Exposure to FDI and New Plant Survival: Evidence in Canada

Yanling Wang*

May 2010

Acknowledgement: I wish to thank John Baldwin, Director of the Economic Analysis Division in Statistics Canada for granting me the access to Canadian plant level data. I benefited greatly from discussions with Wuong Gu, Marcel Voia and Chi Wan.

*: Norman Paterson School of International Affairs, Carleton University. Ottawa, ON K1S 5B6.
E-mail: Yanling_Wang@carleton.ca. Phone: 1(613) 520-2600 ext. 2626.

Exposure to FDI and New Plant Survival:
Evidence in Canada

Abstract

This paper examines Canadian indigenous plants' survival though their economic linkages with FDI affiliates as competitors, input suppliers and customers. One unique feature of the paper is that it studies a country with extensive exposure to FDI, and relies on a dataset including hundreds of thousands of manufacturing plants born to Canadian domestic firms, covering a long span from 1973 to 1997. The study finds that indigenous plants tend to have shorter lives (more deaths) due to competition with FDI affiliates operating in the same industry, but benefit from FDI affiliates operating in upstream and downstream industries as input suppliers and customers. The positive benefits of FDI outweigh the negative competition effects, resulting in net positive impact on the survival of indigenous Canadian-owned plants.

Keywords: FDI, Survival, economic linkages

JEL No: F2, O3

1. **Introduction**

In the era of globalization, FDI (foreign direct investment), trade and migration of workers are the main drivers. FDI is the most visible, migration of workers is still up to the most constraints, and trade lies in between. For instance, in both the developed and the developing world, FDI inflows increase steadily over the years. World Development Report (2007) records that FDI inflows to developed countries reach US$857 billion in 2006, an increase of 45% from 2005; and in developing and the transition economies, FDI inflows reach US$379 billion in 2006, a 21% increase over those in 2005. Given the large presence of FDI, and its growing importance in the host economy, FDI has received lots of attention both from policy makers and researchers.

Empirical research has identified three main channels through which FDI effects on domestic-owned plants take place: horizontal intra-industry economic linkage, and vertical upstream and downstream inter-industry linkages. Horizontal intra-industry linkages refer to the economic relationships between domestic- and foreign-controlled affiliates within the same industry, mainly through competition for market shares. Upstream inter-industry linkage is the economic relationships of an industry with its upstream industries through purchasing intermediate inputs from them, and downstream inter-industry linkage is the economic relationships of an industry with its downstream industries through selling products to them.

Most of the studies in the FDI literature have focused on examining the technology spillovers effects of FDI to its host economy, primarily on the productivity effects. What has been largely neglected is an analysis of the link between FDI affiliates and the survival of indigenous new born plants in the host country. Plant death is the end point of its life cycle, by ceasing production and displacing workers, and thus plant death/survival not only directly affects the dynamics of the industry, but also workers' welfare. How indigenous new plants adjust to the presence of FDI (and trade) should be of interests to both policy makers and the academic world, which is the focus of this paper. To be specific, this study examines the presence of FDI on the survival of domestically-owned new plants through both intra- and inter-industry economic linkages, with a dataset including hundreds of thousands of manufacturing plants born between 1973 and 1996 in Canada. It explicitly differentiates the economic linkages between FDI affiliates and domestic-owned plants as competitors, input suppliers, and customers, and identifies their associated economic effects on the survival of indigenous plants.

The focus on death/survival of indigenous plants from the effects of FDI in a developed country like Canada offers some interesting perspectives, and makes solid contributions to the FDI literature. First, examining the effects of FDI on new plants survival directly addresses how FDI affects industry dynamics in its host economy. Plant entry and plant exit represent a form of industry renewal. In Canada, plant entry and plant exit affect a fairly large proportion of Canadian manufacturing plants: some 9 percent of manufacturing jobs are affected by plant entry and exit during the period between 1973 and 1997 (Baldwin, Gibson and Wang, 2009).

Second, FDI presence in Canada is mature and big, which is different from lots of other country studies on FDI where FDI controls only a small fraction of production. Canada has a long and extensive exposure to foreign investments, which controls around 45% of all manufacturing output during the sample period between 1973 and 1997 (Baldwin and Wang, 2010a). Further, inward FDI in Canada is dominated by FDI originating from the United States, accounting for nearly 70% of total shipments produced by all foreign affiliates in Canada on average (Wang, 2010). In most industries, US affiliates control more than half of all shipments produced by all FDI affiliates. With a large presence of FDI and having a technologically advanced country as the dominating source of inward FDI in the manufacturing industries, Canada stands to be a great case to examine of presence of FDI on new plants survival.[1]

Third, inter-industry linkages of FDI affiliates with indigenous Canadian plants are a two-way street, with both serving as input suppliers and customers for each other. This is different from most studies on the productivity effects of FDI through inter-industry linkages in developing or transition economies, where inter-industry linkages between FDI and domestic-owned affiliates are mostly limited to one-way. It is often the case for those studies that FDI affiliates purchase some intermediate inputs from domestic-owned firms in upstream industries, but do not sell their products in the host market, rather mainly export their products overseas—thus leading to only one-way inter-economic linkages between domestic firms and FDI affiliates.[2] This is not the case in Canada, where the inter-industry linkages are more complete: FDI affiliates not only purchase intermediate inputs from upstream industries, but also sell their

[1] Girma and Wakelin (2007) show that host country mainly benefits from FDI originating in the neighboring region.
[2] There is a separate literature which categorizes the types of FDI as horizontal and vertical (Caves, 2007). Horizontal FDI refers to FDI affiliates which sell their products to the host economy, where vertical FDI are FDI affiliates which produce in a host economy, but export their products overseas. Horizontal FDI often takes place among developed countries, where vertical FDI is mainly in developing countries with FDI originating from developed countries.

products to their downstream industries. This is also evidenced by the survey on firms' innovation decision in Canada documented in Baldwin and Peters (2001): 46% of Canadian firms cited customers (in downstream industries) as an important source of innovation, 28% of firms cited suppliers (in upstream industries) and 28% cited competitors (in the same industry). The survey suggests that horizontal intra-industry and upstream and downstream inter-industry linkages generate significant effects on firms' decision in Canada. Therefore, using Canadian data emphasizes both upstream and downstream inter-industry channels.

Fourth, the study uses a rich plant-level cohort panel data from 1973 to 1997, tracking 24 cohorts (1973 to 1996) of new born plants from birth year to 1997 for a maximum of 25 years. The availability of the long panel offers a unique perspective to study the effects of FDI on the long-run dynamics of domestically-born plants, along with trade. This is important, due to the life trajectory of new born plants. As documented in most studies, plant infant mortality rate is high, and those plants born to be less competitive will die within a few years of life, regardless of their exposure to globalization. Thus, once new plants survived the first few risky years through learning and doing, it will be of interests to analyze how the presence of FDI and trade affects their life trajectory. The long rich panel thus allows me this rare opportunity to do so.

2. An Overview of the Effects of FDI and the Literature on Survival

2.1. FDI Effects

Theoretically, there are a number of possible effects of FDI on the survival of domestically-owned plants, and the effects depend on their relationship as competitors or suppliers or customers. As competitors, foreign affiliates and domestic-owned plants operate and compete with each other side by side in a particular industry. The superior technology and better management skills in FDI affiliates give them some competitive edge over domestically-owned plants. The more fierce competition forces certain domestically-owned plants to close down, and thus leads to higher exit rates. But, to some degree, domestic-owned plants can get limited access to the technology in FDI affiliates through imitation of foreign technology and/or through workers' turnover from foreign affiliates to them, thus leading to positive spillover effects. Those spillover effects will undoubtedly improve the performance of domestic-owned plants and lengthens their life durations. However, the positive effects can be very small, as FDI affiliates would try to safeguard their technology as tightly as possible. The net effects of FDI on the domestically-owned plants operating in the same industry come down as the sum of the positive spillover effects and negative competition effects. The net effect is often negative—leading to shortened lives for domestic plants—as competition effects generally dominates (see Gorg and Greenaway, 2004 for an excellent review).

The picture is quite different regarding the effects of FDI through upstream inter-industry linkages. When FDI affiliates are input suppliers, they are able to provide domestic plants with more varieties of, and better quality intermediate inputs. In addition, they also have the resource to provide better customer service. FDI spillover occurs when the survival chances of plants increases resulting from FDI affiliates as input suppliers, and some of the increased survival chances are not completely captured by monetary transactions.

When FDI affiliates in downstream industries are customers of domestically-owned plants, they often provide technical assistance to them, and make the technical assistance widely available, in order to have a high-standard and stable stream of input suppliers.[3] This leads to increased productivity and lower prices of upstream industries (Blalock and Gertler, 2008), and hence higher survival chances of those input-supplying domestic plants. Spillover exists when increases in plants' survival result from FDI affiliates as customers, and FDI affiliates are unable to extract the full value of the resulting gains in upstream industries through direct monetary payment. Since the relationships between FDI affiliates and domestic-owned plants through inter-industry economic linkages are solely involved with positive spillover effects, FDI effects through inter-industry economic linkages tend to be positive.

2.2. The Literature on FDI and Survival

Empirical evidences on the effects of FDI are country specific, and most of the studies focus on the productivity effects in developing or transition economies. Regarding horizontal intra-industry effects of FDI, there is no consensus, though new micro-data tends to show that there is a negative effect of FDI on domestic-owned plants. For instance, several studies find that

[3] Javorcik (2004) documents some of the anecdotal evidences. This practice has been in business for decades, if not hundreds of years, and is common regardless of the nationality of the owing firms. For instance, Wikipedia writes that after immigrating to and growing up in Canada, John Molson founded Molson Brewery Company in Montreal in 1786, and returned to his birth country England to purchase the finest quality barley seeds. Upon his return to Canada, he offered the seeds ***free of charge*** to neighboring Montreal farmers who agreed to grow them to satisfy the brewery's need for malt.

FDI generates positive spillovers on the productivity of domestic-owned firms—Haddad and Harrison (1993) for Morocco, Chuang and Lin (1999) for Taiwan, and Branstetter (2005) and Keller and Yeaple (2009) for the US, among others. But others find significant and negative effects of FDI on local firms' productivity, see Aitken and Harrigan (1999) in the case of Venezuela. The results reflect the theoretical arguments that intra-industry FDI effects are jointly determined by (positive) spillover effects and (negative) competition effects, but there is mounting evidence that the intra-industry effects of FDI tend to be negative when other controls are present.

Studies on inter-industry FDI productivity effects mainly focus on cases in developing or transition economies and on the channel where domestic-owned firms provide inputs to downstream FDI affiliates (downstream inter-industry linkages). For instance, at the firm level, Javorcik (2004) finds substantial FDI spillover effects to Lithuanian-owned firms through these economic linkages (termed backward linkages there). Similar findings are in Bwalya (2006) for Zambia, Blalock and Gertler (2008) for Indonesia, Marcin (2008) for Poland, Javorcik and Spatareanu (2008) for Romania and Jordaan (2008) for Mexico.

As to the cases in developed countries, both upstream and downstream economic linkages between FDI affiliates and domestic-owned plants are found to be important channels. Although Harris and Robinson (2002) find significant vertical FDI spillover effects using UK plant-level panel data, they do not differentiate between forward and backward inter-industry linkages. Lileeva (2010) find significant FDI spillover effects on Canadian-owned manufacturing plants as input suppliers. Jabbour and Mucchielli (2007) find positive and significant FDI spillovers through both forward and backward inter-industry linkages in Spain, and so is Wang (2010) which studies the productivity effects of FDI for Canadian manufacturing industries.

The above studies have painted a good picture for searching the effects of FDI on productivity from different perspectives. However, the empirical evidence on the impact of FDI on domestic plants' survival is rather limited. On one level, there are a few studies which have examined the survival differences between domestic- and foreign-owned affiliates, but not the presence of FDI on domestic plants' survival , such as Bernard and Sjoholm (2003), Gorg and Strobl (2003a) and Baldwin and Wang (2010b), using plant level data for Indonesia, Ireland and Canada respectively. To our knowledge, there are only a few papers that have investigated in detail the effect of inward FDI on survival of domestic entrants and/or incumbents, which are

Gorg and Strobl (2003b), Burke, Gorg and Hanley (2008) and Girma and Gong (2008). Gorg and Strobl (2003b) use Irish plant level and find some positive effects of FDI on domestic plants' survival, in line with the idea that firms benefit from technology spillovers from multinational firms and are, thus, able to increase their survival prospects. Burke, Gorg and Hanley (2008) use U.K. single-plant firms and document net positive effects from FDI. But, using Chinese State-owned Enterprises (SOEs) data, Girma and Gong (2008) find that competition from sectoral FDI has a deleterious impact on the growth and survival probability of SOEs without access to any foreign capital, that export-oriented FDI in downstream sectors has negative performance ramifications and that there are no discernible spillover effects that can be attributed to FDI in upstream sectors. This study extends the literature by providing some comprehensive evidences for Canada. The analysis of Canadian plant-level data from 1973 to 1997 not only provides a much larger dataset, compared with several years' coverage in the aforementioned studies, but also a country with a relatively more developed economy so that FDI might be expected to have greater potential for displacement/competition effects with domestic enterprises in the same industry, and greater benefits as input suppliers or downstream customers. The long coverage of data also provides a rare opportunity to study and compare the long-term effects of FDI on survival of domestically-owned by purging out the noises which are affecting plants survival during the first few years of life.

In order to purge out the effects on plants' survival due to the presence of FDI, I also control for other factors at the plant and industry levels which are known to be related to plant life durations, such as plant size and industry entry rate. Plant size is an important factor in plants' survival, as large size leads to success and small firms tend to die young (Mata and Portugal, 1994; Mata, Portugal and Guimaraes, 1995; Esteve, Sanchis and Sanchis, 2004; Persson, 2004). Plants belonging to multi-plant firms or to more experienced firms have been found to have better survival chances (Disney, Haskel and Heden, 2003; Audretsch and Mahmood, 1995). Certain industry characteristics also influence plants' survival. For example, Audretsch and Mahmood (1995), Audretsch, Houweling and Thurik (2000) and Segarra and Callejon (2002) all find that exit rates are greater in R&D intensive industries since the competitive environment is more intense there; high entry rates are also found to affect plants' survival probabilities (Audretsch et al., 2000; Baldwin et al., 2000; Baggs, 2005).

The remainder of the paper is organized as follows. Section 3 documents the main variables, Section 4 describes the data, Section 5 discusses the empirical strategy, Section 6 presents the main results, Section 7 carries out some robust analyses, and Section 8 concludes.

3. Description of The Main Variables

3.1. Industry Level Covariates

FDI measurements and trade measurements are built at the industry level. In addition, other industry level controls are included to avoid omitted variable biases as documented in Wooster and Diebel (2006).[4] We describe each covariate in turn.

$FDI_{j,t}^{Own\_Industry}$: a measure of the importance of FDI in the host industry. It is constructed as the ratio of the output (shipment) of foreign-controlled plants over total industry shipments. For industry *j* at year *t*, $FDI_{j,t}^{Own\_Industry}$ is defined as:

$$FDI_{j,t}^{Own\_Industry} = \frac{Q_{j,t}^{f}}{Q_{j,t}}, \qquad (1)$$

Where $Q_{j,t}^{f}$ is total shipment of foreign affiliates in industry *j* at year *t* and $Q_{j,t}$ is total shipment for industry *j* at year *t*.

$FDI_{j,t}^{Upstream}$: a measure of FDI in upstream industries which affects plant *i* in industry *j* through providing intermediate inputs to industry *j*. It is constructed as a weighted average of $FDI_{k,t}^{Own\_Industry}$ in all upstream industries *k* of industry *j*. The weights are input-shares that industry *j* purchases from all its upstream industries (including non-manufacturing industries). At times in the text, $FDI^{Upstream}$ is also referred to as upstream FDI. For industry *j* at year *t*, $FDI_{j,t}^{Upstream}$ is built as:

$$FDI_{j,t}^{Upstream} = \sum_{k \neq j} Input_{j,k,t} * FDI_{k,t}^{Own\_Industry}, \qquad (2)$$

$$Input_{j,k,t} = \frac{x_{j,k,t}}{\sum_{q} x_{j,q,t}}, \qquad (3)$$

[4] Wooster and Diebel (2006) conduct a meta analysis of tens of studies focusing on the spillover effects of FDI, and show that omission of controls at the industry level leads to omitted variable bias in the spillover literature.

Where $Input_{j,k,t}$ is industry *j*'s input purchasing share from industry *k*. $x_{j,k,t}$ or $x_{j,q,t}$ is the input purchases from industry *k* or *q* (producing industry), by industry *j* (purchasing industry) at year *t*, and $\sum_q x_{j,q,t}$ is the total input purchases from all industries. The sum of the input shares over all manufacturing industries, $\sum_j Input_{j,k,t}$, is less than or equal to one (only in the case when industry *j* does not purchase intermediate inputs from non-manufacturing industries).

$FDI_{j,t}^{Downstream}$: a measure of FDI in downstream industries affecting plant *i* in industry *j*, through purchasing products produced by plant *i*. It is constructed as a weighted average of $FDI_{k,t}^{Own\_Industry}$ in all downstream industries of industry *j*. The weights are output-shares that industry *j* sold to all of its downstream industries (including non-manufacturing industries). At times in the text, $FDI^{Downstream}$ is also referred to as downstream FDI. For industry *j* at year *t*, $FDI_{j,t}^{Downstream}$ is built as:

$$FDI_{j,t}^{Downstream} = \sum_{k \neq j} Output_{j,k,t} * FDI_{k,t}^{Own\_Industry}, \qquad (4)$$

$$Output_{j,k,t} = \frac{x_{j,k,t}}{\sum_q x_{j,q,t}}, \qquad (5)$$

Where $Output_{j,k,t}$ is the output share of industry *j* (producing industry) that is sold to industry *j* (purchasing industry). $x_{j,k,t}$ and $x_{j,q,t}$ are the outputs produced by industry *j* and sold to industry *k* and *q* respectively. Similarly, the summation of output share over all manufacturing industries, $\sum_k Output_{j,k,t}$, is less than or equal to one.

In constructing $FDI_{j,t}^{Upstream}$ and $FDI_{j,t}^{Downstream}$, I use year-specific industry-level input-output relations—unlike some other studies which use year-invariant input-output relations—and thus changes in the importance of inter-industry linkages as well as changes in FDI are equally accounted for in estimating the effects of FDI on survival. This also provides me a chance to test the relative importance of FDI and the strength of inter-industry linkages for $FDI_{j,t}^{Upstream}$ and $FDI_{j,t}^{Downstream}$ to affect the survival of domestic-owned plants.

Implicit in the construction of $FDI_{j,t}^{Upstream}$ and $FDI_{j,t}^{Downstream}$ is the assumption that the inter-industry input-output shares for each plant/firm (for those single-plant firms) in an industry are identical, and are the same as the one at the industry level. This assumption might sound strong, though it is the common practice in the literature. This common practice is driven in part by data limitations in that it is generally unknown how much each firm (plant) sold to foreign-owned buyers or purchased from foreign suppliers. Rather, the amount purchased from foreign-owned firms or sold to foreign-owned firms for each industry is inferred from the industry input-output tables. Blalock and Gertler (2008) argue that this measure, although not perfect, also avoids certain endogeneity issue regarding domestic firms' decision to supply foreign firms and to adopt the more advanced foreign technology into their production process. $FDI_{j,t}^{Upstream}$ and $FDI_{j,t}^{Downstream}$ here are better to be viewed as a measure of available technology.[5]

$Mshare_{j,t}$: import share, defined as the ratio of industry *j*'s total imports over its output at year *t*.

$Xshare_{j,t}$: export share, defined as the ratio of an industry *j*'s total exports over its output at year *t*.

Import and export shares are measures of industry exposure to trade—another prominent measure of globalizatioon. Imports could spur technology spillover effects—as often found in the trade literature—and the spillover effects can lead to higher productivity and thus higher survival rates. Exporting to foreign markets not only allows plants to access foreign knowledge, but also

[5] Blalock and Gertler (2008) offer a very nice explanation on this common practice in the literature, quoted as below (p410). "One might prefer to use the actual output sold to foreign buyers by each supplier. This would, in principle, be the correct measure if the firms selling to foreign buyers are the only ones that benefit from the technology transfer. However, Pack and Saggi (2001) argue that foreign buyers distribute their technology to many suppliers to prevent individual suppliers from playing holdup. If the technology becomes widely available so that all firms might benefit, then the correct measure would be the share of all output from the industry-region sold to foreign firms, in which case our average measure would more accurately reflect the true downstream FDI. The truth probably lies somewhere in between, i.e., that the technology is distributed beyond those firms that sell to foreign buyers, but not to all firms. Hence, we would prefer to know which sellers were able to access the foreign technology. A problem with examining the specific suppliers that sold to foreign firms or even those that adopted the foreign technology is that their decisions to supply and to adopt are endogenous. Instead, our measure is intended to capture the availability of buyers' foreign technology to sellers in a particular industry in a particular region at a point in time. Our estimator is then best interpreted as the effect of an increase in the availability of technology on the average productivity of sellers in a particular industry in a particular region. By considering availability we also step back from the endogeneity issue."

an expanded customer base. Accordingly, those exporting plants are expected to generate some positive effects on their survival.[6]

Ind_KLRatio$_{j,t}$: ratio of capital income to labor income of industry *j* at year *t*. Capital intensive industries serve as a barrier for new entries, and plants already operating in capital intensive industries might reap the benefits of fewer entries and thus are expected to live longer.

Ind_NLshare$_{j,t}$: wage share of workers with a university degree and above for industry *j* at year *t* (proxy for human capital). Increases in human knowledge at each plant leads to increases in industry-level human knowledge intensity. Wang and Chao (2008) find that firms' total factor productivity (TFP) is significantly and positively affected by the increase in other firms' human capital. In line with that finding, plants operating in higher human knowledge intensity industries are expected to have prolonged durations.

EntryRate$_{j,t}$: defined as the ratio of the number of new entrants over the total number of plants operating in industry *j* for year *t*. Entry rate captures the dynamics of an industry. High levels of entry are associated with conditions that make entry experimentation less costly. *Ceteris paribus*, industries with higher entry rates experience higher level of competition, and higher rates of churning, and thus higher exit rates.

3.2. Plant-Level Covariates

Plant level covariates are to control for plant level heterogeneity and the importance of certain characteristics affecting plant survival. Plant heterogeneity plays an important role in determining plant survival: more successful plants are able to better weather negative impact and harbor more fully positive effects from the environment where they are operating. The plant level characteristics are described below.

Birth_Size: plant size in term of total employment (absolute number) 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 will be associated with capabilities. More competent plants are more likely to survive and grow.

[6] Imports are found to be an important channel for productivity growth (Frankel and Romer, 1999). Grossman and Helpman (1991) argue that imports embed the technology level of the producing countries, and a country can get access to other countries' technology through imports. Indeed, Coe and Helpman (1995) find that imports promote technology diffusion among OECD countries. That finding is confirmed by later studies using data on OECD or developing countries, such as Keller (2002a), Keller (2002b), Schiff and Wang (2006) and Schiff and Wang (2008). Exports are also argued to improve productivity performance of the domestic economy (Falvey, Foster and Greenaway, 2004).

Rel_Size: relative plant size measured in terms of total employment in a plant relative to that in the median plant operating in the same industry.[7] Relative plant size is a general proxy for the types of competencies that allow some plants to grow larger. Large firms possess assets that allow them to organize and control large-scale production. They also differ substantially in terms of knowledge base from small firms. Large firms are more likely to be innovative, to perform R&D, and to have a science-based workforce, all of which leads to a competitive edge over its competitors and thus means these plants are more likely to survive.

OC: a time-switching binary dummy for those plants with ownership changes. It switches from 0 to 1 from the time when a plant changed owner for the first time, and stays at 1 for the remaining period of the plant. It takes on value of 0 for those plants with no ownership changes during the sample period. Studies have generally found that plants, once switched to new ownerships, have different survival profiles from before (McGuckin and Nguyen, 2001; Nguyen and Ollinger, 2009; Girma and Gorg, 2004; Bandick and Gorg, 2009; Baldwin and Wang, 2010b). Including *OC* helps purge out ownership change effects on survival.

Multi_Plant: a binary variable that takes on a value of 1 if a plant is born to a firm that already has operating plants in manufacturing, and 0 otherwise. This variable captures the effects of parent firms' previous experience on plant survival.

NLShare: plant level wage share of non-production employees to total number of employees. This measure is designed to capture the effects of plants' human knowledge intensity on survival. This variable is complementary to the one at industry level, *Ind_NLShare*. *Ceteris paribus*, plants with higher human knowledge intensity are more competitive and thus are expected to live longer.

4. Description of the Data

The sample contains nearly the universe of all manufacturing plants born to domestic Canadian firms during the period from 1973 to 1996, consisting of 47,638 for 24 cohorts. I exclude those plants born to foreign MNEs during the period, those plants born before 1973, as plant level annual data start in 1973 in Canada.[8] The panel data come from the Annual Survey of

[7] Relative measurements are frequently used in studies, such as Olley and Pakes (1992), Dhrymes and Bartlesman (1992), McGuckin and Nguyen (1995) and Baldwin and Wang (2010) to purge out industry differences in terms of plant size.

[8] Those plants born before 1973 are included in the master database maintained by Statistics Canada, but I choose to exclude them in the analysis, as their previous information from birth to 1972 was not recorded.

Manufacturing (ASM), conducted and maintained by Statistics Canada (StatCan). I tracked the plants from birth to year 1997. The cohort 1997 is excluded from the study as I can not differentiate true deaths from censorship for the entire cohort. Among the 47,638 plants born to Canadian firms during the sample period, only 2,415 plants were born to firms which already have previous experiences in the manufacturing sector, accounting for 5 percent, and the majority, 45,223 plants, was born to first-time parent firms.

Like in many other countries, plant infant mortality rate is very high: about 13% of new entrants died within the first year of life, and about 25% of entrants died within the first two years of life. This is rather evident from Figures 1 and 2. Figure 1 plots the true death rates of each cohort for the 24 cohorts (excluding the last year with censorship) over the years, and Figure 2 plots the Kaplan-Meier non-parametric survival estimate. By the end of the 5th year, over half of a cohort has died, and by the end of the 10th year, over two thirds of a cohort have closed down. Over the sample period of the 24 cohorts, there are 30,359 true deaths, accounting for 63.7 percent, and the remaining17,279 plants are still alive in year 1997, representing a 36.3 percent censorship. The longer a cohort lives, the smaller is the censorship, and vice versa. For instance, for the 1996 cohort, the censorship rate is close to 90 percent, and the censorship for the earliest 1973 cohort is only about 13 percent.

Some plants are born large, and others are born small. On average, new entrants start their business with about 15 employees, with a minimum of 0 and maximum of 3,156, which implies that the largest plant is about 210 times the size of the average plant across all births. The plants with zero employees at birth are those the owners do not count themselves as employees and they have not started hiring workers yet. In terms of relative size (relative to the median plant size at the industry), the mean is 1.443, with a minimum of 0 and a maximum of 181 (Table 1). So the largest plant in an industry has 181 times the number of employees as that in median plant operating in the same industry. The percentage of wages paid to non-production workers is about 10.3 percent. Due to missing data on wages to production or non-production workers, once the wage share variable is used in the regression, the number of plants is reduced to 47,173.

Plant control changes only happen to a small set of plants. Among all the new births, only 2,765 plants experienced control changes during the sample of their life time, accounting for only 5.8 percent.

These plants included in the study operated in every single manufacturing industry at the Historical Link (L) level of classification, coded by StatCan.[9] There are a total of 84 manufacturing industries coded as the L level (see appendix for the complete list of the industries). Industry level controls are measured at the L level.

FDI presence in Canada is both large and mature ($FDI^{Own\_Industry}$). During the sample period, FDI controls nearly half of all manufacturing shipments in Canada, though with some fluctuations (Figure 3). Even at the low point in the period, FDI still controls some 40% of total manufacturing output in Canada. One of the prominent features of FDI in Canada is that the majority of FDI comes from the United States. In terms of shipment share, US controlled-affiliates account for nearly 70% of total shipments produced by all foreign affiliates in Canada on average (Wang, 2010).[10] To a large extent, although the effects of FDI in Canada come from diversified origins, they are primarily driven by US FDI. There is a big variation of the FDI presence across the industries (in terms of output share controlled by FDI affiliates).

Input-output inter-industry shares are derived from StatCan's rectangular input (use) and output (make) tables that show the commodity input mix and commodity output mix of industries by year. The extent of inter-industry linkages varies across industries. Averaged across the sample period, for input purchasing shares from upstream industries, they vary from the minimum of 28% for L77—Communication & Other Electronic Equipment Industry to nearly 100% of L23—Brewery Products Industry. Similarly, for output shares sold to downstream industries, they vary from minimum of 14% L70—Railroad Rolling Stock Industry to nearly 100% for L23—Brewery Products Industry.

Total imports and exports are derived from StatCan's database of imports, exports, and re-exports by commodities. Some industries are very open in terms of import or export shares, while others have mainly served the domestic markets. For instance, averaged over the sample period, import share and export share for Ready-mix Concrete Industry (L83) is both less than 1%, while the import share for Other Machinery and Equipment Industry (L65) is around 99%, and export share for Motor Vehicle Industry (L67) is nearly 80%.

[9] The L level classification is very similar to the three-digit SIC80 (Standard Industry Classification, 1980 version), but pools similar the three-digit SIC80 industries to one L level classification. For example, SIC 101 and SIC 102are simply recoded as L14 and L15 respectively, but SIC 105, 108 and 109 are pooled together as one industry in L level coded as L18—Feed, Cane, Beet Sugar and Miscellaneous Food Product Industry. See Statistica Canada corcordance between L level and SIC80 for more detail, which is widely accessible on its website.

[10] This is the main reason why Lileeva (2010) only focuses on US FDI to study the spillovers effects of FDI in Canada.

Industry's wage share of workers with a university degree and above (*Ind_NLShare*) was taken from Gera, Wu and Lee (2003). Industry level capital-labor income ratio (*Ind_KLRatio*) is calculated as capital income divided by labor income, complied from the KLEMS database available on Statistics Canada's website. Entry rate (*EntryRate*) is calculated as the ratio of new entrants by industry-year over all the manufacturing plants operating in that industry-year. Table 1 reports the summary statistics of the main variables.

5. The Empirical Strategy

There are 24 cohorts with 47,638 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. The focus now is to choose a model which best fits the data. For the continuous type models, there are proportional hazard type, such as the Cox proportional hazard model, and the accelerated failure time (AFT) type, such as the lognormal AFT model to choose from.

Rather than deciding a hazard model ad hoc, I first plot a kernel density of plants' maximum durations (Figure 4) to shed light on the hazard in the dataset. It seems that the density distribution suggests a lognormal type AFT hazard (the actual death rates of plants plotted in Figure 1 complements Figure 4 in this sense). 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, that is there is a considerable attrition of the hazard ratio over time. Figure 4 suggests these characteristics and thus an AFT type model is used here. On a safety check, I also conduct a few tests for the proportionality assumption on the time-invariant variables of *Multi_Plant* and *Birth_Size*, and the test results indicate that the proportionality assumption does not hold for *Birth_Size*, and only weakly so for *Multi-Plant*, which makes it problematic to apply a proportionality type model. Plus, with the majority of the covariates are time-varying, it also might not be a good idea to apply the Cox proportional hazard model.

The traditional AFT model assumes a linear relationship between the log of survival time T and characteristics vector X, by assuming that the vector summarizing subject characteristics is time-invariant (cross-sectional analysis):

$$\ln(T) = \beta X + z \,, \tag{6}$$

where β is a vector of parameters and *z* is an error term. This expression may be rewritten as:

$$\ln T = \beta X + \sigma u \,, \tag{7}$$

or:

$$\frac{\ln T - \beta X}{\sigma} = u \,, \tag{8}$$

where $u = z/\sigma$ is an error term with density function $f(u)$. σ is a scale factor for the shape parameters for the hazard function (for more please refer to Professor Steven Jenkins' notes posted on his website).

The term *exp(-βX)* is a survival time scaling factor. If *exp(-βX)*>1, failure is "accelerated" (survival time is shortened), and if *exp(-βX)*<1, failure is "decelerated" (survival time lengthened). The Stata routine reports the estimated parameter σ . For σ <1, the error term u is thinned, which implies shortened durations, but for σ >1, the error term u is fattened, which implies lengthened durations.

Interpretation of the coefficients is rather straight forward. For a continuous variable X_k, differentiation produces $\beta_k = \frac{\delta \ln(T)}{\delta X_k}$. Thus an AFT regression coefficient relates proportionate changes in survival time to a unit change in a given regressor, with all other characteristics held fixed. For a discrete variable X_q, the coefficient relates proportionate changes from one category to another (from 0 to 1).

To be able to incorporate the time-varying panel data into the traditional AFT model, a couple techniques are needed. First, I assume that the hazard rate is constant within each year, though the hazard rate differs across each year (the recorded durations). Second, I split the episode so that every observing year of a plant, from the birth year to the last year in the sample, enters as a separate record for that plant—i.e., there are multi records per subject (so called episode splitting). 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 survivor functions—so called delayed entry.[11]

I also include industry and cohort dummy variables to control for the industry specific and cohort specific heterogeneity. For instance, over the period from 1973 to 1997, there are many policy initiatives coming into effect, such as the Canada-United States Free Trade Agreement in

[11] A more detailed discussion is available in the lecture notes on incorporating time-varying covariates in AFT models discussed in Chapter 3—"Functional Forms for the Hazard Rate"—by Professor Steven P. Jenkins, posted on his website, and Chapter 5 in his Stata manual for expanding the survival dataset to incorporate multi records per subject.

1987, and the North America Free Trade Agreement in 1994. Some industries might have witnessed very different growth experiences, like the fast technology growth in the 90s in high-tech industries. The regression equation with all of the variables is:

$$\ln T_{i,t} = \alpha + \beta_1 FDI_{j,t}^{Own\_Industry} + \beta_2 FDI_{j,t}^{Upstream} + \beta_3 FDI_{j,t}^{Downstream} + \beta_5 Xshare_{j,t} + \beta_6 Mshare_{j,t}$$
$$+ \beta_7 Ind\_KLRatio_{j,t} + \beta_8 Ind\_NLWage_{j,t} + \beta_9 EntryRate_{j,t} + \beta_{10} Birth\_Size_i$$
$$+ \beta_{11} \mathrm{Re}\, l\_Size_{i,t} + \beta_{12} Multi\_Plant_i + \beta_{13} OC_{i,t} + \beta_{14} NLWage_{i,t}$$
$$+ \sum_{w=1} \lambda_w Ind_w + \sum_{y=1} \theta_y Cohort_y + \sigma u_{i,t} + \sum_{w=1} \lambda_w IND_w + \sum_{y=1} \theta_y Cohort_y + \sigma u_{it}, \qquad (9)$$

Where *IND* is industry dummy at the SIC80 2-digit level by grouping similar L-level industries into a two-digit SIC80 level and *Cohort* is a cohort dummy.[12]

Before I move on to the empirical results, I would like to emphasis that the potential endogeneity issue of FDI at the aggregate level is not a problem at the micro-level. Although FDI tend to be endogenous at the aggregate level (Wang, 2010), when the effects of industry-level FDI are examined at the plant level, the potential endogeneity tend to disappear. On the one hand, plants/firms operating in a certain industry tend to take the industry-level FDI as given and exogenous, and on the other hand, the inclusion of other industry covariates along with those at the plant level have, to be large degree, already controlled the possible endogeneity issue of FDI. As such, most studies do not even try to correct it (for instance, Jovarcik, 2004; Blalock and Gertler, 2008), except Lileeva (2010). But Lileeva's finding rejects the hypothesis that industry-level FDI is endogenous, which in turn tends to support the common practice in the literature by treating the level of FDI as exogenous. This study uses the same period (1973 to 1997) of Canadian plant level data as Lileeva, but focuses on survival rather than on productivity. I thus will treat FDI measures (and in the similar line of arguments, trade measures) exogenous along the line with the literature. In the regressions, I correct plant level heterogeneity by using the robust variance-covariance matrix, and report the corresponding t-statistics.

6. The Main Results

Table 2 reports the main results. Since FDI and trade variables are the measures of globalization, they are included in all regressions. Because inclusion of the plant level wage ratio

[12] Doing so, rather including 84 industry dummies at the L-level, here, there are a total of 29 dummies at the 2-digit level of SIC 80. Since there are several L-level variables included, a higher grouping of the industries makes most sense, and also helps ease computation.

of non-production workers, *NLWage*, shrinks the number of plants from 47,638 to 47,173, it is added sequentially, for comparison with previous results. In Table 2, Column (1) contains industry level FDI and trade measures, and Column (2) adds other industry level controls. Columns (3) and (4) repeat the exercises by adding *NLWage* as well. In all columns, other plant-level covariates, industry and cohort dummies are included to control for respective effects on plant survival. I now describe the main results.

We choose to discuss on results in Column (2) first, as it also includes other industry level controls, and thus is least likely to suffer omitted variable biases. The results show that the presence of FDI in the same industry generates significant and negative effects on the durations of domestically-owned new plants. The negative effects imply that competition between FDI affiliates and domestically-owned plants strongly dominate the learning effects of domestically-owned plants from FDI affiliates, which is commonly found in the literature (for example, Aitken and Harrison, 1999; Javorcik, 2004; Lileeva, 2010; Blalock and Gertler, 2008; and Jordaan, 2008). However, the negative competition effects become significant only after conditioning on other industry level controls. This is as documented in Wooster and Diebel (2006), where they show that omission of controls at the industry level leads to omitted variable bias in the FDI spillover literature. The negative coefficient -.284 means that that plants' expected durations will decrease by nearly 0.3 percentage points as the share of foreign ownership increases one percentage point, and vice versa. To see this, let me write out the relationship between $FDI^{Own\_Industry}$ and duration *T*. The estimation result shows that for one percentage point increase in $FDI^{Own\_Industry}$ leads to changes in log duration by $\Delta \ln T = \Delta FDI^{Own\_Industry} * .284$ =.001*.284 = .00284. This implies that $\frac{\Delta T}{T} = .00284 \approx .3\%$. In the data, actual changes in $FDI^{Own\_Industry}$ are quite uneven from 1973 to 1997 across all industries, and thus the implied duration effects will be different: plants operating in those industries which experienced growing FDI will be negatively affected, while others which experienced declining FDI will be positively affected. The top panel of Table 3 provides the top three industries mostly affected by changes in $FDI^{Own\_Industry}$ (positive or negative), and the estimated effects on plants' durations operating in those industries. For instance, plant durations in Small Electrical Appliance Industry (L73) increased by 13.09% due to the decrease in the output share controlled by FDI affiliates in that industry. But for Brewery

Products Industry (L23), plants durations on average are shortened by 19.03% due to increase in the level of output share controlled by FDI affiliates during the sample period.

The effects of upstream FDI on durations of domestically-owned new plants are large and significant, indicating that industries with growing upstream FDI acquire technology through purchasing intermediate inputs, and these technology are beneficial for their plants' survival. This result is not commonly found in the previous FDI spillover literature, due to the fact that FDI affiliates do not serve their host markets. The coefficient 0.422 in Column (2) means that plants' expected durations will increase by over 0.4 percentage points as the share of upstream foreign ownership increases one percentage point, and vice versa. The middle section of Table 3 provides a list of the industries mostly affected by changes in upstream FDI (positive or negative), and the estimated effects on plants' durations operating in those industries. For instance, plant durations in Motor Vehicle Industry (L67) would have been 7.92% higher if there were no decrease in its upstream FDI, whereas for Broad Knitted Fabric Industry (L30), the increase in its upstream FDI raises plant durations by 7.49%.

The effects of downstream FDI on domestic-owned new plants are also large and significant, suggesting that domestic-owned plants acquire technology through supplying its customers in downstream. This result is often found is other studies, such as Javorcik (2004), and Blalock and Gertler (2008). The result indicates that plant durations will increase by .57% if the share of foreign ownership downstream rises by one percentage point. Thus, the industries which experienced fastest downstream FDI growth benefited the most from downstream FDI, and vice versa. The bottom part of Table 3 presents a list of industries most affected by changes in downstream FDI, with the estimated effects on its productivity growth. For example, regarding Communication and Other Electronics Equipment Industry (L77), plant durations would have been 13.68% longer if there were no decrease in its downstream FDI. On the other hand, for Miscellaneous Transportation Equipment Industry (L72), increase in its downstream FDI raises plant durations by 20.26%.

Note that for a particular industry *k*, it might be an upstream industry for industry *j*, but a downstream industry for industry *q*. Thus, the total effects of FDI on domestic-owned plants' survival should be the sum of the effects from $FDI^{Own\_Industry}$, $FDI^{Upstream}$ and $FDI^{Downstrean}$. This is because one percentage point increase in the share of output controlled by FDI affiliates ($FDI^{Own\_Industry}$) in all industries across the board would also lead to a one percentage point increase in $FDI^{Upstream}$ and $FDI^{Downstream}$ respectively. The estimated results imply that one percentage point increase in the share of output controlled by FDI affiliates across the board leads to an estimated net increase on domestic plants' durations by .71% (=-.28%+.42%+.57%). That is, FDI in Canada is beneficial for indigenous plants, mainly through serving as their upstream input suppliers and downstream customers, and the benefits to domestic plants associated with inter-industry economic linkages with either upstream FDI affiliates or downstream FDI affiliates outweigh the negative competition effects between FDI affiliates and domestic new plants.

Imports and exports do not seem to matter, a result though not commonly found in the trade literature, but rather consistent with Lileeva (2010) and Wang (2010) with Canadian data.[13]

For other industry level controls, plants operating in those industries with higher capital-labor income ratio (*Ind_KLRatio*) enjoy longer lives. Industries with higher capital-labor ratio are more capital intensive, which implies a barrier to entry—plants operating in capital-intensive industries are required to have a big chunk of capital, and only a small portion of firms are able to enter in capital-intensive industries. In other words, plants operating in capital-intensive industries are shielded from more competition due to entry, and thus are expected to live longer.

Industries with higher portion of college degree workers (*Ind_NLWage*) have higher human knowledge intensity, and the higher industry level human knowledge intensity comes from higher human intensity in the plants operating in that industry. The positive effects from industry-level human knowledge intensity can also be viewed as positive spillover effects from human capital of other plants, as argued in Wang and Chao (2008).

Plants operating in industries with higher entry rates (*EntryRate*) experienced shortened life durations, a similar finding also reported in Baggs (2005) which focuses on survival of Canadian manufacturing firms. In general, industries with higher entry rates signal that plant experimentation cost is cheaper there. Thus, more firms enter those industries to experiment, and those which are not successful exit. That is, higher entry rate leads to higher churning and higher exit rates. Higher entry rate also implies higher competition, and fierce competition leads to more deaths. On that latter explanation, the result is consistent with another measure of industry level competition, number of plants operating in an industry, a finding in Baldwin and Wang (2010).

[13] Most of the studies in the trade literature on trade-related spillovers do not control for FDI, however.

For plant level controls, those plants which are born large (*Birth_Size*) and stay large (*Rel_Size*) live longer. Larger plants are more competitive and they tend to survive, while small plants tend to die young, a common finding in the literature.

For those plants which experienced control changes live longer (*OC*), a similar finding in Baldwin and Wang (2010) and Bandick and Gorg (2010). The merger and acquisition literature documents two main motivations for plants to undergo control changes: synergistic motivations or managerial disciplinary motivations. Either motivation will make the acquired plants live longer by becoming stronger (synergistic takeovers) or less sick (managerial disciplinary motivations).

Plants born to experienced firms tend to outlive those born to new parents, a similar result reported in Disney et al. (2003) and Audretsch and Mahmood (1995). *Ceteris paribus*, plants born to experienced firms tend to experience a 6.4% higher duration than those born to new parents. However, this result is sensitive to inclusion of *NLWage*, to be discussed below.

Columns (3) and (4) add another plant-level control *NLWage*, wage ratio of nonproduction workers, for comparison with results from Columns (1) and (2). The results show plants with higher wage ratio of nonproduction workers live longer. This is as expected.[14]

The inclusion of *NLWage* does not affect the effects from the industry level controls, but primarily the significance level of *Multi_Plant*.[15] Once conditioning on plant human knowledge intensity, there is no significant difference on the survival between plants born to experienced firms or not. The different results with and without *NLWage* on *Multi_Plant* is the least likely to be caused by different sample size. The number of plants included in Column (3) account for 99.02% of plants in Column (1), and the number of observations in Column (3) also account for over 99% of those in Column (1). This result suggests plant characteristics, rather than their parent firms' experiences, are more important factors affecting plant survival. In a similar vein, Bernard and Bradford (2007) find that plants owned by multiunit firms and U.S. multinationals tend to live longer, but only conditioning on plant level covariates, the results are reversed.

[14] To a certain degree, higher wage ratio to non-production workers can come from two sources: higher wages to non-production workers and more non-production workers. It might be likely that increase in wage ratio to non-production workers solely comes from increases in the wages to non-production workers, not from increase in the proportion of non-production workers, though this case will not be the dominating one. However, using the ratio of non-production worker to total workers (*NLRatio*) instead of *NLWage* produces basically the same set of results. But *NLWage* is chosen because it better reflects plants' human knowledge intensity.

[15] The different results with and without *NLWage* on *Multi_Plant* is the least likely to be caused by different sample size. The number of plants included in Column (3) account for 99.02% of plants in Column (1), and the number of observations in Column (3) also account for over 99% of those in Column (1).

As to the shape of the hazard, the estimated delta (σ) is significantly greater than 1 (logσ is significantly greater than 0). That means a fattened error term, implying a decelerated hazard over time. On the other hand, estimated exp(BX) is significantly smaller than 1, leading to a decelerated hazard rate over time.

7. Sensitivity Analysis

In this section, I conduct a few sensitive analyses to see how robust the main results are. The sensitive analyses are designed to test the strength of inter-industry linkages—the necessary condition for FDI to exert influences across industries, the importance of FDI, and the long-term effects of FDI. The first two tests are primarily motivated by the construction of upstream FDI and downward FDI, and the third on is to compare how the factors affecting plants' survival change in the short-term and in the long-term. I now address each in turn.

7.1. Closely Related Industries

For most industries, they are often closely related with a limited number of industries as input suppliers or buyers for their products. I thus suspect that those closely related industries will be the driving forces to shape out the main results. To test this, I first rank the importance of upstream and downstream industries for a particular industry *j*, according to the average input and output shares over the sample period, and then retain the inter-industry economic linkages to only the top10 supplying industries and the top 10 purchasing industries. The new measures of $FDI^{Upstream}$ and $FDI^{Downstream}$ that originate only from the top 10 most important upstream and downstream industries for industry *j* are constructed as follows:

$$FDI_{j,t}^{Upstream\_top10} = \sum_{k \neq j} Input_{j,k,t} * FDI_{k,t}^{Own\_Industry} * D_k , \quad (10)$$

$$FDI_{j,t}^{Downstream\_top10} = \sum_{q \neq j} Output_{j,q,t} * FDI_{q,t}^{Own\_Industry} * D_q , \quad (11)$$

where D_k =1 if *k* is one of the top 10 input-suppliers, and 0 otherwise, and D_q =1 if *q* is one of the top 10 customers, and 0 otherwise.

Table 4 reports the corresponding results. Comparing the results with those in table 2, the coefficients and their significance levels on all the covariates are almost identical—that is, all of the main results hold. What this tells us is that plants are mostly affected by FDI in industries which the plants closely interact with, a result not surprising. As a side effect, the results here also sort of confirm pervious findings on the productivity effects of FDI in developing or transition economies that only FDI in downstream industries generate significant effects, due to the existence of only backward linkages between domestic firms and foreign affiliates.

7.2. FDI Spillovers and Plant Survival

Given that the magnitudes of $FDI^{Upstream}$ and $FDI^{Downstream}$ are affected both by changes in input-output shares, and by changes in the level of FDI, it will be reassuring to test that the level of FDI is the driving force in the main results, as input-output shares do not change as much as the level of FDI. To do so, I conduct a counterfactual experiment by building $FDI^{Upstream}$ and $FDI^{Downstream}$ indices using a fixed (the mean of the input-output shares across the sample period), rather than year-specific input-output shares, so that all the changes in $FDI^{Upstream}$ and $FDI^{Downstream}$ are caused by changes in the levels of FDI in upstream and downstream industries respectively. The new pair of the proxies for $FDI^{Upstream}$ and $FDI^{Downstream}$ are built as:

$$FDI_{j,t}^{Upstream\_fix} = \sum_{k \neq j} Input_{k,j} * FDI_{k,t}^{Own\_Industry}, \qquad (12)$$

$$FDI_{j,t}^{Downstream\_fix} = \sum_{q \neq j} Output_{q,j} * FDI_{q,t}^{Own\_Industry}, \qquad (13)$$

where $Input_{k,j}$ and $Output_{q,j}$ are the time –invariant (sample mean) input shares of industry *j* from industry *k* and output shares of industry *j* to industry *q* respectively.

Table 5 reports the associated results. Compared with the results in Table 2, the coefficients and significance levels on all the variables are quite similar, except a slightly smaller effect from $FDI^{Upstream}$ here. The new set of results indicates that FDI in upstream and downstream industries are important sources affecting plants' survival.

7.3. Long-term Effects of FDI and Censorship

Having a long coverage of plant-level data allows me the rare opportunity to test the long-term effects of FDI (and trade) and at the same time to test how heavy censorship affects the main results. Although I do not have information on plant's import and export status in the dataset, other studies (like Sui, 2010) documents that the majority of Canadian exporters are not born to be exporters—in that they become exporters after a few years in business. Also, given that over 50% of plants die within the first five years of life, it is of interests to see how FDI and trade affecting plants' survival for those plants which have been in business long enough to adjust to globalization. Since the mean durations of plants (with censorship) is 6.7 years, I then decide to exclude the last 7 or 8 cohorts from the main sample. In other words, I retain plants born between 1973 and 1990, or 1991 for 18 or 19 cohorts, so that each cohort of plants has at least six years of data. Retaining only those longer cohorts not only avoids heavy censorships, but also helps examine the long-term effects of FDI and trade, by purging out the initial churning effects on survival. For this sub-sample, the kernel density distribution of plants' maximum durations is very similar to that of the whole sample (Figure 4), and then the lognormal AFT type model is still applied here. Table 6 shows the corresponding main results.

Column (1) in Table 6 shows the results with cohorts of 73 and 91, and Column (2) adds other industry level controls and also by restricting the cohorts up to cohort 90 for longer coverage of data for each cohort. The rest of the two columns add *NLShare* for cohorts 73 to 90. Comparing the results here with those in Table 2, it is clear that all of the conclusions reached previously hold here. This implies that, on the one hand, uneven censorship does not affect the main results, and on the other hand, the main results are primarily driven by the longer cohorts.

The only notable difference for the longer cohorts lies in the industry control of export shares. For the longer cohorts, exports generate significant (at the 1 percent level) and positive effects on plants' durations. Results in Column (2) and Column (4) in Table 6 suggest that if industry export share increases from 0 to 1, plants' expected durations increase in the range by 11.30% to 13.10%. The positive benefits associated with accessing to foreign markets are only materialized for longer cohorts, which could be explained by the nature of Canadian exporting firms. Sui (2010) groups Canadian small and medium-sized export manufacturing firms as *born global* (firms become exports within the first two years of their life and have exported no less than 25% of its revenue during the first year of their export activity**)** and *gradual global* (the rest of the firms in her sample) based on a dataset of Canadian exporters (with at least CAD$2000 of exports per year). She reports that between 1997 and 2005, only about 25% of firms in her dataset are born global, and the remaining 75% are gradual global. Gradual global firms first earn business experiences, pass the relatively higher risky earlier years, and then start to expand their business overseas by exporting to other countries. Thus gradual global plants/firms which have already been in business many years are better at reap the benefits associated with accessing to foreign markets, and thus live longer.

I also conduct a couple of other sensitivity analysis for the longer cohorts to see how the results change by limiting the inter-industry relations to the top 10 closely related industries, and by using the fixed inter-industry relations to construct $FDI^{Upstream}$ and $FDI^{Downstream}$, just as for the pooled sample. The respective results are documented in Table 7. Comparing the results in Table 7 and those in Table 6, it is clear that they are almost identical, indicating that, as for the pooled sample, the effects of FDI through inter-industry linkages are primarily driven by those closely-linked industries, and by the level of FDI in upstream and downstream industries.

8. Conclusions

FDI affiliates in a host country interact with its indigenous plants in many ways—as competitors, input suppliers and customers. FDI affiliates compete for market shares with domestic-owned plants in the same industry (the so called intra-industry economic linkages), they supply intermediate inputs to domestic-owned plants (the upstream inter-industry linkages), and they purchase products produced by domestic-owned plants (the downstream inter-industry linkages). Through these intra- and inter-industry economic linkages, FDI generates significant impact to indigenous plants. The impacts can be shown through productivity changes, employment changes and ultimately through plant death/survival. This paper examines the effects of FDI on the survival of domestically-born manufacturing plants in Canada.

Departing from the productivity or employment effects of FDI on domestic-owned plants, and using the plant-level data in a developed country like Canada, the study offers a few advantages. First, plant death/survival directly affects industry dynamics, and thus focusing on death/survival offers some perspectives on how FDI affects industry dynamics in the host country. Second, FDI presence in Canada is both mature and large, and inter-industry linkages between domestic-plants and FDI affiliates are extensive. Thus using Canadian data provide a good opportunity to study the upstream and downstream effects of FDI. Third, the data used here cover nearly three decades from the 1970s to the 1990s, long enough to study the long-term effects of FDI on plant survival.

The study finds that the presence of FDI in Canada exerts significant and overall positive effects on its indigenous plants. The indigenous Canadian-owned plants tend to have shorter lives (and more deaths) due to competition from FDI affiliates operating in the same industry, but benefit from FDI affiliates operating in upstream and downstream industries through inter-industry economic linkages. The positive benefits outweigh the negative competition effects, resulting in net positive impact on the survival of indigenous Canadian-owned plants. Not surprisingly, the effects of FDI overwhelmingly come from those industries with which plants closely interact as input suppliers or downstream customers. Although inter-industry linkages are pre-requirements for FDI in upstream and downstream industries to exert impacts on the survival of domestic-owned plants, the levels of FDI are the driving forces behind the inter-industry effects of FDI.

References

Aitken, Brian J. and Ann E. Harrison. 1999. "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela," *American Economic Review*, 89: 605-618.

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, John R. and Alice Peters. 2001. "Innovation and Connectivity: The Nature of Market Linkages and Innovation Networks in Canadian Manufacturing Industries," Statistics Canada Puplication catalogue number 11F0019MPE No. 165.

Baldwin, John R. and Yanling Wang. 2010a. "Plant Size, Nationality and Ownership Changes," Economic Analysis (EA) Research Paper Series No. 60. Statistics Canada.

Baldwin, John R. and Yanling Wang. 2010b. "Foreign Acquisitons, Domestic Acquisitions and Plant Survival," Memo.

Baldwin, John R., Bob Gibson, and Yanling Wang. 2009. "Control Changes in Canadian Manufacturing Plants: Disciplining Failure and Exploiting Synergies," Ottawa. Economic Analysis (EA) Research Paper Series No. 56. Statistics Canada.

Bandick, Roger and Holger Görg. 2010. "Foreign acquisition and plant survival," *Canadian Journal of Economics*, 43(2): *547–573.*

Bernard, Andrew and Sjoholm, Frerik. 2003. "Foreign Owners and Plant Survival," NBER Working Paper 10039.

Bernard, Andrew B and Jensen J Bradford. 2007. "Firm Structure, Multinationals, and Manufacturing Plant Deaths," *Review of Economics and Statistics*, 89(2): 193-204.

Blalock, Garrick and Paul Gertler. 2008. "Welfare Gains from Foreign Direct Investment through Technology Transfer to Local Suppliers," *Journal of International Economics*, 74:401-21.

Branstetter, Lee. 2005. "Is Foreign Direct Investment a Channel of Knowledge Spillovers? Evidence from Japan's FDI in the United States," *Journal of International Economics*, 68(2): 325-344.

Burke, Andrew, Holger Gorg and Aoife Hanley. 2008. "The Impact of Foreign Direct Investment on New Firm Survival in the UK: Evidence for Static versus Dynamic Industries," *Small Business Economics*, 31(4): 395-407.

Bwalya, Samuel Mulenga. 2006. "Foreign Direct Investment and Technology Spillovers: Evidence from Panel Data Analysis of Manufacturing Firms in Zambia," *Journal of Development Economics*, 81: 514-26.

Caves, Richard. E, 2007. *Multinational Enterprise and Economic Analysis*, 3rd edition, Cambridge University Press.

Chuang, Yih-Chyi. and Chi-Mei Li. 1999. "Foreign Direct Investment, R&D and Spillover Efficiency: Evidence from Taiwan's Manufacturing Firms," *The Journal of Development Studies*, 35(4): 117-137.

Coe, David T and Elhanan Helpman. 1995. "International R&D Spillovers," *European Economic Review,* 39: 859-87.

Disney, Richard, Jonathan Haskel and Ylva Heden. 2003. "Entry, Exit and Establishment Survival in UK Manufacturing", *Journal of Industrial Economics*, 51(1): 91-112.

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.

Falvey Rod, Neil Foster and David Greenaway. 2004. "Imports, Exports, Knowledge Spillovers and Growth," *Economic Letters,* 85: 209-13.

Frankel, Jeffrey A. and David Romer. 1999. "Does Trade Cause Growth?" *American Economic Review,* 89(3): 379-99.

Gera, Surendra, Wulong Gu and Frank C. Lee. 1999. "Foreign Direct Investment and Productivity Growth: the Canadian Host-Country Experience," Industry Canada Working Paper No. 30.

Girma Sourafel and Katharine Wakelin. 2007. "Local Productivity Spillovers from Foreign Direct Investment in the U.K. Electronics Industry," *Regional Science and Urban Economics,* 37: 399-412.

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 Yundan Gong. 2008. "Putting People First? Chinese State-Owned Enterprises' Adjustment to Globalisation," *International Journal of Industrial Organization,* 26(2): 573-85.

Gorg, Holger and David Greenaway. 2004. "Much Ado about Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment?" *The World Bank Research Observer,* 19(2): 171-97.

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.

Grossman, Gene and Elhanan Helpman. 1991. *Innovation and Growth in the World Economy*. Cambridge, MA, MIT Press

Haddad, Mona and Ann Harrison. 1993. "Are There Positive Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morocco," *Journal of Development Economics*, 42(1): 51-74.

Harris, Richard and Catherine Robinson. 2004. “Productivity Impacts and Spillovers from Foreign Ownership in the United Kingdom,” *National Institute Economic Review*, 187: 58-75.

Jabbour, Liza and Jean Louis Mucchielli. 2007. “Technology Transfer through Vertical Linkages: The Case of the Spanish Manufacturing Industry,” *Journal of Applied Economics*, 10(1): 115-36.

Javorcik Beata S. and Mariana Spatareanu. 2008. “To Share or not to Share: Does Local Participation Matter for Spillovers from Foreign Direct Investment?” *Journal of Development Economics*, 85(1-2): 194-217.

Javorcik, Beata S. 2004. “Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages,” *American Economic Review*, 94(3): 605-627.

Jordaan, Jacob A. 2008. “Intra- and Inter-Industry Externalities from Foreign Direct Investment in the Mexican Manufacturing Sector: New Evidence from Mexican Regions,” *World Development*, 36(12): 2838-54.

Jovanovic, Boyan. 1982. “Selection and the Evolution of Industry,” *Econometrica*, 50(3): 649-70.

Keller, Wolfgang and Stephen R. Yeaple. 2009. “Multinational Enterprises, International Trade and Productivity Growth: Firm-level Evidence from the United States,” *Review of Economics and Statistics*, 91(4): 821-31.

Keller, Wolfgang. 2002a. “Geography and Channels of Diffusion at the World’s Technology Frontier,” *American Economic Review*, 92(1): 120-42.

Keller, Wolfgang. 2002b. “Trade and the Transmission of Technology,” *Journal of Economic Growth*, 7: 5-24.

Lileeva, Alla. 2010. ‘The Benefits to Domestically-Owned Plants from Inward Direct Investment: The Role of Vertical Linkages,’ *Canadian Journal of Economics*, 43(2): 574–603.

Marcin, Kolasa. 2008. “How does FDI Inflow Affect Productivity of Domestic Firms? The Role of Horizontal and Vertical Spillovers, Absorptive Capacity and Competition,” *Journal of International Trade & Economic Development*, 17(1): 155-73.

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.

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 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.

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.

Olley, Steven G. and Arial Pakes. 1992. “The Dynamics of Productivity in the Telecommunications Industry,” *Econometrica*, 64(6): 1263-1297.

Pack, Howard and Kamal Saggi. 2001. “Vertical Technology Transfer via International Outsourcing,” Journal of Development Economics, 65(2): 389-415.

Persson, Helena, 2004. “The Survival and Growth of New Establishments in Sweden, 1987-1995”, *Small Business Economics*, 23(5): 423-40.

Schiff, Maurice and Yanling Wang. 2006. “North-South and South-South Trade-related Technology Diffusion: An Industry Level Analysis of Direct and Indirect Effects,’ *Canadian Journal of Economics*, 39(3): 831-44.

Schiff, Maurice and Yanling Wang. 2008. “North-South and South-South Trade-related Technology Diffusion: How Important Are They in Improving TFP Growth?” *Journal of Development Studies*, 44(1): 49-59.

Segarra, Agusti and Maria Callejon. 2002. “New Firms’ Survival and Market Turbulence: New Evidence from Spain,” *Review of Industrial Organization*, 20(1): 1-14.

Wang, Yanling and Chiawen Chao. 2008. “‘Spillovers and Productivity’: the Case of Taiwanese High-Tech Firms,” *Contemporary Economic Policy*, 26(2): 248-58.

Wang, Yanling. 2010. “FDI and Productivity Growth: The Role of Inter-Industry Linkages,” *Canadian Journal of Economics*. Forthcoming in the November Issue.

Wooster, Rossitza B. and David S. Deibel. 2006. “Productivity Spillovers from Foreign Direct Investment in Developing Countries: A Meta-Regression Analysis,” SSRN: http://ssrn.com/abstract=898400. Forthcoming in *Review of Development Economics.*

Table 1. Summary Statistics of the Mean Variables

	Variable	Mean	Std. Dev.	Min	Max
Plant Level	***Birth_Size***	**12.45**	**32.88**	**0**	**3156**
	Rel_Size	**1.44**	**3.00**	**0**	**181**
	NLWage	**0.10**	**0.19**	**0**	**1**
Industry Level	$FDI^{Own\_Industry}$	**0.30**	**0.22**	**0.01**	**0.999**
	$FDI^{Upstream}$	**0.16**	**0.16**	**0.001**	**0.84**
	$FDI^{Downstream}$	**0.22**	**0.10**	**0.01**	**0.70**
	Mshare	**0.65**	**1.42**	**0.002**	**0.88**
	Xshare	**0.33**	**0.65**	**0.002**	**0.54**
	Ind_KLRatio	**0.44**	**0.27**	**-0.54**	**5.84**
	Ind_NLWage	**0.08**	**0.07**	**0**	**0.56**
	EntryRate	**0.088**	**0.065**	**0**	**0.53**

Figure 1: True Death Rates of Each Cohort Over Time

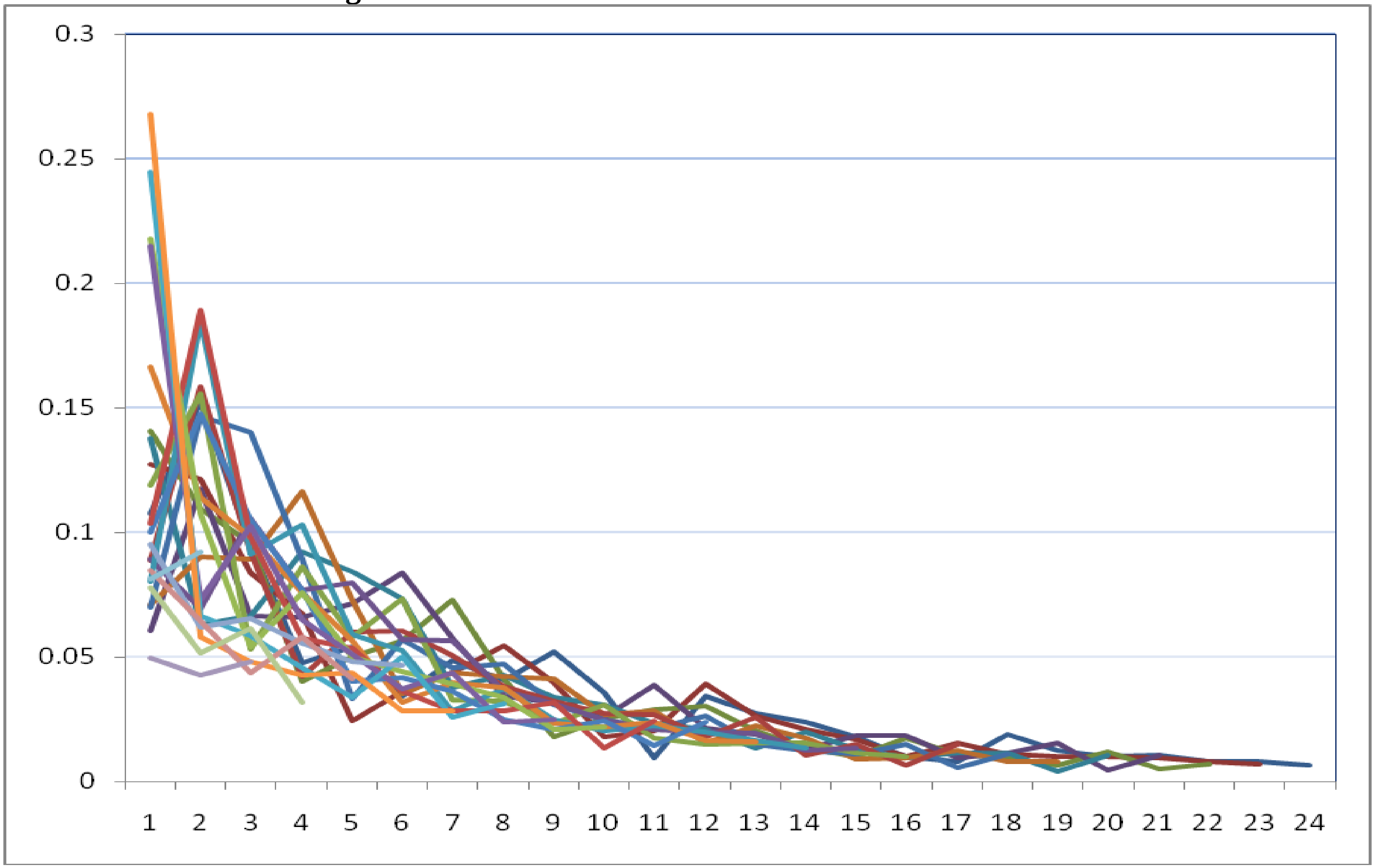

Figure 2: Non-Parametric Survival Estimate

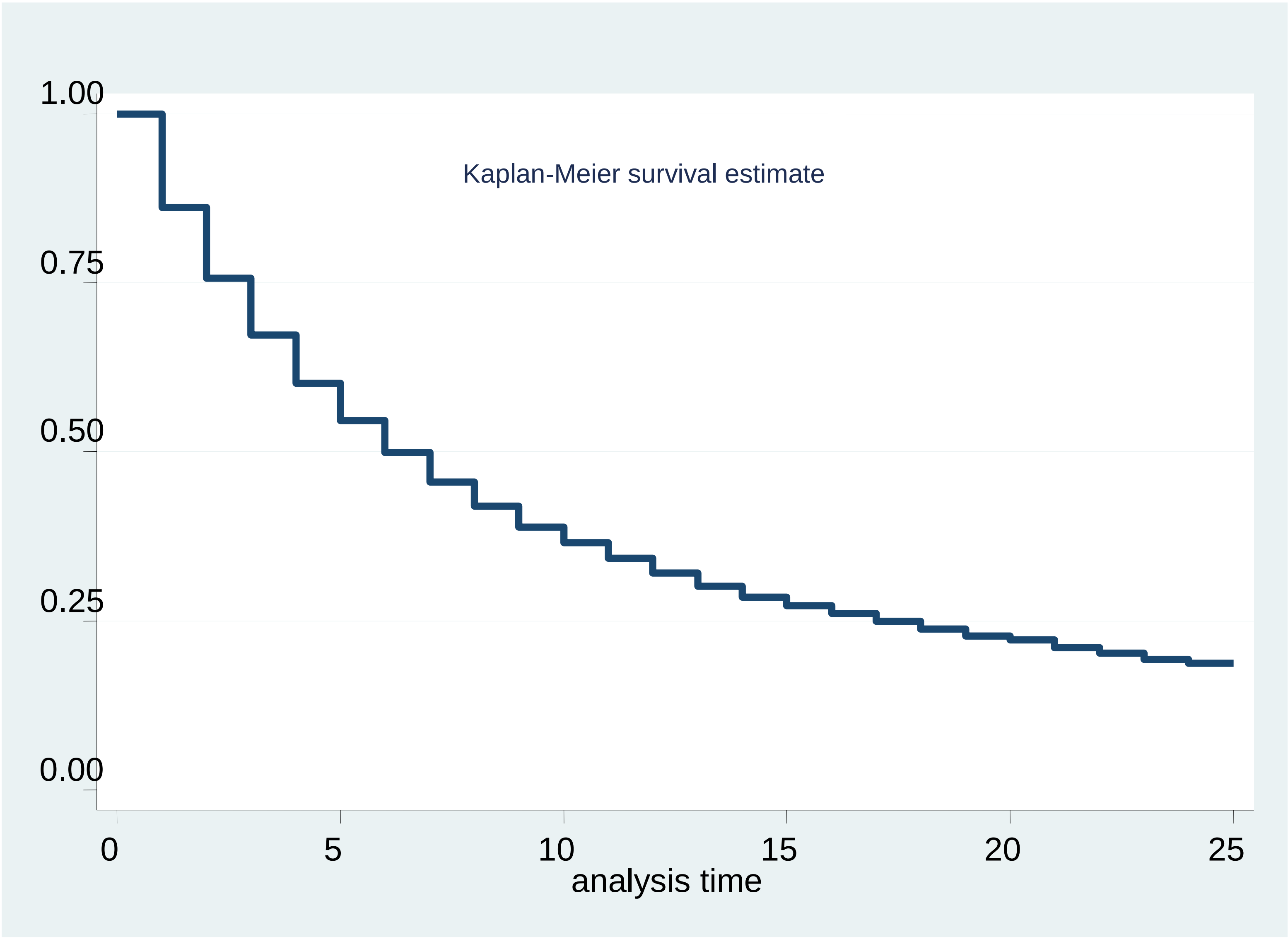

Figure 3: Shipment Share of FDI-controlled Affiliates in Canada

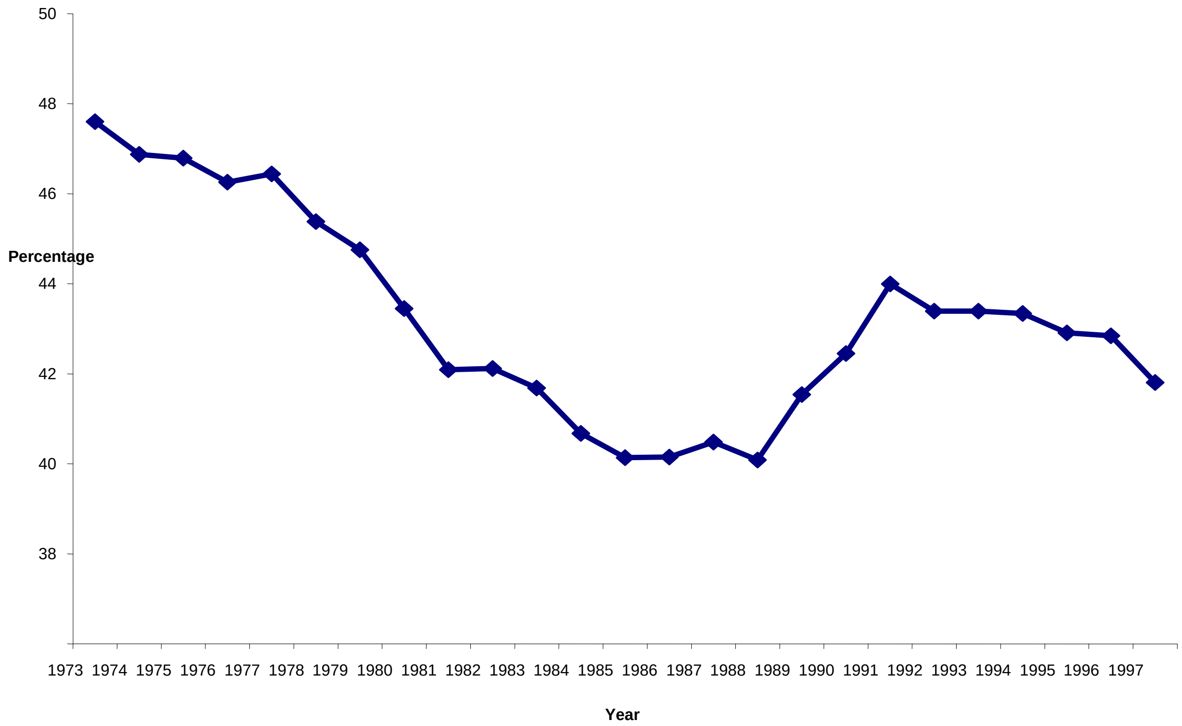

Figure 4: Density Distribution of Plant Durations

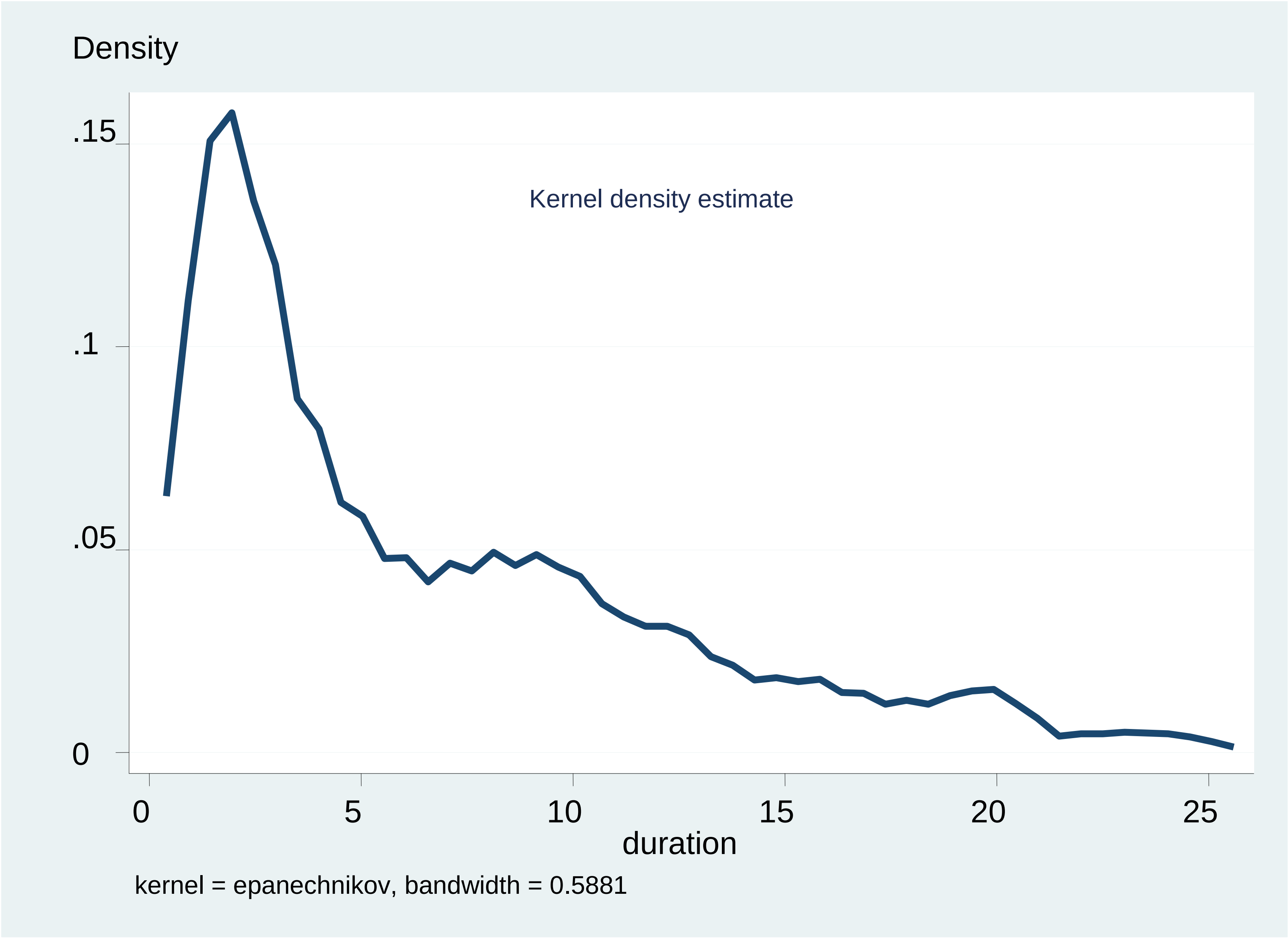

Table 2: The Main Results

Variables	**(1)**	**(2)**	**(3)**	**(4)**
Variables of Main Interests:				
$FDI^{Own\_Industry}$	**-0.022**	**-0.284*** **	**-0.055**	**-0.303*** **
	(0.47)	*(6.61)*	*(1.18)*	*(7.00)*
$FDI^{Upstream}$	**0.167*** **	**0.422*** **	**0.213*** **	**0.453*** **
	(3.33)	*(9.17)*	*(4.22)*	*(9.82)*
$FDI^{Downstream}$	**0.379*** **	**0.572*** **	**0.271*** **	**0.472*** **
	(4.67)	*(7.68)*	*(3.33)*	*(6.31)*
Other Controls at Industry Level:				
Xshare	**0.020**	**0.043**	**0.013**	**0.036**
	(0.58)	*(1.33)*	*(0.43)*	*(1.19)*
Mshare	**0.006**	**-0.001**	**0.007**	**0.000**
	(0.53)	*(0.09)*	*(0.57)*	*(0.00)*
Ind_KLRatio		**0.102*** **		**0.090*** **
		(3.76)		*(3.33)*
Ind_NLWage		**3.784*** **		**3.678*** **
		(20.90)		*(20.31)*
EntryRate		**-2.966*** **		**-2.873*** **
		(40.60)		*(38.60)*
Plant Level Controls:				
Birth_Size	**0.002*** **	**0.001*** **	**0.001*** **	**0.001*** **
	(4.60)	*(3.49)*	*(3.64)*	*(2.69)*
Rel_Size	**0.085*** **	**0.083*** **	**0.076*** **	**0.076*** **
	(9.42)	*(9.71)*	*(9.30)*	*(9.58)*
OC	**0.289*** **	**0.212*** **	**0.235*** **	**0.175*** **
	(6.79)	*(5.57)*	*(5.64)*	*(4.68)*
Multi_Plant	**0.079** **	**0.064** **	**0.005**	**0.008**
	(2.49)	*(2.24)*	*(0.16)*	*(0.29)*
NLWage			**0.715*** **	**0.529*** **
			(17.44)	*(14.29)*
sigma	**1.181*** **	**1.083*** **	**1.175*** **	**1.080*** **
	(44.08)	*(18.61)*	*(42.37)*	*(18.01)*
Number of plants	**47,638**	**47,638**	**47,173**	**47,173**
Number of deaths	**30,359**	**30,359**	**29,611**	**29,611**
Number of Obs	**308865**	**308865**	**306,347**	**306,347**
Ward chi2	**2236.66**	**5043.65**	**2508.12**	**5231.44**

Note: Regression results on constant, industry dummies and cohort dummies are not reported due to space limitations. Figures in parentheses are robust t-statistics. *** and ** represent the significance levels of 1 and 5 percent respectively.

Table 3: Estimated Effects of FDI on Plants' Durations

Ind Code	By FDI In Own Industry…….	Change in $FDI^{Own\_Industry}$: Percentage Points from 1973 to 1997	Effect on plants expected duration (%): =percentage points change in $FDI^{Own\_Industry}$*(-.284)
	Negative Changes: Top Three		
73	Small electrical appliance industry	-46.10	-13.09
76	Radio and Record Player Industry	-39.73	-11.28
86	Refined petroleum and coal products industry	-36.86	-10.47
	Positive Changes: Top Three		
79	Communication and Energy Industry	41.50	11.79
19	Vegetable oil mills	56.04	15.92
23	Brewery products industry	67.00	19.03

Ind Code	By Upstream FDI…….	Change in $FDI^{Upstream}$: Percentage Points from 1973 to 1997	Effect on plants expected duration (%): =percentage points change in $FDI^{Upstream}$*.422
	Negative Changes: Top Three		
67	motor vehicle industry	-18.76	-7.92
87	industrial chemicals industry	-18.61	-7.85
26	rubber products industry	-17.81	-7.52
	Positive Changes: Top Three		
31	misc. textile products industry	11.97	5.05
53	Copper and alloy rolling, casting and extruding industry	13.05	5.51
30	Broad knitted fabric industry	17.74	7.49

Ind Code	By Downstream FDI……	Change in $FDI^{Downstream}$: Percentage Points from 1973 to 1997	Effect on Plant durations: (%) = percentage points change in $FDI^{Downstream}$*.572
	Negative Changes: Top Three		
77	Communication and other electronics equipment industry	-23.92	-13.68
43	Asphalt roofing industry	-20.95	-11.98
50	Iron foundries	-19.24	-11.01
	Positive Changes: Top Three		
74	major appliance industry	17.10	9.78
95	jewellery and precious metal industry	20.94	11.98
72	miscellaneous transportation equipment industry	35.42	20.26

Table 4: The Most Important Customers and Suppliers

Variables	(1)	(2)	(3)	(4)
Variables of Main Interests:				
$FDI^{Own\_Industry}$	**-0.023**	**-0.297*****	**-0.0006**	**-0.315*****
	(0.50)	*(6.88)*	*(1.20)*	*(7.26)*
$FDI^{Upstream\_top10}$	**0.178*****	**0.460*****	**0.0023*****	**0.499*****
	(3.35)	*(9.44)*	*(4.34)*	*(10.19)*
$FDI^{Downstream\_top10}$	**0.373*****	**0.464*****	**0.0026*****	**0.362*****
	(4.25)	*(5.84)*	*(2.96)*	*(4.53)*
Other Controls at Industry Level:				
Xshare	**0.009**	**0.025**	**0.0063**	**0.021**
	(0.29)	*(0.85)*	*(0.21)*	*(0.76)*
Mshare	**0.012**	**0.007**	**0.0102**	**0.006**
	(0.99)	*(0.63)*	*(0.89)*	*(0.60)*
Ind_KLRatio		**0.101*****		**0.089*****
		(3.74)		*(3.30)*
Ind_NLWage		**3.742*****		**3.656*****
		(20.75)		*(20.26)*
EntryRate		**-2.964*****		**-2.870*****
		(40.62)		*(38.61)*
Plant Level Controls:				
Birth_Size	**0.002*****	**0.001*****	**0.0014*****	**0.001*****
	(4.60)	*(3.45)*	*(3.64)*	*(2.64)*
Rel_Size	**0.085*****	**0.083*****	**0.0760*****	**0.076*****
	(9.41)	*(9.71)*	*(9.30)*	*(9.58)*
OC	**0.288*****	**0.212*****	**0.2339*****	**0.174*****
	(6.78)	*(5.55)*	*(5.63)*	*(4.65)*
Multi_Plant	**0.078****	**0.063****	**0.0044**	**0.007**
	(2.47)	*(2.20)*	*(0.14)*	*(0.24)*
NLWage			**0.7160*****	**0.534*****
			(17.48)	*(14.41)*
sigma	**1.181*****	**1.083*****	**1.174*****	**1.080*****
	(43.98)	*(18.51)*	*(42.26)*	*(17.86)*
	47,638	**47,638**	**47,173**	**47,173**
Number of deaths	**30,359**	**30,359**	**29,611**	**29,611**
Number of Obs	**308865**	**308865**	**306,347**	**306,347**
Ward chi2	**2233.33**	**5035.59**	**2509.06**	**5234.07**

Note: Regression results on constant, industry dummies and cohort dummies are not reported due to space limitations. Figures in parentheses are robust t-statistics. *** and ** represent the significance levels of 1 and 5 percent respectively.

Table 5: Fixed Input-Output Shares

Variables	(1)	(2)	(3)	(4)
Variables of Main Interests:				
$FDI^{Own\_Industry}$	**-0.020**	**-0.281*** **	**-0.053**	**-0.300*** **
	(0.43)	*(6.53)*	*(1.15)*	*(6.91)*
$FDI^{Upstream\_fix}$	**0.031**	**0.316*** **	**0.083**	**0.353*** **
	(0.60)	*(6.54)*	*(1.58)*	*(7.26)*
$FDI^{Downstream\_fix}$	**0.366*** **	**0.565*** **	**0.251*** **	**0.460*** **
	(4.31)	*(7.23)*	*(2.96)*	*(5.87)*
Other Controls at Industry Level:				
Xshare	**0.018**	**0.043**	**0.011**	**0.035**
	(0.52)	*(1.28)*	*(0.35)*	*(1.13)*
Mshare	**0.008**	**-0.0003**	**0.009**	**0.001**
	(0.68)	*(0.03)*	*(0.73)*	*(0.07)*
Ind_KLRatio		**0.098*** **		**0.087*** **
		(3.65)		*(3.22)*
Ind_NLWage		**3.668*** **		**3.562*** **
		(20.11)		*(19.52)*
EntryRate		**-2.975*** **		**-2.884*** **
		(40.67)		*(38.70)*
Plant Level Controls:				
Birth_Size	**0.002*** **	**0.001*** **	**0.001*** **	**0.001*** **
	(4.59)	*(3.48)*	*(3.61)*	*(2.66)*
Rel_Size	**0.085*** **	**0.083*** **	**0.076*** **	**0.076*** **
	(9.43)	*(9.73)*	*(9.31)*	*(9.60)*
OC	**0.288*** **	**0.213*** **	**0.234*** **	**0.176*** **
	(6.76)	*(5.58)*	*(5.62)*	*(4.69)*
Multi_Plant	**0.079** **	**0.065** **	**0.005**	**0.009**
	(2.49)	*(2.24)*	*(0.17)*	*(0.30)*
NLWage			**0.714*** **	**0.531*** **
			(17.40)	*(14.28)*
sigma	**1.181*** **	**1.0852*** **	**1.175*** **	**1.083*** **
	(44.12)	*(19.09)*	*(42.50)*	*(18.54)*
Number of plants	**47,638**	**47,638**	**47,173**	**47,173**
Number of deaths	**30,359**	**30,359**	**29,611**	**29,611**
Number of Obs	**308865**	**308865**	**306,347**	**306,347**
Ward chi2	**2222.17**	**4956.64**	**2488.29**	**5138.16**

Note: Regression results on constant, industry dummies and cohort dummies are not reported due to space limitations. Figures in parentheses are robust t-statistics. *** and ** represent the significance levels of 1 and 5 percent respectively.

Figure 5: Kernel Density Distribution for Cohorts 73 to 90

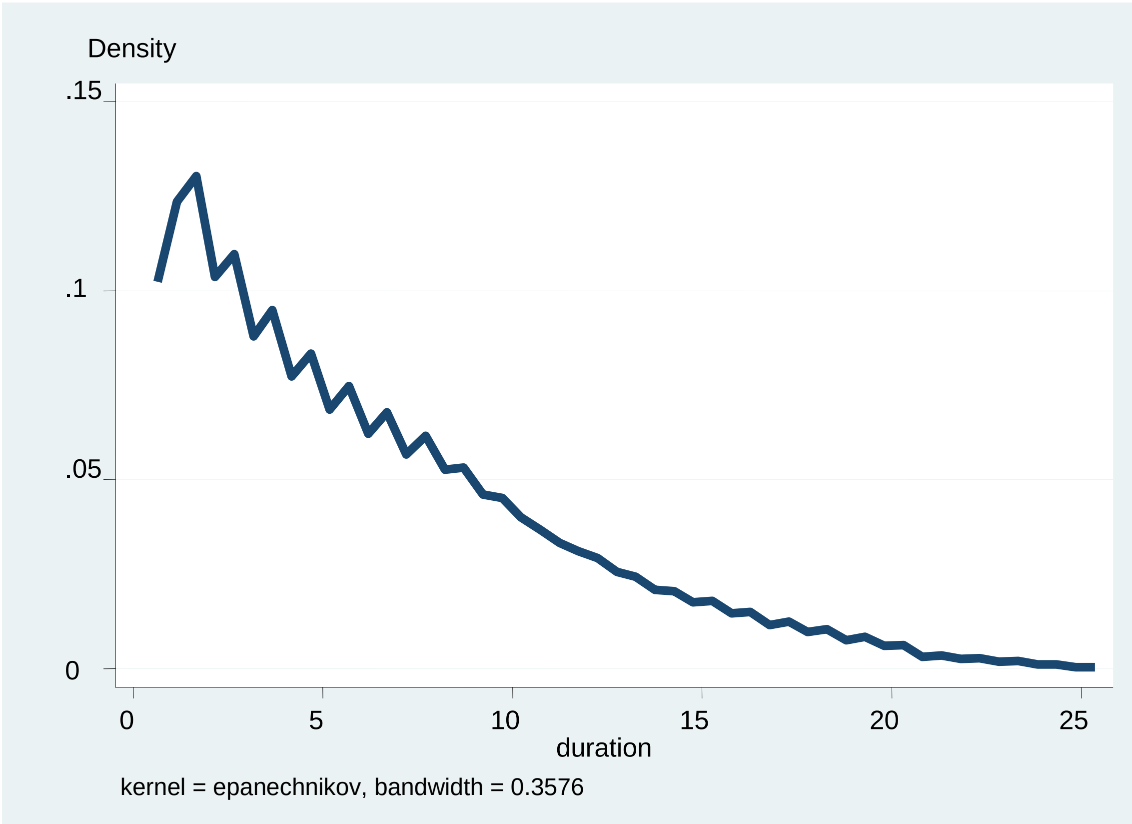

Table 6: The Main Results—Long Cohorts

Variables	(1)	(2)	(3)	(4)
Variables of Main Interests:				
$FDI^{Own\_Industry}$	**0.021**	**-0.265*** **	**-0.019**	**-0.284*** **
	(0.44)	*(5.86)*	*(0.39)*	*(6.22)*
$FDI^{Upstream}$	**0.080**	**0.372*** **	**0.133** **	**0.389*** **
	(1.48)	*(7.68)*	*(2.49)*	*(7.95)*
$FDI^{Downstream}$	**0.615*** **	**0.737*** **	**0.488*** **	**0.636*** **
	(7.05)	*(9.46)*	*(5.61)*	*(8.09)*
Other Controls at Industry Level:				
Xshare	**0.132*** **	**0.131*** **	**0.108*** **	**0.113*** **
	(3.08)	*(3.62)*	*(2.78)*	*(3.33)*
Mshare	**-0.013**	**-0.015**	**-0.010**	**-0.011**
	(0.99)	*(1.28)*	*(0.76)*	*(0.97)*
Ind_KLRatio		**0.080*** **		**0.059** **
		(2.74)		*(1.99)*
Ind_NLWage		**4.183*** **		**4.104*** **
		(21.41)		*(21.01)*
EntryRate		**-2.649*** **		**-2.534*** **
		(33.77)		*(31.61)*
Plant Level Controls:				
Birth_Size	**0.002*** **	**0.002*** **	**0.002*** **	**0.001*** **
	(4.90)	*(3.82)*	*(3.71)*	*(2.87)*
Rel_Size	**0.095*** **	**0.092*** **	**0.084*** **	**0.083*** **
	(10.40)	*(10.79)*	*(10.23)*	*(10.53)*
OC	**0.232*** **	**0.153*** **	**0.170*** **	**0.109*** **
	(5.14)	*(3.81)*	*(3.85)*	*(2.75)*
Multi_Plant	**0.085** **	**0.078** **	**-0.001**	**0.003**
	(2.49)	*(2.53)*	*(0.03)*	*(0.08)*
NLWage			**0.830*** **	**0.625*** **
			(19.02)	*(15.82)*
sigma	**1.176*** **	**1.081*** **	**1.168*** **	**1.077*** **
	(41.79)	*(17.76)*	*(39.45)*	*(16.67)*
Number of plants	**40367**	**40829**	**39915**	**39915**
Number of deaths	**29120**	**29301**	**28384**	**28384**
Number of Obs	**288834**	**291338**	**286379**	**286379**
Ward chi2	**1970.37**	**4173.50**	**2390.57**	**4502.80**

Note: Regression results on constant, industry dummies and cohort dummies are not reported due to space limitations. Figures in parentheses are robust t-statistics. *** and ** represent the significance levels of 1 and 5 percent respectively. Cohorts included in column (1) are from 73 to 91, and from 73 to 90 in all other Columns.

Table 7: Other Sensitivity Analysis—Long Cohorts

Variables	Top 10 Closely-related industries (1)	(2)	Fixed input-output shares (3)	(4)
Variables of Main Interests:				
$FDI^{Own\_Industry}$	**-0.277*****	**-0.296*****	**-0.266*****	**-0.284*****
	(6.12)	*(6.45)*	*(5.89)*	*(6.22)*
$FDI^{Upstream}$	**0.405*****	**0.426*****	**0.273*****	**0.298*****
	(7.87)	*(8.19)*	*(5.39)*	*(5.81)*
$FDI^{Downstream}$	**0.648*****	**0.553*****	**0.747*****	**0.644*****
	(7.80)	*(6.60)*	*(9.09)*	*(7.80)*
Other Controls at Industry Level:				
Xshare	**0.100*****	**0.087*****	**0.137*****	**0.119*****
	(3.10)	*(2.79)*	*(3.58)*	*(3.34)*
Mshare	**-0.004**	**-0.001**	**-0.016**	**-0.012**
	(0.31)	*(0.12)*	*(1.34)*	*(1.05)*
Ind_KLRatio	**0.084*****	**0.062****	**0.076*****	**0.055***
	(2.88)	*(2.11)*	*(2.61)*	*(1.85)*
Ind_NLWage	**4.118*****	**4.058*****	**4.104*****	**4.033*****
	(21.18)	*(20.87)*	*(20.80)*	*(20.44)*
EntryRate	**-2.649*****	**-2.533*****	**-2.652*****	**-2.538*****
	(33.82)	*(31.64)*	*(33.76)*	*(31.63)*
Plant Level Controls:				
Birth_Size	**0.002*****	**0.001*****	**0.002*****	**0.001*****
	(3.80)	*(2.85)*	*(3.81)*	*(2.85)*
Rel_Size	**0.092*****	**0.083*****	**0.092*****	**0.083*****
	(10.79)	*(10.53)*	*(10.80)*	*(10.54)*
OC	**0.153*****	**0.108*****	**0.153*****	**0.109*****
	(3.80)	*(2.72)*	*(3.80)*	*(2.74)*
Multi_Plant	**0.076****	**0.000**	**0.078****	**0.003**
	(2.48)	*(0.01)*	*(2.54)*	*(0.09)*
NLWage		**0.630*****		**0.625*****
		(15.95)		*(15.76)*
sigma	**1.081*****	**1.076*****	**1.083*****	**1.078*****
	(17.71)	*(16.56)*	*(18.05)*	*(16.98)*
Number of plants	**40829**	**39915**	**40829**	**39915**
Number of deaths	**29301**	**28384**	**29301**	**28384**
Number of Obs	**291338**	**286379**	**291338**	**286379**
Ward chi2	**4164.54**	**4502.60**	**4098.52**	**4427.77**

Note: Regression results on constant, industry dummies and cohort dummies are not reported due to space limitations. Figures in parentheses are robust t-statistics. *** and ** represent the significance levels of 1 and 5 percent respectively. Cohorts are included in the subsample are from 73 to 90.

Appendix

There are eighty (84) manufacturing industries used in the study at the Historical Link level of classification according to Statistics Canada. They are coded as follows. L14—Meat and meat products industry; L15—Fish products industry; L16—Fruit and vegetable industry; L17—Dairy products industry; L18—Feed, cane, beet sugar and miscellaneous food product industry; L19—Vegetable oil mills (except corn oil); L20—Biscuit, bread and other bakery products industry; L21—Soft drink industry; L22—Distillery products industry; L23—Brewery products industry; L24—Wine industry; L25—Tobacco products industry; L26—Rubber products industry; L27—Plastic products industry; L28—Leather, footwear and allied products industry.; L29—Man-made fibre yarn, wool yarn and woven cloth industry; L30—Broad knitted fabric industry; L31—Miscellaneous textile products industry; L32—Carpet, mat and rug industry; L33—Clothing industry; L34—Sawmill, planning mill and shingle mill product industry; L35—Veneer and plywood industry; L36—Sash, door and other millwork industry; L37—Wooden box and coffin industry; L38—Other wood industry; L39—Household furniture industry; L40—Office furniture industry; L41—Other furniture and fixture industry; L42—Pulp and paper industry; L43—Asphalt roofing industry; L44—Paper box and bag industry; L45—Other converted paper products industry; L46—Printing and publishing industry; L47—Platemaking, typesetting and bindery industry.; L48—Primary steel industry; L49—Steel pipe and tube industry; L50—Iron foundries; L51—Non-ferrous metal smelting and refining industry; L52—Aluminum rolling, casting and extruding industry; L53—Copper and alloy rolling, casting and extruding industry; L54—Other rolling, casting and extruding non-ferrous metal product industry; L55—Power boiler and structural metal industry; L56—Ornamental and architectural metal product industry; L57—Stamped, pressed and coated metal prod. industry; L58—Wire and wire products industry; L59—Hardware, tool and cutlery industry; L60—Heating equipment industry; L61—Machine shop industry; L62—Other metal fabricating industry; L63—Agricultural implement industry; L64—Commercial refrigerator and air conditioner equipment industry; L65—Other machinery and equipment industry; L66—Aircraft and aircraft parts industry; L67—Motor vehicle industry; L68—Truck and bus body and trailer industry; L69—Motor vehicle parts and accessories industry; L70—Railroad rolling stock industry; L71—Shipbuilding and repair industry; L72—Misc. transportation equipment industry; L73—Small electrical appliance industry; L74—Major appl. industry (electric and non-electric); L75—Other electrical and electronic product industry; L76—Radio and Record Player Industry; L77—Communication & other electronic equipment industry; L78—Office, store and business machine industry; L79—Communication and Energy Industry; L80—Clay products industry; L81—Hydraulic cement industry; L82—Concrete products industry; L83—Ready-mix concrete industry; L84—Glass and glass products industry; L85—Miscellaneous non-metallic mineral prod. industry; L86—Refined petroleum and coal products industry; L87—Industrial chemicals industry n.e.c.; L88—Chemical products industry n.e.c.; L89—Plastic and synthetic resin industry; L90—Pharmaceutical and medicine industry; L91—Paint and varnish industry; L92—Soap and cleaning compounds industry; L93—Toilet preparations industry; L94—Other manufacturing industry; L95—Jewellery and precious metal industry; L96—Sporting goods and toy industry and L97—Sign and display industry.