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Blessing or Curse?
Domestic Plants Survival and Employment Prospects After Foreign Acquisition

By S. Girma and H. Görg

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Blessing or Curse? Domestic Plants Survival and Employment Prospects After Foreign Acquisition

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Abstract

This paper investigates whether the acquisition of a domestic establishment by a foreign owner has any effects, positive or negative, on the survival prospects and employment growth of that plant. The empirical analysis uses data from the Annual Respondents Database (ARD) for the UK electronics industry for the period 1980 to 1993. Estimating a standard hazard model including a dummy variable for the incidence of acquisition yields the result that foreign takeover reduces the lifetime of the acquired plant. Estimations of the determinants of employment growth in domestic plants provide some evidence that the incidence of takeover reduces employment growth, in particular for unskilled labour. Both survival and employment growth estimations do not appear to be subject to endogeneity problems.

Outline

Non-Technical Summary

There has been growing concern among policy makers and academics that productivity, competitiveness and living standards of the UK economy are lagging behind those of other advanced economies, in particular the US. This concern, amongst other things, has led to a growing interest into the differences, in terms of productivity, employment, etc. between domestic and foreign establishments and the effects of foreign direct investment (FDI) on the performance of domestic firms in the UK, with the expectation that FDI may help to reduce the UK competitiveness gap .

It is by now a well established empirical fact that foreign-owned plants have substantially higher productivity, investment intensity, and skill intensity than domestic plants in UK manufacturing industries. These findings suggest a related question, namely, whether the different characteristics of foreign-owned firms also translate into different survival and employment prospects for such firms. In particular, are domestic establishments more likely to survive or exit and do they experience more or less rapid employment growth after being acquired by a foreign firm? These are the two main issues to be addressed in this paper. Such an analysis seems particularly relevant not least given the concerns that foreign acquisitions may lead to the closure of acquired establishments and, thus, leading to job losses in the closed plants.

We use establishment level data for the UK electronics industry obtained from the Annual Respondents Database (ARD) for our analysis. Estimating a standard hazard model including a dummy variable for the incidence of acquisition yields the result that foreign takeover reduces the lifetime of the acquired plant. We also estimate the effect of a foreign takeover on employment growth in the acquired domestic plant. This approach can also yield further insights into the magnitude of potential job losses, as the new foreign owners may not only shed jobs by closing plants but also by reducing employment levels in continuing plants. Estimations of the determinants of employment growth in domestic plants provide some evidence that the incidence of takeover reduces employment growth, in particular for unskilled labour.

These results should not be taken as evidence that foreign takeovers have purely negative effects on the domestic economy and should therefore be avoided. On the contrary, it may be the case that the exiting plants are those that are relatively inefficient in comparison with foreign establishments and that the shedding of labour, in particular unskilled labour may enable surviving plants to boost their productivity levels. Thus, given the concerns about the UK s lagging behind other advanced economies in terms of productivity levels the shake out of plants and labour due to foreign acquisitions may indeed help to improve productivity figures. The detailed analysis of this issue, which is beyond the scope of the present paper, is a high priority on our future research agenda.

1. Introduction

There has been growing concern among policy makers and academics that productivity, competitiveness and living standards of the UK economy are lagging behind those of other advanced economies, in particular the US (for example, DTI, 2001). This concern, amongst other things, has led to a growing interest into the differences, in terms of productivity, employment, etc. between domestic and foreign establishments and the effects of foreign direct investment (FDI) on the performance of domestic firms in the UK, with the expectation that FDI may help to reduce the "UK competitiveness gap".

Investigating differences between domestic and foreign establishments, Griffith and Simpson (2001) show that foreign-owned plants have substantially higher labour productivity, investment intensity, and skill intensity than domestic plants in UK manufacturing industries. Girma et al. (2001) also find higher labour productivity and higher wages in foreign than in domestic manufacturing establishments. Focusing solely on the electronics industry in the UK Girma and Wakelin (2001) report results that foreign-owned firms have significantly higher labour productivity, capital intensity, input intensity [1]

These findings suggest a related question, namely, whether the different characteristics of foreign-owned firms also translate into different survival and employment prospects for such firms. In particular, are domestic establishments more likely to survive or exit and do they experience more or less rapid employment growth after being acquired by a foreign firm? These are the two main issues to be addressed in this paper.[2] Such an analysis seems particularly relevant not least given the concerns that foreign acquisitions may lead to the closure of acquired establishments and, thus, leading to job losses in the closed plants. To the best of our knowledge however, the effects of a foreign acquisition of a domestic plant on the survival and employment growth of this establishment have not been examined in the literature to-date.[3]

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[1] See also Disney et al. (2000) and Driffield (2001) for related papers on productivity differences between foreign and domestic plants in UK manufacturing industries and the effect of foreign firms on productivity in domestic firms.

[2] Griffith and Simpson (2001) find that labour productivity, investment per employee and wages increase after a takeover of a domestic British establishment by a foreign firm, while Harris and Robinson (2001) report evidence that total factor productivity declined in domestic plants after acquisition by a foreign firm.

[3] Görg and Strobl (2000) examine the effect of foreign presence in a sector on the survival of domestic plants in the same sector, using data for the Republic of Ireland. There is also a somewhat related literature

There have been a limited number of papers examining the link between acquisitions and company performance. Dickerson et al. (1997), for example, use a large panel of UK firms to analyse the impact of acquisitions on the performance of the acquiring company. They find that growth through acquisitions yields a lower rate of return for companies than internal growth. In a similar study for the US Ravenscraft and Scherer (1987) study the impact of acquisitions on profitability of the acquired target. Similar to the results for the UK they find that profitability declined post-takeover.

More closely related to our paper, there have also been a small number of papers analysing the effect of acquisitions on employment. Conyon et al. (2001a,b) analyse the impact of mergers and acquisitions on company employment for a large panel of UK firms for the period 1967-1996. In general their findings do not support the contention that mergers have a rationalising effect on the firms' demand for labour after controls are made for wage and output effects. Indeed, the contemporaneous effect on the acquiring firms' derived demand for labour is both positive and statistically significant. This is consistent with a merger process in which the less efficient firms are acquired by more efficient firms, and as result an initial lowering of labour productivity prior to re-organisation of the firm which has been taken over is observed.[4] In their study of the wage and productivity impact of foreign acquisitions in the UK, Conyon et al (2001c) report that conditional on output and wages, the labour demand of the typical firm decreased by 6.2 percent during the years following foreign acquisition. That is, there is an increase in the technical efficiency with which labour is used.

This paper provides a systematic investigation into the effect of foreign acquisitions on the survival probabilities of the acquired domestic plants. Furthermore, we examine employment growth in the acquired domestic plants in order to be able to pick up not only employment losses due to plant closures but also the shedding of labour in such plants that do survive after being acquired by a foreign owner.

As in Girma and Wakelin (2001) we use establishment level data for the UK electronics industry obtained from the Annual Respondents Database (ARD) for our analysis. The

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analysing the determinants of firm survival in the UK. See, for example, Disney et al. (1999) and McCloughan and Stone (1998).

[4] There have also been a number of related papers analysing the employment effects of mergers in the US; see, Brown and Medoff (1988), Lichtenberg and Siegel (1992), McGuckin et al. (1998), McGuckin and Nguyen (2001).

focus on only one broadly defined industry allows us to minimise the potential problems involved in analysing data from heterogeneous manufacturing sectors. The electronics industry appears to be particularly interesting given its size - around 400,000 people are employed in electronics manufacturing - and the high level of multinationals activity in the industry - over 25 percent of inward FDI stocks in 1996 were in the electronics industry (Girma and Wakelin, 2001).[5]

The remainder of the paper is structured as follows. Section 2 discusses the construction of the dataset and presents some summary statistics for the data used in the analysis. Section 3 sets out the hazard model used to analyse the effect of foreign acquisition on the survival of the acquired plants, and presents empirical results. Section 4 analyses the effect of foreign acquisition on employment growth in the acquired plants while Section 5 summarises and concludes.

2. Database and Summary Statistics

This paper draws on the Annual Respondents Database (ARD) to identify acquisitions of on-going domestic establishments by foreign companies in the UK electronics industry for the period 1980-93. The ARD is provided by the Office for National Statistics in the UK under controlled conditions, and it consists of individual establishments' records underlying the Annual Census of Production. As Oulton (1997), Griffith (1999) and Barnes, Haskel and Ross (2001) provide very useful introductions to the data set, we only include a brief discussion of some of the features of the data that are relevant to the present work.

In the above period, the ARD consists of two files. What is known as the 'selected file', contains detailed information on a sample of establishments that are sent inquiry forms. The second file comprises the 'non-selected' (non-sampled) establishments and only basic information such as employment, location, industry grouping and foreign ownership status is recorded. During our study period, some 14,000-19,000 establishments are selected each year, based on a stratified sampling scheme. The scheme tends to vary from year to year, but establishments with more than 100 employees are always sampled. In the electronics industry, selected establishments account for less than one eight of the total number of establishments, but for more than 80 percent of output and employment.

[5] Furthermore, Blonigen and Taylor (2000) argue that acquisition activity is particularly important for high-tech industries such as electronics.

In the ARD, an establishment is defined as the smallest unit that is deemed capable of providing information on the Census questionnaire. Thus a 'parent' establishment reports for more than one plant (or 'local unit' in the parlance of ARD). For selected multi-plant establishments, we only have aggregate values for the constituent plants. Indicative information on the 'children' is available in the 'non-selected' file. In the sample period considered in this paper 95 percent of the establishment that are present in the electronics industry are single-plant firms.[6] In the actual sample we used for the econometric estimation this figure is around 80 percent. Thus most of the data we used is actually plant level data.

The ARD gives a nationality indicator for establishments, and an indigenous establishment is identified as being foreign acquired at time *t* if its status changes from being domestic to being a subsidiary of a foreign firm. Establishments that appear to have experienced more than one changes of ownership between 1980 and 1993 are excluded from the analysis. This is partly to avoid conflating the effects of different events, and partly because we suspect the presence of measurement error problems. The final sample consists of 239 foreign acquisitions, the frequency distribution of which is given in Table 1.

[Table 1 here]

A four-digit industry-stratified random sample of 524 establishments that act as a control group in the analysis was drawn from the population of domestic establishments that did not experience a change of nationality of ownership during the sample period.[7] In order to obtain a control group as similar as possible to the acquired plants, control group plants were chosen according to three criteria; they had to be in the same age and size group and have a similar level of efficiency relative to the industry frontier. We defined three age groups, *viz.*, less than 3, 3 to 6, and over 6 years of age as well as three size groups, less than 50, 50 to 200, and over 200 employees. As for the efficiency criteria, we estimated a plant's efficiency relative to the industry frontier using stochastic production frontier estimation (see Coelli, 1994). Using these estimates the third criterion to qualify for the

[6] As a result we tend to use the terms plant and establishment interchangeably for what are termed establishments in the ARD.

[7] Another possibility would be to define the control group as those establishments that experienced a *domestic* takeover and compare their performance to plants taken over by foreigners. This would mean a different focus of the paper, however. A foreign firm has the option of entering the UK either via greenfield investment or acquistion of an existing domestic establishment. We are interested in the effect the latter mode of entry has on the domestic takover target rather than comparing foreign to domestic takeovers.

control group was that domestic plants had to be within a band of plus/minus twice the standard deviation of the efficiency level of an acquired plant. Depending on availability, two to three matching establishments were randomly chosen for each acquired plant.

In Table 2 we report some summary statistics to describe the two groups of plants in our sample, giving the means and standard errors of employment, ratio of skilled labour, output and labour productivity. As found in previous studies foreign firms are generally larger than domestic ones, and they exhibit greater productivity levels (see, for example, Girma et al., 2001; Griffith and Simpson, 2001).

[Table 2 here]

By way of preliminary analysis we compare the survival of plants which are acquired with those in the control group, calculating Kaplan-Meier (K-M) survival functions separately for plants of those two groups. A K-M function gives the probability of surviving up to time t or beyond and is calculated as $\hat{S}(t) = \prod_{j|t_j \le t} \left([n_j - d_j] / n_j \right)$, where n_t is the population alive and d_t is the number of failures respectively at time t. The functions are plotted in Figure 1. Inspection shows that the survival function of firms that are acquired is marginally below the survival function for the control group. For example, the probability of a plant surviving up to 10 years or beyond is 81 percent for control group plants compared with 78 percent for acquired establishments. The respective probabilities to survive up to 13 years and more are 72 and 64 percent for those two groups of plants. However, a log-rank test which tests for equality of the survival functions across the two groups does not allow us to reject the null hypothesis that the two functions are not statistically different ($\chi^2 = 2.39$).

[Figure 1 here]

We also examine, for those plants that are taken over, the post-acquisition trajectories of some key labour market variables using *t*-tests of equality between the pre-acquisition and post-acquisition values. These are reported in Table 3. The raw data suggest that plants experiencing foreign ownership changes are associated with a significant decrease in employment (mainly unskilled jobs). This seems to be mainly due to the increase in labour productivity (29 percent three years after acquisition) outstripping output growth (17.7 percent), rather than job destruction linked to declines in production. However, it would be

inappropriate to conclude from Table 3 that the employment decrease is the result of ownership change *per se*. The simple t-tests do not control for other factors that may have impacted on employment growth over the period, such as technological progress and the dynamics of wages. For this reason we turn to an econometric analysis in Section 4, with the aim of isolating the net impact of foreign acquisitions on employment growth.

[Table 3 here]

3. Acquisition and Firm Survival

3.1 The Hazard Model

In order to establish whether the acquisition of a plant by foreign owners changes its survival prospects compared to other plants that are not acquired we model the determinants of plant survival and check whether the incidence of acquisition is a statistically significant determinant of plant survival or, to be more precise, of a plant's hazard of exiting. Following the related empirical literature (for example, Agarwal and Audretsch, 2001, Audretsch and Mahmood, 1995, Mata and Portugal, 1994) we utilise a Cox proportional hazard model (Cox, 1972) for the empirical analysis of this question.

The Cox proportional hazard model specifies the hazard function $h(t)$ to be the following:

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

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 Cox model is suited for a number of reasons. Firstly, it does not require any restrictive assumptions regarding the baseline hazard, such as for instance a Weibull or lognormal specification. This is appropriate for our purposes, as our main interest is not in the estimation of the underlying baseline hazard but in the effect of a foreign acquisition on plant survival. As pointed out in the literature on survival analysis, the semi-parametric modelling approach of the Cox proportional hazard model is advantageous if the parametric form of the underlying baseline hazard function is not known with certainty. Moreover, the Cox model allows us to explore the effect of time varying plant and industry specific explanatory variables, which a Weibull or lognormal specification would not allow.

In line with the empirical literature (see Geroski, 1995) we include plant age and size as independent variables in the vector *X*. Both current and initial (i.e., size of plant at entry) plant size have been used alternatively in the literature and we therefore also include both in turn in our model. We also allow for non-linear relationships between the age and size variables and survival by including squares of the variables. Furthermore, we include the age of the plant at acquisition as a further covariate as suggested by McCloughan and Stone (1998). Two industry variables are included, namely industry growth and the industry Herfindahl index. A priori we would expect that plants in a growing industry will have higher survival rates as the competitive pressure in a growing industry may be alleviated (Audretsch, 1991). The Herfindahl index is included in an analysis of plant survival by Mata and Portugal (1994) although the expected effect is ambiguous. On the one hand, high levels of market concentration allow firms to reap higher price-cost-margins which should, ceteris paribus, increase the probability of survival. On the other hand, however, highly concentrated markets may be subject to aggressive behaviour by rivals which may reduce chances of survival. Furthermore, a dummy which is set equal to one if a plant is located in one of the UK Assisted Areas is included in the hazard function in order to take account of possible differences in survival probabilities across plants in assisted and non-assisted areas.

Most important, from our point of view, is the inclusion of a variable capturing the incidence of a domestic plant being acquired by a foreign owner. In order to capture the effect of such a foreign takeover on plant survival we, in the first instance, include a dummy variable set equal to one once the plant has been taken over and thereafter. However, it is likely that such a dummy variable is endogenous if foreign firms are more likely to acquire firms with particularly good or bad survival prospects (McGuckin and Nguyen, 2001). In this case, the stochastic dependence between the acquisition dummy and the error term may bias our estimators. In order to take account of this possible endogeneity we construct an instrumental variable as the probability of a plant being taken over by foreign owners. This instrumental variable is constructed as the predicted value of the dependent variable from a probit regression for the probability of foreign takeover.[8] The probit model takes the following form

[8] A similar approach was taken by McGuckin and Nguyen (2001) who analyse the effect of acquisitions on employment, wages and plant exit using US data. Hujer et al. (1999) use this approach in a nonlinear model for the analysis of the effect of training on unemployment duration in Germany utilising a hazard model.

$$\Pr(A) = Y\alpha \qquad (2)$$

where Y is a vector of plant characteristics including labour productivity in plant i, plant age, age-squared, current size, size-squared and sectoral dummies. Equation (2) is estimated using random effects probit techniques in order to take account of the panel nature of the data.

3.2 Estimation Results

The results of estimating different specifications of equation (1) are presented in Table 4. 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). Since the asymptotic standard errors for the estimators using generated instrumental variables are, to the best of our knowledge, not yet worked out in the econometric literature we compute bootstrapped standard errors for these cases. We employed block bootstrapping where all establishment-specific observations are considered as one i.i.d. observation.

The different specifications presented in the table differ in their definition of the variable capturing the effect of a foreign acquisition on plant survival. In columns (i) and (ii) we include a dummy equal to one once the firm is taken over. The statistically significant and positive coefficient suggests that an acquisition of a plant by a foreign owner reduces this plant's probability of survival, all other things being equal. In order to be able to interpret the magnitude of this coefficient we can calculate the hazard ratio by calculating the exponentiated coefficient. For the case of a dummy variable covariate, equation (1) shows that calculating the exponential of the coefficient β generates the increase in the hazard ratio for the case when X equals 1, holding everything else constant. Thus calculating the hazard ratio for the coefficients on *acquired* yields 2.56 and 2.48 for columns (i) and (ii) respectively. This indicates that the hazard of exiting is approximately 2.5 times higher for acquired establishments than for purely domestic plants.

There are two possible explanations for this result. First, foreign owners acquire establishments which, a priori, are more likely to exit than plants in the control group. In this case, it is likely that the establishments that are acquired are those that have low efficiency levels and the foreign owner is expected to increase efficiency and productivity post takeover (Lichtenberg and Siegel, 1990). However, inspection of the results of the probit estimation of the determinants of the likelihood of takeover (which we report in

Appendix 1) show that a plant's labour productivity is positively related to the probability of takeover. This suggests that it is not the poor performers in the industry that are taken over, but rather that foreign acquirers "cherry pick" high productivity plants.

Accepting this argument implies that there must be a negative post-takeover effect from foreign acquisition on domestic plants. This is in line with Ravenscraft and Scherer's (1987) finding that target firms profits declined considerably post-takeover, based on using data on mergers and acquisitions in the US. One possible explanation may be that foreign firms take over domestic competitiors in order to close them down and thus reduce the number of competing firms in the industry. Unfortunately, however, since we have no information on the identity of the foreign acquirer we are not able to investigate the validity of this explanation. In terms of policy relevance our empirical finding implies that there is a threat of job losses through foreign acquisitions of domestic plants as the probability of that plant exiting and hence destroying jobs is higher than pre-acquisition.

Correcting for the possible endogeneity of the acquisition dummy by employing the probability of foreign acquisition as an instrument in columns (iii) and (iv) shows that there is no statistically significant effect of foreign takeover once controlling for the possible endogeneity. Unfortunately there is, to the best of our knowledge, no formal method of choosing between the standard and the IV estimation in the context of a hazard model. Hence, preference of the IV model would be predicated on the assumption of endogenous acquisitions which is, strictly speaking, not reliably testable. However, the standard Hausman tests, which are reported in Table 4 do not provide evidence that foreign acquisitions are endogenous to survival.

As regards the covariates we find that age at acquisition is statistically insignificant in columns (i) and (ii) while in columns (iii) and (iv) we find that age at acquisition increases the hazard of exiting for a plant, i.e., plants that are older at the time of acquisition are less likely to survive.[9] The effect of the other control variables is similar in all specifications. Plant age has the expected effect of reducing a plant's hazard of exiting, although the effect of age is non-linear. In contrast with most of the empirical literature on firm survival the results do not give evidence that the size of a plant matters for survival. Note also that results do not differ substantially between initial and current size. Examining the industry covariates we find that plant survival is enhanced in growing industries, which is in line

with expectations, while the level of industry concentration does not appear to exert any statistically significant effects on plant survival. We also find that plants based in assisted areas have higher probabilities of survival than those located in non-assisted areas.

[Table 4 here]

We also estimated a number of alternative specifications of equation (2) to check whether our results in columns (iii) and (iv) depend on the process by which the instrument was generated. First, we included size and age cubed as well as labour productivity squared and cubed in addition to the variables already included in the baseline specification in equation (2). Second, we use the predicted probability instead of the fitted value obtained from estimating equation (2) as the instrument in equation (1). Third, we estimated equation (2) using a standard pooled probit model rather than the random effects probit.[10]

The results of the survival estimations using the alternative instruments generated through these three approaches are presented in columns (i) to (iii) in Table 5. Only results for specifications including initial size rather than current size are reported; however, including current size instead produced similar results. Inspection of the table shows that the results obtained above appear to be robust to different specification of the instrument generating equation. All coefficients are very similar, in terms of magnitude and statistical significance, to the results reported in Table 4.

[Table 5 here]

4. Acquisition and Employment Growth

4.1 Econometric Methodology

Plant closure is, of course, not the only mechanism by which jobs can be lost after takeover as the foreign owner may also shed labour in surviving acquired plants after acquisition. In order to estimate the impact of ownership change on employment growth in acquired plants we adopt a differences-in-differences methodology.[11] The first step proceeds by comparing the average employment growth $\dot{E}$ before acquisition with its post-acquisition counterpart. However, as argued in Section 2, the resulting quantity, say, $\Delta^a \dot{E}$, is a biased estimator of

[9] This latter result is in line with the findings by McCloughan and Stone (1998).
[10] A further test of robustness may be to use different hazard models, for example the lognormal or Weibull models. However, such models do not allow the inclusion of time varying variables and can therefore not be utilised for our purposes.

the impact of the ownership change on employment growth since it is likely to be affected by other factors which are contemporaneous with the acquisition. Now consider the changes in employment growth of the control plants corresponding to the pre and post acquisitions periods, say, $\Delta^c \dot{E}$. If exogenous shocks which are contemporaneous with the acquisitions affect the acquired and control firms in more or less similar fashions, the differences-in-differences estimator which is defined as $\delta = \Delta^a \dot{E} - \Delta^c \dot{E}$ would purge the effects of common shocks and provide an unbiased estimator of the impact of ownership change.

To implement the above methodology within a regression framework, one can estimate the following equation, using the sample of acquired plants plus the control group:

$$\dot{E}_{it} = \alpha + \delta A_i + \varepsilon_{it} \qquad (3)$$

Here *i* and *t* index plants and time periods respectively and *A* is vector of post-acquisition dummies. In equation (3) the estimator for δ yields the average percentage point change in the growth rate of employment that can be attributed to foreign acquisitions. To allow for differential acquisition effects across the years, we construct three separate dummies: a contemporaneous dummy, a second one for the subsequent year and a third for the period starting from two years after ownership change.

In our empirical implementation, we extend the basic regression framework in several directions. Year dummies (β_t) and industry-specific effects (f_s) are included to capture aggregate shocks and permanent differences in the trend of employment growth across sectors respectively. A vector of plant characteristics is also included to control for observable changes that are correlated with employment changes. This vector consists of the growth rates of wages ($\dot{W}$), capital labour ratio ($\dot{K}$), past level of employment (E) as a measure of plant size and dummies for age bands.

Older and larger plants are expected to grow more slowly as they are more likely to have already reached efficiency size. Wage growth is also expected to be negatively related to employment changes, as is the percentage change in capital labour ratio provided that capital and labour are compliments. Existing empirical work (Brown and Medoff, 1988;

[11] See Mayer (1994) for an excellent exposition of this methodology.

McGuckin and Nguyen, 2001) provided evidence that the impact of acquisitions on employment tend to vary according to the size of the plants at the time of acquisitions. We therefore add a size-acquisition dummy interaction in the list of regressors to test whether this is also true in our data. We estimate separate regressions with and without output growth ($\dot{Y}$). The coefficient on the acquisition dummies in the case where output is not included capture employment effects coming from changes in productivity and the scale of production. When output growth is taken account of, the acquisitions dummies would simply reflect the change in employment growth induced by the productivity effects of acquisition.

The extended version of our regression equation can then be written as:

$$\dot{E}_{it} = \beta_t + \beta_1 E_{it-1} + \beta_2 \dot{W}_{it} + \beta_3 \dot{K}_{it} + \beta_3 \dot{Y}_{it} + \beta_4 A_{it} + f_s + \varepsilon_{it} \qquad (4)$$

The above methodology assumes that foreign acquisitions are exogenous to the process underlying the process of employment dynamics of the acquired plants. However, if employment growth plays some role in driving acquisitions, then it is possible that the acquisition indicators may be endogenous to equation (4). As above, possible endogeneity may be allowed for by using the estimate of the probability of foreign acquisition as an instrument. Vella and Verbeek (1999) have recently shown that this type of instrumental variables (IV) approach generates estimates comparable to Heckman's (1978) well-known endogeneity bias corrected OLS estimator. We therefore report estimates from an IV version of equation (4), where the instrument for the acquisition variable is generated from a probit model as used above in the hazard model. Recall that the probit model includes labour productivity plant age, age-squared, current size, size-squared and sectoral dummies as covariates.

4.2 Estimation Results

Table 6 reports the OLS and IV regressions results from the differences-in-differences analysis of the employment growth series. In this linear regression framework we can test for possible endogeneity using a Hausman test; the test statistics do not support the notion that foreign acquisitions might be endogenous to the process of employment growth. Thus we do not have any compelling reason to believe that plants with a lower/higher than average employment growth rates tend to be the targets for foreign acquirers. The coefficients for the control variables are generally in line with the theoretical expectations

and empirical findings elsewhere in the literature (see McGuckin and Nguyen, 2001). Plants with a higher level of past employment tend to grow at a slower rate, as do older plants. Growth in capital intensity and wage rates also lead to employment losses.

In the regressions that do not condition on output, the first year of acquisition is associated with a greater job loss than would be the case had the plants not been acquired. But controlling for output, the OLS estimate suggests that employment growth rate has decreased by less than one percentage point at the time of acquisition. The IV model, however, fails to confirm this (productivity-induced) initial employment effect of ownership change. The year following acquisition witnesses a significant slowdown in the rate of employment growth, with smaller plants suffering most.

Fixing acquisition size at its mean level,[12] foreign acquisition leads to an average decline of the growth of employment by about 3 percentage points. This does not appear to be due to productivity improvement, as the acquisition coefficients become insignificant once output is conditioned on. We have, however, some evidence of productivity-induced employment effects two years after acquisition. The IV (OLS) estimates show that at the 5 percent (10 percent) level of significance, employment growth in the newly foreign owned plants is lower by 1 percentage point compared to the growth rate they would have experienced had they remained domestically owned. This is consistent with the result obtained by Conyon et al. (2001c) that the technical efficiency with which labour is used improves under foreign ownership.

[Table 6 here]

We also estimated employment growth equations by type of labour, and the results are presented in Table 7. The growth of unskilled labour is shown to be quite insensitive to the growth in capital intensity, while the latter attracts a negative coefficient in the skilled labour regressions. In the electronics industry capital seems to be a substitute for skilled labour. A curious result is the positive relationship observed between the growth rates in the unskilled wages and unskilled labour. However, since we have no information on the development of overall supply of unskilled labour this result cannot be meaningfully interpreted.

[12] The mean of the (log) size at acquisition is 5.73 and the median is 5.68.

A key finding from our analysis is that the growth rate of skilled labour is not affected by the change in ownership whereas the growth of unskilled labour declined by 6.6 percentage points, one year after acquisition. This result barely changes when output is controlled for. At the ten percent level, there is also further evidence that foreign acquisition continues to exert a negative, albeit small, influence on the rate of growth of unskilled labour in subsequent years.

[Table 7 here]

5. Conclusions

This paper investigates whether the acquisition of a domestic establishment by a foreign owner has any effects, positive or negative, on the survival prospects and employment growth of that plant. This issue is not the least important from a policy perspective as one fear is that foreign acquisitions lead to plant closures and job losses in the acquired establishments. We provide evidence on these effects using data from the ARD database for the electronics sector in the UK.

Estimating a standard hazard model including a dummy variable for the incidence of acquisition yields the result that foreign takeover reduces the lifetime of the acquired plant. We also estimate the effect of a foreign takeover on employment growth in the acquired domestic plant. This approach can also yield further insights into the magnitude of potential job losses, as the new foreign owners may not only shed jobs by closing plants but also by reducing employment levels in continuing plants. Estimations of the determinants of employment growth in domestic plants provide some evidence that the incidence of takeover reduces employment growth, in particular for unskilled labour.

These results should not be taken as evidence that foreign takeovers have purely negative effects on the domestic economy and should therefore be avoided. On the contrary, it may be the case that the exiting plants are those that are relatively inefficient in comparison with foreign establishments and that the shedding of labour, in particular unskilled labour may enable surviving plants to boost their productivity levels. While the probit estimation of the determinants of the probability of takeover suggest that labour productivity in a domestic plant is positively correlated to its probability of being acquired by a foreign establishment it may still be the case that the domestic plants are relatively poor performers compared to

foreign establishments.[13] Thus, given the concerns about the UK's lagging behind other advanced economies in terms of productivity levels the "shake out" of plants and labour due to foreign acquisitions may indeed help to improve productivity figures. The detailed analysis of this issue, which is beyond the scope of the present paper, is a high priority on our future research agenda.

[13] As a preliminary step we estimated a simple regression of a plant's efficiency index obtained from stochastic production frontier estimations on a dummy equal to 1 if a plant is foreign for a sample containing only foreign plants and domestic establishments that are subsequently being acquired by foreigners. The result shows that foreign plants have, on average, higher levels of efficiency than those domestic establishments that are acquired by foreigners which is in line with this argument.

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Table 1
Number of acquisitions in the sample by year

Year	Frequency
1980	7
1981	11
1982	9
1983	4
1984	29
1985	8
1986	6
1987	15
1988	16
1989	35
1990	14
1991	34
1992	29
1993	22
Total	239

Table 2
Summary Statistics

	Control Group		**Acquired Group**	
	Mean	Standard deviation	Mean	Standard deviation
Total employment	539.6764	1038.654	642.0051	1057.439
% of Skill labour	41.1	0.003	43.01	0.004
Output (£ million)	14.9	26.7	38.2	18.4
Labour productivity	30531.73	25068.45	41403.44	79948.13
No. of plants	*524*		*239*	
No. of observations	*4286*		*2177*	

Table 3 (Table_0.log)

Post-ownership changes of employment, output and labour productivity: Evidence form the raw data

Variables	**t**	**t+1**	**t+2**	**t+3**
Total Employment	-5.39**	-11.19**	-13.62**	-11.38**
Skilled labour	-3.41	-5.26	-4.7	-3.92
Unskilled labour	-4.18	-12.9**	-17.96**	-16.07*
Output	6.0*	6.16	11.66*	17.73*
Labour productivity	11.41**	17.36**	25.27**	29.11**

Notes:

(i) Column **t+s** represents the % changes in the relevant variables that are due ownership change **s** years after the event. Here the pre-ownership change year (i.e. **t-1**) is used as the base.

* Significant at 5%; ** significant at 1% from the paired t-tests.

Table 4: Results of Cox Hazard Model

	(i)	(ii)	(iii)	(iv)
Acquired	0.940 (0.442)*	0.910 (0.439)*		
Predicted			-0.548 (0.635)	-0.794 (0.683)
Acquisition age	0.012 (0.033)	0.017 (0.032)	0.076 (0.016)**	0.080 (0.018)**
Age	-0.227 (0.099)*	-0.233 (0.099)*	-0.279 (0.099)**	-0.300 (0.108)**
Age^2	0.010 (0.004)*	0.010 (0.004)*	0.012 (0.004)**	0.013 (0.005)**
Size (initial)	0.538 (0.379)		0.547 (0.460)	
$Size^2$ (initial)	-0.043 (0.033)		-0.045 (0.041)	
Size (current)		1.325 (0.793)		1.411 (0.961)
$Size^2$ (current)		-0.121 (0.070)		-0.129 (0.084)
Growth	-2.714 (1.096)*	-2.545 (1.051)*	-2.841 (1.139)*	-2.700 (1.064)*
Herfindahl	-0.220 (3.481)	-0.316 (3.853)	-0.276 (5.042)	-0.380 (4.222)
Assisted Area	-0.116 (0.044)**	-0.118 (0.044)**	-0.109 (0.049)*	-0.113 (0.049)*
Obs	5033	5033	5033	5033
Log Likelihood	-341.86	-340.86	-343.34	-341.85
LR	52.88**	52.33**	41.66**	44.65**
Hausman test (p-value)	0.8876	0.5351		

Estimations are stratified by sector
Standard errors in parentheses, columns (iii) and (iv) are bootstrapped standard errors
**, * denote statistical significance at 1 and 5 percent level respectively
Hausman test tests the consistency of the standard hazard model (i.e. exogeneity of the acquisition dummy).
The tests fail to reject the assumption of exogeneity.

Table 5: Estimates based on alternative specifications of equation (2)

	(i)	(ii)	(iii)
Predicted	-0.215 (0.559)	-1.423 (5.540)	-1.423 (5.661)
Acquisition age	0.076 (0.017)**	0.075 (0.016)**	0.075 (0.017)**
Age	-0.258 (0.110)*	-0.248 (0.099)*	-0.248 (0.109)*
Age^2	0.011 (0.005)*	0.011 (0.004)*	0.011 (0.005)*
Size (initial)	0.538 (0.426)	0.546 (0.461)	0.546 (0.441)
$Size^2$ (initial)	-0.044 (0.039)	-0.044 (0.041)	-0.044 (0.039)
Growth	-2.797 (1.115)*	-2.807 (1.140)*	-2.807 (1.129)*
Herfindahl	-0.163 (4.745)	-0.103 (4.993)	-0.103 (5.176)
Assisted Area	-0.110 (0.049)*	-0.110 (0.048)*	-0.110 (0.047)*
Obs	5033	5033	5033
Log Likelihood	-343.66	-343.72	-343.72
LR	41.03**	40.91**	40.91**

Estimations are stratified by sector
Bootstrapped standard errors in parentheses
**, * denote statistical significance at 1 and 5 percent level respectively

Notes:
(i) equation (2) additionally includes size and age cubed, labour productivity squared and cubed
(ii) *predicted* = predicted probability instead of fitted value of equation (2)
(iii) equation (2) is estimated using standard pooled probit instead of random effects probit

Table 6
The impact of foreign acquisitions on total employment growth

	OLS (exogenous acquisitions)		**IV (endogenous acquisitions)**	
	Without Output	With Output	Without Output	With Output
Past employment	-0.030	-0.017	-0.031	-0.017
	(0.004)**	(0.002)**	(0.004)**	(0.002)**
Wage growth	-0.246	-0.391	-0.247	-0.390
	(0.047)**	(0.032)**	(0.047)**	(0.032)**
Capital intensity growth	-0.036	-0.024	-0.036	-0.024
	(0.010)**	(0.005)**	(0.010)**	(0.005)**
Output growth		0.508		0.508
		(.029)**		(.029)**
4<=Age <=6	0.031	-0.001	-0.031	0.001
	(0.021)	(0.013)	(0.021)	(0.013)
Age > 6	-0.042	-0.022	-0.073	-0.021
	(0.013)**	(0.009)*	(0.018)**	(0.011)
Foreign(t)	-0.091	-0.080	-0.118	-0.105
	(0.055)	(0.032)*	(0.134)	(0.074)
Size*Foreign(t)	0.012	0.007	0.020	0.010
	(0.010)	(0.006)	(0.022)	(0.012)
Foreign(t-1)	-0.501	-0.310	-0.501	-0.314
	(0.175)**	(0.169)	(0.175)**	(0.169)
Size*Foreign(t-1)	0.082	0.050	0.082	0.050
	(0.032)*	(0.031)	(0.032)*	(0.031)
Foreign(t - 2^{+})	-0.019	-0.010	-0.017	-0.012
	(0.009)*	(0.005)	(0.010)	(0.006)*
Size* Foreign(t- 2^{+})	-0.000	-0.001	-0.000	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Constant	0.193	0.105	0.171	0.071
	(0.043)**	(0.028)**	(0.048)**	(0.029)*
Observations	5255	5255	5255	5255
R-squared	0.11	0.52	0.11	0.52
Hausman test (p-value)	1	.999		

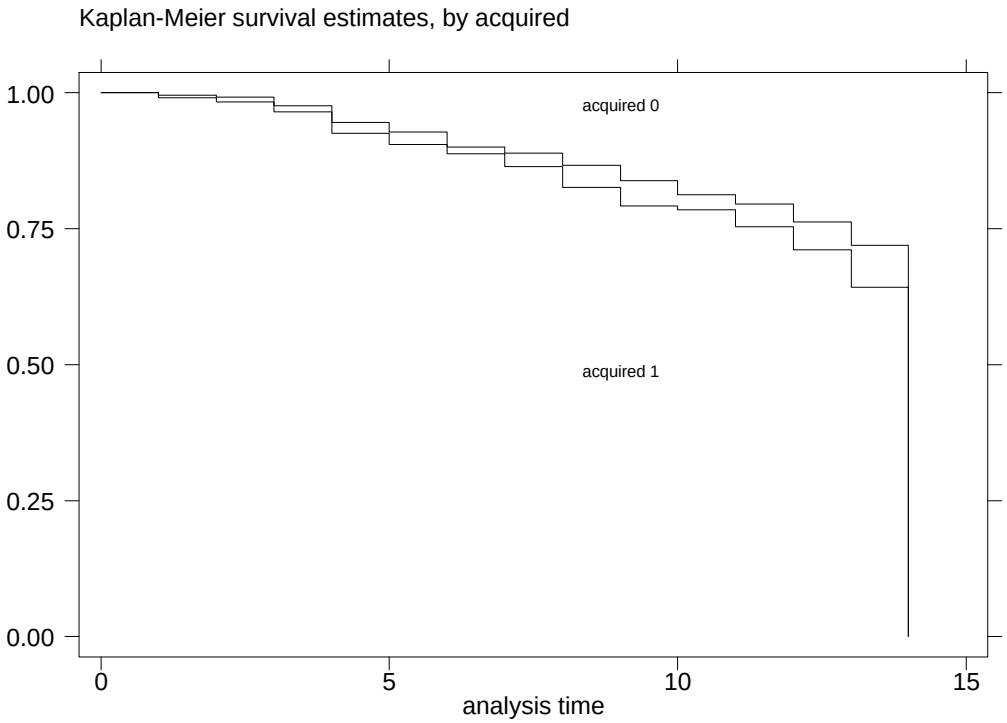
Heteroscedasticity and serial correlation consistent standard errors in parentheses
**, * denote statistical significance at 1 and 5 percent level respectively
All regressions contain time and 4-digit industry dummies.
The Hausman test test the consistency of the OLS estimator (i.e. exogeneity of the acquisition dummy). The tests fail to reject the assumption of exogeneity.

Table 7
The impact of foreign acquisition on employment growth:
IV estimates by type of labour

	Skilled labour		**Unskilled labour**	
	without output	with output	without output	with output
Past employment	-0.030	-0.018	-0.035	-0.023
	(0.004)**	(0.003)**	(0.005)**	(0.004)**
Skilled wage growth	-0.449	-0.492	0.140	0.099
	(0.043)**	(0.037)**	(0.035)**	(0.042)*
Unskilled wage growth	-0.039	-0.058	0.402	0.384
	(0.013)**	(0.011)**	(0.035)**	(0.034)**
Capital intensity growth	-0.030	-.019	-0.022	-0.011
	(0.010)**	(0.006)**	(0.017)	(0.014)
Output growth		0.479		0.461
		(0.039)**		(0.041)**
4<= Age <= 6	-0.031	0.002	-0.009	0.022
	(0.024)	(0.018)	(0.035)	(0.030)
Age > 6	-0.063	-0.014	-0.060	-0.012
	(0.019)**	(0.015)	(0.025)*	(0.022)
Foreign(t)	-0.100	-0.075	-0.179	-0.154
	(0.137)	(0.083)	(0.227)	(0.182)
Size*Foreign(t)	0.019	0.006	0.013	0.001
	(0.022)	(0.014)	(0.037)	(0.030)
Foreign(t-1)	-0.374	-0.202	-0.628	-0.463
	(0.208)	(0.203)	(0.173)**	(0.164)**
Size*Foreign(t-1)	0.066	0.037	0.098	0.070
	(0.039)	(0.038)	(0.031)**	(0.029)*
Foreign(t - 2^{+})	-0.019	-0.013	-0.028	-0.023
	(0.012)	(0.009)	(0.015)	(0.013)
Size* Foreign(t - 2^{+})	-0.000	-0.002	-0.002	-0.003
	(0.002)	(0.002)	(0.003)	(0.003)
Constant	0.214	0.118	0.163	0.071
	(0.048)**	(0.034)**	(0.068)*	(0.056)
Observations	5255	5255	5255	5255
R-squared	0.12	0.29	0.47	0.55

Heteroscedasticity and serial correlation consistent standard errors in parentheses
**, * denote statistical significance at 1 and 5 percent level respectively
All regressions contain time and 4-digit industry dummies.

Figure 1: Kaplan-Meier Survival Functions



Appendix

Results of the random effects probit estimation of equation (2)

Labour productivity	1.884 (0.292)***
Age	-0.054 (0.020)***
Age2	0.003 (0.001)***
Size	1.921 (0.387)***
Size2	-0.114 (0.027)***
Wald test	94.08***
Log-likelihood	-946.16***

Standard errors in parentheses
**, * denote statistical significance at 1 and 5 percent level respectively