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# "Globalizing Activities and the Rate of Survival: Panel Data Analysis on Japanese Firms"[*]

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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 confirms a number of peculiar features of Japanese firms claimed in the academic and semi-academic literature.

First, we find that excessive internalization in corporate structure and conducted activities seems to be harmful for corporate survival. Having too many establishments and affiliates is no good for corporate survival. Active concentration on core competence by using outsourcing contracts increases the probability of survival. This finding may depend on the historical background and the market condition that Japanese firms in the mid-1990s must be confronted with.

Second, global commitment seems to help Japanese firms be more competitive and more likely to survive. However, the channels or types of global commitment must carefully be selected with considering the size of firm. Small firms can benefit from exporting activities though having foreign affiliates or conducting foreign outsourcing may rather aggravate their performance. Large firms, on the other hand, can utilize the channels of foreign direct investment and foreign outsourcing and enhance the probability of survival.

Third, we find that corporate performance matters in the choice of exits for affiliate firms, but it does not in the survival/exit of independent firms. We must cast doubt on the possible malfunctioning of market mechanism in the exits of independent firms. With observing the low level of turnover ratios in Japan, we definitely need to provide economic environment where corporate turnovers are easier and efficient.

Fourth, we do not find any statistically significant evidence that firms with foreign asset holdings are more likely to exit. After controlling other factors, our regression results indicate that little evidence exists for foot-loose behavior of foreign companies.

## 1. Introduction

The era of the 1990s are said to be the lost decade for the Japanese economy. After the series of hard debates among economists, we now share the view that issues are not simply cyclical along the business cycle but are related to the existence of serious structural problems that have driven the long-term recession. The financial sector and macroeconomic management have obviously had fatal problems. In addition, Japanese corporate firms, once being praised as the core of "Japanese economic system," also seem to suffer from crucial structural impediments to adjusting new economic environment in the 1990s.

The recent academic and semi-academic literature has reached a loose consensus that three stylized facts exist on Japanese corporate firms in the 1990s. First, Japanese firms excessively expanded their boundaries and internalized too many activities in the late 1980s. To take advantage of economies of scope and risk pooling, many firms got into new fields and diversified their products. In the course of diversification, they founded a number of establishments and affiliates in both domestic and foreign locations in order to launch new enterprises. Furthermore, firms were active in developing tight intra-firm-group 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 as well as facing foreign competition 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.

Second, excessive adaptation to high growth period resulted in rigid industrial structure and low turnover ratios of firms. Cross-shareholding and other types of long-term inter-firm relationship made the cost of firms' exit extraordinary high. The

cooperative labor relations as well as various government regulations also became an obstacle to efficient turnovers. We did not observe many mergers and acquisitions (M&As) and hardly experienced hostile takeovers.[1] Inactive turnovers obviously delayed necessary adjustments of industrial structure and prolonged poor economic situation.

Third, even in such stagnant situation, the global commitment of firms worked as a crucial element for enhancing efficiency. Good firms tend to develop external activities. At the same time, with the opposite arrow of causality, various types of global commitment such as exporting activities, foreign direct investment, and foreign outsourcing seem to improve corporate performance by accelerating efficient reformulation of corporate structure and inter-firm relationship.

These stylized facts have not been fully proved by formal economic analysis. In particular, no serious empirical study of survival and exit of firms with comprehensive statistics has been done for the Japanese economy because we did not have any census-coverage statistics that provided stable data over time.[2] However, we now have the METI's firm-level survey in a certain length of time series and are ready to conduct formal survival/exit analysis.

Because M&As are not observed quite often in Japan, we can primarily interpret the exit of a firm as an indication of poor performance. If so, we would like to confirm whether over-internalization of corporate structure truly makes a firm prone to exit and whether global commitment helps a firm survive. In addition, if the cost of exiting matters in the turnover of firms in Japan, we may find differences between the cases of affiliates of other firms and those of independent firms when we investigate the relationship between corporate performance and the probability of survival/exit. This paper focuses on the characteristics specific to Japanese firms in terms of corporate

[1] Shimizu (2001, p. 88) reports that listed companies at Tokyo Stock Exchange that conducted mergiers are only 71 out of all listed companies during the period of 1949-1998 (1273 in his sample). The Fair Trade Commission (FTC), Government of Japan (2002, p. 220) presents that the number of mergers reported to FTC is only 151, 170, and 127 in 1999 F/Y, 2000 F/Y, and 2001 F/Y, respectively.

[2] Honjo (2000) conducted survival analysis 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.

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 and started being applied for the survival analysis of corporate firms and establishments in the mid 1990s. 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), being followed by Agarwal (1998), Klepper and Simons (2000), Agarwal and Audretsch (2001) and others. Similar studies were conducted in Europe. Mata and Portugal (1994) and Mata, Portugal and Guimaraes (1995) on Portuguese firms were in the first cohort, and a number of studies are conducted with the data of Germany (Harhoff, Stahl and Woywode, 1998), Italy (Audretsch, Santerelli and Vivarelli, 1999), Norway (Tveteras and Eide, 2000), and others. These studies primarily found that the size and technological level of a firm seemed to positively affect its survival. However, the relationship of corporate structure including establishments and affiliates with survival/exit has not fully been explored yet. Furthermore, few studies analyze the connection of global commitment with their survival.[3] Our study has a unique focus in this regard.

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

Our dataset is constructed from the firm-level micro data of *Kigyou Katsudou*

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However, their datasets are far from census-coverage statistics.

[3] Li (1995) and McCloughan and Stone (1998) analyze the exit of foreign affiliates from the viewpoint of host country. However, their studies do not directly examine the global commitment of firms.

*Kihon Chousa (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 though financial information is barely included. 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 *Kougyou Toukei Hyou (Census of Manufactures).* 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.[4] 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* collects 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

[4] 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.

statistics (shounin toukei). *The Basic Survey* is the first type, and thus firms in the survey must return the questionnaires under the Statistics Law.[5] 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 in other countries. Hence, we can be confident that the distortion due to low effective returns is relatively small.

Even with such a date set of quality, though, 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.

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 firm numbering system in *the Basic Survey* could deal with most of the industry changes and geographical relocation.[6] However, when a firm changes the contents of activities and loses establishments covered by the survey, for example, the firm gets 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

[5]"Approved" statistics is not accompanied with strong legal enforcement so that effective return ratios tend to be low.

[6] Kimura and Kiyota (2000) find 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.

possibility of relatively small firms dropping from the data set due to the shrinkage in size, we conduct regressions not only with the whole sample set but also with sample sets for firms with different cutoffs, which is discussed in details in the Appendix.

## 3. Methodology: the proportional hazard model

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

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

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. The hazard function describes the probability of the risk of occurring some event. When we

denote the probability density function of event occurrence as $f(t)$, the hazard function can be written as

$$h(t) = \frac{f(t)}{S(t)} \ . \tag{2}$$

The hazard function is in general specified as follows:

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr(t \le T \le t + \Delta t \mid T \ge t)}{\Delta t} \ , \tag{3}$$

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 $\Delta$t, conditional on no occurrence of the event until time t (i.e., the firm survives by time t). 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.[7]

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

$$h_i(t)/h_0(t) = \exp(\beta x_i) \tag{4}$$

$$h_i(t) = h_0(t)\exp(\beta x_i) \ . \tag{5}$$

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

$$\log h_i(t) = \log h_0(t) + \beta x_i \ . \tag{6}$$

[7] In the case of durable time analysis of machines, for example, we can specify the survival function or hazard function because we a priori know the distribution of durable time as the Weibull distribution. It however is not the case when we conduct survival analysis of corporate firms.

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 variable accelerate the exit of firms.

Although the baseline hazard, $h_0(t)$, is not obtained ex ante because the distribution of hazard is not known it can be estimated ex post.[8], Figure 1 presents the baseline survival function $S_0(t)$ calculated from the estimated baseline hazard $h_0(t)$.[9] This function indicates the survival pattern of sample firms when any covariates do not affect to the survival of firms, which is specified as

$$S_0(t) = \exp\{-H_0(t)\}, \qquad (7)$$

where $H_0(t)$ is the cumulative function of baseline hazard, $h_0(t)$. This curvature suggests that the probability of exit is higher in younger period before covariates are taken into account. The deviation of actual hazard from the baseline hazard ($h_0(t)$) is explained by covariates.[10]

<Figure 1>

4. Explaining the probability of exits

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[8] To estimate parameter $\beta$, 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, $\beta$, 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).

[9] The baseline hazard $h_0(t)$ is obtained from model 1 in table 2.

[10] Figure 1 shows the baseline survival function because it is convenient to interpret the survival pattern of sample firms. However, baseline hazard function $h_0(t)$ is used for estimating the proportional hazard model. The relationship between $h_0(t)$ and $S_0(t)$ is derived from equation (2) as follows;

$$h_0(t) = -\frac{d(\log(S(t))}{dt} \quad .$$

In general, 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.[11] 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 four groups: (i) variables related to individual corporate performance, (ii) variables representing firms' competitiveness and technology, (iii) variables expressing internalization patterns and global commitment of firms, and (iv) industry dummies at the 2-digit level of *the Basic Survey.* The list of variables with the expected signs (except industry dummies) is summarized in Table 1.[12]

<Table 1>

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.[13] Capital-labor ratio represents the quality of production

[11] 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.

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

[13] Jovanovic (1982) theoretically demonstrated a strong positive relationship between firm size and firm performance, as opposed to the stochastic growth rate hypothesis regardless of firm size along the intuition of Gibrat's law. Many of the previous empirical studies on the survival of firms. including 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.

equipments or the efficiency in production, and thus a firm with higher ratio would have stronger competitiveness to survive. Operating surplus ratio, which is operating surplus divided by total sales, is also included. The expected signs are negative for the coefficient of these variables. The expected sign of the coefficient for value added ratio is not sure after controlling operating surplus ratio. The expected sign of the coefficient for wage ratio is positive; heavy personnel payments would be a burden for firms in survival.

The variables presenting firms' competitiveness and technological intensity include R&D dummy and advertisement cost ratio, the latter of which is the ratio of advertisement cost to operating cost.[14] As Audretsch and Mahmood (1994, 1995) emphasized, R&D intensity 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 thus negative.

The variables that we would like to highlight on in our analysis are those representing internalization and global commitment of firms. Outsourcing dummy, the number of establishments, owning affiliates dummy are intended to capture the degree of internalization. Outsourcing is in general much more foot-loose form of inter-firm relationship than the traditional long-term subcontracting system. The expected sign of the coefficient for outsourcing dummy is negative because outsourcing indicates parsimony in specifying internalized activities. The number of establishments and having affiliates present the extensiveness of internalized activities, which means that the expected signs of the coefficients are positive.

Multiple forms of global commitment are expressed as foreign sales ratio, foreign procurement ratio, foreign outsourcing dummy, and owing foreign affiliates dummy.[15] The expected signs are negative, except for foreign procurement ratio,

[14] The ratio of R&D expenditures to total sales provides basically the same results as R&D dummy does. Because the large number of firms do not have any R&D expenditure, the results with R&D dummy is shown in the following.

[15] Foreign sales and foreign procurement are slightly different from exports and imports because they include sales and procurement of establishments located abroad. It does

because global commitment is supposed to make a firm more likely to survive.[16] In the case of foreign procurement ratio, we are not sure about the sign of coefficient because purchasing commodities and sell them in the domestic market really provides competitive environment; rather, the recession of domestic economy may adversely affect such firms.

Foreign ownership ratio indicates whether firms are affiliates of foreign firms or not and how strong foreign managerial control is.[17] 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.

Affiliate firm dummy is introduced to check whether affiliate firms owned by other firms and independent firms have different probability to survive. If the exiting cost is high, the exit of an affiliate would be easier than that of an independent firm. We thus expect a positive sign for the coefficient of affiliate firm dummy.

## 5. Results

This section presents the results of our hazard model analysis and discusses their implication. Table 2 provides the results of analysis with all firms in our data set. The results are fairly stable no matter whether we include industry dummies or not and mostly confirm our intuition.

<Table 2>

First, consistent with the previous literature, firm size and R&D dummy have

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not make much difference, however, since the number of establishments located abroad is limited.

[16] Lewis and Richardson (2001) make comprehensive surveys on the empirical evidence of the connection between global commitment and corporate performance in the case of the United States and conclude that the positive relationship is almost decisive.

[17] Note that *the Basic Survey* simply collects total foreign ownership ratios, and thus "foreign ownership" includes both foreign direct investment and portfolio investment.

negative coefficients, which means that larger firms and firms that conduct R&D are more likely to survive. The coefficients for advertisement cost ratio unexpectedly have positive signs. Signs of these three variables are unaltered even if we change the sample set in the following analysis. Capital labor ratio, operating surplus ratio, value added ratio, and wage ratio are sensitive to the sample set so that we will discuss later.

Second, excessive internalization is proved to be a serious problem. Both the number of establishments and owning affiliates dummy have significantly positive signs while outsourcing dummy has a negative sign. After being controlled by other variables, the compact design of corporate structure concentrating on core competence is important for enhancing the probability of survival.

Third, global commitment seems to be important for survival though the result is mixed for some variables. Foreign sales dummy has a negative coefficient, which is consistent with our intuition that exporting activities are positively correlated with the likelihood of survival. However, foreign outsourcing dummy and owning foreign affiliates dummy have positive coefficients in these regressions, as opposed to our prior belief. Actually, the size of firms matter for the signs of these coefficients; we will discuss this issue more in detail below.

Fourth, the sign of coefficient for foreign ownership ratio is positive but is not significantly different from zero. This means that the public belief blaming foot-loose behavior by foreign companies is not statistically warranted.

Fifth, affiliate firm dummy has a strongly positive coefficient, which means that affiliates of other firms are more likely to exit than independent firms. As shown in Appendix Table A1, the "exit ratio" of affiliates firms is 6.4% while that of independent firms is 5.6%.[18] Even after controlling other factors, the probability of exiting is different.

Related to the last point, we separate our sample set into two, affiliate firms and independent firms, and conduct regressions again. The results are shown in Tables 3 and 4. Most notable is that the signs of the coefficients for operating surplus ratio, value added ratio, and wage ratio are negative, negative, and positive for affiliates firms while signs are insignificant for independent firms. This means that whether an

[18] As for the definition of "exit ratio," please refer to the Appendix.

affiliate is closed or not strongly depends on its performance while such natural selection mechanism does not work for independent firms. The exit of affiliates can be a part of the restructuring of corporate structure, and thus the cost of exiting may be lower than usual exits, taking into account possible relocation of released resources. In other words, the cost of exiting is high for independent firms so that it cannot get out of the market even if the performance is poor. Or, an alternative interpretation is that independent firms exit regardless of their performance due to financial crunch and other factors external to the firms themselves.

<Table 3>

<Table 4>

Tables 5 and 6 present regression results when we separate our sample into firms with affiliates and firms without. As shown in Appendix Table A1, the "exit ratio" of firms with affiliates (4.6%) is much lower than that of firms without (7.6%). However, both firm groups pretty much share common factors that affect the probability of exiting.

<Table 5>

<Table 6>

Because over-internalization issue seems to strongly influence survival and exit, we separate our sample into different employment size categories and conduct regressions. Then, as shown in Table 7, very clear-cut results are obtained for global commitment variables. Foreign sales dummy has a significant negative coefficient when firms are small, but the significance is diluted as firms become larger. On the other hand, owning foreign affiliates dummy switches the sign of its coefficient from positive to negative as firm size goes up. Exporting activities seem to be a proper form of global commitment for small firms while having foreign affiliates costs them too much. Large firms are affordable enough to hold foreign affiliates in order to take advantage of global commitment. Foreign outsourcing dummy also changes the sign

from positive to negative (though not significantly different from zero) as firm size increases. Foreign procurement dummy has a significantly positive coefficient when firms are small but looses its significance as firm size goes up. We can thus conclude that global commitment improves the probability of survival if the channel is properly chosen, particularly considering the size of firms.

<Table 7>

## 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 confirms our intuition on the three stylized facts listed in the introduction. Our findings are summarized as follows.

First, excessive internalization in corporate structure and conducted activities seems to be harmful for corporate survival. This finding may 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 stagnant economic environment. In addition, we have to point out that international competition became by far intense in the 1990s even in the sectors, such as electronic machinery, in which Japanese firms had competitiveness. Having too many establishments and too many affiliates is no good for corporate survival. Concentration on core competence by using outsourcing contracts seems to enhance the probability of survival. The challenge that Japanese firms confront with is whether the efficient reorganization of corporate structure and inter-firm relationship is realized or not.

Second, global commitment seems to help Japanese firms be more competitive and more likely to survive. However, the channels or types of global commitment must carefully be selected with considering the size of firm. Small firms can benefit from exporting activities though having foreign affiliates or conducting foreign outsourcing may rather aggravate their performance. Large firms, on the other hand, can utilize the channels of foreign direct investment and foreign outsourcing and enhance the probability of survival. Kimura and Kiyota (2000) found that global commitment accelerates corporate restructuring, but we here add a caveat that proper degree of internalization must be chosen even in the context of global commitment.

Third, we find that corporate performance matters in the choice of exits for affiliate firms, but it does not in the survival/exit of independent firms. Taking into consideration that M&As are not a common form of exits, we must cast doubt on the possible malfunctioning of market mechanism in the exits of independent firms. One possibility is that the cost of exiting is too high for independent firms so that they stay in the market for long even if the performance is bad. Or, the selection of survival or exit is done regardless of each firm's performance because of financial crunch with incomplete information. With observing the low level of turnover ratios in Japan, we definitely need to provide economic environment where corporate turnovers are easier and efficient.

Fourth, we do not find any statistically significant evidence that firms with foreign asset holdings are more likely to exit. There is a long-lasting debate on whether accepting inward foreign direct investment is beneficial or not. Some express concern about foot-loose behavior of foreign companies. However, after controlling other factors, our regression results indicate that little evidence exists for such tendency.

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.

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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 observations and exit firms in our data set for regressions. If a firm survives, say, throughout the sample period of 1994 F/Y-1997 F/Y, it is counted as four observations. Hence, “exit ratio” shown in this table is much higher than the proportion of exit firms in one year.

<Table A1>

Table A2 presents the number of firms that dropped from the sample and “returned” later. These tables show that a considerable number of firms did return to the sample; about 30% of firms once disappeared from the sample returned the next year. For example, among 1,552 firms that disappeared in the 1995 F/Y survey, for instance, 448 firms re-appeared in 1996 F/Y. 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 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 about 150 while median is 7 to 8. When looked at the sample for small and medium sized firms, the mean is 10 to 11, and the standard deviation is about 25. 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. Although not reported, we conducted regressions with different size cut-off and found that the regression results are fairly robust.

<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 | - |
| Value added ratio | (Total sales-total procurement) / total sales | ? |
| Wage ratio | Total wage / operating cost | + |
| R&D dummy | 1 for firms with R&D expenditure; 0 for firms without | - |
| Advertisement cost ratio | Advertisement cost / operating cost | - |
| Foreign sales dummy | 1 for firms with foreign sales; 0 for firms without | - |
| Foreign procurement dummy | 1 for firms with foreign procurement; 0 for firms without | ? |
| Outsourcing dummy | 1 for firms with outsourcing; 0 for firms without | - |
| Foreign outsourcing dummy | 1 for firms with outsourcing to firms abroad; 0 for firms without | - |
| Foreign ownership ratio | Foreign ownership ratio | + |
| Number of establishments | Number of establishments owned by each firm | + |
| Affiliate firm dummy | 1 for firms that are affiliates of other firms; 0 for independent firms | + |
| Owning affiliates dummy | 1 for firms with affiliate(s); 0 for firms without | + |
| Owning foreign affiliates dummy | 1 for firms with foreign affiliate(s); 0 for firms without | - |

Summary statistics of independent variables

| | Mean | s.d. | Minimum | Maximum |
|---|---|---|---|---|
| Firm size | 402 | 1079 | 50 | 53584 |
| Firm size (in natural logarithm) | 5.280 | 0.996 | 3.912 | 10.889 |
| Capital labor ratio | 9.634 | 15.661 | 0.000 | 962.275 |
| Operating surplus ratio | 0.020 | 0.450 | -89.032 | 0.860 |
| Value added ratio | 0.431 | 0.346 | -30.427 | 1.000 |
| Wage ratio | 0.169 | 0.107 | 0.001 | 1.000 |
| R&D dummy | 0.393 | 0.488 | 0.000 | 1.000 |
| Advertisement cost ratio | 0.006 | 0.018 | 0.000 | 0.626 |
| Foreign sales ratio | 0.256 | 0.436 | 0.000 | 1.000 |
| Foreign procurement ratio | 0.242 | 0.428 | 0.000 | 1.000 |
| Outsourcing dummy | 0.506 | 0.500 | 0.000 | 1.000 |
| Foreign outsourcing dummy | 0.030 | 0.170 | 0.000 | 1.000 |
| Foreign ownership ratio | 0.013 | 0.095 | 0.000 | 1.000 |
| Number of establishments | 9.109 | 27.544 | 0.000 | 997 |
| Affiliate firm dummy | 0.345 | 0.475 | 0.000 | 1.000 |
| Owning affiliates dummy | 0.565 | 0.496 | 0.000 | 1.000 |
| Owing foreign affiliates dummy | 0.175 | 0.380 | 0.000 | 1.000 |

Data source: The MITI database.

Note: the following observations are dropped from the sample;

(1) firms with more than 100 affiliates

(2) firms with more than 1000 establishments

(3) firms with outsourcing cost larger than operating cost

(4) firms with R&D expenditure larger than operating cost

(5) firms with advertisement cost larger than operating cost

(6) firms with total wage larger than operating cost

Table 2 Results of Cox regressions: the case of all firms (base case)

| Independent variables | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Firm size | -0.809*** | -0.823*** | -0.851*** | -0.864*** |
| | 0.025 | 0.025 | 0.026 | 0.026 |
| Capital labor ratio | -0.001 | -0.001 | -0.00002 | -0.00001 |
| | 0.001 | 0.001 | 0.001 | 0.001 |
| Operating surplus ratio | -0.022 | -0.017 | -0.025 | -0.024 |
| | 0.020 | 0.021 | 0.021 | 0.021 |
| Value added ratio | 0.031 | 0.014 | 0.029 | 0.025 |
| | 0.048 | 0.039 | 0.046 | 0.043 |
| Wage ratio | 0.882*** | 0.736*** | 0.435** | 0.422** |
| | 0.156 | 0.148 | 0.174 | 0.172 |
| R&D dummy | -0.165*** | -0.189*** | -0.093** | -0.101** |
| | 0.039 | 0.038 | 0.041 | 0.041 |
| Advertisement cost ratio | 4.284*** | 4.397*** | 4.207*** | 4.170*** |
| | 0.594 | 0.582 | 0.635 | 0.633 |
| Foreign sales dummy | -0.183*** | -0.261*** | -0.141*** | -0.211*** |
| | 0.050 | 0.052 | 0.052 | 0.054 |
| Foreign procurement dummy | 0.342*** | 0.265*** | 0.340*** | 0.264*** |
| | 0.048 | 0.050 | 0.049 | 0.051 |
| Outsourcing dummy | -0.119*** | | -0.102*** | |
| | 0.034 | | 0.040 | |
| Foreign outsourcing dummy | | 0.361*** | | 0.282*** |
| | | 0.104 | | 0.105 |
| Foreign ownership ratio | 0.084 | 0.179 | 0.215 | 0.296 |
| | 0.181 | 0.182 | 0.182 | 0.183 |
| Number of establishments | 0.005*** | 0.005*** | 0.005*** | 0.004*** |
| | 0.0004 | 0.0005 | 0.001 | 0.001 |
| Affiliate firm dummy | 0.997*** | 1.000*** | 0.982*** | 0.985*** |
| | 0.034 | 0.033 | 0.034 | 0.034 |
| Owning affiliates dummy | 0.083** | | 0.081** | |
| | 0.035 | | 0.035 | |
| Owning foreign affiliates dummy | | 0.331*** | | 0.332*** |
| | | 0.059 | | 0.059 |
| Industry dummies | Not included | Not included | Included | Included |
| Log-likelihood | -37027.82 | -37014.18 | -36855.40 | -36841.47 |
| Chi-squared | 2344.88*** | 2372.17*** | 2689.73*** | 2717.59*** |
| N | 67970 | 67970 | 67970 | 67970 |

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: the case of affiliate firms

| Independent variables | Model 5 | Model 6 | Model 7 | Model 8 |
|---|---|---|---|---|
| Firm size | -0.634*** | -0.649*** | -0.656*** | -0.707*** |
| | 0.040 | 0.039 | 0.041 | 0.040 |
| Capital labor ratio | -0.001 | -0.002 | 0.00001 | -0.001 |
| | 0.002 | 0.002 | 0.002 | 0.002 |
| Operating surplus ratio | -0.333*** | -0.314*** | -0.342*** | -0.330*** |
| | 0.090 | 0.093 | 0.093 | 0.096 |
| Value added ratio | -0.345*** | -0.408*** | -0.332** | -0.338** |
| | 0.141 | 0.139 | 0.150 | 0.149 |
| Wage ratio | 1.277*** | 1.338*** | 0.943*** | 1.082*** |
| | 0.262 | 0.259 | 0.278 | 0.275 |
| R&D dummy | -0.141** | -0.183*** | -0.049 | -0.075 |
| | 0.065 | 0.064 | 0.070 | 0.069 |
| Advertisement cost ratio | 5.940*** | 6.136*** | 5.490*** | 5.908*** |
| | 0.776 | 0.763 | 0.804 | 0.800 |
| Foreign sales dummy | -0.159* | -0.175* | -0.143 | -0.158* |
| | 0.088 | 0.091 | 0.091 | 0.093 |
| Foreign procurement dummy | 0.426*** | 0.406*** | 0.400*** | 0.381*** |
| | 0.084 | 0.085 | 0.086 | 0.087 |
| Outsourcing dummy | -0.153*** | | -0.048 | |
| | 0.056 | | 0.066 | |
| Foreign outsourcing dummy | | -0.001 | | -0.005 |
| | | 0.231 | | 0.233 |
| Foreign ownership ratio | -0.094 | -0.020 | 0.001 | 0.070 |
| | 0.198 | 0.199 | 0.200 | 0.200 |
| Number of establishments | 0.004*** | 0.005*** | 0.004*** | 0.004*** |
| | 0.001 | 0.001 | 0.001 | 0.001 |
| Owning affiliates dummy | -0.312*** | | -0.347*** | |
| | 0.063 | | 0.064 | |
| Owning foreign affiliates dummy | | -0.158 | | -0.143 |
| | | 0.129 | | 0.130 |
| Industry dummies | Not included | Not included | Included | Included |
| Log-likelihood | -12221.72 | -12237.64 | -12174.42 | -12189.64 |
| Chi-squared | 555.19*** | 523.34*** | 649.79*** | 619.34*** |
| N | 23456 | 23456 | 23456 | 23456 |

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: the case of independent firms (not affiliate firms)

| Independent variables | Model 9 | Model 10 | Model 11 | Model 12 |
|---|---|---|---|---|
| Firm size | -0.926*** | -0.924*** | -0.976*** | -0.971*** |
| | 0.033 | 0.033 | 0.034 | 0.034 |
| Capital labor ratio | -0.001 | -0.0002 | -0.0001 | 0.0003 |
| | 0.002 | 0.001 | 0.001 | 0.001 |
| Operating surplus ratio | -0.041 | -0.031 | -0.027 | -0.026 |
| | 0.027 | 0.026 | 0.027 | 0.026 |
| Value added ratio | 0.169 | 0.100 | 0.066 | 0.053 |
| | 0.107 | 0.100 | 0.091 | 0.075 |
| Wage ratio | 0.726*** | 0.511** | 0.214 | 0.080 |
| | 0.239 | 0.234 | 0.244 | 0.238 |
| R&D dummy | -0.153*** | -0.148*** | -0.110** | -0.093* |
| | 0.049 | 0.048 | 0.051 | 0.051 |
| Advertisement cost ratio | 2.263** | 2.425** | 2.447** | 2.366** |
| | 0.991 | 0.966 | 1.085 | 1.084 |
| Foreign sales dummy | -0.175*** | -0.285*** | -0.132** | -0.238*** |
| | 0.061 | 0.063 | 0.063 | 0.066 |
| Foreign procurement dummy | 0.280*** | 0.167*** | 0.284*** | 0.179*** |
| | 0.058 | 0.061 | 0.059 | 0.062 |
| Outsourcing dummy | -0.093** | | -0.124** | |
| | 0.044 | | 0.050 | |
| Foreign outsourcing dummy | | 0.446*** | | 0.345*** |
| | | 0.116 | | 0.118 |
| Foreign ownership ratio | -0.038 | -0.077 | 0.112 | 0.058 |
| | 0.534 | 0.537 | 0.535 | 0.537 |
| Number of establishments | 0.006*** | 0.006*** | 0.005*** | 0.005*** |
| | 0.001 | 0.001 | 0.001 | 0.001 |
| Owning affiliates dummy | 0.302*** | | 0.313*** | |
| | 0.044 | | 0.044 | |
| Owning foreign affiliates dummy | | 0.521*** | | 0.525*** |
| | | 0.068 | | 0.068 |
| Industry dummies | Not included | Not included | Included | Included |
| Log-likelihood | -22267.73 | -22256.43 | -22127.24 | -22120.94 |
| Chi-squared | 1189.94*** | 1212.54*** | 1470.93*** | 1483.52*** |
| N | 44514 | 44514 | 44514 | 44514 |

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: the case of parent firms with affiliate(s)

| Independent variables | Model 13 | Model 14 | Model 15 | Model 16 |
|---|---|---|---|---|
| Firm size | -0.822*** | -0.845*** | -0.850*** | -0.871*** |
| | 0.033 | 0.033 | 0.034 | 0.034 |
| Capital labor ratio | -0.001 | -0.001 | -0.0001 | -0.0003 |
| | 0.002 | 0.002 | 0.002 | 0.002 |
| Operating surplus ratio | -0.039 | -0.026 | -0.019 | -0.013 |
| | 0.035 | 0.035 | 0.036 | 0.036 |
| Value added ratio | 0.202 | 0.131 | 0.068 | 0.034 |
| | 0.127 | 0.125 | 0.135 | 0.135 |
| Wage ratio | 1.099*** | 1.010*** | 0.612* | 0.606* |
| | 0.294 | 0.294 | 0.316 | 0.315 |
| R&D dummy | -0.133** | -0.154*** | -0.100* | -0.113** |
| | 0.055 | 0.054 | 0.058 | 0.058 |
| Advertisement cost ratio | 3.821*** | 4.218*** | 4.128*** | 4.201*** |
| | 1.217 | 1.206 | 1.263 | 1.266 |
| Foreign sales dummy | -0.071 | -0.179*** | -0.033 | -0.132* |
| | 0.065 | 0.068 | 0.068 | 0.071 |
| Foreign procurement dummy | 0.272*** | 0.166** | 0.277*** | 0.177*** |
| | 0.063 | 0.066 | 0.064 | 0.067 |
| Outsourcing dummy | -0.104** | | -0.151** | |
| | 0.052 | | 0.059 | |
| Foreign outsourcing dummy | | 0.363*** | | 0.263** |
| | | 0.125 | | 0.126 |
| Foreign ownership ratio | -0.089 | -0.013 | 0.017 | 0.087 |
| | 0.357 | 0.359 | 0.356 | 0.358 |
| Number of establishments | 0.004*** | 0.004*** | 0.004*** | 0.004*** |
| | 0.001 | 0.001 | 0.001 | 0.001 |
| Affiliate firm dummy | 0.672*** | 0.686*** | 0.660*** | 0.671*** |
| | 0.057 | 0.057 | 0.058 | 0.058 |
| Owning foreign affiliates dummy | | 0.300*** | | 0.299*** |
| | | 0.067 | | 0.067 |
| Industry dummies | Not included | Not included | Included | Included |
| Log-likelihood | -15069.47 | -15056.36 | -14988.80 | -14979.56 |
| Chi-squared | 1000.30*** | 1026.52*** | 1161.65*** | 1180.12*** |
| N | 38424 | 38424 | 38424 | 38424 |

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: the case of firms without affiliates

| Independent variables | Model 17 | Model 18 | Model 19 | Model 20 |
|---|---|---|---|---|
| Firm size | -0.826*** | -0.829*** | -0.877*** | -0.880*** |
| | 0.041 | 0.041 | 0.042 | 0.042 |
| Capital labor ratio | -0.002 | -0.001 | -0.0001 | 0.00001 |
| | 0.002 | 0.002 | 0.002 | 0.002 |
| Operating surplus ratio | -0.118 | -0.074 | -0.147* | -0.144* |
| | 0.087 | 0.090 | 0.086 | 0.087 |
| Value added ratio | 0.109 | 0.061 | 0.142 | 0.138 |
| | 0.091 | 0.093 | 0.090 | 0.090 |
| Wage ratio | 0.559*** | 0.477** | 0.273 | 0.287 |
| | 0.210 | 0.212 | 0.226 | 0.226 |
| R&D dummy | -0.229*** | -0.256*** | -0.121** | -0.126** |
| | 0.057 | 0.056 | 0.060 | 0.059 |
| Advertisement cost ratio | 4.167*** | 4.272*** | 0.983*** | 3.974*** |
| | 0.703 | 0.688 | 0.764 | 0.762 |
| Foreign sales dummy | -0.326*** | -0.339*** | -0.298*** | -0.301*** |
| | 0.081 | 0.081 | 0.083 | 0.083 |
| Foreign procurement dummy | 0.401*** | 0.374*** | 0.384*** | 0.359*** |
| | 0.073 | 0.074 | 0.075 | 0.076 |
| Outsourcing dummy | -0.151*** | | -0.059 | |
| | 0.046 | | 0.054 | |
| Foreign outsourcing dummy | | 0.348* | | 0.328* |
| | | 0.186 | | 0.188 |
| Foreign ownership ratio | 0.107 | 0.162 | 0.253 | 0.281 |
| | 0.214 | 0.215 | 0.216 | 0.216 |
| Number of establishments | 0.007*** | 0.007*** | 0.006*** | 0.006*** |
| | 0.001 | 0.001 | 0.001 | 0.001 |
| Affiliate firm dummy | 1.194*** | 1.191*** | 1.182*** | 1.183*** |
| | 0.043 | 0.043 | 0.044 | 0.044 |
| Industry dummies | Not included | Not included | Included | Included |
| Log-likelihood | -19257.04 | -19260.81 | -19158.01 | -19157.20 |
| Chi-squared | 1229.25*** | 1221.73*** | 1427.31*** | 1428.95*** |
| N | 29546 | 29546 | 29546 | 29546 |

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

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

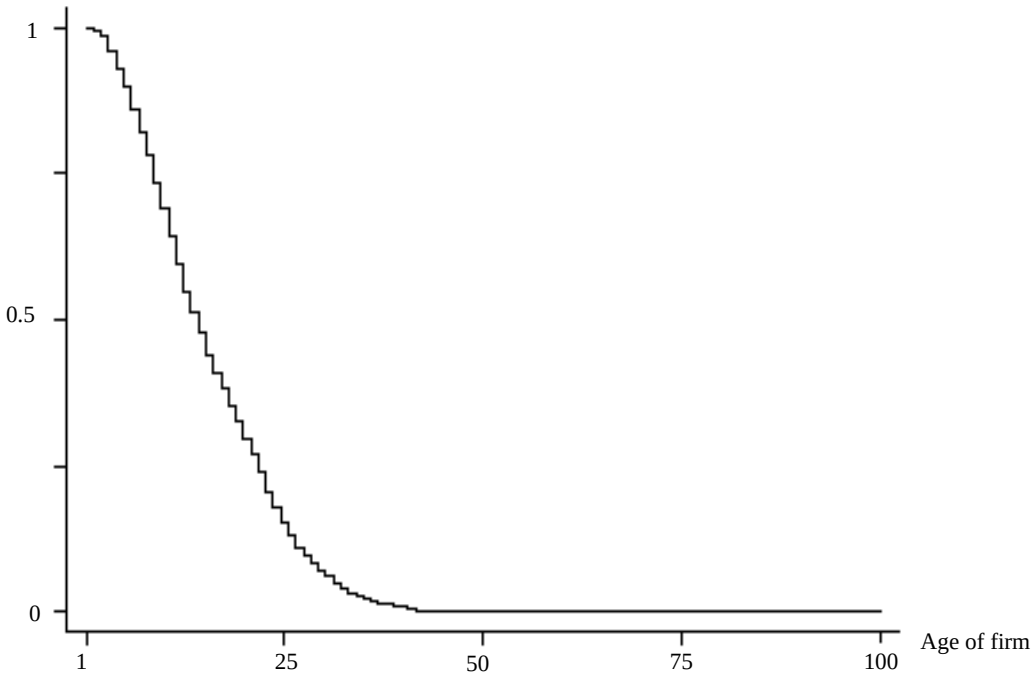
Table 7 Results of Cox regressions: the case by firm size (number of regular worker)

| Independent variables | Model 21 (Firm size:50-99) | Model 22 (Firm size:100-199) | Model 23 (Firm size:200-299) | Model 24 (Firm size:300-499) | Model 25 (Firm size:500-999) | Model 26 (Firm size:1000 or more) |
|---|---|---|---|---|---|---|
| Firm size | -0.237*** | -0.521*** | -0.347 | 0.283 | 0.502 | -0.455** |
| | 0.120 | 0.168 | 0.475 | 0.411 | 0.385 | 0.199 |
| Capital labor ratio | -0.003* | -0.0004 | 0.003 | -0.021** | -0.041*** | 0.004 |
| | 0.002 | 0.002 | 0.002 | 0.008 | 0.013 | 0.007 |
| Operating surplus ratio | -0.216*** | -0.215* | 0.072 | 0.391 | -0.129 | -1.243 |
| | 0.077 | 0.112 | 0.086 | 1.412 | 0.174 | 2.114 |
| Value added ratio | 0.212*** | -0.281* | -0.314 | 0.535 | 0.076 | 0.604 |
| | 0.079 | 0.159 | 0.288 | 0.338 | 0.412 | 0.520 |
| Wage ratio | 0.441** | 1.015*** | 1.366** | -0.472 | 1.788** | 1.830* |
| | 0.218 | 0.349 | 0.058 | 0.800 | 0.778 | 0.987 |
| R&D dummy | -0.070 | -0.236*** | -0.272** | -0.371*** | -0.421** | -0.013 |
| | 0.055 | 0.077 | 0.125 | 0.140 | 0.175 | 0.241 |
| Advertisement cost ratio | 5.047*** | 3.664*** | 3.790 | 3.991* | -11.427* | 2.879 |
| | 0.773 | 1.208 | 2.841 | 2.355 | 6.711 | 4.547 |
| Foreign sales dummy | -0.171** | -0.325*** | -0.342* | -0.256 | -0.280 | -0.136 |
| | 0.074 | 0.105 | 0.175 | 0.185 | 0.248 | 0.294 |
| Foreign procurement dummy | 0.365*** | 0.171* | 0.318* | 0.210 | -0.165 | 0.121 |
| | 0.069 | 0.103 | 0.167 | 0.177 | 0.232 | 0.260 |
| Foreign outsourcing dummy | 0.289* | 0.332 | 0.420 | 0.600** | 0.468 | -0.300 |
| | 0.160 | 0.216 | 0.322 | 0.299 | 0.371 | 0.526 |
| Foreign ownership ratio | 0.148 | 0.163 | 0.294 | 0.404 | 0.624 | -0.711 |
| | 0.320 | 0.360 | 0.571 | 0.485 | 0.685 | 0.706 |
| Number of establishments | 0.008 | 0.013** | 0.002 | 0.010*** | 0.005** | 0.002*** |
| | 0.008 | 0.005 | 0.006 | 0.003 | 0.002 | 0.001 |
| Affiliate firm dummy | 0.997*** | 0.917*** | 0.958*** | 1.051*** | 1.185*** | 0.944*** |
| | 0.046 | 0.069 | 0.117 | 0.128 | 0.163 | 0.215 |
| Owning foreign affiliates dummy | 0.396*** | 0.563*** | 0.096 | 0.235 | -0.048 | -0.580** |
| | 0.093 | 0.116 | 0.183 | 0.177 | 0.229 | 0.265 |
| Industry dummies | Not included | Not included | Not included | Not included | Not included | Not included |
| Log-likelihood | -17572.40 | -7766.92 | -2421.34 | -1898.48 | -1154.60 | -683.38 |
| Chi-squared | 1327.22*** | 233.84*** | 90.23*** | 107.51*** | 129.41*** | 62.67*** |
| N | 19761 | 20241 | 8871 | 7789 | 6250 | 5058 |

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

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

Figure 1: Survival probability and the age of firm




Note: survival probability ($S_0$(t): baseline survival function) is obtained as follows:

$$S_o(t) = \exp\{-H_0(t)\}$$

where $H_0$(t) is the cumurative function of baseline hazard $h_0$(t), which is estimated by the proportional hazard model,

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

Appendix Table A1: Number of exit firms

| | Total observations | Exit firms | Exit ratio (%) |
|---|---|---|---|
| Independent firms | 44514 | 2485 | 5.58 |
| Afffiliate firms | 23456 | 1511 | 6.44 |
| Total | 67970 | 3996 | 5.88 |
| Firms with affiliates | 38424 | 1764 | 4.59 |
| Firms without affiliates | 29546 | 2232 | 7.55 |
| Total | 67970 | 3996 | 5.88 |
| Firm size: 50-99 | 19761 | 2175 | 11.01 |
| Firm size: 100-149 | 12345 | 624 | 5.05 |
| Firm size: 150-199 | 7896 | 319 | 4.04 |
| Firm size: 200-249 | 5133 | 183 | 3.57 |
| Firm size: 250-299 | 3738 | 147 | 3.93 |
| Firm size: 300 or more | 19097 | 548 | 2.87 |
| Total | 67970 | 3996 | 5.88 |

Notes:

(1) "Exit firms" are defined in our analysis as those who dropped from the surverys in two sequent years or more and also never returned to the survey once they dropped from the sample.

(2) The figures for total observations show the number of firm samples showed up in our panel dataset. Those showed up in the sequent surveys from 1994 to 1997, for instance, are counted as 4 observations. On the other hand, the figures for "exit firms" show the number of exit firms as defined above. Thus, "exit ratio" is obtained by dividing the number of "exit firm" by the number of total sample firms.

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 Firm Total | 1552 | 1070 |
| Returned in 1996 | 448 | |
| Returned in 1997 | 115 | 324 |
| Returned firm total | 563 | 324 |
| Returned firm % | 36.3 | 30.3 |

Note: Samples with missing data are included.

Appendix Table A3: Changes in firm size for the full sample (surviving firms only)

(Number of regular worker, absolute value)

| | 1994-1995 | 1995-1996 | 1996-1997 |
|---|---|---|---|
| Mean | 31.6 | 30.7 | 29.1 |
| Median | 8 | 7 | 7 |
| s.d. | 145.5 | 157.3 | 131.8 |

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

(surviving firms only)

(Number of regular worker, absolute value)

| | 1994-1995 | 1995-1996 | 1996-1997 |
|---|---|---|---|
| Mean | 11.2 | 10.4 | 10.7 |
| Median | 5 | 5 | 5 |
| s.d. | 26.6 | 24.7 | 26.5 |