Foreign Presence and Market Concentration: The Case of Portuguese Manufacturing Industries

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The impact of foreign direct investment (FDI) on host country market concentration has been a controversial issue, both at the theoretical and the empirical levels. Most existing empirical studies point to a positive relationship, enhancing the negative effects of FDI on competition conditions, but there are also studies that support the argument that FDI reinforces competition. In this paper we analyze the impact of FDI on market concentration considering the Portuguese manufacturing industries in the period 2006-2009. Using panel data estimation we found a significant negative impact of FDI on industry concentration, which is in line with the results of other studies for developed countries, and gives support to arguments that FDI has positive effects on domestic firms, eventually through positive externalities.

Key-words: Foreign Direct Investment, Market Concentration, Panel Data
JEL codes: F23, L11, L60, C23

1. Introduction

It is widely recognized that the presence of multinational firms has strong effects on host economies at several dimensions: investment, efficiency, supply diversification, human resources requirements, cross-country mobility of goods, capital and labor, effects on prices and wages, industry structure, and so on. In small countries with quite open economies, as it is the case of Portugal, these effects might assume a significant expression when the presence of foreign firms is large. While manufacturing firms with foreign shareholders represent approximately 14% of the total manufacturing firms operating in Portugal they were responsible for 33.6% of the total sales and 12.2% of total employment in 2009.[1] These numbers illustrate the importance of foreign direct investment (FDI) for Portugal. [2]

Globally in 2010 FDI inflows rose 5% and although this is a moderate growth rate that did not compensate the decline verified in the two previous years, the affiliates of transnational corporations still have a significant role in world economy, as is demonstrated by the fact the they accounted for more than 10% of global GDP and about one-third of world exports (UNCTAD, 2011).

The literature on FDI and market concentration reveals ambiguous results for the impact of foreign presence on the host country market concentration. On the one hand, FDI may boost competition, reducing concentration, due to the entry of foreign companies; on the other hand, it may reduce competition since the foreign companies tend to be large multinationals with great possibilities of monopolizing the market (Rutkowski, 2006).

Empirically, the results are also mixed: some studies found a positive relationship between FDI and market concentration (e.g. Lall, 1979; Blomström, 1986; Bourlakis, 1987; Willmore, 1989; Singh, 2011) while other studies obtained a negative relationship (e.g.

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[1] These values were calculated by the authors from the database SABI - Bureau van Dijk during November 2011, considering as foreign firms the ones where foreign shareholders' participation is at least 10%, a stake that permits a lasting interest in the management of that firm (following UNCTAD's (2007) definition of foreign firm or foreign affiliate). Although SABI does not have information about all Portuguese firms we consider that the manufacturing sector is well represented (for details on the SABI dataset see section 3.1).

[2] Usually FDI is defined as an investment involving a long-term relationship and carried out by an entity (individuals or business entities, called foreign direct investor or parent enterprise) in other entities resident in countries other than its home country (affiliate enterprise or foreign affiliate), involving an important equity stake in, or a significant degree of influence on the management of the enterprise resident in the other economy (UNCTAD, 2007).

Cho, 1990; Ghemawat and Kennedy, 1999; Driffield, 2001a; Driffield, 2001b; Rutkowski, 2006). Additionally other authors conclude that the presence of multinationals have both positive and negative effects on concentration (Backer and Sleuwaegen, 2003; Amess et al. 2005; Barrios et al., 2005) or do not have significant effects on industry concentration (Sathye, 2002).[3]

Given the lack of consensus regarding the effects of FDI in the host country market concentration, and the absence of studies of the Portuguese case, we consider it relevant to analyze the impact of FDI on domestic market concentration in Portuguese manufacturing industries. Using data from 89 manufacturing industries for a 4 years period (2006 to 2009), we intend to add empirical evidence to this controversial subject. With panel data estimation, and after controlling for other determinants of concentration (in particular, the level of entry barriers and market size and growth), we found evidence of a negative impact of FDI on industry concentration. Therefore, this work supports the arguments that enhance the positive effects of the foreign presence on domestic markets through, for instance, positive network effects. Moreover, our results contradict the disseminated view (Blomström, 1986) that in small economies FDI increases industry concentration due to the higher size and degree of technological sophistication of foreign firms compared to the domestic firms.

This paper is organized as follows. In Section 2 we present a review of the theoretical and empirical literature on the effects of FDI on host country market concentration. In Section 3 we describe the methods employed, with details on the econometric model, the proxy variables used, the data sources and the empirical results. Finally, the last section sets out the main results of the study, their limitations and future lines of research.

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[3] Although some of this evidence refers to the industry concentration rather than market concentration, it can be interpreted as indicating a correlation between the presence of foreign firms and seller concentration in host country markets (UNCTAD, 1997). In this work we use the terms industry concentration and market concentration indistinctly to refer the concentration level of the supply side of the market.

2. The impact of FDI on host country market concentration: literature review

The impact of FDI on the degree of market concentration in the host country is a controversial issue since there are effects acting in opposite directions (competitive and anti-competitive effects). Competitive effects arise from the fact that multinationals tend to enter into monopolistic industries with high barriers to entry for domestic companies (Blomström and Kokko, 1997; Driffield, 2001a; Driffield, 2001b). Multinational firms may have a higher ability than strictly domestic firms to overcome some of the cost-related barriers to entry in the host country that limit the number of firms in some industries, since multinational firms have ownership-specific advantages or proprietary assets, such as technological, organizational or marketing knowledge, and/or brand names (UNCTAD, 1997; OCDE, 2002). Also, when multinational firms enter in the host country through greenfield investments (investment in new production facilities), at least in the short run, there is an increase in the number of firms operating in the industry, promoting competition.[4] The long run effects however greatly depend on the reaction of domestic firms (Haller, 2009). When domestic firms have technological, financial and organizational capabilities to sustain or even increase their market position and to interact with multinational firms benefiting from positive spillover effects, it is possible not to observe an increase in market concentration. On the contrary, if the multinationals entry constraints domestic firms strategies then an increase in market concentration due to crowding out effects might be observed.

The relation between the type of FDI impact on industry concentration and the host country firms' features lead some authors to explore the argument that FDI decreases industry concentration in developed countries while in developing countries is found the opposite result (Blomström, 1986; Amess and Roberts, 2005). According to OCDE (2002), it seems more likely that the foreign presence increases the host-country concentration in developing countries than in developed countries.

Anti-competitive effects can also arise since foreign companies tend to be larger than domestic firms, benefiting from international integration and scale economies

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[4] FDI enters through a merger or acquisition tend to leave the number of producers of a product unchanged (UNCTAD, 1997).

(Blomström and Kokko, 1997; Rutkowski, 2006). Frequently foreign firms possess advanced technology and knowledge that allows them to produce at lower costs displacing domestic firms. In these cases some authors (Singh, 2011) advocate competition policy rules to mitigate the undesirable outcomes.

Furthermore the empirical literature also shows contradictory results. There is a strand of works that conclude that the presence of multinationals increases market concentration (Lall, 1979; Blömstrom, 1986; Bourkakis, 1987; Willmore, 1989; Yun and Lee, 2001, Singh, 2011), while another set of studies have obtained a negative relationship (e.g. Cho, 1990; Ghemawat and Kennedy, 1999; Driffield, 2001a; Driffield, 2001b; Rutkowski, 2006). Moreover other authors have obtained both positive and negative effects on concentration (Backer and Sleuwaegen, 2003; Amess et al. 2005; Barrios et al., 2005) while Sathye (2002) concludes that foreign presence do not have significant effects on industry concentration.

Regarding the studies that have found a positive relationship between foreign presence and industry concentration, all of the quoted authors analyze manufacturing industries in one country (Malaysia, Mexico, Greece, Brazil, Korea, India, respectively) using data for almost four decades (the oldest studies use data for the 1970s and the recent ones use data for 2000s). All these authors use the n-firm concentration ratio (CRn, $n=3$ or 4)[5] as a measure of market concentration, and the foreign share of employment, sales or output in each industry as a proxy for the foreign presence, except Yun and Lee (2001) who use the ratio of Cumulative FDI to Fixed Assets as proxy for foreign presence. After controlling for other determinants of concentration such as capital intensity, advertising intensity, market size, economies of scale, among others, results obtained from ordinary least squares regression analysis (except Singh's study who used pooled and panel regression models) suggest that there is positive and significant impact of foreign presence on industrial concentration, which means that the foreign presence has enhanced the levels of concentration in the manufacturing sectors analyzed. The authors consider that the main drivers of this relationship is due to the fact that multinationals tend to belong to capital intensive sectors and foreign presence cause an increase in barriers to entry.

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[5] The concentration ratio CRn is the proportion of industry's output (Willmore, 1989; Singh, 2011), employment (Lall, 1979; Blomström, 1986), assets (Bourlakis, 1987) or sales (Yun and Lee, 2001) accounted for the n largest firms.

According to Lall (1979), the effect of foreign presence on market concentration is exercised mainly through introducing new processes and products and raising the capital intensity of production. Likewise Bourlakis (1987) considers that the foreign presence affects the level of concentration since multinational firms tend to belong to capital intensive sectors. Additionally multinational firms tend to capture a large amount of funds from the banking system, deterring the entry of new firms and raising further the entry barriers.

For Blomström (1986) foreign presence is an independent source of concentration due to two main reasons: the multinationals' firm-specific advantages increase the level of entry barriers for local firms, and the multinationals may use predatory conduct. This idea is also shared by Singh (2011) who explains the positive impact of FDI on industry concentration by the incapacity of domestic firms to build and maintain the necessary capabilities to compete with foreign firms. In the absence of a local competitive base that allows local firms to learn from multinationals, these multinational companies increase their market power (promoting concentration) by using anti-competitive methods (e.g. predatory conduct). As stated by Willmore (1989), foreign presence increases concentration in Brazilian industries for two main reasons: "by reducing suboptimal capacity and by reducing the rate of entry of firms at efficient scale".

Alongside there is another set of empirical literature that reaches opposite results concluding that FDI has a negative effect on market concentration (Cho, 1990; Ghemawat and Kennedy, 1999; Driffield, 2001a; Driffield, 2001b; Rutkowski, 2006). Like the previous strand of research each paper studies the relation between FDI and market concentration in one country, respectively, Indonesia, Poland, United Kingdom for both papers of Driffield. Only Rutkowski (2006) made a cross-country analysis considering 13 Central and East European countries. All works previously mentioned analyze manufacturing industries with the exception of Cho (1990) who studies the commercial banking industry.

According to Driffield (2001a, 2001b), the negative effect obtained is consistent with the argument that multinational firms, attracted by high potential profits, enter in industries where domestic entry is difficult. Due to their technological and organizational advantages, foreign firms reduce the market share of host-country firms. With data from the

UK and using a model of concentration change Driffield (2001b) found evidence to support the argument that FDI may overcome barriers to entry, as he concluded that FDI reduces concentration and also decreases the speed up rate at which concentration is reduced. Additionally, Driffield (2001b) shows that these effects are stronger in industries with high levels of concentration, advertising intensity and R&D intensity.

Cho (1990), Ghemawat and Kennedy (1999) and Rutkowski (2006) followed a more traditional approach analyzing industry concentration levels and not industry concentration change as Driffield (2001a, 2001b) did. Both Ghemawat and Kennedy (1999) and Rutkowski (2006) study East European countries in the period after their liberalization (1990s) and conclude that FDI highly contributes to the reduction of industry concentration. It is important, however, to take into account that all the countries considered were departing from a situation of high industry concentration. Indeed, most of manufacturing industries were state monopolies before liberalization and the decrease in concentration levels is due to economic and institutional factors, including the openness to FDI. Both empirical studies, after controlling for the effect of other determinants of industry concentration, conclude that the impact of FDI was quite significant and contributed to the reduction in industry concentration. Although not directly tested, the explanation advanced by the authors is based essentially on the positive externalities of foreign firms that stimulate the entry of domestic private firms which also benefit from positive spillovers. These effects overcome the anti-competitive effects of FDI. Contrary to the previously mentioned authors Cho (1989) does not study manufacturing industries but instead investigates the relationship between FDI and industry concentration of the banking industry. Using the standard independent variables Cho (1987) concludes that FDI is negatively related with industry concentration, advancing as a possible explanation, the positive effects on efficiency.

There is another empirical research set which concludes that the presence of multinationals has both positive and negative effects on concentration (Backer and Sleuwaege, 2003; Barrios et al., 2005; Amess and Roberts, 2005) or do not have significant effects on it (Sathye, 2002).

Backer and Sleuwaegen (2003) and Barrios et al. (2005) analyze the impact of FDI on domestic firms' entry and exit, which is not quite the same as industry concentration, but

their conclusions give us important insights to the main tendencies of industry concentration. Using net entry rate of domestic plants as a dependent variable, the authors conclude (Backer and Sleuwaegen (2003) for Belgian firms and Barrios et al. (2005) for the Ireland case) that the relationship between foreign presence and the number of domestic firms follows a U-shaped curve. In the short run, the competition effect dominates and foreign direct investment discourages entry and stimulates the exit of domestic firms. In the long-run, however, this crowding out effect may be moderated or even reversed due to positive externalities of FDI on domestic firms as a result of learning, demonstration, networking and linkage effects between multinationals and domestic firms.

Amess and Roberts (2005) also found a U-shaped form for the relationship between foreign presence and industrial concentration in manufacturing industries in Poland during 1989-1993. Their conclusions give support to the theoretical arguments presented by Backer and Sleuwaegen (2003) and Barrios et al. (2005).

Finally, Sathye (2002) analyzing the impact of the presence of foreign banks on Indian banking market concentration concluded that the entry of foreign banks did not have a significant impact on reducing the level of concentration. According to the author this may be explained by the maintenance of many legal restrictions on foreign bank activities in India that prevents any strong linkages between foreign and local banks.

Summarizing, existing empirical studies of the relationship between the presence of multinationals and the level of industry concentration have presented ambiguous results. In this way, our work, covering a large number of industries, and focusing on a country that, to our best knowledge, has not yet been studied, may allow us to add empirical evidence to this controversial subject.

3. The model

3.1 Data

In order to test if foreign presence influences the level of concentration in Portuguese manufacturing industries we use panel data estimation (89 sectors defined at 3 digit level for the period 2006-2009).[6]

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[6] The sectors' names follow the statistical classification of economic activity in the European Community, Rev. 2 (2008).

In 2009 there were 74,234 firms in the Portuguese manufacturing sector that employed 718,507 workers and had aggregate sales of 69,473 million Euro (INE, 2009). Our sample was obtained from the SABI database. It includes information about 32,292 firms (43% of the total) that employed 562,296 workers (78% of the total) and had aggregate sales of 61,092 million Euro (87% of the total). Therefore, we consider that our sample represents quite well Portuguese manufacturing activity. In 2009, the sample contains 455 foreign firms (at least 10% of the capital belongs to foreign shareholders), which employed 68,383 workers and had 20,497 million Euro of aggregate sales.

From SABI we extract data for the period 2006-2009 on sales, number of employees, fixed assets, R&D expenditures, advertising expenditures, number of foreign firms, foreign firm's sales and foreign firm's number of employees. In order to obtain concentration ratios and other industry level-characteristics we aggregate individual firm-level data for a given industry. In this period the Portuguese manufacturing sectors globally registered a small activity increase with the exception of the year 2009. In 2009 most sectors had a strong activity decrease regarding the majority of economic indicators. From 89 sectors analyzed only 15 did not register a sales decrease in 2009. Table 1 displays the aggregate growth rates of sales.

Table 1 - Aggregate growth rates of sales (in %)

	2006	2007	2008	2009
Total sales	7.3	4.9	3.9	-18.2
Foreign firm' sales	10.8	4.2	6.1	-26

Source: Authors own calculations.

The most penalized sectors were Electronic Components, Communication Equipment and Building of Ships and Boats with sales growth rates in 2009 of -63,3%, -74,4% and -44,4%, respectively. Nevertheless, in 2009 there were few expanding sectors as Electromedical and Electrotherapeutic Equipment and Railway Equipment.

Having as reference the 2009 sales the major sector is Refined Petroleum Products (sales: 6,548 million Euro) followed by Beverages (sales: 2,485 million Euro) and Wearing (sales: 2,212 million Euro). The smallest sectors are Articles of Fur (sales 2 million Euro) and Musical Instruments (sales 3 million Euro).

3.2 Variables

The industry concentration is quantified by the four-firm concentration ratio (CR4) defined as the total sales share of the four largest firms in the industry. Industry concentration is explained by foreign presence in each sector (our central independent variable) and several other relevant industry features essentially the level of entry barriers and the market size and growth. The proxies used for the independent variables and expected effect are summarized in Table 2.

Table 2: Summary of independent variables and their proxies

Variable	Proxy	Expected effect on concentration
Foreign presence (FP)	Foreign firms sales divided by total sales of the industry	Positive/negative
Economies of scale (SE)	Average sales of the largest firms responsible for 50% of total sales of the sector divided by the total sales of the sector	Positive
Capital intensity (CAP_INT)	Capital/employment	Positive
Advertising intensity (ADV_INT)	Advertising expenditures/sales	Positive
R&D intensity (R_D)	R & D expenditures/sales	Positive
Market growth (MG)	Market sales growth rate	Negative/positive
Market size (MS)	Total sales of the industry	Negative

Like Ghemawat and Kennedy (1999), Driffield (2001a) and Singh (2011) the presence of foreign firms is calculated as the sales share of foreign firms on total sales of the industry and the expected signal for the Portuguese case is our central research question.

To quantify the entry barriers we consider the importance of scale economies, the industry capital intensity, the level of R&D expenditures and the advertising intensity in the industry. For these variables we expect a positive impact on industry concentration, in line with the conclusions of the industry concentration literature (Caves and Porter, 1980; Curry and George, 1983; Sutton, 1991).

In order to successfully enter in industries with strong economies of scale new firms are required to offer large output to benefit from scale economies and not face cost disadvantage regarding large incumbent firms. Therefore, for a given market size, an

increase in industry concentration is expected after an increase in scale economies. Scale economies is quantified by the average sales of the largest firms responsible for 50% of total sales of the sector divided by the total sales of the sector, similarly to Lall (1979) and Amess and Roberts (2005). The intensity of capital derives essentially from technological features. As new firms typically have more difficulties to raise large amounts of capital we assume a positive impact on industry concentration. Capital intensity is defined as the capital/employment ratio (Lall, 1979; Bourlakis, 1987; Yun and Lee, 2001; Backer and Sleuwaegen, 2003; Singh, 2011). According to Sutton (1991), R&D and advertising expenditures are endogenous sunk costs that may be used as strategic barriers to entry. Commonly, sectors with high R&D expenditures are technological, sophisticated and innovative. Hence, to successfully enter new firms are required to achieve also high standards regarding innovative activities which demands large investments. Likewise in industries with high marketing expenditures, new firms must make comparable efforts on their visibility and market popularity in order to attract new customers and compete with the incumbent firms. R&D intensity is quantified by the ratio between total expenditures on R&D and total sales by industry (Ghemawat and Kennedy, 1999; Singh, 2011), and advertising intensity is measured by the ratio between total expenditures on advertising and total sales by industry (Lall, 1979; Willmore, 1989; Ghemawat and Kennedy, 1999; Yun and Lee, 2011; Singh, 2011).

For market size and market growth we expect a negative impact on industry concentration as, ceteris paribus, the largest industries and growing industries accommodate more firms. Regarding the market growth some authors (Singh, 2011) argue that it is possible to find the opposite effect when the largest firms' growth is more intense than the industry growth leading to an increase in industry concentration. Therefore, concerning the signal of the market growth coefficient our expectation is more flexible. Industry size is quantified with total sales of the industry (Bourlakis, 1987; Amess and Roberts, 2005) and sector growth is also evaluated by total sales of the industry (Bourlakis, 1987; Willmore, 1989 confirmar; Backer and Sleuwaegen, 2003; Singh, 2011).

The descriptive analysis of the model's variables for 2009 is presented at Table 3.

Table 3 - Descriptive statistics for 2009

Variable	Mean	Standard deviation	Maximum value	Minimum value
CR4	0.54	0.301	1.00	0.08
FP	0.24	0.287	1.00	0.00
SE	0.25	0.287	1.00	0.00
CAP_INT	55.01	85.065	646.23	1.95
ADV_INT	0.03	0.028	0.18	0.00
R_D	0.00	0.013	0.11	0.00
MG	-0.09	0.436	3.47	-0.74
MS (in million Euro)	686	875	6,548	2

Source: Authors own calculations.

From Table 3 we conclude that there is a considerable variability across sectors. The most concentrated sectors, with only one firm, are Tobacco, Refined Petroleum Products, Pesticides and Other Agrochemical Products, Basic Iron and Steel and Railway Equipment. The less concentrated sectors, with CR4 lower than 10%, are Wearing, Metal Products and Furniture.

Concerning foreign presence Refined Petroleum, Basic Iron and Steel, Railway Equipment, Motor Vehicles and Optical Instruments and Photographic Equipment have exclusively foreign ownership. In opposition there are 16 sectors without any foreign shareholders namely Weaving, Sawmilling and Planning of Wood, Manufacture of Machinery and Equipment.

The sector with the highest economies of scale proxy is Refined Petroleum Products and with the lower value is Wearing. Alongside the sectors with the highest capital intensity (capital per worker) are also the biggest ones, Refined Petroleum Products (646 thousand euro) and Paper (448 thousand euro) and the less capital intensity are and Spacecraft (1.95 thousand euro) and Articles of Fur (2.19 thousand euro).

Regarding Advertising and R&D Intensity there are a significant number of sectors that have very low values for these proxies. Refined Petroleum Products has for the indicator Advertising Intensity a zero value, also 58% of the sectors have values lower than 2% and only three sectors have more than 10%. The sector with higher Advertising

Intensity is Special-Purpose Machinery followed by Reproduction of Recorded Media and Musical Instruments.

A similar pattern is found for R&D Intensity: four sectors have zero value for the corresponding proxy, 89% of the sectors have values lower than 1%. Only one sector, Pharmaceutical Preparations, has R&D Intensity higher than 10%.

3.3 Econometric estimation

Consider the following static linear model of concentration ratio determination:

$$CR4_{it} = \alpha + \beta_1 FP_{it} + \beta_2 SE_{it} + \beta_3 \log(CAP\_INT)_{it} + \beta_4 ADV\_INT_{it} + \beta_5 R\_D_{it} + \beta_6 \log(MS)_{it} + \beta_7 MG_{it} + \epsilon_{it} \qquad (1)$$

where ϵ_{it} refers to the disturbance term for the i-th individual (sector) at time (year) t.

Using a balanced panel data set with 356 observations we start by estimating a pooled regression model by OLS. Column (1), in Table 4, displays the results of this estimation. Four of the seven explanatory variables of the model (foreign presence, economies of scale, capital intensity and industry size) emerge as statistically significant variables. It is possible, however, that a great number of factors that affect the concentration ratio (like those related to the level of industry protection, the price cost margin, as well as other sector specificities) are not included in the right-hand-side of the equation (1). These missing or unobserved variables can be assumed to express the individual (sector) heterogeneity, while remaining constant over time. Additionally, according to Wooldridge (2001), with large number of individuals and small number of periods (as is our case) it is a good idea to allow for separate intercepts for each time period, allowing for aggregate time effects that have the same influence on $CR4_{it}$ for all I (such as macroeconomic factors). A common formulation of such a model can be written as:

$$CR4_{it} = \beta_1 FP_{it} + \beta_2 SE_{it} + \beta_3 \log(CAP\_INT)_{it} + \beta_4 ADV\_INT_{it} + \beta_5 R\_D_{it} + \beta_6 \log(MS)_{it} + \beta_7 MG_{it} + \epsilon_{it} \qquad (2)$$

where $\epsilon_{it} = \alpha_i + \theta_t + u_{it}$ with α_i being the unknown individual effects to be estimated for each unit (sector) i, θ_t represent different time intercepts and the u_{it} refers to the idiosyncratic

disturbance term.[7] In this way, we have estimated a model with both cross and time fixed effects.[8] The results are represented in column (2) of Table 4.

Table 4 – Panel estimation results (Dependent variable CR4)[9]

Independent Variable	(1) Pooled OLS	(2) Cross and time fixed effects
FP	0.137***	-0.118***
	(6.390)	(-3.605)
SE	0.715***	0.177***
	(51.111)	(57.860)
Log(CAP_INT)	0.093***	0.014**
	(19.590)	(2.118)
ADV_INT	-0.153	0.272
	(-0.988)	(1.188)
R_D	-0.068	-0.273
	(-0.249)	(-1.019)
MG	0.022	-0.010
	(0.845)	(-1.373)
Log(MS)	-0.068***	0.070***
	(-24.436)	(4.189)
R²	0.843	0.993
Adjusted R2	0.840	0.990
F-statistic	266.792	376.169

Notes: (1) ***, ** and * indicate 1, 5 and 10 percentage significant levels, respectively; (2) t-statistic in parentheses using White cross-section's heteroscedasticity correction.

Overall, our results suggest that on average, and after controlling for all other variables, foreign presence has a negative impact on industry concentration. The negative and statistically significant sign on the estimated coefficient imply that industries with higher sales share of foreign firms have a lower concentration ratio. This result is in line with other studies (e.g. Cho, 1990; Ghemawat and Kennedy, 1999; Driffield, 2001a; Driffield, 2001b; Rutkowski, 2006) that have also found a negative relationship between

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[7] By testing the joint significance of fixed effects estimates (cross-section effects and period effects), the two statistic values obtained (Cross-section/Period F of 61.25 and Cross-section/Period Chi-Squared of 1111.37) and the associate *p*-values strongly reject the null hypothesis that cross-section and period effects are redundant.

[8] We appealed to a Hausman test in order to check whether the specified model can be estimated under fixed effects or random effects. The result, in terms of the Chi-Squared statistic (261.953) suggests that the fixed effect model is more appropriate (we reject the null hypothesis that there is no misspecification). Moreover, a fixed effects approach makes also sense since the 89 sectors considered are a full partition of all manufacturing sectors.

[9] To estimate the model we have used the Eviews software.

the presence of multinationals and industrial concentration. According to the literature, this negative relationship may indicate that local firms have the capacity to compete with foreign firms, eventually taking advantage from linkages with foreign firms.

With respect to the remaining independent variables of the model, also economies of scale, capital intensity and industry size emerge as statistically significant variables.

As expected, economies of scale show a positive and significant coefficient, which means that industries with higher economies of scale, on average, tend to have a higher concentration ratio, as advocated by industry concentration literature (Caves and Porter,1980; Curry and George, 1983; Sutton, 1991) and corroborated by Lall (1979), Blomström (1986) or Amess and Roberts (2005). The same occurs with the capital intensity variable, another indicator of barriers to entry. The positive and statistically significant coefficient for this variable implies that industries with a higher capital/employment ratio, on average, tend to present a higher concentration ratio. Similar results have been found in early studies (e.g. Lall, 1979; Driffield, 2001a; Yun and Lee, 2001).

Finally, regarding the industry size variable measured by total industry sales, although statistically significant the result was the opposite of that expected. In fact, we would expect that the larger the size of the market, the greater the number of efficient producers and the lower the concentration ratio (Bourlakis, 1987). The positive and statistically significant coefficient obtained in our model implies that larger industries, on average, tend to present a higher concentration ratio. However, Curry and George (1983) point out that, in international comparisons of concentration levels there is not much evidence of an inverse relationship between concentration ratio and the size of the industry. Quoting George and Ward (1975), Curry and George (1983) report that in the 1960s the UK market was more concentrated than that of West Germany, France and Italy, while it was hardly smaller than that of Germany and bigger than that of France or Italy. According to the authors, one possible explanation may be the fact that the post-war growth of the UK market has been much slower than in Germany and France, encouraging a higher level of merger activity and reducing the opportunities for new entry, and consequently contributing to a higher level of concentration. This explanation can also be applied to our analysis since in the period 2006-2009 there was an overall decline in economic activity, with reductions in the growth sales rate, as shown in Table 1.

The results in this section show that when explaining the concentration ratio there is significant sector specific effects to be considered. Additionally, the inclusion of such specificities, by eliminating the other coefficients of their effect, apparently changes the impact of foreign presence in the industry concentration ratio.

4. Conclusions and future research

Both the theoretical and the empirical literature of the impact of FDI on industry concentration reach controversial results. While some studies concluded that the FDI increases industry concentration others found the opposite result. Using a panel with 89 sectors, comprising 32,288 firms, for the period 2006-2009 we test with a model with fixed effects the direction of this relation for Portuguese manufacturing industries.

Our results indicate that, on average and after controlling for other variables capable of influencing industry concentration, foreign presence tends to reduce industry concentration. Economies of scale, capital intensity and industry size also emerge as statistically significant variables in explaining industry concentration although in the case of industry size we obtained a positive effect contrary to what one would expect. As a possible explanation for this unexpected result we considered the fact that in the period analyzed there was an overall decline in economic activity, with reductions in the growth sales rate, which may have encouraged merger activity and discouraged the entry of new firms, both factors contributing to a higher degree of concentration. In this way, future research should test this explanation.

For future research it is also important to investigate the reasons for the negative impact of FDI on industry concentration in the Portuguese manufacturing sectors. The literature advances explanations based on the positive network effects on domestic firms and on the contribution of FDI to remove entry barriers. It is important to evaluate the relevance of these explanations for the Portuguese case or eventually find other significant reasons because these results could be very useful to the government in defining its policy towards FDI.

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