What is Driving the Manufacturing FDI Wave in Asia? *

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Abstract

This paper analyzes the dynamic pattern of Japanese manufacturing foreign direct investment (FDI) in Asia. Japanese electronics firms shifted manufacturing operations abroad in the 1990s. We focus on the timing issue of the surge in FDI: Why in this period did Japanese manufacturing FDI increase? The findings indicate that in addition to productivity improvements, learning experiences from FDI are the primary determinants of the FDI wave: Own past FDI experiences, other firms' experiences and the presence of distribution services encourage manufacturing FDI.

JEL Classifications: F23, D21 Keywords: Direct investment, State dependence, Investment externalities, Distribution sector, Firm heterogeneity

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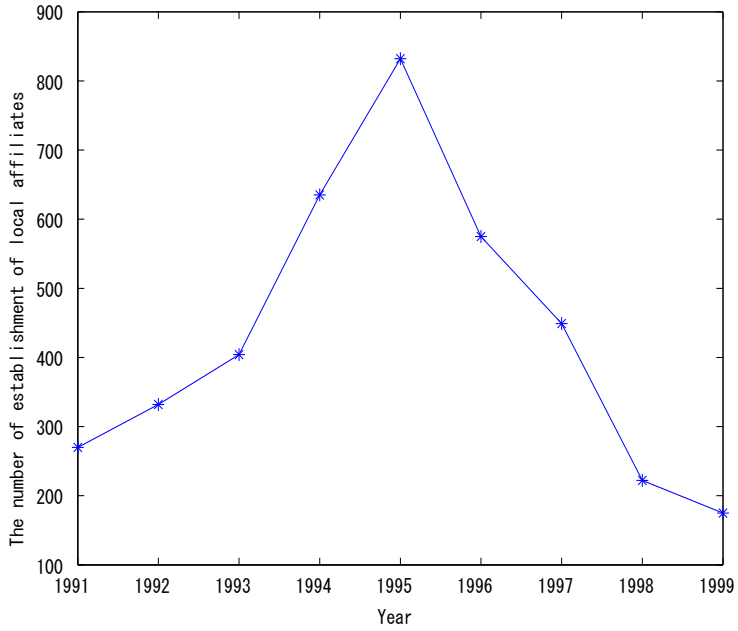
1 Introduction

Foreign direct investment (FDI) has grown more rapidly than trade and the major share of FDI is undertaken by large manufacturing firms. During the 1990s, the number of Japanese electronics firms setting up manufacturing plants overseas increased (in 1994 the number of firms with foreign manufacturing affiliates was 131 and in 1997 it was 382[1]). In Asia, the number of newly established local affiliates by Japanese firms also increased in the mid 1990s (Figure 1). Because a FDI boom and slump may result in an economic boom and slump in host countries, it is important to investigate what causes the dynamic patterns of FDI to assess the impact of multinational firms' behavior. The rapid change of FDI in a given industry and a region is the main issue we examine in the paper.

Figure 1: The number of newly established local affiliates by all Japanese firms in Asia



Source: *The Survey on Overseas Business Activities* by the Ministry of Economy, Trade and Industry.

[1]The figures are from *The results of the basic survey of Japanese business structure and activities (1994, 1997)* by the Ministry of International Trade and Industry.

Because operating in foreign countries requires firms to have management ability and superior technology, the increase of FDI could be regarded as productivity improving. However, when considering dynamic manufacturing FDI patterns in Asia, in particular the rapid change in FDI, because productivity did not fluctuate drastically, there may be additional driving forces of FDI. We believe that, in addition to productivity heterogeneity, firm experiences inherent to manufacturing FDI cause the dynamic pattern of FDI. We examine what experiences are significant in causing the FDI wave in Asia.

We contribute to the literature by finding the determinants of the FDI wave empirically. In particular, we focus on the experiences of firms associated with FDI activities: 1) own past FDI experiences, 2) other firms' FDI experiences and 3) experiences of the operating distribution sector. In examining the dynamic pattern of FDI, FDI experience plays an important role in determining the persistence of investment decisions. In the trade literature, the presence of sunk costs causes heterogeneity of export behavior (Roberts and Tybout (1997) and Bernard and Jensen(1999, 2004)). If there are sunk costs related to FDI and these costs can be saved by investment experience, firms that conducted FDI in the past are likely to invest abroad in the current period. If there exists such a positive state dependence, once firms start investing abroad, these firms keep investing, causing persistence in FDI.

In addition, investment experience affecting current FDI decisions is not only own experience, but also other firms' experience. Firms may hesitate to invest because of risks in operating in foreign countries. However, if they can gain information from observing other firms' FDI, they may invest as well. It is well recognized that Japanese firms follow similar strategies taken by other Japanese firms, which is called *yokonarabi* (see, for example, Yoshimura and Anderson (1997)). The existence of this type of positive externality leads to FDI waves.

Finally, experiences affecting manufacturing FDI are not restricted to manufacturing investment. Dis-

tribution direct investment may induce subsequent investments, referred to by Kogut and Chang (1996) as platform investments. Because Asia experienced rapid economic growth, the distribution sectors were important for penetrating local markets. If an operating distributor already exists, subsequent investment benefits may well be larger because intangible assets, such as goodwill or reputation in local markets, can be shared between foreign affiliates. This motivates firms to set up manufacturing factories.

We estimate a firm-level dynamic decision model by incorporating these factors and find that they are significant for FDI decisions. We use data on FDI in Asia for publicly traded Japanese electronics firms. Our estimates show that all three variables have a positive impact on FDI: past investment experience has a positive effect on current investment, i.e., positive state dependence. There is a positive effect of direct investment in distribution on manufacturing. Lastly, we find a positive externality for FDI: other firms' FDI positively affects investment decisions. These factors, in addition to productivity improvements, caused the boom in FDI.

This paper proceeds as follows. The following section sets up a dynamic decision model for firms, and Section 3 specifies the empirical model, a panel probit model. Section 4 introduces the data. We then present our estimation results in Section 5, and conclude this paper in Section 6.

2 Model

Consider a firm facing a dynamic choice problem of whether to set up a foreign manufacturing affiliate. Our framework is the dynamic discrete choice model of Roberts and Tybout (1997). For each period, t, firm i's gross profit is $\pi = \pi(X_{it}, Y_{it})\lambda(\text{Dist}FDI_{it})$, where $\pi(\cdot,\cdot)$ is the base profit, $Y_{it} = 1$ indicates invest in manufacturing, $Y_{it} = 0$ indicates no investment, and λ is an increasing function of the distribution direct investment ($\text{Dist}FDI_{it}$), where $\lambda(0) > 0$. This λ captures the effects of distribution direct investment on

profit. Firms are assumed to choose the level of distribution direct investment period by period, so the decision to invest in manufacturing is the only dynamic decision. We also assume that if a firm invests in manufacturing, proximity ensures a large instantaneous profit: $\pi(X_{it}, 0) < \pi(X_{it}, 1)$.

The dynamic problem of firm i is to maximize the sum of discounted profits:

$$\max_{Y_i} E_t[\sum_{t=1}^{\infty} \beta^t \pi(X_{it}, Y_{it})\lambda - C(Y_{it}, Y_{it-1})],$$

where β is a discount factor, E_t is the expectation operator, $Y_i = \{Y_{i0}, Y_{i1}, \ldots\}$, and $C(\cdot, \cdot)$ is the cost of investment, $C(Y_{it}, Y_{it-1}) = pY_{it}(1 - Y_{it-1}) + qY_{it}Y_{it-1}$. We assume that firms incur a sunk search cost, p, if they did not invest in manufacturing in the previous period. This sunk cost is specific to manufacturing investment, in which firms are required to pay for setting up new establishments. Firms do not have to incur the costs if they have previous period experience. Similarly, we assume that there is a cost of consecutive investment in manufacturing: if a firm invests consecutively at $t-1$ and t, it has to incur q.

The Bellman equation in period t is:

$$V(X_{it}, Y_{it-1}) = \max_{Y_{it}}\{\pi(X_{it}, Y_{it})\lambda - pY_{it}(1 - Y_{it-1}) - qY_{it}Y_{it-1} + \beta EV(X_{it+1}, Y_{it})\}.$$

Therefore, the firm invests if:

$$\pi(X_{it}, 1)\lambda - p(1 - Y_{it-1}) - qY_{it-1} + \beta EV(X_{it+1}, 1) - [\pi(X_{it}, 0)\lambda + \beta EV(X_{it+1}, 0)] \geq 0$$

$$\iff (\pi(X_{it}, 1) - \pi(X_{it}, 0))\lambda - p + (p - q)Y_{it-1} + \beta(EV(X_{it+1}, 1) - EV(X_{it+1}, 0)) \geq 0$$

Hence, the decision to invest is based on the following rule:

$$Y_{it} = I(\tilde{p}Y_{it-1} + \tilde{\pi}\lambda + W \geq 0), \tag{1}$$

where $I(\cdot)$ is an indicator function, $\tilde{p} = p - q$, $\tilde{\pi} = \pi(X_{it}, 1) - \pi(X_{it}, 0)$, and $W = -p + \beta(EV(X_{it+1}, 1) - EV(X_{it+1}, 0))$. Equation 1 is the decision to invest that will be estimated in the paper.

3 Empirical Specifications

Our empirical model is based on the investment decision condition given by Equation 1. To parameterize equation 1, we assume a particular functional form: $\tilde{p}Y_{it-1} + \tilde{\pi}\lambda + W = \beta_1 Y_{it-1} + \beta_2 \ln \text{Dist}FDI_{it-1} + \beta_3 \ln \text{OtherManu}FDI_{it-1} + X_{it}\delta + \epsilon_{it}$, where X_{it} is a matrix of covariates including the firm's observable characteristics and δ is a vector of parameters.

If the sunk search costs are higher than the consecutive investment costs ($q < p$), the coefficient of the lagged dependent variable is positive. If the sunk search costs are lower than the consecutive investment costs ($p < q$), a negative state dependency results. The relative severity of the costs is tested with the lagged dependent variable coefficient, β_1. If the effect of saving sunk costs is large, β_1 will be positive.

The effect of distribution direct investment, λ, increases profits from exporting and direct investment. If there is a proximity of manufacturing FDI ($\tilde{\pi} > 0$), the level of distribution direct investment positively affects the likelihood of a manufacturing direct investment decision. We use the log of the number of one-year lagged distribution direct investment ($\ln \text{Dist}FDI_{it-1}$) in a linear form. This is a stock of distribution direct investment that captures the distribution FDI effect.

Externalities affect FDI decisions either positively or negatively. The mechanism by which external-

ities affect FDI may have a complicated form, because they may operate through information spillover, product market competition, and competition for the local labor force. We focus on whether externalities affect FDI decisions positively or negatively, instead of examining the mechanism in detail. We use the log of the number of one-year lagged manufacturing FDI of other firms ($\ln \text{OtherManu}FDI_{it-1}$) for capturing the effect of investment externalities.

The other covariates term is: $X_{it}\delta = \delta_0 + \delta_1 \ln Productivity_{it} + \delta_2 \ln Employment_{it} + \delta_3 \ln Cap/Lab_{it} + \delta_4 \ln DebtAsset_{it}$. We consider the effect of productivity differences on FDI choice (Helpman, Melitz, and Yeaple (2004)). Productivity is defined as per worker value-added, which is sales minus the purchase of raw materials divided by the number of employees, deflated by the producer price index ($Productivity_{it}$). This controls for labor productivity. If productive firms are likely to invest abroad, productivity affects FDI decisions positively.

Other variables are conventional controls in the FDI literature. The number of employees ($Employment_{it}$) controls for the size of the firm. The capital–labor ratio (Cap/Lab_{it}) is calculated as depreciable assets divided by the number of employees. This controls for the capital intensity of firms. We use the debt–asset ratio ($DebtAsset_{it}$), which is total debt divided by total assets, to represent the firm's financial constraints.

The error term, ϵ_{it}, may include time-specific factors, individual-specific factors, and serially correlated components. Because including both the exchange rate and time dummies may cause potential problems with multicollinearity, we use only the time dummies. This time dummy is not merely a control variable; it has an important role in taking into account the year-specific effects on Japanese firms: the effects of market conditions in Asian countries (product and labor markets), the Asian currency crisis, and recession in Japan.

3.1 Random Effects Probit Models

Because our dependent variable is an index taking the value of 0 or 1, we employ probit models for the estimation. The random effect probit model is expressed as follows: $Y_{it} = I(\beta_1 Y_{it-1} + \beta_2 \text{Dist}FDI_{it-1} + \beta_3 \text{OtherManu}FDI_{it-1} + X_{it}\delta + \mu_t + \epsilon_{it} \geq 0)$, where μ_t is the time dummy, $\epsilon_{it} = \alpha_i + \eta_{it}$, and is distributed normally.

If we assume that the correlation between error terms caused by the random effect terms is $Cov(\epsilon_t, \epsilon_s) = Cov(\alpha_i + \eta_{it}, \alpha_i + \eta_{is}) = \sigma_\alpha^2$, the choice probability for firm i conditional on the random effect factor is:

$$l_i = Prob(Y_{i1}, \ldots, Y_{iT}) = \int_{a_1}^{b_1} \ldots \int_{a_T}^{b_T} \phi(\epsilon_1, \ldots, \epsilon_T) d\epsilon_1 \ldots \epsilon_T = \int \Pi_{t=1}^{T} [\Phi(b_{it}|\alpha_i) - \Phi(a_{it}|\alpha_i)] \phi(\alpha_i) d\alpha_i,$$

where $a_{it} = -W_{it}\kappa$ and $b_{it} = \infty$ if $d_{it} = 1$, $a_{it} = -\infty$ and $b_{it} = -W_{it}\kappa$ if $d_{it} = 0$, and $W_{it}\kappa = \beta_1 Y_{it-1} + \beta_2 \text{Dist}FDI_{it-1} + \beta_3 \text{OtherManu}FDI_{it-1} + X_{it}\delta + \mu_t$. This is because, conditional on α_i, the error terms are independent, making it possible to integrate out. We can estimate the above model by using the Gauss–Hermite procedure to evaluate integrals (see Butler and Moffitt (1982)).

However, to use the above specification in the dynamic probit model, the assumptions are made that the initial period data generating process is exogenous and the errors are correlated only through individual terms. Because these assumptions are restrictive, they need to be altered. Then, we need to take into account the initial conditions problem (Heckman (1981)) to control for unobservable heterogeneity appropriately. Following Heckman (1981), we deal with this problem by approximating the probability of the initial outcome using a probit model and allowing the error term in the initial period to be correlated with the errors in other periods. Hence, we specify not only the model in the subsequent years but also

the initial stage model as a probit model:

$$Y_{it} = I(\beta_1 Y_{it-1} + \beta_2 \text{Dist}FDI_{it-1} + \beta_3 \text{OtherManu}FDI_{it-1} + X_{it}\delta + \mu_t + \epsilon_{it} \geq 0)$$

$$Y_{i0} = I(X_{i0}\zeta + \epsilon_{i0} \geq 0),$$

where Y_{i0} is the initial period decision, X_{i0} are the covariates for the initial period, ζ is the parameter vector, and ϵ_{i0} is the initial period error term. We allow a correlation between the error terms in the initial period and at subsequent periods in the following parameterized way: $Cov(\epsilon_{i0}, \epsilon_{it}) = \gamma_t$. In the estimation, we impose the restriction $\gamma_t = \gamma_s$ for $t \neq s$, because it is difficult to achieve convergence in the estimation with too many free parameters.

In addition to the initial conditions problem, we consider the persistence of the error term to distinguish the persistent effects caused by firm behavior, namely, state dependence, from merely the persistence of the error term. The serial correlation pattern is represented with an AR(1) process: $\eta_{it} = \rho\eta_{it-1} + \nu_{it}$. For identification, we assume that $Var(\epsilon_{i0}) = 1$ and $Var(\epsilon_{it}) = 1$. The elements of the variance–covariance matrix for Y_i are $(1 - \sigma^2)\rho^{t-s} + \sigma^2$ for $0 < s \leq t$, where $\sigma^2 = \sigma_\alpha^2/(\sigma_\alpha^2 + \sigma_\eta^2)$.

The choice probability for firm i is therefore given by the following joint probability:

$$Prob((X_{i0}\zeta + \epsilon_{i0})(2Y_{i0} - 1) \geq 0, (\beta_1 Y_{i0} + \beta_2 \text{Dist}FDI_{i0} + \beta_3 \text{OtherManu}FDI_{i0} + X_{i1}\delta + \epsilon_{i1})(2Y_{i1} - 1) \geq 0,$$

$$\ldots, (\beta_1 Y_{iT-1} + \beta_2 \text{Dist}FDI_{iT-1} + \beta_3 \text{OtherManu}FDI_{iT-1} + X_{iT}\delta + \mu_T + \epsilon_{iT})(2Y_{iT} - 1) \geq 0).$$

Because this specification requires high dimensional integration, we use the simulated maximum likelihood (SML) method to estimate this model. We use the Geweke, Hajivassiliou, and Keane (GHK) method to evaluate this integration (see, for example, Hajivassiliou and Ruud (1994) and Train (2002)).

4 Data

We compiled data on direct investment and firm characteristics for publicly listed electronics firms from *Kaigai Shinsyutsu Kigyo Soran* (Japanese Overseas Investment) published by Toyo Keizai. Affiliates are defined as entities incorporated in a foreign country with at least 10 percent ownership by the Japanese firm. Because we have collected data from the 2002 issue, our sample captures foreign affiliates existing in 2001. We derived annual counts of FDI based on the start date of investment and constructed a dummy variable based on whether a firm invests in manufacturing. The dummy variable is 1 if a firm invests, irrespective of the number of manufacturing affiliates, and 0 otherwise. This variable is used as our dependent variable.[2]

According to the publisher's classification, we create two main categories of motivation for FDI: distribution and manufacturing. Multiple motivations for FDI are shown in the data file. We take FDI to be manufacturing FDI if the manufacturing motivation is included. We take FDI to be distribution FDI if the only motivation is distribution.

For other covariates, such as the number of employees, depreciable assets, total assets, total debt, sales, and purchases of raw materials, we use the Nikkei Economic Electronic Databank System (NEEDS). These financial data are used to control for observable firm heterogeneity. The financial data corresponds to the firm's fiscal year. Because this is not necessarily the calendar year, as in Blonigen and Taylor (2000), we compile FDI data corresponding to each firm's fiscal year. We use nonconsolidated financial data and because of data availability, our sample period is between 1988 to 1998.

Table 1 presents the summary statistics. Our sample has 141 firms. The number of employees in the

[2]Although information on whether a particular FDI is a greenfield investment or a merger or acquisition is available, because our focus is on the decision to invest abroad, we do not specify it as a separate category. Also, because of missing data, we do not take into account size differences between foreign affiliates based on the number of employees.

Table 1: Summary statistics

Summary statistics of sample	Mean	Standard dev.	Min.	Max.
Asian manufacturing FDI in each year by our sample firms	39.8	15.3	21	66
European manufacturing FDI in each year by our sample firms	5.8	4.2	0	14
North American manufacturing FDI in each year by our sample firms	9.3	5.6	1	17
The number of employees	5345.9	12175.8	96	81488
The number of firms 141				
The number of observations 1551				
Years 1988–1998				

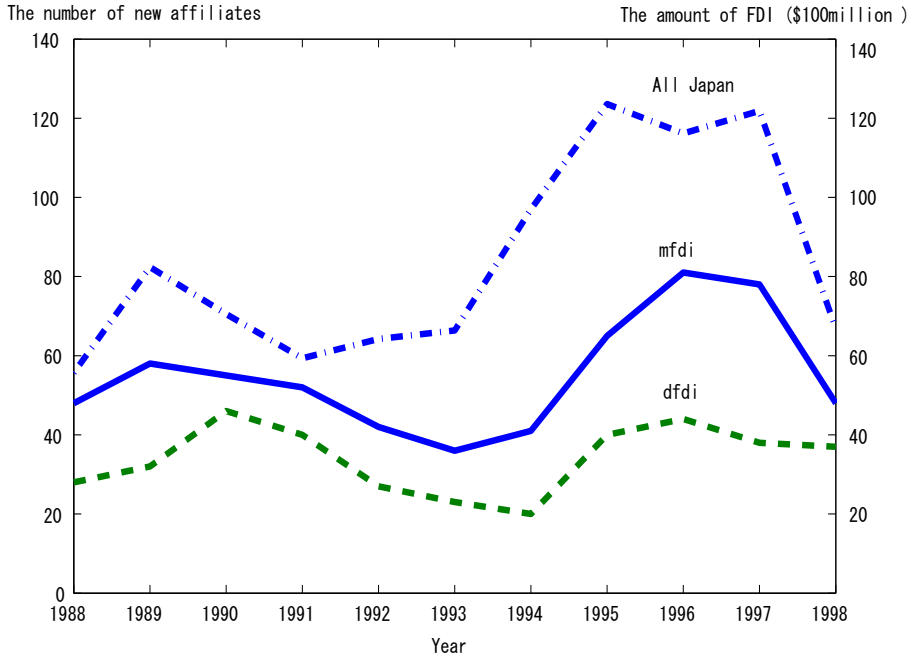
parent firms ranges from 96 to 81,488.[3] There is therefore a large dispersion in firm size, meaning that we are dealing with heterogeneous firms. We divide our sample of FDI into regions: Asia, Western Europe, and North America.[4] On average, there are about 40 new manufacturing FDIs in Asia by our sample firms each year, six in Europe, and nine in North America. In our sample period, 62 percent of firms (87 firms) invested in manufacturing in Asia, 31 percent (44 firms) invested in Europe, and 40 percent (56 firms) invested in North America. On the other hand, 51 percent (72 firms) invested in distribution in Asia, 47 percent (66 firms) invested in Europe, and 50 percent (70 firms) invested in North America. Note that because our focus is on FDI in Asia, we only consider FDI in Asia in the paper.

Figure 2 plots the time series of the number of new affiliate establishment for the sample firms and the amount of FDI in Asia by all Japanese firms measured in 100 millions of dollars (see JETRO, www.jetro.go.jp/en/stats). Here, mfdi corresponds to the number of manufacturing affiliates and dfdi to the number of distribution affiliates. The pattern of FDI in the sample is quite similar to total Japanese direct investment in Asia, which is depicted as the line "All Japan". Figure 2 shows that in the early 1990s, the growth of both investments slowed down; however, from the mid 1990s, FDI drastically in-

[3]The largest firm is Hitachi.

[4]In Asia: South Korea, China, Taiwan, Hong Kong, Singapore, Thailand, the Philippines, Malaysia, Indonesia, Vietnam, India, and Sri Lanka. In Western Europe: UK, Germany, Austria, France, the Netherlands, Belgium, Luxembourg, Sweden, Spain, Italy, and Portugal. In North America: Canada, USA, and Mexico.

Figure 2: The number of new affiliates by sample firms and the amount of FDI by all Japanese firms in Asia

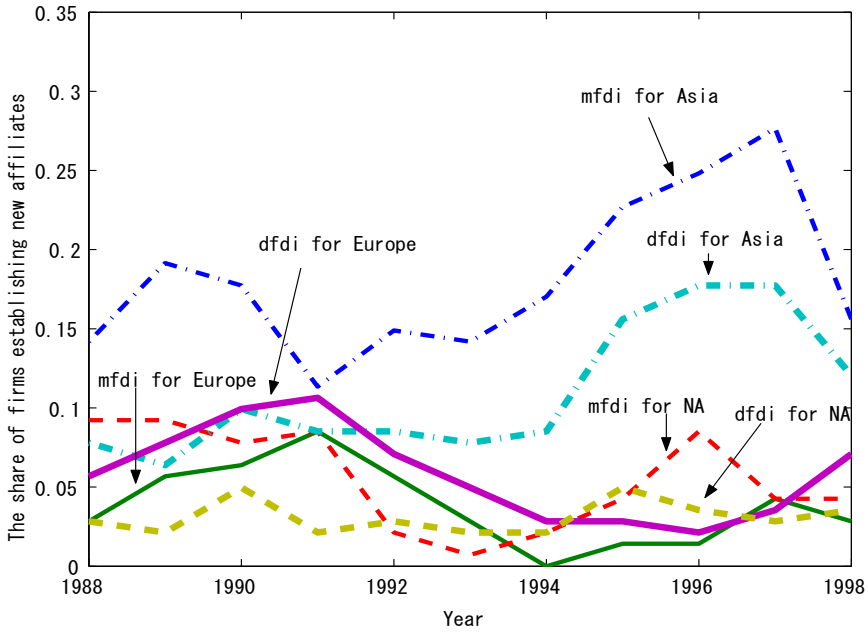


Note: "All Japan" = the amount of direct investment in Asia by all Japanese firms measured in 100 millions of dollars. "mfdi" = the number of manufacturing affiliates by our sample firms and "dfdi" = the number of distribution affiliates by our sample firms.

creased. Thus, we call this the FDI wave in Asia in this paper. As can be seen, it may be safe to maintain that the sample firms' behavior is not too dissimilar to the typical behavior of Japanese direct investment.

To provide some idea about the increase in the number of parent firms investing in Asia, we consider what percentage of firms invest abroad each year. On a regional basis, Figure 3 plots the percentages of firms that establish new foreign affiliates each year. In Figure 3, NA stands for North America, mfdi for manufacturing, and dfdi for distribution direct investment. In each area, distribution and manufacturing direct investment follow a similar pattern. However, there are significant differences across regions. In the late 1980s, there were no significant differences in the share of firms establishing new affiliates, whereas in the 1990s, the share increased in Asia and decreased in Europe and North America.

Figure 3: The share of firms establishing new affiliates: By region



Note: "mfdi" = manufacturing direct investment, "dfdi" = distribution direct investment, "NA" = North America.

The most important determinants of FDI in a given industry is considered to be productivity heterogeneity. Table 2 shows descriptive statistics of the log of labor productivity (sales minus raw material purchases divided by the number of employees) in each year. The mean productivity monotonically rises except in 1993, which is roughly consistent with the idea that productive firms tend to invest abroad. As the skewness and kurtosis show, the distribution is skewed to the right and has fat tails. Also, the standard deviations in the late 1990s are higher than those in the early 1990s. These figures show that the productivity heterogeneity increases in our sample period. However, even as the mean productivity and standard deviation increased, the percentage of firms undertaking FDI did not necessarily increase in the sample period. Therefore, it is still necessary to investigate factors other than productivity that affect the FDI decision.

Table 2: Log of productivity

Year	Mean	Std. Dev.	Skewness	Kurtosis
1988	−1.946	0.487	−0.02	3.382
1989	−1.807	0.491	−0.057	5.014
1990	−1.708	0.459	0.247	3.276
1991	−1.603	0.433	0.479	2.983
1992	−1.587	0.467	0.983	5.231
1993	−1.592	0.473	0.86	5.454
1994	−1.578	0.475	1.02	5.446
1995	−1.512	0.524	0.579	5.243
1996	−1.332	0.526	0.832	4.201
1997	−1.208	0.511	0.73	3.928
1998	−1.126	0.549	0.897	4.06

One thing we should note here is that because our dependent variable is an index on whether to invest in Asia, there are advantages and disadvantages in using regional basis data for the FDI decision. Because we focus on the parent firms' direct investment decision, not on which region to invest in (i.e., the destination of investment), regional data can be used to construct an index that helps identify whether to invest in each period. It still may not be clear whether direct investments in some countries affect the decision to invest in others. We implicitly assume that the benefit from past direct investment is able to transcend borders. In fact, Ando and Kimura (2003) suggest that in East Asia, a production/distribution network transcends borders because the share of intermediate goods trade in East Asian countries is larger than in other regions. Therefore, based on the observations of direct investment and trade in Asia, we would expect cross-border networks to have an impact on direct investment in Asia.

5 Estimation Results

In this section, we present the results of a variety of empirical specifications of the direct investment models discussed in Section 3.

First, we employ a panel random effects probit estimation by maximum likelihood without controlling for initial conditions and serial correlation. Then, we estimate panel random effects probit models with the initial conditions and serial correlation as an AR(1) form by SML.

Table 3 presents the estimation results. The top four rows display the parameter estimates for the variables of primary interest: the lagged dependent variable, the number of distribution affiliates, the number of other manufacturing affiliates, and productivity.

5.1 Maximum Likelihood

In Table 3, columns 1–6 present the results of the panel probit estimation without considering initial conditions and serial correlation. Column 1 is a parsimonious specification, where only the lagged investment status and time dummies are included. The coefficient of the lagged dependent variable is negative, suggesting negative state dependence. However, it is not found to be significant, implying that either search costs and consecutive costs are canceled out or these elements are not important. The time dummies in column 1 are not significant for 1995, 1996, 1997, when the FDI wave occurred. These results may be due to misspecification, because other factors related to the dynamics of FDI are not included in this specification.

Column 2 presents the results for when the number of distribution affiliates is added. The lagged dependent variable is negative and insignificant again. On the other hand, the effect of distribution is positive and significant. The importance of the presence of distribution networks is found. Previous studies, such as Yamawaki (1991) and Head and Ries (2001), found positive effects of distribution direct investment on firms' exports. It is reasonable to assume that distribution activities also promote local sales. Because multinational firms engage in economic activities in local markets, these firms often know

more about local markets than do firms lacking a distribution sector. Therefore, this may also lead to manufacturing direct investment to exploit production proximity. Kogut and Chang (1996) find a positive effect of distribution direct investment on subsequent investment. This study confirms the positive effect of distribution direct investment on manufacturing.

Taking externalities into account by adding the number of other firms' foreign affiliates changes the effect of own prior investment experience to be positive (column 3). Without externalities, the estimation of own prior investment experience might be biased. This is because the effect through prior experience may be related to other firms' FDI and common time effects, and because other firms' FDI may be related to common time effects as well. The inclusion of externalities reveals that the signs of the time dummies for 1995, 1996, and 1997 are negative and the magnitude becomes large. As we mentioned, the common time effect factors might capture the positive effect of other FDI in the previous specification. Therefore, the size of the coefficient is highly negative with other firms' FDI considered. Controlling for externalities leads to positive state dependence of manufacturing FDI and negative common time effects, although these are not significant.

The effect of externalities is positive. While the coefficient is not statistically significant, the positive point estimate may imply the existence of positive externalities. The coefficient of distribution direct investment continues to suggest a positive effect on manufacturing FDI. These results may characterize the driving forces of FDI by our sample firms: positive effects of own and other prior investment experience and a distribution sector, and negative effects of common time-specific factors.

Thus far, we have not included a control for firm characteristics. Columns 4–6 present the estimates when we include productivity, firm size, capital–labor ratio, and debt–asset ratio. Productivity affects the FDI decision positively. This implies that productive firms tend to invest abroad, confirming the idea

behind the literature on productivity heterogeneity and FDI (Helpman, Melitz, and Yeaple (2004)). An examination of the coefficient estimates for our primary interests, the lagged dependent variable, other firms' FDI, and distribution FDI, across the first six columns reveals that the inclusion of the control variables does not change the sign of these variables. While no significant effects of the lagged investment status and externalities are found, the positive effect of distribution FDI exists.

5.2 SML

While the maximum likelihood estimation implies that there are positive effects of prior own and other FDI and distribution FDI, prior own and other firms' FDI are not statistically significant. This is because there could be a bias created by ignoring initial conditions and serial correlations. We can take these elements into account by SML. Columns 7–9 in Table 3 report the estimation results of the SML estimations.

Columns 7–9 show that the serial correlation parameter is negative and statistically significant. Controlling for initial conditions and serial correlation increases the magnitude of the lagged investment status. This stems from the fact that in the previous specification, our lagged dependent variable captures not only state dependence, but also negative serial correlation. Therefore, we are able to pin down the true state dependence by accounting for initial conditions and serial correlation.

The problem of statistical insignificance of the lagged dependent variable, other FDI, and time dummies is solved by taking initial conditions and serial correlation into account. In column 9, by including all three variables (lagged investment decision, distribution FDI, and other firms' FDI), the lagged investment status has a positive and significant effect. In addition to own investment status, the coefficient of other FDI is positive and significant. The effect of distribution also positively affects the manufacturing

FDI decision. These results suggest that combining these elements generates positive persistence in FDI. In the literature, the main dynamic element considered is normally only own experience (Roberts and Tybout (1997)). However, our estimates imply that a phenomenon such as an FDI wave may occur if there exist not only an own experience effect, but also other FDI and distribution FDI effects.

The time dummies for 1995, 1996, and 1997 are negative and statistically significant. This finding implies that the common year factors discourage FDI. This may be because of severe recession in Japan. However, the fact that the FDI wave seemed to occur around these years gives us the idea that elements such as saving sunk costs, distribution services, and investment externalities, are strong enough to encourage FDI. The reason why FDI decreased in 1998 might be because of the Asian currency crisis. This crisis was strong enough to discourage investment in Asia, where the negative time effect was largest in 1998.

Overall, the results reported here reveal that prior own and other firms' FDI experience and the presence of distribution services positively affect FDI decisions. In addition, we confirm that productive firms tend to undertake FDI. While common time effects when the FDI wave occurred have a negative impact, the factors having positive effects lead to the FDI wave in Asia in this period.

6 Conclusion

Our study examines the determinants of FDI that are important for explaining the FDI wave in Asia in the 1990s. We found that there exist positive state dependence of manufacturing direct investment, positive effects of distribution direct investment, and positive investment externalities. In addition to productivity heterogeneity, the positive persistence factors created the FDI wave.

Our findings of a positive state dependence and positive externalities suggest that past investment

experience of their own and other firms is significant enough to encourage firms to invest in manufacturing. These characteristics may well explain the pattern of Japanese FDI. While there are many studies on the M&A (mergers and acquisitions) wave (for example, Harford (2005)), the FDI wave has not been examined intensively. In recent years, because the major form of FDI has been M&A, it is important to investigate the determinants of not only the FDI wave, but also the international M&A wave.

Our data also support the hypothesis that a distribution FDI effect exists in Asian countries because in the sample period, rapid economic growth was experienced in East Asia. The countries in this region have increased their demand for manufactured products, thereby increasing the importance of the distribution sector. Our findings suggest that distribution direct investment plays an important role in the decision to build manufacturing operations. The importance of the distribution sector or service sector should be studied in more detail. This requires future research.

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Table 3: Probit estimation

	Probit	Probit	Probit	Probit	Probit	Probit	SML	SML	SML
Y_{t-1}	−0.016	−0.056	0.137	−0.046	−0.084	0.07	0.229	0.149	0.329^{c}
	(0.13)	(0.135)	(0.177)	(0.136)	(0.137)	(0.169)	(0.211)	(0.21)	(0.236)
Distribution		0.261^{a}	0.276^{a}		0.074^{b}	0.085^{a}		0.07^{a}	0.08^{a}
		(0.03)	(0.032)		(0.031)	(0.033)		(0.026)	(0.025)
Other FDI			0.163			0.129			0.13^{b}
			(0.1)			(0.087)			(0.073)
Productivity				0.334^{a}	0.284^{b}	0.296^{b}	0.296^{a}	0.249^{a}	0.26^{a}
				(0.116)	(0.117)	(0.119)	(0.07)	(0.087)	(0.097)
Firm Size				0.519^{a}	0.433^{a}	0.442^{a}	0.452^{a}	0.379^{a}	0.383^{a}
				(0.051)	(0.06)	(0.061)	(0.047)	(0.05)	(0.049)
Cap/Lab				0.298^{b}	0.253^{b}	0.245^{b}	0.276^{a}	0.235^{a}	0.225^{b}
				(0.119)	(0.12)	(0.122)	(0.065)	(0.089)	(0.098)
Debt/Asset				−0.288^{b}	−0.315^{b}	−0.319^{b}	−0.26^{a}	−0.292^{a}	−0.293^{a}
				(0.132)	(0.132)	(0.134)	(0.091)	(0.108)	(0.107)
1990 dummy	−0.082	−0.102	−1.084^{c}	−0.144	−0.141	−0.919	−0.148	−0.14	−0.922^{b}
	(0.204)	(0.197)	(0.635)	(0.2)	(0.2)	(0.563)	(0.145)	(0.148)	(0.477)
1991 dummy	−0.427^{b}	−0.485^{b}	−0.824^{a}	−0.584^{a}	−0.58^{a}	−0.851^{a}	−0.553^{a}	−0.547^{a}	−0.817^{a}
	(0.216)	(0.21)	(0.297)	(0.214)	(0.213)	(0.283)	(0.131)	(0.123)	(0.237)
1992 dummy	−0.225	−0.325	0.963	−0.457^{b}	−0.458^{b}	0.558	−0.398^{a}	−0.403^{a}	0.63
	(0.209)	(0.204)	(0.816)	(0.211)	(0.21)	(0.717)	(0.138)	(0.133)	(0.612)
1993 dummy	−0.264	−0.402^{c}	−0.737^{b}	−0.494^{b}	−0.506^{b}	−0.772^{a}	−0.451^{a}	−0.463^{a}	−0.727^{a}
	(0.21)	(0.207)	(0.294)	(0.211)	(0.211)	(0.279)	(0.117)	(0.117)	(0.24)
1994 dummy	−0.095	−0.258	−0.59^{b}	−0.319	−0.341^{c}	−0.605^{b}	−0.281^{a}	−0.304^{a}	−0.566^{a}
	(0.204)	(0.2)	(0.287)	(0.204)	(0.204)	(0.273)	(0.108)	(0.111)	(0.216)
1995 dummy	0.165	−0.022	−1.492	−0.044	−0.07	−1.234	−0.029	−0.055	−1.226^{b}
	(0.198)	(0.194)	(0.924)	(0.197)	(0.197)	(0.812)	(0.132)	(0.118)	(0.685)
1996 dummy	0.258	0.019	−4.374	−0.018	−0.047	−3.524	−0.009	0.036	−3.542^{b}
	(0.196)	(0.193)	(2.706)	(0.2)	(0.2)	(2.358)	(0.135)	(0.129)	(1.987)
1997 dummy	.378^{c}	0.079	−5.942	0.057	0.019	−4.746	0.05	0.021	−4.787^{b}
	(0.194)	(0.192)	(3.705)	(0.202)	(0.202)	(3.226)	(0.126)	(0.127)	(2.72)
1998 dummy	−0.176	−0.599^{a}	−6.465^{c}	−0.555^{b}	−0.628^{a}	−5.269^{c}	−0.543^{a}	−0.606^{a}	−5.284^{b}
	(0.207)	(0.213)	(3.612)	(0.222)	(0.225)	(3.144)	(0.146)	(0.138)	(2.651)
ρ							−0.2^{b}	−0.18^{c}	−0.197^{b}
							(0.113)	(0.115)	(0.117)
log-likelihood	-575.871	-541.918	-540.67	-512.297	-509.329	-508.278	-547.47	-544.055	-543.738
number of obs.	1410	1410	1410	1410	1410	1410	1551	1551	1551

Note: The number of firms = 141. The numbers in parentheses are standard errors. The superscripts ^{a}, ^{b}, and ^{c} indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels.