio of the prices of Spanish exports to the industrial prices of the industrialized countries, the latter adjusted by the Pta-US $ exchange rate.

The data are quarterly, most of them taken from the database at the Spanish Ministry of Economy and Finance (\textit{Síntesis de Indicadores Económicos}).
taken from the IMF’s *International Financial Statistics* (imports of the industrialized countries, and their unit value index); OECD’s *Main Economic Indicators* (industrial prices of the industrialized countries); and Bank of Spain’s *Statistical Bulletin* (outward FDI). The sample period runs from 1977 to 1998.3

As a first step of the empirical analysis, we tested for the order of integration of the series by means of the Dickey-Fuller test (see Dickey and Fuller, 1979). According to the test results, shown in Table 3, the null hypothesis of a unit root was not rejected in all cases; indeed, the null of a second unit root was rejected.4

[Table 3 here]

Next, we tested for the presence of cointegration between exports and outward FDI. To this end, we estimated a long-run equation by means of the method proposed by Phillips and Hansen (1990), robust to the presence of serial correlation and endogeneity bias. The results are shown in Table 4, where the figures in brackets below each estimated coefficient are not the standard $t$-statistics but the Phillips and Hansen’s fully-modified Wald test statistics, distributed asymptotically as a $\chi^2$ with one degree of freedom.

[Table 4 here]

As can be seen, a positive and statistically significant relationship between exports and outward FDI is obtained. Together with the estimated equations, we also present the results from some cointegration tests: the cointegrating-regression Durbin-Watson, augmented Dickey-Fuller,
and Phillips-Ouliaris tests (denoted by CRDW, CRADF, and CR \( \hat{Z}_t \), respectively), which allow us to reject the null hypothesis of no cointegration at the 1 per cent significance level in all cases. Therefore, a first conclusion would emerge from Table 4: there would exist a long-run relationship between exports and outward FDI, and the sign of that relationship would agree with the hypothesis of complementarity.

The results from Tables 3 and 4 suggest that Granger-causality tests should be performed with all the variables transformed into first differences, and including an ECM in the equations to estimate. As in Ngama and Sosvilla (1991), three alternative specifications for the ECM have been tested:

a) Restricted ECM: i. e., including, in a short-run equation estimated by ordinary least squares, the lagged equilibrium error from the corresponding long-run equation estimated by the Phillips-Hansen method.

b) Unrestricted ECM (Inder, 1993): i. e., jointly estimating, in one step, a short-run and a (lagged) long-run equation by the method of non-linear least squares.

c) General ECM (Banerjee, Dolado, Hendry and Smith, 1986): i. e., including, in a short-run equation estimated by ordinary least squares, all the variables appearing in the corresponding long-run equation, lagged and without imposing any restriction on them.

The results of applying Granger-causality tests are shown in Table 5. In all cases, we started taking a maximum of four lags of all the variables involved, compared the FPEs, and chose as the best specification that with the minimum FPE; the number of lags for each variable in all the selected model specifications is indicated in the table. As explained in Section 2, short-
run Granger causality is assessed by the comparison of the FPEs from the models excluding and including the additional variable assumed to presumably Granger-cause the dependent variable. In turn, long-run Granger causality is tested from the significance of the coefficient on the ECM, evaluated, respectively, from the $t$-statistic (for the restricted and unrestricted ECM), and a Wald test on the joint significance of the coefficients on all the variables included in the ECM, distributed as a $\chi^2$ (for the general ECM).\(^5\)

[Table 5 here]

As can be seen in the table, FPEs decrease when outward FDI is included as an additional variable in the estimated equations for exports. This is not the case, however, for outward FDI equations, where FPEs increase when exports are added to the regression. Therefore, outward FDI would Granger-cause exports in the short run, but not otherwise.

On the other hand, regarding long-run Granger-causality, all the coefficients on the ECMs would be significant at the usual levels of significance; the only exception would be the general ECM in the equation for exports, which would be significant only at a 20 per cent significance level. In other words, long-run Granger-causality would appear running in both directions.

Notice that in the first version of this paper (Bajo and Montero, 1999a), with the sample period ending in 1992, similar conclusions were obtained. In particular, we found a positive and statistically significant relationship between exports and outward FDI, with both variables cointegrated, and long-run Granger-causality from outward FDI to exports. The
narrower association between both variables found in the present version might be due to the
deeper involvement of the Spanish economy within the world economy over the more recent
years, as shown by the continued increase in FDI outflows that became especially remarkable
after 1997.

These results would agree with those previously found in microeconomic studies using
data from industries or individual firms (see the references in the introduction). They would be
also in line with other studies of a macroeconomic nature, either estimating export equations
(Lin, 1995; Bajo and Montero, 1999b), or performing Granger-causality tests as in this paper
(Pfaffermayr, 1994). However, unlike this author, we have found a cointegration relationship
between exports and outward FDI. Also, our analysis differs from Pfaffermayr’s in that we use a
stock measure of outward FDI and not data on flows (which seems to be more appropriate), as
well as real figures for both exports and outward FDI instead of GDP shares.

4. Conclusions
In this paper we have analysed the empirical relationship between outward FDI and exports,
using Spanish quarterly data for the period 1977-1998. The empirical methodology consisted of
Granger-causality tests in a cointegration framework, where the lag lengths of the variables
have been chosen by means of Hsiao’s sequential approach in order to avoid misleading
inferences arising from inconsistent model estimates. Unlike other similar studies on the
subject, outward FDI was taken as its accumulated sum over a long period, instead of taking flow
figures. The tests were performed in a multivariate setting, including as additional variables a
proxy for world income and the relative price of exports. Since cointegration between outward
FDI and exports was found, error-correction mechanisms under three alternative specifications
(i.e., restricted, unrestricted, and general) were included, which allowed us to discriminate between short- and long-run Granger causality.

The empirical results of the paper showed that exports and outward FDI were cointegrated, and the relationship between both variables was positive and statistically significant. Also, Granger-causality from outward FDI to exports was found in the short run, but not otherwise, whereas long-run Granger-causality was found to run in both directions.

The results of this paper would generally agree with the predictions from theoretical models of “vertical” FDI. In particular, we argued that the main part of Spanish outward FDI would be aimed to provide some specialized and skill-intensive services activities to relatively less skill-abundant host countries, such as Latin America or Portugal. And then, these FDI-related services would be later used to promote manufacturing exports to those countries; all of them characterized by a very high growth potential of their domestic markets.

In this way, the relationship of complementarity found between outward FDI and exports would suggest that an increased outward FDI is not necessarily associated with deindustrialization and employment losses in the home country, as is often claimed. Therefore, increased capital outflows, in the context of a process of liberalization and external opening such as the one experienced by the Spanish economy during our period of analysis, might lead to higher exports. This, in turn, would illustrate the potentially important role to be played by an increased FDI abroad as a useful tool to promote exports.

Acknowledgments
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Notes

1. Due to several changes in statistical sources that occurred during that time, we have been obliged to make some aggregations in order to show a homogeneous classification of countries and, especially, sectors, for the whole period of analysis. On the other hand, the data on outward FDI in Tables 1 and 2 refer to investment projects reported to the Spanish Administration for statistical reasons (so that they are not strictly comparable to the balance of payments data appearing in Figures 1 and 2), and are not available before 1979.

2. This procedure was used before in Bajo and Sosvilla (1994) to compute the value of the stock of foreign capital in Spain.

3. Notice that a change in the elaboration of the Spanish balance of payments took place in 1993, following the adoption of the IMF’s revised methodology contained in the V edition of the Balance of Payments Manual (International Monetary Fund, 1993). This change, compulsory for all member countries by 1995 and basically involving the accounting of capital flows, makes the comparison of FDI figures before and after 1992 difficult. This was the reason why in the first version of this paper (Bajo and Montero, 1999a) we decided to end the sample period in that year. In this version, however, the old series for outward FDI have been extended until 1998 using the rates
of change of the new series. The main features of the new accounting of FDI in the Spanish balance of payments are extensively discussed in Duce (1996).

4. Some doubts might appear regarding the variable \( LINV \). However, when Perron’s (1989) test was performed, assuming a structural change in the first quarter of 1993 (i.e., the first observation of the extended series for outward FDI), the existence of a second unit root could be clearly rejected. The results from this test are available from the authors upon request.

5. The equations estimated with \( LX \) as a dependent variable include seasonal dummies. This is not the case, however, for the equations estimated with \( LINV \) as a dependent variable, since in this case seasonal dummies never proved to be significant, according to a Wald test of joint significance.

References


### TABLE 1
EXPORTS AND FDI OUTFLOWS IN SPAIN, 1977-1998: SECTORAL DISTRIBUTION

(million Pta. and % on total)

A) Exports

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<tr>
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<tr>
<td></td>
<td>Total</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td>Foodstuffs and raw materials</td>
<td>3,786,878</td>
<td>19.6</td>
<td>6,930,746</td>
</tr>
<tr>
<td>Fuels</td>
<td>1,365,181</td>
<td>7.1</td>
<td>1,758,897</td>
</tr>
<tr>
<td>Chemicals</td>
<td>1,472,502</td>
<td>7.6</td>
<td>3,030,909</td>
</tr>
<tr>
<td>Consumer goods</td>
<td>5,397,663</td>
<td>27.9</td>
<td>7,495,338</td>
</tr>
<tr>
<td>Machinery and transportation equipment</td>
<td>5,114,135</td>
<td>26.5</td>
<td>13,494,648</td>
</tr>
<tr>
<td>Other manufacturing</td>
<td>2,027,926</td>
<td>10.5</td>
<td>3,456,006</td>
</tr>
<tr>
<td>Other</td>
<td>158,182</td>
<td>0.8</td>
<td>128,807</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>19,322,467</strong></td>
<td><strong>100</strong></td>
<td><strong>36,295,351</strong></td>
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**TABLE 1 (continued)**

B) FDI outflows

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<td></td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
</tr>
<tr>
<td>Primary sector</td>
<td>11,236</td>
<td>4.1</td>
<td>33,056</td>
<td>1.4</td>
<td>24,774</td>
<td>0.4</td>
</tr>
<tr>
<td>Energy and water</td>
<td>7,346</td>
<td>2.7</td>
<td>208,657</td>
<td>8.9</td>
<td>216,411</td>
<td>3.9</td>
</tr>
<tr>
<td>Industry</td>
<td>58,944</td>
<td>21.6</td>
<td>376,890</td>
<td>16.0</td>
<td>444,039</td>
<td>7.9</td>
</tr>
<tr>
<td>Construction</td>
<td>10,455</td>
<td>3.8</td>
<td>17,232</td>
<td>0.7</td>
<td>65,614</td>
<td>1.2</td>
</tr>
<tr>
<td>Commerce and hotel trade</td>
<td>37,366</td>
<td>13.7</td>
<td>182,799</td>
<td>7.8</td>
<td>157,479</td>
<td>2.8</td>
</tr>
<tr>
<td>Transport and communications</td>
<td>3,533</td>
<td>1.3</td>
<td>90,601</td>
<td>3.8</td>
<td>481,921</td>
<td>8.6</td>
</tr>
<tr>
<td>Financial sector, insurance, real estate, and other services</td>
<td>143,943</td>
<td>52.8</td>
<td>1,446,991</td>
<td>61.4</td>
<td>4,213,986</td>
<td>75.2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>272,823</strong></td>
<td><strong>100</strong></td>
<td><strong>2,356,226</strong></td>
<td><strong>100</strong></td>
<td><strong>5,604,224</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Spanish Ministry of Economy and Finance.


### TABLE 2
EXPORTS AND FDI OUTFLOWS IN SPAIN, 1977-1998: GEOGRAPHICAL DISTRIBUTION

(million Pta. and % on total)

A) Exports

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td>Germany</td>
<td>1,830,652</td>
<td>9.5</td>
<td>4,912,341</td>
</tr>
<tr>
<td>Belgium-Luxembourg</td>
<td>493,951</td>
<td>2.6</td>
<td>1,134,044</td>
</tr>
<tr>
<td>Denmark</td>
<td>118,140</td>
<td>0.6</td>
<td>247,651</td>
</tr>
<tr>
<td>France</td>
<td>3,022,438</td>
<td>15.6</td>
<td>7,088,034</td>
</tr>
<tr>
<td>Greece</td>
<td>105,254</td>
<td>0.5</td>
<td>264,494</td>
</tr>
<tr>
<td>Netherlands</td>
<td>958,570</td>
<td>5.0</td>
<td>1,727,608</td>
</tr>
<tr>
<td>Ireland</td>
<td>69,486</td>
<td>0.4</td>
<td>136,996</td>
</tr>
<tr>
<td>Italy</td>
<td>1,185,490</td>
<td>6.1</td>
<td>3,642,759</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1,511,550</td>
<td>7.8</td>
<td>3,199,787</td>
</tr>
<tr>
<td>Portugal</td>
<td>461,661</td>
<td>2.4</td>
<td>2,153,453</td>
</tr>
<tr>
<td><strong>Total EC-12</strong></td>
<td>9,757,193</td>
<td>50.5</td>
<td>24,507,167</td>
</tr>
<tr>
<td>United States</td>
<td>1,581,209</td>
<td>8.2</td>
<td>2,397,078</td>
</tr>
<tr>
<td>Japan</td>
<td>282,167</td>
<td>1.5</td>
<td>394,955</td>
</tr>
<tr>
<td>Latin America</td>
<td>897,730</td>
<td>4.6</td>
<td>880,619</td>
</tr>
<tr>
<td>Rest of countries</td>
<td>6,804,168</td>
<td>35.2</td>
<td>8,115,533</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>19,322,467</strong></td>
<td>100</td>
<td><strong>36,295,351</strong></td>
</tr>
</tbody>
</table>
TABLE 2 (continued)

B) FDI outflows

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td>Germany</td>
<td>5,109</td>
<td>1.9</td>
<td>56,498</td>
</tr>
<tr>
<td>Belgium</td>
<td>1,998</td>
<td>0.7</td>
<td>53,356</td>
</tr>
<tr>
<td>Denmark</td>
<td>299</td>
<td>0.1</td>
<td>1,553</td>
</tr>
<tr>
<td>France</td>
<td>11,532</td>
<td>4.2</td>
<td>163,094</td>
</tr>
<tr>
<td>Greece</td>
<td>5</td>
<td>0.0</td>
<td>1,235</td>
</tr>
<tr>
<td>Netherlands</td>
<td>4,138</td>
<td>1.5</td>
<td>308,875</td>
</tr>
<tr>
<td>Ireland</td>
<td>1,188</td>
<td>0.4</td>
<td>13,462</td>
</tr>
<tr>
<td>Italy</td>
<td>3,332</td>
<td>1.2</td>
<td>148,308</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>5,494</td>
<td>2.0</td>
<td>88,190</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>12,530</td>
<td>4.6</td>
<td>241,397</td>
</tr>
<tr>
<td>Portugal</td>
<td>13,110</td>
<td>4.8</td>
<td>242,210</td>
</tr>
<tr>
<td>Total EC-12</td>
<td>58,735</td>
<td>21.5</td>
<td>1,318,178</td>
</tr>
<tr>
<td>United States</td>
<td>43,790</td>
<td>16.1</td>
<td>191,157</td>
</tr>
<tr>
<td>Japan</td>
<td>372</td>
<td>0.1</td>
<td>4,658</td>
</tr>
<tr>
<td>Rest of OECD</td>
<td>26,208</td>
<td>9.6</td>
<td>162,037</td>
</tr>
<tr>
<td>Latin America</td>
<td>91,378</td>
<td>33.5</td>
<td>205,909</td>
</tr>
<tr>
<td>Rest of countries</td>
<td>52,340</td>
<td>19.2</td>
<td>474,287</td>
</tr>
<tr>
<td>TOTAL</td>
<td>272,823</td>
<td>100</td>
<td>2,356,226</td>
</tr>
</tbody>
</table>
Source: Spanish Ministry of Economy and Finance.
# TABLE 3

## UNIT ROOT TESTS

### A) First differences

<table>
<thead>
<tr>
<th></th>
<th>ΔLX</th>
<th>ΔLINV</th>
<th>ΔLY*</th>
<th>ΔLPRX</th>
</tr>
</thead>
<tbody>
<tr>
<td>ττ</td>
<td>-5.30a</td>
<td>-8.17a</td>
<td>-9.09a</td>
<td>-4.46a</td>
</tr>
<tr>
<td>τµ</td>
<td>-5.06a</td>
<td>-7.68a</td>
<td>-9.06a</td>
<td>-4.48a</td>
</tr>
<tr>
<td>τ</td>
<td>-2.63a</td>
<td>-1.50</td>
<td>-1.96b</td>
<td>-4.49a</td>
</tr>
</tbody>
</table>

### B) Levels

<table>
<thead>
<tr>
<th></th>
<th>LX</th>
<th>LINV</th>
<th>LY*</th>
<th>LPRX</th>
</tr>
</thead>
<tbody>
<tr>
<td>ττ</td>
<td>-0.79</td>
<td>-1.18</td>
<td>-1.81</td>
<td>-2.13</td>
</tr>
<tr>
<td>τµ</td>
<td>0.90</td>
<td>2.42</td>
<td>0.62</td>
<td>-1.70</td>
</tr>
<tr>
<td>τ</td>
<td>7.28</td>
<td>11.36</td>
<td>2.92</td>
<td>0.33</td>
</tr>
</tbody>
</table>

**Notes:**

(i) ττ, τµ and τ are the Dickey-Fuller statistics with drift and trend, with drift, and without drift, respectively.

(ii) (a) and (b) denote significance at the 1% and 5% levels, respectively. The critical values are taken from MacKinnon (1991).
TABLE 4
COINTEGRATION TESTS

\[
L_X = -3.03 + 0.13 \text{ LINV} + 1.26 \text{ LY}^* - 0.37 \text{ LPRX}
\]

\[
(14.90) \quad (5.01) \quad (52.06) \quad (32.79)
\]

\[
R^2 = 0.98, \text{ CRDW} = 1.67, \text{ CRADF} = -6.66, \text{ CR} \hat{Z}_t = -8.75
\]

Notes:

(i) \quad \text{CRDW, CRADF and CR} \hat{Z}_t \text{ are the cointegrating-regression Durbin-Watson, augmented Dickey-Fuller, and Phillips-Ouliaris statistics, respectively. The estimated equation includes a dummy variable taking the value one for the years following the Spanish integration into the EC.}

(ii) \quad \text{The null hypothesis of no cointegration is rejected at the 1% significance level. The critical values are taken from MacKinnon (1991) and Phillips and Ouliaris (1990).}
**TABLE 5**

**GRANGER-CAUSALITY TESTS**

Dependent variable: LX

<table>
<thead>
<tr>
<th></th>
<th>Restricted ECM</th>
<th>Unrestricted ECM</th>
<th>General ECM</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><em>Only lags of LX, LY</em>, LPRX</em>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lags</td>
<td>p=1; r=2; s=2</td>
<td>p=1; r=2; s=2</td>
<td>p=1; r=2; s=2</td>
</tr>
<tr>
<td>FPE</td>
<td>0.00306</td>
<td>0.00324</td>
<td>0.00324</td>
</tr>
<tr>
<td>Test on ECM</td>
<td>-1.79166&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-2.07596&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.89287</td>
</tr>
<tr>
<td><strong>Adding lags of LINV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lags</td>
<td>p=1; q=1; r=2; s=2</td>
<td>p=1; q=1; r=2; s=2</td>
<td>p=1; q=1; r=2; s=2</td>
</tr>
<tr>
<td>FPE</td>
<td>0.00302</td>
<td>0.00318</td>
<td>0.00313</td>
</tr>
<tr>
<td>Test on ECM</td>
<td>-1.99298&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-2.31617&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.27215</td>
</tr>
<tr>
<td><strong>Decision</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-run</td>
<td>LINV causes LX</td>
<td>LINV causes LX</td>
<td>LINV causes LX</td>
</tr>
<tr>
<td>Long-run</td>
<td>LINV causes LX</td>
<td>LINV causes LX</td>
<td>LINV does not cause LX</td>
</tr>
</tbody>
</table>
### TABLE 5 (continued)

**Dependent variable: LINV**

<table>
<thead>
<tr>
<th></th>
<th>Restricted ECM</th>
<th>Unrestricted ECM</th>
<th>General ECM</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><em>Only lags of LINV, LY</em>, LPRX</em>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lags</td>
<td>p=4; r=4; s=1</td>
<td>p=1; r=1; s=1</td>
<td>p=1; r=1; s=1</td>
</tr>
<tr>
<td>FPE</td>
<td>0.00112</td>
<td>0.00114</td>
<td>0.00114</td>
</tr>
<tr>
<td>Test on ECM</td>
<td>-2.70164(^a)</td>
<td>-2.33821(^b)</td>
<td>12.6703(^b)</td>
</tr>
</tbody>
</table>

| **Adding lags of LX**          |                |                  |             |
| Number of lags                 | p=4; q=1; r=4; s=1 | p=1; q=1; r=1; s=1 | p=1; q=1; r=1; s=1 |
| FPE                            | 0.00114        | 0.00117          | 0.00117     |
| Test on ECM                    | -2.60963\(^b\) | -2.29419\(^b\)  | 12.4377\(^b\) |

**Decision**

<table>
<thead>
<tr>
<th></th>
<th>Restricted ECM</th>
<th>Unrestricted ECM</th>
<th>General ECM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-run</td>
<td>LX does not cause LINV</td>
<td>LX does not cause LINV</td>
<td>LX does not cause LINV</td>
</tr>
<tr>
<td>Long-run</td>
<td>LX causes LINV</td>
<td>LX causes LINV</td>
<td>LX causes LINV</td>
</tr>
</tbody>
</table>
TABLE 5 (continued)

Notes:

(i) The estimated equations are:

\[
\Delta L_X = \alpha + \sum_{i=1}^{p} \beta_i \Delta L_{X_{t-i}} + \sum_{k=1}^{r} \lambda_k \Delta Y_{-k}^* + \sum_{l=1}^{s} \mu_l \Delta LPRX_{t-l} + \delta ECM_{t-3} + u_t
\]

\[
\Delta L_X = \alpha + \sum_{i=1}^{p} \beta_i \Delta L_{X_{t-i}} + \sum_{j=1}^{q} \gamma_j \Delta LINV_{t-j} + \sum_{k=1}^{r} \lambda_k \Delta Y_{-k}^* + \sum_{l=1}^{s} \mu_l \Delta LPRX_{t-l} + \delta ECM_{t-1} + v_t
\]

\[
\Delta LINV = \alpha + \sum_{j=1}^{q} \beta_j \Delta LINV_{t-j} + \sum_{k=1}^{r} \lambda_k \Delta Y_{-k}^* + \sum_{l=1}^{s} \mu_l \Delta LPRX_{t-l} + \delta ECM_{t-1} + u_t
\]

\[
\Delta LINV = \alpha + \sum_{j=1}^{q} \beta_j \Delta LINV_{t-j} + \sum_{j=1}^{q} \gamma_j \Delta L_{X_{t-j}} + \sum_{k=1}^{r} \lambda_k \Delta Y_{-k}^* + \sum_{l=1}^{s} \mu_l \Delta LPRX_{t-l} + \delta ECM_{t-1} + v_t
\]

(ii) (a), (b) and (c) denote significance at the 1%, 5% and 10% levels, respectively. The critical values are taken from the \( t \) distribution (restricted and unrestricted ECM), and the \( \chi^2(5) \) distribution (general ECM).
FIGURE 1
EXPORTS AND FDI OUTFLOWS IN SPAIN, 1977-1998
(Aggregate figures, billion Pta. in real terms)

Source: Spanish Ministry of Economy and Finance and Bank of Spain

FIGURE 2
EXPORTS AND FDI OUTFLOWS IN SPAIN, 1977-1998
(% of GDP)

Source: Spanish Ministry of Economy and Finance and Bank of Spain