On the Dynamics of Exports and FDI: The Spanish Internationalization Process.

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Abstract: This paper aims to provide further insights on the dynamics of exports and outward foreign direct investment (FDI) flows in Spain from a Time Series approach. The contribution of the paper is twofold; i) A substitution or complementary relationship between Spanish outward investments and exports is empirically tested under a multivariate cointegrated model (VECM) framework. Recent exchange flows' evolution (1993-2008) and country-specific variables (such as world demand - including recently growing and main Spanish host foreign markets - for trade flows and relative prices of exports in order to proxy new global competitors) are for the first time taken into account. And ii) the raise of trade on services during the last decades claims to test such specific causality relationship by disaggregating between goods and services flows. Our results provide evidence of a positive (Granger) causality relationship running from FDI to exports of goods (stronger) and to exports of services (weaker) in the long run, whose complementarity relation is consistent with vertical FDI motivations. Whereas, in the short run only exports on goods are affected (positively) by foreign direct investments.

Keywords: Foreign Direct Investment, Exports, Granger-Causality.

JEL Codes: F21, F40.

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1. Introduction

In recent years more and more companies have started to operate on international markets[2]. By doing so, over the last decades the internationalization process of developed economies is giving a new direction through outward foreign direct investment (FDI). [3] The dramatic increase in both goods and services exchange - under a progressive liberalization of international economic relations framework - has led growing interest on the dynamics of trade and investments. Particularly, FDI has grown at a remarkable rate since 1980. This surge has occurred worldwide, but it has been particularly dramatic in Spain. Thus, Spain's outward FDI flows have recently outpaced world FDI transactions, especially in the second half of the nineties when Spanish firms began to internationalize. [4] Initially a net importer, Spain's outflows have steadily increased and become more active, eventually making the country a current net capital exporter. In this way, according to data from Bank of Spain, during the last years Spanish exports increased at yearly average rates of 7.3 per cent, whereas outward FDI grew by 25.6 per cent (See Chart 1).

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Spanish Exports and Outward Foreign Investment Business Cycles

Spanish FDI outflows have reached higher growth rates than exports of goods and services between 1993 and 2008. To what extent such a trend might lead negative impacts on domestic activity and employment? From this point of view, focusing on whether these foreign investment flows represent a substitution or complement for exports (disaggregated in goods and services) might yield illuminating results.

Nevertheless, albeit exports and outward foreign direct investment in Spain have experienced relevant growth rates during the last years, extremely little work has been undertaken in the recent empirical FDI literature to test such linkages in Spain. Moreover, the internationalization process of Spanish services (to the detriment of goods) has been steadily gaining ground during the last fifteen years, demanding some light to be shed on the nature and the character of these specific investment flows as well. [5]

In this line, the theoretical relationship between exports and outward FDI has usually been treated as alternative modes of supplying foreign markets. FDI will represent a substitute for the home county's exports. [6] Conversely, international firms seeking for better access to their potential market who invest abroad will lead to complementary

[2] See Helpman (2006) for a comprehensive survey on trade and FDI literature.
[3] See Graham and Krugman (1993) and Markusen and Venables (1998).
[4] See Gordo, Martin & Tello (2008).
[5] See Cuadrado-Roura & Visitin (2008) for more details on the Spanish internationalization of services by investment processes.
[6] In this case, FDI might have no beneficial effects on domestic employment and production. FDI is said to be a substitute (complement) for exports an exogenous increase in FDI produces a decrease (increase) in exports from this country.

relationship with exports. [7] Likewise, from a traditional point of view on foreign investment, trade in goods is considered perfect substitutes [8] while FDI is considered in terms of capital factor mobility. In other words, if FDI entails moving production capacity and employment towards other countries (based on lower transportation costs motivations) outward FDI will probably be accompanied by a lower export level from the home to the host country. [9] As a result, an empirical study claims to be applied for the Spanish case since is not possible to conclude how these magnitudes are related by simply looking at theoretical grounds.

Although previous findings of the empirical literature are not absolutely contradictory, they suggest researching further insights in this line since the results are mixed. From an international point of view, a positive causal relationship between trade flows and FDI has been analysed once disaggregated by industries by Lipsey and Weiss (1981, 1984). Blomström et al (1988) showed such relationship for Sweden and U.S while Yamawaki (1991) solely focused the attention on Japanese firms settled in the U.S. Pfaffermayer (1994, 1996) found such evidence for Austrian manufacturing exports while Barrel and Pain (1997) covered a wider range of European countries. Under the Spanish framework, Bajo-Rubio & López-Pueyo (1998) studied such relationship for manufacturing sectors and Dritsaki *et al.* (2004) evidenced the causal relationship for Greece.. However, Svensson (1996) finds that the negative relationship between Swedish firms' foreign production and home country's exports is dominant.

Unlike recent trends in international applied research, little empirical approaches have focused on Spanish FDI outflows and exports from an aggregate point of view. These few exceptions are Caballero et al (1989), Doménech & Taguas (1997), Alguacil & Orts (1998, 2002) and Bajo-Rubio & Montero-Muñoz (1999). The first and third attempts report evidence of a substitution relationship between outward FDI and exports in Spain, while the rest works obtained a positive relationship. [10] However, none of them takes into account the recent evolution of Spanish exchange international flows, country-specific variables and disaggregates between goods and services. Hence, there is no categorical econometric evidence with regard to the causal relationship between FDI and exports in Spain. [11] The differences in data and methodology make difficult to directly compare these results and, even at a more aggregate level, the differences still remain. [12] On the empirical side, an exception becomes the recent descriptive study by Martin & Rodriguez (2009) using discrete choice data for Spanish firms. They conclude that higher levels of exports within exporter national firms but further insights remain to be tested under econometrics framework.

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[7] In this case, FDI might improve the production capacity and might lead to the generation of employment in the domestic country.

[8] Even in such perfect competition models there is no room for multiplant production, whether vertical or horizontal.

[9] For more details see Alguacil & Orts (2002)

[10] See Alguacil, Bajo, Montero & Orts (1999) for a joint compilation of their respective works' results.

[11] Under a cointegrating framework model García, Gordo and Martínez-Martín (2008) and García, Gordo, Martínez-Martín and Tello (2009) find no empirical relationship between exports of goods and foreign direct investment.

[12] A detailed discussion may be found at Blomström and Kikko (1994).

Thus, this paper aims to fill the gap by investigating the dynamic relationship between Spanish outward foreign direct investment and exports (in real terms) for the period 1993.I-2008.IV. A substitution or complementary relationship is empirically tested under a multivariate cointegrated model framework. In this sense, a Vector Error Correction Model (VECM) has been estimated for the first time taking into account country-specific variables such as world demand (including recent and main Spanish host foreign markets) in order to proxy trade flows, and price-competitivity variables in order to capture the effect of new global competitors.

The empirical results show traces that in addition to the absence of a short-run relationship in services but not in goods' flows, there exists a positive long-run causality relationship going from FDI to exports for both services and goods. The velocity of adjustment to the equilibrium is slower for services than goods and they behave with much less sensitivity to domestic income changes (contrary to goods' flows, whose behaviour evolve more in line with the previous related literature).

The remainder of the paper proceeds as follows. Section (2) reviews the related theoretical literature emphasizing those approaches that consider causality relationships on trade and FDI. Section (3) discusses the empirical model and variables employed, while section (4) provides the estimation method. Section (5) describes the data and provides a brief overview of the Spanish cycles on exports and FDI. Section (6) highlights the main empirical results and section (7) concludes.

2. Theoretical Issues

Several related works consider foreign direct investment (FDI) as a key element within the internationalization strategy of Multinational Enterprises (MNEs). However, the relationship between exports and investment flows is far from being unambiguous.

On the exports side, the relationship is quite ambiguous: firstly, investments abroad may constitute a way of straight access to markets previously supplied by means of exports, what may exert a negative impact over them. But it is also possible that MNEs may invest in those markets offering costs or location advantages, aiming to use them as export-platform to third countries. [13] In the latter case, exports and foreign investment with no doubt will be related in a positive way.

From a traditional point of view the relationship between exports and foreign direct investment has been at issue. Foreign investment and trade in goods and services are considered perfect substitutes [14] while FDI is considered in terms of capital factor mobility. In this sense, factor mobility induced by differences in factor prices between regions 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, 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). Thus, according to the related literature, foreign investment represents the international activity of multinational firms that, in addition to the location advantages stressed in the traditional approach, tend to be relevant in industries featured by scale economies and/or imperfect competition. From this perspective, the international investment flows might also be contemplated as a way to expand the domestic firm's control over other markets, improving their access and sales facilities to them. Consequently, outward FDI may eventually contribute to a higher level of exports from the home to the host country.

In recent years more and more companies have started to operate on international markets. In doing so companies can choose between two major strategies to serve foreign markets and participate in the global economy. The more traditional mode is to ship (export) the produced goods to foreign markets. Another strategy is to engage in horizontal FDI and duplicate an existing production facility in foreign countries through FDI and to serve foreign demand locally.

Earlier research has found some evidence for a substitution relationship while other arguments support the hypothesis of a complementary relationship between exports

[13] As recently has been empirically demonstrated by Martínez-Martín, J. (2009) based on a third-country effects model for the Spanish case.
[14] The traditional trend (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.

and foreign production. [15] Brainard (1997) analyses the location decision of multinational companies by a trade-off between proximity to customers and concentration of productions stages to achieve scale economies. This has led to the Knowledge-capital model as analyzed by Markusen and Venables (2000) and Markusen (2002). Recent research focuses on productivity differences that determine the preferred strategy in models with heterogeneous firms. More productive forms will do FDI to serve foreign markets while the less productive firms will trade their goods. [16] In these models the decision on the mode of serving foreign markets is also explained by a trade-off between fixed plant set-up costs and variable transportation costs, the latter including trade costs. The FDI (export) strategy causes higher (lower) fixed costs but lower (higher) variable costs.

Helpman et al. (2004) emphasize that only the most productive firms are able to afford the additional facility duplicating fixed costs and gain through less variable costs. Less productive firms have to use the export strategy and accept higher variable costs triggered by the necessity of trade. Hence, they suggest the hypothesis that the more productive companies substitute their exports through FDI.

Up to this point and given that the decision to undertake an FDI project comprises many aspects; economic theory needs to connect all these ideas with firm and country features in a consistent manner. The Knowledge-capital model of FDI, which has become the workhorse of the multinational firm theory, makes a serious effort in this direction, especially in the formulation of the location aspect of the FDI decision.

The first attempt to tackle the question was made by Markusen (1984) and Helpman (1984). MNE general equilibrium theory has suggested two very distinct motivations for FDI: To access markets in the face of trade frictions (*Horizontal FDI*) or to access low wages (or lower factor endowment costs) for part of the production process (*Vertical FDI*). More recently, a number of papers have begun to stress more complicated patterns of FDI. For instance, a logical possibility is *export platform FDI* (Ekholm, Forslid, and Markusen, 2003, and Bergstrand and Egger, 2004) where an MNE places FDI in a host country to serve as a production platform for exports to a group of (neighbouring) host countries.

Thus, this paper aims to tackle the decision of firms on how to serve foreign markets. As mentioned above, distant markets, which imply higher transportation costs, may be served by subsidiaries abroad, while closer markets by exports. Theoretically, outward foreign direct investment and exports may be act as substitutives or complements, but although the interdependence of both internationalization modes has been widely treated in trade literature, no statement on its relationship may be considered only relying on theoretical fundamentals. Therefore, an empirical estimation of a VECM under cointegrated framework aims to answer such haunting issue.

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[15] Head and Ries (2004) summarize earlier research and provide arguments for both possible relationships.
[16] See Melitz (2003) and Helpman, Melitz and Yeaple (2004).

3. Empirical Model

In order to overcome the fact that FDI may be seen as substitute or complement of exports, Sims (1980) approach is followed by formulating a vector autoregressive (VAR) system. [17] However, two main problems may arise once this causal relationship is analyzed: First, the selection of the optimal lag length for the vector autoregressive VAR model. And second, to identify long-term relationships among the variables considered in the system.

In terms of the optimal number of lags to be included in the model two opposing views may be taken into account. On one hand, an overparameterized model would induce insignificant and inefficient parameters. [18] But, on the other hand, it is well known that shorter lag length selection might produce serially correlated errors. To tackle this issue, the lag structure is determined by using Perron & Qu information criterion for cointegration tests which are based on a VAR approximation. [19]

Following the related empirical literature the coherence of the VARs was duly considered once the optimum lag length was selected for both models (i.e. goods and services). [20] Thus, the next step comprises testing multivariate cointegration of the variables embodied in the model by using Johansen (1987) and Johansen and Joselius (1992) techniques.

Likewise, in addition to short- and long-run causality testing by the traditional Wald a *t* tests, the impulse response analysis described by Sims (1988) was employed. In addition of the variance decomposition, the plots of impulse response functions completed the causal analysis between outward foreign direct investment and exports in this work.

In order to test the recent relationship between foreign investment and exports, aggregate data for both series from the Spanish economy is employed, in real terms, covering the period 1993.I-2008.IV. [21] The main determinants associate to both exchange flows will be three. First, a proxy for foreign demand (wd) related to the level of income in the importing region. Second, the relative prices (compet) and third, the domestic pressure of demand proxied by the Gross Value Added (vab). See section (5) for an exhaustive explanation of variables' construction.

The importance of all the variables on exports has been broadly treated in trade literature. [22] However, in order to proxy world income as a determinant variable,

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[17] The main advantage is the fact that at first stage all variables are considered endogenous in order to avoid false identifying restrictions.
[18] For detailed guidance see Canova (1995)
[19] For further econometric details see Qu & Perron (2007)
[20] For empirical results, move forward to Section (6).
[21] Recall that the methodological change in the elaboration of the Spanish Balance of Payment from 1993 on yields a breakpoint hard to tackle from a Time Series approach, and makes it difficult to jointly work with the trade and capital movements data before and after 1992.
[22] See, for instance, a seminal paper of Goldstein and Kahn (1985).

country-specific series for Spain were included in the dynamic model (*wd*). The recent global competitors for the Spanish exchange flows (i.e. such as China and India) played their role on the weighted growth of Spanish exports' markets variable. Under such a setting, relative prices on Spanish exports might lead empirical guidance on how much the competitivity of Spanish goods and services have varied across time (*compet*). The variable is based on the ratio of the Spanish prices to the prices of the weighted countries (competitors), all of them adjusted by the effective nominal exchange rate. In order to proxy home country demand the Gross Value Added of the Spanish economy was used for (*vab*).

The expected effect of an eventual real relative prices' (*compet*) depreciation might generate an advantage for goods and services produced at home. Similarly, it is also expected that a growth in world income (*wd*) conveys to a greater level of domestic sales towards these foreign host countries. In contrast, a rise in the own country's demand will probably exert a negative impact over exports, given the existence of an anticyclical component. However, the influence of all these variables over foreign direct investment appears to be slightly less obvious.

According with the theoretical arguments, a five-variable vector autoregressive model is estimated, by including relevant variables such as outward foreign direct investment (*fdi*), exports (*exp*), domestic income (*vab*), world demand (*wd*) and competitivity (*compet*), all expressed in natural logs (See Model [1]). All variables are symmetrically and endogenously considered at first : [23]

Vector Autoregressive Model

$$\begin{bmatrix} fdi_t \\ \exp_t \\ vab \\ wd_t \\ compet_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} fdi_{t-1} \\ \exp_{t-1} \\ vab_{t-1} \\ wd_{t-1} \\ compet_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} fdi_{t-2} \\ \exp_{t-2} \\ vab_{t-2} \\ wd_{t-2} \\ compet_{t-2} \end{bmatrix} + \ldots + A_s \begin{bmatrix} fdi_{t-s} \\ \exp_{t-s} \\ vab_{t-s} \\ wd_{t-s} \\ compet_{t-s} \end{bmatrix} + \mu_t \qquad (1)$$

Thus, prior to the identification of possible long-term relation, it is necessary to verify that all variables are integrated of order one in levels. [24] For this purpose, several tests for unit roots have been undertaken such as Augmented Dickey Fuller (1979,1981), Phillips and Perron (1988), and Ng and Perron (2001). One advantage of the PP test over the ADF test is that the PP tests are robust to general forms of heteroskedasticity in the error term μ_t. However, recent Ng and Perron (2001) test entails higher levels of statistical powerful. Taking this view for the results of stationarity collectively, greater reliance is placed on the M statistics from Ng and Perron tests' results.

[23] All series are quarterly levels and are seasonally adjusted.
[24] Since this is a necessary, although not sufficient, condition for cointegration. In some cases, such cointegration may exists with other values of "d".

After having completed examination of the stationary of each time series, [25] the next step is to figure out the existence of a cointegration relationship between the examined variables. For simplicity, this step investigates whether the stochastic trend in the examined variable, which contain unit roots, have a long term relationship.

Under such a setting all variables have a unit root and the same order or integration, and then the likelihood ratio test is used to find out the number of cointegrating vectors. Therefore, if there is one or more than one cointegrating vector, the long run combination among the variables might be found, even though they may drift apart in the short run.

The results of Johansen's maximum eigenvalue test (λ_{max}) and trace test (λ_{trace}) for the presence of long-term relationships are reported in the section (6). No linear trend, a linear trend and a quadratic trend inclusion options were tested in levels. Hence, the potential presence of cointegrating vectors may imply that there exists a significant cointegrating relationship connecting all the variables and we may conclude that there is a long run relationship among the variables under study.

Consequently, and following the Granger Representation Theorem, an ECM is added in each equation of the first differentiated VAR model so that it would be possible, in what follows, to separate the long-run relationship between the economic variables from their short-rum responses. [26]

The cointegration between two or more variables is sufficient to demonstrate the presence of causality in at least one direction (Granger, 1986). Thus, once ensured the stationarity and the cointegrating vector of the series embodied in the dynamic model, Granger causality will further require the inclusion of an error correction mechanism (ECM) in the stationary model in order to capture the short-run deviation of series from their long-run equilibrium path. By using the VECM two sources of causality are detected. First, the traditional channel of causality through the F-statistics of the lagged explanatory variables which demonstrates short term causal effects, whereas the second additional channel is implied through the significance of the lagged error correction term which represents the long-run causality. The cointegration vector coefficient's interpretation may yield evidence on the long run relationship between exports and FDI. In this sense, the application of a VECM will allow not only testing such significant relationship but also the revelation of the direction of the causality, as well as distinguishing between the short-run and the long-run Granger causality mentioned above.

[25] See section (6) for empirical results.

[26] With cointegrated series or order one, an ECM has to be included in the differentiated model in order to capture the equilibrium relationship among the cointegrated variables in their dynamic behaviour, according to the Granger Representation Theorem.

4. Estimation of Vector Error Correction Model

In spite of the fact that the results of the cointegration analysis demonstrate that all these five variables are tied together by a long-run equilibrium relationship, it does not say anything about the direction of the Granger causality. This procedure, therefore, will be done by the analysis of results based on the VECM.

The non-stationary in levels of the embodied series demands keeping the system estimation within a cointegrated framework. A methodology based in the existence or the absence of a long-run relationship between the dependent variable and the independent ones. The construction of an error correction mechanism, whereby short- and long-run dynamics are compiled in a single equation, becomes statistically unavoidable.

Likewise, with regard to the order of the VAR model, a system with a lag length of five and six for services and goods, i.e. a VAR (5) and a VAR (6), respectively, models were opted for by means of Perron & Qu (2007) tests. .

From this starting point and also based on our recent Vector Error Correction Model (VECM) estimations, a negative causal relationship existence claims to be tested, what would provide evidence consistent with the presence of outward foreign investment flows mainly due to *horizontal* expansion FDI motivations, whereas a positive causal relationship would provide evidence on location decisions motivated on *vertical* integration patterns.

Following Johansen (1988) Johansen and Joselius (1992) seminal papers, and according to the results previously obtained in model selection and cointegration analyisis, the corresponding vector error-correction model can be written as follows:

$$\Delta fdi_t = \alpha_{10} + \sum_{s=1}^{5}\alpha_{11}(s)\Delta fdi_{t-s} + \sum_{s=1}^{5}\alpha_{12}(s)\Delta \exp_{t-s} + \sum_{s=1}^{5}\alpha_{13}(s)\Delta vab_{t-s} + \sum_{s=0}^{5}\alpha_{14}(s)\Delta wd_{t-s} + \sum_{s=0}^{5}\alpha_{15}(\alpha)\Delta compet_{t-s} + \gamma_1 ECM_{t-1} + \varepsilon_{1t}$$

$$\Delta \exp_t = \alpha_{20} + \sum_{s=1}^{5}\alpha_{21}(s)\Delta fdi_{t-s} + \sum_{s=1}^{5}\alpha_{22}(s)\Delta \exp_{t-s} + \sum_{s=1}^{5}\alpha_{23}(s)\Delta vab_{t-s} + \sum_{s=0}^{5}\alpha_{24}(s)\Delta wd_{t-s} + \sum_{s=0}^{5}\alpha_{25}(\alpha)\Delta compet_{t-s} + \gamma_2 ECM_{t-1} + \varepsilon_{2t}$$

$$\Delta vab_t = \alpha_{30} + \sum_{s=1}^{5}\alpha_{31}(s)\Delta fdi_{t-s} + \sum_{s=1}^{5}\alpha_{32}(s)\Delta \exp_{t-s} + \sum_{s=1}^{5}\alpha_{33}(s)\Delta vab_{t-s} + \sum_{s=0}^{5}\alpha_{34}(s)\Delta wd_{t-s} + \sum_{s=0}^{5}\alpha_{35}(\alpha)\Delta compet_{t-s} + \gamma_3 ECM_{t-1} + \varepsilon_{3t} \quad (2)$$

Where $\alpha_{i,j}, \gamma_i$ (i=1,2,3 and j=1,2,3,4,5) are all parameters and ε_i (i=1,2,3) are white noise disturbances. ECM_{t-1} is the error correction term generated from the cointegrated regression from the Johansen multivariable process. Δ denote first differences required to induce stationarity for the corresponding variables and the estimated coefficients $\alpha_{i,j}$ (i=1,2,3 and j=1,2,3,4,5) indicates the short run causal effects, shown by the F-test of the explanatory variables whereas the coefficient γ_i (i=1,2,3) measures the long run causal relationship implied through the significance of the t-statistics. The relevant error correction term is to be included to avoid misspecification and omission of important constraints. The lag structure is determined by using Perron & Qu (2007) Criteria.

5. Data

In this work, aggregated data of exchange flows are employed in real terms for the more recent period 1993.I to 2008.IV. Thus, the outward foreign direct investment (fdi_t) series is originally obtained from the Bank of Spain and represent the gross payment for Spanish investments abroad ,[27] net of disinvestment in real terms using the Spanish GFCF (*Gross Fixed Capital Formation*) deflator from the Bank of Spain. Data of Spanish foreign direct investment is expressed in millions of euros as a stock variable. Since a proper disaggregation between goods and services claimed to be obtained, the series regarding equal concepts from the Registro de Inversiones Exteriores (RIE) were employed in order to compute the percentage distribution among both types of exchange flows. Once such weights were obtained the former aggregated series has been transformed into FDI in services and FDI in goods. [28]

Spanish exports (exp_t) of goods and services are obtained from the Quarterly National Accounts (CNTR) base 2000 published by the Instituto Nacional de Estadística (INE).

The determinants embodied in the model are the world demand (wd_t), relative prices ($compet_t$) and domestic pressure of demand (vab_t). For the Spanish exports of goods, for instance, the variable whereby foreign demand is *proxied* comprises the growth of the Spanish exports markets, constructed from the sum of the growth of import volumes in goods and services of Spanish customers weighted by its participation in the Spanish exports of goods. This series is computed as an index and is expressed in levels (base=100). The demand variable has been quantitatively computed as follows:

$$DEX_t = \sum_1^n \alpha_{it-1} MBS_{it}$$

Where α_{it-1} is the participation in year t-1 of country i on the value of the Spanish exports. Thus, MBS_{it} becomes the volume growth of imports of goods and services of country i. The statistical sources used have been, for the weighting scheme, the data base *Direction of Trade Statistics* (DOTS) from the IMF, and in the case of import volumes of goods and services the National Accounts from Eurostat, OECD and IMF.

Moreover, the variable whereby the competitiveness of Spanish goods is captured reflects the relative prices of Spanish outward exchange flows over worldwide Spanish competitors' prices, corrected by the exchange rate. The competitors' prices are computed by means the prices of the Spanish exports of goods applied for the main exporter countries, and weighted by its participation - corrected by third markets - in the Spanish exports oriented to each region considered. Competitors' prices in national currency are converted to euros by means of the nominal effective exchange rate, constructed from the bilateral rates of each single currency to the euro, and weighted by its importance as mentioned above. The prices of Spanish exports and the rest of the

[27] Such data is publicly available at www.bde.es

[28] From the National Accounting Economic Activity (CNAE), activities from section 41 on were considered "services" flows, and "goods" otherwise.

world are proxied by the units value index (IVUS) of exports of goods from the Spanish Ministerio de Economía.

The relative prices variable has been quantitatively computed as follows:

$$COMPt = TCEN_t * \left[\frac{\frac{P0}{Pt}}{\prod_1^n \left[\frac{Pi0}{Pit} \right]^{wi}} \right]$$

$$TCENt = 100 * \left[\frac{ei0}{eit} \right]^{wi}$$

Where *wi* is the weight of currency i in year 2000 and reflects the participation of each country on the Spanish exports as well as the competitivity in third countries; likewise, *ei0* and *eit* are the bilateral exchange rate of the euro over the currency i for the base period and period t, respectively. Pi and Pit are the IVUS of exports of country I at base period and at t, respectively. Regarding the data source, for Spain base 2000 for IVUS is employed, based on the Ministerio de Economía. The IVUs for the rest of countries, as well as the series employed for the weighting scheme come from the IMF. The exchange rates are published by the Bank of Spain.

The variable whereby exports of services is employed has been constructed as the sum of real GDP growths of Spanish main customers, weighted by its relative importance on the Spanish exports of services. The variable has been quantitatively computed as follows:

$$DEXS_t = \sum_1^n \beta_i PIB_{it}$$

Where β_i is the participation of country *i* in the value of Spanish exports of services in the period 2003-2004 and PIB_{it} is the real GDP growth of country *i*. The statitiscal sources employed have been, for the weighting scheme, OECD and for the GDP series, Eurostat, OECD and IMF.

The variable whereby relative prices of exports of services is proxied has been computed as the ratio between prices of Spanish exports of services and ours competitors' prices, obtained by a weighted geometric average of the applied prices applied by the main exporter countries, where the weighting scheme is based on the participation of each country on the world exports of services. Then, have been converted to euros by means of a nominal effective exchange rate constructed taking into account such weights. [29] The prices of the Spanish exports of services are proxied by the deflator of exports of services published at the Quarterly National Accounts (CNTR) by the Instituto Nacional de Estadística (INE), while for the rest of countries the deflator of exports of goods and services from Eurostat, OECD and IMF are employed.

[29] The weighting schemes are computed using data on exports of services disaggregated by countries from the United Nations.

The variable whereby the domestic demand pressure may be captured in the Spanish case has been the volume index the Spanish Gross Value Added (vab), obtained from the Quarterly National Accounts (CNTR) published by the Instituto Nacional de Estadística.

Finally, it is worthy to mention that all quarterly series have been eventually seasonally adjusted. All computations taken with non seasonally adjusted series provide even weaker but similar results. The effects therefore on Unit Roots tests and Cointegration relationships are limited. Thus, those variables embodied in the model are expressed in natural logs. [30]

Exchange Cycles Dynamics

From the begining of the nineties up till now a slightly positive but clear correlation between growth rates of the Spanish exports and outward foreign investment flows. This evolution has been emphasized lately according the Hodrick-Prescott cyclical decomposition of the series reported in Graph 1.

First, the volatility of the foreign direct investment growth rate has been clearly higher than the exports, whereas the latter's persistency has been lower, hence the differential among both variables showed a decreasing trend in slowing down periods. See Table 1. Business Cycles Dynamics.

Secondly, by decomposing the growth rate of each variable among trend and cycle by means of Hodrick-Prescott filter, it shows that both series have a similar trend although different scales apply. ON the other hand, a lag synchronization of the cycle between exports and outward foreign investment is easily observed. Likewise, by taking a look at the cyclical component, both series seem to follow a similar path, showing lower levels of volatility from 2000 on however. The highest correlation between both cycles is contemporaneous during the last decada, while from 1993 to 2008 lower levels of sincronization in terms of correlation are observed, suffering lags of two years approximately.

Given the strong correlation between exports and foreign direct investment abroad, a simple econometric model will be estimated in such a setting under cointegration framework. The estimated model results showed in section 6 highlights higher economic dependence of exports with respect to foreign investments abroad than the other way round.

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Business Cycles Dynamics

[30] See Appendix 1 for variables descriptive statistics.

6. Empirical Results

Under the assumption that the model is correctly specified, the following attention will be focused on the temporal Granger noncausality testing. However, we first will focus our attention on those previous and needed results obtained in order to build such a model.

Following the Dickey and Pantula (1987) approach, the null hypothesis of a second unit root (and higher orders of integration) were previously tested and indeed rejected. Thus, on the basis of Tables 2A and 2B and according to the Ng-Perron tests results, the null hypothesis of nonstationarity cannot be rejected in most cases considered (i.e. including a drift, a drift and a trend or none of them). This implies that most of the variables have a stochastic trend at levels. However, after differencing the variables (denoted with Δ) the results of the unit root tests suggest stationary behaviour for all the series. In other words, the time series data are first difference stationary.

<Insert C_Causality_02A>
<Insert C_Causality_02B>
Unit Root Tests

The Johansen procedure to test cointegration was the dollowing step undertaken. The obtained results suggest that is possible to accept the hypothesis that a single cointegrating vector is present in the model, since the null of no cointegration is rejected at all levels of confidence.

Evidence from Tables 3A and 3B confirms that the number of statistically significant cointegration vectors based on a model with linear trends is equal to three for trace statistics and one cointegrating vector for maximal eigenvalue in terms of goods flows and two for both statistics in terms of services.

This implies that there exists a significant cointegrating relationship connecting all the variables and we may conclude that there is a long run relationship among the variables under study.

<Insert C_Causality_03A>
<Insert C_Causality_03B>
Johansen's test for multivariate cointegrating vector VAR(p). Services / Goods

Once VECM is estimated, Granger noncausality may help us to differentiate short- and long-run causality between variables (Engle and Granger, 1987). From this point of view, causality can be derived through: (a) the X^2*-test* of the joint significance of the lags of other variables (Wald test); and (b) the significance of the lagged ECM (t-test). Table 3 report the empirical results once temporal Granger causality has been tested. Since our main attention is specially paid on the relationship between fdi and exp, only the results for these two equations are reported, although the outcomes shown have been obtained by jointly estimating with gdp following the related literature procedure.

<Insert C_Causality_04>
Dynamic Multivariate Causality Analysis through Vector Error Correction Modelling (VECM)

In terms of short-run Granger causality relationship, the results obtained show the presence of a short-term causal relationship going from vab, wd and competitivity to exports of goods, whereas neither of the variables seems to play a significant role in explaining the dynamic of exports on services (as showed by the unsignificance, at all levels, of the X^2 test of the lags of the differentiated variables). However, with regard to the foreign direct investment equation, it may be observed that exports of goods and world demand appear to be the main determinants in explaining the variations of this variable in the short term.

Once we observe the long-run causality tests, the results reported on this table show that changes in exports are a function of the level of disequilibrium of the cointegrating relationship. On the contrary, the results do not yield the same conclusions in terms of variations in foreign investment. As we observe, the ECM coefficient is statistically significant in the export equation, but not in the foreign direct investment equation. Moreover, is quite statistically stronger in terms of exchange of goods but the long-run relationship from fdi to export of services is rather weaker.

To sum up the existence of a causal relationship running from *fdi* to *exp* is empirically provided, whereas it should be highlighted that no evidence of either short-run or long-run causality from exports to *fdi* exists. [31]

Under a multivariate cointegrated framework it is useful to examine the post-sample effects of shocks to the variables in the system. [32] For a more in depth study and to analyse the dynamic properties of the model, when the cointegration relationship is also interacting among the variables, the impulse response function and the variance decomposition of the different variables are estimated by solving the model in levels from the final VECM estimates. The impulse response functions allow us to observe the response paths of each variable to shocks in the others, also taking into account the short-run adjustment to long-run disequilibrium in the dependence.

<Insert G_Causality_02>
Impulse Response Functions

The impulse response functions whereby the behaviour of exports to shocks in *fdi* and *gdp* is obtained are treated separately between goods and services and are presented in Chart 2. The first (third) plot indicates a positive effect of an exogenous increase in *fdi* over exports of services (and goods). This largely agrees with our previous outcome in the ECM estimate, where the long-run positive relationship between FDI and exports was significant for both types of flows. Moreover, looking at these graphs, it seems that the negative influence of the domestic income over both exports is confirmed.

[31] The estimated model guarantees the usual assumptions under a cointegration Framework such as no autocorrelation and residual normality.
[32] See Mellander *et al.* (1992).

Note that for both flows the response of *exp* to shocks in *gdp* is negative after a short period. Moreover, an interesting overshooting is observed during a brief period of two quarters for goods flows when a shock in domestic income happens. Besides, a very slightly negative response of exports of goods should be taken into account whenever shocks in FDI (of goods) are produced. Finally, according to ECM estimates the velocity of adjustment in terms of services flows is slower compared to goods' flows. Likewise compared to the related past empirical results the long-equilibrium adjustment of recent Spanish flows seems to be slower than before.

The second and fourth graphs show the response paths of *fdi* of a surprise increase in exports and domestic income. A graphical examination of plotting the dynamic behaviour of *fdi* reflects higher effects of this variable (especially for goods flows). Foreign direct investment responds positively in the initial periods after a shock in both exports and gdp occurs, but in the case of services an increase in the *gdp* series seem to play a negative influence over *fdi* in the posterior part of the sample. On the other hand, foreign investment in goods responds negatively in the initial periods after a shock in exports occurs, but then responds positively and negatively to go back to its pre-shock level eventually.

In addition to the impulse response analysis the variance decomposition is put to use for the investigation of the quantitative impact of *fdi* on *exp*, and vice versa. With the variance decomposition how much of the variability of one variable at time t is due to an innovation in itself or in any other variable is examined. Since the results of these decompositions are sensitive to the relative ordering of variables, alternative ordering were taken into account, however they do not seem to significantly change the results.

<Insert C_Causality_05>
Variance Decomposition

The figures reported in Table 5 show the presence of a relatively rapid adjustment going from *fdi* to *exp*. Taking a look at the forecast error variance after two years we observe that approximately 25% of the shock in exports of services is explained by innovations in *fdi* on services, remaining constant up to 5 years. After two years less than a 7% of the forecast error variance of exports in services is however due to changes in domestic income. In the other hand, as the findings based on the VECM estimate, exports of services appear to play a significant role in explaining the variance of *fdi*. After a two year horizon the quantitative impact of a variation in exports of services are approximately 30%. Two years later these percentages move up to 42%.

The results reported for goods flows are in line with the related literature. In this sense, after five years the forecast error variance explained by innovations in *fdi* (goods) when a shock in exports of goods happens, is less than a 4%. Likewise, after five years less than a 2% of the forecast error variance of exports in goods is however due to changes in domestic income. Also on the contrary, exports of goods do not appear to play a significant role in explaining the varianceof fdi (goods). After five years the quantitative impact still stays below a 7%. Finally, although the within sample results show that this variable is relatively unexplained by domestic income, the postsample dynamic variance decomposition shows, however, that a substantial part of the variance of the forecast error of *fdi* is explained by *vab* (after five years, 17% approx).

7. Conclusions

In this paper the decision of firms on how to serve foreign markets is under revision. Distant markets, which imply higher transportation costs, may be served by subsidiaries abroad, while closer markets by exports. Theoretically, outward foreign direct investment and exports may be act as substitutives or complements, but although the interdependence of both internationalization modes has been widely treated in trade literature, no statement on its relationship may be considered only relying on theoretical fundamentals. According to traditional models of trade, foreign investment and exports may be considered perfect substitutes. However, this seems to contrast with the new developments on trade theory and industrial organization, whereby the volumes of trade and the emergence of MNEs may be positive or negatively related. Moreover, in location models where advantages of membership justify not only the emergence of MNEs but also different ways of expansion taken within firms eventually play a key role.

From this point of view, FDI may be considered a substitute for trade in goods and services whenever foreign production is mainly driven by *horizontal* expansion motivations (i.e. where affiliates use to replicate the parent's production activity).

Such horizontal pattern on investment flows tend to be considered however contrary to decisions based on *vertical* motivations (i.e. expansions within the multinational enterprise), or to decisions establishing distributional assets in local markets. In this sense, as the related literature highlights, some MNEs may find it profitable to internationally spread several stages of their production or distribution process, with the aim of fitting factor requirements with country's resources in a better way, or aiming to establish distributional networks at host countries in order to attend closely demand requirements and increase market share (i.e. export platform motivations). In this latter case, a complementarity relationship between foreign investment and exports would be expected.

Under this hypothesis a multivariate cointegrated model (VECM) is, therefore, estimated in order to test the (Granger) causality relationship existence both in the short-run and the long-run between exports and outward foreign direct investment. In this sense, recent exchange flows' evolution (1993-2008) and country-specific variables (such as world demand - including recently growing and main Spanish host foreign markets - for trade flows and relative prices of exports in order to proxy new global competitors) are for the first time taken into account.

Our main results provide evidence of a positive (Granger) causality relationship running from FDI to exports of goods (stronger) and to exports of services (weaker) in the long run, whose complementarity relation is consistent with vertical FDI motivations. Whereas, in the short run only exports on goods are affected (positively) by foreign direct investments.

Likewise, by differentiating between goods and services' flows interesting and illuminating results have been obtained. Under a VECM framework services speed of adjustment to the long-term equilibrium tend to be slower than goods, however by contrast to the related literature they behave with much less sensitivity to domestic income changes and its long term relationship has been empirically observed to be statistically weaker. Finally, the post sample investigation shed some light on the results for goods, yielding conclusions more in line with the related previous literature since Spanish exchange flows in the eighties were composed mainly by goods.

To end up, it should be highlighted that outward FDI and exports have been empirically evidenced to act as complements. Thus, it would be far from the economic reality thinking about negative impacts of investment flows over the domestic production activity. In this sense, incorporating more disaggregating data would be a useful extension of the literature since it will reveal different behaviours among several industries.

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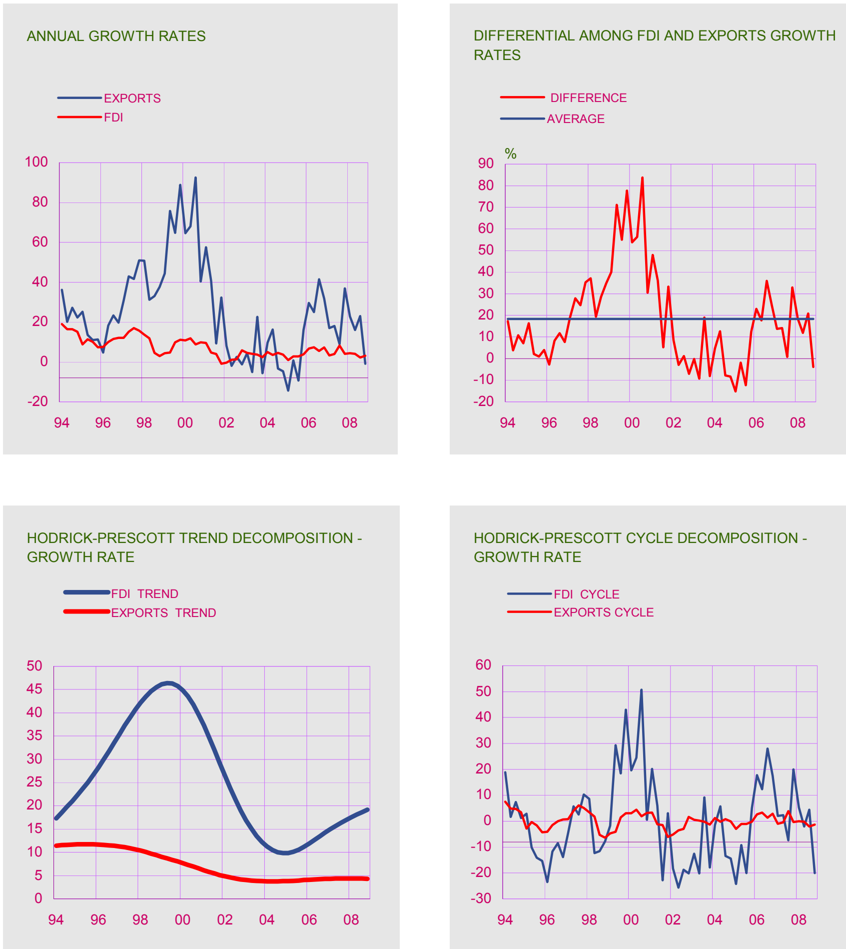
SPANISH EXPORTS AND OUTWARD FOREIGN INVESTMENT BUSINESS CYCLES CHART 1



SOURCES: Banco de España.

Table 1. Busines Cycles Dynamics

Annual Growth Rates - FDI and FDI

	1993-2000		2001-2008		1993-2008	
	FDI	X	FDI	X	FDI	X
1 Volatility	5.47	0.17	2.95	0.05	5.64	0.23
2 Long Run Volatility	1.70	0.03	2.80	0.03	2.62	0.08
3 Persistence (2) / (1)	0.31	0.15	0.95	0.49	0.46	0.33

Correlations between FDI and Exports

	1993-2000	2001-2008	1993-2008
T-8	-0.12	0.05	0.54
T-6	-0.42	0.03	0.46
T-4	-0.50	0.05	0.30
T-2	-0.34	0.30	0.23
T	-0.07	0.43	0.24
T+2	0.01	-0.07	0.32
T+4	-0.16	-0.20	0.41
T+6	-0.20	-0.16	0.31
T+8	-0.09	-0.17	0.07

Source: Banco de España.

Table 2A. Unit Root Tests

Services	**Aug Dickey-Fuller statistic**			**Phillips-Perron statistic**		
	τ_{τ} *[1]*	τ_{μ} *[2]*	τ *[3]*	$Z(t_{\tilde{\alpha}})$ *[1]*	$Z(t_{\alpha^*})$ *[2]*	$Z(t_{\hat{\alpha}})$ *[3]*
Levels						
fdi	-3.71	1.08	2.14	-3.60	-1.14	1.01
exp	-1.32	-0.83	4.09	-1.81	-0.72	4.20
Wdemand	-1.74	-1.26	0.87	-2.21	-1.31	6.59
Compet	-2.25	-1.23	1.50	-5.39	-2.64	0.54
VABs	-1.26	3.35	15.05	-1.24	3.51	15.13
First Differences						
fdi	-9.98	-9.67	-9.29	-11.86	-10.86	-10.14
exp	-10.48	-10.53	-2.04	-10.22	-10.20	-8.33
Wdemand	-1.72	-1.75	-1.42	-7.81	-7.76	-4.47
Compet	-3.15	-3.35	-2.91	-11.64	-11.32	-10.15
VABs	-8.28	-2.96	-0.76	-8.28	-7.22	-2.44
Critical Values						
1% level	-4.11	-3.54	-2.60	-4.11	-3.54	-2.60
5% level	-3.48	-2.91	-1.95	-3.48	-2.91	-1.95
10% level	-3.17	-2.59	-1.61	-3.17	-2.59	-1.61

Goods	**Aug Dickey-Fuller statistic**			**Phillips-Perron statistic**		
	τ_{τ} *[1]*	τ_{μ} *[2]*	τ *[3]*	$Z(t_{\tilde{\alpha}})$ *[1]*	$Z(t_{\alpha^*})$ *[2]*	$Z(t_{\hat{\alpha}})$ *[3]*
Levels						
fdi	-4.85	-4.04	-1.20	-5.02	-4.12	-2.40
exp	-2.33	-1.32	5.56	-2.21	-1.72	5.52
Wdemand	-3.32	-0.75	1.29	-2.16	-0.19	5.20
Compet	-2.95	-1.49	0.10	-2.90	-1.49	0.15
VABs	1.36	-2.11	1.36	0.72	-1.80	2.98
First Differences						
fdi	-9.90	-9.93	-10.02	-12.75	-12.81	-12.93
exp	-8.31	-8.15	-2.36	-8.42	-8.15	-5.43
Wdemand	-2.43	-2.72	-1.44	-3.89	-4.14	-2.37
Compet	-10.22	-10.03	-10.09	-10.66	-10.12	-10.12
VABs	-6.29	-2.92	-2.37	-6.36	-5.73	-4.54
Critical Values						
1% level	-4.11	-3.54	-2.60	-4.11	-3.54	-2.60
5% level	-3.48	-2.91	-1.95	-3.48	-2.91	-1.95
10% level	-3.17	-2.59	-1.61	-3.17	-2.59	-1.61

Notes: [1], [2]and [3] refers to the model statitistics with drift and trend, with drift and without either drift or trend, respectively. The optimal lag used for the Augmented Dickey-Fuller tests and the truncation parameter used for Phillips-Perron tests was selected using the formula $m = ent\left[4(T/100)^{1/4}\right]$ suggested by Schwert (1989). Critical values are taken from Fuller (1976) and Dickey and Fuller (1981).

Table 2B. Unit Root Tests

Services	Ng-Perron statistic		*Goods*	Ng-Perron statistic	
	MZa [1]	*MZa [2]*		*MZa [1]*	*MZa [2]*
Levels			**Levels**		
fdi	3.48	-19.48	*fdi*	-5.05	-25.20
exp	0.78	-6.29	*exp*	1.64	-6.72
Wdemand	-11.28	-571.08	*Wdemand*	-27.04	-207.39
Compet	-1.99	-4.35	*Compet*	-3.77	-5.59
VABs	-129.73	-1.39	*VABs*	-0.18	-7.25
First Differences			**First Differences**		
fdi	-75.11	-85.81	*fdi*	-69.47	-73.68
exp	-5.78	-28.83	*exp*	-29.40	-30.75
Wdemand	-266.67	-15.36	*Wdemand*	-0.05	-18.14
Compet	1.30	-0.15	*Compet*	-2.26	-30.06
VABs	-8.97	-30.14	*VABs*	-6.45	-11.02
Critical Values			**Critical Values**		
1% level	-13.80	-23.80	1% level	-13.80	-23.80
5% level	-8.10	-17.30	5% level	-8.10	-17.30
10% level	-5.70	-14.20	10% level	-5.70	-14.20

Notes: Spectral estimation method (AR, GLS-Detrended). [1] model statistics with intercept, and [2] refers to model with drift and trend.

Table 3A. Johansen's test for multivariate cointegrating vector VAR(5). Services

Model 1. With no linear trends in the levels of the data

Ho	H1	Trace Statistics	Critical Value 5%	Critical Value 1%	Max Eigenvalue Statistics	Critical Value 5%	Critical Value 1%	Trace Results	Max Eig Results
r=0	r>0	102.83	59.46	66.52	60.06	30.04	35.17	None **	None **
r≤1	r>1	42.77	39.89	45.58	20.96	23.80	28.82	At most 1 *	At most 1
r≤2	r>2	21.81	24.31	29.75	13.98	17.89	22.99	At most 2	At most 2
r≤3	r>3	7.83	12.53	16.31	5.98	11.44	15.69	At most 3	At most 3
r≤4	r>4	1.85	3.84	6.51	1.85	3.84	6.51	At most 4	At most 4

**(*) denotes rejection of the hypothesis at the 5%(1%) significance level

Model 2. With linear trends in the levels of the data

Ho	H1	Trace Statistics	Critical Value 5%	Critical Value 1%	Max Eigenvalue Statistics	Critical Value 5%	Critical Value 1%	Trace Results	Max Eig Results
r=0	r>0	125.21	68.52	76.07	57.12	33.46	38.77	None **	None **
r≤1	r>1	68.09	47.21	54.46	38.23	27.07	32.24	At most 1 **	At most 1 **
r≤2	r>2	29.86	29.68	35.65	18.19	20.97	25.52	At most 2 *	At most 2
r≤3	r>3	11.67	15.41	20.04	11.19	14.07	18.63	At most 3	At most 3
r≤4	r>4	0.48	3.76	6.65	0.48	3.76	6.65	At most 4	At most 4

**(*) denotes rejection of the hypothesis at the 5%(1%) significance level

Model 3. With quadratic trends in the levels of the data

Ho	H1	Trace Statistics	Critical Value 5%	Critical Value 1%	Max Eigenvalue Statistics	Critical Value 5%	Critical Value 1%	Trace Results	Max Eig Results
r=0	r>0	154.88	77.74	85.78	53.77	36.41	41.58	None **	None **
r≤1	r>1	101.11	54.64	61.24	44.69	30.33	35.68	At most 1 **	At most 1 **
r≤2	r>2	56.43	34.55	40.49	34.53	23.78	28.83	At most 2 **	At most 2 **
r≤3	r>3	21.90	18.17	23.46	15.04	16.87	21.47	At most 3 *	At most 3
r≤4	r>4	6.85	3.74	6.40	6.85	3.74	6.40	At most 4 **	At most 4 **

**(*) denotes rejection of the hypothesis at the 5%(1%) significance level

Table 3B. Johansen's test for multivariate cointegrating vector VAR(6). Goods

Model 1. With no linear trends in the levels of the data

Ho	H1	Trace Statistics	Critical Value 5%	1%	Max Eigenvalue Statistics	Critical Value 5%	1%	Trace Results	Max Eig Results
r=0	r>0	127.70	59.46	66.52	60.85	30.04	35.17	None **	None **
r?1	r>1	66.85	39.89	45.58	33.00	23.80	28.82	At most 1 **	At most 1 **
r?2	r>2	33.84	24.31	29.75	17.56	17.89	22.99	At most 2 **	At most 2
r?3	r>3	16.28	12.53	16.31	11.84	11.44	15.69	At most 3 *	At most 3 *
r?4	r>4	4.44	3.84	6.51	4.44	3.84	6.51	At most 4 *	At most 4 *

**(*) denotes rejection of the hypothesis at the 5%(1%) significance level

Model 2. With linear trends in the levels of the data

Ho	H1	Trace Statistics	Critical Value 5%	1%	Max Eigenvalue Statistics	Critical Value 5%	1%	Trace Results	Max Eig Results
r=0	r>0	132.32	68.52	76.07	60.21	33.46	38.77	None **	None **
r?1	r>1	72.12	47.21	54.46	31.79	27.07	32.24	At most 1 **	At most 1 *
r?2	r>2	40.32	29.68	35.65	21.41	20.97	25.52	At most 2 **	At most 2 *
r?3	r>3	18.91	15.41	20.04	14.59	14.07	18.63	At most 3 *	At most 3 *
r?4	r>4	4.32	3.76	6.65	4.32	3.76	6.65	At most 4 *	At most 4 *

**(*) denotes rejection of the hypothesis at the 5%(1%) significance level

Model 3. With quadratic trends in the levels of the data

Ho	H1	Trace Statistics	Critical Value 5%	1%	Max Eigenvalue Statistics	Critical Value 5%	1%	Trace Results	Max Eig Results
r=0	r>0	137.01	77.74	85.78	59.88	36.41	41.58	None **	None **
r?1	r>1	77.13	54.64	61.24	36.37	30.33	35.68	At most 1 **	At most 1 **
r?2	r>2	40.76	34.55	40.49	25.02	23.78	28.83	At most 2 **	At most 2 *
r?3	r>3	15.74	18.17	23.46	14.08	16.87	21.47	At most 3	At most 3
r?4	r>4	1.65	3.74	6.40	1.65	3.74	6.40	At most 4	At most 4

**(*) denotes rejection of the hypothesis at the 5%(1%) significance level

Table 4. Dynamic Multivariate Causality Analysis through Vector Error Correction modeling (VECM)

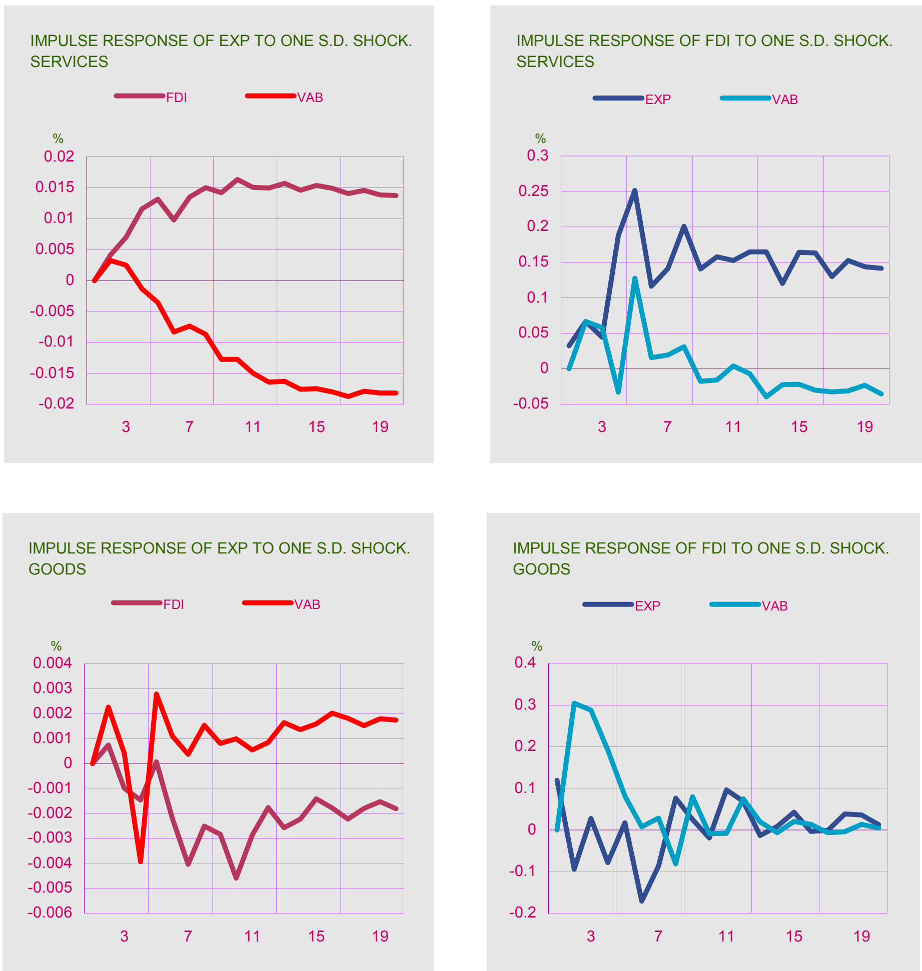
Temporal Granger-causality tests on VECM.

	Source of Causation											
	Short Run										ECM	
Services	Δfdi		Δexp		Δvab		Δwd		$\Delta compet$		ε_{t-1}	
	$\chi^2(4)$	$\sum coeff.$	$\chi^2(4)$	$\sum coeff.$	$\chi^2(4)$	$\sum coeff.$	$\chi^2(4)$	$\sum coeff.$	$\chi^2(4)$	$\sum coeff.$	t	γ_i
(1) Δfdi	-	-	3.37	-9.45	1.86	-11.11	3.75	165.97	2.50	2.36	[0.17]	2.11
(2) Δexp	2.97	0.06	-	-	4.75	0.75	4.44	-8.04	3.74	0.55	[-1.38]*	-0.56
Goods	Δfdi		Δexp		Δvab		Δwd		$\Delta compet$		ε_{t-1}	
	$\chi^2(4)$	$\sum coeff.$	$\chi^2(4)$	$\sum coeff.$	$\chi^2(4)$	$\sum coeff.$	$\chi^2(4)$	$\sum coeff.$	$\chi^2(4)$	$\sum coeff.$	t	γ_i
(1) Δfdi	-	-	16.66***	31.73	4.79	14.35	11.96**	-28.82	2.07	-2.46	[-0.72]	-2.81
(2) Δexp	3.85	0.03	-	-	10.59*	2.20	27.36***	-1.12	12.78***	1.61	[-2.21]**	-0.14

Notes: *,**,*** denotes significance at the 10%, 5% and 1%, respectively. VECM for Services includes a time trend from 1993.

IMPULSE RESPONSE FUNCTIONS
Disaggregation by components

CHART 2



FUENTES: Banco de España.

Table 5. Variance Decomposition

Services	Percentage of forecast variance explained by innovations in:				
	t	σ	*exp*	*fdi*	*vab*
Variance decomposition of:					
exp	1	0.02	100	0.00	0.00
	4	0.04	84.41	14.26	1.32
	8	0.06	69.25	24.36	6.39
	12	0.08	58.32	26.31	15.37
	16	0.10	50.72	26.93	22.35
	20	0.12	46.43	26.49	27.08
fdi	1	0.55	0.35	99.65	0.00
	4	0.62	11.07	86.63	2.29
	8	0.78	29.27	66.38	4.35
	12	0.88	35.65	60.80	3.54
	16	0.96	39.78	56.91	3.31
	20	1.04	42.05	54.72	3.23

Goods	Percentage of forecast variance explained by innovations in:				
	t	σ	*exp*	*fdi*	*vab*
Variance decomposition of:					
exp	1	0.02	100	0.00	0.00
	4	0.04	98.13	0.28	1.59
	8	0.04	96.71	1.61	1.67
	12	0.05	95.60	2.95	1.44
	16	0.05	95.25	3.12	1.63
	20	0.06	94.85	3.28	1.86
fdi	1	0.90	1.78	98.22	0.00
	4	1.13	2.36	80.92	16.73
	8	1.18	5.28	78.30	16.42
	12	1.19	6.20	76.97	16.83
	16	1.19	6.33	76.83	16.84
	20	1.20	6.51	76.69	16.80

Notes: Figures of *exp, fdi* and *vab* refers to the variance decomposition of an orthogonal one S.D. shock, *t* indicates the forecast horizon in quarters and σ denotes the forecast variance.

Table A1. Descriptive Statistics

	Xgoods	FDIgoods	WDGoods	Cpgoods	VABGoods
Mean	30,496.4	54,475.8	99.4	119.4	28,826.1
Median	32,251.1	28,857.8	101.2	118.5	30,295.8
Maximum	44,238.0	227,119.6	152.8	132.1	33,420.5
Minimum	13,898.1	1,631.5	53.7	109.5	22,622.8
Std. Dev.	8,796.9	58,809.9	29.4	6.5	3,558.2
Skewness	-0.27	1.33	0.21	0.41	-0.47
Kurtosis	1.94	3.84	1.98	2.11	1.71
Jarque-Bera	3.76	20.15	3.28	3.86	6.76
Probability	0.15	0.00	0.19	0.15	0.03
Observations	64	62	64	64	64

Notes: X=exports, WD=World Demand, CP=Competitivity, VAB=Gross value added

	Xservices	FDIServices	WDServices	CPServices	VABServices
Mean	13,374.3	105,048.9	116.2	114.5	97,430.8
Median	14,688.1	62,715.7	118.2	112.2	96,807.1
Maximum	19,055.1	390,458.1	138.1	142.4	128,119.7
Minimum	7,405.0	125.1	93.1	93.4	74,148.6
Std. Dev.	3,519.1	100,682.0	13.5	14.2	16,349.0
Skewness	-0.24	1.08	-0.05	0.37	0.33
Kurtosis	1.85	3.51	1.83	2.00	1.88
Jarque-Bera	4.12	12.68	3.68	4.14	4.47
Probability	0.13	0.00	0.16	0.13	0.11
Observations	64	62	64	64	64

Notes: X=exports, WD=World Demand, CP=Competitivity, VAB=Gross value added