Does Foreign Investment Facilitate Exports? Evidence from Venezuelan Manufacturing*

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February 2006

Abstract

Export-led industrial expansion has proven greatly beneficial in driving productivity growth in less developed countries. This study seeks to contribute to understanding the determinants of exporting behavior of Venezuelan manufacturers. There are fixed costs faced by producers intending to penetrate foreign markets. A substantial share of such costs is of an informational nature. Thus, there is a potential role of multinational corporations (MNCs) in promoting exports. The activities of MNC subsidiaries can convey valuable information about foreign market opportunities. Export knowhow may diffuse through a demonstration effect when domestic manufactures learn about market niche development, distribution channels, product standards and customization of their particular product. In the econometric analysis, we assess whether MNC subsidiaries stimulate exports at both the extensive and intensive margins. The specification allows for export knowhow diffusion to be both vertical, across sectors via supply chains, and horizontal, within sectors. We also explore the export promotion effect of better input availability induced potentially by both MNC demand and supply. The analysis was conducted using a panel data set constructed for the period 1995 – 2001 from the Annual Venezuelan Manufacturing Survey. The data permit estimation of the production function and exploration of the determinants of export behavior in relation to the sectoral distribution of foreign direct investment.

Keywords: Export knowhow; Learning; Vertical and horizontal information diffusion; MNC input demand and pecuniary externalities.

JEL Classification: F10, F14, F23, O19, O47.

*I thank Corporación Andina de Fomento for funding this research and Instituto Nacional de Estadística de Venezuela for providing access to their Annual Industrial Survey. Also, I would like to thank Facundo Albornoz, Pol Antras, Jon Eaton, German Rios, Stefania Scandizzo and T.N. Srinivasan for comments.

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1 Introduction

Export oriented growth is one of the cornerstones of economic development. Recent reforms in Latin America have been geared to enhance factor reallocation towards export diversification and productivity improvement. It is important to assess the extent to which export activity is expanding and what policies could accelerate such expansion. In particular, analysis of export behavior among Venezuelan manufacturers will be used to draw lessons about foreign market penetration. Studying Venezuelan manufacturing provides an opportunity to assess whether natural resources are a stumbling block to a growth strategy based on export diversification and higher productivity. The importance of oil extraction has often been identified as an obstacle for the development of domestic manufacturing exports as factors are specialized in that activity. However, manufacturing could be stimulated through linkages along the production chain. In particular, if producers upstream emerge to supply intermediate inputs that are outsourced by multinational subsidiaries, offshoring may be stimulated whereby domestic firms provide intermediate inputs and services to foreign producers. One important aspect of the analysis concerns the regional pattern of industry location. Clusters can be a central feature of export diversification in Latin America.

An open question is whether regional concentration with sectoral specialization or diversification generates export growth. While specialization can lead to knowledge spillovers, variety facilitates linkages along the production chain and enhances efficiency. Hence, the optimal sectoral composition of export clusters balances the trade off between technology spillovers and intermediate input variety. In this sense, the link of multinational corporation (MNC) subsidiaries to local plants along the supply chain is fundamental. For example, if MNC subsidiaries outsource some inputs locally, the input suppliers may benefit from offshoring opportunities as a result. At the same time, the availability of better local inputs, due to foreign direct investment (FDI) upstream spillovers, may provide the productivity edge to host-country producers to allow them to become exporters. The impact of MNC presence may also direct through a within industry demonstration effect, as long a domestic producers are not a potential threat to compete in the same export markets as MNCs. Hence, if the local producers are not in the MNCs' competitive fringe, export knowhow horizontal spillovers may be observed. Plant level data is suited to explore in detail the influence of foreign direct investment on the dynamic pattern whereby firms decide whether to enter export markets or not. To the extent to which the sunk costs blocking the emergence of new exporters are informational, the presence of MNCs can provide learning opportunities to lower the costs for host-country producers to enter foreign markets. FDI may affect not only the extensive margin of exports but also the intensive margin if existing exporters learn about new market opportunities though the presence of MNCs.

The characteristics of manufacturers associated with lower costs to enter export

markets can be examined (e.g. location relative to other producers, sectoral technology, proximity to transportation infrastructure, linkages with MNCs, etc.). The production function methodology of Olley and Pakes (1996) to measure productivity used by Blyde, Kugler and Stein (2004) shows that in Venezuelan manufacturing firms with foreign ownership, and firms that export, are significantly more productive. We exploit the rich set of firm characteristics available in the database to explore the sources of export firms' greater productivity. It is in aiming for export markets that firms make decisions that raise productivity. It is not simply that more-productive firms self select into exporting; rather, firms that explicitly target export markets consistently make different decisions regarding investment, training, technology and the selection of inputs, and thus raise their productivity. At the margin, FDI can be catalyst to exports both by extending the set of plants which are able to meet the costs of entering foreign markets and by intensifying market growth opportunities for existing exporters. An open question is whether openness, and specifically exporting, leads to higher productivity growth (Rodrick and Rodriguez, 2001) or employment growth (Haltiwanger et al., 2004).

In one of the most widely cited papers on FDI spillovers, Aitken, Hanson and Harrison (1997) report plant-level evidence that, by and large, shows absence of intra-industry spillovers in Venezuelan manufacturing. This result is to be expected from the point of view of the MNCs optimal market penetration strategy. In particular, horizontal FDI spillovers are more likely to generate profit losses to MNCs than vertical FDI spillovers, especially if the subsidiary supplies the domestic market. Other things equal, FDI deployed to supply the host country are more likely to locations in which horizontal spillovers do not occur. Yet, the authors of that paper conclude absence of positive FDI spillovers in Venezuela without considering the role of exports.

Now, intra-industry FDI spillovers may indeed occur if they do not induce profit loses to MNCs. Specifically, if the MNC uses the host country as an export platform, horizontal FDI spillovers may occur. Also, vertical FDI spillovers may be expected as the MNC may find it advantageous to share technical information with upstream suppliers and downstream clients. The analysis by Blyde, Kugler and Stein (2004) complements Aitken and Harrison's findings by allowing for FDI to impact upon domestic productivity differently depending on whether it takes place in upstream sectors, whether the subsidiaries of the MNCs investing in the host country are export oriented, and on the size of the domestic firms that are potential recipients of FDI spillovers. This last dimension is meant to capture the fact that large producers are most likely to have the absorptive capacity to adopt new technologies. Only large plants in Venezuelan manufacturing are recipients of positive spillovers from FDI in upstream sectors and, to a lesser extent, in the same sector. Furthermore, only FDI by export-oriented MNCs generates spillovers, whether between or within sectors. For large domestic plants, the evidence is consistent with MNC entry yielding diffusion of generic knowhow about exporting and vertical FDI spillovers upstream but not

downstream.

In this paper we investigate empirically whether FDI in a developing country generates better export opportunities for local producers. Initial measurements of spillovers with panel data have yielded limited evidence of improvements in domestic productivity ensuing FDI partly because only intra-industry spillovers were considered, without allowance for inter-industry diffusion. Since MNC's locate their subsidiaries to avoid rent erosion due to local competition, other things equal, the MNC's deployment of subsidiaries via FDI is designed to minimize the risk of propagation of specific technical knowledge to potential competitors. In particular, for strategic reasons, intra-industry knowledge spillovers to host-country firms from MNCs' manufacturing activities, and from subsidiaries competing for local markets, are unlikely. Furthermore, evidence about spillovers from industrial R&D, as well as urban economics studies, reveals technology diffusion more between than within industries.

The paper is organized as follows. After this introduction, Section 2 reviews and discusses the related literature. The theoretical and empirical research on plant export activity is surveyed. With regard to the potential role of MNCs in promoting host-country exports, a synthesis of the implications of the literature is provided. In Section 3, the estimation framework and the background facts are provided with data description. Then, Section 4 contains the evidence that characterizes the impact of FDI on domestic exports. Finally, Section 5 offers concluding remarks.

2 Related Literature

This section starts with a review of the theoretical literature on export activity and the implications for the impact of FDI on the host country producers. The general presumption about the effect of FDI on domestic manufacturing exports that emerges from these models is that MNCs may facilitate exports by lowering sunk information costs of penetrating new markets. After reviewing the theoretical literature, a synthesis is provided of evidence from plant panel data. The discussion of the econometric evidence documents that the impact of MNCs on input availability has not featured prominently in previous research on the impact of FDI on domestic manufacturing in general, and exports in particular, in the host country.

2.1 Theoretical Background

As there are sunk costs to enter new markets, plants need to attain a threshold productivity to generate enough profits to cover entry costs. Theoretical underpinnings of this selection process have been provided in the models of *inter alia* Baldwin and Krugman (1989), Dixit (1989), Clerides, Lach and Tybout (1998), and Melitz (2003). The key point is that exporting involves fixed costs associated with covering new markets and, in order to cover those fixed costs, productivity has to be higher to enable the firm to enter. Thus, more productive firms self-select into export markets.

Once there, learning effects or procompetition effects might lead them to become even more productive. Clerides et al. (1998) assess whether exporters are more productive due to self-selection as only most efficient producers can compete in global markets or due to learning through integration into international business networks.

If domestic firms acquire information about export markets due to FDI, we may observe an extensive margin response via entry to export markets or an rise in export intensity of existing exporters.

Also, there are models about the pecuniary externalities from FDI via the backward linkages to input markets that MNC entry can generate (see e.g. Rivera-Batiz and Rivera-Batiz, 1990; Rodriguez-Clare, 1996; Markusen and Venables, 1999). Finally, research has focused on the impact of entry by an enterprise with technological opportunities superior to local ones, such as a MNC, on incumbent domestic industry when different types of market structure prevail (see e.g. Bardhan, 1982; Varian, 1996).

First, the literature on the optimal market penetration strategy by the MNC emphasizes the minimization of the probability of imitation. Organizational choices can be used to delay the emulation by domestic producers with absorptive capacity. In an incomplete contracts environment, resource and information transfer within the MNC minimize transaction costs (Ethier, 1986). Also, economies of scope stemming from product-specific R&D can explain the vertically integrated nature of MNCs (Helpman, 1984). Trade secrecy and efficiency wages are also used to mitigate technology leakage from FDI. Over time, the dissipation of technical knowledge rents if intra-industry spillovers materialized is mitigated as the MNC organizes production to maximize the imitation lag (Ethier and Markusen, 1996). In the case of export knowhow diffusion, the MNC will only avoid diffusion if local producers can possibly compete for the same foreign markets.

The literature on MNC strategy considers the risks of imitation and eventual replacement faced by the subsidiaries (see e.g. Helpman, 1984; Ethier, 1986; Ethier and Markusen, 1996; Markusen and Venables, 1998). From this point of view, MNCs may try to avoid export knowhow diffusion if host-country plants could challenge subsidiaries in export markets. However, as Eaton, Kortum and Kramarz (2005) point out, if the costs associated with selling output abroad are country specific, rather than generally related to the activity of exporting, then more remote and possibly more profitable markets may only be reached by the most productive plants. Hence, to the extent that subsidiaries have a considerable productivity edge over host-country manufacturers, the latter will not be in the competitive fringe for the same export markets as MNCs.

The location of the MNC subsidiary minimizes rent erosion due to copying by local firms. Proximity to potential competitors with absorptive capacity to reverse engineer proprietary technology would be detrimental to the MNC, and subsidiaries will be set up where potential rivals cannot erode its market share (Markusen and Venables, 1998). But, in the case of export knowledge transfer, this is not a problem

as due to the substantial productivity gap between them, domestic manufacturers and subsidiaries end up covering different export markets (Eaton et al., 2005). Indeed, vertical FDI may facilitate intra-industry diffusion of export knowhow as long as the MNCs most profitable markets are too remote for host-country producers to penetrate given their productivity level.

Also, the alignment of incentives between subsidiaries and local producers along the supply chain can facilitate the diffusion of information useful to enter export markets. Since the MNC can benefit from knowledge diffusion when it reaches downstream clients and upstream suppliers, it will encourage vertical flows of generic knowledge which may increase both the extensive and intensive margin of exports. Linkages can thus be a propagation mechanism for informational externalities above and beyond the pecuniary externalities highlighted by Hirschman (1977).

Some of the literature on backward linkages emphasizes these latter pecuniary externalities due to the increased demand by the MNC for local intermediate inputs. The static effect on host country employment is considered by Rivera-Batiz and Rivera-Batiz (1990). More recent models emphasize the dynamic effect on host-country productivity ensuing expansion of both the demand and supply of intermediate inputs and services. Not only do incumbent upstream sector producers benefit, as pointed out by Markusen and Venables (1999), but also the MNC, may start providing goods or services that were previously unavailable in the host country, as pointed out by Rodriguez-Clare (1996). Thus, MNC operations can induce local availability of new intermediate services and inputs, and thereby a nexus between FDI penetration and growth in the productivity of downstream manufacturers (Romer, 1994).

Hence, the impact of FDI goes beyond the change in utilization of the host-country factor endowment that improves allocative efficiency, the type of effect typically emphasized in trade theory, and may include improvements information about potential markets abroad. As the entry of the MNC induces the supply of new intermediate inputs, the productivity of downstream local firms can be enhanced due to a feasible increase in specialization. The direct demand effect on sectors upstream from MNC subsidiaries can propagate into an indirect input-availability effect on domestic producers downstream from MNC input suppliers. Even if FDI is associated with a situation in which there are few direct competitors and many input suppliers resulting in limited intra-industry export knowhow transfer, the propagation of information along backward linkages may generate offshoring opportunities to suppliers. At the same time, the improvement in intermediate input availability due to FDI may boost productivity of some plants beyond the threshold of profitability to cover the costs of entry into export markets.

The models in the literature imply that export knowhow diffusion ensuing FDI can take place through a number of channels. For the MNC, it is optimal to minimize horizontal spillovers of industry specific knowhow to potential competitors while encouraging vertical flows of generic knowledge to supplier and client industries. The finding by BKS that, in Venezuelan manufacturing, FDI spillovers emanate exclu-

sively from export oriented MNCs suggests the possibility that subsidiaries facilitate learning for domestic manufacturers about entry into foreign markets.

More recent literature has recognized that the production line of MNCs may be fragmented with manufacturing of various components and assembly taking in different countries (e.g. Venables, 1999). In the event that the MNC uses the host country as an export platform, the subsidiary may not have any domestic direct competitors. Then, horizontal and vertical export knowhow diffusion may occur if neither entails a loss of profits to MNC subsidiaries. Of course, if host-country producers could emerge as potential exporting competitors, MNCs would avoid conceding information useful for market penetration. The theory suggests that for horizontal demonstration effects to occur the productivity gap between indigenous and foreign plants must be sufficiently wide. At the same time, if host-country suppliers could offshore to MNC competitors in other countries, MNCs would avoid facilitating learning about exporting. Hence, vertical information diffusion associated with knowledge sharing by MNCs along the supply chain is more likely when the input providers remain local and do not export.

We have thus characterized four main channels through which FDI may facilitate exports, at both the extensive and intensive margins. First, there may be a horizontal demonstration effect to other producers in the same industry where subsidiaries operate. Second, there may be a vertical knowledge sharing effect to both suppliers and clients of subsidiaries along the production chain. Third, MNCs may supply new and better intermediate inputs and services to domestic producers enhancing production opportunities. Fourth, the demand due to local outsourcing by MNCs may be a catalyst for exports by boosting input quality and variety. Below, we consider the empirical literature on the effect of FDI on exporting activity, which has primarily focused on the first channel.

2.2 Empirical Evidence

First, the methodology of Roberts and Tybout (1997) has been deployed to measure the magnitude of sunk costs required for domestic producers to penetrate foreign markets with exports. As it turns out such costs are largely informational. To account for them, a dynamic discrete choice model of exporting behavior is used that separates the roles of productivity heterogeneity and sunk costs to explain exporting status.

Due to data limitations, until recently, empirical evidence on FDI spillovers was made up of case studies. The picture that emerged from the early literature has been important in guiding progress in the theory of FDI. The evidence has provided us with information about the mechanisms whereby MNC entry and presence can affect industrial organization in the host-country. This research emphasized linkages, labor turnover and demonstration effects. Recently database development has afforded the possibility of econometric testing on spillovers. And, only very recently, dynamic

analysis has been conducted as panel data has replaced cross-section data.

One immediate channel for export spillovers is by domestic firms learning from the export activities of foreign subsidiaries in the host country through information externalities, a possibility that Aitken, Hanson and Harrison (1997) emphasize. The operation of export oriented MNC subsidiaries in Mexico is associated with a higher propensity for domestic enterprises to enter foreign markets. The finding highlights the potential positive effect on host-country manufacturing of the diffusion of MNCs' generic knowhow about how to export, including information on standards, market access and distribution channels. Subsidiaries may have easier access to information on foreign markets because they form part of a multinational enterprise. As Krugman (1989) and Clerides et al. (1998) demonstrate, exporting involves fixed costs. These might include the establishment of distribution networks, creation of transport infrastructures, investment in advertising to gain public exposure, research about the foreign market to gain intelligence on consumers' tastes, market structure, competitors, regulations and so on. These will be lower for MNCs as they already have knowledge and experience of operating in foreign markets and can benefit from network economies and know-how of managing the international marketing, distribution and servicing of their products. A transfer of this knowledge from MNCs to domestic firms would constitute an information spillover.

MNCs can also be a source of another sort of information not directly related to exporting, namely, new technologies and management techniques, from which domestic firms could benefit through demonstration and imitation, for example, via contact with local clients and suppliers and training of personnel and management staff. The presence of MNCs would thus complement the indigenous firms' innovation activities and contribute to the emergence of a more competitive pool of local firms geared to exporting.

Entry of foreign companies will, at least in the first stage, lead to increased competition. This is particularly the case where MNCs invest in sectors with higher barriers to entry and therefore more oligopolistic market structures. It has been argued elsewhere in the literature that technological innovation plays an important role in promoting export performance. Empirical evidence supports this view, particularly for industrialized economies (see Hirsch and Bijaoui, 1985; Wakelin, 1998).

MNC entry led to decreasing market shares of European Union firms in some sectors. Increased competition in the domestic market may also be responsible for reinforcing the imitation effect, as it constitutes an incentive to engage in more efficient and leaner production techniques which in turn facilitate entry into foreign markets (see Wang and Blomstrom, 1992; Cantwell, 1989).

While it is possible to identify the channels via which export spillovers could occur, empirical evidence on their existence is very limited. There are a few case studies which provide some support in developing countries, for instance, Rhee and Belot (1990). But Aitken et al. (1997) were the first to test the hypothesis that MNCs act as export catalysts to indigenous firms in the host. Using panel data on

4104 Mexican manufacturing plants for the period 1986–1990, they analyze a firm's decision of whether to serve the domestic market or to export, taking into account fixed costs of supplying foreign markets. They argue that the latter decreases due to information externalities resulting from the local concentration of export activity in general and MNCs' export performance in particular.

They use a Probit model to test the impact of MNCs on the domestic firm's decision to export, controlling for the local concentration of MNCs' export activity, sectoral concentration of export activity in general and the overall geographic concentration of economic activity. Their results support the hypothesis that spillovers from both MNC export activity and export activity in general are important. However, they are not robust to changes in the sample. When natural resource-intensive industries and those facing high transport costs are excluded, local concentration of export activity becomes insignificant.

Nonetheless, export spillovers due to MNCs remain significant. In further tests of robustness, the authors replace MNC export activities by a measure of general MNC production and obtain the same positive and statistically significant relationship using the production measure as with the export variable. This raises the question of whether the impact of MNCs on export behavior of domestic firms is associated with their export performance or whether it occurs because of their presence in the domestic market.

Kokko et al. (1997) also investigate export spillovers using a cross section of manufacturing firms in Uruguay in 1988. They estimate a probit model using firm-level as well as sector-level variables as regressors, including a measure of the impact of foreign MNCs at the sector level. Their results suggest that the likelihood of exporting increases with the presence of foreign MNCs established after 1973, the more outward-oriented period in Uruguay. For foreign firms established before 1972 (Uruguay's inward-oriented period), there is no evidence of spillovers. They also explore whether the geographical destination of exports matters. They find most evidence of export spillovers outside of Uruguay's neighboring markets (Brazil and Argentina). Their explanation for this is that exports to these countries are driven mainly by low transaction costs and preferential institutional arrangements.

The estimating model includes a range of other variables thought to affect the export decision. These include domestic final-goods prices, cost variables, employment in the plant relative to industry average, value added tax payments as a share of sales, royalty payments as a share of sales and a set of dummy variables to control for the foreign-ownership status, the industry of the firm, the region where it is located and the year of the observation. In addition, they include variables related to the country's trade policies like average tariffs and import-licence requirements.

The reported evidence about FDI spillovers in Cote d'Ivoire, the Czech Republic, Morocco and Venezuela constitutes the first systematic effort to measure externalities from MNC activities using longitudinal data. The general finding of spillover absence contrasts with previous evidence of spillovers in cross-sectional data. However, the ex-

clusively intra-industry character of possible externalities allowed in the specification of the empirical estimations is very limiting. While the positive contemporaneous correlation between sectoral productivity and sectoral FDI flows in cross-sectional data could reflect a causal relation in either direction, the nonpositive correlation in panel data confirms one of the implications from the theoretical literature.

Studies on inter-sectoral effects of FDI for Indonesia (Blalock, 2001), Lithuania (Smarzynska, 2002), Mexico (Lopez-Cordova, 2002) and Venezuela (Blyde et al., 2004) are confined to assess the impact of technology transfer on its recipients, namely input suppliers. Like Kugler (2005) on FDI spillovers in Colombia, the current study analyzes the indirect impact of FDI on plants that are not recipients of technology transfer by MNCs.

In contrast to previous empirical research about FDI based on longitudinal data, in this paper, the estimation of the extent of new technological opportunities for domestic manufacturers stemming from MNC operations includes potential effects within the subsidiary's sector as well as across other sectors, but not limited to upstream producers. This occurs both directly through linkages to suppliers, or clients, and indirectly through enhanced input availability. The estimation framework allows for not only for information spillovers but also the pecuniary externalities. We also allow for heterogeneity of the impact of FDI on domestic producers depending on the export orientation of the MNC and the location of the subsidiary.

3 Data and Estimation

3.1 Basic Statistics and Database Description

Due to the dynamic nature of the diffusion process, FDI export spillover estimation requires to follow sectors longitudinally. Consequently, the information needed to analyze FDI spillovers is used to construct a panel database with sufficient variables for productivity measurement, and also information on foreign ownership structure.

In Table 1, the mean, standard deviation, maximum and minimum of each variable is listed. There is evidence of substantial dispersion of variables measuring plant output and inputs. The foreign capital share variable also displays substantial variation with the mean participation at 13.6%. The variables measuring plant exposure to FDI flows generally display less dispersion. However, there is great variation across plants in terms of both intra-regional exposure to FDI and exposure to FDI by export oriented MNCs.

The paper uses a panel of manufacturing plants drawn from the annual Venezuelan Industrial Survey (Encuesta Industrial de Venezuela). The choice of period is 1995-2000. The annual survey includes all the plants with more than 50 employees. In addition, the Venezuelan Manufacturing Bureau includes every year a random sample of those plants with 50 or less employees. The number of plants varies greatly from

year to year with a maximum of 3,759 plants in 1996 and a minimum of 1,788 in 1998. The construction of a balanced panel, however, and the exclusion of the outliers brings the final number of plants to 896 per year.

Data are recorded on each plant's geographic location, industry, age, capital structure, investment flows, expenditures on labor and materials, and value of output sold. The variables in the plant-level panel database yield a wide range of observable characteristics.

Data for each plant include gross production per worker, based on sale revenues, and capital per worker, based on book value reports. The labor force is classified by activity and the capital stock by type. Intermediate inputs and materials are reported as either imported or domestic. The fraction of foreign participation in the firm allows us to both construct measures of the impact of FDI in manufacturing and to control in estimation of the production function within each plant for the importance of links to MNCs. Three distinct measures of sectoral FDI in manufacturing, at the ISIC two-digit level, are used. A variable aggregating FDI within the plant's industry accounts for horizontal spillovers. Two variables aggregating FDI to downstream and upstream sectors use I/O matrix entries as weights and measure vertical spillovers propagated by forward and backward linkages respectively. Gross output was deflated using sectoral PPI, intermediate materials were deflated using wholesale sectoral PPI weighted with the I/O table.

The capital stock for each plant was constructed following the perpetual inventory method. All investment figures were transformed into 1995 prices using wholesale prices of various types of equipment. The depreciation rate was calculated using the reported amount of depreciated assets during one year and the value of the assets at the beginning of that year. Starting with the capital stock at the beginning of 1995, we updated the capital stock using the investment figures and the depreciation rates.

3.2 Estimation Framework

We estimate an augmented production function using plant-level data to measure productivity. There are two sources of estimation bias when using ordinary least squares in this context. First, there is simultaneity problem generated by the endogeneity of inputs to productivity shocks observed by plant management but not by the econometrician. And, second, there is a selection bias induced by plant closings. To deal with these issues we use the estimation method proposed by Olley and Pakes (1996).

3.2.1 Attrition with Plant Heterogeneity

We assume plants are heterogeneous with respect to their level of productivity. In every period, given factor prices and the market structure, the plant management selects to exit or to stay in business. The exit selection is irreversible. Management

decisions are made after observing an idiosyncratic productivity shock that is a random draw from an exogenous Markov process. If the firm continues in operation, management deploys variable factors and decides how much to invest in capital. If exit is chosen, the plant's sell-off value Θ is realized. The exit choice is based on the maximization of expected discounted net profit cash flows.

The management's problem is

$$V_t(\omega_t, k_t) = \max\{\Theta, \sup_{i_t \geq o} \pi_t(\omega_t, k_t) - c(i_t) + \beta E_t V_{t+1}(\omega_{t+1}, k_{t+1})\}$$

where $V_t(\cdot)$ is the value function at period t and $\pi_t(\cdot)$ is the profit function of the plant, which both depend on the current value of the two state variables, namely capital k_t and productivity ω_t.Also, $c(i_t)$ represents the cost of investment, β is the discount factor, and E_t the expectation operator conditional on all information known at time t. Indexing of functions by time allows for shifting market structures and changing factor and output prices.

The law of motion for capital is given by

$$k_{t+1} = (1 - \delta)k_t + i_t$$

where i_t is the current period's gross investment.

In this set up, as shown by Ericson and Pakes (1995), conditional on the capital stock k_t, the optimal exit decision rule is to shut down operations if realized productivity is below a threshold level $\omega_t^*(k_t)$. If $\omega_t \geq \omega_t^*(k_t)$, the production continues, and otherwise the plant exits. The threshold function is decreasing (i.e. $\omega_t^{*\prime}(k_t) < 0$) if plants with more installed capital sustain bigger losses upon exit relative to plants endowed with less capital. This would mean that the difference between the discounted expected value of net profits and the sell-off value increases with the capital stock. Hence, other things equal, it is optimal for larger plants to stay in business even if current productivity is relatively low. Finally, if the plant continues, the investment demand is given by $i_t = i_t(\omega_t, k_t)$. This function is strictly increasing in ω_t, for any capital stock, if investment is strictly positive, as shown by Pakes (1994). The monotonicity of the productivity threshold function $\omega_t^*(k_t)$ and the investment demand function $i_t(\omega_t, k_t)$ are essential for the estimation algorithm outlined below. Then, observed capital and investment series can be used to infer the unobserved productivity shocks.

3.2.2 Olley and Pakes' (1996) Algorithm

Within the above theoretical framework, the estimation of production function is not straight forward because productivity, a state variable in the management's decision problem, is not unobserved. The two biases mentioned before plague the OLS production function estimation. Due to the simultaneity problem, as factor demands are positively correlated with the unobserved productivity term, OLS estimates of

the corresponding coefficients are biased upwards. Moreover, the expectation of productivity decreases with the capital stock since firms with a larger capital stock can afford to survive with a relatively lower productivity level. Thus, as only continuing plants are observed, the estimated capital coefficient is biased downwards.[1]

We implement the Olley-Pakes algorithm in three steps. In the first step, we estimate consistently the coefficients corresponding to variable factors. Let the production function of firm i at time t be

$$\ln Y_{it} = \beta_0 + \beta_1 \ln K_{it} + \beta_2 \ln L_{it} + \beta_3 \ln M_{it} + \omega_{it} + \mu_{it}$$

where Y_{it} is output, K_{it} the plant's capital stock, L_{it} is the number of workers, M_{it} is real intermediate input expenditure, ω_{it} is plant-specific productivity, and μ_{it} is a term distributed around zero accounting for measurement error and for unexpected productivity shocks that do not affect the choice of inputs.

In terms of measured variables, Y_{it} stands for firm i's real gross output at time t, which is calculated by adjusting the reported sales for changes in inventories of finished goods and deflating the resulting value by the Producer Price Index for the appropriate two-digit ISIC sector. K_{it}, capital, is defined as before and it includes machinery and equipment; office, accounting and computing machinery; electrical machinery and apparatus; motor vehicles, trailer and semi-trailers; and other transport equipment. L_{it}, employment, is measured by the number of workers. M_{it}, material inputs, are equal to the value of material inputs adjusted for changes in material inventories, deflated by material inputs deflator calculated for each sector based on the two-digit input-output matrix and deflators for the relevant two-digit ISIC sectors. FS_{it} measures the share of foreign capital in firm's total capital.

To infer the unobserved productivity term ω_{it}, we invoke the monotonicity of the investment function $i_t(\omega_{it}, k_{it})$ to invert it and obtain an expression for the unobserved productivity term as a function of observables, i.e. $\omega_{it} = f(i_{it}, k_{it})$. Defining $\varphi(i_{it}, k_{it}) \equiv \beta_0 + \beta_1 \ln K_{it} + f(i_{it}, k_{it})$, the production function reduces to

$$\ln Y_{it} = \beta_2 \ln L_{it} + \beta_3 \ln M_{it} + \varphi(i_{it}, k_{it}) + \mu_{it}$$

Since the function $\varphi(\cdot)$ is unknown, it is approximated by a polynomial expansion in investment and capital. While we cannot disentangle the direct contribution of capital as an input from its indirect effect via investment, this quasi-linear regression can be estimated semiparametrically to obtain consistent estimates of β_2 and β_3, as we control both for the capital stock and unobserved productivity.

In the second step of the algorithm, we estimate the exit probability for each plant to address the selection problem. Let P_t be the probability that a plant will continuer. Then, $P_t = \Pr\{\omega_{t+1} \geq \omega^*_{t+1}(k_{t+1}) \mid i_t, k_t, \omega_t\}$ is the probability that next period's productivity will be larger than appropriate threshold conditional on the

[1]The simultaneity problem is only partially addressed in fixed effect estimation, given the assumption that the productivity term is constant over time.

information available at t. Note that from the law of motion of the capital stock we can write $\omega^*_{t+1}(k_{t+1}) = \omega^*_{t+1}(i_t + (1-\delta)\, k_t)$. Hence we can substitute for ω_t and ω^*_{t+1} to get $P_t = P_t\,(i_{it}, k_{it})$. Since the family of distribution functions from which ω_t is drawn is unknown, the survival probability is estimated non-parametrically. We use a probit model with a polynomial expansion on investment and capital as regressors.

In the third step we estimate the coefficient on the capital stock. We have to take account that capital is correlated with the unobserved productivity term, and that surviving plants have a level of productivity that exceeds a threshold, which in turn depends on the capital stock. We assume that next period's productivity depends on current period's productivity, which in turn can be written in terms of observable investment and capital.

Next define $g(\omega^*_{t+1}, \omega_t) = \beta_0 + E\left[\omega_{it+1} \mid \omega_t, \omega_{t+1} \geq \omega^*_{t+1}\right]$, i.e. the expectation of next period's productivity conditional on current productivity and on survival, plus the constant β_0. Now consider the expectation of $\ln Y_{it} - \beta_2 \ln L_{it} - \beta_3 \ln M_{it}$ conditional on k_{it+1} and survival,

$$E\left[\ln Y_{it} - \beta_2 \ln L_{it} - \beta_3 \ln M_{it} \mid k_{t+1}, \omega_{t+1} \geq \omega^*_{t+1}\right] = \beta_1 \ln K_{it} + g(\omega^*_{t+1}, \omega_t)$$

Let η_{it}be the innovation in productivity at t+1, which is assumed to be independent of the capital stock at the beginning of the period t+1. That is, $\eta_{it} = \omega_{it+1} - E\left[\omega_{it+1} \mid \omega_t, \omega_{t+1} \geq \omega^*_{t+1}\right]$. Then next period's production function can be written as

$$\ln Y_{it+1} - \beta_2 \ln L_{it+1} - \beta_3 \ln M_{it+1} = \beta_1 \ln K_{it+1} + g(\omega^*_{it+1}, \omega_{it}) + \eta_{it+1} + \mu_{it+1}$$

As the capital stock is not correlated with either error term, the coefficient on capital can be consistently estimated by controlling for ω^*_{t+1} and ω_t. While these variables are unobservable, we can be proxy by inverting the survival probability function and expressing ω^*_{t+1} as a function of P_t and ω_t. To complete the last step of the algorithm, we run the nonlinear least squares regression

$$\ln Y_{it+1} - \widehat{\beta}_2 \ln L_{it+1} - \widehat{\beta}_3 \ln M_{it+1} = \beta_1 \ln K_{it+1} + g(\widehat{P}_t, \widehat{\varphi}_{it} - \beta_1 \ln K_{it+1}) + \varepsilon_{it+1}$$

where terms with hats represent the estimates of the first and second steps substituted for the respective true values, and the unknown function is approximated by a polynomial expansion in its arguments.[2]

[2] As pointed out by Syverson (2001) the algorithm assumes that the only state variable that affects the firm's decisions, but that is unobserved by the econometrician, is the productivity shock. Without this assumption, the investment demand cannot be inverted in order to write productivity as a function of observables. If investment depends on other unobservables, the one-to-one correspondence between productivity and investment, holding fixed the capital stock, no longer holds and if the choice of inputs depends upon the (unobserved) expectation of variables such as the state of demand or input prices, the algorithm can yield biased estimates of the coefficients of the production function.

3.2.3 Estimation

To examine the link between plant exports and foreign presence in the same industry or downstream sectors, the determinants of the probability of exporting and the intensity of plant export activity. Also included are the indirect effect of MNC input demand on other downstream sectors and importantly control for MNC export orientation as well as location.

Several variations of the following equation are estimated to capture the effect of FDI on the extensive margin of indigenous exports:

$$E_{it} = \Omega'_{it}\gamma_1 + \Gamma'_{it}\gamma_2 + \alpha_t + \alpha_r + \alpha_j + \varepsilon_{ijrt}$$

where E_{it} is a dichotomous variable representing the export status of plant i at time t, Ω_{it} is a vector of plant characteristics which includes variable describing the technological attributes and Γ_{it} is a vector of variables measuring MNC presence to capture the four channels through which FDI may generate exports. We use probit and Logit estimation techniques, and also allow for lags in the variable vectors, finding the results to be robust.

To capture the intensive margin of exports, the following Tobit specification was used to take into account selection issues due to censoring in the case of nonexporters:

$$\begin{aligned} x^*_{it} &= e(\Omega_{it}, \Gamma_{it}; \alpha_t, \alpha_r, \alpha_j) + u_{ijrt} \\ x_{it} &= \begin{cases} x^*_{it} & \text{if } x^*_{it} > 0 \\ 0 & \text{otherwise} \end{cases} \end{aligned}$$

where x^*_{it} is a latent variable representing the optimal export fraction of plant output exported given the productivity of the plant captured by the plant characteristics Ω_{it} and the costs of exporting captured by $\Gamma_{it}, \alpha_t, \alpha_r$, and α_j, which includes the impact of FDI as well as temporal, regional and sectoral effects. We only observe this latent variable for plants for which it is optimal to enter export markets and this would obviously create a selection bias if OLS were employed. By using Tobit, we estimate the impact of FDI on the observed fraction of plant output exported x_{it}.

Now we describe the components of Γ_{it} in detail. First, there may be a horizontal demonstration effect to other producers in the same industry where subsidiaries operate. $Horizontal_{jt}$ captures the extent of foreign presence in the sector and is defined as foreign equity participation averaged over all firms in the sector, weighted by each firm's share in sectoral output. In other words,

$$Horizontal_{jt} = [\Sigma_{\text{i for all i}\epsilon\text{j}} FS_{ijt} Y_{ijt}] / \Sigma_{\text{i for all i}\epsilon\text{j}} Y_{ijt}$$

where FS_{it}measures the share of foreign capital in firm's total capital.

Second, there may be a vertical knowledge sharing effect to both suppliers and clients of subsidiaries along the production chain. The variable Backward is a proxy for the foreign presence in the industries that are being supplied by the sector to

which the firm in question belongs and thus is intended to capture the extent of potential contacts between domestic suppliers and multinational customers.

It is defined in the following way:

$$Backward_{jt} = \Sigma_{\text{k if k}\neq\text{j}} \delta_{jk} Horizontal_{kt}$$

where δ_{jk} is the proportion of sector j output supplied to sector k taken from the 1995 I/O matrix at the two-digit ISIC level. The proportion is calculated excluding products supplied for final consumption but including imports of intermediate products. As the formula indicates, we do not include inputs supplied within the sector, since we want this effect to be captured by the *Horizontal* variable. Thus the greater the foreign presence in sectors supplied by industry j and the larger the share of intermediates supplied to industries with multinational presence, the higher the value of the variable. We use the basic specification to characterize the sectoral pattern of diffusion of FDI spillovers.

Third, MNCs may supply new and better intermediate inputs and services to domestic producers enhancing production opportunities. Thus the value of the variable increases with the output of foreign investment enterprises and the share of foreign capital in these firms. The variable *Forward* measures foreign presence in the industries that supply the sector to which the plant belongs and thus is intended to capture the extent of potential contacts between multinational suppliers and domestic customers.

It is defined in the following way:

$$Forward_{jt} = \Sigma_{\text{k if k}\neq\text{j}} \delta_{kj} Horizontal_{kt}$$

where $\delta_{kj}$is the proportion of sector k output supplied to sector j taken from the 1995 I/O matrix at the two-digit ISIC level.

Fourth, the demand due to local outsourcing by MNCs may be a catalyst for exports by boosting input quality and variety. The variable *Indirect* is constructed to capture the impact of MNC upstream demand on input availability across sectors for domestic producers:

$$Indirect_{jt} = \Sigma_{\text{k if k}\neq\text{j}} \delta_{kj} Backward_{kt}$$

where $\delta_{kj}$is the proportion of sector k output supplied to sector j taken from the 1995 I/O matrix at the two-digit ISIC level. Here, the direct impact of FDI on upstream suppliers is aggregated across sectors which are downstream from the MNCs input suppliers. Hence, the variable measures the indirect effect of MNC demand for local inputs on other plants in the host-country which as a result experience enhanced quality and variety input availability.

These two specifications are estimated using time, industry and regional fixed effects to control for factors that might affect the correlation between plant exports and the presence of foreign activity. These include among others exchange rate variation

(over time), sectoral comparative advantage (across industries), and heterogenous transportation infrastructure (between regions). Among, the plant characteristics we include a measure of productivity. In order to address for the possibility of an endogenous relationship between inputs and productivity, as suggested by Olley and Pakes (1996), we use the Olley-Pakes correction to generate our productivity measure.

4 The Impact of FDI on Venezuelan Exports

We consider the impact of FDI on both the extensive and intensive export margin by considering four channels through which MNC activities can facilitate entry by domestic plants into foreign markets. Table 1 presents descriptive statistics of the variables used in the Probit and Tobit estimations. In the first instance, we estimate productivity. The results presented in Table 2 show that foreign plants experience higher productivity. Then, after characterizing the link between productivity and exporting, we explore the effect of FDI on exports.

4.1 Horizontal Demonstration Effects

Potential horizontal demonstration effects to facilitate exports are considered. In doing so, the specification allows for the effect on plant exports of FDI within the plant's sector to vary depending on the export orientation and location of the MNC subsidiary. Even controlling for all these characteristics, the evidence of a demonstration effect in Tables 3 and 4 is somewhat mixed. Considering MNC strategy and the results on FDI spillovers in Venezuelan manufacturing found by BKS, the evidence of absence of a demonstration effect can be explained. There the evidence points to horizontal spillovers, in terms of productivity improvements, to local producers from FDI by export oriented MNCs only. The explanation is that as long as local producers are not in the competitive fringe, MNC subsidiaries will not avoid technology diffusion. In the case of MNC subsidiaries covering the host-country market, their FDI does not generate spillovers as local producers are in the competitive fringe. In the case of MNC subsidiaries using the host-country as an export platform, their FDI generates horizontal spillovers suggesting that local producers are not in the competitive fringe. But, if there were export knowhow diffusion, the local producers may then eventually be in the competitive fringe.[3] When regional and industrial controls are absent, there is some suggestion of an association between manufacturing exports and within sector FDI. Yet, once the full set of controls is introduced, the results in Tables 3 and 4 show that the correlation between export status and export propensity with intra-industry FDI turns insignificant.

[3] Although as pointed out above, it is possible that the local producers export to different markets from the MNCs, which in view of their higher productivity probably export to more remote, and more profitable, markets. However, in the case of Venezuelan manufacturing, it seems likely that MNC subsidiraries exports are regional rather than global.

4.2 Vertical Knowledge Sharing

The possibility of vertical transfer of export knowhow through backward linkages is considered also in Tables 3 and 4. When the MNC subsidiary outsources from local suppliers, technical knowledge is shared to enhance the specification of the components it purchases. The information received by local suppliers in this context may allow them to upgrade their product in way that provides export opportunities. We assess whether this is indeed the case. From a strategic perspective, it may be surprising if a MNC outsourcing locally would take the risk of sharing knowledge with a local supplier who may later export to potential competitors of the MNC. Effectively the local input supplier would then provide offshoring opportunities to foreign firms as it exports components to them. In all likelihood, this could be detrimental to the MNC subsidiary which has outsourced its inputs locally. Hence, the MNC would avoid vertical export knowhow diffusion. Here also, the specification controls for the export orientation and geographic location of subsidiaries. When regional and industrial controls are absent, there is some suggestion of an association between manufacturing exports and FDI in upstream sectors. Yet, once the full set of controls is introduced, the correlation between export status and export propensity with MNC outsourcing turns insignificant. Even when FDI flows are disaggregated by regions, within sectors as well as across upstream and downstream sectors, the evidence of vertical export knowhow transfer is not present when both regional and industrial controls are present.

4.3 MNC Input Supply via Forward Linkages

In principle, there are no strategic dangers for MNC subsidiaries from facilitating exports by supplying inputs to local producers. In practice, the relevance of this mechanism seems limited. There is absolutely no evidence to suggest that MNC subsidiaries supply inputs which allow local plants to penetrate foreign markets. In principle, MNCs may provide key components that raise productivity or quality in the manufacturing process above a threshold which makes domestic plants competitive enough to export. At the same time, MNC subsidiaries providing components may transfer export knowhow to their local clients. Yet, the results in Tables 5 and 6 reveal that the supply of inputs by MNCs is not a channel whereby FDI promotes exports, neither on the extensive margin nor on the intensive margin.

4.4 MNC Input Demand and Pecuniary Externalities

Another channel through which FDI may stimulate growth is that demand for local components by MNCs can be a catalyst for viable intermediate input markets. Hence, specialization of local suppliers would be promoted by FDI and this may result in enhanced input availability for local manufacturers, in terms of both variety and quality. This process was modeled by Rodriguez-Clare (1996) who pointed out that

the presence of MNCs would create demand for specialized intermediate inputs. With horizontally differentiated intermediate inputs, the increased demand may be a catalyst for the introduction of new intermediate varieties. The availability of new inputs and components has the effect of increasing productivity. In our context efficiency boost associated with the feasibility of key inputs can facilitate the manufacturing of products with export standard.

The evidence in Tables 5 and 6 suggests that to the extent that Venezuelan manufacturers have better export opportunities as a result of FDI, the channel through which this occurs is the pecuniary externality whereby the demand of MNCs for local inputs results in enhance availability of intermediates to other producers. In the regressions with full set of controls, including year dummies, sector dummies and regional dummies, the aggregate impact of MNC input demand as suppliers provide enhanced variety and quality of intermediates is to indirectly induce exports, at both the extensive and intensive margin. This is the only effect that emerges as a robust effect from FDI on exports by host-country producers. An increase of one standard deviation in demand by MNCs of inputs from sectors providing local producers generates a rise in the probability for a domestic plant of becoming an exporter of 19.2%. Also, a similar increase is favorable for existing exporters which experience an increase in the share of their revunue accruing to sdales aborad by 8.3%

4.5 Subsidiary Exports, Subsidiary Location and Time Lags

The regressions presented in Tables 3 to 6 were also run by allowing for heterogenous effects depending on both the MNC's export orientation and the subsidiary location relative to other producers. The horizontal demonstration, vertical transfer and pecuniary externality effects were allowed to impact exports heterogenously depending on the export activity of the MNC undertaking FDI and whether the subsidiary is in the same region as the plant whose exporting behaviour is being characterized. The effects reported above were confirmed in these regressions. In particular, the absence of horizontal or upstream export knowhow diffusion cannot be explained because of lack of controls for MNC exports or location.

Also, lags were allowed in the effect of FDI on manufacturing exports. Given that the panel's duraction is six years, the lag length was limited to one year. In particular, this captures the impact of FDI on exports which takes place within two years, which would be a reasonable period for plant management to react to new export opportunities. To the extent that export knowhow diffusion may take time to materialize, it may be important to allow for such lags. The regressions show that allowing for lags does not change the conclusion that the impact of FDI on exports is through the pecuniary externality from input demand on other downstream producers, rather than horizontal or upstream diffusion of export knowhow by MNCs.

4.6 Plant Size and the Impact of Oil Production

The regressions presented in Tables 3 to 6 include size as one of main the determinants of export volumes. For existing exporters, an increase in the number of employees of one standard deviation (enough to make a mediam sized enterprise "large") will induce rise of 44 percentage points in the fraction of revenue generated by international sales. Access to export markets can potentially expand demand. This may allow small and medium size plants to breakaway from a trap of low productivity and slow growth. Given the results in BKS, whereby large plants may benefit from FDI but small ones do not, it is important to assess the extent to which exports can be promoted by FDI as manufacturing expansion may take off. Our evidence indicates that MNC input demand facilitates manufacturing exports. This pecuniary externality from FDI manifests through the availability of intermediate inputs and enhanced specialization providing access to foreign markets.

With respect to the influence of oil production, it is important to point out that all reported regressions have controls for both cyclical volatility and exchange rate fluctuations. Hence, the results presented net out the macroeconomic impact of the oil sector. To the extent that the oil sector absorbs resources, which otherwise may de deployed in other sectors, manufacturing may expand slowly. We verify what the effect of oil activities may be by pointing to the fact that an expansion of the oil sector is likely to induce real appreciation of the exchange rate. In particular, if manufacturing exports are sufficiently elastic to exchange rate fluctuations, activity in the oil sector may undo the potentially positive impact of FDI on exports. In fact, we do not find this to be the case as a real appreciation of one standard deviation (which correnspond to 17%) would induce a fall in the probability of becoming an exporter of only 4.5%. Thus, while oil production via exchange rate appreciation mitigates export incentives, it does not cripple the drive to access international markets.

5 Concluding Remarks

As pointed out in Kugler (2000), knowledge diffusion from MNC subsidiaries to other plants is unlikely when those plants are direct competitors. This is because propagation of technical knowledge to competitors might result in a loss of market share. However, technology diffusion that does not result in a loss market share will not be averted by the MNC. For that reason, we observe that to the extent that there is export knowhow diffusion associated with FDI, it seems to occur through a pecuniary externality in input markets. Local outsourcing by MNCs generates widespread improvements, possibly both of variety and quality, in input availability which facilitate exports. This evidence supports the importance of the channel highlighted by Rodriguez-Clare (1996) whereby MNCs impact host-country industrial development by expanding input markets. The insight is that it is through a pecuniary externality from the demand of MNCs for inputs that host country plants enhance their

production opportunities. Our evidence shows that Venezuelan manufacturers are more likely to export, and export more, when local outsourcing by MNCs generates improvements in input supply.

In BKS, the evidence of spillovers from FDI by export oriented MNCs depends the size of plants receiving technical information. Positive FDI spillovers arising from export oriented MNCs (horizontal and vertical via backward linkages) appear only in the sample of large firms.[4] Size is an important indicator of absorptive capacity to capture the potential positive spillovers due to technology diffusion from FDI by MNCs.

In contrast, small and medium sized plants are unable to deploy new technologies. Indeed, small plants can be caught in a trap that prevents their growth. As they do not produce much output, it is not viable to incur sunk investments associated with the adoption of new technology impeding absorptive capacity to be built. Hence, access to export markets can potentially expand demand. This may allow small and medium size plants to breakaway from a trap of low productivity and slow growth. Given these results, whereby large plants may benefit from FDI but small one do not, it is important to assess the extent to which exports can be promoted by FDI as manufacturing expansion may take off. Our evidence indicates that MNC input demand may facilitate manufacturing exports. This pecuniary externality from FDI manifests through the availability of intermediate inputs and enhanced specialization providing access to foreign markets.

We verify what the effect of oil activities may be by pointing to the fact that an expansion of the oil sector is likely to induce real appreciation of the exchange rate. In particular, if manufacturing exports are sufficiently elastic to exchange rate fluctuations, activity in the oil sector may undo the potentially positive impact of FDI on exports. In fact, we do not find this to be the case as a real appreciation of one standard deviation (which correnspond to 17%) would induce a fall in the probability of becoming an exporter of only 4.5%. Thus, while oil production via exchange rate appreciation mitigates export incentives, it does not cripple the drive to access international markets.

If the MNC uses the country as an export platform, horizontal FDI spillovers may be expected due to the absence of direct domestic competitors. BKS find that *only* FDI by export-oriented MNCs generates productivity spillovers, whether between or within sectors. Thus, export activity by the MNC subsidiary is the main determinant of FDI productivity spillovers in Venezuela. Note that the diffusion of technology to upstream sectors emanating from MNC subsidiaries, like the horizontal diffusion, occurs only when FDI is by export oriented MNCs. This is because, as in the case of intra-industry spillovers, if the MNC is local market oriented, substantially enhancing technological opportunities for intermediate input suppliers could provide important benefits to direct competitors. In that case, the MNC might prefer to import its

[4]The Venezuelan Statistical Bureau grouped firms according to the following criteria: Small, up to 20 employees; medium, from 21 to 100 employees; and large, more than 100 employees.

components therefore shutting down backward linkages as a potential channel for technology diffusion.

The finding in BKS is that in Venezuelan manufacturing it is whether the MNC exports, rather than whether the MNC buys local inputs, or not that matters for FDI spillovers. This evidence could be consistent with export knowhow transfer from subsidiaries to indigenous producers as documented by Aitken, Hanson and Harrison (1997) in the case of Mexican manufacturing, where geographic proximity of domestic producers to plants with foreign participation enhances export opportunities. In that case, domestic plants are able to benefit from generic export knowhow diffused by nearby MNCs as long as they do not compete for the same market. The set of results from the analysis of BKS could add empirical grounding to this explanation. Yet, the results in the current paper show that the FDI spillovers identified in BKS cannot be attributed to export knowhow transfer.

In fact, we have found that neither horizontal demonstration effects nor vertical knowledge sharing are channels of export knowhow diffusion. This is consistent with the finding of horizontal and upstream spillovers from FDI only originate from export oriented MNC. Given that the finding of FDI spillovers is explained by the fact that domestic producers are not in the competitive fringe of exporting subsidiaries, it would be susprising if MNCs were facilitating entry into export markets. In this case export platform MNCs would be creating competition against themselves if we observed both productivity spillovers and export knowledge transfer to local producers. We find that to the extent that FDI stimulates exports this occurs solely through MNC input demand. But, rather than knowledge sharing, what we observe is that MNCs generate a pecuniary externality. If MNC subsidiary demand for intermediates makes viable variety and quality improvements, downstream local producers in other sectors may enhance their production process to the point of boosting exports, on both the extensive and intensive margins. The policies that are conducive to an export promotion effect by MNCs should (i) remove barriers to the emergence of domestic intermediate input suppliers and (ii) reduce frictional transaction costs which distort linkages along supply chains.

References

[1] Aitken, B., Hanson, G., Harrison, A., 1997. Spillovers, Foreign Investment, and Export Behavior. Journal of International Economics 43(1), 103-32.

[2] Aitken, B., Harrison, A. , 1999. Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela. American Economic Review 89(3), 605-18.

[3] Bernard, A., Jensen, J.B., 1999. Exceptional exporters' performance: cause, effect or both. Journal of International Economics 47, 1 – 25.

[4] Blake, A.P., Pain, N., 1994. Investigating structural change in UK export performance: the role of innovation and direct investment. NIESR Discussion paper no. 71.

[5] Blomstrom, M., Kokko, A., Zejan, M., 2000. Foreign Direct Investment: Firm and Host Country Strategies Macmillan, London.Blalock, G., 2001. Technology from Foreign Direct Investment: Strategic Transfer through Supply Chains. Mimeo, UC Berkeley.

[6] Blomstrom, M., Kokko, A., 1998. Multinational corporations and spillovers. Journal of Economic Surveys; 12(3), 247-77.

[7] Blyde, Juan, Maurice Kugler and Ernesto Stein (2004), "Exporting vs. Outsourcing by MNC Subsidiaries: Which Determines FDI Spillovers?" University of Southampton Working Paper.

[8] Cabral, S., 1995. Comparative export behaviour of foreign and domestic firms in Portugal. Banco de Portugal Economic Bulletin, 69–78 (March).

[9] Cantwell, J., 1989. Technological Innovation and Multinational Corporations Basil Blackwell, Oxford. Castellani, D., 2002. Export behaviour and productivity growth: evidence from Italian manufacturing firms. Weltwirtschaftliches Archiv 138, 605– 628.

[10] Clerides, Sofronis, Saul Lach and James Tybout (1998), "Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico and Morocco." Quarterly Journal of Economics, August, pp. 903-947.

[11] Delgado, M., Farinas, J., Ruano, J., 2002. Firm productivity and export markets: a non-parametric approach. Journal of International Economics 57, 397–422.

[12] Eaton, J., S. Kortum and F. Kramarz (2005), "An Anatomy of International Trade: Evidence from French Firms," Mimeo.

[13] Eslava, M., J. Haltiwanger, A. Kugler and M. Kugler (2004), "The Effects of Structural Reforms on Productivity and Profitability Enhancing Reallocation: Evidence from Colombia," Journal of Development Economics, Volume 75, No. 2, pp. 333 – 371.

[14] Ethier, W. ,1986. The multinational firm. Quarterly Journal of Economics, 101(4): 805-834.

[15] Girma, S., Greenaway, D., Wakelin, K., 2001. Who benefits from foreign direct investment in the UK? Scottish Journal of Political Economy 48, 119– 133.

[16] Girma, S., Greenaway, D., Kneller, R., 2004. Does exporting lead to better performance? A microeconometric analysis of matched firms. Review of International Economics (in press).

[17] Gorg, H., Greenaway, D., 2004. World Bank Research Observer 17 (in press).

[18] Gorg, H., Strobl, E., 2001. Multinational companies and productivity spillovers: a meta analysis. Economic Journal 111, F723– F739.

[19] Hallward-Driemeier, Mary, Giuseppe Iarossi and Kenneth L. Sokoloff (2002), "Exports and Manufacturing Productivity in East Asia: A Comparative Analysis with Firm-Level Data," NBER Working Paper.

[20] John Haltiwanger, Adriana Kugler, Maurice Kugler, Alejandro Micco and Carmen Pagés (2004) "Effects of Tariffs and Real Exchange Rates on Job Reallocation: Evidence from Latin America," Journal of Policy Reform , Vol. 7, No. 4, pp. 189 – 208.

[21] Hanson, G., 2000. Should countries promote foreign direct investment? Unpublished paper, Department of Economics, University of Michigan.

[22] Hausmann, Ricardo and Micheal Gavin (1996), "Securing Stability and Growth in a Shock- Prone Region: The Policy Challenge for Latin America," in Ricardo Hausmann and Helmut Reisen, eds., Securing Stability and Growth in Latin America: Policy Issues and Prospects for Shock- Prone Economies. Paris: OECD.

[23] Helpman, E., 1984. Multinational corporations and trade structure, Review of Economic Studies 92(3), 451-71.

[24] Hirschman, A., 1977. A Generalized Linkage Approach to Development, with Special Reference to Staples, Economic Development and Cultural Change 25, 67-98.

[25] Kokko, A., 1994. Technology, market characteristics, and spillovers. Journal of Development Economics, 43(2), 279-293.

[26] Krugman, P.R., 1989. Exchange Rate Stability. MIT Press, Cambridge, MA.

[27] Kugler, M., 2000. Essays on International Productivity Growth and Technological Diffusion, Ch. 1, PhD Dissertation, UC Berkeley.

[28] Kugler, M., 2005. Spillovers from Foreign Direct Investment: Within or between sectors?, Journal of Development Economics, in press.

[29] Lopez-Cordova, J., 2003. NAFTA and Mexico's manufacturing productivity. Economía, Journal of LACEA 4 (1), 55– 98.

[30] Manzano, Osmel and Roberto Rigobon (2003), "Resource Curse or Debt Overhang? in Natural Resources and Development: Are They a Curse? Are They Destiny?, Daniel Lederman and William F. Maloney (eds.), Stanford University Press.

[31] Markusen, J. ,Venables, A., 1999. Foreign Direct Investment as a Catalyst for Industrial Development, European Economic Review 43(2) 335-56.

[32] Markusen, J., Venables, T., 1998. Multinational Firms and the New Trade Theory. Journal of International Economics 46(2), 183-203.

[33] Melitz, M., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71, 1695– 1726.

[34] Olley, S. and Pakes, 1996. The Dynamics of Productivity in the Telecommunications Equipment Industry, Econometrica, November, 1263-97.

[35] O'Sullivan, P.J., 1993. An assessment of Ireland's export-led growth strategy via foreign direct investment: 1960–1980. Weltwirtschaftliches Archiv 129, 139– 158.

[36] Rhee, Y.W., Belot, T., 1990. Export catalysts in low-income countries. World Bank Discussion Paper no. 72. The World Bank, Washington, DC.

[37] Rivera-Batiz, F. and L. Rivera-Batiz, 1990. The effects of direct foreign direct investment in the presence of increasing returns due to specialization. Journal of Economic Development 34(2), 287-307.

[38] Rodriguez-Clare, A., 1996. Multinationals, linkages, and economic development. American Economic Review 86(4), 852-73.

[39] Roberts, Mark and James Tybout (1997), "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs," American Economic Review, 87 (4), September, pp. 545-563.

[40] Roberts, Mark and James Tybout (1996), Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity and Market Structure. 1996. New York: Oxford University Press.

[41] Rodrik, Dani and Francisco Rodriguez (2001), "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence," in Ben Bernanke and Kenneth Rogoff, eds., Macroeconomics Annual 2000. Cambridge, MA: MIT press for NBER.

[42] Romer, P., 1994, New goods, old theory and the welfare costs of trade restrictions, Journal of Development Economics 43(1), 5-38.

[43] Smarzynska, B., 2004. Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages. American Economic Review 94 (3), 605– 627.

[44] F. Scherer, 1982. Inter-Industry Technology Flows and Productivity Growth. Review of Economics and Statistics 64 (4), 627-634.

[45] Venables. A. 1999. Fragmentation and Multinational Production, European Economic Review, 43, 935-45.

Table 1. Descriptive Statistics

	No. of obs	Mean	Std. Dev.	Min.	Max.
Production	5376	335059	9917788	0	209000000
Intermediate inputs	5376	4110975	12800000	0	201000000
No. of employees	5376	209	288	0	3474
Capital stock	5376	543468	1984922	0	28100000
Exports	5376	607576.5	4060349	0	98600000
Export share (%)	5376	7.8	18.4	0	99.9
Foreign capital share (%)	5376	13.6	31.9	0	100.0
Horizontal	5376	28.3	18.4	0	67.1
Backward	5376	26.7	10.6	12.5	59.4
Forward	5376	33.5	13.8	7.4	58.0
Horizontal (same region)	5376	2.6	7.9	0	52.4
Horizontal (other regions)	5376	23.9	17.3	0	64.0
Backward (same region)	5376	1.6	4.5	0	45.7
Backward (other regions)	5376	23.4	10.8	5.2	59.4
Forward (same region)	5376	2.6	6.9	0	41.9
Forward (other regions)	5376	29.5	14.3	4.1	58.0
Horizontal (local market oriented)	5376	25.1	17.0	0	63.0
Horizontal (export oriented)	5376	3.1	5.3	0	22.1
Backward (local market oriented)	5376	22.8	9.6	8.7	57.7
Backward (export oriented)	5376	3.8	3.3	0.3	18.5
Forward (local market oriented)	5376	28.9	14.3	4.6	55.6

Table 2. Production Function

	1st Differences		2nd Differences	
	All firms	Domestic firms	All firms	Domestic firms
M	**0.5449** **(14.72)*** **	**0.5199** **(14.33)*** **	**0.3163** **(6.70)*** **	**0.3154** **(6.14)*** **
L	**0.3814** **(11.37)*** **	**0.4119** **(8.15)*** **	**0.3360** **(4.80)*** **	**0.3047** **(3.59)*** **
K	**0.1422** **(6.75)*** **	**0.1319** **(6.02)*** **	0.0267 (1.25)	0.0345 (1.43)
Foreign Share	**0.0018** **(5.39)*** **		-0.0005 (1.48)	
No. of obs.	4480	3490	3584	2792
R^2	0.56	0.55	0.23	0.19

All regressions include time, industry and regional dummies
O-P: Olley & Pakes algorithm applied
t-statistics in parentheses. ***, **, * denote significance at the 1, 5 and 10% level

Table 3. Entry in Export Markets and Knowhow Transfer from MNCs

	National		Same Region	
	All firms	Domestic firms	All firms	Domestic firms
Plant TFP (OP)	**0.2069** **(.0274)*** **	**0.1647** **(.0328)*** **	**0.1996** **(.0282)*** **	**0.1870** **(.0615)*** **
Employees	**0.6269** **(.0322)*** **	**0.7241** **(.0386)*** **	**0.7005** **(.0324)*** **	**0.7214** **(.0364)*** **
Capital per worker	**0.5176** **(.0483)*** **	**0.1319** **(6.02)*** **	**0.4862** **(.0541)*** **	**0.4848** **(.0308)*** **
Foreign Share	**0.0043** **(.0006)*** **		**0.0040** **(.0006)*** **	
Horizontal	-0.0048 (.0034)	-0.0052 (.0039)	-0.0062 (.0035)	-0.0044 (.0038)
Backward	0.0013 (.0035)	0.0008 (.0040)	-0.0001 (.0037)	0.0051 (.0038)
Forward	-0.0028 (.0053)	-0.0047 (.0063)	0.0004 (.0054)	0.0002 (.0058)
No. of obs.	5341	4155	5341	4155
Pseudo R^2	0.2628	0.2572	0.2760	0.2754

Probit regressions with export status as dependant variable. All regressions include time, industry and regional dummies as well as exchange rate controls.
O-P: Olley & Pakes algorithm applied in preliminary TFP regression.
Standard errors are in parentheses. ***, **, * denote significance at the 1, 5 and 10% level

Table 4. Export Intensity and Knowhow Transfer from MNCs

	National		Same Region	
	All firms	Domestic firms	All firms	Domestic firms
Plant TFP (OP)	**0.0106** **(.0143)*** **	**0.0386** **(.0065)*** **	**0 .0199** **(.0028)*** **	**0.0293** **(.0057)*** **
Employees	**0.6573** **(.0277)*** **	**0.5932** **(.0084)*** **	**0.6975** **(.0324)*** **	**0.5214** **(.0674)*** **
Capital per worker	**0.5107** **(.0491)*** **	**0.1620** **(.0153)*** **	**0.4834** **(.0541)*** **	**0.1823** **(.0157)*** **
Foreign Share	**0.0039** **(.0006)*** **		**0.0054** **(.0012)*** **	
Horizontal	-0.0015 (.0029)	0.0057 (.0822)	0.4814 (.0329)	-0.0014 (.0083)
Backward	0.0015 (.0036)	0.0044 (.0151)	0.3802 (.5533)	0.0072 (.0156)
Forward	-0.0294 (.4606)	-0.0055 (.0066)	0.0082 (.0075)	-0.0105 (.0783)
No. of obs.	5359	4165	5359	4165
Pseudo R^2	0.2628	0.2572	0.2751	0.3347

Tobit regressions with fraction of output exported as dependant variable. All regressions include time, industry and regional dummies as well as exchange rate cont
O-P: Olley & Pakes algorithm applied in preliminary TFP regression.
Standard errors are in parentheses. ***, **, * denote significance at the 1, 5 and 10% level

Table 5. Entry in Export Markets and Pecuniary FDI Externalities

	Unweighted Downstream Effect		Downstream Effect Interacted with Material Use	
	All firms	Domestic firms	All firms	Domestic firms
Plant TFP (OP)	**0.2259** **(.0274)*** **	**0.1946** **(.0322)*** **	**0.4861** **(.0542)*** **	**0.1620** **(.0153)*** **
Employees	**0.4754** **(.0223)*** **	**0.4951** **(.0267)*** **	**0.7012** **(.0325)*** **	**0.6781** **(.0385)*** **
Capital per worker	**0.4855** **(.0541)*** **	**0.5176** **(.0483)*** **	**0.4861** **(.0542)*** **	**0.4537** **(.0627)*** **
Foreign Share	**0.0047** **(.0006)*** **		**0.0041** **(.0006)*** **	
Horizontal	-0.0047 (.0034)	0.0046 (.0039)	-0.0046 (.0041)	0.0048 (.0036)
Backward	0.0006 (.0034)	0.0006 (.0040)	0.0002 (.0037)	0.0011 (.0039)
Forward	-0.0028 (.0053)	-0.0036 (.0062)	-0.0039 (.0063)	-0.0037 (.0063)
Indirect	**0.0231** **(.0.100)*** **	**0.0096** **(.0001)*** **	**0.0238** **(.0105)*** **	**0.0261** **(0.0114)** **
No. of obs.	5341	4164	5341	4155
Pseudo R^2	0.2562	0.2381	0.2758	0.2456

Probit regression with export status as dependant variable. All regressions include time, industry and regional dummies as well as exchange rate controls.
O-P: Olley & Pakes algorithm applied in preliminary TFP regression.
Standard errors are in parentheses. ***, **, * denote significance at the 1, 5 and 10% level

Table 6. Export Intensity and Pecuniary FDI Externalities

	Unweighted Downstream Effect		Downstream Effect Interacted with Material Use	
	All firms	Domestic firms	All firms	Domestic firms
Plant TFP (OP)	**0.0342** **(.0065)*** **	**0.0339** **(.0052)*** **	**0.0385** **(.0085)*** **	**0.0461** **(.0085)*** **
Employees	**0.1753** **(.0086)*** **	**0.1759** **(.0062)*** **	**0.1924** **(.0084)*** **	**0.3130** **(0.1426)*** **
Capital per worker	**0.1481** **(.0155)*** **	**0.1124** **(.0125)*** **	**0.1615** **(.0152)*** **	**0.1753** **(.0085)*** **
Foreign Share	**0.0011** **(.0002)*** **		**0.0014** **(.0001)*** **	
Horizontal	0.1274 (.0827)	-0.0005 (.0009)	-0.0008 (.0009)	0.1274 (.0827)
Backward	0.0271 (.1481)	0.0004 (.0010)	0.0026 (.0044)	-0.0005 (.0010)
Forward	-0.0007 (.0015)	-0.0008 (.0015)	-0.0012 (.0058)	-0.0007 (.0015)
Indirect	**0.0057** **(.0029)** **	**0.0061** **(.0028)** **	**0.0104** **(.0037)*** **	**.0072** **(.0028)*** **
No. of obs.	5359	4165	5359	4165
Pseudo R^2	0.3341	0.3333	0.3041	0.3040

Tobit regressions with fraction of output exported as dependant variable. All regressions include time, industry and regional dummies as well as exchange rate contro
O-P: Olley & Pakes algorithm applied in preliminary TFP regression.
Standard errors are in parentheses. ***, **, * denote significance at the 1, 5 and 10% level