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Article
原　著

Growth and Ownership: Evidence from Foreign Manufacturing Affiliates in Japan[1]

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Using panel data on 500 foreign manufacturing affiliates in Japan over the period 1991-2000, fixed effect estimates indicate that partnership with a local firm increases the growth potential of foreign firms but is less beneficial for larger and older foreign affiliates. Also, it is found that size and age have significant effects on foreign affiliate growth as demonstrated in previous studies on domestic firms. Hence, the size, age, and ownership structure of foreign affiliates appear to be important considerations in determining long-term growth potential from a policy perspective.

Keywords: joint venture; growth; ownership; foreign affiliate; Japan.

1. INTRODUCTION

Most countries have recognized the increasing significance of foreign direct investment (FDI) in accelerating and sustaining an economy. Japan is not an exception. The Japanese government has been accelerating its efforts to promote investment in the country. As a result, FDI into Japan has gained in momentum considerably in recent years. FDI inflow soared from ¥369.7 billion in 1995 to ¥3.1 trillion in 2000, of which 36% are investments by foreign-affiliated firms (Ministry of Finance, Japan). The ***Survey on the Actual Conditions Regarding Access to Japan for Inward Foreign Direct Investment***, conducted by the Japan External Trade Organization (JETRO) in 2000, reports that 80% of foreign firms operating in Japan have added their workforce since they were founded.[3] Yet there has been almost no previous research examining the growth of foreign firms in the country, which is our major concern in this study. We expect that this study will not only contribute to firm growth literature but also will draw attention from other scholars.

Previous empirical studies on firm growth are basically focused on domestic firms (e.g., Simon and Bonini, 1958; Evans, 1987; Hart and Oulton, 1996; Sutton, 1997; Goddard and Blandon, 2002). These studies provide evidence on scale effects on growth; and demonstrate that smaller and younger firms grow faster than larger and older firms (Dunne, Roberts and Samuelson, 1989; Dunne and Hughes, 1994; Geroski, 1995), as predicted by Jovanovic's (1982) learning theory. In contrast, Shanmugam and Bhaduri (2002) find that older firms grow faster than younger firms using a sample of firms in a developing economy. Hence, the conclusion regarding the scale effect as well as age effect on growth is still far from agreement.

The purpose of this paper is to investigate the growth pattern of foreign-affiliated firms operating in the

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3 See http://www.jetro.go.jp/ip/e/access/e_toushi.pdf.

manufacturing sector of Japan between 1991 and 2000 by extending the existing studies on firm growth and considering the ownership structure of these affiliates. The ownership structure of foreign affiliates has been examined in the context of the entry mode literature (Delios and Beamish, 1999). However, an overlooked issue is that the ownership strategy of a foreign investor may affect the growth of an established foreign firm, noting that most foreign investors alter their ownership strategy over time. There has been almost no previous research on whether engaging in joint ventures contributes to the growth of a foreign firm in a host country. In the only research reported to date, Blonigen and Tomlin (2001), examine the growth of Japanese manufacturing affiliates in the US.

In our descriptive and empirical analyses, we use a 3-year unbalanced panel data set of 500 foreign affiliates from ***Affiliates and Offices of Foreign Corporations in Japan***, published by Nihon Keizai Shimbun Inc., unlike in previous studies in which cross-sectional data is employed. In descriptive analysis, we analyze the dynamic growth behavior of the same foreign affiliate. To control for fixed effects, fixed effects estimations are used in the empirical analysis. Also, to observe whether growth pattern varies across different groups of samples, we estimate the growth model separately by size and ownership structure in our empirical analysis.

LITERATURE REVIEW

The study on the relationship between firm size and growth can be traced back on the early 1930's[4]. Gibrat's Law, also known as the Law of Proportional Effect, which as interpreted by Sutton (1997) argues that the expected value of the increment to a firm's size in each period is proportional to the current size of the firm. In support of this law, earlier authors show no significant relationship between firm growth and size such as Simon and Bonini (1958), and Hymer and Pashigian (1962).[5]

On the other hand, there is a large body of studies that negates the validity of Gibrat's Law. These studies find significant scale effect on growth although implications have been mixed. Hall (1987) in his investigation of the dynamics of firm growth in the US manufacturing sector finds that firm size and growth are negatively related and the variance in growth rates across firms changes significantly over time. Evans (1987), examining the relationship between firm size and growth with several alternative samples of firms, also finds that firm growth decreases with firm size for all relevant samples and proves that the negative relationship is significant and robust to sample censoring, which rejects the argument of Mansfield (1962) that the inverse relationship is an artifact of the exit of slow-growing firms from the sample.[6]

Following Evans (1987), Dunne, Roberts and Samuelson (1989) explore a data set of over 200,000 plants that entered the US manufacturing sector in the 1967, 1972, or 1977 Census of Manufactures and avoid the sampling difficulties by grouping observations on individual plants into cells based on the plant's current size, age, two-digit industry, year of observation, establishment ownership status, and initial size. The empirical results indicate that the firm growth-size relationship is negative for plants owned by single-plant firms but positive for plants owned by multiplant firms.

Aside from the econometrical issues addressed in the studies of Hall, and Dunne, Roberts, and Samuelson, these studies also examine the linkage between firm size and growth by including firm age as a determinant of firm growth. These studies suggest a decreasing growth effect of age: the proportional rate of growth becomes smaller as the firm gets older. As Evans indicated, the firm age-growth relationship, is important because some earlier theories of firm growth predict a particular pattern of growth over the life cycle of the firm. Ever since this argument, the firm growth model is extended by considering the scale effect as well as the age effect[7].

The validity of Gibrat's Law has also been tested for

4　Firm size is measured in a number of ways such as by sales, employment and assets.

5　The study of Simon and Bonini is based on the British data of Hart and Prais (1956) and data on large American firms in 1955 while that of Hymer and Pashigian is based on 1,000 largest manufacturing firms in the US between 1946 and 1955.

6　The sample consists of approximately 20,000 manufacturing firms drawn the Small Business Data Base (SBDB) constructed by the Office of Advocacy of the US Small Business Administration (SBA) for 1976, 1978, 1980 and 1982.

Japanese firms. Goddard and Blandon (2002) employ cross sectional and panel tests of the law for a sample of 443 Japanese manufacturing firms between 1980-1996. They also conclude that the law should be rejected for Japanese manufacturing over the period and suggest that the cross sectional estimate of the annual growth on size may overstate significantly the true value of the parameter, favoring the estimate of the panel test.

While there have been enormous empirical works on the scale and age effects on firm growth focusing on domestic firms, there has been almost no previous research on how size, age, and ownership structure affect the growth of an affiliate in a host country. To date, Blonigen and Tomlin (2001) have examined the growth of Japanese manufacturing affiliates in the US. In line with previous studies, they also provide evidence on the inverse firm size-growth and firm age-growth relationships, which are robust and consistent results both for acquired and greenfield establishments. They point out that the effects of joint ownership with a domestic firm are at two extremes. In a sense that an enterprise can begin as a more experienced firm through partnership with a domestic firm, it will experience lower growth and/or the learning effect on growth will not be as pronounced. On the other hand, joint venture activity may facilitate the ability of the enterprise to learn and grow more quickly in the market. However, using cross sectional data, they find that there is no significant difference between joint ventures and other greenfield investments with respect to the effect on plant growth.

In summary, there exist three issues that concern us: the ownership, scale and age effects on the growth of foreign affiliates in a host country. We build our hypotheses based on the foregoing arguments and extend the model of firm growth by showing how scale and age effects on growth vary with ownership structure, and controlling for unobservable factors that may be significant determinants of foreign affiliate growth.

7 Other recent studies also indicate the effect of the intensiveness of a firm's R&D on its growth (e.g., Cohen, Levin, and Mowery; 1987 and Del Monte and Papagni; 2003). Here, it is not examined because of limited availability of data.

HYPOTHESES

In contrast to stochastic models based on Gibrat's Law, learning models emphasize the role of the learning process in explaining firm growth (e.g., Penrose, 1959; Jovanovic, 1982; Geroski and Mazzucato, 2002). One may argue that large firms have wider range of information sources and methods of acquiring knowledge and thus have higher level of knowledge. However, this does not necessarily imply that large firms learn faster.[8] In fact, there is a tendency for an increasing firm size to dilute the ability of a manager to catch information and solve problems decisively. Further, as size increases, the manager's delegation of tasks to committees or staffs makes distortion in the learning process likely. This phenomenon may be considered as an outcome of the absorptive capacity of the firm indicated by firm size which limit or constraint the ability of firms to learn.

Hypothesis 1: Smaller foreign affiliates are more likely to grow faster than larger foreign affiliates.

As discussed in the previous section, the firm growth-age relationship has also become an interest in the field of firm dynamics. Strong arguments support the view that older firms are more likely than young firms to achieve lower performance on average (Jovanovic, 1982; Dunne and Hughes, 1994). According to Jovanovic's model, the firm's learning over time follows a Bayesian learning process, implying that the firm's output level converges to its optimal state over time. Older firms are more likely to be close to convergence and thus, experience lower growth. Further, older firms suffer from ossification of their routines, non-learning processes, blindness and conservatism, which cause poor performance and decline (Boeker, 1997; Szulanski, 1996).

Hypothesis 2: Younger foreign affiliates are more likely to grow faster than older foreign affiliates.

When entering a foreign market, investors frequently have the option to own 100%, majority or minority shares of an affiliate based in a host country. These alternatives

8 If one assumes that large firms tend to have high R&D investments that help them acquire new knowledge, there may be positive relation between firm size and knowledge stock growth. However, the unavailability of data on R&D investments limits our ability to explore this issue.

imply varying levels of control and commitment as well as limits and opportunities. A common motivation for finding a local partner is the need to acquire new assets that are likely to be subject to market inefficiencies, making the cost of market-based exchange prohibitive (Delios and Beamish, 1999). Moreover, under conditions of uncertainty and lack of knowledge, internationalizing firms are subject to the liability of foreignness (Zaheer, 1995). Joint venturing offers them the opportunity to make use of market-specific capabilities of joint venture partners and offers the prospect of generating knowledge that could be valuable in their performance. In line with this argument, Youssef and Hoshino (2003) indicate that the local assets acquired by firms from their local partners will consequently influence the growth of these firms. Nevertheless, the beneficial effects of local ownership may vary across foreign firms. For instance, larger foreign affiliates which usually possess vital assets that consequently make them more capable of allocating intensive investments in intangibles may not consider local presence beneficial or important to their performance as smaller affiliates do. Moreover, the advantages associated with local ownership may be more concentrated in the early years of operation of foreign affiliates since they are more resource-constrained and more lacking in relevant knowledge about the market at this stage. Thus younger foreign affiliates may benefit more than older foreign affiliates.

Hypothesis 3: Establishing a joint venture with a domestic firm has beneficial effect on the foreign affiliate growth. However, this beneficial effect decreases with the size and age of the foreign affiliate.

DATA

The descriptive and empirical analyses of this paper are based on a 3-year unbalanced panel data set for 500 foreign-affiliated firms in the manufacturing sector of Japan throughout the period 1991-2000, producing a total of 790 samples.[9] The primary data source is the 1992, 1995, 1998 and 2001 ***Affiliates and Offices of Foreign Corporations in Japan***, which is a survey published annually by the Nihon Keizai Shimbun Inc.[10] The industry data are from the ***Basic Survey of Japanese Business Structure and Activities***, conducted annually by the Ministry of Economy, Trade and Industry (METI). The scope of this survey covers enterprises with 50 or more employees and whose paid-up capital or investment fund is over ¥30 million, whose operation falls under the mining, manufacturing, and wholesale and retail trade, and eating and drinking places (excluding "Other eating and drinking places"). Financial data are all deflated using the overall wholesale price index obtained from the Bank of Japan.

DESCRIPTIVE ANALYSIS

Table 1 shows the 1991-2000 growth of foreign manufacturing affiliates by size and age.[11] In total, the youngest (less than 7-year old) and the smallest (less than 20 employees) categories both have the highest average growth rate of 4.29% and 5.75%, respectively; the oldest category (more than 32-year old) and the fourth size category (from 100 to 299 employees) on the other hand, have the lowest average growth rate, -1.72% and -1.33%, respectively. These observations suggest that the younger and the smaller (the older and larger) the foreign firm is the more (less) likely for this firm to have higher or positive growth rates.

9 The period analyzed covers the period after all manufacturing investments were liberalized in Japan, i.e., 100% foreign ownership was allowed. Hence, results on foreign ownership in this paper are not subject to ownership restrictions. Further, the Japan's economic downturn as revealed by its negative real GDP growth rate (-1.1%) in 1998 is assumed to be reflected in the 1997-2000 growth rates of foreign-affiliated firms.

10 This survey was first published in 1992 and there is no data available for years after 2000. This survey includes various types of foreign-affiliated firms such as affiliates owned by a foreign investor, government or group, joint ventures, branches, offices, agencies and subsidiaries of a foreign affiliate in all industries.

11 Growth is the average annual growth rate of employment, measured at 3-year interval so that growth reported for 1991 is the 1991-1994 average annual growth and so on. Size is measured by the average number of employees. Age is the number of years in business since establishment.

Table 1. Average growth (%) of foreign manufacturing affiliates in Japan, by size and age

Size	Age					Total
	0 ~ 6	7 ~ 14	15 ~ 24	25 ~ 32	33+	
1 ~ 19						
Percentage of Samples	2.66	5.82	3.54	1.01	0.25	13.29
Growth rate	14.55	2.00	7.64	0.68	-4.41	5.75
20 ~ 49						
Percentage of Samples	2.53	4.94	3.92	2.28	1.27	14.94
Growth rate	2.54	1.00	1.67	-0.42	-3.57	0.72
50 ~ 99						
Percentage of Samples	1.39	3.54	5.06	4.68	1.01	15.70
Growth rate	7.48	2.00	-1.59	-1.90	-0.74	-0.05
100 ~ 299						
Percentage of Samples	2.78	3.92	5.82	6.33	5.95	24.81
Growth rate	-4.21	2.00	0.30	-2.05	-2.99	-1.33
300 ~ 499						
Percentage of Samples	0.89	2.03	2.15	2.41	2.78	10.25
Growth rate	6.00	1.96	0.43	-0.94	-1.17	0.46
500+						
Percentage of Samples	1.39	3.04	3.67	3.80	9.11	21.01
Growth rate	0.58	-0.53	-1.52	-2.56	-0.83	-1.13
Total	11.65	23.29	24.18	20.51	20.38	100.00
	4.29	1.33	0.94	-1.66	-1.72	0.35

To observe the dynamic growth behavior of the same foreign affiliate over time, which is not captured in the preceding analyses, we show the transition pattern of foreign firms in Japan as determined by their size throughout the period of 1991-2000 in Table 2. The quartiles represent the percentile ranking of a foreign firm's scale: Quartile I as the lowest 25% and Quartile IV as the highest 25%. The quartiles in horizontal are for the initial period; the quartiles in vertical are for the final period. In Table 3, we present the characteristics following their transition pattern and group foreign affiliates into three based on their transition pattern for brevity: Group A represents foreign firms that moved to higher quartiles (i.e., experienced an increase in scale position); Group B those that remained in the same quartile (i.e., remained in the same scale position); and Group C those that moved to lower quartiles (i.e., experienced a decrease in scale position).

Table 2. Transition pattern of foreign manufacturing affiliates in Japan, by size

Period	Quartile[a]	I	II	III	IV
	I	22.46	3.74	0.00	0.00
1991-94	II	2.67	20.32	1.60	0.00
N=187	III	0.00	1.07	21.39	2.67
	IV	0.00	0.00	2.14	21.93
	I	23.76	4.95	0.50	0.00
1994-97	II	0.99	19.31	1.49	0.00
N=203	III	0.00	0.99	22.28	0.99
	IV	0.00	0.00	0.99	23.76
	I	17.75	0.50	0.50	0.00
1997-00	II	2.00	26.50	0.50	0.00
N=400	III	0.75	2.50	22.50	0.75
	IV	0.00	0.00	1.50	24.25

[a] The quartiles represent the percentile ranking of a foreign firm's scale: Quartile I as the lowest 25% and Quartile IV as the highest 25%. The quartiles in horizontal are for the initial period; the quartiles in vertical are for the final period. Figures in quartiles indicate the percentage of firms belonging to respective quartiles.

Table 3. Characteristics of foreign manufacturing affiliates in Japan following their transition pattern, by size

Group	Number of firms (%)	Size	Age	Foreign ownership share (%)	Growth rate (%)
A: Firms that moved to higher quartiles	8.02	304	12	80.22	24.87
B: Firms that remained in the same quartile	86.10	765	24	63.67	2.09
C: Firms that moved to lower quartiles	5.88	252	18	77.55	-13.52
A: Firms that moved to higher quartiles	7.92	314	15	68.92	50.58
B: Firms that remained in the same quartile	89.11	829	25	62.31	0.66
C: Firms that moved to lower quartiles	2.97	127	24	100.00	-9.00
A: Firms that moved to higher quartiles	2.25	128	19	53.67	38.79
B: Firms that remained in the same quartile	91.00	568	24	60.33	-1.39
C: Firms that moved to lower quartiles	6.75	155	28	68.59	-32.53

In regard to the respective characteristics of each group, the main findings are as follows. First, foreign firms that moved to higher scale position were relatively smaller to those remained in their scale position and younger to all other foreign firms; and also they had remarkable average growth rate ranging from 26 to 46%. Second, those that moved to lower quartiles are the oldest and have an average growth rate of -32.53%. Also, they have relatively higher foreign equity ownership (i.e., less domestic equity ownership) than those in Group A and B. Third, foreign affiliates that remained in their scale position are the largest and had negative average growth rate between 1997 and 2000. Finally, foreign affiliates that had downsizing in 1994-1997 are mostly wholly foreign-owned firms.

To summarize, the findings from the transition pattern of foreign affiliates are consistent with those observations drawn from Table 1. That is, the younger and the smaller (the older and larger) a foreign affiliate is the more (less) likely for this foreign affiliate to have higher or positive growth rates; and joint-ventured foreign affiliates reveal better growth performance than wholly foreign-owned affiliates. These descriptive statistics support the hypotheses of this paper that will be further tested empirically in the following section.

METHODOLOGY

The estimating equation corresponds to the following form:

$$Growth\ rate = a + \beta_1 Ln(Size)_{it-d} + \beta_2 Ln(Age)_{it-d} + \beta_3 Dshare_{it-d} + \beta_4 Dshare * Ln(Size)_{it-d} + \beta_5 Dshare * Ln(Age)_{it-d} + \beta_6 Industry_{jt-d} + \Psi_{it} \quad (1)$$

where d is the number of interval years between the initial year and ending year of observation (i.e., lags); and Ψ_{it} is the random error term.[12] For comparability of results with those in previous empirical works (e.g., Evans, 1987, Blonigen and Tomlin, 2001), $Growth\ rate = Ln(Size)_{it} - Ln(Size)_{it-d}/d$, where $Ln(Size)$ is measured as log of employment; and $Ln(Age)$ is measured as log of age (i.e., number of years of the foreign affiliate's business operation).[13] The use of employment as proxy for firm size is assumed to be more appropriate in this

12 Kumar (1985) has noted that a smaller d yields higher persistency growth rates and so greater probability of inconsistency. Conversely, a larger d yields smaller serial correlation in growth and less unreliable estimates. Here, d is equal to 3 which controls for possible serial correlation.

13 A notable statistical problem in the model is that $Ln(Size)$ may be an endogenous variable, which may lead to biased results in an OLS regression. To test the null hypothesis that $Ln(Size)$ is actually exogenous, the endogeneity test suggested by Wooldridge (2001) is performed. The residuals (τ_{it}) from the reduced form regression of $Ln(Size)$ on all exogenous variables are first estimated and then included in the estimation of equation (1). The coefficient of τ_{it} is found to be insignificant, suggesting that $Ln(Size)$ is exogenous. Thus endogeneity is not an issue in the model.

paper since employment-based measures apply for resource and knowledge-based views of the firm (Penrose, 1959; Kogut and Zander, 1992). In addition, although sales or output is relatively insensitive to capital intensity and degree of integration, it is sensitive to inflation and currency. Dshare is domestic ownership share. ***Dshare*Ln(Size)*** and ***Dshare*Ln(Age)*** are interaction terms of domestic ownership share with size and age, respectively.

We controlled for the environmental conditions by including industry factors such as industry employment growth and profitability, which is deflated using the overall wholesale price index obtained from the Bank of Japan. These industry variables will control for the changing conditions of the industry in which a foreign affiliate is located.

To capture omitted variables in the model, the error structure for the disturbance term is specified as follows:

$$\Psi_{it} = \nu_i + \phi_t + \eta_{it}, \qquad (2)$$

where η_{it} is assumed to be uncorrelated with the independent variables. The first term of the decomposition, ν_i , varies across foreign affiliates but is constant across time (i.e., firm-fixed effect).[14] The second term, ϕ_t, varies across time but is constant across foreign affiliates (i.e., time-fixed effect). This will be estimated using year dummies. The third part on the other hand, varies unsystematically across time and affiliates. Another remaining issue is whether ν_i is correlated with independent variables or not. One can use either fixed effect or random effect model for estimation. The former allows for such a correlation, which is more likely to occur; the latter assumes that ν_i is uncorrelated with independent variables. In order to determine which estimation method yields efficient results, we perform the Hausman χ^2 specification test for all estimations.

It has been suggested that the true firm growth specification is not linear but of a higher order (Evans, 1987). Therefore, estimations with a specification that includes squared terms for size and age for both are also analyzed. In addition, industry dummies for OLS estimation are also included in the regression models. The summary statistics of all variables is reported in Table 3.

14 The null hypothesis of no firm-fixed effects is tested against the alternate that there are firm-fixed effects using F-test. The estimated F-test value is reported in the table of regression results.

Table 4. Descriptive statistics of variables

Variables	Mean by sample group[a]				
	Full sample	Small and medium affiliates	Large affiliates	Joint ventures	Wholly foreign-owned affiliates
Growth rate	0.003	0.008	-0.006	0.005	0.001
	(0.134)	(0.150)	(0.087)	(0.135)	(0.127)
Ln(Size)	4.891	4.021	6.826	4.837	5.005
	(1.695)	(1.133)	(0.992)	(1.828)	(1.539)
Ln(Size squared)	26.791	17.450	47.570	26.730	27.410
	(17.658)	(8.370)	(14.955)	(18.860)	(16.644)
Ln(Age)	2.933	2.819	3.187	2.972	2.888
	(0.741)	(0.700)	(0.766)	(0.704)	(0.801)
Ln(Age squared)	5.731	5.491	6.264	5.815	5.632
	(1.586)	(1.509)	(1.632)	(1.508)	(1.715)
Dshare	37.324	37.618	36.670	50.076	
	(32.916)	(33.434)	(31.789)	(16.405)	
Dshare*Ln(Size)	179.43	147.75	249.906	240.989	
	(179.103)	(147.85)	(218.539)	(125.789)	
Dshare *Ln(Age)	110.150	107.201	116.710	149.140	
	(103.418)	(101.206)	(108.102)	(64.40)	
Industry profit	0.044	0.045	0.043	0.044	0.046
	(0.020)	(0.020)	(0.022)	(0.020)	(0.020)
Industry employment growth	-0.019	-0.020	-0.017	-0.020	-0.018
	(0.027)	(0.029)	(0.023)	(0.028)	(0.027)
Year 1994	0.257	0.247	0.279	0.252	0.271
	(0.437)	(0.432)	(0.450)	(0.434)	(0.445)
Year 1997	0.506	0.532	0.449	0.503	0.491
	(0.500)	(0.499)	(0.498)	(0.501)	(0.501)
Number of Observations	790	545	245	445	273

[a] Figures in parentheses are standard deviation values.

Further, as Mansfield (1962) and later Sutton (1997) point out, the discrepancy in conclusions about the validity of Gibrat's Law emanates from using three different types of sample of firms—all firms, only surviving firms, and only large firms. To ensure that the results in this paper are not slanted towards any one of these, the growth model is estimated using different group of samples such as all samples; joint ventured and wholly-owned foreign firms; small- and medium-scale, and large scale foreign firms. Through this, sample selection bias is observed.[15] That is, when the consequences of not obtaining a high growth opportunity differ systematically between large, and small and medium foreign firms in terms of the likelihood of survival, the size effect on growth patterns across different samples should vary, i.e., Gibrat's law will tend to hold for large firms but not for small and medium firms, and suggests that sample bias may be an issue in this paper.

EMPIRICAL ANALYSIS

Table 5 reports the fixed effects estimation results of specifications of the growth model for full sample, small- and medium-scaled, and large-scaled samples, joint ventures, and wholly-owned samples, respectively. We also estimate the model using pooled OLS and random effects model.[16] In terms of goodness of fit, the estimated R^2s are more than 4 times higher in all cases of fixed effect estimations than pooled OLS estimations. The ***F***-tests consistently reject the null hypothesis that the effect of firm-fixed effect, ν_i , is equal to zero at the 1% significance level. These suggest that the fixed effects model performs better than the OLS model and the omission of firm-fixed effects biases the OLS results. Also, the Hausman χ^2-test statistics reported in the table reject the null hypothesis that random effects estimator is efficient at the 1% significance level and thus support the fixed effect model in all cases. Hence, we only report the results of fixed effects estimations.[17]

In regard to estimation results for full sample (Models 1 and 2), the negative coefficient on ***Ln(Size)*** and positive coefficient on ***Ln(Size squared)*** indicate that growth is convex in size—foreign affiliate growth initially decreases with size but then flattens out as size increases. The nonlinearity in the relationship between age and growth is also supported as the significantly negative coefficient on ***Ln(Age)*** and positive coefficient on ***Ln(Age squared)*** indicate, suggesting that the effect of increasing age weakens as foreign affiliates get older.

The positive and significant coefficient on domestic ownership supports our hypothesis, indicating that domestic ownership promotes affiliate growth. However, the significant and negative coefficient on ***Dshare*Ln(Size)*** suggests that the extent of increasing effect of local ownership on growth decreases with the size of the foreign affiliate. In the other dimension, the negative scale effect on growth escalates with local ownership percentage. Substantively, these results suggest that local ownership is particularly beneficial to smaller foreign affiliates, and that it is less beneficial to foreign affiliates with larger size.

Although Year 1997 is found to be significant only when industry variables such as industry profitability and employment growth are included in the fixed effect estimation, an ***F***-test of the hypothesis that the effects of Year 1994 and Year 1997 on growth are equal is rejected

15 In estimating the effects of any variable on the growth of affiliates, a critical problem is that for computing a growth rate, only surviving firms can be used for observation. Doms, Dunne and Roberts (1995) and Hall (1987) use Heckman's two step estimation procedure to control this sample selection bias. In this paper however, the fact that an affiliate is not in the dataset in $t+d$ may mean several things. It may have failed; it may have merged with or acquired by another firm; it may have voluntarily dissolved itself (i.e., refused to respond to the survey). Since the survey used is not mandatory and does not provide information on survival or dissolution, the latter reason seems to be to a greater extent, which will lead to "false dissolution" of affiliates in a survival analysis.

16 In pooled OLS estimations, heteroskedasticity is controlled using White-type standard errors and including industry dummies in regressions. Industry dummies are found to be insignificant in all OLS specifications. Although their inclusion remedies the heteroskedasticity in the model as indicated by a White test of heteroskedasticity, the ***F***-test of the null hypothesis that there is no difference in growth patterns across industries cannot be rejected.

17 The pooled OLS and random effects estimation results are available upon request.

Table 5. Fixed effects estimation of the determinants of foreign manufacturing affiliate growth in Japan

Independent variables	Full sample		Small and medium		Large		Joint ventures		Wholly-owned	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(Size)	-0.332	-0.638	-0.400	-0.749	-0.282	0.057	-0.444	-0.728	-0.224	-0.035
	(16.23)***	(11.33)***	(14.21)***	(5.46)***	(7.97)***	(0.130)	(11.26)***	(12.35)***	(7.35)***	(0.270)
Ln(Size squared)		0.032		0.046		-0.025		0.039		-0.017
		(5.79)***		(2.48)**		(0.800)		(6.08)***		(1.500)
Ln(Age)	-0.026	-0.471	-0.039	-0.874	-0.026	0.400	0.394	1.021	-0.056	-0.506
	(1.310)	(1.98)**	(1.79)*	(2.85)***	(0.740)	(0.320)	(3.20)***	(0.790)	(2.29)**	(1.660)
Ln(Age squared)		0.205		0.398		-0.185		-0.332		0.213
		(1.87)*		(2.74)***		(0.340)		(0.610)		(1.480)
D share	0.007	0.007	0.009	0.009	0.003	0.002	0.025	0.021		
	(3.54)***	(3.32)***	(3.91)***	(4.12)***	(0.530)	(0.350)	(4.29)***	(3.84)***		
Dshare*Ln(Size)	-0.001	-0.001	-0.002	-0.001	0.000	0.000	0.001	-0.001		
	(3.04)***	(3.58)***	(3.34)***	(2.55)**	(0.530)	(0.350)	(0.840)	(1.350)		
Dshare *Ln(Age)	-0.001	-0.001	0.000	-0.001	0.000	0.000	-0.008	-0.004		
	(1.90)*	(1.470)	(0.600)	(1.580)	(0.260)	(0.130)	(3.74)***	(2.21)**		
Industry profit	1.183	1.064	1.509	0.790	1.156	1.263	1.423	1.127	2.279	2.290
	(1.650)	(1.570)	(1.540)	(0.810)	(1.370)	(1.470)	(1.67)*	(1.460)	(1.420)	(1.440)
Industry employment growth	-0.085	-0.127	-0.255	-0.316	0.513	0.474	-0.601	-0.632	0.220	0.276
	(0.380)	(0.610)	(1.050)	(1.340)	(1.400)	(1.270)	(2.16)**	(2.51)**	(0.580)	(0.740)
Year 1994	0.004	0.004	0.017	0.027	-0.024	-0.028	-0.012	-0.023	-0.024	-0.030
	(0.340)	(0.300)	(0.920)	(1.520)	(1.510)	(1.490)	(0.710)	(1.050)	(0.830)	(1.040)
Year 1997	-0.026	-0.023	-0.013	0.002	-0.044	-0.056	-0.064	-0.083	-0.062	-0.069
	(1.370)	(1.240)	(0.490)	(0.090)	(1.85)*	(1.68)*	(2.43)**	(2.02)**	(1.550)	(1.72)*
Constant	1.637	2.439	1.623	2.418	1.989	0.669	0.690	1.202	1.220	0.855
	(14.47)***	(14.14)***	(12.98)***	(8.91)***	(8.17)***	(0.450)	(1.84)*	(1.590)	(7.36)***	(2.35)**
Number of Observations	790	790	545	545	245	245	445	445	273	273
Number of Firms	500	500	371	371	142	142	281	281	179	179
R-squared	0.650	0.690	0.770	0.780	0.610	0.610	0.790	0.830	0.480	0.510
Hausman χ^2-statistics	447.75 [a]	528.07 [a]	497.85 [a]	547.59 [a]	118.51 [a]	103.87 [a]	553.45 [a]	643.86 [a]	64.90 [a]	70.39 [a]
F-statistics (u=0)	3.54 [a]	4.02 [a]	5.13 [a]	5.49 [a]	2.34 [a]	2.23 [a]	4.64 [a]	5.74 [a]	2.76 [a]	2.85 [a]

[a] The dependent variable is the 3-year interval employment growth rate of foreign-affiliates. Robust *t*-statistics in parentheses. ***, **, * indicate statistical significance level at 1%, 5% and 10%, respectively. (3) [a] Indicates (Prob>χ^2, F) = 0.000.

at the 5% significance level. The negative sign of the coefficient on Year 1997 suggests that there was a decreasing overall trend in the growth of foreign affiliates in 1997 as compared to the trend in 1991 (the benchmark year). Industry variables on the other hand, are found to be insignificant. Thus, the growth of foreign affiliates in Japan may be more likely to be affected by the overall economic trend rather than changing conditions in their respective industry locations such as industry growth and profitability.

Turning to estimation results based on sample censoring, the results for small and medium foreign affiliates (with employees no more than 300), and large affiliates (with more than 300 employees) are first compared (Models 3~6). In the case of small and medium foreign affiliates, all the estimated coefficients have consistent signs with that of full sample's results. The estimates for large foreign affiliates on the other hand, show differences from earlier results. The quadratic term for size is no longer significant, suggesting that size has a linear relationship with growth across large foreign affiliates. Comparing the magnitudes of size effects, that of large foreign affiliates is found to be smaller. Age is also found to be insignificant for large foreign affiliates, indicating that growth does not vary with age among large foreign affiliates.

Further, we find that joint venturing with a local partner plays a significant role only for the growth of small- and medium-scaled foreign affiliates and not for large foreign affiliates. The estimated result on Year 1997 is also noteworthy. In oppose to the insignificant coefficient on Year 1997 for small and medium foreign affiliates, it is negatively significant for large foreign affiliates suggesting that large foreign affiliates experienced a decreasing trend in growth between 1997 and 2000.[18]

18 This result may serve as supporting evidence to the theory of Ghemawat and Nalebuff (1990) which says that large firm acts as a kind of "Stackelberg leader" that absorbs the general shocks in demand. They predict that in declining industries the largest firms will downsize first for two reasons: (1) they recognize that their production has the largest effect on price levels; and (2) they recognize that given the anticipated decline in demand, smaller firms will be able to produce profitability for a longer time.

The estimated results for Models 7～10 show that differences in ownership structure across affiliates are indeed related to growth differentials. The estimated size effect for the joint ventures is larger than that for the wholly-owned. This shows that the former experiences more decrease in their growth when their size increases than the latter does. Although the results on quadratic term of age are likewise insignificant across the two ownership structures, the age effect turns to be positive for joint ventured foreign affiliates while negative for wholly foreign-owned affiliates. It is also clear that differences in the percentage of domestic ownership in joint ventures are significantly related to differences in their growth patterns. The estimated positive coefficients on local ownership, and negative coefficients on the interactions terms of local ownership with size and age are all significant and suggest that the increasing effect of domestic ownership on growth shrinks with the size and age of joint-ventures. Interestingly, industry variables and Year 1997 are only found to be statistically significant for joint ventures, which may suggest that joint ventures are more likely to be affected by external factors than wholly foreign-owned affiliates.

CONCLUSION

Considering the rising prominence of foreign-affiliated firms in Japan, we investigate the growth behavior of foreign-affiliated firms in the manufacturing sector of the country. We estimate the growth model separately by affiliate size and ownership structure using panel data estimations. One key objective of this paper is to examine whether ownership structure has an impact on the growth behavior of foreign affiliated firms. This is a vitally important issue since as observed in the descriptive analysis, foreign investors in Japan use joint ventures to a great extent. Most of the estimated coefficients of the variables for full sample have theoretically predicted signs and are highly significant determinants of affiliate growth. Firm size, in support to the learning model, is found to be negatively related to the growth of foreign affiliates. Further, the implication of size effect on ownership structure is that smaller joint-venture foreign affiliates are more likely to gain from partnering with a local firm than larger joint-ventured foreign affiliates. This confirms the proposition that domestic ownership share is less beneficial to larger affiliates. Aside from economies of scale, another explanation to the plausibility of this finding is given that two or more parent firms of different origins are in control of a joint venture, the beneficial effect of domestic ownership is conditioned on cooperation and compromise between two managements, which may be required to a greater extent in large affiliates, unlike in a sole management of wholly-owned affiliates. This may imply that there are more growth distortions accompanied by increasing size in joint-ventured affiliates than in wholly-owned affiliates

In regard to the effect of age on growth, the estimated coefficients differ not only in magnitude but also in signs across samples. While the results for large and wholly-owned affiliates are similar to those found by previous studies of mainly domestic-owned firms, those for small and joint-venture affiliates reveal contrasting findings. In the former, growth decreases with age while increases at a diminishing rate with age in the latter. Based on these results, it seems that large and wholly-owned affiliates are less growth-constrained than small and joint-ventured affiliates in their early years of operation. Thus, it is desirable to identify the factors hampering the growth of small foreign affiliates and joint-venture affiliates, and provide them further assistance especially in their early years of operation as these factors may result in their withdrawal. Moreover, the negative coefficient on the interaction term of age with domestic ownership suggests that the increasing effect of joint venture on growth shrinks with age of foreign affiliates. This supports our hypothesis that as foreign affiliates age, they benefit less from joint ventures since their liability to foreignness diminishes over time.

The results in this paper show that ownership structure leads us to observe differentials in growth behavior among foreign firms already operating in Japan even after controlling for unobserved heterogeneity in time-invariant factors. The estimates of the effect of domestic ownership share on affiliate growth indicate the substantial role of joint venturing in small and medium affiliates, which is not observed among large affiliates. Noting that Gibrat's Law, i.e., firm growth is independent of firm size fails to hold, the size, age and ownership structure of foreign-affiliated firms appear to be important considerations in determining long-term

growth potential from a policy perspective. Hence, our findings favor differential in growth promoting policies or aids based on the said factors.

We expect that the aforementioned findings in this paper have raised vital issues about foreign-affiliated firms, particularly in Japan, as the growth performance of foreign firms, by definition, leads to opportunities for the growth of foreign investments. In other words, aside from the economic contributions of existing foreign firms, they serve as benchmark for other foreign investors planning to establish a business in Japan.

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