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ABSTRACT

Blessing or Curse? Domestic Plants' Survival and Employment Prospects after Foreign Acquisitions*

This paper investigates whether the acquisition of a domestic establishment by a foreign owner has any effects on the survival prospects and employment growth of that plant. The analysis uses plant level data for the UK electronics and food industries for the period 1980 to 1993. We control for possible endogeneity using a matched sample of firms and instrumental variables. Estimating a standard hazard model yields the result that foreign takeover reduces the liftetime of the acquired plant in both the electronics and food sectors. 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 in the electronics industry. There is no significant effect for the food sector, however.

JEL Classification: L25, F23

Keywords: foreign direct investment, acquisitions, survival, employment growth

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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 (2002) 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.[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?

[1] These premia for foreign firms have also been found for other countries, see, for example, Doms and Jensen (1998) for the US.

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.

While there have been a number of papers examining the employment effects of acquisitions for the US (e.g., Lichtenberg and Siegel, 1992, McGuckin et al., 1998, McGuckin and Nguyen, 2001) and the UK (Conyon et al., 2001, 2002a) only Conyon (2002b) appear to be concerned with foreign take-overs in particular. In their study of the wage and productivity impact of foreign acquisitions in the UK they find 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.

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.[2] An establishment acquired by a foreign owner may experience a reduction or an increase in its survival probabilities. Firstly, multinationals are usually regarded as being more "footloose" and have been found to have lower probabilities of survival than domestic firms, ceteris paribus (Görg and Strobl, 2002). One of the reasons may be that multinational expansion is inherently more risky than a purely domestic venture of comparable characteristics. Secondly, foreign acquisition may be a device to acquire market access, distribution channels, skills etc. for a new foreign market entrant (Thompson, 1999). Once these resources/capabilities have been ingested the acquiring firm may divest itself of the acquired establishment and source its requirements from its plants elsewhere.

However, foreign acquisition may also lead to increasing survival probabilities if the foreign acquirer transfers technology, knowledge or skills to the acquired plant and hence contributes to an improvement in the establishment's performance (Görg and Strobl, 2000).

Our paper contributes to the literature in a number of ways. First, we provide, to the best of our knowledge for the first time, a systematic investigation into the effect of foreign acquisitions on the survival probabilities and employment growth of the acquired domestic plants. This allows us 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. Second, in order to alleviate the ever present problem of endogeneity of acquisition and performance we use a matching approach and instrumental variable estimations. The matching approach is used to construct a reasonable counterfactual by creating a control group of establishments with similar characteristics to the acquired plants. This group is then used in our comparison of survival and employment growth.

Our results for UK establishment level data for the electronics and food industries (which are two of the highest FDI attracting sectors in the economy) suggest that foreign acquisition leads to reductions in survival probabilities for the acquired domestic plants in both sectors. We also find some evidence that it leads to reductions in employment growth, in particular of unskilled workers, in the acquisition target in the electronics industry. No such effect is found for the food industry, however.

[2] In a somewhat related paper McCloughan and Stone (1998) analyse the determinants of the survival of multinational companies in the UK.

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 Data and Summary Statistics

This paper uses data on acquisitions of on-going domestic establishments by foreign companies in the UK electronics and food industries for the period 1980-93.[3,4] Foreign-owned firms are important players in both, accounting for about 19 percent of employment in electronics and 10 percent of employment in the food industry in 1996 (Griffith and Simpson, 2002, Table 4). We may, however, expect the two sectors to be different in their technology usage and, hence, may expect differences in survival probabilities and employment growth.[5] Also, arguably the electronics industry is characterised by relatively short product life cycles, while this may not be the case for food industries.

The data include 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 change of ownership between 1980 and 1993 are excluded from the analysis. This is partly to avoid conflating the effects of

[3] More precisely, using SIC 1980 classification, SIC 33 (manufacture of office machinery and data processing equipment), SIC 34 (electrical and electronic engineering), and SIC 41/42 (food, drink and tobacco).
[4] See Appendix I for a description of the dataset used.
[5] According to an OECD classification as cited by Kearns and Ruane (2001) "electronics and communication" are classified as high-tech, while "food and beverages" are low-tech industries

different events, and partly because we suspect the presence of measurement error problems. The final sample consists of 239 foreign acquisitions in the electronics and 121 in the food industry. The frequency distribution of these acquisitions by year is given in Table 1.

[Table 1 here]

When examining the survival and employment prospects of acquired establishments after acquisition the important issue is, of course, how to establish what would have happened to the plant had it not been acquired by the foreign establishment. This analysis of evaluating the causal effect of foreign acquisitions can be viewed as confronting a missing-data problem, since survival and employment information for the acquired firms had they remained in domestic hands is obviously not available. This implies that a direct pre- versus post-entry comparison cannot be made. The construction of the missing information (or the counterfactual) is therefore paramount for our analysis.

We address this point by comparing establishments that were acquired with those that are very similar in terms of a number of plant-specific characteristics but did not experience an acquisition. Specifically, we draw a four-digit industry-stratified random sample of establishments that act as a control group in the analysis from the population of domestic establishments that did not experience a change of nationality of ownership during the sample period.[6]

[6] 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 acquisition of an existing domestic establishment. We are interested in the effect the latter mode of entry has on the domestic takeover target rather than comparing foreign to domestic takeovers.

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 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. Eventually, we selected 524 establishments in electronics and 241 establishments in food as the control group.

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 acquired firms are generally larger than domestic ones, and they exhibit greater productivity levels (see, for example, Griffith and Simpson, 2002).

[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 Figures 1 and 2.

[Figures 1 and 2 here]

Inspection shows that, in the electronics industry, 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 ($\chi^2 = 2.4$).

In contrast, in the food sector we find quite a substantial gap between the survival functions of the two groups of establishments. The probability of surviving up to 10 years is 81 and 87 percent respectively for acquired and non-acquired plants. The comparable probabilities for surviving up to 13 years are 72 and 82 percent respectively. In support of the graph a log-rank test gives a $\chi^2 = 7.4$ which allows us to reject the hypothesis of equality of the two functions. Hence, this preliminary analysis suggests that foreign acquisition leads to reductions in the probability of survival for the acquired target in the food industry.

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 for plants in the two sectors. These are reported in Table 3. The raw data suggest for both sectors 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 outstripping output growth, rather than job destruction linked to declines in production.

[Table 3 here]

However, it would be inappropriate to conclude from the survival functions or from the data reported in Table 3 that the changes in survival probabilities or employment are the result of ownership change *per se*. The simple survival functions and *t*-tests do not control for other factors that may have impacted on survival and employment growth over the period, such as technological progress, changes in plant size and the dynamics of wages. For this reason we turn to the estimation of a hazard model in the following section, and an econometric analysis of employment growth in Section 4, with the aim of isolating the net impact of foreign acquisitions on plant survival and employment growth.

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 particularly suited since 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.

In line with the empirical literature (see Geroski, 1995) we include plant age and size as independent variables in the vector X.[7] 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

[7] The results reported below are based on estimations including initial size. We also re-ran the regressions including current size; results were qualitatively and quantitatively similar.

[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

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

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 separately for the two sectors using random effects probit techniques in order to take account of the panel nature of the data. The results of estimating equation (2) are reported in Appendix II.[9]

3.2 Estimation Results

The results of estimating different specifications of equation (1) for electronics and food industries separately are presented in Table 4. All estimations are stratified by four digit 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. The columns labelled "exogenous acquisitions" include a dummy equal to one once the firm is

in a nonlinear model for the analysis of the effect of training on unemployment duration in Germany utilising a hazard model.

[9] We also estimated alternative specifications of equation (2) to check whether the results reported below 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). The results of the survival estimations using the alternative instruments are not reported herein to save space. However, they are similar to the results reported in Table 4, suggesting that the results are robust to alternative definitions of the instruments.

taken over. The statistically significant and positive coefficient suggests that, in both electronics and food, 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 for the electronics sector and 10.03 for the food sector respectively. This indicates that the hazard of exiting is approximately 2.5 times and 10 times higher for acquired establishments than for purely domestic plants in the electronics and food industries respectively.

Correcting for the possible endogeneity of the acquisition dummy by employing the probability of foreign acquisition as an instrument in the columns labelled "endogenous acquisitions" shows that there is no statistically significant effect of foreign takeover in the electronics sector once controlling for the possible endogeneity, while we still find a positive coefficient (i.e., a reduction in the probability of survival) in the food sector. As the variable *acquired* is now defined as a probability and not a dummy, the implied hazard ratio can be calculated as exp(β * probability). Evaluated at the mean predicted probability the hazard ratio equals 2.70.

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, we may use a

standard Hausman test to get a rough indicator of whether or not the assumption of exogeneity holds. These tests, which are reported in Table 4 do not provide evidence that foreign acquisitions are endogenous to survival in the electronics industry. However, we can reject the assumption of exogeneity for the food sector. Hence, our results provide evidence that foreign acquisition reduces the survival of the acquired domestic plants in both sectors.

There are a number of possible explanations for this result. First, as pointed out in the introduction, multinationals may be more likely to divest themselves of acquired plants due to the "footloose" nature of the investment or because they are only interested in short term gains from market access, access to resources etc.

Even if multinationals per se did not have different survival prospects than domestic firms there may be reasons why foreign acquired plants are less likely to survive, e.g., if 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 2) 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. Another possible explanation may be that foreign firms take over domestic competitors 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 these different explanations in any detail.

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.

[Table 4 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.[10] 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 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.

[10] See Meyer (1995) for an excellent exposition of this methodology.

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 complements. Existing empirical work (Brown and Medoff, 1988; 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:

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

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.[11] 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.

[11] 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.

4.2 Estimation results

Table 5 reports the IV regression results from the differences-in-differences analysis of the employment growth series for both sectors.[12] 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.

The effect of foreign acquisition on employment growth differs between the electronics and the food sectors. For the former, in the regressions that do not condition on output the year following acquisition witnesses a significant slowdown in the rate of employment growth, with smaller plants suffering most. When controlling for output, however, the estimates suggest that employment growth only declines slightly two years after the acquisition. By contrast, we do not pick up any significant employment effects of foreign acquisitions in the food sector.

Fixing acquisition size at its mean level,[13] foreign acquisition leads to an average decline of the growth of employment by about 3 percentage points in the electronics sector. 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 estimates show that at the 5 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

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

domestically owned. This is consistent with the result obtained by Conyon et al. (2002b) that the technical efficiency with which labour is used improves under foreign ownership.

[Table 5 here]

We also estimated employment growth equations by type of labour, and the results are presented in Table 6 for skilled and Table 7 for unskilled labour. The growth of unskilled labour is shown to be quite insensitive to the growth in capital intensity in particular in the electronics industry, while capital intensity attracts a negative coefficient in the skilled labour regressions in both sectors. Hence, 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 in both industries. However, since we have no information on the development of overall supply of unskilled labour this result cannot be meaningfully interpreted.

A key finding from our analysis is that the growth rate of skilled labour is not significantly affected by the change in ownership in either electronics or food. However, in the electronics industry, the growth of unskilled labour declined significantly by about 6.6 percentage points, one year after acquisition. This result barely changes when output is controlled for. In contrast, we do not find any evidence of an effect, either negative or positive, of foreign acquisitions on plant employment growth in the food sector.

[Tables 6 and 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 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 for the electronics and food sectors in the UK.

Since analyses of this kind are plagued by the problem of endogeneity we use a matched sample of domestic plants which did not experienced a foreign acquisition as a control group for those plants that were acquired by foreign owners. This allows us to construct a reasonable counterfactual. We also use an instrumental variable approach to control for endogeneity.

Estimating a hazard model of plant survival yields the result that foreign takeover reduces the lifetime of the acquired plant in both the electronics and the food industries. 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 in the electronics industry. We do not find any significant effects of foreign acquisition on employment growth for food sector plants, however.

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.[14] 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.

[14] 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	
	Electronics	Food
1980	7	0
1981	11	3
1982	9	5
1983	4	9
1984	29	16
1985	8	4
1986	6	3
1987	15	9
1988	16	6
1989	35	17
1990	14	9
1991	34	15
1992	29	8
1993	22	17
Total	239	121

Table 2
Mean (and standard deviation) of some variables of interest

	Electronics		Food	
	Control group	Acquired group	Control group	Acquired group
Total employment	539.7 (1038.6)	642 (1057.439)	418 (621.4)	746.75 (1636)
% of Skill labour	41.1 (0.003)	43.01 (0.004)	24.1 (0.173)	28.97 (0.169)
Output (£ million)	14.9 (26.7)	38.2 (18.4)	23.1 (44.4)	43.6 (75.4)
Labour productivity (£ thousand	30.53 (25.07)	41.40 (79.98)	59.72 (61.93)	93.02 (15.82)
No. of plants	*524*	*239*	*241*	*117*
No. of observations	*4286*	*2177*	*2317*	*1076*

Table 3

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

	Electronics sector			
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**

	Food sector			
Variables	**t**	**t+1**	**t+2**	**t+3**
Total Employment	-4.97*	-8.88*	- 1.0	1
Skilled labour	-6.56*	-14.8*	-6.8	-8.98
Unskilled labour	-5.73*	-6.19*	4.52	0
Output	0	5.32	12.2*	15.9*
Labour productivity	4.62*	14.2**	12.98**	13.96**

Notes:
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: Hazard ratios and standard errors

	Electronics sector		**Food sector**	
	Exogenous acquisitions	Endogenous acquisitions	Exogenous acquisitions	Endogenous acquisitions
Acquired	0.940 (0.442)*	-0.548 (0.635)	2.306 (0.458)**	20.03 (4.35)**
Acquisition age	0.012 (0.033)	0.076 (0.016)**	-0.134 (0.062)*	-0.047 (0.039)
Age	-0.227 (0.099)*	-0.279 (0.099)**	0.098 (0.279)	-0.213 (.476)*
Age^2	0.010 (0.004)*	0.012 (0.004)**	0.014 (0.167)	0.036 (0.082)
Size (initial)	0.538 (0.379)	0.547 (0.460)	-0.001 (0.005)	-0.003 (0.005)
$Size^2$ (initial)	-0.043 (0.033)	-0.045 (0.041)	0.000 (0.00001)	0.000 (0.00001)
Growth	-2.714 (1.096)*	-2.841 (1.139)*	-0.881 (0.819)	-1.088 (0.673)
Herfindahl	-0.220 (3.481)	-0.276 (5.042)	-8.03 (4.83)	-7.545 (5.339)
Assisted Area	-0.116 (0.044)**	-0.109 (0.049)*	-0.052 (0.483)	-0.025 (0.340)
Obs	5033	5033	2609	2609
Log Likelihood	-341.86	-343.34	-204.68	-213.51
LR	52.88**	41.66**	31.74**	14.07
Hausman test (p-value)	0.8876		0	

Estimations are stratified by sector
Standard errors in parentheses,
With endogenous acquisitions, standard errors are bootstrapped
**, * 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).

Table 5
The impact of foreign acquisitions on total employment growth
(endogenous acquisitions)

	Electronics sector		**Food sector**	
	Without Output	With Output	Without Output	With Output
Past employment	-0.031	-0.017	-0.027	-0.023
	(0.004)**	(0.002)**	(0.006)**	(0.004)**
Wage growth	-0.247	-0.390	-0.435	-0.466
	(0.047)**	(0.032)**	(0.080)**	(0.073)**
Capital intensity growth	-0.036	-0.024	-0.064	-0.049
	(0.010)**	(0.005)**	(0.028)*	(0.020)*
Output growth		0.508		0.617
		(.029)**		(0.061)**
4<=Age <=6	-0.031	0.001	0.000	0.176
	(0.021)	(0.013)	(0.000)	(0.000)
Age > 6	-0.073	-0.021	-0.025	-0.011
	(0.018)**	(0.011)	(0.024)	(0.017)
Foreign(t)	-0.118	-0.105	0.047	-0.066
	(0.134)	(0.074)	(0.088)	(0.109)
Size*Foreign(t)	0.020	0.010	-0.016	0.004
	(0.022)	(0.012)	(0.017)	(0.018)
Foreign(t-1)	-0.501	-0.314	-0.065	-0.114
	(0.175)**	(0.169)	(0.113)	(0.097)
Size*Foreign(t-1)	0.082	0.050	0.002	0.013
	(0.032)*	(0.031)	(0.022)	(0.017)
Foreign(t - 2^{+})	-0.017	-0.012	-0.082	-0.058
	(0.010)	(0.006)*	(0.098)	(0.065)
Size* Foreign(t- 2^{+})	-0.000	-0.001	0.016	0.009
	(0.002)	(0.001)	(0.018)	(0.012)
Constant	0.171	0.071	0.204	0.176
	(0.048)**	(0.029)*	(0.060)**	(0.038)**
Observations	5255	5255	2815	2815
R-squared	0.11	0.52	0.17	0.44
Hausman test (p-value)	1	.999	0	1

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 6
The impact of foreign acquisition on skilled employment growth
(endogenous acquisitions)

	Electronics sector		**Food sector**	
	without output	With output	without output	With output
Past employment	-0.030	-0.018	-0.032	-0.024
	(0.004)**	(0.003)**	(0.006)**	(0.005)**
Skilled wage growth	-0.449	-0.492	-0.049	-0.127
	(0.043)**	(0.037)**	(0.041)	(0.061)*
Unskilled wage growth	-0.039	-0.058	0.010	-0.007
	(0.013)**	(0.011)**	(0.025)	(0.023)
Capital intensity growth	-0.030	-.019	-0.053	-0.038
	(0.010)**	(0.006)**	(0.019)**	(0.013)**
Output growth		0.479		0.309
		(0.039)**		(0.084)**
4<= Age <= 6	-0.031	0.002	0.000	0.000
	(0.024)	(0.018)	(0.000)	(0.000)
Age > 6	-0.063	-0.014	-0.018	-0.005
	(0.019)**	(0.015)	(0.027)	(0.024)
Foreign(t)	-0.100	-0.075	-0.225	-0.242
	(0.137)	(0.083)	(0.149)	(0.145)
Size*Foreign(t)	0.019	0.006	0.030	0.032
	(0.022)	(0.014)	(0.028)	(0.027)
Foreign(t-1)	-0.374	-0.202	0.045	0.020
	(0.208)	(0.203)	(0.217)	(0.199)
Size*Foreign(t-1)	0.066	0.037	-0.025	-0.020
	(0.039)	(0.038)	(0.043)	(0.038)
Foreign(t - 2^{+})	-0.019	-0.013	-0.094	-0.057
	(0.012)	(0.009)	(0.119)	(0.097)
Size* Foreign(t - 2^{+})	-0.000	-0.002	0.020	0.012
	(0.002)	(0.002)	(0.022)	(0.018)
Constant	0.214	0.118	0.229	0.212
	(0.048)**	(0.034)**	(0.084)**	(0.069)**
Observations	5255	5255	2816	2816
R-squared	0.12	0.29	0.05	0.15
Hausman test (p-value)	0	0	0	0

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.

Table 7
The impact of foreign acquisition on unskilled employment growth
(endogenous acquisitions)

	Electronics sector		**Food sector**	
	without output	With output	without output	with output
Past employment	-0.035	-0.023	-0.036	-0.026
	(0.005)**	(0.004)**	(0.008)**	(0.006)**
Skilled wage growth	0.140	0.099	-0.106	-0.208
	(0.035)**	(0.042)*	(0.094)	(0.066)**
Unskilled wage growth	0.402	0.384	0.328	0.306
	(0.035)**	(0.034)**	(0.062)**	(0.064)**
Capital intensity growth	-0.022	-0.011	-0.092	-0.072
	(0.017)	(0.014)	(0.036)*	(0.029)*
Output growth		0.461		0.407
		(0.041)**		(0.100)**
4<= Age <= 6	-0.009	0.022	0.000	0.000
	(0.035)	(0.030)	(0.000)	(0.000)
Age > 6	-0.060	-0.012	-0.040	-0.022
	(0.025)*	(0.022)	(0.033)	(0.030)
Foreign(t)	-0.179	-0.154	0.179	0.156
	(0.227)	(0.182)	(0.147)	(0.168)
Size*Foreign(t)	0.013	0.001	-0.035	-0.033
	(0.037)	(0.030)	(0.026)	(0.028)
Foreign(t-1)	-0.628	-0.463	-0.173	-0.206
	(0.173)**	(0.164)**	(0.144)	(0.126)
Size*Foreign(t-1)	0.098	0.070	0.021	0.029
	(0.031)**	(0.029)*	(0.026)	(0.022)
Foreign(t - 2^{+})	-0.028	-0.023	-0.077	-0.029
	(0.015)	(0.013)	(0.114)	(0.093)
Size* Foreign(t - 2^{+})	-0.002	-0.003	0.014	0.004
	(0.003)	(0.003)	(0.021)	(0.017)
Constant	0.163	0.071	0.148	0.126
	(0.068)*	(0.056)	(0.067)*	(0.059)*
Observations	5255	5255	2816	2816
R-squared	0.47	0.55	0.31	0.43
Hausman test (p-value)	0	0	0	0

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

Electronics sector

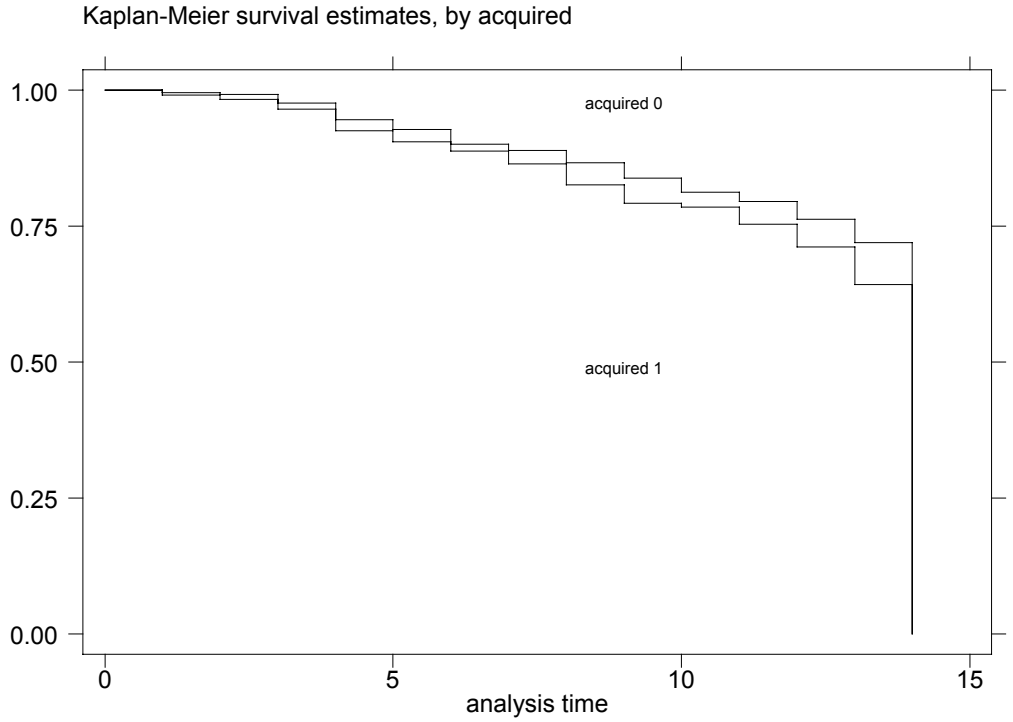
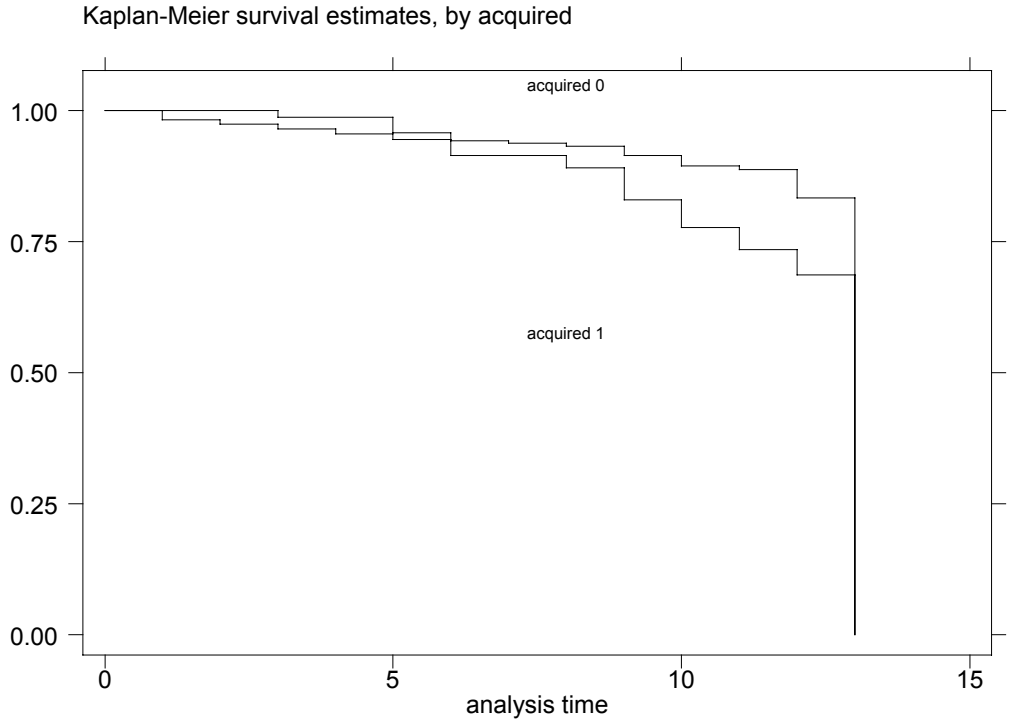


Figure 2: Kaplan-Meier Survival Functions

Food sector



Appendix I

Data background

The data are taken from the Annual Respondents Database (ARD) which is provided by the Office for National Statistics in the UK under controlled conditions. It consists of individual establishments' records underlying the Annual Census of Production. As Barnes and Martin (2002) provide a very useful introduction 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 period under analysis, the ARD consists of two files. What is known as the 'selected file', contains detailed information from responses and imputed responses of a sample of establishments that are sent inquiry forms. The second file comprises the 'non-selected' (non-sampled or non-responding) 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 for the period under consideration establishments with more than 100 employees were always sampled.

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. 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. As a result we tend to use the terms plant and establishment interchangeably.

Appendix II

Results of the probit estimation of equations

	Electronics	Food
Labour productivity	1.884 (0.292)**	.299 (.781)**
Age	-0.054 (0.020)**	.722 (.068)
Age2	0.003 (0.001)**	-.006 (.276)
Size	1.921 (0.387)**	-.484 (.276)
Size2	-0.114 (0.027)**	.038 (.023)
Wald test	94.08**	147.02**
Log-likelihood	-946.16	-435.22

Standard errors in parentheses
**, * denote statistical significance at 1 and 5 percent level respectively
Random effect probit estimator is used for electronics sector. The food sector results are based on pooled probit estimated because the random effect model failed to converge.
Sectoral and time dummies are included in the regressions

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