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Tomohiko Inui, Richard Kneller, Toshiyuki Matsuura and Danny McGowan

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The Authors

Tomohiko Inui is Professor of Economics at Nihon University and a Research Fellow at the Economics and Social Research Institute, Cabinet Office, Japan. Richard Kneller is Associate Professor and Reader in Economics at the University of Nottingham and a GEP Fellow. Toshiyuki Matsuura is Professor of Economics at Keio University. Danny McGowan is a PhD student at the University of Nottingham.

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Tomohiko Inui
(Economic and Social Research Institute, Cabinet Office and Nihon University)

Richard Kneller*
(GEP, University of Nottingham)

Toshiyuki Matsuura
(Keio University)

Danny McGowan
(GEP, University of Nottingham)

Abstract

This paper investigates why plants belonging to multi-plant firms are more likely to exit. Using Japanese plant data linked to firm data we study the process of plant closure among domestic multi-plant firms as well as multi-plant multinationals. As elsewhere in the literature these organisational forms are found to raise the probability of plant exit despite the superior characteristics of the plants they own. We find that the domestic multi-plant ownership effect is attributable to these firms closing the weakest elements of the firm. We reject the idea of multinationals being 'footloose' but instead find a residual effect of multinational ownership which reduces the probability of plant death when we control for the process of closure within those firms.

Keywords: Exit, Multinational Firms, Multi-plant firms, International Trade

JEL classification: D21, D24, F15, F23, L20, L6

Outline

* Corresponding author: e-mail: richard.kneller@nottingham.ac.uk, Sir Clive Granger Building, University of Nottingham, University Park, NG7 2RD, tel: +44(0)115 95 14735, fax: +44(0) 115 95 14159

Non-Technical Summary

Plants owned by multi-plant firms are known to possess characteristics that reduce their likelihood of closure compared to single plant firms. Their plants are generally larger, more capital intensive and more productive, all factors shown in numerous contexts to be negatively associated with the probability of exit. Despite these qualities multi-plant firms are invariably found to be more likely to shutdown a plant regardless of whether the firm's affiliates are located domestically or abroad. For the United States Bernard and Jensen (2007) find that domestic multi-plant ownership raises the probability a plant will die by 4.2%.

In this paper we use rich data that includes the characteristics of a firm and its plants to study the determinants of plant closure within multi-plant firms in Japan, including multinational firms. We find strong evidence that plants belonging to multi-plant firms are much more likely to shut plants compared to similar single plant firms and regardless of whether the firm has foreign affiliates or not. There is evidence of a clear ordering of the likelihood of death according to ownership structure: relative to single-plant domestic firms, plants belonging to multi-plant multinationals are 292% more vulnerable to closure, multi-plant non-MNE firms are 134% more likely to shut plants, while single plant MNEs are 62% more likely to close down.

We next consider the type of plants that are closed within multi-plant firms. A high degree of similarity is found among those closed by domestic multi-plant firms and multi-plant multinationals. The key differences being that domestic multi-plant firms are significantly more likely to keep open plants that are capital intensive and that pay high wages.

In the final part of the analysis we consider whether it is this process of plant closure that explains why these ownership structures are associated with higher exit odds compared to single plant firms. We find some support for this view for non-MNEs but not MNEs: once we control for the characteristics of plants relative to the rest of the firm, domestic multi-plant firms are no more likely to close a plant than a single plant firm. However, when the same tests are performed on multinationals we find a residual impact of multi-plant MNE ownership that actually insulates plants against exit. Therefore once we control for the characteristics of a plant relative to the rest of the firm, we reject the idea that multinationals are 'footloose'.

1. Introduction

The recent global financial crisis and the resulting global recession has highlighted the often severe, localised output and employment losses that occur when large firms close their plants. But which plants are most at risk of closure by parent firms? Are they really more likely to be shut than single plant firms with similar characteristics? Are they more likely to be owned by multinationals, in particular foreign multinationals? Are they concentrated in declining industries, or produce products that can be easily offshored?

In this paper we use rich data that includes the characteristics of a firm and its plants to study the determinants of plant closure within multi-plant firms in Japan, including multinational firms. We find strong evidence that plants belonging to multi-plant firms are much more likely to shut plants compared to similar single plant firms and regardless of whether the firm has foreign affiliates or not. There is evidence of a clear ordering of the likelihood of death according to ownership structure: relative to single plant domestic firms, plants belonging to multi-plant multinationals are 292% more vulnerable to closure, multi-plant non-MNE firms are 134% more likely to shut plants, while single plant MNEs are 62% more likely to close down.

Building on this result we next explore the type of plants that are shut by multi-plant firms. Within this we consider the relative characteristics of plants compared to the rest of the firm, but also the behaviour of multinationals with respect to other multi-plant firms that do not have overseas affiliates. The data on plants are sufficiently rich that we can do this for a wide range of characteristics including their size, capital intensity, average wage bill and material intensity. We find from this a certain degree of similarity in the type of plants that are shut across MNEs and non-MNEs. Plants are more likely to be closed if they are small regardless of ownership structure for example. However, domestic multi-plant firms are more likely to keep open plants that are capital intensive and high wage relative to the rest of the firm; an indication that multi-plant firms without foreign affiliates are more concerned with closing the relatively small and capital un-intensive parts of their operations.

As a final exercise we consider whether it is this process of plant closure that explains why these ownership structures are associated with higher exit odds compared to single plant firms. We find some support for this view for non-MNEs but not MNEs: once we control for the characteristics of plants relative to the rest of the firm, domestic multi-plant firms are no more likely to close a plant than a single plant firm. However, when the same tests are performed on multinationals we find a residual impact of multi-plant MNE ownership that actually insulates plants against exit. Therefore once we control for the characteristics of a plant relative to the rest of the firm, we reject the idea that multinationals are 'footloose'.

In seeking explanations for the exit process of multi-plant firms, we build on a relatively small literature and which has focused narrowly on the question of whether multi-plant or multinational firms are more likely to close plants compared to single plant firms (the first question we explore). Explanations for why multi-plant firms are more likely to shut plants range from declining industry arguments (Lieberman, 1990) to trade liberalisation (Gibson and Harris, 1996). Harrigan (1980) and Baden-Fuller (1989) posit that one explanation for the positive correlation between multi-plant ownership and plant closure could be that large, diversified firms face fewer agency problems thereby making their plants more vulnerable to closure. However, the existing empirical literature casts doubt on these hypotheses. Specifically, Gibson and Harris (1996) find that the multi-plant firm effect remains robust to the inclusion of a firm diversity variable while Bernard and Jensen (2007) show that increasing dissimilarity between plant and parent does not affect the role played by multi-plant ownership. An alternative set of explanations focuses on demand conditions in the plant's industry: Lieberman (1990) shows that multi-plant firms are more likely to close plants in declining industries for example. For Japan we find that declining industries, measured by the degree of import competition, or indeed measures of trade openness more generally, does not predict which plants are more likely to be closed. We also find no effect from whether the plant is in the same industry or a different industry of the parent

Finally a separate strand of literature has shown multinational ownership to raise the probability of plant exit although the reasons for this 'footloose' effect of multinational ownership are not explored (Bandick, 2007; Kimura and Kiyota, 2006;

Alvarez and Görg, 2005; Bernard and Jensen, 2007). As explained above we find that this result does not hold once we control for plant relative to firm characteristics.

The rest of the paper is organised as follows. Section 2 provides a brief review of the literature on exit and multi-plant firms. Section 3 describes the dataset we use. In Section 4 we investigate the magnitude of the domestic multi-plant ownership and 'footloose' effects. Section 5 studies the determinants of exit within multi-plant firms. In Section 6 we address what explains the multi-plant and multinational ownership effects. Finally, conclusions are drawn in Section 7.

2. Literature Review

Numerous hypotheses have been advanced to explain the effect of multi-plant ownership on plant death within the group. Lieberman (1990), for example, shows that larger multi-plant firms are more likely to close plants in declining industries. Alternatively large, diversified firms may encounter fewer agency problems when deciding upon plant closure, making their plants less likely to survive relative to standalone plants (Harrigan, 1980; Baden-Fuller, 1989). In their study of a period of trade liberalisation and quota reduction in New Zealand Gibson and Harris (1996) find that large, old, low cost establishments are more likely to survive the liberalisation episode but diversified multi-plant firms remain more likely to close plants. Dissimilarity within the group is also found to increase the probability that a plant will exit by Bernard and Jensen (2007) but this does not explain the multi-plant ownership effect. Related to this is the idea that strategic interactions within multi-plant firms may be the source of the higher failure rates. Where a multi-plant firm expands output or cuts price to improve the profit of one of its plants, it generates a negative externality for the other plants within the group (Sutton, 1997).

A separate strand of literature has considered how ownership by a subset of multi-plant firms affects survival. Substantial evidence has accrued which has shown multinationals to be more likely to closedown plants even when multi-plant status is taken into account. The regularity of these findings has been impressively robust across countries with similar evidence found for Sweden (Bandick, 2007), Japan (Kimura and Kiyota, 2006), Chile (Alvarez and Görg, 2005) and the United States

(Bernard and Jensen, 2007) contributing to the idea of multinationals being ‘footloose’.

The theories used to explain the ‘footloose’ nature of multinational firms emphasise vertical over horizontal FDI motives.[1] Under vertical FDI multinational firms change the geography of their production plants in response to changes in local costs (as in for example Antras and Helpman, 2004). They relocate low skill intensive activities for example, in countries that are low-skill abundant.[2] Empirically much of the literature has focused on the factors that make locations relatively attractive, either generally or specific determinants, rather than linking those FDI decisions and the closure of production units in a different location.[3] Cowling and Sugden (1999) argue that wage costs, labour unrest, tax incentives and governmental subsidies are pivotal to the multinational location decision. This view is echoed by Hood and Young (1997) who stress that multinationals in the United Kingdom only have “shallow roots” and are not fully integrated into the local economy.[4] Or more narrowly Devereux and Griffith (1998) focus on the roles of taxation and agglomeration. They find that conditional on producing in Europe, industries with lower effective tax rates attract more U.S. multinationals. Finally, recent theories of economic geography suggest that firms within the same industry may be drawn together through spillovers created by agglomeration effects. Evidence in support of these models can be found in Devereux and Griffith (1998) and Head et al. (1995).

A smaller number of papers have focused on the consequences of outward FDI decisions for other aspects of the firm. Head and Ries (2002), Brainard and Riker (1997a,b) and Braconier and Ekholm (2000) all find that firms undertaking outward FDI is associated with changes in employment levels and the skill-mix of workers at home. Most closely associated with this paper is the work of Simpson (2008). Using data for the UK she finds that overseas investment in low-wage economies leads to changes in the structure of firms, the closure of plants. These effects are found to be

[1] Under horizontal FDI all stages of the production process are replicated in a different location. Models of this type include Markusen (1984) and Brainard (1997).
[2] In practice FDI decisions often contain elements of both horizontal and vertical motives. For theoretical models consistent with this view see Helpman (1984) Venables (1999) and Yeaple (2003).
[3] A more comprehensive review of this literature can be found in Blonigen (2005).
[4] Similarly, the ability of multinationals to shift production across borders is emphasised by Rodrik (1997) as an explanation for multinational’s relatively higher elasticity of demand for labour.

strongest for multinationals operating in low-skilled industries with affiliates located in low-skill abundant countries compared to firms in the same industry not investing in low wage countries.

3. Data and Summary

Our primary data sources are the linked longitudinal data sets of the Census of Manufactures (COM) and the Basic Survey of Japanese Business Structure and Activities (BSJBSA) for the period 1994-2005. The COM data is an establishment-level dataset administered by the Ministry of Economy, Trade and Industry (METI). The COM data covers all plants with more than 3 employees located in Japan and includes information on plant characteristics, such as their location, number of employees, tangible assets, and value of shipments. Summary statistics of the main plant variables are provided in Table 1.

{INSERT TABLE 1}

The plant data is linked to the BSJBSA, a firm-level survey also conducted by METI. The survey includes all firms with more than 50 employees or with capital in excess of 30 million yen. This data source provides information on corporate characteristics such as R&D activity, exports, imports, the foreign ownership ratio, foreign direct investment, and financial details. The use of the BSJBSA restricts our regression analysis to include only firms with more than 50 employees, while the lack of data on intangible assets, necessary in the construction of TFP, means we are also forced to exclude plants with less than 10 employees. Given our interest in the behaviour of multi-plant firms these are not thought to be serious exclusion restrictions. The average size of multi-plant firms within our dataset is 514, while for multinationals this figure is even higher at 1,490. In comparison single plant firms are approximately 7% of this size.

There are 23,100 observations of multinational firms within the data, 16,970 of multi-plant firms that are not multinational and 74,264 observations of single plant firms. These multinationals are mostly Japanese owned; foreign owned firms represent around 1 percent of all firms.[5] Summary statistics of the firm variables are shown in Table 2.

{INSERT TABLE 2}

In addition to the differences in average size multinationals and multi-plant firms are shown to be different in Table 2 across a number of dimensions. There is for example a clear decline in productivity and capital intensity from multinationals to multi-plant firms and standalone enterprises. Japanese firms appear to be highly globalised: 29% export, 25% import and 18% conduct FDI. However, these patterns are far from uniform across firm type. Some 78% of multinational firms export while only 18% of single plant firms have any sales abroad. Overall it would seem that Japanese MNEs display characteristics relative to other types of firm that are consistent with those found elsewhere in the literature (see for example the reviews in Greenaway and Kneller, 2007, and Wagner, 2007).

To identify plant entry and exit, we use a unique identification number given to each plant. A plant is deemed to have entered where it is observed at time *t* but was not observed in the dataset in the previous period, *t-1*. Equivalently, an exiting plant is one that was observed at *t-1* but not at time *t*. A limitation of the data is that it is not possible to identify firm closure separately from employment falling below 3 and therefore exit from the sample.[6] However, given that the average exiting plant employs 131 workers we are confident that we are capturing closure.

In Table 3 we report the entry and exit rates for each year of our sample and by the type of firm. A general observation would be that the percentage of firms that either enter or exit in the sample is low in Japan. Throughout the sample there are 2,230 instances of entry and 3,392 observations of exit. This feature of Japanese manufacturing has been previously commented on by Caballero et al. (2003), Peek and Rosengren (2003) and Ahearne and Shinada (2005). It is however consistent with

[5] Görg and Strobl (2003) also use the 50% criteria. The value rises (but remains low) to 1.8% if we define foreign ownership according to the International Monetary Fund's definition as being when a foreign firm holds in excess of 25% of capital.
[6] We are more confident that we are not misclassifying mergers and acquisition as exit. The number of mergers in Japan is low. Shimizu (2001 cited in Kimura and Fujii, 2003) reports that of all companies listed on the Tokyo Stock Exchange between 1949 and 1998 of 1273 only 78 have conducted mergers.

the high average age of firms reported in Table 2, which even for single plant firms is over 40 years. We conclude from this average age that the low rate of exit is not likely explained by the size threshold imposed on the Japanese census data of 3 employees.[7] This rate of exit is much lower than that found for other developed countries such as the US, where Bernard and Jensen (2004) calculate 32 per cent of plants are shut over a 5 year period. Finally, the table also reveals that the rate of plant exit is similar amongst single, multi-plant firms and MNEs.

{INSERT TABLE 3}

In Table 4 we compare the characteristics of continuing, entering and exiting plants, again separated by their organisation. In general the table shows that continuing plants are on average larger, have higher capital intensities, have greater sales, use more intermediate inputs and are more productive than exiting or entering plants. They pay higher wages than entering plants, but lower wages than exiting plants. On average, continuing plants are the most productive. Exiting plants are smaller, use fewer intermediate inputs and have fewer sales than either continuing or entering plants. They also pay higher wages. Table 4 suggests that, on average, these plants are not as productive as continuing plants, but are more productive than entrants.

Ownership also appears to matter. There is considerable heterogeneity in the size, productivity and capital intensity of plants depending on their owners and whether they enter, exit or continue. Multinationals' plants pay higher wages, have higher sales and use more intermediate inputs, regardless of whether they are an entering, exiting or continuing plant. T-tests reveal that non-MNE owned plants are significantly smaller, less capital intensive and have lower TFP and wages than multinational owned plants.[8]

{INSERT TABLE 4}

[7] Indeed the average exiting plant employs 131 workers and depending upon firm type employment at exiting plants ranges from 96 to 217 workers.

[8] T-tests are computed by subtracting the mean of group *j* from the mean value of group *i* to find the difference. A t-test is then run where the null hypothesis is that the differences between the means are zero.

4. How Does Multi-Plant Ownership Affect Survival?

To investigate how ownership structure affects plant survival we generate four ownership dummy variables.

MNE^{M} = 1 if the firm owns more than one plant and conducts FDI, 0 otherwise

MNE^{S} = 1 if the firm owns one plant and conducts FDI, 0 otherwise

MUL = 1 if the firm owns more than one plant but does not conduct FDI, 0 otherwise

SIN = 1 if the firm owns one plant and does not conduct FDI, 0 otherwise

In the regressions that follow domestic single plant firms (*SIN*) act as the base category. To investigate the role of ownership we employ survival analysis. The hazard function, *h(t)*, is defined as the rate at which plants exit in the interval between *t* and *t+1* conditional upon having survived until *t*. Failure is defined as when a plant exits and survival is the number of years the plant is present in the dataset. The hazard rate is specified as

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

where h_0 is the baseline hazard. *X* is a vector containing plant, firm and industry variables. Throughout the analysis a Cox proportional hazards model is used due to its flexibility though we also use duration models to ensure our results are not a product of unobserved heterogeneity. Using a Cox model also implicitly incorporates entry into the model. A hazard ratio less than 1 indicates that an explanatory variable reduces the probability of exit while values in excess of 1 implies a greater risk of failure.

A range of plant, firm and industry variables such as plant size, firm export status and measures of import penetration are included in the regression to capture factors that have been shown to affect survival in other contexts. In order that we capture time-varying industry characteristics we measure these plant variables relative to the industry total.

$$size_{ijt} = \ln\left(\frac{employees_{ijt}}{employees_{jt}}\right). \qquad (2)$$

For example, as shown in equation (2) plant size is calculated as the natural logarithm of the number of workers in plant *i* divided by the average number of plant employees in plant *i*'s industry, *j*. We construct similar measures for productivity, wages and capital and material intensity.[9]

Generally we find that the plants that are most vulnerable to closure in Japan are similar to those studied in other countries by Dunne et al. (1989), Görg and Strobl (2003), Mata and Portugal (1994), Bernard and Sjoholm (2003) and Bernard and Jensen (2007). Plants that are large, productive and capital intensive are less likely to exit. Of the plant characteristics it is size that has the strongest effect on reducing the hazard rate by 72.3% while the point estimates on the capital intensity and TFP variables are closer to one at 0.81 and 0.57. Contrary to Bernard and Jensen’s (2007) findings for the United States, high-wage Japanese plants are more likely to exit. To capture the how the plant’s position in the production chain affects its survival we also include a measure of the input intensity (or material intensity) of the plant relative to the firm. Input intensity is defined as the ratio of intermediate inputs to sales. We interpret higher values as indicating upstream production. The results suggest that firms are more likely to close plants producing intermediate inputs rather than final goods.

Unlike in studies of other countries we do not find firm exporting status to affect survival. Elsewhere in the literature exporters have been found to be less likely to

[9] When the plant variables are included by themselves, rather than relative to the industry, the results remain robust.

close due to their superior characteristics (see The International Study Group on Exports and Productivity, (2007) for a cross-country comparison). Although exporters are often believed to be less likely vulnerable to closure, the reason why this should be is not necessarily apparent.[10] However, international engagement matters when the firm imports. In this case a plant faces a hazard 23.2 percent above the baseline, a first indication that offshoring may be a motive behind the decision to shut plants. We also find that the firm's R&D intensity has little effect upon a plant's survival. However, when the plant characteristics are excluded in regression 3 R&D intensity becomes significantly negatively correlated with failure. This indicates that firms with high R&D intensities tend to own plants that are larger, more productive etc.

Across the sample there are 53338 observations of multinational owned plants. Although 78% of this group are also multi-plant firms this means that there are still a large number of single-plant multinational firms. In later regressions we exploit this variation to investigate whether the 'footloose' effect is attributable to multinationals being predominantly multi-plant firms. A clear ordering of the probability of plant exit is found in regression 1 according to multiplant and MNE status. Relative to domestic single-plant firms we find that multi-plant multinationals are the most likely to shutdown their plants followed by domestic multi-plant firms and then single-plant multinationals. The premium upon plant survival within the multinational category differs substantially according to whether the firm owns more than one plant: multi-plant MNEs raise the hazard by 292% compared with 62% for single-plant multinationals. The existing evidence on the link between survival and multi-plant ownership is ambiguous. After controlling for plant features, Bernard and Jensen (2007) find that there is no difference in the likelihood of exit for plants owned by a multi-plant firm in the United States, while Mata and Portugal (1994) and Bandick (2007) find the contrary results for Portugal and Sweden respectively. For Japan we find that belonging to a domestic multi-plant firm increases the hazard by approximately 134%. This indicates that patterns of exit are similar across multi-plant firms regardless of whether they have foreign affiliates and that the footloose effect is not confined to multinationals alone.

[10] Mayer and Ottaviano (2008) show the productivity distributions of exporting and non-exporting firms to greatly overlap.

{INSERT TABLE 5}

Of the remaining industry level control variables included in regression 1 of Table 5, only industry sunk costs are found to have a significant effect on exit. This supports evidence from Dunne et al. (1988, 1989) and Bernard and Jensen (2007) for the US, Geroski (1991a, 1991b) for the UK and Greenaway et al. (2008) for Sweden. For Japan we do not find industry measures of globalisation to affect exit. This contrasts with the evidence from Bernard et al. (2006) who found that imports from both low-wage and other countries increase the probability that a plant will die in the United States, and is a feature of the results discussed in greater detail in Inui et al. (2010).

In regression 3 we test the extent to which the evidence for multinationals being more likely to close plants is conditional on the inclusion of other plant controls. We test this by excluding the other plant controls. We continue to observe that domestic multi-plant firms, multinationals and importers are significantly more likely to shutdown their plants. In contrast with Bernard and Jensen's (2002) findings for the United States we find that this view of multinationals as footloose is unconditional. More generally multinationals are more likely to closedown their plants than single-plant domestic firms.

In the remaining regressions of the table we consider the robustness of our findings to different estimation techniques. A particular concern is that the results may be a product of unobserved heterogeneity. To control for this we estimate the model using a duration model with the hazard rate assumed to follow a Weibull distribution and unobserved heterogeneity parameterised by a gamma distribution. The results in regression 2 of Table 5 are robust to this change. We continue to find that large, capital intensive, productive plants with low wage costs are less likely to exit as are materially intensive plants. The firm-level variables are also unchanged. Importers and domestic multi-plant firms remain more likely to close plants, as are both types of multinationals. Sunk costs continue to be the sole significant industry-level determinant of exit. The duration parameter, theta, is found to be insignificant with a t-statistic of 0.39. Unreported cumulative hazard plots also show our model to be correctly specified. When we exclude the plant variables from the model in regression 4 the duration parameter becomes significant. However, the following regressions include the variables used in regression 3 which leads us to conclude the results are not an artefact of unobserved heterogeneity.

5. Exit within Multi-plant Firms

Given that multi-plant firms in general have been shown to be more likely to shut their plants, an interesting question that follows from this is, can we identify the characteristics of those plants and the possible motives behind their closure. In Table 6 we consider these questions separately for multi-plant firms that only have operations domestically and those with foreign affiliates. In the following regressions in addition to the existing plant variables the plant variables are measured relative to the firm

$$Relative\ Size_{ifjt} = \ln\left(\frac{employees_{ifjt}}{employees_{fjt}}\right). \qquad (3)$$

For example, the relative size ratio is the natural logarithm of the number of plant employees in plant *i* divided by the number of workers employed by the firm, *f*, that owns that plant as shown in equation (3). Similar measures are constructed for wages, capital and input intensity. Difficulties in comparing productivity across possibly different industries of the firm lead us to exclude this variable from this part of the analysis.

A feature of the results in Table 6 is the high degree of similarity between the type of plants that are closed by multinationals and domestic multi-plant firms. For example, regardless of whether the firm has affiliates abroad or not, plants that are large, high productivity and materially intensive are less vulnerable to closure. Moreover, plants that are large relative to the firm face significantly lower hazard rates although the effect is stronger for plants with domestic only owners. Plants that are capital intense relative to the firm are more likely to survive but only among domestic multi-plant firms. For both types of firm we continue to observe that plants paying high wages relative to the industry are approximately twice as vulnerable to close; an indication of outsourcing. However, conditional upon this plants which pay relatively high wages within domestic multi-plant firms face lower hazard rates. This may be an indication that domestic multi-plant firms tend to concentrate production among their best plants.

{INSERT TABLE 6}

We also include in the regression a variable indicating whether the plant operates in the same 3 digit industry as the firm itself. Kimura and Fujii (2003) have previously suggested that plant closure in Japan was attributable to firm's expansion into industries outside their core competencies in the 1980s. We do not find this to be the case. Similarly exporting status continues to be an insignificant determinant of exit but now so too is the import dummy. This suggests differences in hazard rates between multi-plant and single-plant firms were driving this relationship in Table 5. Finally there are reasons to believe that that a firm's R&D expenditure may affect the markets in which a firm operates. Baldwin and Gu (2004) find Canadian exporters to perform more R&D than non-exporters. For Spain, Perez et al. (2004) find that R&D intensity lowers the hazard rate. Kimura and Kiyota (2003) also find Japanese firms which conduct R&D face lower hazard rates. R&D intensity lowers the probability of exit only among domestic multi-plant firms where a one standard deviation increase in firm R&D intensity reduces the threat of closure by 7 percentage points.

The effect of the industry-level variables remains similar to those found in Table 5, in particular the globalisation variables are again not found to affect closure among multi-plant firms. The sunk cost variable remains significant but only for multinational owned plants suggesting they tend to operate in industries with more competition.

In regression 3 we test whether the behaviour of MNEs and non-MNEs can be more formally accepted as different. We pool the observations on all multi-plant firms and then include a multinational dummy variable which takes the value of 1 if the firm is either a domestic or foreign multi-plant multinational and zero if the owner is a domestic multi-plant firm and then interact this variable with the plant, firm and industry variables. For reasons of space we report the coefficient estimates for the interactions between the multinational variable and the plant, firm and industry variables only. The results of the full model may be found in Appendix Table 2.

The results from this regression confirm that multinationals and multi-plant non-MNEs behave similarly in their choice about which plants to shut. In this sense domestic MNEs are no more likely to shutdown plants than domestic multi-plant firms. The interactions only show a few significant differences between the criteria used to close plants across these firms. Specifically, multinationals are significantly more likely to close relatively large plants and those that are capital un-intensive. Likewise the R&D intensity interaction shows domestic multi-plant firms with high R&D intensities are significantly less likely to close plants than similar multinationals. We also find that industry sunk costs are more important within multinationals.

6. Why Does Ownership Matter?

The results in the previous section showed that domestic multi-plant firms are more likely to close relatively small and capital un-intensive plants; traditional indicators of weakness. Given that on average plants owned by domestic multi-plant firms display superior performance characteristics compared to single plant firms, in this section of the paper we consider two hypotheses. First, whether the positive signs on the multi-plant and MNE dummies in Table 5 can be explained by the attributes of the plants they close. The second test builds on the evidence in Table 6 and asks whether it is this process of closing plants that are weaker *relative* to the rest of the firm that explains the footloose qualities of multi-plant firms in general in Table 5.

The introduction of interactions between the plant variables and the multi-plant MNE, single-plant MNE and domestic multi-plant firm indicators in regression 1 of Table 7 is capable of explaining the footloose nature of single-plant multinationals. Conditional on plant, firm and industry characteristics we find the material intensity of plants closed by single-plant multinationals that explains their footloose nature. Specifically, exit is decreasing in the plant’s material intensity. We also find that large plants face higher hazards when owned by single-plant firms but this result is conditional and due to the inclusion of the plant size variable.

While plant characteristics are capable of explaining why single-plant multinationals are found to raise the probability of plant death the same cannot be said for multi-plant MNEs and domestic multi-plant firms. However, we do see that the plant characteristics do affect survival. For example, conditional upon plant characteristics, larger, productive and high wage plants face higher hazard ratios when owned by multi-plant multinationals. Among domestic multi-plant firms more productive plants are more liable to closure. However, these results largely reflect the absolute differences between plants owned by these firm types relative to the base category, domestic single-plant firms.

We return to the issue of whether it is the characteristics of plants relative to their parent that explains why multi-plant firms in general are associated with lower survival rates. To examine whether there is a specific footloose effect or whether this is attributable to the multi-plant characteristics of many MNEs we introduce an interaction term between the multi-plant MNE (0/1) indicator and the plant relative to firm variables from Table 6. If multinationals are inherently footloose then we would expect to observe similar hazard ratios for the multi-plant and single-plant MNE variables when we control for the type of plants that are closed within multi-plant multinationals. Similar interaction effects are included for domestic multi-plant firms as well.

The evidence presented in column 2 of Table 7 suggests a difference in the survival rate according to the ownership of the firm: multi-plant multinationals appear to be concerned with their production chain while domestic multi-plant firms keep open their best plants. For example, plants that are large and capital intensive relative to the firm are less vulnerable to exit when owned by a domestic multi-plant firm. However, among multi-plant MNEs these variables are insignificant but plants that are relatively material intensive within the group have higher survival rates. Given that one motive for closing upstream plants producing intermediate inputs is to take advantage of lower production costs abroad it would seem that this has predominantly affected multinational firms within Japan.

When the relative plant variables are included in the regression multi-plant multinationals are no longer footloose. Rather plants belonging to multi-plant MNEs face a hazard 89.2% lower than the baseline. Hence, when we condition upon the process of plant closure among multi-plant multinational firms we find that rather than being footloose they are significantly less likely to close their plants. This residual impact may be due to superior organisational characteristics. For example, pan-national organisations possess managerial capabilities to enable the coordination of production across borders. Alternatively where a multinational decides to locate more than one plant in a country may be an indication of the importance of that market to the MNE or that it is favourable to produce in that country. Finally, the characteristics of plants relative to their parents render the domestic multi-plant dummy insignificant. The literature suggests that multi-plant ownership raises the probability that a plant will die. Our results suggest that this trait of multi-plant ownership is due to the closure of the weakest plants by domestic multi-plant firms and changes in production chains by multi-plant multinationals. As in Harris and Hassaszadeh (2002) it appears that multi-plant firms often prefer plant closure to spreading reductions in capacity across all plants within the group.

{INSERT TABLE 7}

7. Conclusions

This paper has investigated why multi-plant ownership is frequently found to raise the probability of plant death using unique Japanese data that links plant data with firm data. We find that the positive link between domestic multi-plant ownership and the probability of plant exit is explained by these firms closing the weakest elements of the group. In particular, plants that are small and that are capital un-intensive relative to the firm face significantly higher exit likelihoods when owned by a domestic multi-plant firm. In contrast multi-plant multinational firms are more likely to shut plants that lie further upstream in the production process relative to the rest of the firm. However, we find that this does not explain the ‘footloose’ nature of multinational ownership. Rather there is a residual impact of multinational ownership that reduces the probability of closure which may reflect organisational competences.

The above results have a potentially interesting implication for aggregate productivity growth in Japan. Within the Melitz (2003) model of heterogenous firms and international trade, trade liberalisation is welfare improving because it leads to the death of the least productive firms. Subsequently, their output is then reallocated towards more productive firms within the industry which raises aggregate productivity. An assumption of the model is that the least productive firms will always be the ones that exit. However, our results suggest that when a plant is weaker compared to other units within the same firm, but both larger and more productive relative to other firms in the same industry, its death could disrupt the positive effect that increased globalisation is predicted to have on aggregate industry productivity. Based on a Griliches and Regev decomposition of aggregate productivity growth we find for Japan that this effect is small. Entry and exit account for 0 per cent of total aggregate productivity growth.[11] This is perhaps explained by the Japanese context which has been characterised by both low productivity growth (Inui et al., 2010,) and low rates of entry and exit (Caballero et al., 2003; Peek and Rosengren, 2003; Ahearne and Shinada, 2005; and Inui et al., 2009). It would therefore be interesting to investigate this possible negative effect of globalisation in other contexts.

[11] This finding is robust to the use of a Foster, Haltiwanger and Krizan (2001) decomposition.

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Tables

Table 1: Plant Variables across the Sample

Variable	Obs	Mean	Std. Dev.	Min	Max
Plant size	169590	225	489	10	21309
Number of employees					
Capital	169590	5119	23240	.07	1052705
Millions of Japanese yen					
TFP	169590	.96	.35	-4.81	4.36
Total factor productivity					
Wages	169590	4.84	1.79	.03	90.55
Millions of Japanese yen					
Intermediate inputs	169590	6669	39879	.10	4276681
Millions of Japanese yen					
Sales	169590	11321	54454	2.88	5855928
Millions of Japanese yen					

Table 2: Firm-level Variables by Type of Firm

Variable/Sample	Firm Type		
	MNE	Multi-plant	Single Plant
Observations	23100	16970	74264
Age	49	45	41
In years			
Size	1490	514	190
Number of workers			
Capital per worker	20.92	15.36	14.22
Millions of Japanese yen			
Firm TFP	1.01	.96	.95
Total factor productivity			
R&D complexity	.02	.01	.01
R&D divided by firm sales			
Intermediate inputs	71924	15410	5052
Millions of Japanese yen			
Foreign ownership dummy	.01	.01	.01
1 if a foreign firm holds more than 50% of equity			
Export dummy	.78	.24	.18
1 if the firm exports			
Import dummy	.65	.19	.15
1 if the firm imports			

Notes: The MNE group comprises both single- and multi-plant multinationals. 'Multi-plant' refers to domestic multi-plant firms.

Table 3: Annual Entry and Exit Rates

Sample Year/Indica	Sample		MNE		Domestic Multi-Plant		Single-Plant	
	Entry	Exit	Entry	Exit	Entry	Exit	Entry	Exit
1994	.01	.01	.01	.01	.01	.01	.01	.01
1995	.01	.01	.01	.01	.01	.01	.01	.01
1996	.01	.01	.01	.01	.01	.01	.01	.01
1997	.01	.02	.01	.02	.01	.02	.01	.02
1998	.03	.03	.03	.03	.03	.03	.03	.03
1999	.01	.03	.01	.03	.01	.04	.01	.03
2000	.01	.03	.01	.03	.01	.03	.01	.03
2001	.02	.03	.01	.03	.02	.03	.02	.03
2002	.01	.03	.02	.03	.01	.02	.01	.03
2003	.01	.02	.01	.02	.01	.02	.01	.02
2004	.01	.02	.01	.02	.01	.02	.01	.02
2005	.02	-	.02	-	.02	-	.02	-

Table 4: Characteristics of Continuing, Entering and Exiting Plants by Firm Type

Variable/Firm Type Sample	Firm Type MNE	 Multiplant	 Single Plant
Continue			
Observations	51381	40013	72699
Plant size Number of employees	423	144	136
Capital per worker Millions of Japanese yen	25.59	14.41	12.23
Plant TFP Total factor productivity	1.03	.94	.92
Plant wages Millions of Japanese yen	5.57	4.51	5.51
Intermediate inputs Millions of Japanese yen	15558	3156	2530
Plant sales Millions of Japanese yen	26275	5478	4320
Exit			
Observations	1316	1237	839
Plant size Number of employees	207	76	97
Capital per worker Millions of Japanese yen	28.22	14.77	11.76
Plant TFP Total factor productivity	1.02	.88	.90
Plant wages Millions of Japanese yen	6.16	4.56	4.53
Intermediate inputs Millions of Japanese yen	6819	1678	1721
Plant sales Millions of Japanese yen	11678	2904	3004
Enter			
Observations	680	798	752
Plant size Number of employees	244	112	107
Capital per worker Millions of Japanese yen	30.79	19.37	15.90
Plant TFP Total factor productivity	.95	.86	.89
Plant wages Millions of Japanese yen	4.94	3.86	4.35
Intermediate inputs Millions of Japanese yen	8205	2513	2197
Plant sales Millions of Japanese yen	14447	4285	3480

Notes: The MNE group comprises both single- and multi-plant multinationals. ‘Multi-plant’ refers to domestic multi-plant firms.

Table 5: Cox Proportional Hazard Regressions

Variable/Regression	1 Haz. Ratio	2 Haz. Ratio	3 Haz. Ratio	4 Haz. Ratio
Multiplant MNE dummy	3.92	3.911	3.19	4.086
	(18.33)**	(17.56)**	(16.26)**	(14.21)**
Single plant MNE dummy	1.623	1.647	1.391	1.498
	(4.60)**	(4.62)**	(3.16)**	(3.21)**
Domestic multiplant dummy	2.338	2.308	3.149	4.216
	(14.86)**	(14.17)**	(20.83)**	(16.53)**
Plant Variables Relative to Industry Variables				
Size	0.300	0.284		
	(28.13)**	(27.54)**		
Capital intensity	0.812	0.805		
	(9.15)**	(9.10)**		
TFP	0.568	0.55		
	(8.04)**	(8.22)**		
Wages	2.22	2.23		
	(9.60)**	(9.18)**		
Material intensity	0.745	0.732		
	(6.78)**	(6.86)**		
Firm Variables				
Export dummy	0.993	0.99	0.929	0.906
	(0.11)	(0.14)	(1.11)	(1.18)
Import dummy	1.223	1.236	1.162	1.205
	(3.09)**	(3.14)**	(2.39)*	(2.35)*
R&D intensity	1.002	1.001	0.979	0.972
	(0.65)	(0.46)	(7.39)**	(7.69)**
Industry Variables				
Grubel-Lloyd index	0.885	0.879	0.91	0.868
	(0.88)	(0.93)	(0.67)	(0.79)
LWPEN	1.05	1.049	1.045	1.044
	(0.46)	(0.45)	(0.41)	(0.33)
OTHPEN	0.897	0.911	0.96	0.959
	(0.62)	(0.53)	(0.23)	(0.18)
Sunk costs	0.958	0.959	0.96	0.952
	(2.89)**	(2.88)**	(2.76)**	(2.63)**
Theta		0.00		16.72
		(0.39)		(3.66)
Log pseudolikelihood	-31106	-13973	-32462	-15391
Wald Statistic	4567.39	3792.53	1292	1330.06
Number of observations	131669	131669	131669	131669

Notes: Cox Proportional hazards model is used in regressions 1, 2, 3 and 5. A duration model is used in regressions 4 and 6 with the hazard parameterised using a Weibull distribution and unobserved heterogeneity assumed to be gamma distributed. Z-scores are clustered at the firm level and reported in parentheses. The multinational dummy includes domestic and foreign multinationals. The industry dummies include controls for the both the plant and firm's industry. **, * and + indicate significance at the 1, 5 and 10 percent level of confidence.

Table 6: Exit within Multiplant Firms

Sample Variable/Regression	MNE 1	Multi 2	Both 3
Plant Variables Relative to Firm Variables			
Size	0.804	0.738	1.202
	(1.71)+	(3.32)**	(1.67)+
Capital Intensity	0.871	0.729	1.168
	(1.50)	(5.04)**	(1.61)
Wages	1.001	0.719	1.534
	(0.01)	(2.01)*	(1.90)+
Material Intensity	0.922	1.011	0.9
	(1.52)	(0.32)	(2.28)*
Plant Variables Relative to Industry Variables			
Size	0.382	0.312	1.155
	(7.49)**	(11.75)**	(1.34)
Capital intensity	0.811	1.032	0.815
	(2.20)*	(0.51)	(2.06)*
TFP	0.599	0.601	1.002
	(4.37)**	(4.92)**	(0.01)
Wages	2.306	2.056	1.028
	(4.34)**	(4.63)**	(0.12)
Material intensity	0.741	0.845	0.896
	(3.19)**	(2.53)*	(1.06)
Firm Variables			
Export dummy	0.965	0.878	1.186
	(0.27)	(1.27)	(1.04)
Import dummy	1.042	1.153	0.868
	(0.37)	(1.31)	(0.93)
R&D intensity	0.996	0.986	1.016
	(0.49)	(2.92)**	(1.82)+
Same industry dummy	0.938	0.931	0.925
	(0.69)	(0.90)	(0.68)
Multinational dummy			0.332
			(1.26)
Industry Variables			
Grubel-Lloyd index	1.032	0.848	1.099
	(0.12)	(0.73)	(1.10)
LWPEN	1.152	1.094	1.052
	(0.74)	(0.52)	(1.04)
OTHPEN	1.029	0.602	1.021
	(0.10)	(1.54)	(0.26)
Sunk costs	0.934	0.983	0.951
	(2.66)**	(0.70)	(1.66)+
Log pseudolikelihood	-9222	-10218	-20894
Wald Statistic	13220	13890	8832
Number of observations	131669	131669	131669

Notes: Z-scores are clustered at the firm level and reported in parentheses. The multinational dummy includes domestic and foreign multinationals. ‘Multi’ refers to domestic multi-plant firms. The industry dummies include controls for the both the plant and firm's industry. **, * and + indicate significance at the 1, 5 and 10 percent level of confidence.

Table 7: Differences in Hazard Rates between Groups

Base category	S DOM Haz. Ratio	S DOM Haz. Ratio
Multiplant MNE dummy	3.813	.108
	(5.93)**	(3.27)**
Singleplant MNE dummy	1.926	2.057
	(1.54)	(1.66)+
Domestic multiplant dummy	1.546	.578
	(2.04)*	(.98)
Multi-plant MNE dummy interacted with		
Plant relative to firm size		.993
		(.08)
Plant relative to firm capital intensity		.926
		(.96)
Plant relative to firm wages		1.165
		(.99)
Plant relative to firm material intensity		.847
		(4.44)**
Domestic multi-plant dummy interacted with		
Plant relative to firm size		.833
		(2.27)*
Plant relative to firm capital intensity		.778
		(4.23)**
Plant relative to firm wages		.782
		(1.61)
Plant relative to firm material intensity		.955
		(1.41)
Multi-plant MNE dummy interacted with		
Size	1.421	1.241
	(4.05)**	(2.13)*
Capital intensity	1.025	.984
	(.42)	(.17)
TFP	1.543	1.353
	(2.20)*	(1.51)
Wages	2.069	1.325
	(3.32)**	(1.07)
Material intensity	.942	1.021
	(.52)	(.18)
Single-plant MNE dummy interacted with		
Size	1.302	1.319
	(1.66)+	(1.71)+
Capital intensity	1.116	1.119
	(1.02)	(1.02)
TFP	1.165	1.148
	(.40)	(.35)
Wages	1.190	1.212
	(.48)	(.53)
Material intensity	.582	.569
	(2.41)*	(2.43)*
Domestic multi-plant dummy interacted with		
Size	.945	1.008
	(.67)	(.09)
Capital intensity	1.030	1.225
	(.56)	(2.88)**
TFP	1.530	1.419
	(2.22)*	(1.78)+
Wages	1.174	1.199
	(.71)	(.77)
Material intensity	1.184	1.167
	(1.64)	(1.47)

Table 7 continued

Base category	S DOM Haz. Ratio	S DOM Haz. Ratio
Plant Variables Relative to Industry Variables		
Size	.255 (18.53)**	.254 (17.66)**
Capital intensity	.788 (5.59)**	.790 (5.51)**
TFP	.399 (5.63)**	.417 (5.18)**
Wage	1.543 (2.35)*	1.559 (2.39)*
Material intensity	.722 (3.84)**	.755 (3.22)**
Firm Variables		
Export dummy	.994 (.10)	.980 (.31)
Import dummy	1.222 (3.06)**	1.174 (2.48)*
Firm R&D intensity	1.002 (.73)	.992 (2.57)*
Industry Variables		
Grubel-Lloyd index	.897 (.78)	.906 (.71)
LWPEN	1.056 (.51)	1.056 (.51)
OTHPEN	.913 (.52)	.925 (.45)
Sunk costs	.958 (2.91)**	.955 (3.11)**
Log pseudo likelihood	-31035	-30857
Wald Statistic	3353	3856
Number of observations	131669	131648

Notes: Z-scores are clustered at the firm level and reported in parentheses. The multinational dummy includes domestic and foreign multinationals. ‘Multi’ refers to domestic multi-plant firms. The industry dummies include controls for the both the plant and firm's industry. **, * and + indicate significance at the 1, 5 and 10 percent level of confidence.

Appendix

Total Factor Productivity

There are 48 manufacturing industries in our dataset. Total factor productivity (TFP) is calculated for each plant relative to the industry average. Following Good et al. (1997) and Aw et al. (1997), we define the TFP level of establishment *p* in year *t* in a certain industry in comparison with the TFP level of a hypothetical representative establishment in year 0 in that industry as follows

$$\begin{aligned} \ln TFP_{pt} &= \left(\ln Q_{ft} - \overline{\ln Q_t}\right) - \sum_{i=1}^{n} \frac{1}{2}\left(S_{ift} + \overline{S_{it}}\right)\left(\ln X_{ift} - \overline{\ln X_{it}}\right) \\ &+ \sum_{s=1}^{t}\left(\overline{\ln Q_s} - \overline{\ln Q_{s-1}}\right) - \sum_{s=1}^{t}\sum_{i=1}^{n}\left(\overline{S_{is}} + \overline{S_{is-1}}\right)\left(\overline{\ln X_{is}} - \overline{\ln X_{is-1}}\right) \end{aligned} \quad (1)$$

where Q_{ft}, S_{ift} and X_{ift} denote the gross output of plant *f* in year *t*, the cost share of factor *i* for establishment *p*'s input of factor *i* in year *t*. Variables with an upper bar denote the industry average of that variable. We use 1994 as the base year. Capital, labour and real intermediate inputs are used as factor inputs.

The representative establishment for each industry is defined as a hypothetical establishment whose gross output as well as input and cost share of all production factors are identical to the industry average. The first two terms on the right hand side of equation (1) denote the gap between plant *f*'s TFP level in year *t* and the representative establishment's TFP level in year *t* and the representative establishment's TFP level in the base year. $\ln TFP_{ft}$ in equation (1) constitutes the gap between establishment *f*'s TFP level in year *t* and the representative establishment's TFP level in the base year.

Industry Variables

Globalisation has been shown to cause exit. The source of import competition in the US affects plant survival and causes firms to adjust their product mix (Bernard and Jensen, 2002; Bernard et al., 2006). We disaggregate import penetration into low-wage import penetration (LWPEN) and import penetration from all other countries (OTHPEN)[12]. These measures are calculated as:

$$LWPEN_{it} = \frac{M_{it}^{LW}}{M_{it} + Y_{it} - X_{it}} \quad ; \quad OTHPEN_{it} = \frac{M_{it} - M_{it}^{LW}}{M_{it} + Y_{it} - X_{it}}$$

where $LWPEN_{it}$ represents low-wage country import competition in industry *i* at time *t*, M_{it}^{LW} is the value of imports from low-wage countries in industry *i* at time *t*, M_{it} and X_{it} represents the value of total imports and exports in industry *i* at time *t* and Y_{it} denotes output in industry *i* during year *t*. $OTHPEN_{it}$ denotes imports from all countries except low-wage economies.

Bernard et al. (2006) find that both forms of import competition raise the probability of closure. A one standard deviation increase in LWPEN increases the probability of plant exit by 2.2 percentage points which is considerably greater than the effect of OTHPEN. Similar results are found by Greenaway et al. (2008) for Sweden. In their results, the estimated coefficient on imports from outside the OECD is twice as large as that for OECD imports.

Intra-industry trade is often found to have a positive effect upon firm exit. As international trade grows firms diversify their product range which may lead them to enter new industries and exit sectors they operate in currently. It has been established by Greenaway et al. (2008) that firms do not just closedown their operations, they switch to new industries too. Using Swedish manufacturing data they find that intra-industry trade leads to exit through plant closure, and, mergers and acquisition. This is also found by Bernard et al. (2006) for the United States: firms which are confronted by low-wage import competition sometimes switch to more capital intensive sectors.

Our measure of intra-industry trade is constructed using the Grubel-Lloyd index:

[12] Countries are deemed to be low-wage where they have a GDP less than 5% that of Japan.

$$GL_{it} = \left[(X_{it} + M_{i}) - \left| X_{it} - M_{it} \right| \right] \frac{100}{(X_{it} + M_{i})}$$

where GL_{ijt} is the Grubel-Lloyd index of intra-industry trade in industry *i* in year *t*, X_i are exports in industry *i* during year *t* and M_{it} are imports in industry *i* during year *t*.

The industry variables mentioned so far capture the influence of globalisation upon plant exit. We also include a measure of sunk costs. The empirical literature has identified sunk costs as being an important factor in shaping exit. Sunk costs also play a key role in determining exporting behaviour (Roberts and Tybout, 1997) and can affect the distribution of productivity in the industry (Aw et al. {2002}).

Appendix Table 1: Industry-level Variables

Variable	Obs	Mean	Std. Dev	Min	Max
Grubel-Lloyd index Trade that is intra-industry	144739	.50	.27	.01	1.00
Sunk costs Minimum of entry and exit rates	155714	.01	.01	.00	.05
Import competition Imports divided by apparent consumption	121760	.09	.09	.00	.67
LWPEN Low-wage imports	121760	.03	.04	.00	.28
OTHPEN Imports from all other countries	121760	.06	.06	.00	.55

Appendix Table 2: Multinational Interactions

Variable/Regression	1 Haz. Ratio	2 Haz. Ratio	3 Haz. Ratio	4 Haz. Ratio
Multiplant MNE dummy	1.838	3.813	3.93	0.091
	(4.86)**	(17.70)**	(18.25)**	(6.75)**
Singleplant MNE dummy	1.631	1.619	1.623	1.691
	(4.66)**	(4.58)**	(4.60)**	(4.98)**
Domestic multiplant dummy	2.426	2.34	2.337	2.315
	(15.43)**	(14.88)**	(14.85)**	(14.62)**
<u>Plant relative to firm variables interacted with the multiplant MNE dummy</u>				
Relative size	0.741			
	(7.25)**			
Relative capital intensity		0.94		
		(1.37)		
Relative wages			1.033	
			(0.28)	
Relative material intensity				0.839
				(10.94)**
Plant Variables				
Size	0.326	0.3	0.301	0.276
	(24.08)**	(28.11)**	(28.11)**	(34.70)**
Capital intensity	0.794	0.824	0.812	0.781
	(10.10)**	(7.50)**	(9.11)**	(10.77)**
TFP	0.574	0.566	0.568	0.56
	(8.04)**	(8.00)**	(8.02)**	(8.33)**
Wages	1.995	2.233	2.198	1.879
	(8.40)**	(9.61)**	(8.45)**	(7.58)**
Material intensity	0.753	0.744	0.745	0.795
	(6.60)**	(6.73)**	(6.76)**	(5.32)**
Firm Variables				
Export dummy	0.987	0.995	0.993	0.979
	(0.20)	(0.08)	(0.10)	(0.31)
Import dummy	1.215	1.223	1.224	1.194
	(3.03)**	(3.08)**	(3.11)**	(2.71)**
R&D intensity	0.998	1.002	1.002	0.997
	(0.57)	(0.57)	(0.68)	(0.85)
Industry Variables				
Grubel-Lloyd index	0.896	0.888	0.885	0.897
	(0.79)	(0.86)	(0.88)	(0.78)
LWPEN	1.046	1.053	1.049	1.043
	(0.42)	(0.49)	(0.46)	(0.40)
OTHPEN	0.911	0.9	0.898	0.915
	(0.53)	(0.60)	(0.61)	(0.50)
Sunk costs	0.956	0.958	0.958	0.956
	(3.02)**	(2.90)**	(2.89)**	(3.07)**
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Log pseudo likelihood	-31043	-31095	-31106	-30968
Wald Statistic	3432	3193	3228	3458
Number of observations	131669	131669	131669	131669

Notes: Z-scores are clustered at the firm level and reported in parentheses. The multinational dummy includes domestic and foreign multinationals. The industry dummies include controls for the both the plant and firm's industry. **, * and + indicate significance at the 1, 5 and 10 percent level of confidence.
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