

Foreign Acquisition, Domestic Acquisition and Plant Survival

Yanling Wang

Norman Paterson School of International Affairs

Carleton University

E-mail: Yanling_Wang@carleton.ca

July 2012

Acknowledgements: I am very grateful to Dr. John Baldwin, Director of Economic Analysis Division at Statistics Canada for providing the hospitality so that I could conduct the research at Statistics Canada, and for giving me many constructive comments. I also benefited greatly from discussions with Marcel Voia and Danny Leung on the econometrics and comments from seminar participants at Statistics Canada, and the Chinese Economists Society 2010 conference.

Foreign Acquisition, Domestic Acquisition and Plant Survival

Abstract

This paper studies the effects of plant control changes on plant survival. A unique feature of the paper is that it groups new born plants as born-domestic and born-foreign, and groups plant control changes as foreign acquisitions and domestic acquisitions, and then analyzes the effects of foreign acquisitions and domestic acquisitions on the duration of born-domestic and born-foreign plants respectively. Using 26 cohorts of plants born in Canada between 1973 and 1998, the paper finds that both foreign acquisitions and domestic acquisitions significantly increase life durations of born-domestic plants, although domestic acquisitions generate larger effects. For born-foreign plants, acquisitions do not seem to change their life durations.

Keywords: Foreign Acquisition, Domestic Acquisition, Plant Survival

JEL No: F2, L1

1. Introduction

Plant control or ownership changes—through mergers and acquisitions (hereafter referred to as acquisitions)—are the most significant events in the life cycle of plants. A plant’s life commences with birth and ends when production ceases. With control changes, plants might undertake significant re-organizations, and embark on a different life trajectories, that directly affect industry dynamics. This is probably the major reason why plant control changes have attracted lots of attention from both policy makers and researchers.

Researchers have mainly focused their study on the motivations or short-term outcomes associated with plant control changes. What has been largely ignored is how plant control changes affect plant survival. Understanding the impact of plant control changes on plant survival is practically important. On the one hand, the length of plant life is a proxy for success. Firms/plants that fail are those that do not match their competitors either with respect to product price or product quality. Thus, studying plant survival/death directly addresses industry dynamics. On the other hand, plant control changes occur to both domestic-controlled plants and foreign-controlled plants, and the acquiring firms can be foreign multinationals firms or domestic firms. Due to the intrinsic differences between foreign and domestic firms, it will not be surprising if the effects of plant control changes on the survival of foreign-controlled plants are significantly different from those of domestic-owned plants, and plants acquired by foreign firms have significantly different survival path from those acquired by domestic firms. In the context of plant control changes and survival, survival comparison between foreign acquisitions (acquiring firms are foreign-controlled firms) and domestic acquisitions (acquiring firms are domestic-controlled firms) on born-foreign (plants born to foreign-controlled firms) and born-domestic (plants born to domestic-controlled firms) plants is nonexistent in the literature. However, the

above comparison not only portrays the relative riskiness of born-foreign and born-domestic plants in terms of plant closures, but also compares the effectiveness of foreign acquisitions and domestic acquisitions in prolonging their respective life durations. This is what the paper does.

The paper tracks 26 cohorts of manufacturing plants born in Canada from 1973 to 1998 from their birth year to 1999, and explicitly studies how plant control changes affect their life durations with the foreign-domestic dichotomy of plant controlling firms. The new born plants are differentiated as born-foreign and born-domestic and plant control changes as foreign and domestic acquisitions. By explicitly differentiating plant controlling firms' nationality of being foreign and domestic, pre- and post-control changes, the paper can clearly address the following comparisons. First, how differently do born-foreign and born-domestic plants respond to plant control changes in terms of survival? Second, how effective are foreign acquisitions compared with domestic acquisitions in terms of improving plants' survival prospects? And third, do foreign acquisitions and domestic acquisitions generate similar effects on survival to both born-foreign and born-domestic plants?

The survival comparison between born-foreign and born-domestic plants, and the effectiveness comparison between foreign and domestic acquisitions in improving plants' survival are primarily driven by the increasing importance of FDI (foreign direct investment) in the global economy. Governments in many countries have attracted FDI, and foreign presence in many countries is both large and mature, which is especially the case in developed countries that have been open to foreign investment for decades. Canada is a particular case in point. FDI enters Canada either through building new plants (born-foreign) or through acquisition of existing domestic plants (foreign acquisitions), and FDI presence is both mature and large. On average, foreign-controlled plants produce about 45% of output in the Canadian manufacturing sector during the sample period (Baldwin and Gellatly, 2005). Together with nearly three decades of

data coverage (1973 to 1999), Canadian manufacturing plant-level panel data provide a unique opportunity to study how the survival profile of born-foreign and born-domestic plants changed after foreign and domestic acquisitions respectively.

The study makes a few notable contributions to the literature. First, the paper explicitly tracks plants' owning firms' nationality, pre- and post-control changes, and thus can differentiate the effects of plant control changes between foreign acquisitions and domestic acquisitions to plants born to foreign firms and to domestic firms. Second, the data contain the universe of tens of thousands of manufacturing plants born in Canada between 1973 and 1998, and were tracked over from birth to 1999. The comprehensiveness of the coverage of plants and time period makes the study the least biased in terms of the results. Lastly, foreign firms have a large and mature presence in Canada over the sample period. The fairly large number of foreign-controlled plants would make a comparison study like this feasible.

2. The Importance of the Foreign-Domestic Dichotomy

The foreign-domestic differentiation of plants at birth and at acquisition posts an interesting issue of studying the foreign-domestic dichotomy. Regarding plants' survival, foreign ownership might not necessarily translate into longer durations. On the one hand, multinational firms have been postulated to be superior to domestic firms, and the superiority can be translated into competitiveness, and competitiveness into longer lives. For instance, studies have found that multinational firms are more likely to contain embedded special assets and they may enjoy significant other advantages: rich resources to develop more advanced technologies, access to overseas financial markets, access to overseas markets for their products, and better management skills (Markusen, 1995; Caves, 2007). In Canada, Baldwin

and Gu (2005) show that foreign-controlled plants differ substantially from Canadian-controlled plants: they tend to be more productive, pay higher wages and be more innovative because of the embedded special capabilities.¹ On the other hand, foreign-controlled affiliates are often viewed to be “footloose”, partly because they have the ability to reorganize their global production chain in response to the changing economic conditions in any particular country.² Due to that ability, foreign affiliates might face a lower threshold value before poor performers are divested or closed down. Thus, whether the superiority associated with foreign affiliates is translated into longer life is an empirical investigation.

Further, it is equally important to take into account the heterogeneity between foreign acquisitions and domestic acquisitions. Foreign acquisitions, often as a form of entry of FDI into a particular country, tend to target plants with a particular set of skills. Caves (2007) stresses that foreign acquisitions are driven by the desire to transfer knowledge across international boundaries and involve target firms (plants) with the capabilities to ingest the special knowledge assets possessed by multinationals. Baldwin, Gibson and Wang (2009) show some empirical evidences in Canada that foreign acquisitions put more emphasis on knowledge capital possessed by the acquisition targets, while motivations for economies of scale and scope are more behind domestic acquisitions, which is clearly echoed in Baldwin and Wang (2011).

Therefore, regarding the effects of plant control changes on survival, if the effect of acquisitions depends both on the nationality of the acquiring firms, and the nationality of the acquired, studies that do not distinguish plants’ pre- and post-controlling firms’ nationality will

¹ Similar results have been reported for the U.S. (Doms and Jensen, 1998), for the U.K. (Conyon et al., 2002), and for Indonesia (Takii, 2004).

² Hood and Young (1997) argue that multinational companies may be more footloose than UK-owned firms due to their having only shallow roots in the host country economy. Cowling and Sugden (1999) also point to potential problems for host country development due to the footloose nature of multinationals’ investment. Though Gorg and Strobl (2003a), using Irish data, do not find any significant evidence.

confound the “acquisition” effects and the “ownership” effects. With the foreign and domestic ownership dichotomy at birth and at plant control changes, the paper categorizes plant control changes into four groups: F-to-D control changes (*FDOC*)—born-foreign plants were acquired by domestic firms; F-to-F control changes (*FFOC*)—born-foreign plants were acquired by other foreign firms; D-to-D control changes (*DDOC*)—born-domestic plants were acquired by other domestic firms; and D-to-F control changes (*DFOC*)—born-domestic plants were acquired by foreign firms. This detailed grouping can help disentangle the mixed “acquisition” and “ownership” effects.

The paper reaches the following conclusions. For plants born to domestic firms, both foreign acquisitions and domestic acquisitions generate significant positive effects in prolonging their life durations, but domestic acquisitions generate a much larger effect. For plants born to foreign firms, control changes do not significantly alter their survival profile, no matter whether their effective control was shifted to indigenous domestic firms or to other foreign firms.

3. The Literature on Plant Control Changes and Survival

The majority of the studies on plant control changes have focused either on the motivations behind the process or on the outcomes of the process. On the motivations, studies have postulated two popular themes— the “synergistic” and the “disciplinary” motivations (Baldwin and Wang, 2011; Lichtenberg and Siegel, 1990, 1992; Nguyen and Ollinger, 2006; McGuckin and Nguyen, 1995; McGuckin, Nguyen and Reznick, 1998). Synergistic takeovers are cases that the acquiring firms target good plants in order to create synergy, and disciplinary acquisitions are cases that the acquiring firms target sick plants in order to turn them around.

Thus, both synergistic and disciplinary theories of takeovers suggest that acquisitions could improve the survival prospects of the acquired targets.

On the outcomes resulting from plant control changes, there are only a few studies which have directly focused on the effects of plant control changes on survival.³ For instance, using plant level data in the US, McGuckin and Nguyen (2001) find that plants that changed hands of control had a higher probability of survival than those that did not; Nguyen and Ollinger (2009) find that control changes are negatively associated with plant closures in the US meat product industries. Girma and Gorg (2004), using UK electronics and food industries, find that the lifetime of domestic-owned plants was reduced once taken-over by foreign firms. Bandick and Gorg (2010), using Swedish domestic-owned plant data, find that acquisitions by foreign owners increase the lifetime of the acquired plants only if the plant was an exporter. These studies suggest that the results of plant control changes may differ across industries and countries and that allowance for the different characteristics of plants, firms, industries and countries may be important if researchers are to identify the various correlates of the impact of control changes on industries. Our study includes all plants born in Canada from 1973 to 1998 and all control changes, and thus offers a more complete picture on the dynamics of plant control changes.⁴

The paper also introduces a host of other controls to allow for differences arising from plant and firm characteristics that are known to be related to plant life durations—such as size and industry covariates. Large size leads to success and small firms tend to die young (Dunne,

³ On the outcomes, most economic analyses that use data on sales, wages, or productivity of plants focus on performance changes in the years immediately after a merger (Lichtenberg and Siegel, 1990, 1992; Nguyen and Ollinger, 2006; McGuckin and Nguyen, 1995, 2001; Gugler and Yurtoglu, 2004; Bertrand and Zuniga, 2006; Marsh, Siegel and Simons, 2007). In particular, researchers have examined how foreign acquisitions affect various aspects of plants' performance (Fukao et al., 2006; Mattias Arnold and Javorcik, 2010; Girma and Gorg, 2004, 2007).

⁴ To a certain degree, this paper is also related to a literature which has compared survival chances between foreign- and domestic-controlled plants, although these studies do not analyze the role of plant control changes, such as Bernard and Sjöholm (2003), Gorg and Strobl (2003), Baggs (2005), and Mata and Portugal (1994).

Roberts and Samuelson, 1988; Mata and Portugal, 1994; Mata, Portugal and Guimaraes, 1995; Esteve, Sanchis Llopis and Sanchis Llopis, 2004; Persson, 2004). Plants belonging to multi-plant firms and to more experienced (older) firms have been found to have better survival chances (Baldwin et al., 2000, Bernard and Jensen, 2007; Disney, Haskel and Heden, 2003; Audretsch and Mahmood, 1995). Industry characteristics, such as high entry rates and/or high exit rates are also found to affect plants' survival probabilities (Audretsch, Houweling and Thurik, 2000; Baldwin et al., 2000, Baggs, 2005). We control them all in the paper.

The rest of the paper proceeds as the following. Section 4 documents the data, Section 5 describes the main variables, Section 6 discusses the estimation strategy, Section 7 presents the main results, Section 8 conducts some sensitivity analyses and Section 9 concludes.

4. Description of the Data

The data here are unique in terms of the comprehensiveness of the coverage of a population, the length of time covered and the nature and accuracy of firm identifiers that are used to measure control changes. The data are taken from a longitudinal database of Canadian manufacturing plants that covers the period from 1973 to 1999, that were derived from the Annual Survey of Manufacturing (ASM), conducted by Statistics Canada. Plants born in 1999 (the 1999 cohort) are excluded as it has only one year of observations and thus does not permit a differentiation between true plant death and censoring for the entire cohort. During the period from 1973 to 1999, the file was essentially a census of all plants—with the smallest plants being covered with administrative tax files.⁵ The 1973-99 file has a constant industry classification, which makes it possible to study the impact of industry characteristics on a consistent basis.

⁵ It is only post 2003 that the file has become a sample survey.

The longitudinal data base contains plant and firm identifiers and the nationality of the owning firms. The plant identifier stays with the plant for its life. In other words, regardless of which firm owns a plant, a plant always carries the same identifier. Firm identifiers were taken from Statistics Canada's Business Register, which is maintained annually and allows plants to be grouped by its owning enterprise.⁶ The enterprise identifier is constructed at the level of all firms under common ownership in the Canadian economy, and changes when the effective control of the firm passes from one legal entity to another. In this study, a control change occurs when a plant's firm identifier changes from the current year to the next. The direct linkage between plants and firms, along with firms' nationality, allows the study to track plants' movements from one controlling firm to another, along with the controlling firm's nationality.

Plant birth is coded in the first year of a plant's life, plant death is coded in its last year of data entry if the last year is before 1999, and plant censorship is coded when plants are still alive in 1999, the last year of the sample. Plants that lack data for a couple of years between birth year and the last year, but have the same identifier throughout their lifetime, are treated as continuing plants with missing data. In all the 26 cohorts between 1973 and 1998, there are a total of 69,927 manufacturing plants born (Table 1). 67,100 plants or 96% are born to firms controlled by Canadians; and the remaining 2827 plants are born to firms controlled by foreigners. 64,650 plants were born to brand new parent firms—new greenfield entrants; only 5,277 plants were born to firms that have been in business in Canada for sometime—incumbent greenfield entrants (Table 2). For born-foreign plants, 65% of them are incumbent greenfield entrants ($1827 / (1827 + 1000)$), while the ratio is only 5.1% for born-domestic plants ($3450 / (3450 + 63650)$).

⁶ Because of the care taken to maintain both plant and firm identifiers and the annual coverage of the survey, this file offers much better coverage than some others that have been used to study the impact of mergers. Many of the merger studies (Nguyen and Ollinger, 2009) have been restricted to individual industries like food or meat-packing.

It is entirely possible and indeed the case that some plants have gone through multiple control changes. Here, I choose to focus on the effects of the first control change. There are 4,992 plants which underwent hands of control.⁷ Among these, there are 3,119 D-to-D control changes, 984 D-to-F control changes, 647 F-to-F control changes, and 242 F-to-D control changes (Table 1). That means there are 1,631 (=647+984) total foreign acquisitions, and 3,361 (=3119+242) total domestic acquisitions. It is clear that the majority of plant control changes occur within the same nationality (D-to-D or F-to-F): F-to-F control changes account for 73% ($647/(647+242)$) for born-foreign plants with control changes, and D-to-D control changes account for 76% ($3119/(3119+984)$) for born-domestic plants with control changes. Plant entry, control changes and death (exit) affect a fairly large proportion of Canadian manufacturing plants. From 1973 to 1999, about 10% of all Canadian manufacturing jobs were affected—2.4% of manufacturing jobs were created through opening new plants, 2.7% were destroyed through plant closures, and 4.8% were affected by control changes (Table 3).

The profile of the merger activity for the 26 cohorts is also summarized in Table 2. For new greenfield entrants: about 5% of born-domestic plants underwent at least one control change, while the ratio is 27.2% for born-foreign plants. For incumbent Greenfield entrants, 31.6% of born-domestic plants underwent at least one ownership change, while the ratio is 33.8% for born-foreign plants. Thus, plants belonging to multi-plant firms are more likely to undergo control changes. Altogether, 31.45% of born-foreign plants had at least one ownership change during

⁷ Among the 4992 plants, the majority, 3115 of them, have only one ownership change during the sample period. And 1551 plants have at least two ownership changes. Focusing on the first control change will not affect the pooled acquisition effects (pooling foreign and domestic acquisitions together). But when we differentiate the nationality of plants' owning firms, pre- and post- control changes, this treatment might be a problem, as the first ownership change determines the direction of the plant' ownership changes. But among the 1551 plants with at least 2 ownership changes, the majority of them were taken over by firms with the same nationality as the first acquiring firm. That is, if a plant was first acquired by a domestic firm, the subsequent acquirers are also domestic firms, and the same is true for foreign acquisitions. Thus, this treatment is unlikely to cause any big problems in the later regression results.

their life time, while this ratio is only 6.11% for born-domestic plants. The average time for the 4992 plants with control changes is between ages 7 and 8.

Plants are heterogeneous, especially across the foreign-domestic ownership dichotomy. Born-domestic plants are significantly smaller than born-foreign plants, in terms of plant size (Table 4). Entrants are slightly larger than exitors, and plants with control changes are much larger than those without, which is true for both born-foreign and born-domestic plants.

Infant mortality rate is high. Figure 1 depicts the percentage of plants in each cohort that exits each year. On average, 12% of new entrants die at the end of their first year. At the 10th year, the cumulative death rate is almost 66% of the original cohort. The average duration for born-foreign and born-domestic plants is 9.2 and 7.3 years respectively. With Kaplan-Meier non-parametric method, born-domestic plants with control changes have significantly higher survival rates (Figure 2), but the pattern is not that clear for born-foreign plants. On average, survival rates for born-foreign plants are higher than for born-domestic plants.

5. The Main Variables

To identify the acquisition effects on plant survival, allowance also needs to be made for other factors which are known to have an influence on plant survival. Here, I include two sets of variables to control for plant level and industry level heterogeneity.

5.1. Plant Level Covariates

Plant level covariates directly affect the probability of a plant's survival and therefore its expected length of life. They are described below.

Birth_Size: plant size in term of total employment at birth (first year). Plant birth size captures the initial effects of size on plants' survival. Jovanovich (1982) argues that the initial size of a plant is associated with capabilities. Born large plants are more competent since they are better positioned to weather negative environments and are more likely to survive and grow.

Rel_Size: relative plant size measured in terms of total employment relative to its 4-digit SIC80 industry median. Relative plant size is a general proxy for the types of competencies that allow some plants to grow larger. Large firms (plants) also tend to possess assets that allow them to organize and control large-scale production to achieve efficiency. They also tend to have a sound knowledge base, and therefore are more likely to innovate and to perform R&D. Relative plant size is sometimes referred to as minimum efficient scale (Persson, 2004).

OC: a time-switching binary variable. For those plants with control changes, *OC* switches from 0 to 1 at the time when the plant first changed owner, and stays at 1 for the remaining years. For plants without control changes, it takes on the value of 0 throughout. To further differentiate control change by the nationality of the acquiring firms, we code *FOC* and *DOC* when acquiring firms are foreign-controlled and Canadian-controlled respectively. Once plants' birth firms' nationalities are considered, we further code *FFOC* for F-to-F control changes, *FDOC* for F-to-D control changes, *DDOC* for D-to-D control changes and *DFOC* for D-to-F control changes to correspond with ownership changes across different ownership types.

Multi_Plant: a binary variable with the value of 1 if a plant is born to a firm that already has operating plants in Canada, and 0 otherwise. This variable captures the parent firm's previous experience in business. Plants born to experienced firms might enjoy better survival chances, as their parent firms can take advantages of their business experiences to deal with adverse events, and to take better advantages of good times.

Owner_Birth: a binary variable with the value of 1 if a plant is born to a foreign parent (born-foreign plants), and 0 to a Canadian parent (born-domestic). This is to capture whether ownership has an additional influence on plants' length of life. If, *ceteris paribus*, access to more advanced technology or a larger overseas market is the dominating advantage, then foreign affiliates might have a better chance of survival and thus a longer life.

5.2. Industry Level Controls

There are certain industry level characteristics that influence plants' survival.

Rel_Ind_Size: relative industry plant size, calculated as the ratio of the average industry plant size to the manufacturing average. *Rel_Ind_NL*: relative industry nonproduction worker ratio, calculated as the number of nonproduction workers to the total number of workers, relative to the manufacturing average. *Rel_Ind_KV*: relative industry capital intensity, calculated as valued added subtracted by wages then divided by value added, relative to the manufacturing average. Plants operating in industries with larger plants, higher non-production worker ratios, and higher industry capital intensity are expected to live longer, as these factors act like entry barriers.

EntryRate: the ratio of the number of entrants to the total number of existing plants in an industry. High levels of entry are associated with conditions that make entry experimentation less costly and therefore are expected to be associated with a lower expected length of life.

6. The Estimation Strategy

Although the observations are on yearly basis, there are 26 cohorts with nearly 69,927 plants in the dataset and it is therefore reasonable to apply a continuous type survival model, like many other papers have done in the literature. For the continuous type models, several

alternatives are most frequently used—proportional hazard type models, such as the Cox proportional hazard model, and the accelerated failure time (AFT) type models, such as the lognormal AFT model.

Without deciding ad hoc whether to use a Cox hazard model or an AFT model, we first plot a kernel density of plants' maximum durations (Figure 3). Given the death rates in Figure 1, Figure 3 tends to suggest a lognormal AFT-type hazard. A key feature of the lognormal AFT model for survival data is that the hazard function is non-monotonic. The hazard starts at zero, rises rapidly to a peak, and then falls off gradually. The lognormal model thus predicts considerable attrition of the hazard ratio over time, a behavior that is very different from cases in which a proportional hazards model is suitable. I thus choose the AFT type model with the lognormal distribution. But I also conduct a few tests to see whether the hazard proportionality assumption for a Cox model holds. The test results show that among all of the time-invariant variables (*Birth_Size*, *Owner_Birth*, and *Multi_Plant*), the proportionality assumption only holds for one of them (*Multi-Plant*), which makes it problematic to apply a proportionality type model.

AFT models have been specified by assuming that the vector summarizing subject characteristics is time-invariant (i.e., for cross-sectional analysis):⁸

$$\ln(T) = \beta X + z, \quad (1)$$

where β is a vector of parameters, X is a vector of the explanatory variables and z is an error term. This expression may be rewritten as:

$$\ln T = \beta X + \sigma u, \quad (2)$$

⁸ The following borrows from the lecture notes by Professor Steven P. Jenkins. See the lecture notes on incorporating time-varying covariates in AFT models discussed in Chapter 3—"Functional Forms for the Hazard Rate", posted on his website.

where $u = \frac{z}{\sigma}$ is an error term with density function $f(u)$, and σ is a scale factor (which is related to the shape parameters for the hazard function). The term $\exp(-\beta X)$ is a survival time scaling factor. If $\exp(-\beta X) > 1$, it is as if the clock ticks faster, and thus failure is “accelerated” (survival time is shortened). Similarly for $\exp(-\beta X) < 1$, failure is “decelerated” (survival time lengthened). The Stata routine used for the estimation reports the parameter σ .

Under the cross-section setting, some researchers have used the first year data, others have used the last year data to capture the effects of plant level factors on survival. The shortcoming of that approach is that it discards rich historical information which captures year to year changes of plant characteristics. These characteristics tell the growth (change) path of plants which leads to death or survival. Thus, I decide to take advantage of the rich panel data. To be able to incorporate time-varying covariates into the AFT model, we need to make an assumption that the hazard rate is constant within some pre-defined time interval. I define the pre-defined time interval is one year, and thus assume that the hazard rate is constant within a particular year, though it differs for each before and following years.

Estimation of the AFT models with time-varying covariates thus requires a combination of episode splitting and utilization of estimation routines that allow for conditioned survival functions—so called delayed entry. Episode splitting is to make sure that there is a row entry of data for each plant-year—the plant panel data are already recorded in that way. The only crucial step is to correctly define the censor variable (*censored* in this case) for each plant to properly define delayed entry. To achieve that, I define the censor indicator *censored* as the following. For every plant-year observation, it (*censored*) takes on the missing value (.) for all observations but the last year, 1 if the last year is not 1999 (a true death), and 0 if the last year is 1999 (censored). In other words, if a plant died after n years, the spell (episode) for a plant has been split into n

sub-spells for each of the year lived: the first $n-1$ years are right-censored spell, and the last is a non-censored spell, but with delayed entry (left truncation) at $t = n-1$.⁹ With this technique, the baseline estimation equation is:

$$\begin{aligned} \ln T_{i,t} = & \alpha + \gamma OC_{i,t} + \beta_1 Birth_Size_{i,t} + \beta_2 Rel_Size_{i,t} + \beta_3 Owner_Birth_{i,t} \\ & + \beta_4 Multi_Plant_i + \beta_5 Ind_Rel_Size_{j,t} + \beta_6 Ind_Rel_NL_{j,t} \\ & + \beta_7 Ind_Rel_KV_{j,t} + \beta_8 EntryRate_{j,t} + \sum_{w=1} \delta_w Ind_w + \sum_{y=1} \theta_y Cohort_{y,t} + \sigma_{i,t}, \quad (5) \end{aligned}$$

Where i is for plants, j for SIC80 4-digit industry and t for year, IND is industry dummy at SIC80 2-digit level, and $Cohort$ is a cohort dummy. Industry and cohort dummies are included to control for the industry and cohort specific effects. Given that industry-level covariates do not change at the plant level, the estimations are clustered.

7. Estimating Plants' Survival Profile

7.1. The Potential Endogeneity of Plant Control Changes

Plants control changes might be endogenous. That is, control changes may occur in those plants with characteristics that presage synergistic control changes or managerial disciplinary control changes. Baldwin and Wang (2011), using Canadian manufacturing plant level data, find that the motivations for plant control changes lie in both synergy and managerial discipline, and there acquirers target on foreign-owned plants and domestic-owned plants for different sets of reasons. To some extent, both synergistic and managerial disciplinary control changes are partially controlled for by including the relevant plant characteristics in the base regressions. There is, however, no formal method of choosing between the standard and the instrumental

⁹ On this topic, Professor Steven Jenkins has written detailed notes, and the notes can be freely downloaded from his website.

variables (IV) estimation in the context of a hazard model. Preference of the IV model would be predicted on the assumption of endogenous acquisitions, which is not reliably testable. The previous literature has used a probit equation to get the fitted probability of plant control changes, and then used the fitted probability in the main regression equations to capture the effects of plant control changes.¹⁰ This approach is handy, but there are two potential problems. First, this IV approach is nonlinear, thus it is not clear how the correction of the endogeneity effectively purges the endogeneity problem itself. And second, using the fitted probabilities in the main regression changes the nature of the plant control variable from a binary to a continuous type variable. Thus, the regression results based on the fitted probabilities not only capture the switching effects of control changes, but also increases in the probability.

With these caveats in mind, we use the IV approach as a robustness check to the baseline results without correcting the endogeneity, reported under "Baseline" in the results table. We use the following probit equation to predict the fitted probability of plant control changes:

$$\begin{aligned}
Pr(OC_{it}) = & \alpha + \gamma Foreign_i + \delta Multi_Plant_i + \beta_1 Rel_Size_{it-1} + \beta_2 \Delta Rel_Size_{it} \\
& + \beta_3 Rel_WR_{it-1} + \beta_4 \Delta Rel_WR_{it} + \beta_5 Rel_KV_{it-1} + \beta_6 \Delta Rel_KV_{it} \\
& + \beta_7 Ind_Rel_Size_{jt-1} + \beta_8 Ind_Rel_WR_{jt-1} + \beta_9 Ind_Rel_KV_{jt-1} \\
& + \sum_{w=1} \lambda_w IND_w + \sum_{y=1} \theta_y Year_y + \varepsilon_{it}, \tag{6}
\end{aligned}$$

The probit equation includes both the lagged level variables and their short-term changes.

Here, ΔRel_Size is the difference of relative plant size from year $t-1$ to t . $Foreign$ is a binary

¹⁰ See, for instance, Bandick and Gorg (2010) use this as one approach to correct for the endogeneity associated with foreign acquisition when they estimate the effects of foreign acquisitions on plant survival, McGuckin and Nguyen (2001) use this method to analyze the effect of acquisitions on plant exit in the US, and Conyon et al. (2002) also use this approach in modeling the wage effects of foreign acquisitions. Girma and Gorg (2004) and Bandick and Gorg (2010) also use propensity score matching to correct for the endogeneity of plant control changes. Propensity score matching relies on the strong assumption that the endogeneity associated with plant control changes are completely controlled for by the observables.

variable, with value of 1 for foreign-controlled, and 0 for domestic-controlled. Rel_WR is plant relative wage rate—calculated as the ratio of plant’s wage rate (wage bill divided by total number of employees) relative to that of the four-digit SIC80 industry mean. ΔRel_WR is the difference of relative wage rate between year t and year $t-1$. Rel_KV is the plant level capital intensity, calculated as the ratio of value added¹¹ minus wages and salaries divided by value added, relative to the four-digit SIC80 industry mean, and ΔRel_KV is the change. Ind_Rel_WR is calculated as the ratio of industry wage bill divided by total number of employees, relative to the manufacturing average. The predicted probabilities from the probit equation for each plant-year will then replace the value 1 in plant control change variable, OC . Using the fitted probabilities, we report the final regression results from the survival equation under the “IV” column, in comparison with those obtained from the baseline regressions.

7.2. The Average Effects of Plant Control Changes on Survival

This sub-section takes a step back and examines how control changes *per se* affect plant survival, by pooling all plant control changes and all plants together. That is, it assumes that foreign acquisitions and domestic acquisitions generate similar effects, and the binary variable "*Owner_Birth*" can effectively capture the different responses to acquisitions between foreign-born and domestic-born plants. The results are reported in Column (1) in Table 5.

The results clearly indicate that plant control changes increase their length of life, thereby demonstrating an “acquisition effect” (as in Bandick and Gorg, 2010). The results imply that everything else equal, plants, once acquired by other firms, have their durations increased by about 21.7%. Figure 4 plots the estimated hazard rates for plants that had control changes and

¹¹ Value added is defined here as the value of sales minus the value of purchases of intermediate goods.

those that had not. It is evident that the hazard rate for plants that had control changes are monotonically smaller than for those which had not.

Regarding other controls, I get compatible results with those reported in the earlier literature. The positive and significant coefficients on *Birth_Size* and *Rel_Size* imply that plants that start with a relatively large size and that maintain their size advantage enjoy longer lives, a result consistent with other findings in the literature (Dunne et al., 1988; Mata and Portugal, 1994; Mata et al. 1995; Baldwin et al., 2000; Esteve et al., 2004; Persson, 2004). On average, increasing one employee at birth leads to 0.1% increase in plants' expected durations and a one percentage point increase in plants' relative size compared to the industry median leads to an 8 percentage point increase in the expected life durations.

The *Owner_Birth* variable that captures the ownership difference between born-domestic and born-foreign plants is not significantly different from zero, which indicates that, in Canada, born-foreign plants do not seem to significantly live longer expected life, *ceteris paribus*.

Plants born to experienced firms, *Multi_Plant*, (incumbent greenfield entrants) live longer: on average, their expected duration is 11% higher — a finding consistent with others in the literature (Disney et al. 2003; Audretsch and Mahmood, 1995).

Other industry level factors that are commonly found to influence plant survival are also significant here. Plants operating in industries with relatively larger plants tend to live longer. Larger plant size implies higher entry costs and is generally associated with longer lives. Plants in industries with higher capital intensity have shorter life expectations. It might be because of the tougher competition environment.¹² Higher entry rates are associated with shorter expected life, both for born-domestic and born-foreign plants, which is consistent with findings in Baldwin et

¹² Audretsch and Mahmood (1995), Audretsch et al. (2000) and Segarra and Callejon (2002) all find that exit rates to be greater in R&D intensive industries given that competition environment is tougher.

al., 2000 and others. The finding is also consistent with Jovanovich (1982), which shows that higher entry rates suggest low experimentation costs and therefore a lower length of life.

The estimate of sigma (σ) is significantly greater than 1 for both born-domestic and born-foreign plants. When the error term μ is augmented by a sigma that is larger than one, the error term is fattened. The estimated $exp(-\beta X)$ is significantly less than 1, implying a decelerated hazard rate.¹³

7.3. Effects on Survival between Foreign Acquisitions and Domestic Acquisitions

This sub-section relaxes the assumption that foreign acquisitions generate similar effects as domestic acquisitions, and examines their separate effects on plant survival to incorporate the view that foreign firms are significantly different from domestic ones. Similarly, binary variable "*Owner_Birth*" is assumed to fully capture the different responses between foreign-born and domestic-born plants. Foreign acquisitions are termed as *FOC* and domestic acquisitions as *DOC*. Column (1) in Table 6 reports the associated results.

Compared with the corresponding results in Table 5, effects from all other factors are not affected by the finer level of differentiation of acquisitions. I will then only focus on the effects from *FOC* and *DOC* respectively. The results indicate that both foreign acquisitions and domestic acquisitions increase the acquired plants' expected life, but domestic acquisitions have a larger impact: about twice as large an impact on expected plant duration as foreign acquisitions. This is interesting, and contrasts with the commonly held perception that foreign acquisitions will exert

¹³ Recall that Hazard rate in AFT model is defined as: $\theta(t) = f(t)/S(t) = f(t)/(1 - F(t))$. The probability density function $f(t)$ summarizes the concentration of spell lengths (exit times) at each instant of time along the time axis. The hazard function summarizes the same concentration at each point of time, but conditional the expression on survival in the state up to that instant, and so can be thought of as summarizing the instantaneous transition intensity. There is a one-to-one relationship between a specification for the hazard rate and a specification for the survivor function.

larger (positive) effects due to their superiority in many aspects, especially in developing countries where foreign-domestic difference is more acute. The results are not contradictory to those found in the developed economy.¹⁴ Baldwin and Wu (2005) show that foreign ownership advantage disappears once foreign affiliates in Canada are compared with Canadian-controlled plants whose parent Canadian firms have business overseas (Canadian multinational firms), which indicates that foreign advantage is a multinational advantage. If the acquiring Canadian firms are indeed large firms with overseas operations, then it is not surprising that domestic (Canadian) acquisitions generate larger effects in that they also know the culture better.¹⁵

Figure 5 plots the hazard rates for plants acquired by foreign firms and by domestic firms respectively, in comparison with those having no control changes. It is clear that plants with no control changes have the highest hazard rates. Plants acquired by domestic firms have the lowest hazard rates, and plants acquired by foreign firms lie in between. The nearly identical hazard rates for plants with $FOC=0$ and for plants with $DOC=0$ comes from the fact that both subsets of plants include those plants which had not control changes.

7.4. Effects of Foreign and Domestic Acquisitions on Born-Foreign and Born-Domestic Plants

In order to take into consideration the argument that born-foreign plants are systematically different from born-domestic plants, I further differentiate plant control changes according to the plants' controlling firms' nationality, pre- and post-control changes. Doing so leads to four groups of plant control changes, coded as *FFOC*, *FDOC*, *DDOC*, and *DFOC* respectively. This most detailed differentiation can compare which types of plant control changes

¹⁴ Girma and Gorg (2004) found negative effects of foreign acquisitions; Bandick and Gorg (2010) documents positive foreign acquisition effects only when domestic plants are exporters.

¹⁵ The ASM plant-level database is not linked with Canadian firm-level database, and thus it is not possible to make a concrete argument. However, Baldwin et al. (2000) show that acquiring firms are much larger.

(foreign versus domestic) are more effective in prolonging which types of plants (born-foreign or domestic-born). Column (1) in Table 7 reports the corresponding results, described below.

First, for born-domestic plants, both foreign acquisitions (*DFOC*) and domestic acquisitions (*DDOC*) have a significant impact on their life expectations, though *DDOC* generates larger effects than *DFOC*. For born-foreign plants, control changes that involve a switch of control to other foreign firms (*FFOC*) do not significantly improve its expected life durations; those acquired by domestic Canadian firms (*FDOC*) witness only marginal increases in their expected durations. In other words, the results suggest that when Canadian firms are the acquirers, the acquired plants genuinely benefit from this new control and live longer lives. Foreign acquisitions are only effective to born-domestic plants, although their effects are smaller than those obtained from domestic acquisitions. What implies is that for born-foreign plants, changing hands of control does not seem to alter their survival profile.

7.5. Results from the Correction of Endogeneity in Plant Control Changes

Using the probit equation and its predicted values to correct the control change endogeneity, I re-estimate the equations in Tables 5, 6 and 7, and report the corresponding results under the column “IV” in all the corresponding tables. How robust are the baseline results compared with those obtained from IV? It is evident that the results from the IV approach are consistent with those estimated from the baseline approach, but are larger in magnitudes. Basically they confirm the main findings that plant control changes do increase their expected life in general, and domestic acquisitions exert much larger impacts than foreign acquisitions. If faith were to be put on the IV results, they suggest that the baseline estimates underestimate the effects of plant control changes, primarily driven by the managerial disciplinary motivations—as managerial disciplinary control changes target sick plants.

7.6. A Further Test on the Different Response to Plant Control Changes for Born-Foreign and Born-Domestic Plants

In the previous subsections, I assume that the binary variable, *Owner_Birth*, can capture all the differences arising between born-foreign and born-domestic plants, conditional on other plant level factors. But this might not be true, and plant factors might respond differently across foreign-domestic dichotomy.¹⁶ Accordingly, only including ownership dummy may hide the real reasons for differences in length of life between born-domestic and born-foreign plants if the significant differences in the characteristics between born-domestic and born-foreign plants respond differently to plant control changes. As shown in Table 4, born-foreign plants are much larger than born-domestic ones. This sub-section will estimate for born-domestic and born-foreign plants separately to capture their respective responsiveness to plant control changes. In light of the findings in section 7.5, I here only proceed with the baseline approach. Results are shown in Table 8.

For born-domestic plants, acquisitions *per se* (Column (1)), foreign acquisitions or domestic acquisitions (Column (2)), have strong and significant effects on plants' expected life durations. Domestic acquisitions are the more effective in improving born-domestic plants' durations than foreign acquisitions. For born-foreign plants, acquisitions in general, foreign acquisitions or domestic acquisitions do not significantly affect their survival profile (Columns (3) and (4)). This seems to confirm the previous findings that born-foreign plants are not responsive to plants' control changes, in terms of survival.

Initial plant size has similar effects on plants' duration for both born-domestic and born-foreign plants, but the increase in relative plant size generates a larger impact on born-domestic

¹⁶ Baldwin and Wang (2010) show foreign-owned plants have different tendencies for plant ownership changes, and those different possibilities are only partially captured by the foreign (domestic) ownership dummy.

than for born-foreign plants. For born-domestic plants, a one percentage point increase in relative plant size leads to an increase in plants' expected life of 9 percentage points, while it is 3 percentage points for born-foreign plants. The smaller marginal effects for born-foreign plants reflect the diminishing marginal effects of relative plant size, as born-foreign plants are on average much larger than born-domestic plants (Table 4).

For born-foreign plants, their parent firms' previous business experiences in Canada (*Multi_Plant*) does not seem to matter regarding their expected life durations, in contrast with born-domestic plants. The result indicates that *Multi_Plant* is not a perfect measure to capture foreign firms' (parents to born-foreign plants) previous business experiences. By definition, even though the parent firm of a born-foreign plant does not have previous business experiences in Canada (*Multi_Plant* is 0 in this case), it has already accumulated business experiences in other countries. These business experiences can be easily transferred to their Canadian affiliates. However, that is not the case for born-domestic plants, where a 0 value of *Multi_Plant* truly indicates no previous business experience of the owning firm.

For born-domestic plants, those operating in higher capital intensity industries have shorter expected life, while the opposite is true for foreign-born plants. This may be driven by the fact that born-domestic plants lag behind their foreign counterparts in terms of technology, as born-foreign plants enjoy access to their parent firms' technology, and thus they are better able to reap the benefits operating in higher capital intensity industries.

9. Conclusions

Plant control changes through mergers and acquisitions are significant events in plants' life cycles. Plant control changes would affect many aspects of plants' life, and ultimately their

death/survival. Plant death/survival directly relates to industry dynamics, by ceasing production and displacing workers.

This paper examines how plant control changes affect plants life durations, explicitly differentiating plant controlling firms' nationality of being foreign versus domestic at plant birth, and the acquiring firms' nationality of being foreign versus domestic at plant control changes. In so doing, four groups of plant control changes are recorded: DFOC—plants born to domestic firms were acquired by foreign firms; DDOC—plants born to domestic firms were acquired by other domestic firms; FFOC—plants born to foreign firms were acquired by other foreign firms; and FDOC—plants born to foreign firms were acquired by foreign firms. The paper can then compare which types of plant control changes (foreign acquisitions versus domestic acquisitions) are more effective in prolonging born-foreign and born-domestic plants.

The paper examines the above issues using a rich plant level panel data from 1973 to 1999 in Canada, containing tens of thousands of new plants born between 1973 and 1998. It reaches the following conclusions. First, for plants born to domestic firms, control changes, both foreign acquisitions and domestic acquisitions, generate significant positive effects in prolonging their life durations, but domestic acquisitions are more effective in prolonging born-domestic plants' life durations than foreign acquisitions. Second, for plants born to foreign firms, control changes do not significantly alter their survival profile, no matter whether their effective control was shifted to indigenous domestic firms or to other foreign multinational firms. The results indicate that plants born to domestic firms are very responsive to plant control changes, especially so to domestic acquisitions.

Reference

- Audretsch, David B and Talat Mahmood. 1995. "New Firm Survival: New Results Using a Hazard Function," *Review of Economics and Statistics*, 77(1): 97-103.
- Audretsch, David B, Patrick Houweling and A Roy Thurik. 2000. "Firm Survival in the Netherlands," *Review of Industrial Organization*, 16(1):1-11.
- Baggs, Jen, 2005. "Firm Survival and Exit in Response to Trade Liberalization," *Canadian Journal of Economics*, 38(4):1364-83.
- Baldwin J. R. & Gellatly G. 2005. *Global Links: Long-term Trends in Foreign Investment and Foreign Control in Canada, 1960 to 2000*. The Canadian Economy in Transition. No. 8. Catalogue No. 11-622-MIE2005008. Ottawa: Statistics Canada.
- Baldwin J.R. and Y. Wang. 2011. "Plant Size, Nationality and Ownership Changes", *International Journal of the Economics of Business*, 18(3): 351-80.
- Baldwin, J.R., B. Gibson, and Y. Wang. 2009. *Control Changes in Canadian Manufacturing Plants: Disciplining Failure and Exploiting Synergies*. Ottawa. Economic Analysis (EA) Research Paper Series No. 56. Statistics Canada.
- Baldwin, J.R., L. Bian, R. Dupuy and G. Gellatly. 2000. *Failure Rates for New Canadian Firms: New Perspectives on Entry and Exit*. Catalogue No. 61-526-XPE. Ottawa: Statistics Canada.
- Baldwin, John R and Wulong Gu. 2005. "Global Links: Multinationals, Foreign Ownership and Productivity Growth in Canadian Manufacturing," Statistics Canada Research Paper Catalogue no. 11-622-MIE — No. 009.
- Bandick, Roger and Holger Görg. 2010. "Foreign acquisition and plant survival," *Canadian Journal of Economics*. 43(2): 547–573.
- Bernard, Andrew B and Fredrik Sjöholm. 2003. "Foreign Owners and Plant Survival," National Bureau of Economic Research, Inc, NBER Working Papers: 10039.
- Bernard, Andrew B and J Bradford Jensen. 2007. "Firm Structure, Multinationals, and Manufacturing Plant Deaths," *Review of Economics and Statistics*, 89(2): 193-204.
- Bertrand, Olivier and Pluvia Zuniga. 2006. "R&D and M&A: Are Cross-Border M&A Different? An Investigation on OECD Countries," *International Journal of Industrial Organization*, 24(2): 401-23.
- Caves, Richard E. 2007. *Multinational Enterprise and Economic Analysis*, Cambridge University Press.
- Canyon, M.J., S. Girma, S. Thompson and P.W. Wright. 2002. "The productivity and wage effects of foreign acquisition in the United Kingdom," *Journal of Industrial Economics*, 50(1): 85–102.
- Cowling, K. and Sugden, R. 1999. "The Wealth of Localities, Regions and Nations: Developing Multinational Economies," *New Political Economy*, 4: 361–78.
- Disney, Richard, Jonathan Haskel and Ylva Heden. 2003. "Entry, Exit and Establishment Survival in UK Manufacturing," *Journal of Industrial Economics*, 51(1): 91-112.

- Doms, M.E., and J.B. Jensen. 1998. "Comparing wages, skills, and productivity between domestically and foreign-owned manufacturing establishments in the United States." *Geography and Ownership as Bases for Economic Accounting*. R.E. Baldwin, R.E. Lipsey and J.D. Richardson (eds.). Chicago. University of Chicago Press. p. 235–258. NBER Book Series Studies in Income and Wealth. Vol. 59.
- Dunne, Timothy, Mark J Roberts and Larry Samuelson. 1988. "Patterns of Firm Entry and Exit in U.S. Manufacturing Industries," *Rand Journal of Economics*, 19(4): 495-515.
- Esteve Perez, Silviano, Amparo Sanchis Llopis and Juan Alberto Sanchis Llopis. 2004. "The Determinants of Survival of Spanish Manufacturing Firms," *Review of Industrial Organization*, 25(3): 251-73.
- Fukao, Kyoji, Keiko Ito, Hyeog Ug Kwon and Miho Takizawa. 2006. "Cross-Border Acquisitions and Target Firms' Performance: Evidence From Japanese Firm-Level Data", National Bureau of Economic Research, Inc, NBER Working Papers: 12422.
- Girma, Sourafel and Holger Gorg. 2004. "Blessing or Curse? Domestic Plants' Survival and Employment Prospects after Foreign Acquisition," *Applied Economics Quarterly*, 50(1): 89-110.
- Girma, Sourafel and Holger Gorg. 2007. "Evaluating the Foreign Ownership Wage Premium using a Difference-in-Difference Matching Approach," *Journal of International Economics*, 72(1): 97-112.
- Gorg, Holger and Eric Strobl. 2003a. "Footloose Multinationals?" *The Manchester School*, 71: 1-19.
- Gorg, Holger and Eric Strobl. 2003b. "Multinational Companies, Technology Spillovers and Plant Survival," *Scandinavian Journal of Economics*, 105: 581-95.
- Gugler, Klaus and B. Burcin Yurtoglu. 2004. "The Effects of Mergers on Company Employment in the USA and Europe," *International Journal of Industrial Organization*, 22(4): 481-502.
- Hood, N. and Young, S. 1997. "The United Kingdom", in J. H. Dunning (ed.), *Governments, Globalization and International Business*, Oxford, Oxford University Press.
- Jovanovic, Brian. 1982. "Selection and the Evolution of Industry," *Econometrica*, 50(3): 649-70.
- Lichtenberg, Frank R. and Donald Siegel, 1990: "The Effects of Leveraged Buyouts on Productivity and Related Aspects of Firm Behavior," *Journal of Financial Economics*, 27(1): 165-94.
- Lichtenberg, Frank R. and Donald Siegel, 1992: "Productivity and Changes in Ownerships of Manufacturing plants," *Corporate takeovers and productivity*: 25-43.
- Markusen, James, 1995: "Incorporating the Multinational Enterprise into the Theory of International Trade," *Journal of Economic Perspectives*, 9: 169-189.
- Marsh, John, Donald S Siegel and Kenneth L Simons. 2007. "Assessing the Effects of Ownership Change on Women and Minority Employees: Evidence from Matched Employer-Employee Data," *International Journal of the Economics of Business*, 14(2): 161-78.
- Mata, Jose and Pedro Portugal. 1994. "Life Duration of New Firms," *Journal of Industrial Economics*, 42(3): 227-45.

- Mata, Jose, Pedro Portugal and Paulo Guimaraes. 1995. "The Survival of New Plants: Start-up conditions and Post-entry Evolution," *International Journal of Industrial Organization*, 13(4): 459-81.
- Mattias Arnold, Jens and Beata S Javocik. 2009. "Gifted Kids or Pushy Parents? Foreign Direct Investment and Plant Productivity in Indonesia," *Journal of International Economics*, 79(1): 42-53.
- McGuckin, Robert H and Sang V. Nguyen, 1995. "On the Productivity and Plant Ownership Change: New Evidence from the Longitudinal Research Database," *Rand Journal of Economics*, 26(2): 257-76.
- McGuckin, Robert H and Sang V. Nguyen, 2001. "The Impact of Ownership Changes: A View from Labor Markets," *International Journal of Industrial Organization*, 19(5): 739-62.
- McGuckin, Robert H, Sang V. Nguyen and Arnold P. Reznick, 1998. "On Measuring the Impact of Ownership Change on Labor: Evidence from US Food-Manufacturing Plant-Level Data," *Labor Statistics Measurement Issues*, pp: 207-46.
- Nguyen, S.V., and M. Ollinger. 2006. "Mergers and acquisitions and productivity in the U.S. meat products industries: Evidence from the micro data," *American Journal of Agricultural Economics*, 88(3): 606-616.
- Nguyen, Sang V and Michael Ollinger. 2009. "Mergers and Acquisitions, Employment, Wages and Plant Closures in the US Meat Product Industries," *Agribusiness*, 25(1): 70-89.
- Persson, Helena, 2004. "The Survival and Growth of New Establishments in Sweden, 1987-1995," *Small Business Economics*, 23(5): 423-40.
- Segarra, Agusti and Maria Callejon. 2002. "New Firms' Survival and Market Turbulence: New Evidence from Spain," *Review of Industrial Organization*, 20(1): 1-14.
- Takii, S. 2004. "Productivity differentials between foreign and local plants in Indonesian manufacturing, 1995," *World Development*, 32(11): 1957-1969.

Table 1: Direction of Plant Control Changes

	birth firm's nationality	control change history	number of firms	Percentage I	Percentage II
Greenfield Entrants (69927)	Born-domestic (67100)	no control changes	62997	93.89%	93.89%
		D-to-F control changes	984	1.47%	6.11%
		D-to-D control changes	3119	4.65%	
	born-foreign (2827)	no control changes	1938	68.55%	68.55%
		F-to-D control changes	242	8.56%	31.45%
		F-to-F control changes	647	22.89%	

Table 2: Plant Born Mode and Tendency for Plant Control Changes

	Born Mode	Birth Firm Nationality	Plant Control Change	Number of plants	Percentage
Greenfield Entrants (69927)	New Greenfield Entrants (64650)	Born-Domestic (63650)	OC=0	60636	95.3%
			OC>=1	3014	4.7%
		Born-Foreign (1000)	OC=0	728	72.8%
			OC>=1	272	27.2%
	Incumbent Greenfield Entrants (5277)	Born-Domestic (3450)	OC=0	2361	68.4%
			OC>=1	1089	31.6%
		Born-Foreign (1827)	OC=0	1210	66.2%
			OC>=1	617	33.8%

**Table 3. The Importance of Plant Control Changes, Entrants and Exitors
(Share of Employment: %)**

	All Plants	Employment in Affected Foreign- controlled Plants over Total Employment	Employment in Affected Domestic- controlled Plants over Total Employment	Employment in Affected Foreign- controlled Plants over Total Employment in Foreign- controlled plants	Employment in Affected Domestic- controlled Plants over Total Employment in Domestic- controlled plants
Exitors	2.7	0.6	2.0	1.8	3.1
Entrants Plants with Control Changes	2.4	0.4	2.0	1.1	3.0
	4.8	1.8	3.0	5.3	4.6

**Table 4. Relative Plant Size Comparison Among
Plants with Control Changes, Entrants and Exitors (1973-99)**

All plants:	
Entrants	0.40
Plants with Control Changes	2.26
Exitors	0.37
Born-foreign plants:	
Entrants	1.31
Plants with Control changes	2.79
Exitors	1.49
Born-Domestic plants:	
Entrants	0.35
Plants with Control Changes	1.91
Exitors	0.29

Note: Ratios calculated as weighted average across all plants in each year and averaged over 1973-99 (source: Baldwin, Gibson, and Wang, 2009).

Figure 1: Death Rate of Plants

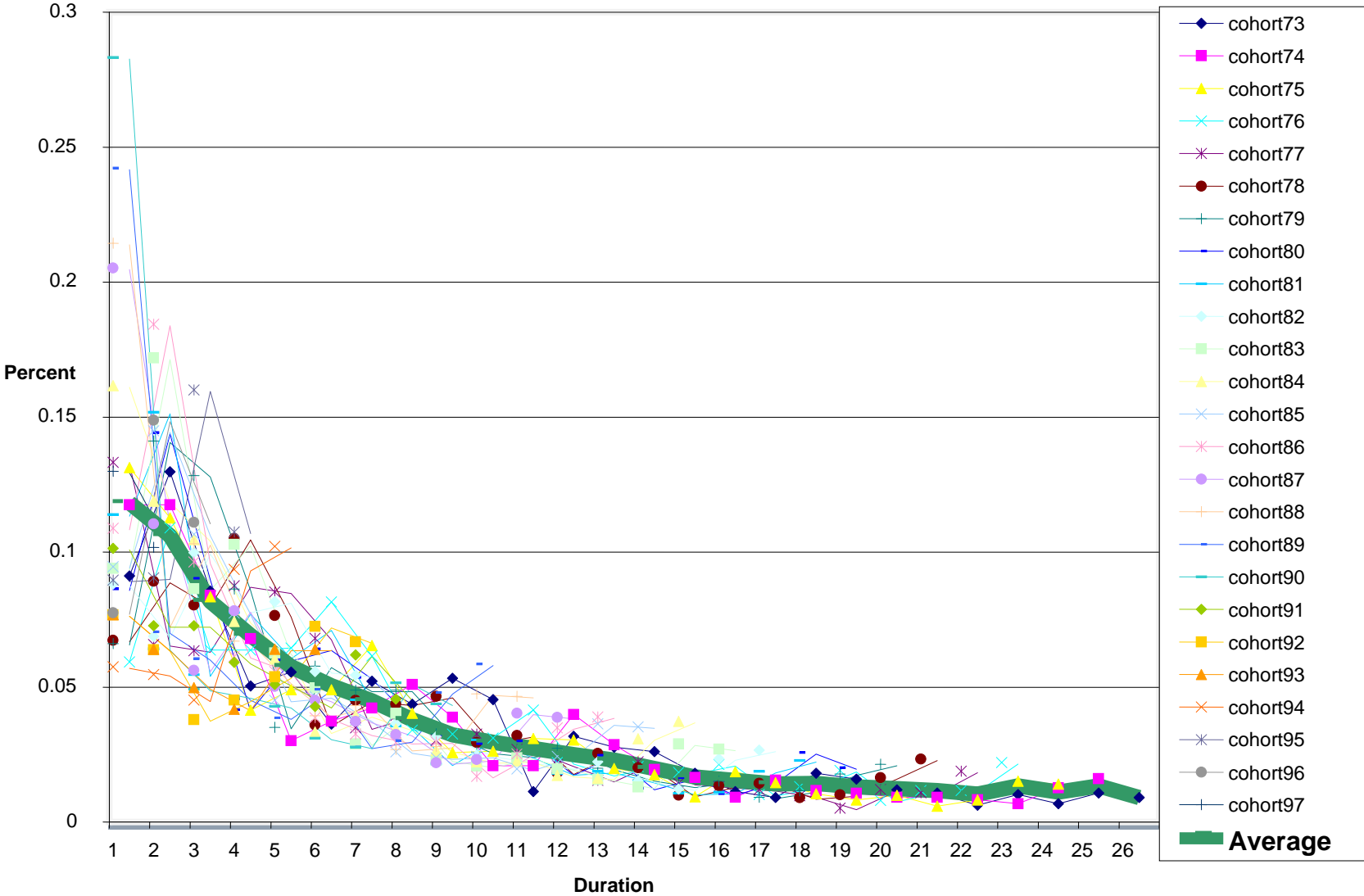


Figure 2: Survival Comparison By Ownership Change Status and By Nationality

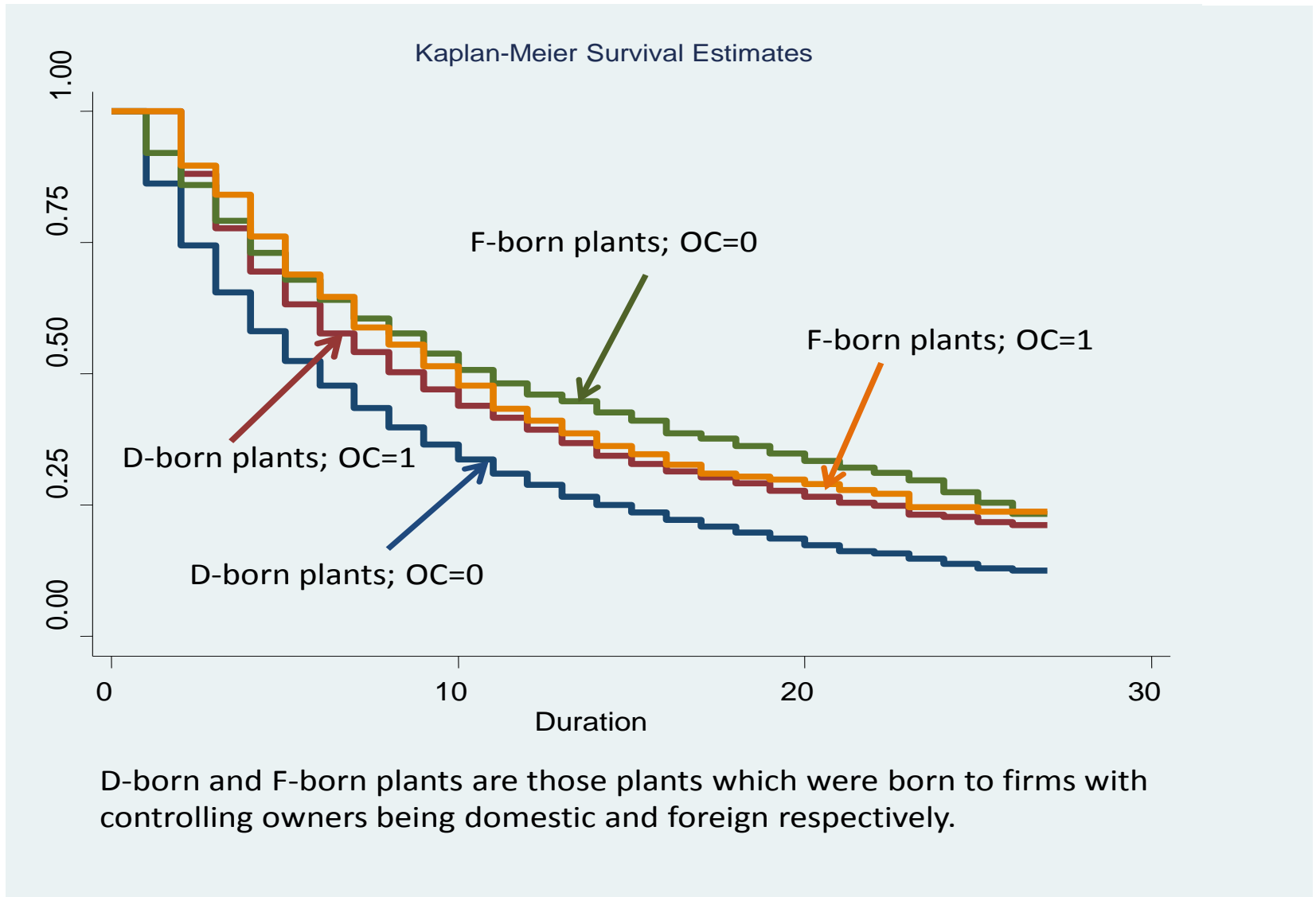


Figure 3: Kernel Density of Maximum Durations

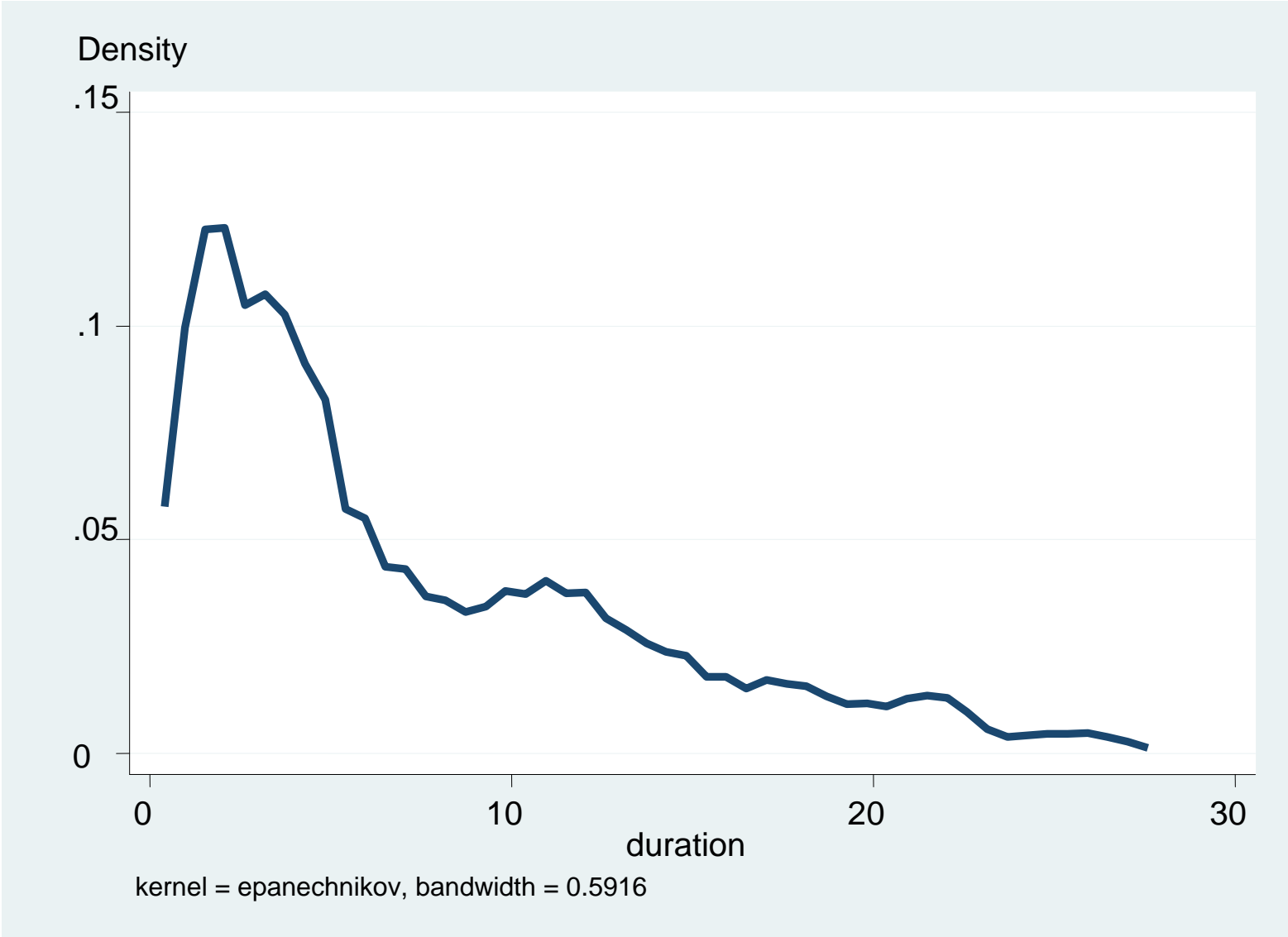


Table 5: Average Ownership Change Effects on Duration—Pooled Sample

variables	(1) Baseline		(2) IV	
<i>OC</i>	0.2174***	(0.0283)	0.3279***	(0.0507)
Other plant control				
<i>Plant Size At Birth</i>	0.0009***	(0.0003)	0.0010***	(0.0003)
<i>Relative Plant size</i>	0.0799***	(0.0060)	0.0803***	(0.0061)
Firm Level Controls				
<i>Owner_Birth</i>	0.0285	(0.0281)	0.0297	(0.0282)
<i>Multi_Plant</i>	0.1240***	(0.0221)	0.1280***	(0.0222)
Industry Level Controls				
<i>Relative Industry Plant Size</i>	0.0219***	(0.0055)	0.0220***	(0.0055)
<i>Rel. Industry Human Capital Ratio</i>	0.0187	(0.0161)	0.0188	(0.0162)
<i>Relative Industry Capital Intensity</i>	-0.1133***	(0.0333)	-0.1127***	(0.0333)
<i>Entry Rate</i>	-2.3160***	(0.0613)	-2.3178***	(0.0613)
sigma	1.0896***	(0.0034)	1.0903***	(0.0034)
Number of plants	69927		69927	
Number of deaths	48309		48309	
Number of Obs	502591		502591	
Ward chi2	4525.67		4466.60	

Note: Numbers in parentheses are robust standard errors. Regression results on constant, cohort dummies, and 2-digit SIC industry dummies are not reported due to space limitations. ***, ** and * indicate 1, 5 and 10 percent significance levels respectively.

Figure 4: Hazard Rates for Plants with and Without Ownership Changes—Pooled Sample

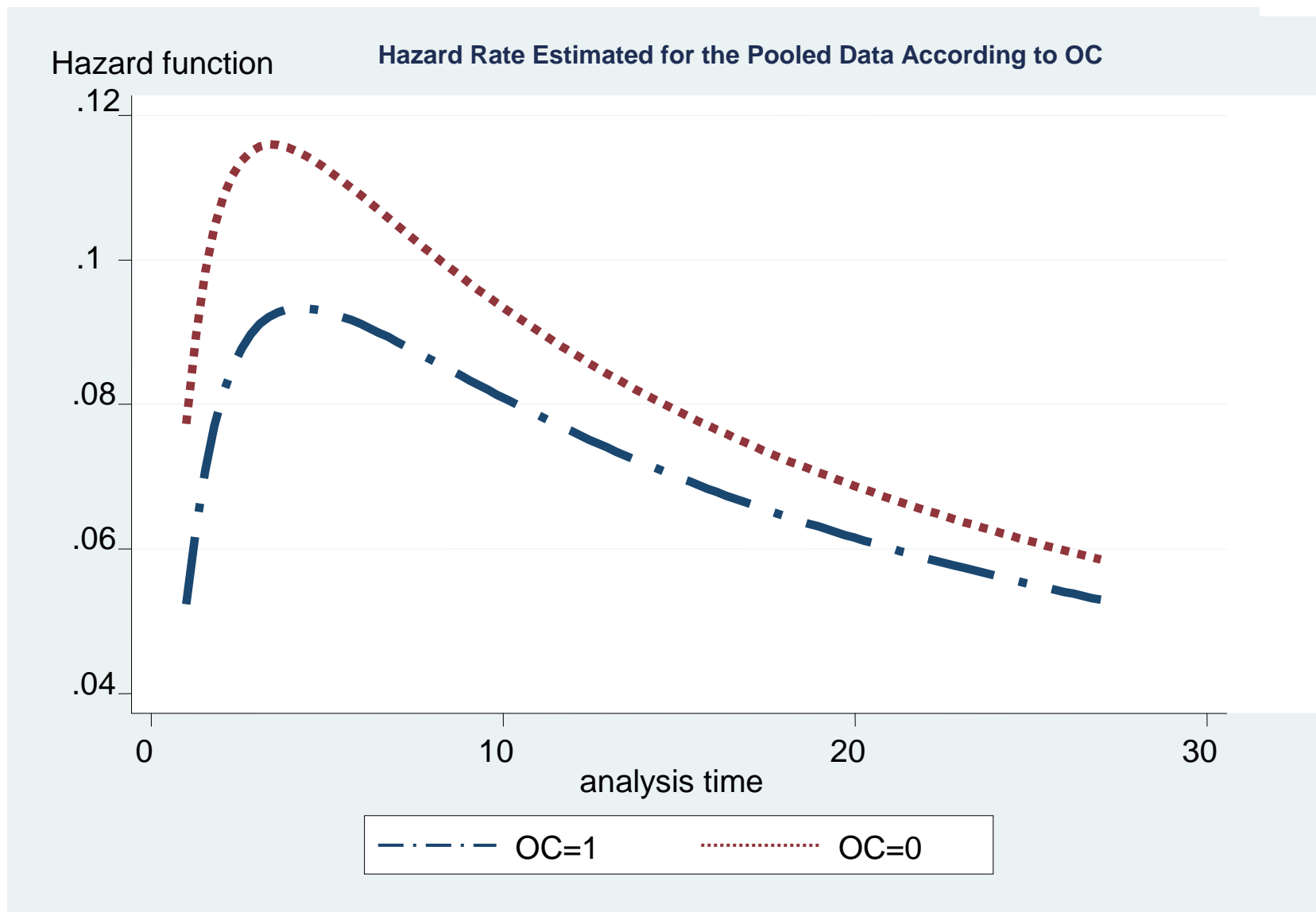


Table 6: Average Effects Foreign and Domestic Acquisitions—Pooled Sample

Variables	(1) Baseline		(2) IV	
<i>FOC</i>	0.1328***	(0.0453)	0.2227**	(0.0844)
<i>DOC</i>	0.2636***	(0.0351)	0.3814***	(0.0618)
Other plant controls				
<i>Plant Size At Birth</i>	0.0009***	(0.0003)	0.0010***	(0.0003)
<i>Relative Plant size</i>	0.0797***	(0.0060)	0.0803***	(0.0061)
Firm Level Controls				
<i>Owner_Birth</i>	0.0364	(0.0285)	0.0348	(0.0285)
<i>Multi_Plant</i>	0.1232***	(0.0221)	0.1277***	(0.0222)
Industry Level Controls				
<i>Relative Industry Size</i>	0.0218***	(0.0055)	0.0219***	(0.0055)
<i>Rel. Industry Human Capital Ratio</i>	0.0187	(0.0161)	0.0188	(0.0162)
<i>Relative Industry Capital Intensity</i>	-0.1131***	(0.0333)	-0.1126***	(0.0333)
<i>Entry Rate</i>	-2.3159***	(0.0613)	-2.3177***	(0.0613)
sigma	1.0895***	(0.0034)	1.0903***	(0.0034)
Number of plants	69927		69927	
Number of deaths	48309		48309	
Number of Obs	502591		502591	
Ward chi2	4543.00		4479.86	

Note: Numbers in parentheses are robust standard errors. Regression results on constant, cohort dummies, and 2-digit SIC industry dummies are not reported due to space limitations. *** and ** indicate 1 and 5 percent significance levels respectively.

Figure 5: Hazard Rates Comparison between Foreign and Domestic Acquisitions—Pooled Sample

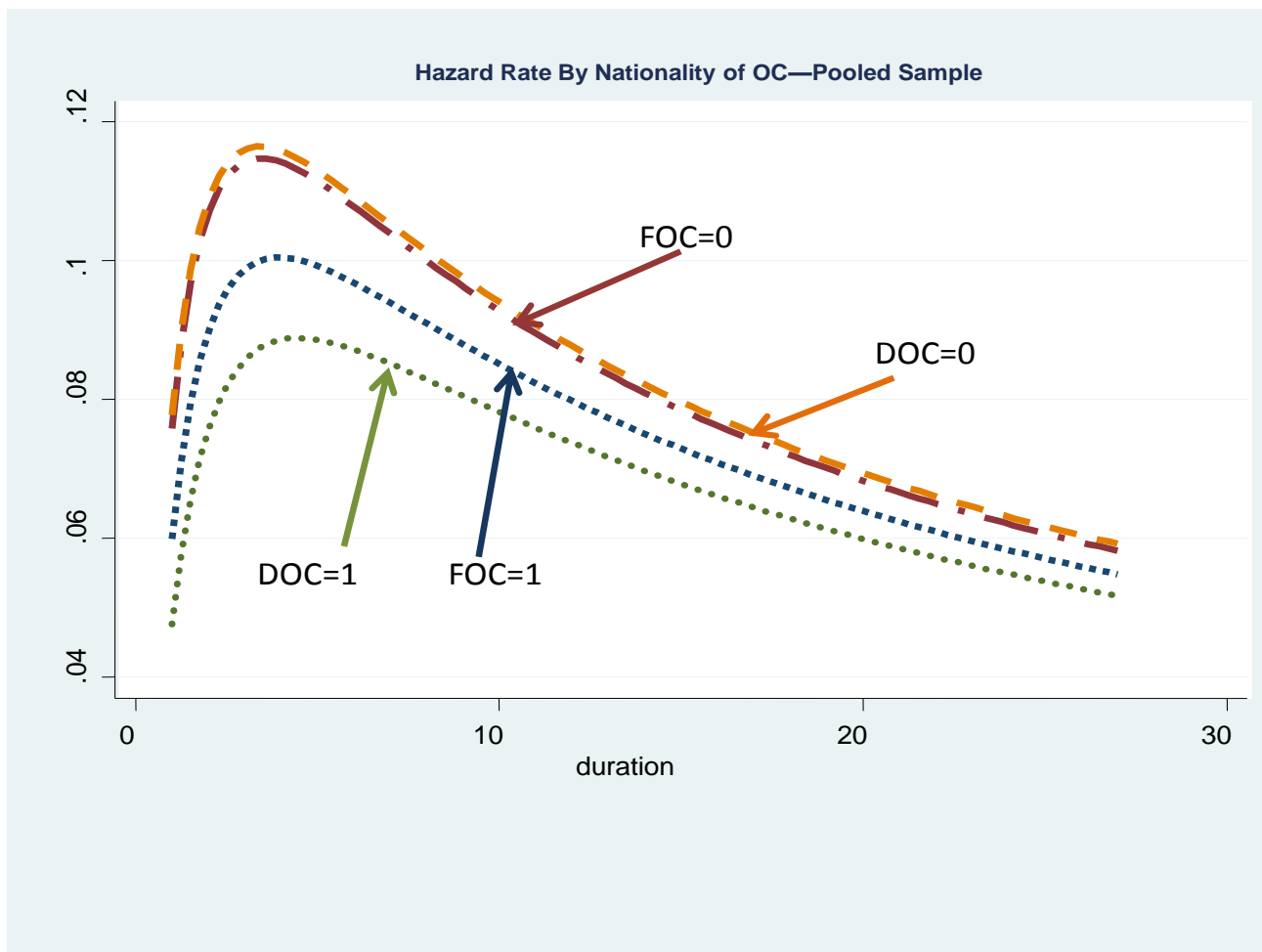


Table 7: Average Effects of Foreign and Domestic Acquisitions to Foreign- and Domestic-born Plants

variables	(1) Baseline		(2) IV	
<i>FDOC</i>	0.0658	(0.0799)	0.0643	(0.1521)
<i>FDOC</i>	0.2372*	(0.1251)	0.3173*	(0.2171)
<i>DDOC</i>	0.2659***	(0.0364)	0.3871***	(0.0643)
<i>DFOC</i>	0.1709***	(0.0551)	0.3134***	(0.1013)
Other plant control variables				
<i>Plant Size At Birth</i>	0.0009***	(0.0003)	0.0009***	(0.0003)
<i>Relative Plant size</i>	0.0797***	(0.0060)	0.0802***	(0.0060)
Firm Level Controls				
<i>Owner_Birth</i>	0.0455*	(0.0304)	0.0465	(0.0305)
<i>Multi_Plant</i>	0.1228***	(0.0221)	0.1272***	(0.0222)
Industry Level Controls				
<i>Relative Industry Size</i>	0.0218***	(0.0055)	0.0219***	(0.0055)
<i>Relative Industry Human Capital Ratio</i>	0.0188	(0.0161)	0.0190	(0.0162)
<i>Relative Industry Capital Intensity</i>	-0.1137***	(0.0333)	-0.1134***	(0.0333)
<i>Entry Rate</i>	-2.3152***	(0.0613)	-2.3168***	(0.0613)
sigma	1.0896***	(0.0034)	1.0904***	(0.0034)
Number of plants	69927		69927	
Number of deaths	48309		48309	
Number of Obs	502591		502591	
Ward chi2	4558.19		4501.88	

Note: Numbers in parentheses are robust standard errors. Regression results on constant, cohort dummies, and 2-digit SIC industry dummies are not reported due to space limitations. ***, ** and * indicate 1, 5 and 10 percent significance levels respectively.

Table 8: Average Effects on Duration of Born-Domestic and Born-Foreign Plants

Variables	Born-Domestic Plants (Baseline)		Born-Foreign Plants (Baseline)	
	(1)	(2)	(3)	(4)
<i>OC</i>	0.2201*** (0.0320)		0.0380 (0.0730)	
<i>FOC</i>		0.1597*** (0.0555)		-0.0053 (0.0835)
<i>DOC</i>		0.2429*** (0.0371)		0.1470 (0.1250)
Other plant controls				
<i>Plant Size At Birth</i>	0.0012*** (0.0003)	0.0012*** (0.0003)	0.0010** (0.0004)	0.0010*** (0.0004)
<i>Relative Plant size</i>	0.0905*** (0.0072)	0.0904*** (0.0072)	0.0308*** (0.0086)	0.0307*** (0.0086)
Firm Level Controls				
<i>Multi_Plant</i>	0.1109*** (0.0245)	0.1105*** (0.0245)	0.0336 (0.0546)	0.0352 (0.0547)
Industry Level Controls				
<i>Relative Industry Size</i>	0.0217*** (0.0060)	0.0216*** (0.0059)	0.0121 (0.0135)	0.0121 (0.0135)
<i>Rel. Industry Human Capital Ratio</i>	0.0328** (0.0164)	0.0327*** (0.0164)	-0.0527 (0.0873)	-0.0507 (0.0873)
<i>Relative Industry Capital Intensity</i>	-0.1455*** (0.0341)	-0.1450*** (0.0341)	0.4468*** (0.1654)	0.4480*** (0.1654)
<i>Entry Rate</i>	-2.3246*** (0.0620)	-2.3149*** (0.0620)	-1.9945*** (0.4097)	-1.9963*** (0.4097)
sigma	1.0836*** (0.0035)	1.0836*** (0.0035)	1.1850*** (0.0216)	1.1850*** (0.0216)
Number of plants	67100	67100	2827	2827
Number of deaths	46711	46711	1598	1598
Number of Obs	476975	476975	25616	25616
Ward chi2	4265.43	4267.36	252.79	255.63

Note: Numbers in parentheses are robust standard errors. Regression results on constant, cohort dummies, and 2-digit SIC industry dummies are not reported due to space limitations. *** and ** indicate significance levels of 1 and 5 percent respectively.