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Foreign direct investment and local economic development: Beyond productivity spillovers

by

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Abstract

We investigate how multinational companies can foster economic development of the host country at the micro level. Traditionally the empirical literature measuring spillovers to the host economy arising from foreign direct investment has focused on productivity spillovers, i.e., technological externalities. In this paper we emphasise that pecuniary externalities from multinationals can also be important. These can affect plant start-up and post-entry performance in terms of survival and growth. We substantiate this by outlining and discussing previous and providing new empirical results using a comprehensive plant level panel data set for the Republic of Ireland.

JEL classification: F2

Keywords: Foreign direct investment, productivity spillovers, industrial development, plant entry, survival, plant growth

Outline

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3. *Productivity spillovers*
4. *Plant entry*
5. *Plant survival*
6. *Plant growth*
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Non-Technical Summary

This paper argues that the focus in the literature to-date on measuring productivity spillovers has perhaps led researchers to neglect studying other potentially beneficial effects of FDI on the development of local firms. The authors point out that host country firms may not only benefit from technological spillovers (which are at the centre of studies on productivity spillovers) but also from pecuniary externalities. Taking these two potential externalities into account leads the authors to look at the effects of foreign direct investment on productivity, plant entry and post-entry performance in terms of survival and growth. The empirical estimations are undertaken using plant level data for the Republic of Ireland, an economy that has experienced a considerable influx of foreign capital over the last decades, which has arguably assisted in its economic development.

The paper briefly reviews the evidence for "conventional" productivity studies for Ireland and then moves on to focus on the effects of multinationals on plant entry of domestic firms. Based on a model by Markusen and Venables (1999) the authors argue that multinationals can foster the entry of domestic firms through backward and forward linkages, which increase market size for domestic suppliers as well as final good producers. In other words, multinationals create a pecuniary externality which benefits local new entrants. Estimating a simple entry model the authors find that the influx of FDI has indeed stimulated the entry of domestic plants in the same industry. Using some simple simulations, they find that without the influx of multinationals, the plant population would have been considerably less than the actual number: depending on the counterfactual, the population of plants may have been as much as 30 percent less.

The authors then proceed to argue that technological as well as pecuniary externalities can affect plants' post entry performance by impacting on survival and growth of such establishments. Estimating a hazard model in order to study survival, the authors find that the larger the foreign presence in an industry, the higher are domestic establishments' probabilities of survival. However, this only holds for plants in high tech industries. This points to the importance of technological externalities, which only benefit local plants that have the necessary "absorptive capacity" to utilise the technology from multinationals. On the other hand, the paper finds that an increasing presence of foreign firms in a sector reduces the growth of incumbent domestic plants in the same industry. This indicates that the pecuniary externalities leading to increasing entry of domestic plants increase competition in the industry and hence may reduce the growth performance of incumbent plants.

1 Introduction

The increasing importance of multinational companies (MNCs) and associated foreign direct investment (FDI) for international production has prompted considerable interest in the effects of MNCs on host countries. Specifically, it has long been recognised that foreign direct investment not only leads to an inflow of capital into a country, but that foreign affiliates located in the host country can benefit indigenous firms through technological spillovers. These spillovers arise because multinational companies in general bring with them some sort of firm-specific assets (Caves, 1996; Markusen, 1995) which allow them to compete successfully abroad.[1] These firm specific assets, which can manifest themselves in a variety of forms, for example, as superior marketing, management, or production techniques, can be conveniently described as "technological advantages", i.e., foreign affiliates use a higher technology than indigenous firms. Since this technology has, at least to some extent, the characteristics of a public good, there is scope for positive technological externalities to arise which can benefit indigenous firms through technological spillovers.

Only recently has the theoretical literature pointed out that in the presence of imperfect competition and increasing returns to scale, linkages between MNCs and indigenous firms can also lead to pecuniary externalities benefiting firms in the host country (see Markusen and Venables, 1999). In contrast to technological externalities, pecuniary externalities do not affect the production function of the benefiting firm, but impact on the profit function via reductions in costs or increases in revenues. In a nutshell, increases in output by multinationals lead to an expansion of demand for intermediate products supplied by indigenous suppliers. This increase allows domestic suppliers to produce at a more efficient scale, reducing average costs, which will reduce the price of intermediates multinationals and other domestically based final good producers have to pay.

The empirical literature on technological externalities and the measurement of spillovers has thus far largely focused on measuring productivity spillovers from MNCs to domestic firms in the host country.[2] This literature has its origins in the papers by Caves

[1] There is, however, a recent literature which argues that firm-specific assets are not necessary for multinationals to emerge, see, for instance, Fosfuri and Motta (1999).

[2] Görg and Strobl (2001a) review empirical studies of productivity spillovers, using meta-analysis techniques. Görg and Greenaway (2004) provide a review of the issues from a more policy oriented viewpoint.

(1974) and Globerman (1979), who analysed productivity spillovers in Australia and Canada, respectively. Their initial approach has been refined and extended subsequently by, for example, Blomström and Persson (1983), Kokko (1992) and, most recently, Girma et al. (2001) and Keller and Yeaple (2003). There have, however, to the best of our knowledge, only been a scant number of attempts at measuring other channels of technological spillovers, or indeed pecuniary spillovers.

Our purpose in this paper is to discuss alternative means of assessing the impact of multinationals on industrial development. We examine the effects of MNCs on the development of domestic firms using the example of the Republic of Ireland, which appears to be a model case study due to the importance of MNCs for its economy. For example, data from the Irish Central Statistics Office show that foreign multinationals in Ireland accounted for roughly 47 percent of manufacturing employment and 77 percent of net output in manufacturing in 1996. The corresponding figures in 1983 (the first year for which these data are available) were 38 and 58 percent respectively, which illustrate the increasing importance of multinationals for Irish manufacturing. While indigenous manufacturing tended to be concentrated on traditional and food-sector manufacturing activities, MNCs have invested primarily in modern high tech sectors. This has led to a rapid increase in the significance of the high tech sectors for the Irish economy (Barry and Bradley, 1997). Furthermore, many observers have argued that the influx of foreign direct investment into the Irish economy has had significant effects on the growth of the economy (e.g., Sachs, 1997, de la Fuente and Vives, 1997).

This paper looks at some of the microeconomic mechanisms through which such growth effects may work. In particular, we examine the effect on the entry and post-entry performance, in terms of survival and growth, of new plants. To this end, we discuss our previous work on these issues, but also extend our work in new directions.

The remainder of our paper is organised as follows. In Section 2 we emphasise the importance of linkages for allowing technological and pecuniary externalities from FDI to take place. We also provide evidence of the incidence of linkages between foreign and indigenous firms in Irish manufacturing. Section 3 reviews the evidence of a "conventional" study of productivity spillovers for Ireland, namely that by Ruane and Ugur (2002). Section 4 discusses our study of the effect of multinationals on domestic plant entry (Görg and Strobl,

2002a). We also extend our previous work by looking at simulations which attempt to calculate what would have happened to the population of domestic plants in the absence of multinationals. Section 5 examines whether multinationals can assist the survival of new domestic plants via technology spillovers, reviewing our study in Görg and Strobl (2003). In Section 6 we extend the discussion of post-entry effects of multinationals by looking at the effect on plant growth. An assessment of the evidence thus far, and concluding remarks are provided in the final section.

2 Linkages

Multinational companies can be expected to have only little effect on the domestic economy if they operate in so-called enclave sectors with no contacts to the domestic economy. Hence, it is not surprising that the importance of backward or forward linkages between multinational companies and domestic suppliers and/or customers has also been emphasised in the literature on externalities. Blomström and Kokko (1998) in their review of the literature on productivity spillovers point out that "local firms may be able to improve their productivity as a result of forward or backward linkages with MNC affiliates" (p. 248). Linkages are also important components in the models by Rodriguez-Clare (1996) and Markusen and Venables (1999), where multinationals can foster the development of domestic firms through creating linkages and expanding demand for local supplies.

An analysis of linkages between multinational companies and domestic firms in Irish manufacturing industries can, therefore, provide information as to whether the conduit for the presence of external effects from multinationals exists. Data on linkages are available from the *Irish Economy Expenditure Survey*, which is undertaken annually by Forfás, the policy and advisory board for industrial development in Ireland.[3] The summary statistics, which are published in Forfás (1999), calculate backward linkages as the share of raw materials and components purchased in Ireland relative to total raw materials and components used.[4] Unfortunately, the survey does not include data to analyse forward linkages.

[3] The survey is sent out to firms with more than 30 employees in manufacturing and internationally-traded services industries. It is not compulsory for firms to take part in the survey, but response rates are normally such that firms responding to the survey account for around 60-80 per cent of employment of the target population each year (O'Malley, 1995). The survey includes information on output and employment as well as on each firm's input purchases.

4 Note that Rodriguez-Clare (1996) and Alfaro and Rodriguez-Clare (2004) suggest to calculate linkage

Table 1 presents the data for the value of backward linkages by foreign-owned firms in manufacturing industries. These figures exclude firms in the Food & Drink sectors, which seems reasonable since one would expect firms in these sectors to have higher linkages than firms in other sectors due to the availability of perishable inputs (McAleese and McDonald, 1978). The Tobacco sector is also excluded because of the sectoral aggregation of the data. As can be seen, the overall extent of backward linkages in foreign firms reached 18 per cent in 1996.[5]

[Table 1 here]

The table also shows that foreign manufacturing firms have increased their linkages between 1987 and 1996 by roughly 3 percentage points. Although the aggregate data may suggest that the development of linkages has stagnated since the mid 1990s, Görg and Ruane (2001) present econometric evidence to suggest that individual firms increase their linkages over time. They undertake a firm level econometric study of linkages between multinationals and indigenous firms in the Irish electronics sector between 1982 and 1995. On the basis of these results, they argue that the apparent stagnation in the aggregate level of linkages can be attributed to the increase in the number of new foreign firms setting up in Ireland, and does not represent stagnation at the firm level. New foreign firms start off with an initially low level of linkage, but increase their linkages over time as they get accustomed to the supplier environment.[6]

Based on the arguments presented above, we suggest that the greater the extent of backward linkages between indigenous and foreign-owned firms, the greater the possibility of externalities from foreign firms benefiting domestic firms. An important caveat to this argument is that the potential for externalities through backward linkages is also associated with what precisely is being purchased. For example, the potential externalities from an electronics multinational buying electronic components might be greater than they are for the same firm buying packaging material. However, data to answer such a question are not

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coefficients as the ratio of the value of inputs bought domestically to total employment in the firm. This takes into account different input intensities for domestic and foreign firms. However, such data are not published by Forfás.

[5] While comparison with other countries is difficult due to different definitions and sectoral aggregations, it might be worthwhile to note that Turok (1993) in his study of backward linkages in the Scottish electronics industry found that, in 1991, foreign-owned firms sourced 14 per cent of their material inputs in Scotland and 31 per cent in the rest of the UK.

available to us at present. Acknowledging this limitation, the level and growth of linkages in foreign firms may still suggest that there is further scope for positive effects through externalities between foreign and indigenous firms. We now discuss the channels for such externalities.

3 Productivity spillovers

Multinational companies can impact on indigenous firms through affecting their productivity. Because MNCs use a higher level of technology, and technology, or knowledge, has certain characteristics of public goods, there is scope for technological externalities and indigenous firms may benefit through spillovers from MNCs. If there are technological externalities, the presence of MNCs leads to productivity increases in domestic firms, allowing them to become more efficient. Productivity spillovers are difficult to measure since, as Krugman (1991) argues, "knowledge flows […] leave no paper trail by which they may be measured and tracked" (p. 53). The approach adopted in the empirical literature therefore largely avoids the (arguably difficult to answer) question as to how productivity spillovers actually take place, but focuses on the simpler issue of whether or not the presence of multinationals affects productivity in domestic firms.

The presence of multinationals can also have negative effects on the productivity of host country firms, however. As Aitken and Harrison (1999) argue, multinationals producing at lower marginal costs than host country firms have an incentive to increase output and attract demand away from these firms. This will cause host country rivals to cut production which, if they face fixed costs of production, will raise their average cost. Also, to the extent that the presence of multinationals leads to higher wage demands in the economy, this will increase a firm's average costs. Whether the effect of MNCs on productivity of host country firms is, on average, positive or negative is, therefore, ambiguous and needs to be decided empirically.

An empirical analysis of productivity spillovers usually comprises an econometric analysis in which labour productivity or total factor productivity in domestic firms is regressed on a number of independent variables assumed to have an effect on productivity. One of these variables is a measure of the presence of foreign firms in either the same

[6] See also McAleese and McDonald (1978) and Kennedy (1991) for similar arguments.

industry (horizontal spillovers) or in vertically linked industries (vertical spillovers), usually defined as the share of employment, sales or capital by foreign-owned firms. If the regression analysis yields a positive and statistically significant estimate of the coefficient on the foreign presence variable, this is taken as evidence that spillovers have taken place from MNCs to domestic firms. This approach dates back to the papers by Caves (1974), Globerman (1979), and Blomström and Persson (1983), which focus on horizontal spillovers using cross-section industry level data. The initial approach has been refined and extended to use firm level panel data (e.g., Girma et al., 2001; Keller and Yeaple, 2003) and to investigate vertical spillovers (Smarzysnka-Javorcik, 2004, Girma et al., 2004).

Ruane and Ugur (2002) implement this "conventional" approach using firm level panel data available from the Irish Central Statistics Office for the period 1991 to 1998. They regress labour productivity (defined as net output per worker) on the employment share of foreign-owned firms in the same industry (defined alternatively at the 2, 3 and 4 digit level) and control for capital intensity, skill intensity as well as firm specific time invariant effects. They do not find any statistically significant evidence for productivity spillovers from these regressions. In alternative estimations, they use a similar set up but include total employment in foreign-owned firms in the industry as the "spillover variable", controlling additionally for total employment in domestic firms also. From these estimations they find robust evidence for horizontal spillovers based on the 4 digit definition of the industry, however, not for 2 or 3 digit definitions. One possible explanation for their lack of significant spillovers is that they do not allow for heterogeneity among domestic firms in terms of absorptive capacity.

Rather than spending more time on discussing the "conventional" approach of measuring productivity spillovers we suggest that it may also be fruitful to explore other ways of measuring technological externalities. While, as discussed above, the production function approach to measuring productivity spillovers has been dominant in the literature, it takes account of only one dimension of benefits from multinationals by measuring the effect of foreign presence on productivity of existing domestic firms. This neglects a number of other potentially positive effects of multinationals. Pecuniary spillovers, i.e., multinationals increasing market size for domestic suppliers, can benefit entry, survival and growth of domestic establishments. Also, increases in productivity through technological externalities will, all other things being equal, reduce a host country firm's average cost of production,

which has obvious benefits for the firm in terms of its survival and growth performance.[7] We therefore now turn to discuss the effects of multinationals, through creating pecuniary as well as technological externalities, on the entry and post-entry performance of indigenous firms.

4 Plant entry

Multinationals do not only benefit indigenous firms through technological externalities, but there is scope for pecuniary externalities as well, given that multinationals may increase demand for domestically produced supplies. Markusen and Venables (1999) show formally that multinationals can change the structure of imperfectly competitive industries in the host country by fostering the development of domestic industry through pecuniary externalities. The model features two types of industries, intermediate and final consumer good producing, and three types of firms: domestic firms producing intermediate goods, domestic firms producing final consumer goods, and multinational firms producing final consumer goods. Both industries are assumed to be imperfectly competitive with increasing returns to scale of production.

According to the model the presence of multinationals has three effects on the host economy. First, there is a competition effect as multinationals compete with domestic final good producers. The increase in total output due to output produced by multinationals decreases the market price, which leads to the exit of some domestic firms. This, thus, leads to multinationals crowding out domestic firms. Second, multinationals create additional demand for domestically produced intermediate goods through linkages with indigenous suppliers. In an imperfectly competitive domestic supplier industry, this leads to decreasing average costs leading to increases in profits for intermediate good producers, which, in turn, may induce entry into the intermediate good producing sector. This entry causes the third effect, namely a fall in the price of intermediates which favours customer firms through lower input prices. Customer firms can be both domestic or multinational final good producing

[7] Technological externalities can also benefit indigenous firms' export performance (see Aitken et al., 1997, Barrios et al., 2003), which Blomström and Kokko (1998) refer to as "market access spillovers". A further way of looking at technological externalities leading to spillovers from foreign firms is by examining R&D spillovers (Bernstein, 1988 for Canada and Wakelin, 2001 for the UK) and their effects on indigenous firms. As far as we are aware, there has as yet not been any analysis of R&D spillovers, or export spillovers from MNCs for the Irish economy. In a first analysis of a rich dataset Kearns and Ruane (2001) show that foreign firms which are R&D active employ higher skilled labour than other foreign firms. They do not look at the effects on indigenous employment, however.

firms. Through these effects multinationals may induce the entry of domestic intermediate good producers as well as domestic final good producing firms.[8]

Whether the latter two positive effects outweigh the potential negative competition effect remains an empirical question. In Görg and Strobl (2002a) we tackle this issue using plant level data for manufacturing industries in Ireland for 1973 to 1995.[9] We argue that the competition effect is likely to have been negligible in Ireland over that period. Most of the multinationals that located in Ireland since the 1970s operated in high tech sectors, which were largely underdeveloped in Ireland. This was in part due to an explicit industrial strategy by Irish policy makers and part due to the fact that Ireland could provide a relatively cheap pool of skilled and educated workers. This argument is supported by the fact that a simple shift and share analysis of sectoral employment share dynamics show that most of employment losses of the indigenous sector over the period was due to a decline in importance of indigenous employment intensive, mostly traditional, sectors.

In order to test whether the data support the contention that multinationals in net acted to encourage the entry of indigenous plants, Görg and Strobl (2002a) run a simple entry rate model:

$$E_{jt} = f(FOR_{jt}, X_{j_t}) \qquad (1)$$

where E is the entry rate, defined alternatively as the total gross and net number of indigenous entrants over t to t+1 relative to total plant population in industry j at time t, and X is a vector of plant and industry characteristics postulated to impact on a plant's hazard rate. In accordance with authors such as Acs and Audretsch (1989) and Mata and Machado (1996) X includes measures of plant's employment size at time t, minimum efficient scale defined as the log of median employment size in sector j, the sectoral Herfindahl index of sector j

[8] The latter two effects resemble the backward and forward linkage effects as discussed by Hirschman (1958). Rodríguez-Clare (1996) examines a similar mechanism in a more aggregate two-country model with countries specialising in the production of different goods. Multinationals can help develop domestic supplier industries which in turn leads to the development of indigenous final-good producers. See also Barrios, Görg and Strobl (2004) for a related theoretical approach and empirical evidence on the effect of multinationals on the development of domestic industry.

[9] The primary data source for all of our empirical work reported subsequently is the annual employment panel survey carried out since 1973 by Forfás. The survey covers all known active manufacturing plants, with the response rate being generally over 99 per cent. The unit of observation is the individual plant, for which the number of permanent full-time and part-time employees is reported. Each plant is, amongst other things, identified by a unique plant number, the year of start-up, nationality of ownership and its 4-to-5 digit NACE

measured in terms of plants' employment shares, and the net sectoral (employment) growth rate. Most importantly, the model includes a measure of multinational presence within a sector, *FOR*, defined as the share of employment by MNCs in sector *j* at time *t*.

The main estimation results, taken from Görg and Strobl (2002a) are given in Table 2. As can be seen from the first column, foreign presence acts to increase significantly the gross entry rate of plants. The actual size of the coefficient suggests that a one percentage point increase in foreign presence increases the gross entry rate by 6.1 per cent. One could argue that what one is interested in when evaluating the effects of multinationals on indigenous development is the net entry rate rather than the gross entry rate, since the latter is more likely to include any competition effect (i.e., plant exit due to competition). We therefore also report the results of using the net entry rate as the dependent variable in the second column of Table 2. As can be seen in the second column, the coefficient on *FOR* remains statistically significant. Notable is, however, that the size is virtually unchanged to that of the gross entry rate regression, suggesting that there is little additional negative or positive effect on start-ups controlling for exits.[10],[11]

[Table 2 here]

As an extension to our earlier work in Görg and Strobl (2002a) we can use the coefficient estimate from the net entry rate in Table 2 to run a simple simulation of how multinationals have affected the evolution of the domestic plant population size. More precisely, consider that the actual size of the plant population at any time *t* is given by:

$$P_t = P_0 + \sum_{t=1}^{t=T} (NE_t)(P_{t-1}) \qquad (2)$$

where P_t is the actual size of plant population at time t, P_0 is the actual plant population at time 0 (the beginning of the sample period), P_{t-1} is the actual size of plant population at time t-1, and NE_t is the actual indigenous net entry rate from t-1 to t. One

code sector. These identifiers are only changed if there is an actual change of ownership. A plant is classified as being foreign-owned if 50 percent or more of its shares are held by foreign owners.

[10] The results of a positive entry effect are robust to a number of specifications. In particular, to defining the FOR variable in terms of plant share instead of employment share, to including of up to three lags of the FOR variable, and to the inclusion of vertical measure of FOR (which turns out to be not statistically significant in most cases).

[11] In a companion paper, Görg and Strobl (2002b) find that foreign presence reduces the start-up size of domestic new entrants.

should note that the product $(NE_t)(P_{t-1})$ is simply the observed number of entrants between t-1 and t.

Using this identity we can construct hypothetical values by considering alternative values of the degree of multinational presence by:

$$P_t^h = P_0 + \sum_{t=1}^{t=T}[(NE_t) + \beta(FOR^h{}_t - FOR_t)](P_{t-1}) \qquad (3)$$

where P_t^h is the estimated hypothetical plant population at time t, FOR_t is the actual foreign share of employment at time t, FOR_t^h is some choice of hypothetical foreign share of employment which may vary over t or be time invariant, and β is a (estimated) parameter that relates *FOR* to the plant population size.

One should note that in (3) we are implicitly assuming that multinational presence, *FOR*, is a significant determinant of the indigenous net entry rate and thus of the plant population size at any time t. Equation (3) thus allows one to calculate what the plant population size would have been if the degree of multinational presence had been different from that observed in reality. A natural candidate of β is of course the estimated coefficient on FOR reported in Table 2, so one only needs to choose a hypothetical value for FOR. We experiment with two such values.

First, we keep FOR fixed at its 1972 level, the start of our sample period, and this allows us to calculate the indigenous plant population size if no new multinationals had entered Ireland. However, this may be an unrealistic scenario. Many of the multinationals that existed at the beginning of 1970s may have either changed their size or left Ireland entirely. Thus, alternatively, we followed these multinationals over time and calculated their share relative to total employment in 1972 for each and every subsequent period.

The actual, the 1972 level and the evolution of the share of the in 1972 incumbent multinational plants are first graphed in Figure 1. Accordingly, the share of multinationals in total employment (*fs_actual*) rose from about a third to nearly a half by the end of the century. However, if one only considers those multinationals incumbent in 1972 (*fs_incumbents*) one discovers that this rise was due to new multinational entrants, as the importance of incumbents fell both due to exits and downsizing.

[Figure 1 here]

Inserting actual values for initial indigenous plant population size and the net entry rates and, alternatively, the initial degree of foreign presence and that time varying degree of the 1972 incumbents in (3), we calculated the hypothetical indigenous plant population series. These alongside the actual evolution of the indigenous plant population size are graphed in Figure 2. As can be seen from the dotted line, the indigenous plant population stood at around 3,700 plants in 1972. It rose considerably until about the mid-1980s, from which point onwards this trend has been reversed. Our simulations show that holding the share of multinationals fixed at the level in 1972 would have resulted in considerably lower plant population size – by the year 2000 the total number of indigenous plants would have been nearly 800 less (*hypothetical1*). If one further considers the fact that the multinationals that existed in 1972 both exited Ireland and downsized, the difference relative to the actual observed is even more drastic. More specifically, we find that the absence of the total cumulative effect that multinational presence had in each year on the domestic plant start-up rate would have resulted in reducing the plant population size by about 30 per cent or by nearly 1,700 plants (*hypothetical2*).

[Figure 2 here]

It is important to point out that the actual figures presented here are somewhat tentative and must be viewed with some caution. This arises in part from the very simplicity of the simulations that make them tractable. However, there are also a number of underlying assumptions that should be at the very least be taken into consideration. For one we are assuming that the impact of multinational presence is of a relatively short-term nature, which is in part supported by our results in Görg and Strobl (2002a). The methodology used also assumes that the exit and downsizing of incumbent multinationals is independent of both new domestic and foreign entrants over the period. If this is not the case, our simulations may be either over- or underestimating the impact, depending on whether such entries tended to reinforce or counteract the share loss of the incumbents. Finally, it must be pointed out that we have assumed that the other control variables are not affected by changes in the foreign share variable.

5 Plant survival

Once a plant has entered, the presence of multinationals in the host country may affect the post-entry performance of the plant in a number of ways. Firstly, an increase in productivity through technology spillovers (as argued in Section 3) will, all other things being equal, reduce a host country plant's average cost of production. This may have implications for the survival of domestic plants, as we discuss in Görg and Strobl (2003).

Audretsch (1991, 1995) argues that the probability of plant *i* remaining in industry *j* at time *t* is determined by a plant's price cost margin, i.e., the degree to which price exceeds average cost. According to this argument a plant's ability to increase price and/or reduce average cost will have a positive effect on plant survival, ceteris paribus. In this framework, technology spillovers from MNCs and the associated increase in productivity enable host country plants to produce at lower average cost for a given level of production, which increases their price-cost-margins. All other things equal, this leads to a higher probability of survival for host country establishments. Of course, if negative competition effects are important, the presence of multinationals may actually reduce the survival of domestic establishments. Whether the effect of MNCs on the survival of indigenous plants is, on average, positive or negative is, therefore, ambiguous and needs to be decided empirically.

In Görg and Strobl (2003) we investigate whether the presence of multinational companies in sector *j* has any effect on the survival of indigenous plants in the same sector, ceteris paribus. As regards indigenous establishments, we would expect a potential technology gap to exist between these and MNCs (due to MNCs' firm-specific assets) which creates the opportunity for technology spillovers between the two groups. In order to properly disentangle the role of plant and industry specific factors from that of the presence of MNCs on the survival of plants we postulate a Cox proportional hazard model,

$$h(t) = h_0(t)e^{(\beta_1 FOR_t + \beta_2 Z_t)} \qquad (4)$$

where $h(t)$ is the rate at which plants exit at time t given that they have survived in t-1 and h_0 is the baseline hazard function when all of the covariates are set to zero. *FOR* is a proxy for the presence of foreign multinationals in a sector and is defined as the share of employment by MNCs in sector *j* at time *t*. *Z* is a vector of covariates which are identified in the IO literature as having an effect on plant survival, including plant size, industry minimum

efficient scale, industry concentration, and industry growth. *Z* also includes a dummy variable equal to one if a plant was borne before Ireland's accession to the EU in 1973 since one may expect such establishments to adjust only slowly to the new policy regime (see Walsh and Whelan, 2000) and therefore to have lower survival rates. We focus on the survival of indigenous establishments, and separate these plants further into high and low tech sectors to allow for differences in absorptive capacity and, hence, obtain more homogenous comparison groups.

Estimation of the Cox Hazard model, the results of which are summarised in Table 3, shows that, within the high tech sectors foreign presence reduces indigenous plants' hazard of exiting, i.e., increases their chances of survival. We take this as evidence that technological spillovers have benefited indigenous establishments. In the low tech group we find that the presence of MNCs does not appear to impact on plant survival in either direction. This could indicate that, even though there is a technology gap between these firms which creates a potential for technology spillovers, these do not take place, perhaps because indigenous low tech firms are not able to absorb the potential spillovers (see, Kokko, 1996, Girma and Görg, 2002). In other words, the technology gap between these two groups of firms is too wide, indigenous establishments operating in low tech sectors do not have the absorptive capacity to learn from foreign firms.

[Table 3 here]

6 Plant growth

Multinationals can also impact upon the post-entry growth of indigenous establishments. Firstly, as described in the model by Markusen and Venables (1999) increases in demand for intermediate products and changes in prices create pecuniary externalities which benefit indigenous plants. The expanded market size may allow indigenous plants to grow faster than in the previously smaller market. Secondly, technological externalities may improve the performance of domestic plants and, hence, their growth performance. Thirdly, however, the pecuniary externalities leading to increasing entry of domestic plants (as discussed in Section 3) increase competition in the industry and hence may reduce the growth performance of incumbent plants.

To investigate the effect of MNC presence on the post-entry growth of indigenous

establishments we postulate the following empirical model for the growth of plant *i* (measured in terms of employment growth) *GRO* between t+1 and t:[12]

$$GRO_{it+1} = \beta_1 + \beta_2 FOR_{jt} + \beta_3 SIZE_{it} + \beta_4 SIZE_{it}^2 + \beta_5 AGE_{it} + \beta_6 AGE^2_{it} \ldots$$
$$\ldots + \beta_7 NETS_{jt} + \lambda_t + \eta_i + \varepsilon_{it} \qquad (5)$$

where *FOR* is the percentage of employment in the sector due to MNCs, *SIZE* is given as the ranking of the plant's size, measured as employment, within its sector in every year,[13] *AGE* is measured as years since start-up date, and *NETS* is the net sectoral growth rate defined for 68 sub-sectors. Furthermore, λ are year specific effects modelled as time dummies, η is a time invariant establishment specific effect, and ε is an error term assumed to be independent across plants and time.

There has been much debate on the growth rates of small relative to large firms, see for instance Hart and Oulton (1996). Although this discussion is far from conclusive, it does cast considerable doubt on whether small plants can be considered identical in behaviour to large establishments. Thus to truly disentangle the effect of ownership one should control for plant size. We have also included plant size squared to allow for a non-linear relationship between employment growth and its size.

Plant age is included in order to take account of the fact that rate of growth may also change as plants move through their life cycle. Age itself, regardless of start-up period, may influence the growth rate (see, for instance, Dunne and Hughes, 1994; Dunne et al., 1989; Evans, 1987). On the one hand, establishments may take some time before they reach their optimal size; on the other hand, long established incumbents may have absolute cost advantages *vis-a-vis* newer entrants. Similarly as for size we have included age squared to allow for the possibility of non-linear relationships.

Most importantly for the purpose here, we have included the share of employment by foreign firms in the plant's sector, *MNC*, as a proxy for the presence of foreign multinationals. Finally, equation (5) includes the net sectoral growth rate and time dummies to control for sectoral and aggregate economic conditions.

[12] This model is in line with similar empirical work in the empirical IO literature (see, for instance, Dunne and Hughes, 1994; Dunne et al., 1989)

[13] An alternative measure of size would have been the actual level of employment, although this would clearly be endogenous given the definition of the dependent variable.

In estimating (5) we used a fixed effects estimator which purges the plant specific time invariant effects, both observed and unobserved, from the equation and hence circumvents possible measurement problems due to potential correlation between unobserved factors and our explanatory variables. Furthermore, we reduce our sample to observations from continuing plants, as in Hart and Oulton (1996). Thus, our results should be interpreted as effects on growth conditional on staying in the industry.

Our results for estimating (5) are provided in the first column of Table 4. In terms of our explanatory variables we firstly find that the net sectoral growth rate, as would be expected, is positively related to a plant's net employment growth rate – if an establishment is located in a sector that is experiencing economic growth it is likely to grow also. We also discover that larger plants experience lower rates of net employment growth. This relationship however takes a convex form, indicating that this effect occurs at a diminishing rate. While age in levels appears not to be a significant factor in determining an indigenous plant's employment growth, age squared is negative and significant, indicating that the relationship between age and employment growth is not of a simple linear or concave/convex form.[14]

Finally, and most importantly from our point of view, we find that foreign presence acts to decrease the growth of indigenous plants significantly after controlling for other factors. This suggests that indigenous establishments located in sectors with high foreign presence grow slower than other plants. To interpret this result, it may be helpful to recall our finding from Section 4, that the presence of foreign firms fosters plant entry. Hence, if there is a large foreign presence, more indigenous plants are in the market, leading to increased competition. This may imply that individual plants grow slower because of the higher degree of competition in the sector.

Similar to our analysis of plant survival, we also divided our sample into indigenous plants operating in low and high tech sectors and estimated equation (5) for these two sub-samples; the results are given in the second and third columns of Table 4. As can be seen, the

[14] If age squared is excluded, then age in levels turned out to be negative and significant. Also, including higher order terms did not change the original result. Given that these other specifications showed no noticeable changes in our other explanatory variables, and that our main focus is on the impact of FDI presence, we did not pursue this matter further.

results of the overall sample hold for all covariates for these two sub-samples, except for the age terms. In the case of the high tech sectors older indigenous plants experience higher employment growth, whereas the result for the low tech sample is similar to that of the overall sample. More importantly, however, we find that the negative effect of FDI presence on indigenous plant employment growth holds for both the high and low tech sector. This could be interpreted as indicating something about the relative importance of technological and pecuniary externalities in driving these effects. While technological externalities can be expected to benefit high and low tech establishments differently (due to different levels of absorptive capacity) there is no obvious reason why pecuniary externalities should have different effects on these two groups of plants.

[Table 4 here]

7 Conclusions

In this paper we discuss the potential externalities for domestic firms emanating from the presence of multinational companies which can assist the development of local establishments in the host country. We present empirical results on the effect of MNCs on entry, productivity, survival and employment growth in indigenous plants in the Republic of Ireland. The literature to-date has focused largely on measuring productivity spillovers from foreign to indigenous firms, which are the result of technological externalities. We argue that this focus neglects other important sources and channels for spillovers from multinationals. Multinationals not only benefit indigenous firms through technological externalities, but there is also scope for pecuniary externalities created through foreign presence. Foreign multinationals increase demand for intermediate goods supplied domestically which, in the presence of imperfect competition and increasing returns to scale affects indigenous firms through expansions of markets for domestic supplies and changes in prices. We demonstrate that technological and pecuniary externalities can impact on indigenous plants' entry and post-entry performance in terms of productivity, survival and growth.

Our analysis points to a number of important issues for further research in this area. Firstly, one may argue that the "traditional" way of measuring technological externalities, i.e., productivity spillovers, as improvements in domestic establishments' productivity, is a very narrow concept. It may make sense to look at the effects of technological externalities on

plant or firm performance, such as survival or growth, as well in order to assess the effects of technological externalities more thoroughly. Secondly, apart from technological externalities, multinationals can impact on indigenous performance through pecuniary externalities, which may affect entry, growth and survival of plants and which have not received much attention in the literature to-date.

A drawback of most of the empirical studies to-date is that they treat the specific mechanisms by which the spillovers are supposed to occur as a "black box". "Conventional" spillover studies usually regress total factor or labour productivity of domestic firms on a number of covariates, including a measure of the extent of multinational presence in an industry. A similar criticism, of course, also applies to our empirical work herein. While this can give an indication as to the overall effect of foreign presence on productivity, entry, survival or growth, it does not allow one to discern the channels through which these effects work. While this is arguably difficult to achieve with the data available it should be a priority for further research. Not only would it be important from an academic point of view but it is also necessary for guiding policy makers towards targeting the channels through which spillovers work. Theoretical work has recently stressed the importance of worker movements for technology spillovers (Fosfuri et al., 2001, Glass and Saggi, 2002). Görg and Strobl (2002c), who look at productivity premia in firms owned by individuals who gained experience in foreign multinationals, is one step into that direction. Also, the case studies reported by Moran (2001) as well as the survey evidence in Smarzynska-Javorcik and Spatareanu (2004) provide vital insights into the black box.

One should also note that recent evidence for Ireland and other countries seem to indicate that spillovers occur perhaps primarily at the local rather than at the national level; see, for instance, Barrios et al (2004), Girma and Wakelin (2001), and Driffeld (1999). This may not be surprising given that there is a fair amount of evidence that linkages, either horizontal or vertical, between production units are mostly local in nature. This may be even more so when one considers effects arising from foreign direct investment as multinationals are considered to be more R&D intensive than local firms (see Markusen, 1995), and there is plenty of support according to which knowledge flows measured through R&D are subject to distance decay effects (see Bottazzi and Peri, 2001).

Finally, an important issue is whether the experiences of the Irish case, where FDI has been widely accepted as being a conduit for economic development, can be applied to other countries. In this respect, we need to point out that there are certain aspects of Irish industrial development which suggest that Ireland's experience may not be easily replicable by other potential host countries trying to attract MNCs. For example, Ireland's pro-active industrial policy, in particular as regards the creation of linkages between MNCs and indigenous suppliers (Görg and Ruane, 2001) as well as the possible benefits from agglomeration economies (Barry et al., 2003), can be expected to have impacted upon the contribution of MNCs to indigenous development.[15] This implies that our empirical results, while they may in some senses be encouraging for other countries attempting to embark on industrial development with the help of attracting MNCs, may not be the same for other countries. A full discussion of this issue, however, is beyond the scope of the present paper.

[15] Lipsey (2002) also makes the point that the Irish experience may be quite unique and difficult to replicate by other countries.

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Table 1: Linkages of foreign firms in manufacturing*, 1987-1996
(Purchases of raw materials and components, in million Euro, constant 1997 prices)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Purchases	3,286	3,828	4,238	4,226	4,313	4,819	5,379	6,403	8,434	9,548
Irish Purchases	516	611	702	792	823	921	1,063	1,243	1,666	1,756
Irish % of Total	15.7	16.0	16.6	18.8	19.1	19.1	19.8	19.4	19.8	18.4

Note: * Excluding Food, Drink and Tobacco
Source: Forfás (1999)

Table 2: Effect of foreign presence on domestic entry rate

(results from Görg and Strobl, 2002a)

	Gross Entry Rate	**Net Entry Rate**
FOR	0.061*	0.060*
	(0.024)	(0.027)
SIZE	-0.602*	-0.522*
	(0.194)	(0.275)
Observations:	1496	1496
R-squared	0.15	0.14

Notes:
(a) Heteroskedasticity consistent standard error in parentheses.
(b) * signifies 5 per cent significance level
(c) Estimation conducted using a fixed effects estimator and including measure of minimum efficient scale, average plant age, industry growth and full set of time dummies,
(d) manufacturing is broken into a total of 68 sectors
(e) sample period is 1973-1995

Table 3: Survival analysis of indigenous plants using a hazard model

(results from Görg and Strobl, 2003)

	High Tech	**Low Tech**
FOR	-1.794*	-0.076
	(0.831)	(0.228)
SIZE	-0.014*	-0.008*
	(0.004)	(0.001)
# of obs.	14641	116340
# of subj.	1495	11217
Log Likelihood	-3025	28870
Wald Test (β_i=0)	235*	1519*

Notes:
(a) Heteroskedasticity consistent standard error in parentheses.
(b) * signifies 5 per cent significance level
(c) Hazard model includes measure of minimum efficient scale, Herfindahl index, industry growth, dummy for plants borne before 1973, and a full set of time dummies
(d) manufacturing is broken into a total of 68 sectors
(e) sample period is 1973-1995

Table 4: Results of the Growth Regression

	All	High Tech	Low Tech
FOR	-0.147*	-0.414*	-0.142*
	(0.017)	(0.068)	(0.000)
SIZE	-0.004*	-0.007*	-0.004*
	(0.000)	(0.000)	(0.000)
$SIZE^2$	4.65e-06*	1.11e-05*	4.40e-04*
	(8.69e-08)	(5.18e-07)	(8.84e-08)
AGE	9.48e-05	0.008*	-0.001
	(3.60e-04)	(0.001)	(0.000)
AGE^2	-9.54e-06*	7.89e-07	-7.51e-06
	(3.83e-06)	(1.67e-05)	(3.92e-06)
NETS	0.138*	0.157*	0.135*
	(0.013)	(0.048)	(0.014)
CON	0.337*	0.522*	0.336*
	(0.009)	(0.042)	(0.009)
# Obs.	121,776	13,436	108,340
$F(\beta_i=0)$	437.05*	73.12*	377.93*
$F(\beta_{TIME}=0)$	58.87*	12.73*	52.78*
R^2	0.007	0.003	0.007

Notes:
(a) Heteroskedasticity consistent standard error in parentheses.
(b) * signifies 5 per cent significance level

Figure 1: Evolution of Actual and Incumbent Multinational Employment Share

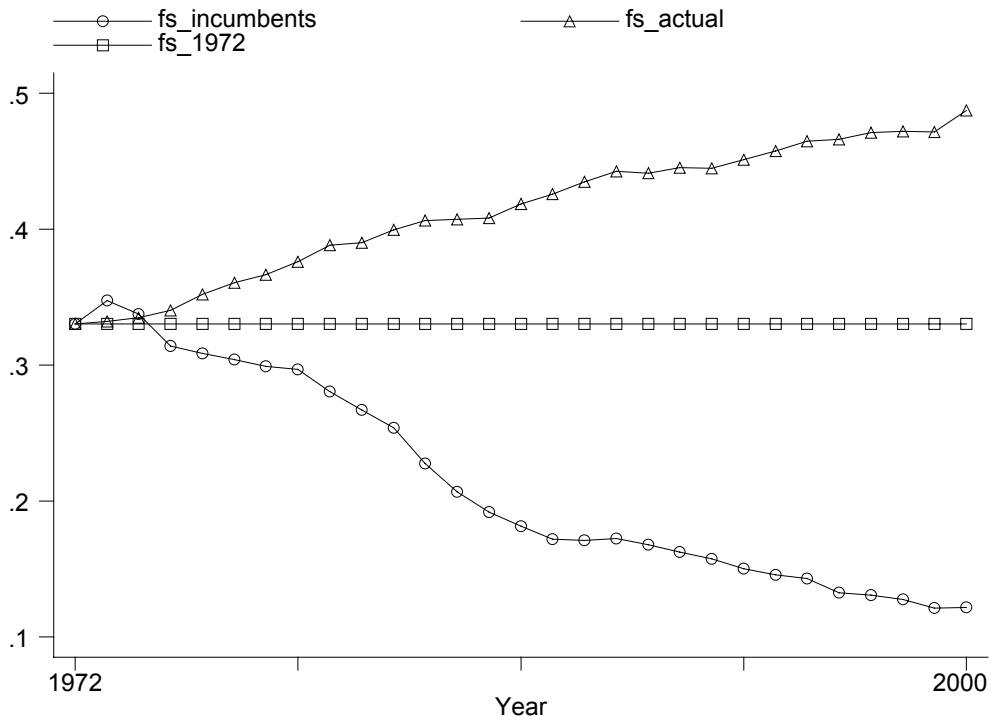

Figure 2: Simulations on Domestic Plant Population Size