The Determinants of Firm Exit in Japanese Manufacturing Industries

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ABSTRACT. This paper presents new evidence on the determinants of firm exits that occurred in Japanese manufacturing industries over the period 1981–1989. Gross-number measure is used for exits. Many structural factors have exerted a definite influence on the extent of exit; across industries, capital intensity and subcontracting relationships have an exit-promoting effect, while profits, industry growth, concentration, and R&D opportunity have a negative relationship with exit. In addition, the minimum efficient size has an inverted-U-shaped relationship. However, export opportunity has only a marginal effect. These results are likely to reflect exits of small business.

1. Introduction

There is little doubt that the Japanese economy has experienced a remarkable structural change in the industrial environment since the First Oil Shock. The evolution and adaptation of an industry to such a change are reflected in the process of firm entry and/or exit. Also, in Japan aggregate business start-up rate is of low level, and is smaller than business exit rate, reflecting stagnant business activity (SMEA, 1998, p. 306).The processes are likely to have a profound impact on industrial organization. Therefore, it is important to examine industry evolution, and in particular the processes of firm entry and exit.

However, there are only some empirical studies on firm mobility for Japanese industries, in sharp contrast to the U.S. and Europe.[1] Both Doi (1986) and Yamawaki (1991) have examined the determinants of net change in the number of firms in an industry.[2] The problem with the studies is that they analyze net change in the number of firms, and therefore fail to illustrate the gross pattern of exit. For example, if gross entry and exit are large, but are roughly equal, then the net change or net exit may be small. Also, those studies do not contain the tests of some important explanatory variables, like technological progress, foreign trade and subcontracting relationships, which may exert an influence on firm mobility. Recently, Doi (1999) examined the relation between firm mobility and its determinants using a new statistical index of mobility. The study did not explain the gross pattern of exit and also did not include the mobility of small businesses. Thus, they do not provide full empirical evidence about the process of exit.

Now, it is necessary to disentangle the extent and process of market mobility. One of the work is to examine the pattern by formulating the gross exit equation. The purpose of this paper is to analyze the relationship between market structure and the extent of gross exit in Japanese manufacturing industries over the period 1981–1989. The organization of this paper is as follows. Section 2 presents the measurement of the gross exit rate. Section 3 describes the methodology used for the empirical analysis is of the determinants of exit. Section 4 discusses the estimated results and their implications. Finally, Section 5 provides conclusion, along with suggestions for further research.

2. Measuring the gross rate of exit

First of all, it is necessary to construct the measures of the gross extent of exit, which also have been used by Dunne et al. (1988), Austin and Rosenbaum (1990), and Joeng and Masson (1991). But, unfortunately in Japan, there is no published statistical data available for its calculation.

This paper measures exit with questionnaire

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data. Data on the number of "exiters" in an industry between 1981 and 1989 were collected by the postal questionnaire survey for trade associations, of which the product classification level was largely a 4-digit or 6-digit SIC industry.[3] The number of exiters here does not include their suppliers or subcontractors.

Exiters here were membership firms (insiders) of trade association for each industry, and therefore are not always equal to the actual number of firms that exited the relevant industry. However, the discrepancy is likely to be very small, since in many industries, most firms had a membership under the "administrative guidance" of the Ministry of Trade and Industry. When there are more than two associations in an industry, exiters are measured as the total number for those associations. Additional and supplementary information was obtained by our interviews with trade associations and corporate staffs.

The extent of gross exit, called gross exit rate, is defined as follows:

$$EXR = \frac{NX}{TF},$$

where EXR stands for gross exit rate, NX the gross number of insider firms that exited the industry over the 1981–1989 time period, and TF the total number of insider firms in the industry at the end of 1980. The period of 1980s is characterized by firm restructuring, and in particular many exits, due to major changes in industrial structure.

However, the gross exit rate does not reflect sufficiently the characteristics of exiters. First, the rate can not capture the differences in exiters' size and also in their survival period. Small firms and new firms are likely to experience more turbulence than large firms and firms with long-term operations, respectively; and the determinants of the decision to exit may be different between the groups. Some studies (for example Kusuda et al., 1979; Acs and Audretsch, 1990; Lieberman, 1990; Mata, 1991; and Audretsch and Mahmoon, 1994a,b) explore the mobility of small or new firms. Similar examinations are beyond our direct purpose here. Nevertheless, most of exiters are very likely to be small business.

Second, the number of exiters may include firms acquired by other firms in the same industry. Further, there may be cases in which association seccessors do not cease production. Therefore, exits do not always reflect the change in production capacity through firm disappearance. The exit rate used here may understate or overstate the actual extent of exit, but, it very likely a good indicator of the extent of exit.

3. Empirical methodology

Exit patterns vary substantially across industries. The factors affecting the propensity to exit, in general, include profits, industry growth, and exit-forestalling conditions. These relationships are examined by Caves and Porter (1976) and Karakaya and Stahl (1991). Among the factors used here are profits, industry growth, concentration, capital intensity, advertising, research and development (R&D), economies of scale, exports, and subcontracting relationships.

Some of these factors are likely to affect both entry and exit. If the mobility barriers hypothesis (Caves and Porter, 1977) is correct, then the traditional barriers to entry such as advertising, R&D, economies of scale, and capital requirements are also barriers to exit. In fact, Shapiro and Khemani (1987), Dunne et al. (1988), Austin and Rosenbaum (1990), Flynn (1991) and Evans and Audretsch (1993) for U.S. industries, and Sleuwaegen and Dehandschutter (1990) for Belgiun industries, show that entry and exit are related. These factors have been examined by many existing studies. Existing studies on small business such as Agarwal and Audretsch (1999) may show suggestions as well.

Also, in this paper, some additional factors were introduced; exports and subcontracting relationships. It is because these factors are characteristic of Japanese industrial organization.

To examine the effects of such factors, the regression equation estimated had the following general structure:

$$EXR = \beta_0 + \beta_1(PCM) + \beta_2(IG) + \sum_i \beta_i(X_i) + \mu$$

where EXR is as described above, and PCM stands for price-cost margin, IG industry growth, X_i (i = 3, . . . , 8) additional explanatory variables, β_1, β_1, β_1, and β_i estimated parameters, and μ an error term. The additional explanatory variables used here include eight factors: CR concentration

ratio, MES minimum efficient size, KO capital-output ratio, DC dummy for consumer goods, DRD dummy for R&D-intensive industry, TFL initial number of firms, EX export ratio, and SR subcontracting ratio.

The equations were of a linear specification form, and were estimated by the ordinary least squares (OLS) method.[4] The sample consists of 101 four-digit SIC manufacturing industries over the period 1981–1989. The sample selection was based on the availability of explanatory variables.

Next, the measurement and expected effects of the variables used in the present paper will be described in turn.[5] All the variables are of an industry level.

(1) *Price-cost margin (PCM).* Higher profits reduce exiters, while lower profits stimulate the decision to exit. This relationship has been empirically confirmed by existing studies. Industry profits were measured as price-cost margin; (value added – payroll)/value-of-shipments. The margin used is three-year mean for 1980, 1985 and 1989.

(2) *Industry growth (IG).* The life stage of industry demand may exert a definite influence on exit; lower demand growth may increase exit. Many existing studies provide empirical support for such a relation. Industry growth was measured as value-of-shipments in 1989 divided by value-of-shipments in 1980.

(3) *Concentration ratio (CR).* In concentrated industries, many firms may be protected from competition. As a consequence, gross exit rate may be small. Thus, industry concentration may be negatively associated with EXR. In this paper, four-firm concentration ratio in 1985 was used.

(4) *Minimum efficient size (MES).* Economies of scale are often captured by minimum efficient size. The latter here was, following Comanor and Wilson's (1967) approach, measured by the average value-of-shipments of the largest establishments producing more than 50 percent of industry shipments divided by industry shipments in 1985.

In industries with larger MES, as Bain (1956) emphasizes, entry may be difficult, and therefore, displacement may not occur, which leads to exit. Also, only optimal firms may exist. However, those industries are likely to include a larger number of sub-optimal firms, which are eventually forced to move out of the industry concerned. Thus, the relation between MES and EXR is not definite. A quadratic term was included to detect possible non-linear relationship.

(5) *Capital-output ratio (KO).* The existing studies suggest that the cost structure, and in particular the extent of sunk costs, will affect entry and exit. The larger the extent of sunk costs, that is, the less the likelihood that part of sunk costs are recovered, the less likely, *ceteris paribus*, are the firms to exit. Thus, in capital- intensive industries exit may be difficult since fixed assets may have large sunk costs due largely to the durability and specificity of assets.

The capital-output ratio measures the degree of capital-intensive production, and therefore is a proxy for the extent of sunk costs. The ratio here was captured by the ratio of fixed assets to value-of-shipments in 1985.

(6) *Dummy for consumer goods (DC).* Consumers often stay with a particular brand because they want to be associated with the image its advertising conveys. In other words, incumbents have product differentiation advantages. The differentiation may impede exit through the goodwill or sunk cost effect. This relationship was examined by dummy for consumer goods; 1 for consumer goods, and 0 otherwise. Exit is less likely in consumer goods industries, since consumer-goods industries are roughly advertising-intensive, while other industries are not so.

(7) *Dummy for R&D-intensive industry (DRD).* R&D opportunity is expected to have conflicting effects on exit. R&D, as Audretsch and Mahmood (1994) suggest, may induce firm turbulence, which in turn is likely to lead to more exits of less-innovative firms. But, R&D may provide viability for more incumbents through innovation. Also, like advertising, R&D is often a specific investments which is sunk, and thereby is a barrier to exit. Therefore, it is difficult to expect *a priori* a definite relationship.

R&D opportunity was proxied by dummy for R&D-intensive industry; 1 for industries of which R&D/sales ratio is larger than the manufacturing mean (3.14%) in 1987, and 0 otherwise.

(8) *Export ratio (EX).* Export presence is large in Japanese firm activity. This fact may be related to firm exit since exports are likely to provide production opportunity for more firms; they can

protect or seat more incumbents, and in particular exports- oriented small firms. But, a stronger yen and fierce trade frictions that have occurred over the period 1980s might do damage to exports-oriented firms, and thereby incite more exiters. The export ratio used here is the ratio of industry exports to industry output in 1985.

(9) *Initial number of firms (TFL).* In an industry with many firms, it is likely that more firms enter and exit the industry, since there are a greater number of smaller firms which are more likely to exit. Therefore, EXR are positively related to the total number of firms (for example Flynn, 1991). In addition, those industries tend to be less concentrated; alternately, concentration is likely to be negatively related to the number of firms. Thus, the total number of firms may be an inverse proxy of the ease of mobility and also of industrial concentration. In this paper, TFL is the logarithm of TF defined in Section 2. The two variables, CR and TFL, were alternatively used.

(10) *Subcontracting ratio (SR).* In Japan, subcontracting relationships prevail. Many large firms contract, or make transactions on a continuous basis, with many small suppliers that bear the brunt of changes in demand or that have lower personnel costs.[6] They have been criticized as one of the notorious "keiretsu"system, since they may act as a barrier to entry, in particular from those overseas. The system in turn may protect existing firms, implying that subcontracting ratio is negatively related to exit. Also, manufacturers may survive by using subcontracting systems, since they can shift the loss on to subcontractors or suppliers.

However, it is likely that subcontracting relationships have an exit-promoting effect. Exit costs may be lower for firms with subcontractors than for firms with in-house production, since sunk costs are higher for plant closure than for rescinding the subcontracting relations. To test these conflicting arguments, the subcontracting ratio was included. It is defined as the ratio of consigned production costs to total material costs in 1985, which also has been used in Audretsch and Yamawaki (1993).

The data source is the *Census of Manufactures Report by Industry* for PCM, IG, MES, KO, and SR, and is the *Input-Output Table* for DRD and EX. EX of some industries was computed from the data offered by the relevant associations. CR was available in JFTC (1990), and for some industries, was calculated from information provided by trade associations and also from other source.[7]

4. Estimated results and their implications

The purpose of this paper is to detect the determinants of gross exit rate. Estimated results are shown in Table I. The table does not include some explanatory variables which had no definite effect.[8] The results involve only the robust relationships.

First, both price-cost margin (PCM) and industry growth (IG), as expected, are negatively and significantly related to the gross exit rate. In other words, lower rates of profits and demand

TABLE I
Estimated results: 1981–1989 (N = 101)

No.	(1)	(2)	(3)
Constant	0.196	–0.095	0.162
PCM$*10^{-2}$	–0.336[a]	–0.389[a]	–0.386[a]
	(1.957)	(2.388)	(2.365)
IG	–0.039[b]	–0.039[b]	
	(2.001)	(2.153)	
CR$*10^{-2}$	–0.190[a]		–0.205[a]
	(2.725)		(3.060)
MES$*10^{-2}$	2.208[a]	2.251[a]	2.408[a]
	(2.741)	(3.001)	(3.005)
MES$^2*10^{-2}$	–0.094[a]	–0.099[a]	–0.101[a]
	(2.803)	(3.061)	(3.007)
KO	0.433[a]	0.581[a]	0.469[a]
	(3.221)	(4.446)	(3.512)
DC	0.023	0.028	0.033
	(0.710)	(0.930)	(1.047)
DRD			–0.059[b]
			(2.054)
TFL		0.038[a]	
		(4.021)	
EX$*10^{-2}$	–0.104		
	(1.445)		
SR$*10^{-2}$	0.440[a]	0.404[a]	0.412[a]
	(3.209)	(3.083)	(3.062)
$\bar{R}^2$	0.272	0.299	0.263
[F]	[5.661]	[6.346]	[5.468]

Note: T-values are in parentheses; F is F-value. Significance level; [a] = 1%, [b] = 5% (two-tailed test).

growth encourage exit. The findings are consistent with those for net exit rate from Doi (1986).

Second, capital-output ratio (KO) unexpectedly takes the positive sign, which is different from the sunk cost effect and has a significant influence on gross exit rate. In capital-intensive industries, less-efficient or failing firms tend to exit. This result is different from that of Doi (1986) on net exit, and also from the evidence for the U.S. (Austin and Rosenbaum, 1990; Dunne and Roberts, 1991). But, it is likely to be consistent with the finding by Yamawaki (1991) that capital-output ratio is negatively related to net entry rate.

Third, the effect of concentration (CR) has a significant and negative relationship. This finding is consistent with Flynn (1991). In other words, industrial concentration deters exit. An alternative explanation for the result is that highly concentrated industries have high entry barriers and therefore have a low turbulence among firms once they have entered. In any case, in concentrated industries, the extent of exit is relatively small and industry structure is likely to be stable.

Fourth, minimum efficient size (MES) has a quadratic, not linear, relationship to the gross exit rate; that is, an inverted-U-shape. The MES has an exit-promoting effect until the critical size point, but beyond the point, the exit rate tends to decrease. The first part of this finding may be explained by the relationship, suggested above, that the larger the minimum efficient size, the more the less-efficient potential exiters.

However, in industries with the largest MES size, there may be a small number of sub-optimal firms which are potential exiters. Therefore, MES is negatively related to EXR. Alternatively, the finding may be attributable to the fact that in most industries the great majority of firms is sub-optimal (Audretsch and Yamawaki, 1993). Sub-optimal firms can continue to operate by offsetting disadvantages of small size with alternative advantages. Therefore, in those industries exit rate may be reduced.

Fifth, the dummy for consumer goods (DC) is not significantly related to exit, though its sign is as expected. Also, advertising intensity (advertising expenses/output ratio in 1985, which is available from the *Input-Output Table*), of which the result is not shown in Table I, has no significant effect. Therefore, advertising or product differentiation is not a significant determinant of exit or turbulence.

Sixth, R&D dummy (DRD) has a negative and significant effect, indicating that R&D discourages exit. This finding implies that the R&D opportunity increases the viability of existing firms, due to their technological capability and/or the entry barriers related to R&D, and thereby reduces exiters.

Seventh, the initial number of firms (TFL) is positively and significantly related to exit. This evidence is likely to reflect that industries with many firms are easy-exit and easy-entry ones, since industries with a large number of firms usually include many small and peripheral firms, which easily move into and out of the industries. Therefore, the result suggests that exit is related to entry as well.

The finding may reflect the effect of concentration as well as the above relationship, since industries with a large number of firms, as suggested above, tend to be less concentrated. This result is consistent with the effect of concentration.

Eighth, export ratio (EX) is statistically significant at the 20 percent level, with negative sign. The prediction that export opportunity seats a larger number of existing firms only receives marginal empirical support. The result may reflect that the seat-increasing effect referred to above might be disturbed by the damaging effect due to stronger yen.

Finally and interestingly, subcontracting ratio (SR) has a robust and positive effect, indicating that there are actually more, not fewer, exits in industries with larger subcontracting ratio. This result is against the expectation of many, and in particular foreign observers. One possible explanation for the finding is, as suggested above, when subcontracting systems are available, principal firms or manufacturers can exit with less costs by rescinding the contracts or transactions with subcontractors or suppliers. Put alternately, sunk exit costs are less for principal firms. In fact, there are a decreasing number of subcontractors (Doi and Cowling, 1999). Therefore, subcontracting relationships are not likely to deter turbulence among firms.

5. Concluding remarks

This paper has provided the first evidence on the determinants of firm exits that occurred in Japanese manufacturing industries over the period 1981–1989, by using several structural variables. The main findings across industries are:

(1) Capital intensity and subcontracting relationships have an exit-promoting effect, while profits (price-cost margin), industry growth, concentration, and R&D opportunity have a negative relationship to exit. Also, in industries with large initial number of firms, gross exit rate tends to increase.
(2) Minimum efficient size has a quadratic relation with an inverted-U-shape.
(3) Exports only have a marginal exit-restricting effect. Also, exit has no discernible relationship to the character of industry (or advertising intensity).

Thus, many structural factors have been important in influencing exit behavior. It is worth noting that the subcontracting relationships have a positive effect on exit, and that R&D opportunity has a negative relationship to exit. Therefore, it is necessary to look at market structure to enhance industrial mobility.

However, some problems remain to be solved. First, the number of exiters used may not always reflect the total number of exiters in an industry since they are firms which have lost membership in trade association(s) in the industry. Therefore, the conclusions derived here may be tentative. It is necessary to replicate the analysis of the extent of exit with the precise data.

Second, it is important to note the types of firms which exit. The present study fails to distinguish large exiters from small exiters, and also domestic exiters from foreign-affiliated firms. The responsiveness of exiters may be asymmetrical between large and small firms, and also between domestic and foreign firms. It is necessary to examine the process and extent of exit according to firm size and ownership (or nationality).

Third, exit includes two types, operation closure and sell-off. The difference in exit method may have an effect on industrial organization. The present study does not take into account the difference.

Finally, this study does not examine directly the relation between exit and entry rate. It is largely due to the unavailability of the number of entrants in many industries out of the industries included in the exit analysis.

These improvements and refinements are left for future studies.

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Notes

[1] Existing studies on mobility are excellently surveyed by Gilbert (1989), Scherer and Ross (1990), Geroski et al. (1990), Geroski (1991), and Siegfried and Evans (1994). Geroski and Masson (1987), Geroski and Schwalbach (1991), Mata and Audretsch (1995), and Baldwin (1995) show interesting findings for some countries as well.

[2] Yamawaki (1991) used the number of firms from the *Census of Manufactures*. Doi (1986) utilized *The Data of Industria1 Organization* (1976) by Economic Planning Agency.

However, firm mobility from the *Census* may be "over-inclusive" for the twofold reasons; first, the digit number for industry classification is less than 4. Second, the *Census* data may include parts manufacturers or subcontractors as well as finished products firms.

[3] The survey form was sent to 301 trade associations in manufacturing industries. We received valid responses from 183 trade associations, which covered 203 industries.

[4] In this paper, there was only a small number of industries with no exit. Therefore, TOBIT regression was not adopted.

[5] In addition to the exit rate used here, the extent of exit can be captured by market share of exiters. For example, Dunne and Roberts (1991) used the exiter share. But, the computation of the share is difficult in Japan, due to the unavailability of the relevant data.

[6] Subcontracting relationships in Japan are discussed in Doi and Cowling (1999).

[7] Additional data sources are: Yano Economic Research Institute, 1987, *Market Share in Japan*, and Nikkei Sangyo Shimbun, 1989, *Market Share*, Nihon Keizai Shimbun-sha.

[8] Further, this test includes two alternative factors; advertising intensity (advertising expenses/output) and R&D intensity (R&D expenses/output). They both have no definite effect.

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