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Foreign Direct Investment and Local Economic Development: Beyond Productivity Spillovers

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The increasing importance of multinational corporations (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 recognized not only that FDI 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 MNCs generally bring some sort of firm-specific assets (Markusen 2002) that allow them to compete successfully abroad.[1] These firm-specific assets, which can manifest themselves in various forms—for example, as superior marketing, management, or production techniques—can be conveniently described as "technological advantages" (foreign affiliates often use more advanced technology than indigenous firms). Since this technology has, at least to some extent, the characteristics of a public good, technological spillovers that benefit indigenous firms are possible.

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

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, rather they affect the profit function via cost reductions or increased 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, thereby reducing average costs, which will ultimately reduce the price that multinationals and other domestically based final good producers pay for intermediates.

The empirical literature on technological externalities and the measurement of spillovers to date have largely focused on measuring productivity spillovers from MNCs to domestic firms in the host country.[2] This literature has its origins in studies by Caves (1974) and Globerman (1979), who analyzed productivity spillovers in Australia and Canada, respectively. Their initial approach has been refined and extended subsequently by, for example, Blomström and Persson (1983) and, most recently, Girma, Greenaway, and Wakelin (2001) and Keller and Yeaple (2003). However, to the best of our knowledge, only a scant number of attempts at measuring other channels of technological spillovers or indeed pecuniary spillovers have occurred.

Our purpose in this chapter 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 given 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 illustrates 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 FDI into the Irish economy has had significant

2. Görg and Strobl (2001) 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.

effects on the growth of the economy (see, for example, Sachs 1997; de la Fuente and Vives 1997).

This chapter 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 not only discuss our previous work on these issues but also extend it in new directions.

The remainder of our chapter is organized as follows. In the second section we emphasize the importance of linkages for allowing technological and pecuniary externalities from FDI to occur. We also provide evidence of the incidence of linkages between foreign and indigenous firms in Irish manufacturing. The third section reviews the evidence of a "conventional" study of productivity spillovers by Ruane and Uğur (2005) for Ireland. The fourth section 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 that attempt to calculate what would have happened to the population of domestic plants in the absence of multinationals. By reviewing our study in Görg and Strobl (2003), the fifth section examines whether multinationals can assist new domestic plants to survive via technology spillovers. In the sixth section we extend the discussion of postentry effects of multinationals by looking at the effect on plant growth. In the final section, we offer concluding remarks and an assessment of the evidence to date.

Linkages

MNCs can be expected to have minimal effect on the domestic economy if they operate in so-called enclave sectors with no contacts with the domestic economy. Hence, it is unsurprising that the importance of backward or forward linkages between MNCs and domestic suppliers and/or customers has also been emphasized in the literature on externalities. In their review of the literature on productivity spillovers, Blomström and Kokko (1998, 248) point out that "local firms may be able to improve their productivity as a result of forward or backward linkages with MNC affiliates." 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 by creating linkages and expanding demand for local supplies.

An analysis of linkages between MNCs and domestic firms in Irish manufacturing industries can, therefore, provide information as to whether the conduit of external effects from multinationals exists. Data on linkages are available from the *Annual Survey of Irish Economy Expenditures,* which is undertaken annually by Forfás, the policy and advisory board for industrial

development in Ireland.[3] The summary statistics, which are published by 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 analyze forward linkages.

Table 6.1 presents the data for the value of backward linkages by foreign-owned firms in manufacturing industries. These figures exclude firms in the food and beverage 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. The tobacco sector is also excluded because of the sectoral aggregation of the data. As illustrated, the overall extent of backward linkages in foreign firms was about 18 percent in 1996.

Table 6.1 also shows that foreign manufacturing firms 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, Görg and Ruane argue that the apparent stagnation in the aggregate level of linkages can be attributed to the increase in the number of new foreign firms 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 become accustomed to the supplier environment.[5]

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 the goods 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

3. The survey is sent out to firms with more than 30 employees in manufacturing and internationally traded services industries. Although it is not compulsory for firms to take part in the survey, response rates are normally such that firms responding to the survey account for around 60–80 percent 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 calculating linkage 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. See also Kennedy (1991, 82–105) for similar arguments.

Table 6.1 Backward linkages by foreign-owned firms in manufacturing industries, 1987–96 (purchase of raw materials and components in millions of euro, constant 1997 prices)

Year	Total purchases	Irish purchases	Irish percent of total
1987	3,286	516	15.7
1988	3,828	611	16.0
1989	4,238	702	16.6
1990	4,226	792	18.7
1991	4,313	823	19.1
1992	4,819	921	19.1
1993	5,379	1,063	19.8
1994	6,403	1,243	19.4
1995	8,434	1,666	19.8
1996	9,548	1,756	18.4

Note: Manufacturing excludes food, drink, and tobacco.

Source: Forfás (1999).

to answer such a question are not 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. Next, we discuss the channels for such externalities.

Productivity Spillovers

MNCs can affect indigenous firms through productivity. Because MNCs use a higher level of technology, and technology, or knowledge, has certain characteristics of public goods, indigenous firms may benefit from spillovers. 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, 53) observes, "knowledge flows . . . leave no paper trail by which they may be measured and tracked." The approach adopted in the empirical literature therefore largely avoids the (arguably difficult to answer) question as to how productivity spillovers actually occur, and focuses instead on the simpler issue of whether or not the presence of multinationals affects productivity in domestic firms.

However, the presence of multinationals can also have negative effects on the productivity of host country firms. 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 that, 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 labor productivity or total factor productivity in domestic firms is regressed on a number of independent variables assumed to have an effect on productivity. One variable is a measure of the presence of foreign firms in either the same 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 from MNCs to domestic firms occurred. This approach dates back to the studies 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, Greenaway, and Wakelin 2001; Keller and Yeaple 2003) and to investigate vertical spillovers (Javorcik 2004; Girma, Görg, and Pisu 2004).

Ruane and Uğur (2005) implement this "conventional" approach using firm-level panel data available from the Irish Central Statistics Office from 1991 to 1998. They regress labor productivity (defined as net output per worker) on the employment share of foreign-owned firms in the same industry (defined alternatively at the two-, three-, and four-digit level) and control for capital intensity, skill intensity, and firm-specific time-invariant effects. Ruane and Uğur do not find any statistically significant evidence for productivity spillovers from these regressions. In alternative estimations, they use a similar setup but include total employment in foreign-owned firms in the industry as the "spillover variable," also controlling additionally for total employment in domestic firms. From these estimations they find robust evidence for horizontal spillovers based on the four-digit definition of the industry, but not for the two- or three-digit definitions. One possible explanation for Ruane and Uğur's 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 discussing the "conventional" approach of measuring productivity spillovers, we suggest that it may also be possible 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 the productivity of existing domestic firms. This neglects a number of other potentially positive effects of multinationals. Pecuniary spillovers—for example, 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.[6] Therefore, we will now discuss the effects that multinationals, by creating pecuniary as well as technological externalities, have on the entry and post-entry performance of indigenous firms.

Multinational Effect on Domestic Plant Entry

Multinationals benefit indigenous firms through both technological and pecuniary externalities, given that MNCs 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 both industries are assumed to be imperfectly competitive with increasing returns to scale of production. The model also features three types of firms: domestic firms producing intermediate goods, domestic firms producing final consumer goods, and multinational firms producing final consumer goods.

According to the model the presence of multinationals has three effects on the host economy. First, a competition effect occurs 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. Thus, multinationals crowd 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 and 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 that favors customer firms through lower input prices. Customer firms can be both domestic and multinational final good–producing firms. Through these effects multinationals may induce

6. Technological externalities can also benefit indigenous firms' export performance (see Aitken, Hanson, and Harrison 1997; Barrios, Görg, and Strobl 2003), which Blomström and Kokko (1998) refer to as "market access spillovers." Another way of assessing whether technological externalities lead to spillovers from foreign firms is by examining research and development (R&D) spillovers (see, for example, Wakelin 2001 for the United Kingdom) and their effects on indigenous firms. As far as we are aware, there has not yet been any analysis of R&D spillovers or export spillovers from MNCs for the Irish economy.

the entry of domestic intermediate good producers as well as domestic final good–producing firms.[7]

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 from 1972 to 1995.[8] We argue that the competition effect was probably negligible in Ireland over that period. Most of the multinationals in Ireland since the 1970s operated in high-tech sectors, which were largely underdeveloped. Both an explicit industrial strategy by Irish policymakers and the country's relatively cheap pool of skilled and educated workers contributed to this underdevelopment. This argument is supported by the fact that a simple shift-and-share analysis of sectoral employment share dynamics shows that most of the employment losses of the indigenous sector from 1972 to 1995 were due to a decline in importance of indigenous employment-intensive sectors.

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

$$E_{jt} = f(FOR_{jt}, X_{jt}) \tag{6.1}$$

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 assumed to affect a plant's entry rate. In accordance with authors such as Mata and Machado (1996) X includes measures of a 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 measured in terms of plants' employment shares, and the net sectoral

7. The latter two effects resemble the backward and forward linkage effects Hirschman (1958) found in his earlier study. Rodríguez-Clare (1996) examines a similar mechanism in a more aggregate two-country model with countries specializing in the production of different goods. Multinationals can help develop domestic supplier industries that in turn lead to the development of indigenous final good producers. See also Barrios, Görg, and Strobl (2005) for a related theoretical approach and empirical evidence on the effect of multinationals on the development of the domestic industry.

8. The primary data source for all of our empirical work reported subsequently is the annual employment panel survey carried out since 1972 by Forfás. The survey covers all known active manufacturing plants, with the response rate being generally over 99 percent. 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, among other things, identified by a unique plant number, the year of startup, nationality of ownership, and its four- to five-digit NACE (nomenclature générale des activités économiques dans les communautés européennes—General Industrial Classification of Economic Activities within the European Communities) code sector. These identifiers are changed only if there is an actual change of ownership. A plant is classified as foreign owned if 50 percent or more of its shares are held by foreign owners.

(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 our work in Görg and Strobl (2002a), are given in table 6.2. As illustrated in the first column, the presence of MNCs acts to significantly increase the gross entry rate of domestic plants. The actual size of the coefficient suggests that a 1 percent increase in MNCs increases the gross entry rate by 0.06 percentage points. 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 6.2. As illustrated in the second column, the coefficient on *FOR* remains statistically significant. Notable, however, is 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 startups controlling for exits.[9]

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 6.2 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

$$P_t = P_0 + \sum_{t=1}^{t=T} (NE_t)(P_{t-1}) \tag{6.2}$$

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 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

$$P_t^h = P_0 + \sum_{t=1}^{t=T} \left[(NE_t) + \beta(FOR_t^h - FOR_t)\right](P_{t-1}) \tag{6.3}$$

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

9. 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). Also, note that in a companion study, we find in Görg and Strobl (2002b) that the presence of MNCs reduces the startup size of domestic new entrants.

Table 6.2 Effect of MNCs on domestic entry rate, 1973–95

	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	1,496	1,496
R^2	0.15	0.14

* signifies 5 percent significance level.
FOR = measure of MNCs' share of employment within a sector
MNC = multinational corporation
SIZE = plant's employment size

Notes: Heteroskedasticity-consistent standard errors are in parentheses. 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. Manufacturing is broken into a total of 68 sectors.

Source: Results from Görg and Strobl (2002a).

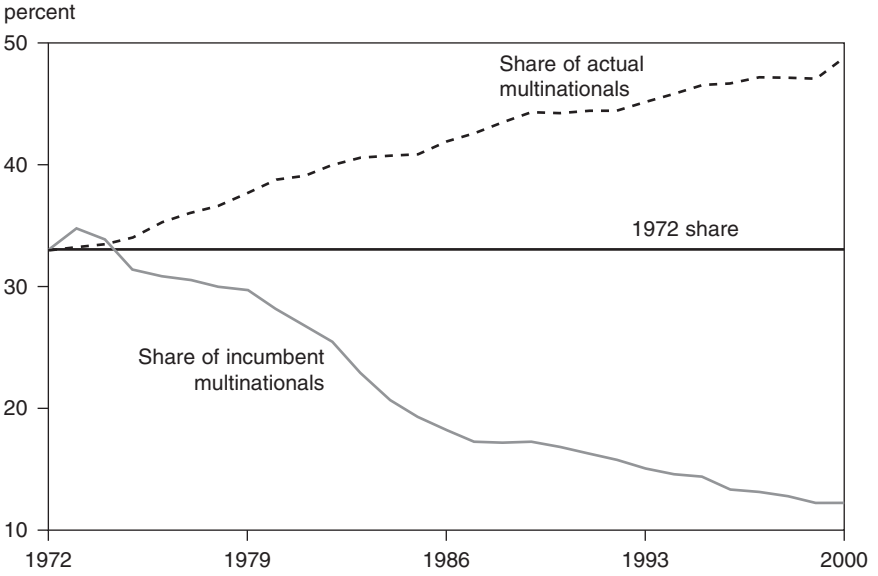
hypothetical foreign share of employment that may vary over *t* or be time invariant, and β is a (estimated) parameter that relates *FOR* to the plant population size.

One should note that in equation 6.3 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 6.3 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 6.2, 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, which allows us to calculate the indigenous plant population size in Ireland if no new multinationals entered the market. However, this may be an unrealistic scenario. Many of the multinationals that existed at the beginning of the 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 1972 incumbent multinational plants are illustrated in figure 6.1. Accordingly, the share of multinationals in total employment rose from about a third to nearly a half by the end of the 20th century. However, if one only consid-

Figure 6.1 Evolution of actual and incumbent multinational employment share, 1972–2000

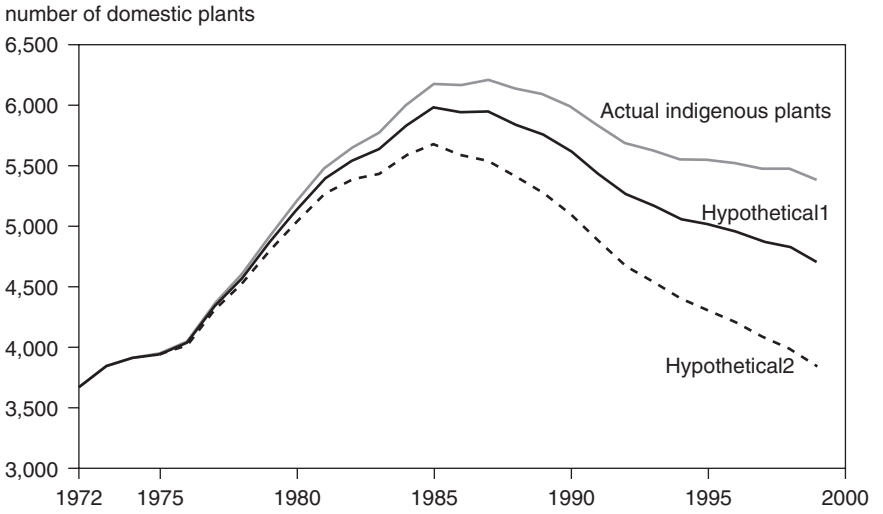


Source: Authors' calculations.

ers those multinationals incumbent in 1972 one discovers that this rise was due to new multinational entrants, as the importance of incumbents fell both because of exits and downsizing.

We calculated the hypothetical indigenous plant population series by inserting actual values for initial indigenous plant population size and the net entry rates in equation 6.3. We used two alternatives to proxy the hypothetical foreign share, first, the initial degree of foreign presence and, second, the share of employment in multinationals incumbent in 1972. These alongside the actual evolution of the indigenous plant population size are illustrated in figure 6.2. As evident 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 this trend 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. Specifically, we find that the absence of the total cumulative effect that multinational presence had in each year on the domestic plant startup rate would have reduced the plant population size by about 30 percent or by nearly 1,700 plants (*hypothetical2*).

Figure 6.2 Simulations of domestic plant population size, 1972–2000



Source: Authors' calculations.

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, at the very least, be taken into consideration. First, we assume that the effect 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 of MNCs, depending on whether such entries tend to reinforce or counteract the share loss of the incumbents. Finally, it must be pointed out that we assume that the other control variables are not affected by changes in the foreign share variable.

Plant Survival

Once a plant has entered the market, the presence of multinationals in the host country may affect the postentry performance of the plant in a number of ways. First, an increase in productivity through technology spillovers (as argued in the third section) 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—for example, 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. With regard to indigenous establishments, we would expect a potential technology gap to exist between these firms 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,

$$h(t) = h_0(t)e^{(\beta_1 FOR_t + \beta_2 Z_t)} \tag{6.4}$$

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 that are identified in the industrial organization 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 1 if a plant was set up before Ireland's accession to the European Union 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 proportional hazard model, the results of which are summarized in table 6.3, shows that, within the high-tech sectors, the presence of MNCs reduces indigenous plants' hazard of exiting (i.e., increases

Table 6.3 Survival analysis of indigenous plants using a Cox proportional hazard model, 1973–95

	High tech	Low tech
FOR	–1.794*	–0.076
	(0.831)	(0.228)
SIZE	–0.014*	–0.008*
	(0.004)	(0.001)
Number of observations	14,641	116,340
Number of subjects	1,495	11,217
Log likelihood	–3,025	28,870
Wald test ($\beta_i = 0$)	235*	1,519*

* signifies 5 percent significance level.
FOR = measure of MNC's share of employment within a sector
SIZE = plant's employment size

Notes: Heteroskedasticity-consistent standard errors are in parentheses. Hazard model includes measure of minimum efficient scale, Herfindahl index, industry growth, dummy for plants established before 1973, and a full set of time dummies. Manufacturing is broken into a total of 68 sectors.

Source: Results from Görg and Strobl (2003).

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 affect 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 occur—perhaps because indigenous low-tech firms are unable to absorb the potential spillovers (see, for example, Girma and Görg 2002). In other words, the technology gap between these two groups is too wide, indigenous firms operating in low-tech sectors do not have the absorptive capacity to learn from foreign firms.

Multinational Effect on Plant Growth

Multinationals can also affect the post-entry growth of indigenous establishments. First, as described in Markusen and Venables' (1999) model, increases in demand for intermediate products and changes in prices create

pecuniary externalities that benefit indigenous plants. The expanded market size may allow indigenous plants to grow faster than in the previously smaller market. Second, technological externalities may improve the performance of domestic plants and, hence, their growth performance. Third, the pecuniary externalities that increase entry of domestic plants (as discussed in the third section) may also increase competition in the industry, however, and may reduce the growth performance of incumbent plants.

To investigate the effect of MNCs' presence on the post-entry growth of indigenous plants, we postulate the following empirical model for the growth, *GRO,* of plant *i* (measured in terms of employment growth) between $t+1$ and t:[10]

$$GRO_{it+1} = \beta_1 + \beta_2 FOR_{jt} + \beta_3 SIZE_{it} + \beta_4 SIZE_{it}^2 + \beta_5 AGE_{it} + \beta_6 AGE_{it}^2 + \beta_7 NETS_{jt} + \lambda_t + \eta_i + \varepsilon_{it} \quad (6.5)$$

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 every year,[11] *AGE* is measured as years since its startup date, and *NETS* is the net sectoral growth rate defined for 68 subsectors. Furthermore, λ are year-specific effects modeled 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 firms can be considered identical in behavior to large firms. 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 nonlinear relationship between employment growth and its size.

Plant age is included in order to take into account 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, Roberts, and Samuelson 1989). On the one hand, plants may take some time before they reach their optimal size; on the other hand, long-established incumbents may have absolute cost advantages vis-à-vis newer entrants. Similarly as for size we have included age squared to allow for the possibility of nonlinear relationships.

Most importantly for this purpose, we have included the share of employment by foreign firms in the plant's sector, *FOR,* as a proxy for the presence

10. This model is in line with similar empirical work in the empirical industrial organization literature (see, for instance, Dunne and Hughes 1994; Dunne, Roberts, and Samuelson 1989).

11. 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.

of foreign multinationals. Finally, equation 6.5 includes the net sectoral growth rate and time dummies to control for sectoral and aggregate economic conditions.

In estimating equation 6.5 we used a fixed-effects estimator that purges the plant-specific, time-invariant effects, both observed and unobserved, from the equation, which 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 remaining in the industry.

Our results for estimating equation 6.5 are provided in the first column of table 6.4. In terms of our explanatory variables we first find that the net sectoral growth rate, as would be expected, is positively related to a plant's net employment growth rate. Thus, if an establishment is located in a sector that is experiencing economic growth it is also likely to grow. 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.[12]

Finally, and most importantly from our point of view, we find that the presence of MNCs decreases the growth of indigenous plants significantly after controlling for other factors. This suggests that indigenous establishments located in sectors with high foreign presence grow more slowly than other plants. To interpret this result, it may be helpful to recall our finding from the fourth section: the presence of MNCs 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 more slowly 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 6.5 for these two subsamples; the results are given in the second and third columns of table 6.4. As you can see, the results of the overall sample hold for all covariates for these two subsamples, 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 sam-

12. If age squared was excluded, then age 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 our main focus is on the impact of FDI presence, we did not pursue this matter further.

Table 6.4 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)
Number of observations	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

* signifies 5 percent significance level.
AGE = plant age
CON = constant
FOR = measure of MNC's share of employment within a sector
NETS = net sectoral growth rate
SIZE = plant's employment size

Note: Heteroskedasticity-consistent standard errors are in parentheses.

Source: Authors' calculations.

ple is statistically insignificant. 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, although the coefficient appears to be larger for the former. We could interpret this result as an indication of 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 higher levels of absorptive capacity in high-tech sectors), there is no obvious reason why pecuniary externalities should have different effects on these two groups.

Conclusions

In this chapter we discussed how the presence of MNCs and their potential externalities can benefit domestic firms and also assist in the development of local establishments in the host country. We presented empirical results on the effect of MNCs on entry, productivity, survival, and employment growth in indigenous plants in the Republic of Ireland. To date, the literature has focused primarily on measuring productivity spillovers from foreign to indigenous firms, which result from technological externalities. We argue that this focus neglects other important sources and channels for spillovers from multinationals. Multinationals benefit indigenous firms through not only technological externalities but pecuniary externalities as well. MNCs increase demand for intermediate goods supplied domestically, which, in the presence of imperfect competition and increasing returns to scale, affects indigenous firms through market expansions for domestic supplies as well as price changes. We demonstrate that technological and pecuniary externalities can affect 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. First, one may argue that the "traditional" way of measuring technological externalities—for example, productivity spillovers—as improvements in domestic establishments' productivity is a very narrow concept. It makes sense to look at the effects of technological externalities on plant or firm performance (such as survival or growth) and to assess the effects of technological externalities more thoroughly. Second, apart from technological externalities, multinationals can affect indigenous performance through pecuniary externalities, which may affect entry, growth, and survival of plants. To date, however, this possibility has not received much attention in the literature.

A drawback of most of the empirical studies to date is the way 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 labor 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 operate. 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, it is also necessary for guiding policymakers toward the channels through which spillovers occur. Theoretical work has recently stressed the importance of worker movements for technology spillovers (Fosfuri, Motta, and Rønde 2001; Glass and Saggi 2002). Our work in Görg and Strobl (2005) looks at productivity premia in firms owned by individuals who gained experience

in foreign multinationals, which is a step in the right direction. Also, the case studies reported by Moran (2001) as well as the survey evidence in Javorcik and Spatareanu (see chapter 3) provide vital insights into the "black box."

One should also note that recent evidence for Ireland and other countries seem to indicate that spillovers may occur primarily at the local rather than at the national level (see, for instance, Barrios, Bertinelli, and Strobl 2005; Girma and Wakelin 2001; and Driffield 2001). This may not be surprising given the fair amount of evidence that linkages, either horizontal or vertical, between production units are mostly local in nature. It may be even more unsurprising when one considers the effects of FDI as multinationals are considered to be more R&D intensive than local firms (see Markusen 2002); there is also plenty of support regarding which knowledge flows measured through R&D are subject to distance decay effects (see Bottazzi and Peri 2003).

Finally, an important issue is whether the experiences of the Irish case, where FDI has been widely accepted as 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 that suggest that Ireland's experience may not be easily replicable by other potential host countries trying to attract MNCs. For example, Ireland's proactive industrial policy, particularly creating linkages between MNCs and indigenous suppliers (Görg and Ruane 2001) as well as the possible benefits from agglomeration economies (Barry, Görg, and Strobl 2003), could affect the contribution of MNCs to indigenous development.[13] Thus, our empirical results, while they may be encouraging for other countries attempting to embark on industrial development with the help of attracting MNCs, may not be as encouraging for other countries. A full discussion of this issue, however, is beyond the scope of the present chapter.

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13. 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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