Grupo de Economía Europea

European Economy Group

Working Paper no. 8/2001

Multinational Companies, Technology Spillovers and Plant Survival: Evidence for Irish Manufacturing

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Abstract

This paper argues that multinational companies can impact positively on the survival of plants in the host country through technology spillovers. We study this effect empirically by estimating a Cox proportional hazard model on plant level data for Irish manufacturing. Our results show that, ceteris paribus, the presence of multinationals has a life enhancing effect on indigenous plants in high tech sectors only.

JEL Classification: F23, L60

Keywords: Multinational Companies, Technology Spillovers, Plant Survival

1   Introduction

There has been much interest in the recent literature in estimating the effects of multinational companies (MNCs) on productivity in host country firms. The basic underlying idea is that multinationals have access to higher levels of technology and are therefore more productive than their domestic counterparts. Firms in the host country may benefit from technology spillovers from multinationals as this superior technology spills-over in the host economy. These effects are usually empirically estimated by regressing labour or total factor productivity in domestic firms on the degree of presence of multinationals in the industry while controlling for other potentially important factors, and the evidence has been at best mixed.[1]

The current paper proposes an alternative way of examining technology spillovers from MNCs based on the idea that an increase in productivity through technology spillovers will, all other things being equal, reduce a host country firm's average cost of production. This has obvious benefits for the firm and, in this paper, we are concerned with the benefit associated with firm survival. Audretsch (1991, 1995) argues that the probability of a firm surviving is determined by a firm's price cost margin, i.e., the degree to which price exceeds average cost. Accordingly a firm's ability to increase price and/or reduce average cost will have a positive effect on firm survival, ceteris paribus. In this framework, technology spillovers from MNCs and the associated increase in productivity enable host country firms to produce at a lower average cost for a given level of production, which increases their price-cost-margins. All other things being equal, this leads to a higher probability of survival for host country firms.

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[1] See Görg and Strobl (2001a) and Blomström and Kokko (1998) for critical reviews of this literature.

The presence of multinationals can, however, also have negative effects on the survival of host country firms. As Aitken and Harrison (1999) argue, foreign firms producing at lower marginal costs than domestic firms have an incentive to increase output and attract demand away from domestic firms. This will cause host country rivals to cut production which, if they face fixed costs of production, will raise their average cost and, therefore, reduce their probability of survival. Whether the effect of MNCs on the survival of host country firms is, on average, positive or negative is, therefore, ambiguous and needs to be decided empirically.

We address this issue using the case study of the Republic of Ireland, which appears to be a model example due to the importance of MNCs for its economy.[2] Using plant level data for the Irish manufacturing sector we investigate whether the presence of multinational companies in a sector has any effect on the survival of indigenous Irish-owned plants in the same sector, ceteris paribus.[3] Our approach to estimating the effect of spillovers on indigenous plants contributes to the existing literature in two ways. First, it allows one to examine more closely one aspect of the consequences of increased productivity in firms benefiting from spillovers. Secondly, the data requirements to estimate our empirical approach are lower than the data usually needed for estimating productivity equations, which require at least data on output, labour and capital on a firm or plant level.

The paper is structured as follows. In Section 2 we discuss briefly the dataset used. Section 3 examines the effect of the presence of multinationals on plant survival by estimating a hazard function. Section 4 summarises our results.

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[2] For instance, 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.

[3] There have been several studies of plant and firm survival for different countries which relate to our paper; see, for example, Audretsch (1991), Audretsch and Mahmood (1995) for the US; Mata et al. (1995) for Portugal; McCloughan and Stone (1998) for the UK and Kearns and Ruane (2001) for Ireland.

2   Data Set

Our data source is the *Employment Survey* which is carried out annually by Forfás, the policy and advisory board for industrial development in Ireland. The data are available to us for the period 1973 to 1996. The main advantages of the survey are that it covers virtually all known active manufacturing plants, and that the response rate is generally over 99 per cent.[4] For these plants we have information on employment, nationality of ownership (indigenous or foreign), sector of location, and start-up year, amongst other things. In the data a plant is classified as being indigenous if less than 50 percent of its shares are held by foreign owners. In total our sample covers 12,812 indigenous plants, of which 4,039 existed at the beginning and 5,830 at the end of our sample period. Of those that existed in the beginning only 1,418 remained at the end of our sample period.[5] These figures are clearly suggestive of considerable plant turnover over our sample period.

In order to obtain a first look at the overall survival performance of indigenous plants we graphed their Kaplan-Meier survival estimates in Figure 1. There is a rapid elimination of a large number of plants in the early stages of their lifetime, a trend that has also been found by Audretsch (1995) for the US and Mata et al. (1995) for Portugal. For example, 50 percent of plants exited during the first 20 years of their existence. As time goes by, however the survival rate begins to stabilize; older plants have higher probabilities of survival than young ones.

[Figure 1 here]

To the best of our knowledge, however, the effect of MNCs on survival has not received any in-depth attention in the literature to-date.

[4] See the working paper version of this paper (Görg and Strobl, 2000) for a further description of the dataset and some summary statistics.

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3   Modelling Plant Survival using a Hazard Function

To estimate the effect of MNCs on survival of indigenous manufacturing plants we follow the related empirical literature (for example, Audretsch and Mahmood, 1995, Mata et al. 1995) and utilise a Cox proportional hazard model (Cox, 1972). The Cox proportional hazard model specifies the hazard function $h(t)$ to be the following:

$$h(t) = h_0(t)e^{(Xb)} \qquad\qquad (1)$$

where $h(t)$ is the rate at which plants exit at time t given that they have survived in t-1, h_0 is the baseline hazard function when all of the covariates are set to zero, and X is a vector of plant and industry characteristics postulated to impact on a plant's hazard rate. The covariates included are described in Table 1.[6]

For our purposes, the most important covariates included in the model are *FOR* and *FOR*TECH*. The former is a proxy for the presence of multinationals in a sector and is defined as the share of employment by MNCs in sector j at time t. It is intended to capture the spillover effects of multinationals on plant survival. *FOR*TECH* is an interaction term of *FOR* and a dummy equal to one if a plant is located in a high-technology sector. With this term we attempt to capture any potential differences in spillovers for high tech compared to low tech indigenous plants. Under the assumption that indigenous high tech plants have a lower technology gap vis-à-vis MNCs than indigenous low tech plants one may expect spillovers to be lower for the low tech group due to their lack of "absorptive capacity" (see Kokko, 1996).

Apart from spillovers, multinationals can have other effects on host country development as has been shown in the recent theoretical and empirical literature

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[5] Given the nature of our data set, the observed life times of some of the plants in the sample is necessarily left censored while others are right censored, and these phenomena are appropriately dealt with in all estimations in the paper. All estimations were performed using STATA version 6.0.

(Markusen and Venables, 1999, Görg and Strobl, 2001b). Specifically, if there are input-output linkages between multinationals and domestic suppliers, multinationals increase market size for domestic suppliers and thus may foster the entry of the latter. To control for these effects we include the market size, calculated as total employment in industry *j*, and the net entry rate in sector *j* in the empirical model.

[Table 1 here]

The results of estimating the hazard model described in (1) using data on all indigenous manufacturing plants are presented in Table 2. All estimations are stratified by sector, which allows for equal coefficients of the covariates across strata (sectors), but baseline hazards unique to each stratum (sector). As can be seen, the Wald test provides satisfactory support for our model specifications. In interpreting the results one should recall that our dependent variable is the hazard rate, i.e., a negative coefficient on an independent variable implies that it reduces the rate of hazard, thus increasing chances of survival.

[Table 2 here]

Our estimations yield a statistically insignificant coefficient on *FOR* but a statistically significant and positive coefficient on *FOR*TECH*. This suggests that a greater presence of MNCs acts to increase only the survival of indigenous high tech plants while indigenous low tech plants do not appear to be effected by the presence of multinationals. Within our framework we interpret this as evidence that technology spillovers take place from MNCs to indigenous high tech plants which increase plants' probabilities of survival. However, this does not appear to be the case for indigenous plants in low tech sectors. As alluded to above, one may expect no spillovers to

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[6] For a further discussion of these see Görg and Strobl (2000).

indigenous low tech plants if these plants do not have the necessary "absorptive capacity" to assimilate the knowledge that spills over from MNCs.

An alternative interpretation of the positive effect of foreign presence on high tech plants could be that multinationals locate in industries that have higher productivity (as argued by Aitken and Harrison, 1999) and hence higher survival rates. In this case, the positive result would of course not necessarily indicate spillovers. Aitken and Harrison (1999) suggest to include sectoral dummies to control for such a possible bias. In our estimation, the baseline hazard is stratified by sector, which allows for different baseline hazards per sector and hence we are similarly taking account of possible productivity differences across sectors. Due to the inclusion of market size and the entry rate we can also be confident that our positive coefficients on *FOR*TECH* do not merely pick up a linkage effect as described above, but that it rather is more likely to reflect true technological spillovers.

5   Conclusions

This paper examines the effect of the presence of MNCs on the survival of indigenous plants in the host country using data for the Irish economy, an economy with high levels of involvement of foreign MNCs. In our empirical analysis we find that, ceteris paribus, the presence of multinationals has a life enhancing effect on indigneous plants in high tech manufacturing sectors, indicating that there may be technology spillovers taking place. However, we do not find any evidence for survival enhancing technology spillovers from MNCs to indigenous low tech plants. This suggests that studies of spillovers using data pooling high tech and low tech sectors may be likely to misrepresent the true nature of spillovers.

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Table 1: Variables included in the Hazard Model

Variable	Description
FOR	Foreign presence measured as share of employment by MNCs in sector *j* at time *t*
TECH	Dummy = 1 if plant is in high technology sector
FOR*TECH	Interaction term of *FOR* and *TECH*
MKTSIZE	Market size calculated as total employment in industry *j*
ENRATE	Net entry rate in sector *j*
SIZE	Plant employment size at time *t*
MES	Minimum efficient scale measured as median employment size in sector *j* at time *t* (cf. Sutton 1991)
HERF	Herfindahl index measured in terms of employment at time *t*
GROWTH	Net sectoral growth rate measured in terms of employment at time *t*
BEU	Dummy = 1 if plant existed before 1973 (Ireland's entry into EU)

Note: All sector specific variables are calculated for the 68 sub-sector classifications commonly used by the Irish Central Statistics Office.

Table 2: Results of the Cox Regression

	(1)	(2)	(3)
FOR	-0.045	-0.164	-0.047
	(0.224)	(0.210)	(0.224)
TECH	0.726***	0.724***	0.726***
	(0.230)	(0.231)	(0.230)
FOR*TECH	-2.240***	-2.237***	-2.240***
	(0.664)	(0.666)	(0.664)
MKTSIZE/10^4	0.328***	0.317**	0.323***
	(0.125)	(0.125)	(0.119)
ENRATE	-0.394**	-0.406**	-0.392**
	(0.177)	(0.177)	(0.176)
SIZE	-0.009***	-0.009***	-0.009***
	(0.001)	(0.001)	(0.001)
MES	-0.002	-0.004	---
	(0.014)	(0.014)	
HERF	0.001	---	0.001
	(0.001)		(0.001)
GROWTH	-1.041***	-1.033***	-1.041***
	(0.185)	(0.185)	(0.185)
BEU	0.116**	0.116**	0.117**
	(0.051)	(0.051)	(0.051)
# obs.	130981	130981	130981
# subj.	12712	12712	12712
Wald Test	3.00e-04***	929.5***	2.46e-04***

Notes: (1) *HERF* and *MES* are dropped in turn due to potential collinearity
     (2) Heteroskedasticity consistent standard errors in parantheses
     (3) Time Dummies are included.
     (4) ***, **, * signify one, five and ten per cent significance levels, respectively.

Figure 1: Kaplan-Meier Indigenous Plant Survival Estimate