Foreign Capital Divestment in Spain: an industry level analysis of its extent and determinants

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Abstract

In this paper we estimate the presence of foreign capital among representative industrial sectors of the Spanish economy along the 1985–2002 period, using the information aggregated up to 57 different sectors provided by the Bank of Spain from the firm survey based data set *Central de Balances*, which distinguishes between national firms, i.e. those whose social capital has a foreign participation below 10 per cent, and foreign firms. A scenario with lower levels of foreign participation that could be significantly affecting income annual growth as well as causing other undesired indirect effects is observed since 1998. Traditional sectors of production intensive in labour use, technologically advanced industries as well as some parts of the service industry (restaurant and hotel business) participate in this process of foreign capital reduction. Divestment in some technologically advanced sectors such as electric machinery and information technologies could negatively affect long term economic growth as these production sectors largely depend on foreign capital. Determinants of foreign direct investment and divestment are explored by means of panel data regressions. In particular, divestment scenarios seem to be encouraged when size, capital per worker, profitability rates and *know how* returns of foreign firms relative to local firms are low, as well as with poor rates of market growth measured by annual growth on sales of a given industrial sector that includes both, local and foreign firms.

Keywords: Divestment of foreign capital, Spanish economy, panel data estimations.

1 Introduction

Two of the most notorious economic facts of the Spanish economy along last decade correspond in one hand to the decrease in foreign direct investment (FDI) and in the other, the increase in the number of divestment cases in foreign firms often as part of industrial restructuring processes (Myro et al., 1996;

Fernández-Otheo and Myro, 2003; Merino de Lucas, 2003; Myro and Fernández-Otheo, 2004; Fernández-Otheo et al., 2005). The results in Myro et al. (1996), Fernández-Otheo and Myro (2003), Myro and Fernández-Otheo (2004), and Fernández-Otheo et al. (2005), based on either exhaustive exploration of the data provided by The Spanish Registry of Foreign Investments, or the analysis of certain divested firms, cannot precisely determine the scope of these divestment phenomena. The estimations in Merino de Lucas (2003) from the Spanish Survey on Business Strategies data only cover up to 1998, leaving out of the study the period where the divestment processes have become more intense. To this respect, this paper analyses the extent of the mentioned phenomena along the 1985–2002 period, and studies the determinants of foreign capital divestments at the industry level, using the information from the Bank of Spain firm survey based data set *Central de Balances*. Along with a classical line of research in Spain (Muñoz et al., 1978; Martínez Serrano and Myro, 1992; Martín and Velázquez, 1996), the aim of this paper is to offer further information on foreign capital presence and its determinants in the Spanish economy, as well as attempting to better understand the foreign divestment scenarios observed over the past few years.

The available information is aggregated up to 57 different manufacturing and services sectors and distinguishes between national firms, i.e. those whose social capital has a foreign participation below 10 per cent, and foreign firms. Divestment determinants are consequently studied through a dependent variable that measures the weight of foreign based value added with respect to national one, and some explanatory variables that attempt to approximate Dunning's ownership, localisation and internalisation advantages for FDI to occur (Dunning, 1977). By means of panel data regressions, the primer objective is to provide an empirical model that both captures main economic features related to foreign capital and allows testing of fundamental hypothesis. In particular we are interested on determining wether a structural break in foreign capital presence occurred during the late 1990s, and on exploring possible differences on the determinants of foreign capital allocation depending on the nature of the aggregated decision, i.e. one of investment or by contrary, one of divestment, as suggested by Benito (1997). Implementing all these findings, a final model is used to estimate the extent of the divestment processes across all manufacturing and non-manufacturing sectors along the considered time horizon.

2 Data

The available information from *Central de Balances* data set constitutes a rich source of cross-sectional time series on a variety of economic variables that are constructed from detailed surveys on firm accounts. Due to privacy laws, we have only access to the information aggregated up to 57 different manufacturing and non-manufacturing sectors. All series are nonetheless available for foreign firms, i.e. those who have a foreign participation in their social capital of at least 10 per cent, and the referred as national firms, a very desirable feature for

the objectives pursued in this paper. The series observed for the whole sector are calculated simply by aggregating the information of foreign and national firms. The time horizon goes from 1985 to 2002, capturing both, the period of rapid growth in the stock of foreign capital, and a decelerating one including some important divestment cases. Table 1 presents the raw variables, their transformations and notation used for the econometric analysis, whilst Table 2 offers the summary statistics of the dependent variable and regressors used in the primer specifications. Some other variables not shown in Table 1 that appear in the analysis are simply indicator variables or cross multiplications of these indicators with the regressors, introduced to allow capturing of specific slope effects and determination of structural breaks.

Table 1: Definition of regression variables

Raw variables notation	**Variable**
vabcf	gross value added at factor costs
imnperworker	capital per worker
oii	intangible assets
size	number of workers per firm (mean value)
pgrcn	proportional growth rate for turnover
r1roan	net asset profitability
export	exports
import	imports
scr	exports net of imports over total trade volume
Regression variables	**Variable calculation**
lnrvabcf	= ln(vabcfext) - ln(vabcfnoext)
lnrimnperworker	= ln(imnperworkerext) - ln(imnperworkernoext)
lnroii	= ln(oiiext) - ln(oiinoext)
lnrsize	= ln(sizeext) - ln(sizenoext)
lnrr1roan	= ln(1+(r1roanext/100)) - ln(1+(r1roannoext/100))
lnr1roantotal	= ln(1+(r1roantotal/100))
lnpgrcntotal	= ln(1+(pgrcntotal/100))
scrtotal	$= \frac{\texttt{exporttotal} - \texttt{importtotal}}{\texttt{exporttotal} + \texttt{importtotal}}$
Additional notation	
ln~	Logarithm
~ext	Variable observed for foreign firms
~noext	Variable observed for national firms
~total	Variable observed for whole sector

As observed in Table 2, panels are unbalanced. This is mainly due to the telecommunication sector in the case of foreign firm based information, with data only in the 1995–2002 period, and the motor vehicles sector in the case of national firms, which only offers information along the 1991–2002 period.

Table 2: Summary statistics for regression variables

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
industry	1026	29	16.460	1	57
year	1026	1993.5	5.191	1985	2002
lnrvabcf	1010	-.69304	1.303	-5.955	3.749
lnrimnperworker	1010	.06276	.61924	-2.403	2.309
lnroii	980	-1.0527	2.127	-7.730	7.055
lnrsize	1010	.89864	.87809	-2.701	3.730
lnrr1roan	1010	.02437	.10322	-.48408	.70170
lnr1roantotal	1026	.10342	.07413	-.35692	.61872
lnpgrcntotal	969	.07322	.18572	-1.607	.95535
scrtotal	1022	.15252	.48291	-1	1

3 Empirical modelling of the relative participation of foreign firms value added

We consider foreign firms value added as a relevant indicator of the presence, importance and kind of strategies followed by foreign capital. In order to explore and determine the extent of the divestment processes we start by specifying a model for the relative participation of foreign firms in the Spanish production process. Negative sign changes in the level of this dependent variable, `lnrvabcf`, are therefore regarded as a proxy for divestment scenarios. The determinants that help explaining the evolution in time of this variable are only some of the commonly used in FDI applications driven by Dunning's eclectic theory. There are some other general explanatory factors not included in the analysis as the relatively low wages of alternative international locations, that affect all industrial sectors although not necessarily in the same proportion. The literature on divestments (Boddewyn, 1976; Mata and Portugal, 2000; Bernard and Sjöholm, 2003) has also suggested other firm based factors such as the age, international experience, property status...

The considered independent variables accounting for ownership advantages include (i) the relative endowment of capital per worker in foreign firms, `lnrimnperworker`, that captures the amount of labour productivity originated by capital, (ii) the average size, `lnrsize`, and (iii) the ordinary profitability of net assets[1], `lnrr1roan`, all expressed in relative terms as indicated in Table 1. A positive parameter is expected in all three regressors as foreign capital is bound to remain with its production activities abroad if it has ownership advantages over national firms. The endowment of capital per worker can also be regarded as a proxy of sunk costs, enforcing the hypothesis of a positive sign in this variable.

Internalisation advantages are approximated via relative endowments of foreign firms intangible assets, `lnroii`. This variable can be understood as an

[1] The profitability of net assets is calculated as stated by *Central de Balances* in their annual reports, Banco de España (2002), Table II.A.8, p. 60.

indicator of product differentiation, i.e. goods being developed internally rather than issuing out patents or specific licences on production. Consequently, a positive sign in the associated parameter would seem as the right result.

In terms of localisation advantages several variables are considered, (i) the proportional annual growth rate of whole sector turnover, `lnpgrcntotal`, which informs on internal market growth opportunities, (ii) whole sector ordinary profitability of net assets, `lnr1roantotal`, as a proxy for business opportunities, and (iii) the index for competitive advantage at the industrial sector level, `scrtotal`. A positive sign is expected in first two cases, indicating that the relative importance of foreign firms value added is consolidated under scenarios with greater business and market growth opportunities. Alternatively, a negative sign could appear in the parameter multiplying the the third variable, as foreign establishments would seem reasonable in sectors with little competitive advantages.

The following parts of the paper are dedicated to the empirical specification and estimation of a model for the relative presence of foreign firms value added which should allow quantification of the extent of recent divestment processes and identification of most affected manufacturing and service sectors.

3.1 The initial model

We begin estimating an initial model by fixed-effects with the form in equation (1),

$$y_{it} = X_{it}\beta + u_i + \epsilon_{it} \tag{1}$$

for industrial sector $i = 1, \ldots, 57$ and year $t = 1, \ldots, T_i$. X_{it} is a $1 \times K$ vector of regressors including $K - 1$ explanatory variables that vary with i and t, and a constant term whose associated parameter is denoted in regression results by `cons`. u_i is a an error term that accounts for unobserved heterogeneity and ϵ_{it} is assumed to be white noise. The intention here is twofold, in one hand we want to choose those variables that better explain the evolution in time of the relative participation of foreign firms value added, and in the other, through the analysis of residuals, to locate possible data distortions and deficiencies in the estimation method. The results of this initial model are presented in Table 3. Alternative specifications in which either relative wages or labour productivity were included instead of relative capital per worker endowments, offered poorer results in terms of the within determination coefficient R^2. The foreign trade variables exports and imports were also tested in numerous and different manners, not getting any relevant results when trying to explain the dependent variable.

As observed in Table 3, all estimated parameters are different to zero at the 95 per cent significance level, except that associated to the competitive advantage index, `scrtotal`.

The obtained signs are as expected apart from that one parameter multiplying whole sector ordinary profitability, `lnr1roantotal`, which presents a negative rather than a positive sign. A possible explanation can be given in terms of the estimated average participation of foreign firms value added in the

Table 3: Initial model for the relative participation of foreign firms value added. Fixed-effects estimation

lnrvabcf	**Coef.**	**Std. Err.**	t	$P > \|t\|$
lnrimnperworker	.3064	.0273	11.23	.000
lnrsize	.9313	.0223	41.84	.000
lnroii	.0446	.0083	5.35	.000
lnrr1roan	1.8874	.1437	13.14	.000
lnr1roantotal	-.5496	.2235	-2.46	.014
lnpgrcntotal	.3476	.0684	5.08	.000
scrtotal	-.0882	.0559	-1.58	.115
cons	-1.5243	.0376	-40.54	.000

σ_u	.78308		
σ_ϵ	.36886		
$N = 931$			
Groups = 57	Min.	Mean	Max.
Obs. per group	8	16.3	17
R^2 within = .7396			
F test $\beta = 0$	F(7,867) = 351.73, Prob > F = .000		
F test $u_i = 0\ \forall i$	F(56, 867) = 58.98, Prob > F = .000		

value added of national firms, $E(y_{it} \mid \beta_2 x_2 = \ldots = \beta_K x_K = 0) = -1.52$, just 22 per cent (i.e. $e^{-1.52}$). An increase in the ordinary profitability of whole sector could mainly be driven by national firms, hence provoking a less favorable scenario for foreign firms.

The fixed-effects estimation of this initial model is equivalent to the ordinary least squares estimation of the extended model in equation (2).

$$y_{it} = Z_{it}\beta + \epsilon_{it} \tag{2}$$

Where Z_{it} is now $1 \times (K+56)$, including the same $K-1$ explanatory variables and a set of 57 dummies or industry indicator variables that allow estimation of the unobserved heterogeneity components u_i in equation (1). The resulting time series of standarised residuals are plotted in Figure 1. A first look at the series informs on the non stationary in mean nature of these residuals, showing negative trending behavior, which intuitively tells that the model may be overestimating the relative participation of foreign firms value added as time approaches the end of the series. The variance does not seem constant throughout the sample and hence several forms of heteroskedasticity could be present. In terms of outliers, the service sector auditing, consulting and social management often presents off-bands values, with an error close to 8σ in 1988.

The analysis on the influence or distortion that certain observations may cause in the estimation can be carried out through a leverage versus standarised squared residuals plot, Figure 2. The mentioned sector (auditing, consulting and social management) presents large error values but low leverage levels, in-

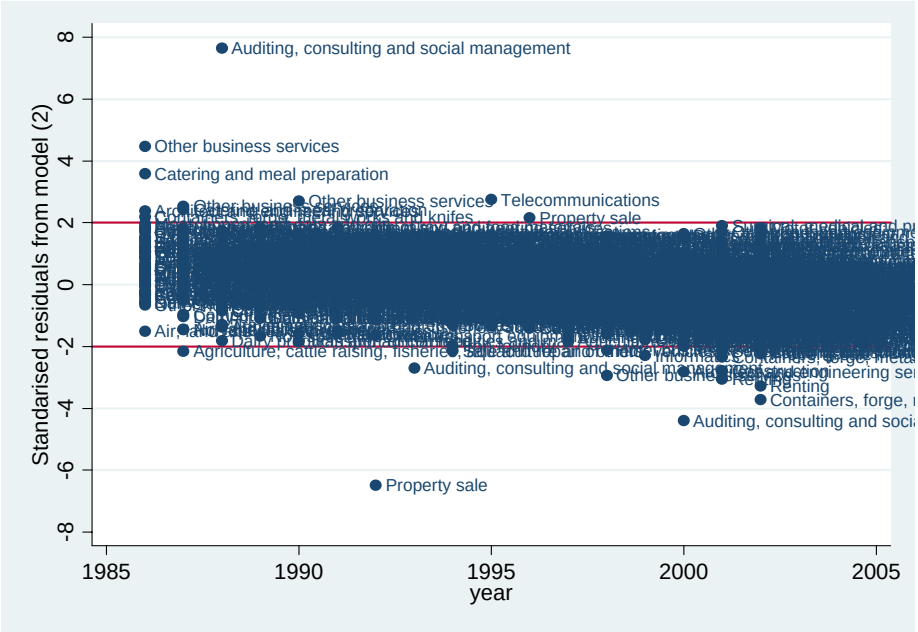

Figure 1: Time series of standarised residuals from model (2)

dicating that these outliers would no be distorting the estimation. The 1992 outlier associated to property sale with an error below -6σ has a larger leverage value nonetheless far too low if compared to the leverage attained by the Rubber manufacturing sector. The sectors with incomplete information should be carefully watched in Figure 2, particularly around the top of the $y-$axis, implying observations finely fitted by the regression model and with a high degree of influence over parameters estimation. Both, the telecommunication and the motor vehicles sectors have several observations around that area (high degree of leverage and low prediction error). Consequently, these two sectors are taken out of the analysis to avoid possible bias induced by this part of the information with important blanks along the series.

In order to evaluate possible serial correlation in residuals, the model in equation (2) is reestimated without discarded sectors. With the resulting residuals we estimate by generalised least squares the equation in (3).

$$\begin{aligned} &\epsilon_{it} = \mu + \rho\epsilon_{it-1} + \nu_{it}; \qquad \forall i \neq \{31, 50\} \\ &\hat{\epsilon}_{it} = \underset{(.0272)}{-.0592} + \underset{(.0440)}{.5425}\epsilon_{it-1} \\ &p - values : .030\ (\mu) \qquad .000\ (\rho) \\ &N = 848 \\ &Log\ pseudolikelihood = -1007.85 \end{aligned} \tag{3}$$

This results show a statistically significant negative mean, μ, and positive

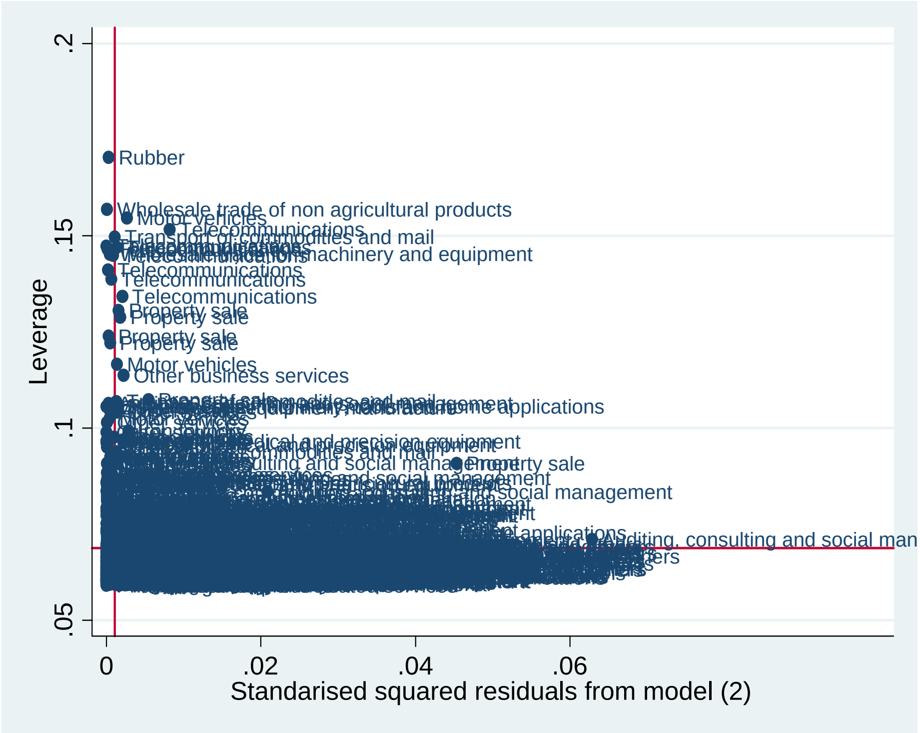

Figure 2: Leverage against standarised squared residuals, model 2

ρ parameter which in principle seems to be inside the unit circle at the 95 per cent significance level. Nonetheless, it would not be sensible to assert mean stationary from these results, as the error term ν_{it} could still present some kind of structure. Only a panel unit root analysis would allow to properly identify those stationary time series.

Residuals from this initial model may therefore present non stationary structures, as well as several forms of heteroskedasticity and serial correlation. For these reasons we switch now into Prais–Winsten regressions, an estimation method that provides panel corrected standard errors under these special circumstances. Furthermore, Beck and Katz (1995) show that in panels where the cross–section size is not much larger than the time series length, as it is the case in this data set, Prais–Winsten estimation method offers better results than generalised least squares.

3.2 Prais–Winsten regressions and structural break detection

The aim of this section is to reestimate the initial model under Prais–Winsten estimation method with a first order autoregressive error term. Reducing the model to the variables with statistically significant parameters, the next step consists in detecting a possible structural break towards the end of the cross–section time series. The general form of the models estimated here is presented in expression (4).

$$\left.\begin{array}{l} y_{it} = X_{it}\beta + \epsilon_{it} \\ \epsilon_{it} = \mu + \rho\epsilon_{it-1} + \nu_{it} \end{array}\right\} \forall i \neq \{31, 50\} \tag{4}$$

The results of the first estimation are presented in Table 4.

Table 4: Model for the relative participation of foreign firms value added. Prais-Winsten estimation with AR(1) residuals, heteroskedastic and correlated panels

	Panel-corrected			
lnrvabcf	**Coef.**	**Std. Err.**	z	$P > \|z\|$
lnrimnperworker	.3067	.0374	8.19	.000
lnrsize	.9236	.0296	31.25	.000
lnroii	.0624	.0100	6.22	.000
lnrr1roan	1.4506	.1573	9.22	.000
lnr1roantotal	-.2426	.2195	-1.11	.269
lnpgrcntotal	.1275	.0484	2.63	.008
scrtotal	-.0438	.0769	-.57	.569
cons	-1.5384	.0750	-20.51	.000
ρ	.79201			
$N = 911$				
Groups = 55	Min.	Mean	Max.	
Obs. per group	12	16.56	17	
$R^2 = .6655$				
Wald test $\beta = 0$	$\chi^2(7) = 1200.38$, Prob $> \chi^2 = .000$			

They are pretty similar to the obtained under fixed effects estimation (Table 3), with minor differences in the value of the parameters and maintaining the sign and the statistical significance in all cases but the ordinary profitability of whole sector net assets parameter (lnr1roantotal), that does not turn to be statistically significant. The autoregressive parameter is .79 and $R^2 = .67$. Reducing the model to the variables with statistically significant parameters only decreases the determination coefficient R^2 in .02 and the parameter estimates are basically the same in both cases, *cf.* Table 4 and 5.

We are now in position to begin with the identification of a possible structural break extending this last reduced model to the inclusion of time period indicator variables and cross multiplications of these indicators with the regressors of the

Table 5: Reduced model for the relative participation of foreign firms value added. Prais-Winsten estimation with AR(1) residuals, heteroskedastic and correlated panels

	Panel-corrected			
lnrvabcf	**Coef.**	**Std. Err.**	z	$P > \|z\|$
lnrimnperworker	.3170	.0382	8.29	.000
lnrsize	.9310	.0292	31.94	.000
lnroii	.0617	.0102	6.04	.000
lnrr1roan	1.5127	.1621	9.33	.000
lnpgrcntotal	.1212	.0518	2.34	.019
cons	-1.5650	.0673	-23.27	.000

ρ	.78816		
$N = 914$			
Groups = 55	Min.	Mean	Max.
Obs. per group	12	16.62	17
$R^2 = .6521$			
Wald test $\beta = 0$	$\chi^2(7) = 1226.9$ Prob $> \chi^2 = .000$		

reduced model. The motivation of the analysis that follows can be found in Figure 1. The residuals appear to have a constant mean along the first part of the series, at least until 1995. Dividing the sample in two, one part until 1995, and the other from 1996 onwards, we can formulate and solve Wald tests in an iterative manner beginning from the end of the time horizon, and reducing each time the sample in one year until the null hypothesis of no structural break between considered time periods cannot be rejected. Defining the indicator $I(\texttt{year} > 1995) = 1$ for each i and t, the idea is to carry out Wald tests with the null hypothesis of no structural break $H_0 : \delta_1 = \ldots = \delta_8 = 0$, where the δ parameters are those multiplying the indicator and the cross multiplication variables. They represent the parameter differences between those obtained for the second part of the sample and those of the first part, i.e. $\delta = \beta_{96,T} - \beta_{85,95}$.

The results of the described set of iterative Wald tests are presented in Table 6. 1999 is determined as the year when the structural break occurs since the null hypothesis cannot be rejected at the 90 per cent significance level, indicating that there is no statistical difference between the parameter values estimated for the period 1985–1995 and those estimated for the 1996–1998 period. The Wald test for structural break in 1999 can be carried out using the whole sample if substituting the indicator variable by $I(\texttt{year} > 1998) = 1$. Results are presented in Table 7 and confirm the solution obtained in the iterative manner.

Table 6: Wald tests results for structural break identification
$H_0 : \delta_1 = \ldots = \delta_K = 0$, no structural break

	N	**Groups**	$\chi^2(6)$	$P > \|z\|$
year < 2003	914	55	20.59	.002
year < 2002	859	55	19.86	.003
year < 2001	804	55	16.76	.010
year < 2000	749	55	14.56	.024
year < 1999	694	55	9.64	**.141**

Table 7: Structural break detection in year 1999 through the reduced model for the relative participation of foreign firms value added. Prais-Winsten estimation with AR(1) residuals, heteroskedastic and correlated panels

	Panel-corrected			
lnrvabcf	**Coef.**	**Std. Err.**	z	$P > \|z\|$
lnrimnperworker	.2716	.0417	6.51	.000
lnrsize	.9711	.0310	31.28	.000
lnroii	.0549	.0112	4.92	.000
lnrr1roan	1.4456	.1983	7.29	.000
lnpgrcntotal	.0843	.0692	1.22	.223
yd9902lnrimnpw	.1168	.0748	1.56	.118
yd9902lnrsize	-.1396	.0466	-3.00	.003
yd9902lnroii	.0572	.0286	2.00	.046
yd9902lnrr1roan	.3327	.2855	1.17	.244
yd9902lnpgrcntotal	.0263	.1072	.25	.806
yd9902	.0060	.0729	.08	.934
cons	-1.5491	.0635	-24.39	.000

ρ	.75357		
$N = 914$			
Groups = 55	Min.	Mean	Max.
Obs. per group	12	16.62	17
$R^2 = .661$			
Wald test $\beta = 0$	$\chi^2(11) = 1505.39$, Prob $> \chi^2 = .000$		
Wald test for structural break $\delta = 0$, $\chi^2(6) = 24.73$, Prob $> \chi^2 = .000$			

3.3 Distinguishing between investment and divestment periods in purely foreign social capital

This section tries to identify possible differences in the regressor elasticities induced by the nature of each considered time period in terms of investments or divestments in purely foreign social capital. The idea is to test wether investment determinants could significantly differ from those of divestment. Let a divestment indicator variable be $I(\nabla k_{it} < 0) = 1$, where k denotes social capital owned by non–residents in the sample of foreign firms, i.e. those firms whose foreign participation is of at least 10 per cent, and $\nabla = 1 - B$, B being the lag or backward operator. This indicator and its complementary, $1 - I(\nabla k_{it} < 0)$, are multiplied by each of the explanatory variables considered in the initial regression of Table 3. The relative participation of foreign firm value added is now explained by the whole group of these crossed or conditioned variables, a constant term, and a time period indicator variable $I(\texttt{year} > 1998)$ that accounts for mean difference in relative foreign firm value added between the two time periods detected by the structural break tests carried out in previous section. In an iterative manner, the explanatory variables with statistically insignificant parameters are taken out of the regression one by one, reestimating the reduced model each time. The derived model results are presented in Table 8.

Table 8: Distinguishing between purely foreign social capital investment and divestment periods. Prais-Winsten estimation with AR(1) residuals, heteroskedastic and correlated panels

	Panel-corrected			
lnrvabcf	**Coef.**	**Std. Err.**	z	$P > \|z\|$
divlnrimnperworker	.2877	.0449	6.41	.000
invlnrimnperworker	.3122	.0404	7.72	.000
divlnrsize	.9116	.0314	29.01	.000
invlnrsize	.9235	.0321	28.76	.000
invlnroii	.0551	.0108	5.09	.000
divlnroii	.0761	.0128	5.93	.000
invlnrr1roan	1.5804	.1597	9.9	.000
divlnrr1roan	1.5470	.2133	7.25	.000
divlnr1roantotal	-.5054	.1951	-2.59	.010
yd9902	-.1429	.0543	-2.63	.009
cons	-1.4809	.0634	-23.37	.000

ρ	.7531		
$N = 914$			
Groups = 55	Min.	Mean	Max.
Obs. per group	12	16.62	17
$R^2 = .6608$			
Wald test $\beta = 0$	$\chi^2(10) = 1212.84$, Prob $> \chi^2 = .000$		

Next step consists in determining whether the elasticities are statistically and significantly different in divestment and investment periods. The results are shown in Table 9. Only those associated to the intangible assets variable, `lnroii`, show statistically significant differences. The relative participation of foreign firms value added is notoriously more sensible to changes in the relative endowment of intangible assets along divestment periods, at least a 75 per cent more, at the 90 and 95 per cent significance levels as shown in Tables 9 and 11 respectively.

Table 9: Testing for slope effects, investment versus divestment periods in purely foreign social capital

Variable	H_0 :	$\chi^2(1)$	$P > \chi^2$
lnrimnperworker	$\beta_{inv} = \beta_{div}$	.45	.5041
lnrsize	$\beta_{inv} = \beta_{div}$	.30	0.5852
lnroii	$\beta_{inv} = \beta_{div}$	5.00	0.0254
lnrr1roan	$\beta_{inv} = \beta_{div}$	.04	0.8482
lnroii	$2.00\beta_{inv} = \beta_{div}$	4.72	0.0299
lnroii	$1.50\beta_{inv} = \beta_{div}$	.31	0.5783
lnroii	$1.75\beta_{inv} = \beta_{div}$	2.23	0.1353
lnroii	$1.80\beta_{inv} = \beta_{div}$	2.71	0.0995

If negative changes in the relative participation of foreign firms value added are interpreted as divestments in foreign capital, then those manufacturing and non manufacturing sectors whose foreign firms become less competitive in terms of intangible assets and in relation to their national counterparts, will be most affected by divestments.

Reducing Table 8 regression to the explanatory variables with statistically different parameters in investment and divestment periods we obtain a regression model whose results are given in Table 10. Comparison with the reduced model obtained just before testing for structural breaks, Table 5, is interesting. The proportional growth rate of whole sector turnover is not longer relevant in explaining the evolution of relative foreign firms value added. Instead, the whole sector ordinary profitability of net assets conditional on divestment in purely foreign social capital taking place, enters the regression with a negative elasticity.

The estimated parameter to capture mean changes in the relative participation of foreign firms value added at the economy level and between both time periods, i.e. (i) 1985–1998 and (ii) 1999–2002, shows a negative value, indicating that the weight of foreign firms value added has decreased 13.2 per cent $\left(e^{-.14} - 1\right)$, *cf.* Proposition 1. Whilst the first period shows an average relative participation in foreign value added of 23 per cent $\left(e^{-1.47}\right)$, in the final one the weight goes down to 19.9 per cent $\left(e^{-(1.47+.14)}\right)$.

The time series of residuals associated to this last regression model are represented in Figure 3. The negative tendency originally observed in Figure 1, is apparently corrected by the included time period indicator variable, `yd9902`.

Table 10: Distinguishing between purely foreign social capital investment and divestment periods. Reduced model. Prais-Winsten estimation with AR(1) residuals, heteroskedastic and correlated panels

	Panel-corrected			
lnrvabcf	**Coef.**	**Std. Err.**	z	$P > \|z\|$
lnrimnperworker	.3011	.0383	7.86	.000
lnrsize	.9173	.0301	30.51	.000
invlnroii	.0560	.0105	5.32	.000
divlnroii	.0762	.0126	6.05	.000
lnrr1roan	1.5608	.1609	9.70	.000
divlnr1roantotal	-.5958	.1312	-4.54	.000
yd9902	-.1416	.0542	-2.62	.009
cons	-1.4741	.0627	-23.50	.000

ρ	.75497		
$N = 914$			
Groups = 55	Min.	Mean	Max.
Obs. per group	12	16.62	17
$R^2 = .6606$			
Wald test $\beta = 0$	$\chi^2(7) = 1187.49$, Prob $> \chi^2 = .000$		

Table 11: Testing for slope effects in the regression of Table 10, investment versus divestment periods in purely foreign social capital

Variable	H_0 :	$\chi^2(1)$	$P > \chi^2$
lnrimnperworker	$\beta_{inv} = \beta_{div}$	5.39	.0202
lnroii	$2.00\beta_{inv} = \beta_{div}$	5.95	.0147
lnroii	$1.50\beta_{inv} = \beta_{div}$	.51	.4748
lnroii	$1.75\beta_{inv} = \beta_{div}$	2.97	.0848
lnroii	$1.80\beta_{inv} = \beta_{div}$	3.56	.0592

The residuals also seem to evolve in a much less disperse manner, with fewer and smaller outliers, associated to the auditing, consulting and social management sector in 1988, and the property sale sector in 1992.

3.4 The extent of divestments: a manufacturing and service sectors analysis

This section estimates the magnitude of identified divestment processes for each of the 55 manufacturing and non manufacturing sectors. Divestments are regarded as negative changes in the mean value for the relative participation of foreign firms value added. The methodology used here is exactly the same as in previous section, although extending the analysis to the industrial sector level simply by including industry sector indicator variables. The regression to be

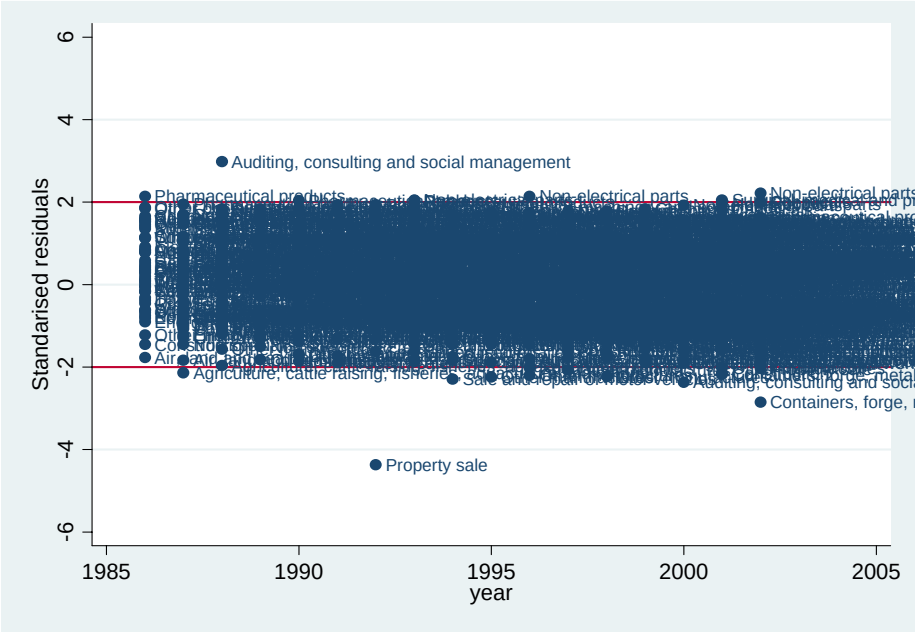

Figure 3: Time series of standarised residuals in final model

estimated is stated in expression (5),

$$\left.\begin{array}{l} y_{it} = \mathbf{z}_{it}\boldsymbol{\theta} + v_{it}\mathbf{z}_{it}\boldsymbol{\gamma} + \mathbf{x}_{it}\boldsymbol{\beta} + \epsilon_{it} \\ \epsilon_{it} = \mu + \rho\epsilon_{it-1} + \nu_{it} \end{array}\right\} \forall i \neq \{31, 50\} \tag{5}$$

where $\mathbf{z}_{it}$ is a 1×55 vector of sector indicator variables, v_{it} is the 1999–2002 time period indicator, and $.\boldsymbol{\theta}$, $\boldsymbol{\gamma}$, and $\boldsymbol{\beta}$ are the vectors of parameters to be estimated. The null hypothesis $H_0 : \gamma_i = 0$ is equivalent to $H_0 : \delta_{i,1999-2002} - \delta_{i,1985-1998} = 0$ in the regression $y_{it} = (1 - v_{it})\mathbf{z}_{it}\boldsymbol{\delta}_{1985-1998} + v_{it}\mathbf{z}_{it}\boldsymbol{\delta}_{1999-2002} + \mathbf{x}_{it}\boldsymbol{\beta} + \epsilon_{it}$, and implies that the average relative participation of foreign firms value added has not changed between the two considered time periods, as $\theta_i = \boldsymbol{\delta}_{i,1985-1998}$ and $\gamma_i = \boldsymbol{\delta}_{i,1999-2002} - \boldsymbol{\delta}_{i,1985-1998}$. Estimating the regression in (5) and testing the null hypothesis $H_0 : \gamma_i = 0$ of no statistically significant differences (at the 95 per cent significance level) in the average value of the relative participation of foreign firms value added between the two time periods, we can identify those manufacturing and service sectors in which foreign divestments have been more intense. The extent of these divestments are estimated applying Proposition 1 Results are shown in Tables 12 and 13 in the appendix.

Proposition 1 *The expression* $e^{\gamma_i} - 1$, γ_i *being any of the* γ *parameters estimated in regression* (5), *calculates the proportional variation in the relative*

participation of foreign firms value added in manufacturing or service sector i, observed between time periods 1985–1998 and 1999–2002.

Proof. $y_{it} \equiv \ln Y_{it}$
Let $y_{i,1985-1998} \equiv \ln Y_{i,1985-1998} \equiv \frac{1}{T_{1i}} \sum^{T_{1i}} \ln Y_{it}$ and
$y_{i,1999-2002} \equiv \ln Y_{i,1999-2002} \equiv \frac{1}{T_{2i}} \sum^{T_{2i}} \ln Y_{it}$
If $\gamma_i = E\left(y_{i,t\in\{1999,\ldots,2002\}} - y_{i,t\in\{1985,\ldots,1998\}} \middle| \beta_1 x_1 = \ldots = \beta_K x_K = 0\right)$
Then $\gamma_i \simeq \ln\left(\frac{Y_{i,1999-2002}}{Y_{i,1985-1998}}\right)$
$\Rightarrow e^{\gamma_i} - 1 \simeq \frac{Y_{i,1999-2002} - Y_{i,1985-1998}}{Y_{i,1985-1998}}$ ■

As it is the case in previous section, where a lower relative participation of foreign firms value added is observed along the period 1999–2002 for the whole economy, the results here show a similar scenario. Only 2 out of the 23 manufacturing and non manufacturing sectors presenting statistically significant differences show a higher relative participation of foreign firms value added along this second time period, (i) non specialised retailers and (ii) paint, varnish and ink. Divestment scenarios seem to be notorious across some of the traditional manufacturing sectors as (i) metal works and products, (ii) meat, tinned food, fats and oils, (iii) wood, pulp, paper and cardboard, (iv) glass and ceramics, (v) textile, and (vi) beverages and tobacco. Also some of the manufacturing sectors with medium technological demand and content, (i) soaps and beauty products, (ii) other chemical products, (iii) other machinery and mechanic equipment, and (iv) pharmaceutical products. Finally, along the technologically advanced sectors with high growth rates in consumer demand, we find the computing and electronic equipment sector. The remaining sectors appearing in Tables 12 and 13 correspond to service sectors. Thus estimated proportional variation are substantially higher when calculated for each of the individual sectors, attaining negative variations of almost 65 per cent, *cf.* Table 13.

4 Conclusions

This paper attempts to empirically model the participation of foreign firms value added in that of national firms. The residuals of the initial model estimated by fixed–effects show negative tendency, giving the first insight about the possible existence of two well differentiated periods in terms of foreign capital participation. The presence of serial correlation in residuals motivates the use of Prais-Winsten models, that estimate panel corrected standard errors robust to heteroskedasticity and contemporaneous correlation across panels.

The first results estimated in this manner show that the relative participation of foreign firms value added increases with the relative endowments of (i) capital per worker, (ii) average size, (iii) intangible assets or *know how*, and (iv) ordinary profitability. In terms of whole sector characteristics, only turnover proportional growth rate seems to have a statistically significant positive elasticity.

A structural break is detected in 1999. In terms of the intercept effect, an important reduction in foreign firms value added participation is observed along the period 1999–2002, a 13.2 per cent less than in the 1985–1998 period.

When trying to distinguish between investment and divestment determinants, we find that in most cases, regressors show the same elasticities. Only the relative endowment of intangible assets has a statistically and significantly different elasticity depending on the sign of the variation of foreign social capital. The intangible assets elasticity in divestment periods is substantially higher, and hence, those sectors whose foreign firms loose relative advantages in terms of *know how* will be bound to be affected by divestment scenarios, as their relative participation in terms of value added decreases more in divestment periods. In this occasion, turnover growth for whole sector is not longer relevant in explaining relative value added, instead, whole sector ordinary profitability conditioned on divestment in foreign social capital occurring enters the regression with a negative sign, indicating that divestments are positively related with whole sector profitability.

An important reduction in the relative participation of foreign firms value added is observed along some labour intense traditional manufacturing sectors such as wood, pulp, paper and cardboard, textile, and some food industries. Divestment nonetheless in technological advanced sectors such as computing and electronic equipment, and in pharmaceutical products, may result more worrying as the foreign capital dependence has been traditionally higher in these sectors of the Spanish production process.

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5 Appendix

Table 12: Manufacturing and service sectors with statistically significant differences in their relative participation of foreign firms value added between the 1985–1998 and the 1999–2002 period. 95 per cent significance level

Manufacturing and service sectors	γ	$\boldsymbol{\sigma}_\gamma$	$P > \|z\|$
Metal works and products	-1.0387	.1942	.000
Auditing, consulting and social management	-.9990	.4394	.023
Meat, tinned food, fats and oils	-.8092	.1730	.000
Catering and meal preparation	-.6977	.2186	.001
Other business services	-.6378	.3069	.038
Architect and engineering services	-.6038	.2314	.009
Construction	-.5916	.2004	.003
Hotel business	-.5624	.2312	.015
Wood, pulp, paper and cardboard	-.5493	.0872	.000
Travel agencies and related services	-.5224	.1719	.002
Sale and repair of motor vehicles	-.5123	.2217	.021
Wholesale trade of raw and food materials	-.4831	.1137	.000
Glass and ceramics	-.4752	.1181	.000
Soaps and beauty products	-.4371	.1908	.022
Computing and electronic equipment	-.4098	.1907	.032
Textile	-.3953	.1252	.002
Other chemical products	-.3455	.1103	.002
Beverages and tobacco	-.3420	.1294	.008
Other machinery and mechanic equipment	-.2761	.1352	.041
Pharmaceutical products	-.2551	.1239	.040
Wholesale trade of non food products	-.2131	.0901	.018
Non specialised retailers	.3814	.1180	.001
Paint, varnish and ink	.4754	.1168	.000

Table 13: Proportional variation in the relative participation of foreign firms value added between the 1985–1998 and the 1999–2002 period for those manufacturing and service sectors with statistically significant differences at the 95 per cent significance level

Sectors	$-1+e^{\gamma}$ %	$-1+e^{\gamma+2\sigma}$ %	$-1+e^{\gamma-2\sigma}$ %
Metal works and products	-64.61	-47.81	-76.00
Auditing, consulting and social manag.	-63.18	-11.32	-84.71
Meat, tinned food, fats and oils	-55.48	-37.07	-68.50
Catering and meal preparation	-50.23	-22.93	-67.85
Other business services	-47.16	-2.37	-71.40
Architect and engineering services	-45.33	-13.16	-65.58
Construction	-44.66	-17.38	-62.93
Hotel business	-43.02	-9.53	-64.11
Wood, pulp, paper and cardboard	-42.27	-31.27	-51.51
Travel agencies and related services	-40.69	-16.37	-57.94
Sale and repair of motor vehicles	-40.09	-6.66	-61.54
Wholesale trade of raw and food mat.	-38.32	-22.56	-50.86
Glass and ceramics	-37.82	-21.26	-50.90
Soaps and beauty products	-35.41	-5.41	-55.90
Computing and electronic equipment	-33.62	-2.81	-54.67
Textile	-32.65	-13.50	-47.57
Other chemical products	-29.21	-11.75	-43.22
Beverages and tobacco	-28.97	-7.99	-45.16
Other machinery and mechanic equip.	-24.13	-0.57	-42.11
Pharmaceutical products	-22.51	-0.72	-39.52
Wholesale trade of non food products	-19.19	-3.24	-32.51
Non specialised retailers	46.43	85.41	15.65
Paint, varnish and ink	60.86	103.20	27.34