

Draft
Comments welcome

TRIO2002: New Developments in Empirical International Trade

“Globalizing Activities and the Rate of Survival:

Panel Data Analysis on Japanese Firms “*

December 2002

Fukunari KIMURA

(Faculty of Economics , Keio University)

and

Takamune FUJII

(Faculty of Business Administration, Aichi University)

* The authors would like to thank the Pre-Conference participants for constructive comments and suggestion. The assistance provided by Mitsuyo Ando is gratefully acknowledged.

The MITI database was prepared and analyzed in the cooperation with the Applied Research Institute, Inc. and the Research and Statistics Department, Minister’s Secretariat, Ministry of International Trade and Industry (currently Ministry of Economy, Trade, and Industry), Government of Japan. However, opinions expressed in this paper are those of the authors.

Abstract

This paper conducts the Cox-type survival analysis of Japanese corporate firms with using the census-coverage data collected by METI in the mid-1990s. The analysis with careful treatment of exiting firms reveals a number of peculiar features of Japanese firms compared with previous studies conducted for other countries.

First, we find that excessive internalization in corporate structure and conducted activities seems to be harmful for corporate survival. This finding may heavily depend on the historical background and the market condition that Japanese firms in the mid-1990s must be confronted with.

Second, globalizing activities seem to help Japanese firms more competitive and more likely to survive. However, also in this context, internalization issue is important. Exporting activities seem to work well for small firms while having affiliates looks good for large firms.

Third, our results suggest that the exit cost of affiliates of other firms is lower than that of independent firms. It seems that independent firms cannot easily exit from business even if their performance is not good. With considering the low level of overall turnover ratios in Japan, we may need to provide economic environment where corporate turnovers are easier.

1. Introduction

In the 1980s, Japanese firms in favorable economic environment were aggressive in expanding their scope of corporate activities. To take the advantage of economies of scope and risk pooling, many firms got into new fields and diversified their products. In the course of diversification, they established a number of establishments and affiliates in both domestic and foreign locations. In particular, affiliates were often established in order to launch new enterprises, to form distribution/services networks, to capture technologies developed by other firms, to hold a R&D laboratory, and to establish commercial presence in foreign countries. Furthermore, firms were active in developing tight intra-group firm networks and long-term inter-firm relationship. The wide scope of internalized activities within a firm as well as extended intra-group/inter-firm relationship were regarded as an essential component of long-term efficiency in the context of so-called Japanese economic system.

However, once the Japanese economy fell into a big slump in the 1990s, a drastic reversal came over. The excessive expansion of corporate activities and inter-firm relationship suddenly became a source of inefficiency, and Japanese firms were forced to reduce the scope of activities, to reorganize establishments and affiliates, and to critically review the old inter-firm relationship. The old type of corporate structure and inter-firm relationship seemed to work adversely on corporate performance in this period.

How do the corporate structure and inter-firm relationship influence the survival rate of firms? Kimura (2002) examines the pattern of subcontracting in Japan by using the micro data of 1994 F/Y and finds that firms in subcontracting system tend to have lower profit-sales ratios than independent firms. Kimura and Kiyota (2000)

investigate the relationship with corporate performance in Japan in terms of per-worker sales and profit-sales ratios in the period between 1994 F/Y and 1997 F/Y and also conclude that excessively expanded domestic activities seem to negatively affect corporate performance. In addition, they claim that foreign exposure through exporting products and holding affiliates abroad would positively work for the restructuring of corporate structure and inter-firm relationship to improve corporate performance. Can we find similar results in the context of firms' survival and exit?

This paper focuses on the characteristics specific to Japanese firms in terms of corporate structure, inter-firm relationship, and globalizing activities and examines how these factors affect the survival of firms. The empirical study is based on the survival analysis using Cox's proportional hazard model with the panel data of Japanese firms for the period between 1994 F/Y and 1999 F/Y.

Cox's proportional hazard model was originally developed in order to analyze the survival of living animals in the field of biology and medical science. Because an investigation period is limited, we cannot usually follow all samples from birth to death. The data that include samples without complete process are called "censored data." Cox's model has its strength in effectively utilizing the information accompanied with censored data.

Cox's model started being applied for the survival analysis of corporate firms and establishments in the mid 1990s. Before that, most of the studies in the literature depended on OLS regressions by picking up exit firms only or conducted the logit or probit analysis with a discrete variable of exit or not. The first application of Cox's model was the survival analysis of the U.S. firms and establishments. Seminal works were Audretsch (1995) and Audretsch and Mahmood (1994, 1995), and Agarwal (1998), Klepper and Simons (2000), Agarwal and Audretsch (2001) and others followed them. These studies found that the size and technological level of a firm seem to strongly

affect its survival positively.

Similar studies were conducted in several European countries. Mata and Portugal (1994) and Mata, Portugal and Guimaraes (1995) on Portuguese firms were in the first cohort. Under the influence of Audretsch and Mata, some studies worked on the data of Germany (Harhoff, Stahl and Woywode, 1999), Italy (Audretsch, Santerelli and Vivarelli, 1999), Norway (Tveteras and Eide, 2000), and others.

Almost all of these studies focus on the domestic activities of firms and establishments, however. Few studies analyze the connection of foreign activity of firms with their survival. Only two studies, Liu (1995) and McCloughan and Stone (1998), to our knowledge, analyze the foreign activities of firms by focusing on the exit of foreign affiliates from the host country's market.

As for Japanese firms, not many studies have been conducted on the survival of firms or establishments. Among a few, Honjo (2000) conducted a similar study for the manufacturing firms located in Tokyo with using the data bank of Tokyo Shoko Research (TSR). Shimizu (2001) analyzed the corporate survival in terms of the listing at Tokyo Stock Exchange. No study with a large sample set has been conducted yet.

The present paper uses a panel data set with comprehensive census coverage collected by the Ministry of Economy, Trade, and Industry, Government of Japan and conducts the survival analysis of Japanese corporate firms in the manufacturing sector and a part of service sector. We find that similar to previous studies in the U.S. and Europe, firm size and capital intensity seem to provide positive impacts on corporate survival. In addition, excessively expanded firms in terms of internalized activities and corporate structure are less likely to survive. However, overseas activities of firms, i.e., exporting and holding foreign affiliates, are positively associated with firms' survival.

The paper plan is as follows: the next section explains statistical data that we use, and section 3 presents our analytical methodology. Section 4 summarizes our hypotheses, and section 5 discusses our analytical results. The last section concludes.

2. Data

The statistical data are obtained from the firm-level micro data of *Kigyō Katsudō Kihon Chōsa (Basic Survey of Business Structure and Activity)*. This survey was first conducted in 1991 F/Y, then in 1994 F/Y, and annually afterward. The prime purpose of the survey is to capture the overall structure of Japanese corporate firms in light of their diversification, internationalization, inter-firm linkages, and strategies on R&D and information technology. It covers all firms that have more than 50 workers, capital of more than 30 million yen, and an establishment in mining, manufacturing, wholesale/retail trade, or restaurants. We constructed a longitudinal data set by connecting annual firm-level data from 1994 F/Y to 1999 F/Y.

The Basic Survey has several attractive features. First, it provides firm-level data. A common form of firm-related statistics in the world is rather on the establishment basis, not on the firm basis, and thus most of the related empirical studies in the United States, Canada, and others have used establishment-level longitudinal data. In case of Japan, establishment-level micro data are also available on the basis of *Kōgyō Tōkei Hyō (Census of Manufactures)*, but we prefer firm-level data for our purposes. Establishment-level data are useful in analyzing production activities but are not perfectly appropriate to examine corporate activities as a whole. A corporate firm is an individual economic agent that makes economic decisions. When we would like to investigate the structure, performance, and strategies of corporate firms, firm-

level data provided by *the Basic Survey* provide clear advantages.

The second strength of *the Basic Survey* is its frequency. Statistics with census coverage tends to be conducted only once in several years because of the huge amount of cost and labor required in processing.¹ However, more data points are needed in time series in order to precisely identify the nature of entry and exit of corporate firms. *The Basic Survey* provides every year's data, which provide precious information on the survival of firms.

Third, relatively high ratios of effective questionnaire returns are also the strength of *the Basic Survey*. Statistics conducted by the Government of Japan is legally classified into two categories: designated statistics (*shitei toukei*) and approved statistics (*shounin toukei*). *The Basic Survey* is the first type, and thus firms in the survey must return the questionnaires under the Statistics Law.² The actual ratios of effective questionnaire returns are not disclosed but are probably about 90% to 95%. More importantly, the preciseness of the firm list itself is well known, which is not necessarily the case in previous studies. Hence, we can be confident that the distortion due to low effective returns is relatively small.

Even with such a data set of quality, we must have a great care in defining the exit of firms. In particular, because turnover ratios of Japanese firms are known to be very low, the data handling could be very sensitive. A weak point of *the Basic Survey* in the context of survival analysis is that it does not include a reconfirmation process to check whether a firm truly exits from the market or not. Therefore, to identify whether a firm exits from the market or not must depend solely on the information on whether the concerned firm shows up in the data set or not.

¹ For example, the seminal paper of the literature, Dunne, Roberts and Samuelson (1989), uses the U.S. manufacturing censuses that are conducted once in five years.

²“Approved” statistics is not accompanied with strong legal enforcement so that effective return ratios tend to be low.

In general, there would be various reasons why a firm gets out of the data set. Such a case occurs when a firm does not return the questionnaire by chance, when a firm geographically relocates headquarters, when a firm switches the industry it belongs to, when mergers and acquisitions (M&As) occur, and others. The permanent numbering system for each firm could deal with most of the industry changes and geographical relocation.³ However, when a firm changes the contents of activities and loses establishments covered by the survey, for example, the firm may get out of the data set. Furthermore, some firms may drop from the sample set because of the shrinkage in size; *the Basic Survey* has a cut-off line in size as mentioned above.

To avoid erroneous interpretation as far as possible, this paper treats firms dropping from the survey in two sequent years as those that get out of the market. Because the data from 1994 F/Y to 1999 F/Y are available, our data set consists of corporate firms that are in business in 1994 F/Y, 1995 F/Y, 1996 F/Y, and/or 1997 F/Y so that we can identify whether the firms survive or not. In addition, considering a possibility of relatively small firms dropping from the data set due to the shrinkage in size, this paper conducts analysis not only with the whole sample set but also with sample sets for firms having more than 100 workers or 150 workers only.⁴

3. Methodology: the proportional hazard model

This section presents the proportional hazard model that we utilize in our

³ Kimura and Kiyota (2000) claim that a substantial number of firms covered by *the Basic Survey* switch industries over time. This suggests that the survey follows industry switching pretty well.

⁴ See the Appendix for more detailed discussion on how firms are regarded as those who exit from the market in our analysis.

survival analysis of corporate firms.

The analysis of survival and exit of corporate firms requires careful consideration on methodology. If we collect data only for firms exiting from the market and conduct OLS regressions, serious sampling bias occurs. Although it is possible to treat survival and exit as discrete choices and conduct logit or probit analysis, we cannot take into account over-time changes of each firm. To completely avoid these problems, we would have to observe all firms from entry to exit, which is virtually impossible in most of the studies. The sample period typically ends before most of the firms get out of the market. We must confront with such a serious censored data problem.

The issue is how to utilize the information on censored firms in survival. One way to deal with this task is to conduct the event history analysis by using a model such as the proportional hazard model.

The event history analysis examines what happens in a time span before some event occurs; in our case, “some event” is the exit of a firm. It specifies the survival function that describes the probability of a firm’s survival until a certain time period. By using a hazard function, the probability of a firm’s exit at a certain time period is expressed.

The survival function is specified as follows:

$$S(t) = \Pr(T \geq t) \quad , \quad (1)$$

where T is the duration of survival of a firm and t is a certain time point. The function presents the probability of a firm’s survival at time t as a function of t.

To actually estimate a survival function, it is common to use the Kaplan-Meier method. Denote the number of observation (firms) as n. At time t_1, t_2, \dots, t_m , the number of events (exiting firms) is d_1, d_2, \dots, d_m , respectively. In this case, the probability that the event does not happen is expressed as

$$\hat{S}(t) = \prod_{t_j < t} \left(\frac{n_j - d_j}{n_j} \right) . \quad (2)$$

This is called the Kaplan-Meier estimator.

Figure 1 plots the Kaplan-Meier estimator derived from our data set. The vertical axis presents the proportion of firms that survive while the horizontal axis denotes the age of firms. We find that Japanese firms in our data set have a sort of peculiar pattern of survival; the number of firms declines rather slowly after the entry, and the rate of survival suddenly drops after around 40 years of survival. The previous literature in other countries, such as Mata, Portugal and Guinaraes (1995), has found low survival rates for young firms.

<Figure 1>

Cox's proportional hazard model is based on a hazard function such as

$$h(t) = \lim_{\Delta t \rightarrow 0} \frac{\Pr(t \leq T \leq t + \Delta t | T \geq t)}{\Delta t} , \quad (3)$$

where T is the duration of a firm and t denotes time. This function presents the probability that the event (exit) occurs in a fraction of time Δt , conditional on no occurrence of the event until time t (i.e., the firm survives by time t). When we denote the probability density function of event occurrence as $f(t)$, this hazard function can be defined as

$$h(t) = \frac{f(t)}{S(t)} . \quad (4)$$

However, it is empirically difficult to specify the functional form of hazard function in our case due to the difficulty in specifying probability distribution and others.⁵

⁵ In the case of durable time analysis of machines, we can specify the survival function or hazard function because we a priori know the distribution of durable time as the

The extended version of the proportional hazard model proposed by Cox (1972, 1975) analyzes the relationship between the probability of event occurrence and various covariates, based on the concept of hazard function. It imposes the condition of “hazard proportionality” and makes the analysis of covariates possible without specifying a hazard function itself. “Hazard proportionality” is the assumption that the proportion of two kinds of hazard is constant over time. The model treats each sample’s hazard rate $h_i(t)$ as a function of a number of covariates. It conceptually defines the baseline hazard ($h_0(t)$) that is not influenced by any covariate and treats the proportion of $h_i(t)$ and $h_0(t)$ as constant based on the hazard proportionality assumption. Hence, the proportion is interpreted as a function of covariates.

If we denote the vector of covariates (explanatory variables) as x_i , we can write

$$h_i(t)/h_0(t) = \exp(\beta x_i) \quad (5)$$

$$h_i(t) = h_0(t)\exp(\beta x_i) \quad . \quad (6)$$

This is the proportional hazard model.⁶ By taking logarithm, we obtain

$$\log h_i(t) = \log h_0(t) + \beta x_i \quad . \quad (7)$$

In this model, we investigate the factors that explain the height of hazard rates. Thus, a negative coefficient means that the explanatory variable is associated with higher survival probability while a positive coefficient suggests that the explanatory

Weibull distribution.

⁶ To estimate parameter β , we use the partial likelihood estimation method. When we denote the set of firms that have not experienced the event (exit) at time t as $R(t)$, Risk Set, we estimate the parameter of covariates, β , by maximizing the partial likelihood estimator, $L = \prod_{i=1}^m \frac{\exp(\beta x_i)}{\sum_{k \in R(t_i)} \exp(\beta x_k)}$. Then, we do not have to specify the baseline hazard

function, $h_0(t)$. For further explanation, please refer to Cox (1972, 1975), Kiefer (1988), or Kalbfleisch and Prentice (2002).

variable accelerate the exit of firms.

4. Explaining the probability of exits

The exit of a firm can take various forms for various reasons. For example, M&As are one of the typical forms of a firm's exit, where poor corporate performance is not necessarily a trigger.⁷ However, in case of Japan in the 1990s, hostile takeovers were quite rare, and thus the exit of a firm can largely be interpreted as a result of bad performance. In the following, we discuss the expected sign of the coefficient for each explanatory variable based on such intuition. In addition, there is a possibility that a firm is an affiliate of another firm and exits as a part of the corporate restructuring. We will take care of such cases by separating our data set into affiliates of other firms and independent firms.

The explanatory factors that possibly affect the survival and exit of firms are categorized into three groups: variables related to individual corporate performance, variables representing firms' competitiveness and technology, and variables expressing foreign exposure and internalization patterns of firms. The list of variables with the expected signs is presented in Table 1.⁸

<Table 1>

⁷ McGuckin and Nguyen (1995), for example, found that M&As are more likely to occur for establishments with higher labor productivity in the U.S. manufacturing sector in 1977-1987 though the opposite is observed for establishments with more than 250 workers.

⁸ Note that all variables are for each corporate firm that includes its establishments but does not include its affiliates.

The variables related to individual corporate performance include the size and the capital intensity of firms. As prior studies found, firm size, expressed by the natural logarithm of the number of regular workers, would have a positive relationship with the firms' survival.⁹ Capital-labor ratio represents the quality of production equipments or the efficiency in production, and thus a firm with higher ratio would have stronger competitiveness to survive. In addition, operating surplus ratio, which is operating surplus divided by total sales, is also included. The expected sign is negative for the coefficient of each variable.

The variables presenting firms' competitiveness and technological intensity include R&D sales ratio and advertisement cost ratio, which are the ratio of R&D investment to total sales and the ratio of advertisement cost to operating cost, respectively. As Audretsch and Mahmood (1994, 1995) emphasized, R&D ratio would have a positive effect on the firms' survival. Advertising cost ratio is a proxy variable for product differentiation in the literature of industrial organization. In general, producers of differentiated goods would enjoy stronger competitiveness than those of standardized goods would do. The expected signs for the coefficients of these two variables are again negative.

The variables that we would like to highlight on in our analysis are those representing foreign exposure and internalization of firms. We introduce the following seven variables: foreign sales/procurement balance, intra-group sales/procurement balance, the cost share of total outsourcing, the cost share of outsourcing to firms abroad, foreign ownership ratio, the share of labor employed in foreign establishments,

⁹ Jovanovic (1982) theoretically demonstrated a strong positive relationship between firm size and firm performance. Many of the previous empirical studies on the survival of firms such as Audretsch and Mahmood (1994, 1995), Mata and Portugal (1994), and Mata, Portugal and Guimaraes (1995) also found a positive relationship between firm size and the survival of firms.

and the number of foreign affiliates.

Foreign sales/procurement balance expresses in what form and how deeply a firm relates itself to foreign market. If a firm actively exports to foreign market, the balance becomes a large positive number. On the other hand, if a firm imports a large amount of intermediate inputs or final goods from abroad, the balance gets negative. We expect that the coefficient of this variable is negative because exporting would make a firm more competitive while importing and selling to domestic market would make a firm less profitable under domestic recession.

Intra-group sales/procurement balance tries to capture how a firm relates itself to its firm group. If we expect that intra-firm transactions are somewhat less competitive than inter-firm transactions, intra-group sales mean a transfer of burdens from a firm to its group firms, and intra-group procurement means the opposite. Therefore, we expect the coefficient of the balance as negative.

Outsourcing cost ratio and foreign outsourcing cost ratio denote the degree of utilizing inter-firm relationship in order to make corporate structure efficient. Outsourcing is one of the ways to correct excessive internalization. We expect that the signs of these variables are negative.

Foreign ownership ratio indicates whether firms are affiliates of foreign firms or not and how strong foreign managerial control is.¹⁰ Foreign firms may make a decision on the exit of their affiliates in Japan more severely and quickly than Japanese indigenous firms may do if the performance of their affiliates in Japan deteriorates. We hence expect a positive coefficient for foreign ownership.

The share of labor employed by foreign establishments denotes the degree of foreign expansion in the form of establishments. Our intuition is that globalizing

¹⁰ Note that *the Basic Survey* simply collects total foreign ownership ratios, and thus “foreign ownership” includes both foreign direct investment and portfolio investment.

activities provide positive impact on competitiveness of firms while excessive internalization deteriorates corporate performance. Compared with foreign affiliates, foreign establishments are more formally internalized in corporate structure. Therefore, the sign of coefficient for this variable could be negative or positive.

The number of foreign affiliates also indicates the degree of foreign expansion of firms. However, foreign affiliates are typically larger in size than foreign establishments and are more stable form of globalizing activities. Therefore, we expect that variable for the number of foreign affiliates would have a negative sign.

5. Results

This section presents the results of our hazard model analysis and discusses their implication. Table 2 provides the results of analysis using the samples including all firms in the data set. Tables 3 and 4 show the results of cases with firms having more than 100 workers and with firms having more than 150 workers, respectively.¹¹

<Table 2>

<Table 3>

<Table 4>

In reading the results, we first need some control on size. Consistent with previous studies for the U.S. and European countries, we find that the coefficient for

¹¹ In this version of the paper, we present regression results without industry dummies. The following results seem to reflect inter-industry differences more strongly than intra-industry idiosyncratic differences. We will investigate this issue further and try to obtain more rigorous results in the next version of the paper.

firm size is negative with statistical significance. Actually, the exit rate is 6.3% for the data set of Table 2 while the rates are 4.0% and 3.6% for Tables 3 and 4, which also shows that larger firms are less likely to exit. With a control on size, let us interpret estimated coefficients in the following.

The key words are over-internalization and globalization. The former raises the probability of exits, particularly in cases of small and medium sized firms. The latter, on the other hand, lowers the probability of exits. By combining these key words, most of the major findings can be interpreted in a consistent manner.

The coefficient of R&D sales ratio has an expected negative sign in Tables 2, 3, and 4, but the statistical significance decreases as firm size goes down. This suggests that R&D activities strengthen the competitiveness of firms but it is harmful for small firms to conduct too ambitious R&D. The coefficient of advertisement cost ratio unexpectedly has a positive sign, which is probably due to long-lasting recession in the Japanese economy, and the sign is most significant in Table 2. This again indicates that too much advertisement expenditure would be harmful particularly for small firms and increase their exit probability.

The coefficient of foreign sales/procurement balance has an expected negative sign. Exporting activities seem to reduce the exit probability, and foreign procurement looks harmful for survival because of extensive internalization and domestic recession. The coefficient is particularly significant for small and medium scale firms, which suggests the importance of exporting activities as a proper channel for globalization for them.

The coefficient of outsourcing cost ratio has a negative sign as expected, which indicates that the efficient squeeze of internalized activities makes a firm more likely to survive. The coefficient is more strongly significant for larger firms, which indicates that larger firms have more room for clearing the sunk cost of making proper

outsourcing arrangements. The coefficient of foreign outsourcing ratio unexpectedly has an insignificant sign probably due to some negative elements of excessive activities.

The coefficient of labor share in foreign establishments is consistently positive and significant. This means that globalizing activities in the form of having foreign establishments tend to cause excessive internalization and make a firm less competitive. On the other hand, the coefficient of the number of foreign affiliates has a positive sign in Tables 3 and 4, which indicates that having foreign affiliates is a suitable way to capture the benefit of globalization for relatively large firms that afford certain level of internalization.

Finally, the coefficient of foreign ownership ratio is positive in Tables 2, 3, and 4 but is statistically significant only in Table 2. Foreign multinational enterprises may remove small affiliates in Japan in response to the long-lasting recession in Japan, but large-scale affiliates do not have significantly higher exit probability than Japanese indigenous firms.

In the following, we would like to check whether affiliates of other firms and independent firms have different pattern of exit or not. The exit of an affiliate can occur in the context of the restructuring of whole firm group and thus may present different characteristics from the exit of an independent firm. Table 5 presents the results for affiliate firms, and Table 6 shows those for independent firms.

<Table 5>

<Table 6>

The exit probability in our sample is 6.6% for affiliates and 5.6% for independent firms. As we expected, affiliates are more likely to exit, but the difference in probability is not very large.

The comparison between Tables 5 and 6 suggests that the performance matters more directly in the case of affiliates than the case of independent firms. Capital labor ratio representing the competitiveness of firms has a negative, significant coefficient only in the case of affiliates. The coefficient of operating surplus ratio is significantly negative only for affiliates. The coefficient of advertisement cost ratio is significantly positive only for affiliates. The survival of affiliates seems to depend on their performance much clearer than the survival of independent firms. This suggests that the cost of exiting is substantially lower in the case of affiliates than in the case of independent firms.

6. Conclusion

This paper conducts the survival analysis of Japanese corporate firms with using the census-coverage data collected by METI in the mid-1990s. The analysis with careful treatment of exiting firms reveals a number of peculiar features of Japanese firms compared with previous studies conducted for other countries.

First, excessive internalization in corporate structure and conducted activities seems to be harmful for corporate survival. This finding may heavily depend on the historical background and the market condition that Japanese firms in the mid-1990s must be confronted with. In the 1980s, the Japanese economic system was praised, and one of the essential components was extensive internalization of various activities in a corporate firm as well as the construction of concerted long-term inter-firm relationship. In the 1990s, however, extensive internalization became rather an obstacle to stay alive in recessionary economic environment. Such unfavorable blast particularly hit firms in small size in the context of survival.

Second, consistent with the finding of Kimura and Kiyota (2000), globalizing activities seem to help Japanese firms be more competitive and more likely to survive. However, also in this context, internalization issue is important. Having foreign establishments is not an efficient form of utilizing globalization in contrast with having foreign affiliates. Exporting activities seem to work well for small firms while having affiliates looks good for large firms.

Third, our results suggest that the exit cost of affiliates of other firms is lower than that of independent firms. It is a sort of ironic that parent firms do not help affiliates to survive but rather strictly determine whether to let the concerned affiliates survive or not by looking at the performance. The other side of coin is that independent firms cannot easily exit from business even if their performance is not good. With considering the low level of overall turnover ratios in Japan, we may need to provide economic environment where corporate turnovers are easier.

The analysis conducted in this paper just utilizes a small part of the information carried by the micro data but already proves to be very effective in investigating what happened in the long-lasting recession in Japan at the micro level. More empirical studies using micro data sets should be encouraged in future research.

Reference

- Agarwal, Rajshree, Small Firm Survival and Technological Activity, *Small Business Economics* 11.3, 1998, pp. 215-224
- Agarwal, Rajshree and David B. Audretsch, Does Entry Size Matter?: The Impact of the Life Cycle and Technology on Firm Survival, *Journal of Industrial Economics* 49.1, 2001, pp. 21-43
- Audretsch, David B., Innovation, Growth and Survival, *International Journal of Industrial Organization* 13.4, 1995, pp. 441-57
- Audretsch, David B., Enrico Santarelli and Marco Vivarelli, Start-up Size and Industrial Dynamics: Some Evidence from Italian Manufacturing, *International Journal of Industrial Organization* 17.7, 1999, pp. 965-983
- Audretsch, David B. and Talat Mahmood, The Rate of Hazard Confronting Firms and Plants in U.S. Manufacturing, *Review of Industrial Organization* 9.1, 1994, pp. 41-56
- Audretsch, David B. and Talat Mahmood, New Firm Survival: New Results Using a Hazard Function, *Review of Economics and Statistics* 77.1, 1995, pp. 97-103
- Cox, David R., Regression Models and Life Tables, *Journal of the Royal Statistical Society Series B.* 34.2, 1972, pp. 187-220
- Cox, David R., Partial Likelihood, *Biometrika* 62.3, 1975, pp. 269-75
- Dunne, Timothy, Mark J. Roberts and Larry Samuelson, Plant Turnover and Gross Employment Flows in the U.S. Manufacturing Sector, *Journal of Labor Economics* 7.1, 1989, pp. 4-71
- Harhoff, Dietmar, Konrad Stahl and Michael Woywode, Legal Form, Growth and Exit of West German Firms: Empirical Results for Manufacturing, Construction, Trade and Service, *Journal of Industrial Economics* 46.4, 1998, pp. 453-488
- Honjo, Yuji, Business Failure of New Firms: An Empirical Analysis Using a Multiplicative Hazards Model, *International Journal of Industrial Organization* 18.4, 2000, pp. 557-574
- Jovanovic, Boyan, Selection and the Evolution of Industry, *Econometrica* 50.3, 1982, pp. 649-670
- Kalbfleisch, John D. and Ross L. Prentice, *The Statistical Analysis of Failure Time Data* (2nd edition), New York; John Wiley and Sons, 2002
- Kiefer, Nicholas M., Economic Duration Data and Hazard Functions, *Journal of Economic Literature* 26.2, 1988, pp. 646-679
- Kimura, Fukunari, Subcontracting and the Performance of Small and Medium Firms in Japan, *Small Business Economics* 18, 2002, pp. 163-175
- Kimura, Fukunari and Kozo Kiyota, Exports and Foreign Direct Investment Accelerate Corporate Reforms: Evidence from the Japanese Micro Data, prepared for

- Analytical Issues in the Trade, Foreign Direct Investment, and Macro/Financial Relations of the United States and Japan Pre-conference Meeting at University of Michigan (Ann Arbor)*, Ann Arbor, Michigan, 2000. Forthcoming in Robert M. Stern, ed., *Analytical Studies in U.S.-Japan International Economic Relations*, Cheltenham: Edward Elgar Publishing.
- Klepper, Steven and Kenneth L. Simons, The Making of an Oligopoly: Firm Survival and Technological Change in the Evolution of the U.S. Tire Industry, *Journal of Political Economy* 108.4, 2000, pp. 728-760
- Liu, Lili, Entry-Exit, Learning, and Productivity Change: Evidence from Chile, *Journal of Development Economics* 42.2, 1993, pp. 217-242
- Mata, Jose and Pedro Portugal, Life Duration of New Firms, *Journal of Industrial Economics* 42.3, 1994, pp. 227-245
- Mata, Jose, Pedro Portugal and Paulo Guimaraes, The Survival of New Plants: Start-up Conditions and Post-Entry Evolution, *International Journal of Industrial Organization* 13.4, 1995, pp. 459-81
- McCloughan, Patrick and Ian Stone, Life Duration of Foreign Manufacturing Subsidiaries: Evidence from UK Northern Manufacturing Industry 1970-93, *International Journal of Industrial Organization* 16.6, 1998, pp. 719-747
- McGuckin, Robert H. and Sang V. Nguyen, On Productivity and Plant Ownership Change: New Evidence from the Longitudinal Research Database, *RAND Journal of Economics* 26.2, pp. 257-276
- Shimizu, Takashi, *Gappei Koudou to Kigyō no Jumyo: Kigyokoudou heno Atarashii Apurouchi (Mergers and Firm Longevity: A New Approach to Firm Behavior)*, Tokyo; Yuhikaku, 2001 (in Japanese)
- Tveteras, Ragnar and Geir Egil Eide, Survival of New Plants in Different Industry Environments in Norwegian Manufacturing; A Semi-Proportional Cox Model Approach, *Small Business Economics* 14.1, 2000, pp. 65-82

Appendix: “Exit” of a firm

As discussed in section 2, *the Basic Survey* does not include a reconfirmation process to check whether a firm truly exits from the market or not. To avoid erroneous interpretation as far as possible, our study treats the “exit” of a firm as a drop of a firm from the survey in two sequent years.

Table A1 counts the number of firms reported in 1994 F/Y and checks whether these firms dropped from the sample or not in 1995 F/Y and afterward. Table A2 presents the number of firms that dropped from the sample and “returned” later. These tables show that although a considerable number of firms did return to the sample, more than 60 per cent of them returned next year. For example, among 2,734 firms that disappeared in the 1995 survey, for instance, 758 firms re-appeared in 1996. This suggests that to treat two-year sequent disappearance from the sample as a criterion of exit effectively reduces possibly erroneous determination of “exit.” In addition, if a firm returned to the sample in more than two years, we treat the firm as “no exit.”

<Table A1>

<Table A2>

It is obvious that the “return” of firms is mostly due to ineffective response to the questionnaire. The cut-off line in size *the Basic Survey* applies would be another factor that induce the “return” of firms, but we believe that the problem is not very serious. Table A3 shows descriptive statistics of annual changes in absolute values of the size of firms, i.e., the number of workers for the full sample, and Table A4 does for only firms with less than 300 workers. Both tables are of course for firms that exist in the sample in two sequent years, so we must be careful that these figures are somewhat

understated by not including firms dropped from the sample. In the case of full sample, the mean is around 30, and the standard deviation is 150 to 200 while median is 7 to 8. When looked at the sample for small and medium sized firms, the mean is 10 to 12, and the standard deviation is about 30. These imply that while some large firms alter the number of workers by a larger amount, smaller firms do not very much change the number of workers. We can thus guess that the cut-off line in size does not distort our study very much. Relatively stable conclusion with different size cut-off in Tables 3 and 4, compared with Table 2, proves our intuition.

<Table A3>

<Table A4>

Table 1 The list of independent variables

Independent variables	Definition	Expected sign
Firm size	Number of total regular workers (natural logarithm)	-
Capital labor ratio	Tangible fixed assets / total regular workers	-
Operating surplus ratio	Operating surplus / total sales	-
R&D sales ratio	R&D investment / total sales	-
Advertisement cost ratio	Advertisement cost / operating cost	-
Foreign sales/procurement balance	(Foreign sales - foreign procurement) / total sales	-
Intra-group sales/procurement balance	(Intra-group sales - intra-group procurement) / total sales	-
Outsourcing cost ratio	Outsourcing cost / operating cost	-
Foreign outsourcing cost ratio	Outsourcing cost to firms abroad / operating cost	-
Foreign ownership ratio	Foreign ownership ratio	+
Labor share in foreign establishments	Regular worker employed in foreign establishments / total regular worker	+/-
Number of foreign affiliates	Number of foreign affiliates	-

Summary statistics of independent variables

	Mean	s.d.
Firm size (in log)	5.166	0.970
Capital labor ratio	9.255	16.932
Operating surplus ratio	0.130	2.076
R&D sales ratio	0.007	0.030
Advertisement cost ratio	0.006	0.034
Foreign sales/procurement balance	0.005	0.104
Intra-group sales/procurement balance	0.054	0.292
Outsourcing cost ratio	0.070	1.001
Foreign outsourcing cost ratio	0.001	0.023
Foreign ownership ratio	0.010	0.085
Labor share in foreign establishments	0.002	0.021
Number of foreign affiliates	0.851	9.991

Note: All variables are calculated, based on *the Basic Survey*.

(Some outliers must be cleaned up in the next version of the paper.)

Table 2 Results of Cox regressions (base case: full sample)

Dependent variables	Model 1	Model 2	Model 3	Model 4
Firm size	-0.810*** 0.023	-0.810*** 0.023	-0.810*** 0.023	-0.810*** 0.023
Capital labor ratio	-0.004*** 0.001	-0.003*** 0.001	-0.003*** 0.001	-0.003*** 0.001
Operating surplus ratio	-0.002 0.016	-0.002 0.015	-0.002 0.016	-0.002 0.015
R&D sales ratio	-0.840 1.013	-0.866 1.017	-0.839 1.014	-0.855 1.018
Advertisement cost ratio	0.265** 0.131	0.268** 0.130	0.265** 0.131	0.268** 0.130
Foreign sales/procurement balance	-0.683*** 0.144	-0.679*** 0.145	-0.683*** 0.143	-0.678*** 0.145
Intra-group sales/procurement balance			-0.002 0.061	-0.011 0.060
Outsourcing cost ratio	-0.226* 0.134		-0.226* 0.135	
Foreign outsourcing ratio		0.674 0.759		0.675 0.759
Foreign ownership ratio	0.467*** 0.181	0.479*** 0.181	0.467*** 0.182	0.478*** 0.182
Labor share in foreign establishments	1.485*** 0.536	1.494*** 0.536	1.485*** 0.537	1.493** 0.536
No. of foreign affiliates	0.001 0.004	0.001 0.004	0.001 0.004	0.001 0.004
Log-likelihood	-37145.65	-37146.77	-37145.65	-37146.75
Chi-squared	1869.12***	1866.88***	1869.12***	1866.91***
N	69027	69027	69027	69027

Note: Standard errors are presented below the estimates of coefficients.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 3 Results of Cox regressions (firm size controlled: firms with more than 100 workers)

Dependent variables	Model 5	Model 6	Model 7	Model 8
Firm size	-0.373*** 0.033	-0.371*** 0.033	-0.373*** 0.033	-0.371*** 0.033
Capital labor ratio	-0.005** 0.002	-0.004** 0.002	-0.005** 0.002	-0.004** 0.002
Operating surplus ratio	0.001 0.029	0.003 0.029	0.001 0.029	0.003 0.029
R&D sales ratio	-3.326** 1.582	-3.413** 1.590	-3.373** 1.586	-3.439** 1.593
Advertisement cost ratio	0.134 0.251	0.142 0.247	0.135 0.250	0.143 0.246
Foreign sales/procurement balance	-1.005*** 0.202	-1.033*** 0.201	-1.010*** 0.202	-1.036*** 0.201
Intra-group sales/procurement balance			0.046 0.087	0.024 0.088
Outsourcing cost ratio	-0.556** 0.221		-0.566** 0.222	
Foreign outsourcing ratio		0.577 1.479		0.572 1.480
Foreign ownership ratio	0.190 0.227	0.203 0.227	0.195 0.227	0.206 0.227
Labor share in foreign establishments	1.765** 0.743	1.798** 0.743	1.771** 0.743	1.801** 0.743
No. of foreign affiliates	-0.024* 0.012	-0.024** 0.012	-0.023* 0.012	-0.024** 0.012
Log-likelihood	-16599.71	-16603.09	-16599.57	-16603.05
Chi-squared	310.50***	303.74***	310.77***	303.81***
N	48935	48935	48935	48935

Note: Standard errors are presented below the estimates of coefficients.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 4 Results of Cox regressions (firm size controlled: firms with more than 150 workers)

Dependent variables	Model 9	Model 10	Model 11	Model 12
Firm size	-0.313*** 0.043	-0.310*** 0.043	-0.312*** 0.043	-0.309*** 0.043
Capital labor ratio	-0.004 0.003	-0.003 0.003	-0.004 0.003	-0.003 0.003
Operating surplus ratio	0.004 0.034	0.006 0.034	0.003 0.034	0.006 0.034
R&D sales ratio	-5.137*** 1.898	-5.221*** 1.908	-5.324*** 1.907	-5.381*** 1.917
Advertisement cost ratio	1.011 0.765	1.051 0.737	1.039 0.745	1.075 0.720
Foreign sales/procurement balance	-0.512* 0.303	-0.562* 0.301	-0.521* 0.303	-0.574* 0.302
Intra-group sales/procurement balance			0.165 0.107	0.140 0.106
Outsourcing cost ratio	-0.584** 0.276		-0.624** 0.278	
Foreign outsourcing ratio		2.618 1.816		2.605 1.824
Foreign ownership ratio	0.109 0.270	0.114 0.270	0.124 0.270	0.128 0.270
Labor share in foreign establishments	1.958** 0.902	1.988** 0.902	1.972** 0.901	2.001** 0.902
No. of foreign affiliates	-0.030** 0.013	-0.032** 0.013	-0.030 0.131	-0.032** 0.013
Log-likelihood	-10559.99	-10561.66	-10558.83	-10560.81
Chi-squared	170.05***	166.71***	172.39***	168.42***
N	36389	36389	36389	36389

Note: Standard errors are presented below the estimates of coefficients.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 5 Results of Cox regressions (affiliate firms)

Dependent variables	Model 13	Model 14	Model 15	Model 16
Firm size	-0.640*** 0.036	-0.640*** 0.036	-0.637*** 0.036	-0.635*** 0.036
Capital labor ratio	-0.006** 0.02	-0.006** 0.002	-0.006*** 0.002	-0.006** 0.002
Operating surplus ratio	-0.319*** 0.077	-0.320*** 0.077	-0.319*** 0.079	-0.321*** 0.079
R&D sales ratio	-1.621 1.484	-1.654 1.489	-1.230 1.432	-1.233 1.433
Advertisement cost ratio	3.102*** 0.381	3.118*** 0.379	3.150*** 0.388	3.162*** 0.387
Foreign sales/procurement balance	-0.795*** 0.264	-0.821*** 0.264	-0.770*** 0.263	-0.785*** 0.263
Intra-group sales/procurement balance			-0.222*** 0.064	-0.233*** 0.064
Outsourcing cost ratio	-0.342 0.226		-0.204 0.219	
Foreign outsourcing ratio		-0.484 2.647		-0.399 2.619
Foreign ownership ratio	0.033 0.202	0.040 0.202	-0.011 0.203	-0.009 0.203
Labor share in foreign establishments	-2.811 2.352	-2.763 2.345	-2.956 2.373	-2.933 2.370
No. of foreign affiliates	-0.045 0.042	-0.046 0.043	-0.048 0.043	-0.049 0.043
Log-likelihood	-12475.57	-12476.83	-12469.59	-12470.05
Chi-squared	488.05***	485.53***	500.02***	499.10***
N	24177	24177	24177	24177

Note: Standard errors are presented below the estimates of coefficients.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

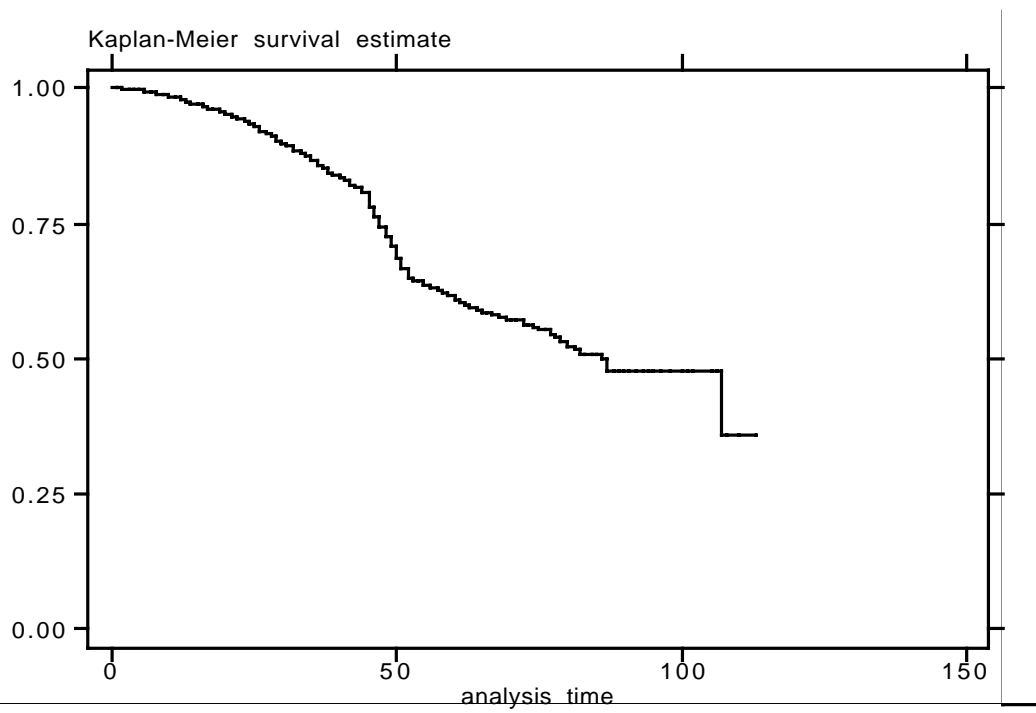
Table 6 Results of Cox regressions (independent firms)

Dependent variables	Model 17	Model 18	Model 19	Model 20
Firm size	-0.927*** 0.030	-0.926*** 0.030	-0.927*** 0.030	-0.926*** 0.030
Capital labor ratio	0.0003 0.001	0.0003 0.001	0.0003 0.001	0.0003 0.001
Operating surplus ratio	0.004 0.022	0.004 0.022	0.004 0.022	0.004 0.022
R&D sales ratio	-0.194 0.861	-0.206 0.880	-0.218 0.900	-0.231 0.921
Advertisement cost ratio	0.209 0.222	0.209 0.223	0.210 0.222	0.209 0.223
Foreign sales/procurement balance	-0.483** 0.189	-0.445** 0.191	-0.488** 0.189	-0.450** 0.191
Intra-group sales/procurement balance			0.074 0.101	0.074 0.101
Outsourcing cost ratio	0.030 0.165		0.025 0.165	
Foreign outsourcing ratio		1.220 0.774		1.218 0.775
Foreign ownership ratio	-0.136 0.489	-0.131 0.489	-0.136 0.489	-0.131 0.489
Labor share in foreign establishments	2.479*** 0.520	2.481*** 0.520	2.486*** 0.520	2.487*** 0.520
No. of foreign affiliates	0.004 0.003	0.004 0.003	0.004 0.003	0.004 0.003
Log-likelihood	-21838.66	-21837.63	-21838.33	-21837.37
Chi-squared	1457.62***	1459.67***	1458.15***	1460.19***
N	44850	44850	44850	44850

Note: Standard errors are presented below the estimates of coefficients.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Figure 1 Estimated survival function for the full sample



Appendix Table A1 Number of dropped firms: the case of firms that appeared in the 1994 F/Y Survey

Year	Listed firms	Dropped firms	Share (%)
1994	25,278		
1995	22,544	2,734	10.82
1996	20,756	1,788	7.93
1997	18,992	1,764	8.50
1998	17,557	1,435	7.56
1999	16,221	1,336	7.61

Appendix Table A2 Number of "returned" firms: the case of firms that appeared in the 1994 F/Y Survey

	Dropped in 1995	Dropped in 1996	Dropped in 1997	Dropped in 1998
Returned in 1996	758			
Returned in 1997	243	548		
Returned in 1998	140	181	536	
Returned in 1999	96	96	214	389
Returned firm total	1,237	825	750	389

Appendix Table A3 Changes in firm size for the full sample

(Number of regular worker, absolute value)

	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999
Mean	33.3	30.5	30.3	34.1	34.9
Median	7	7	7	8	7
s.d.	169.9	160.9	157.9	192.2	206.0

Appendix Table A4 Changes in firm size for firms with less than 300 workers

(Number of regular worker, absolute value)

	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999
Mean	11.8	10.5	10.9	12.2	11.1
Median	5	5	5	6	5
s.d.	33.1	25.4	33.2	31.7	30.3