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### Productivity Effects of FDI Inflows: A Literature Review

Foreign Direct Investment (FDI) flows have increased substantially in the past two decades. These developments have motivated the appearance of a large number of empirical papers that test the expected benefits that FDI inflows are assumed to bring to the host countries. We survey the recent theoretical and empirical literature, but restrict our attention to the productivity changes that are induced by increased FDI inflows. We review both the aggregate productivity effects, as well as the spillover effects of FDI on local firms.



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# 1 Introduction

Foreign Direct Investment (FDI) flows have increased substantially in the last two decades. This has been a result of the reduction of barriers to FDI, considerable improvements in transportation and communication technologies, and the direct policy measures implemented by many governments to attract FDI. These developments have motivated the appearance of a large number of empirical papers that test the expected benefits that FDI inflows are assumed to bring to the host countries. Based on the result of these studies, it is also possible to assess the economic benefits of the governmental incentives to attract multinational enterprises (MNEs).

Increased FDI inflows to a country can create several economic effects. Among others, FDI can affect labour and capital markets, trade patterns and economic growth. In this paper, however, we restrict our attention to the productivity changes that are induced by increased FDI and MNE presence in the host country. We review both the aggregate productivity effects, as well as the productivity spillover effects that are conditional on the characteristics of the domestic firms (e.g. location and absorptive capacity).

Even when the amount of papers on this specific topic is sizeable and still growing, it is possible to classify most of the literature into relatively homogenous groups, which facilitates the overall analysis. Moreover, the recent use of micro-based panel data sets and of improved econometric techniques has dispelled most inconclusiveness and inconsistencies in the early literature. Using as a reference the latest group of studies, it is possible to draw some general conclusions about the productivity spillover effects of inward FDI.

This survey also serves as an input for the modelling of FDI in the WorldScan CGE model (see Lejour et al., 2007). In particular, our attention is focused on those studies that provide numerical evidence of the change in aggregated productivity resulting from increased MNE presence. This estimates will be used in WorldScan to assess the productivity spillovers when the share of foreign capital is increased in the host economy.

## 2 Conceptual framework

To classify the large empirical literature, we make use of the conceptual framework of Barba Navaretti and Venables (2004). They model the different ways in which FDI can affect the productivity levels of the host country. Within this framework, it is easy to sort the different strands in the literature and to clearly understand the issues under analysis.

Assuming that firms are heterogeneous, productivity can be defined as  $q = \beta z(x)$ , where  $x$  is a set of relevant firm characteristics; and  $\beta$  is an efficiency parameter for local firms ( $\alpha$  is the corresponding value for MNEs). The proportion of local firms' total employment in firms with characteristics  $x$  is given by the density function  $n(x)$ . The equivalent function for MNEs is denoted by  $m(x)$ .

Average productivity  $\bar{q}$  of local ( $N$ ) and multinational ( $M$ ) firms is defined as:

$$\bar{q}^N = \int \beta z(x) n(x) \quad \text{with} \quad 1 = \int n(x) dx \quad (2.1)$$

$$\bar{q}^M = \int \alpha z(x) m(x) \quad \text{with} \quad 1 = \int m(x) dx \quad (2.2)$$

If a proportion  $\mu$  of the labour force is employed in MNEs, then average national productivity is:

$$\bar{q} = \mu \bar{q}^M + (1 - \mu) \bar{q}^N \quad (2.3)$$

Within this framework there are several ways in which FDI can affect local productivity. Barba Navaretti and Venables (2004) distinguish two main routes: composition effects and spillover effects.

### 3 Composition effects

If MNEs are different from local firms in some key features, then an increase in the share of foreign firms in the economy changes aggregated productivity via a composition effect. There are two main channels that can be distinguished:

- Unconditional approach. This is when MNEs are on average more productive than local firms:  $\bar{q}^M > \bar{q}^N$ ; irrespective of firm characteristics  $x$ .
- Conditional approach. Controlling for observable firm characteristics  $x$ , one can estimate if MNEs have higher technical efficiency than local firms, i.e. check if  $\alpha > \beta$ .

There is strong empirical evidence for  $\bar{q}^M > \bar{q}^N$ . Using data for US, UK and Italian firms, Conyon et al. (2002) and Criscuolo and Martin (2004) report that there is compelling evidence that MNEs are consistently more productive than local firms. In addition, the survey by Alfaro and Rodríguez-Clare (2004) also confirms these findings for developing countries. Numerical estimates for the UK find that MNEs are roughly twice as productive as local firms (Criscuolo and Martin, 2004). Moreover, using the COMPUSTAT<sup>1</sup> database for 1996, Helpman et al. (2004) estimate a 15% labour productivity advantage of MNEs over domestic firms. In a study that emphasizes the differences in the services sector Griffith et al. (2004) estimate a productivity difference of around 25% between both types of firms in this sector. Another interesting finding of this literature, is that US multinational firms are found to be systematically more productive than other MNEs (Griffith and Simpson, 2003; Benfratello and Sembenelli, 2006).

The strong empirical support for the unconditional approach only confirms the predictions obtained from standard MNE theory (Caves, 1996; Markusen, 2002; Helpman et al., 2004). If there are specific costs for becoming a MNE (e.g. the fixed cost of setting up a foreign subsidiary), then only more productive firms will operate as a MNE in equilibrium.

On the other hand, the conditional effects are more controversial and not as conclusive as the unconditional effects. The controversies arise from the related econometric difficulties of isolating the nationality of firm ownership from other observable and unobservable firm characteristics.<sup>2</sup> MNEs are on average bigger, invest more and use more intermediate inputs per unit of labour (Barba Navaretti and Venables, 2004). These special characteristics grant foreign firms a productivity advantage over local firms. On top of this, MNEs often acquire the most

<sup>1</sup> COMPUSTAT is an international database compiled by Standard and Poor's. It has comprehensive financial data for over 10.000 companies.

<sup>2</sup> Benfratello and Sembenelli (2006) present a survey of this literature, together with an account of the econometric difficulties involved. See also Barba Navaretti and Venables (2004).

productive domestic firms (i.e. cherry picking) and locate in sectors with high average productivity. Despite the empirical difficulties, several papers attempt to control for firm-specific characteristics in order to test if indeed  $\alpha > \beta$ . The general conclusion from this strand of the literature is that there seems to be a positive, but non significant difference between  $\alpha$  and  $\beta$ . Hence, foreign firms are in general more productive than domestic firms because they possess a different set of characteristics  $x$  and also, but less importantly, because they are slightly more efficient in the use of inputs (Barba Navaretti and Venables, 2004).

The focus on the unconditional or the conditional results depends on the aim of the analysis. For the purposes of this review, we want to assess the aggregate productivity effects from increased MNE presence. Hence, we are interested only in the unconditional effect and it is not necessary to distinguish whether the productivity effects are caused by heterogeneous firm characteristics or differences in technical efficiency. One of the main reasons that makes FDI inflows attractive to host economies, is precisely the fact that MNEs bring a set of distinctive characteristics that are not necessarily available to domestic firms. These characteristics include new technologies, increased capital flows, brands and managerial skills. Leaving out of the assessment these distinct characteristics, as done in the conditional approach, will only give a partial account of the full productivity effects of MNEs on the host economy.

## 4 Spillover effects

We focus now on the effects of FDI on domestic firms. Following Blomström and Kokko (1998), we define FDI productivity spillovers as the increase on productivity or efficiency of the host country's local firms as a consequence of the entry or presence of a MNE affiliate. Where, in addition, the MNE cannot internalise the full value of these benefits.

Through this indirect channel, FDI can affect aggregate national productivity. Since this relationship is more complex, we distinguish in this section a theoretical and an empirical subsection.

### 4.1 Theoretical underpinnings

We present here the expected direct and indirect analytical effects of FDI on domestic firms. Using the previous framework, we need to find if  $\beta = f(\mu)$  with  $f'(\mu) > 0$ . The theoretical literature has identified two main channels through which MNEs can affect the productivity of domestic firms via spillovers:

1. Horizontal spillovers. This mechanism is associated with specific knowledge and thus, with intra-industry spillovers. It includes imitation (e.g. reverse engineering and copying of managerial innovations), skill acquisition by MNE employees who later work for a domestic firm, competition effects,<sup>3</sup> and learning to export from MNEs.<sup>4</sup> Since the competition effects can be positive or negative, ideally it will be better to separate them from other horizontal spillovers. This entails a complicated empirical exercise, which is not conducted in the majority of studies.<sup>5</sup>
2. Vertical linkages. This type of spillovers has a longer tradition, beginning with the insights of Hirschman (1958), and complemented with the more recent theoretical models of Rodríguez-Clare (1996) and Markusen and Venables (1999). There can be backward linkages (through the increased demand of inputs by the MNEs) or forward linkages (when local firms use the output of MNEs).<sup>6</sup> Thus, vertical linkages are associated with inter-industry spillovers

<sup>3</sup> This mechanism can either improve the productivity of the local firms in the same industry, or force them out of the market.

<sup>4</sup> For a detailed description of horizontal spillovers see Blomström and Kokko (1998), and Görg and Greenaway (2004).

<sup>5</sup> However, Sembenelli and Siotis (2005) find for panel data of Spanish firms, that short run profit margins decrease for local firms; but in the long run the firms expand again due to efficiency improvements. Using manufacturing data for Mexico, Kokko (1996) also finds positive pro-competitive spillovers.

<sup>6</sup> Rutherford et al. (2005) explore a related channel, where FDI inflows increase the number of varieties of business services. This increase, in turn, raises the productivity of the local firms that use these new business service varieties.



and vertical flows of generic knowledge.

Another channel identified by Barba Navaretti and Venables (2004) is that of general equilibrium effects. For instance, factor markets must adjust to accommodate increased labour demand from MNEs or there can be changes in the demand for public goods due to the activities of MNEs. However, this line of research is beyond the scope of this survey.

## 4.2 Empirical literature on spillover effects

There is a substantial and growing number of papers that test for these spillover effects. Based on Nicolini and Resmini (2006) and Alfaro and Rodríguez-Clare (2004), we classify this large empirical literature into four “generations”:

1. Case studies and surveys. This group of studies provided mixed evidence on qualitative information.<sup>7</sup>
2. Industry-level studies, which are divided in two groups:
  - (a) Cross-section. These studies provided the first quantitative evidence on the spillover effects. The most cited of these studies is Borensztein et al. (1998), who find positive spillovers, but conditional on the absorptive capacity of the host country. However, Aitken and Harrison (1999) and Görg and Strobl (2001) argue that the causal relation in this group of studies is not clear, since there can be a mixture of the composition effect (for instance, MNEs concentrating in the most productive sectors) with the actual horizontal and vertical spillover effects. Moreover, these studies can only measure short run impacts.
  - (b) Panel data. The advantage of these studies is that they allow to study productivity changes over a longer period than before, while controlling for time-invariant differences in productivity across sectors. In the meta-analysis for this group of studies conducted by Görg and Strobl (2001), it is concluded that the spillovers are not a “catch-all” concept, and that the productivity spillovers are conditional on the characteristics and location of domestic firms.
3. Firm-level studies.<sup>8</sup> Haskel et al. (2002) look at the aggregate productivity changes associated with the share of MNEs in total employment. Using micro-level panel data for the UK, they find that a 1% increase in the measured MNE presence in an industry raises TFP of that industry by 0.05%.

Nonetheless, these positive effects are not consistently found in developing countries and tend to

<sup>7</sup> A short review of these papers is given by Aitken and Harrison (1999).

<sup>8</sup> Some studies classified in this group use cross-sections, while others employ panel-data.

be negative in Central and Eastern European Countries (CEECs). For instance, Djankov and Hoekman (2000) find negative spillovers in the Czech Republic, Yudaeva et al. (2003) report positive horizontal but negative vertical spillovers in Russia, while Konings (2001) finds negative spillovers to domestic firms in Bulgaria and Romania, but no spillover effects in Poland. A series of studies also looks at the conditionality of the spillovers on the absorptive capacity of the host country. Using firm-level data from the UK, Girma et al. (2001) report no evidence for spillovers on average, but instead, they find evidence for spillovers to firms with a low technology gap with MNEs. This relation between spillovers and absorptive capacity was also found in Girma (2005), using a different econometric technique with the same UK database. Moreover, Peri and Urban (2004) also report a positive spillover effect conditional on the technological gap for German and Italian firms. Finally, using a panel data of Spanish firms, Sembenelli and Siotis (2005) find that positive spillovers are larger in R&D-intensive sectors. The conditionality of FDI spillovers is also present in geographical terms. Girma and Wakelin (2002) find positive spillovers for UK domestic firms located in the same region as the MNE.

4. Panel-data firm-level studies controlling for time variant productivity shocks. This last group of studies use the semi-parametric estimation method proposed by Olley and Pakes (1996). This methodology deals with the influence that productivity shocks may cause on the endogeneity of the firm's input selection.

Smarzynska Javorcik (2004) looks separately for both vertical and horizontal spillovers in Lithuania. She finds positive backward linkages, but the evidence is not robust for horizontal spillovers or forward linkages. Consistent with the study of Aitken and Harrison (1999), she also concludes that the positive productivity effects originate mainly from joint ventures.<sup>9</sup>

Keller and Yeaple (2003) apply the Olley-Pakes specification to a sub-sample of the COMPUSTAT database that includes US firms. They estimate that a 1% increase in the share of foreign-affiliate employment in total employment, increases TFP of local firms by 1.1%. They also argue that with this kind of productivity elasticity, the governmental incentives given to promote FDI inflows can be justified. For instance, they estimate that FDI spillovers account for about 14% of productivity growth of US firms in the period from 1987 to 1996.

Nicolini and Resmini (2006) check for both horizontal and vertical spillovers in Bulgaria, Poland and Romania. They find positive relations but conditional on the absorptive capacity and technological levels in the host country. The overall productivity elasticity of increased MNE domestic sales is 0.33 for Bulgaria, 0.13 for Poland, and 0.03 for Romania.

There are also related studies for developing countries. Using manufacturing data for Mexico,

<sup>9</sup> This result is consistent with the clear-cut evidence that MNE subsidiaries receive technological transfers from their headquarters (Aitken and Harrison, 1999; Girma and Wakelin, 2002)

López-Córdova (2003) finds that FDI increases TFP. This is the result of positive vertical spillovers outweighing negative horizontal effects. These results are also found in Indonesia, where Blalock and Gertler (2003) provide evidence of positive vertical spillovers while horizontal spillovers are not significant. They also estimate that the overall productivity elasticity of the share of output by foreign owned firms is 0.08.

It is important to note that these values, and those for the CEECs, are much lower than those found in the US. This can indicate that the conditionality of FDI spillovers on the absorptive capacity of the country, may result in higher spillovers for developed countries, than for emerging economies.

### **4.3 Summary on spillover effects**

First, it is important to interpret the empirical evidence with caution. Despite an improvement in the estimation techniques and the quality of the data sets, some methodological controversies remain and the measurement of productivity is still problematic (Alfaro and Rodríguez-Clare, 2004).

Moreover, the main message from the empirical literature is that there are no clear-cut generalized positive effects. As mentioned in the theoretical section, there are several mechanisms at play, and some of them can outweigh others.

With these considerations in mind, we center our analysis on the last “generation” of studies, which have the most comprehensive databases and econometric specifications. From this group of studies one can highlight two sets of evidence:

1. Horizontal spillovers are generally estimated to be non-significant or negative, while vertical spillovers are consistently found to be positive. Moreover, the positive vertical spillovers usually dominate the horizontal spillovers, producing an overall positive productivity impact of FDI. These results are consistent with the intuition that MNEs have incentives to stop or avoid knowledge spillovers to competitors (horizontal spillovers), while they have incentives to transfer knowledge to suppliers in order to improve the quality and/or reduce the prices of the inputs they obtain from these local firms (vertical spillovers).
2. MNE spillovers do not equally affect all local firms. The empirical evidence stresses that absorptive capacity (i.e. technological gap and human capital levels) and geographic proximity condition the transmission of the productivity spillovers (Görg and Greenaway, 2004).

## 5 Concluding remarks

MNEs are, in general, more productive than domestic firms. Thus, FDI inflows directly increase aggregate productivity through a composition effect in the economy. The presence of MNEs also creates indirect effects or spillovers, which can affect local firms in several ways. Even when the aggregate productivity effects of these spillovers are not fully clear nor robust for different countries, recent empirical evidence suggests that positive vertical spillovers outweigh the horizontal spillovers, which are generally close to zero or negative. Moreover, the spillover effects of MNEs on specific firms are conditional on the absorptive capacity of the firms (i.e. technological gap) or the country (i.e. human capital levels). This conditionality also applies to the geographic location of MNEs.

Moreover, the conditionality of FDI spillovers on the absorptive capacity of the host country, in conjunction with the numerical estimates, suggests that the spillover effects are higher for developed countries than for emerging economies. This observation is against the intuition that technologically lagged countries are to gain most from FDI spillovers. In contrast, the evidence suggests that it is precisely the technological gap which conditions how the advanced knowledge embedded in FDI inflows is transmitted to local firms. Thus, the lower the technological gap, the larger the spillovers.

With regard to the numerical estimates that can be used in WorldScan, we consider the empirical estimates by Keller and Yeaple (2003) to be the most appropriate for our purposes. First, this study is among the latest generation of empirical papers, which use micro-level panel-data and the econometric specification of Olley and Pakes. And secondly, it provides numerical estimations of the total (composite and spillover) effect of increased MNE presence on the TFP of local firms. These numerical values, however, can only be taken as “guesstimates” of the full aggregate effects of FDI inflows. As mentioned before, the effects are conditional on the absorptive capacity of countries and thus, are not homogeneous over a wide set of countries as the EU25. Finally, the same conditionality evidence points to within-country heterogeneous effects.<sup>10</sup>

<sup>10</sup> In a recent paper, Fillat and Woerz (2006) address both these heterogeneity issues employing a cross-country panel-data set at the industrial-level. However, they do not report on individual country productivity estimates.

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