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FOREIGN DIRECT INVESTMENT AND IMPERFECT CAPITAL MARKETS: COUNT DATA ANALYSIS OF JAPANESE FDI IN THE UNITED STATES

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Foreign Direct Investment and Imperfect Capital Markets: Count Data Analysis of Japanese FDI in the United States

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ABSTRACT

Between 1981 and 1990, FDI in Japan as a share of total US inward FDI increased four-fold. The increase coincided with the appreciating yen relative to the US dollar. While exchange rate changes can time FDI, Froot and Stein (1991) by assuming imperfect capital markets explain why exchange rate depreciation attracts FDI. Because imperfect capital markets due to asymmetric information makes external finance costly, it constrains firms from borrowing as much as they are willing to finance FDI. These borrowing constraints ease when the foreign currency depreciates resulting in increased relative wealth that can lead to increased FDI.

As rapidly as Japanese FDI in the United States rose, it plummeted after 1990. Between 1990 and 1993, the number of Japanese FDI projects into the United States declined by 67% despite the appreciating yen. Klein, Peek and Rosengren (2002) observe reduced FDI flows resulting from loan constraints faced by bank-dependent firms. Because firms' access to credit is heavily dependent on financial health of affiliated banks in Japan, they propose the relative access to credit hypothesis to explain the decline in FDI. Using aggregated data, Klein, Peek and Rosengren (2002) show that the number of Japanese FDI projects in the United States declined because of firms' reduced access to loans. In addition, they find that lower credit ratings of affiliated banks reduced the probability that firms will undertake FDI.

We investigate the impact of relative wealth and relative access to credit on Japanese FDI in the United States. Using discrete integer values in the dependent variable, we model firms' intention to undertake FDI as a binary outcome. A latent variable that distinguishes firms' intention to undertake FDI is used on firm level count data models. The models estimate the probability that a firm has no intention to engage in FDI. When the firm has the intention to engage in FDI, the model generates a quantity outcome which estimates the rate of FDI.

In the first study we use the zero-inflated negative binomial (ZINB) model and the zero-inflated Poisson (ZIP) model to test both the relative wealth and relative access to credit hypotheses. To determine whether it is important for the ZINB model to account for unobserved heterogeneity, we use the score test developed by Ridout, Hinde and Demétrio (2001). Considering only firms intending to undertake FDI, we find that multiple rating downgrades of a firm's main bank significantly affected the Japanese firm's rate of FDI in the United States between 1987 and 1994. FDI declined most for firms that relied on the most troubled banks. Unlike the findings in Klein, Peek and Rosengren's (2002) the firm's rate of FDI is affected by the firm's relative wealth. These results are consistent with Froot and Stein (1991).

In the second study we test both the relative wealth and relative access to credit hypotheses considering the positive correlation between acquisition and merger FDI and other types of FDI. Because assets are imperfectly divisible the investing firm undertakes additional FDI of a different type in

order to use indivisible assets more efficiently. By considering acquisition and merger FDI jointly with non acquisition and merger FDI in a bivariate zero-inflated negative binomial (BZINB) model, we examine Japanese FDI in the United States between 1987 and 1994.

While we find that Japanese firms' unequal access to credit hampers FDI regardless of market entry modes, relative wealth of firms significantly influences the rate of a firm's non acquisition and merger FDI but not the rate of a firm's acquisition and merger FDI. The results suggest that Japanese acquisition and merger FDI are significantly affected by firm size and profitability implying Japanese firms that acquire US firms between 1987 and 1994 are the largest and most profitable business enterprises. They possess sizable financial resources that enable them to expand operations in the United States. Consistent with traditional theories, their FDI are motivated by US firm-specific assets that complement the Japanese firms' expansion in the United States. The results also show that the relative wealth measure that includes relative price appreciation of Japanese stocks does not affect Japanese acquisition and merger FDI. While stock payment as a form of financing acquisition and merger FDI can be used, the practice is not widely adopted by firms in Japan.

CHAPTER ONE
INTRODUCTION

Multinational enterprises (MNEs) affect the allocation of resources across national boundaries through foreign direct investment (FDI). Through FDI, MNEs facilitate transfer of resources, such as: technology and organizational and marketing skills. These resources allow MNEs to be highly competitive and to wield substantial influence in various national markets. By taking advantage of economic opportunities across countries, MNEs are contributing to the creation of wealth and are becoming key players in the world economy.

According to Navaretti and Venables (2004), activities of MNEs measured by FDI flows grew at an enormous rate from 1985 to 1999. World-wide real FDI inflows grew by an annual rate of 17.7 percent while world-wide real GDP and world exports grew by 2.5 percent and 5.6 percent. More strikingly, a large share of the world trade is carried out by MNEs. According to Dunning (1993), MNEs are responsible for 75 percent of the world's trade in commodities. UNCTAD (1998, 1999 and 2000) also reports that one-third of the world trade is conducted among affiliates of MNEs and their headquarters.

1.1 Foreign Direct Investment in the United States

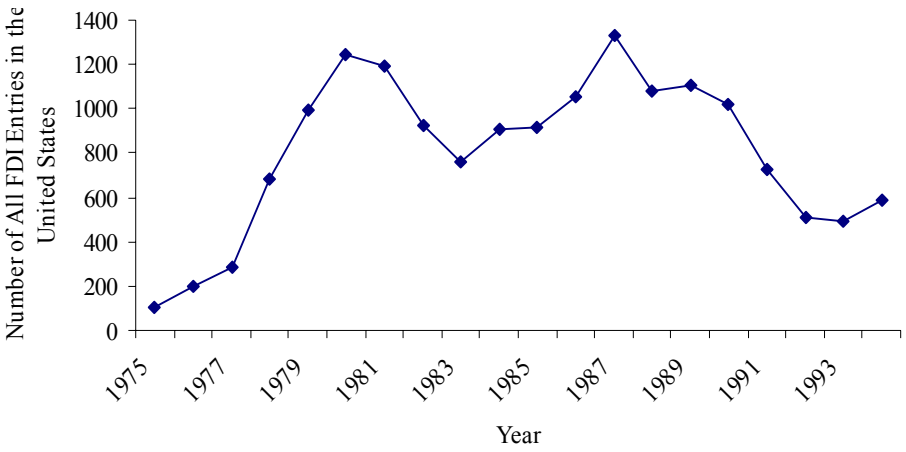
Empirical data show that trade among affiliates of MNEs occurs predominantly between developed economies[1]. Among individual countries, the United States is the largest foreign investor. While the share of US FDI outflow has declined since the early 1970s from 50 percent to 16 percent in 2001, the United States has grown in importance as a host country of FDI over the same period. Graham and Krugman (1995) note that US FDI inflow in 1980 stood at US$83 billion and FDI outflow at US$220 billion. By 1992, US FDI inflow has grown to US$420 billion while US FDI outflow was US$488 billion. The change of status from a FDI source country to a FDI host country reflected the rise of other economies relative to the United States. The United States became an importer of technology as much as an exporter of technology because of comparable innovation and technology in other economies. Nevertheless, the change in the US net FDI position to a host country is part of a long term trend.

During the change, however, the United States experienced fluctuations in FDI inflow between the late 1970s and the early 1990s. Figure 1.1 shows rising number of FDI projects in the United States in the late 1970s that started to decline in the early 1980s. After the mid 1980s, it began to rise again, reaching a peak in 1987 before declining to a low in the early 1990s.

[1] UNCTAD World Investment Report (1998, 1999 and 2000) estimate approximately 92 percent of outward FDI flows originates from the United States, Europe and Japan.

Figure 1.1

Total Number of FDI Projects in the United States



Source: International Trade Administration, United States.

Data on the number of FDI projects in the United States are obtained from the United States International Trade Administration (ITA) publication, Foreign Direct Investment in the United States: Transactions[2]. The ITA publication includes the name and nationality of the foreign investor, the value of investment and the type of investment. The type of investment includes acquisition and merger (AM), equity increase, joint venture, new plant, plant expansion, real estate and others[3]. All types of FDI are presented in figures 1.1, 1.2 and 1.3 that shows the number of FDI project counts. We focus on the

[2] An alternative source of FDI data is the Bureau of Economic Analysis (BEA) from the US Department of Commerce which conducts confidential surveys on US FDI. Although the FDI data from BEA are more comprehensive due to different definition and data collection methods, Klein and Rosengren (1994) note that the correlation between FDI data from both sources is high.

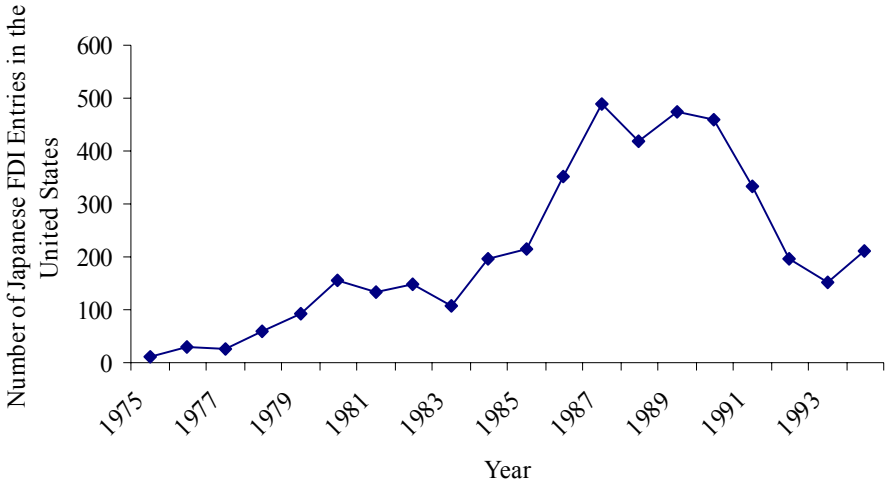
[3] When the type of FDI is classified as "others", it includes unidentified transactions which are not limited to new companies, headquarters, subsidiaries, branches, agencies, representative offices, stores, outlets and warehouses.

number of FDI projects in the US market because of missing observations on the values of FDI projects in the ITA publication.[4]

The rise in the number of FDI projects in the United States that started in the mid 1980s and the subsequent decline that ended in the early 1990s can be mostly attributed to Japanese FDI in the United States. Figure 1.2 shows the rising number of Japanese FDI projects in the United States which accelerated from the mid 1980s peaked in 1987 and declined sharply after 1990.

Figure 1.2

Number of Japanese FDI Projects in the United States



Source: International Trade Administration, United States.

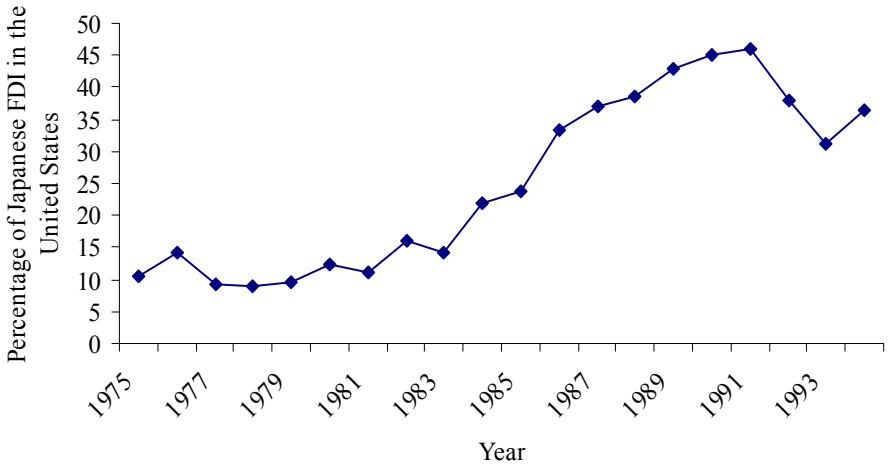
The surge in Japanese FDI into the United States during the mid 1980s and the decline after 1990 remains significant even after controlling for the rise in total FDI into the United States. Figure 1.3 shows the number of

[4] The FDI data series ends in 1994 when ITA ceased collecting FDI data at the firm-level.

Japanese FDI projects computed as a share of total FDI projects in the United States.

Figure 1.3

Share of Japanese FDI Projects in the United States



Source: International Trade Administration, United States.

The acceleration of Japanese FDI in the United States, during the 1980s, raised interest and concerns about the rising role of Japanese MNEs in the US economy. The concerns in the United States intensified as the increasing Japanese FDI in the United States occurred at the same time as the appreciation of Japanese yen relative to the US dollar. This association cannot be explained by the transfer of resources across national boundaries because when MNEs invest in a country, they are concerned with the rate of return from the investments. When foreign subsidiaries in the United States generate future US-dollar-denominated profits, they are converted into the currency of

the foreign investor at the expected exchange rate. With perfect information, the level of exchange rate should not affect the present discounted value of investment.

Alternatively, US FDI inflows can be viewed as MNEs acquiring valuable US assets which are useful to their world-wide operations. Hence, a depreciating US dollar may cause US assets to become more attractive because the same amount of foreign currency can purchase more US assets. In addition, expected changes in exchange rate enable MNEs to time the purchase of assets.

However, timing FDI decisions is highly dependent on existing conditions such as relative technological capacity of the source and host countries, international production structure as well as industrial characteristics of the MNEs. These varied propositions are explored and analyzed in studies by Kohlhagen (1977), Cushman (1985), Campa (1993), Kogut and Chang (1996) and Tomlin (2000). The empirical results show that real exchange rates can affect FDI flows positively or negatively depending on existing conditions. Because data at the aggregated level are frequently used in the earlier studies, the results also remain inconclusive for reasons related to data measures and data availability.

1.2 Asymmetric Information in Capital Markets

The conditional relationship between US FDI and US currency disappears when Froot and Stein (1991) assume imperfect capital markets with

asymmetric information. As a result of the costs of acquiring information, imperfect capital markets make external finance more costly than internal finance. Because the funds that Japanese firms raised are denominated in yen, their value in US dollars increases when the US dollar depreciates. The US dollar depreciation results in relative wealth increase that allows Japanese MNEs to bid more aggressively for US assets. US firms however remain unaffected by US currency movements. Therefore the US currency depreciation unambiguously results in increased FDI inflow when capital markets are imperfect.

In addition to exchange rate changes, Klein and Rosengren (1994) include stock price movements as measures of relative wealth. Both relative wealth measures can explain FDI flows. As discussed in Klein and Rosengren (1994), the increase in Japanese stock market index relative to the United States, is associated with a two-fold increase in Japanese FDI into the United States between 1987 and 1988. Between 1989 and 1991, when the Japanese relative stock market index declined by 45%, Japanese FDI into the United States fell by 73%.

1.3 Firm-Bank Relationship in Japan

While relative wealth changes can explain the rise of Japanese FDI in the United States in the 1980s, the positive correlation between Japanese relative wealth and Japanese FDI in the United States broke down in the 1990s. To explain this breakdown, Klein, Peek and Rosengren (2002) propose the

relative access to credit hypothesis. They hypothesize that Japanese firms, in the 1990s could have encountered loan constraints during the Japanese banking crisis. As many Japanese firms are heavily reliant on bank loans as the main source of external financing, they may reduce FDI when their affiliated banks restrict lending.

Japanese firms' dependence on bank loans evolved from the regulations imposed in the Japanese financial market after World War II. During the post war years, when firms were growing rapidly and were hungry for funds, access to external financing was achieved by maintaining a long term relationship with at least one bank. As almost every Japanese firm, both large and small, maintains close ties with at least one bank, it led to the heavy reliance on banks for external financing. The bank from which firms obtained their largest share of borrowings is usually called the main bank. Every Japanese bank to some extent serves as the main bank for at least some firms.

The main bank-firm relationship, however, extends beyond just merely providing credit. The main bank holds equity in the firm, monitors the performance of the firm and intervenes when the firm has problems. When the main bank is responsible for monitoring the firm's performance, from which a large share of the firm's loans is obtained, asymmetric information and transactional frictions between the firm and the bank are reduced. This, in turn, lowers the cost of bank financing. While the relationship enhances the degree and reduces the cost of accessing information and monitoring, the mechanism can become an obstacle when one party of the firm-bank relationship is in

trouble. The effect could be significant even as the financial positions of firms remain relatively healthy because the firm-bank relationship in Japan is traditionally close and relatively more intensive than in other countries.

The early 1990s witnessed the beginning of the deteriorating financial positions of banks which affected firms' opportunities to engage in FDI. Klein, Peek and Rosengren (2002) use Moody's bank rating as an indicator of Japanese banks financial position to test the relative wealth and relative access to credit hypotheses. They use a logit regression to show that lower Moody's ratings of main banks are associated with lower probabilities that Japanese firms will undertake FDI. In a separate regression, they examine the effect of Moody's bank ratings downgrades on the reduction of Japanese FDI in the United States using aggregated bank-level data.

In the first paper, we examine the relative access to credit hypothesis and the relative wealth hypothesis by extending Klein, Peek and Rosengren (2002). Using a non-negative integer as the dependent variable, we consider the number of FDI projects undertaken by each Japanese firm in the United States. Because the dependent variable is discrete, the data analysis uses count data models.

Modeling FDI count data differs from previous approaches of examining effects of relative wealth and relative access to credit on FDI. Specifically, the zero-inflated count data models distinguish among firms according to their intention to undertake FDI. Firms without the intention to engage in FDI will never undertake any FDI project. However, the intention to

engage in FDI may not necessarily result in positive number of FDI projects because FDI projects may not materialize despite the firms' intention to undertake FDI. To differentiate the intention of a firm to undertake FDI, we use a latent variable that contributes a binary outcome. For firms without the intention to engage in FDI, we estimate the probability that a firm does not intend to engage in FDI. For firms with the intention to engage in FDI, we estimate a quantity outcome that shows a firm's rate of FDI.

We test for effects of relative wealth and relative access to credit by considering the zero-inflated negative binomial (ZINB) model and the zero-inflated Poisson (ZIP) model. To determine if we need to account for additional heterogeneity in the data, we use the score test developed by Ridout, Hinde and Demétrio (2001) to test the ZIP model against the ZINB model. The score test statistic that follows a standard normal distribution favors the ZINB model when the positive score test statistic is large.

In the second paper, we examine the relative access to credit hypothesis and the relative wealth hypothesis using a bivariate zero-inflated negative binomial (BZINB) model. The BZINB model considers acquisition and merger (AM) FDI jointly with non-AM FDI. As in the first paper the observed outcome of a Japanese FDI in the United States is analyzed as two distinct stages of the firm's investment process. The first stage occurs when the firm shows no intention to engage in FDI and FDI typically will not occur. The same firm may not always be in the first stage without any intention to engage in FDI. When conditions become favorable at some interval in time,

the firm becomes prepared for FDI and makes plans to engage in FDI. As the firm plans to engage in FDI, it moves to the second stage where the firm will either undertake FDI by acquisition and merger (AM) or/and FDI other than AM (non-AM).

As assets are imperfectly divisible, to utilize acquired indivisible assets more efficiently, the investing firm will find it necessary to undertake additional FDI of a different type to optimize production. Thus an AM FDI that is complemented by FDI of a different type implies a positive correlation between AM FDI and other types of FDI.

When AM FDI is considered jointly with other types of FDI, the effect of relative wealth on AM FDI may be uncertain. On the one hand, financial constraint of the firm due to limited debt capacity and internal wealth encourages stock payment. Stocks as an additional method of paying for AM FDI implies that a rise in relative wealth would have a greater impact on AM FDI than other types of FDI. On the other hand, the desire to preserve control of the firm discourages stock payment because it dilutes corporate control. If corporate control is desirable and stock payment results in erosion of corporate control, relative wealth would not have a greater effect on AM FDI than other types of FDI.[5]

The rest of the thesis is organized as follows: chapter two provides a survey of the traditional explanations of FDI; the role of exchange rates in FDI

[5] Faccio and Masulis (2005) discuss AM FDI payment choices of European investing firms. They find the tradeoff between corporate governance concerns and debt financing constraints influences the investing firm's choice of payment method.

assuming imperfect capital markets is discussed in chapter three; chapter four gives an overview of the Japanese main bank system in the context of the relative access to credit hypothesis; chapter five discusses data construction and count data methods; chapter six presents firm-level evidence of Japanese FDI in the United States using the ZINB and ZIP models; chapter seven extends the discussion to Japanese acquisition and merger FDI and other types of FDI using the BZINB model; and the concluding chapter eight discusses key findings and explores research in the future.

CHAPTER TWO

TRADITIONAL EXPLANATIONS OF FDI

The literature on the causes of foreign direct investment (FDI) is substantial. Although they all are equally important and significant, the review focuses on major works and issues, complementing the empirical studies in later chapters. The review is aimed at providing an overview of the developments that explains why FDI occurs. It presents early works on the industrial organization motives of FDI, culminating with Dunning's Ownership-Location-Internalization (OLI) framework. The discussion follows with a review of Vernon's product cycle theory that addresses FDI within the context of international production and international trade. The purpose is to provide a broader perspective of the role that FDI plays in international economic activity.

A logical starting point to explain FDI flows is the Balance of Payments (BoP) accounts. The capital account under the BoP contains both short term and long term international capital flows. With regard to long term international capital flows, there are two sub-classifications: foreign portfolio investment and foreign direct investment.

Hymer (1960) recognizes interest rate as the basic determinant of portfolio investments. For investment returns to be maximized, financial capital is attracted to countries where interest rates are highest. In the absence of risk, uncertainties and barriers to movement, capital from countries where

interest rates are low flows to countries where interest rates are high. This occurs until interest rates become equal everywhere. When risk, uncertainties and barriers to movement are present, interest rates need not be equal for capital flows to achieve equilibrium. Interest rate differences among countries simply reflect different risk levels, uncertainties, barriers to movement as well as market imperfections. Unless changes in interest rates are sufficiently large, portfolio investment flows are unlikely to occur.

While the interest rate primarily affects portfolio investments, it is not the key determinant of FDI flows as Hymer (1960) observes:

1 Firms which invest abroad also borrow abroad. Capital used to finance foreign business activities is not limited to FDI but includes borrowings from the foreign country, implying FDI is not about investment seeking the highest interest returns;

2 Increased portfolio investment flows to a certain country may not be accompanied by increased FDI flows to the same country. Portfolio investment and FDI need not move together. Thus, interest rate alone cannot be the key determinant of FDI flows;

3 Many firms engaged in FDI are not financial firms. Instead, FDI appears to be related to the domestic activities of investing firms; and

4 If interest rate can explain FDI flows, FDI should move to some countries and all industries. On the contrary, FDI is persistently associated with the same industries. As observed, it is concentrated

in industries intensive in skills and technology such as electronics, chemicals and petroleum and less so in the textile and agricultural industries.

The observed behavior of FDI flows implies that the interest rate is insufficient to explain FDI flows. When FDI occurs, it results in acquiring a significant share of a foreign firm in order to gain control and participation in its business operations. Control is desired to reap maximum returns on assets. The demand for FDI is therefore the demand for capital to finance foreign activities.

2.1 Control of Firm-Specific Intangible Assets

Higher interest rate abroad indeed does not motivate FDI. Instead, profits derived from controlling the foreign enterprise motivate FDI implying that FDI flows are connected to the international operations of enterprises. In the theory of international operations, two defining characteristics emerge namely, the amount of control one enterprise has over another, and the amount of legal ownership an enterprise has over the other. These two characteristics do not necessarily exist together, although they are related. Control without ownership occurs in licensing agreements. However, when control is achieved by acquiring equities, FDI occurs. Hymer (1960) proposes that FDI flows are capital movements associated with the international operations of enterprises. It involves capital flows from the multinational enterprise (MNE) in the home country to foreign affiliates in the host countries. These flows are usually

sufficiently large to affect ownership and control of foreign assets for use in production. Resultantly, FDI is synonymous with the MNE. To understand why FDI flows occur, it is necessary to understand the behavior of MNEs, both in the home country and in the foreign country.

The multinational status of an MNE arises from its business activities abroad. In her home country, she assumes the status of a national firm. When an MNE operates in its home market, it is better off than when it operates in a foreign country. This is because in its home market, it possesses information related to the home country's economy, language, legal environment and political climate, all of which affect business performance. Being less informed of foreign markets, an MNE would incur costs of acquiring information in order to begin operation in a foreign country. These costs, nonetheless, are fixed. Despite these disadvantages, MNEs with profit motives continue their foreign investments. This led Hymer (1960) to examine the characteristics and behavior of MNEs by extending Bain's (1956) work on barriers to competition of new firms.

Firms do not share the same abilities to operate in an industry. Some firms have advantages in certain activities. The possession of sufficient unique advantages by the MNE will at least compensate for the information disadvantages of operating in a foreign market. These advantages known as firm-specific intangible assets may take the form of distinguishable skills or knowledge embodied in goods and services produced by the MNE. An example is the coffee drinking experience provided by Starbucks coffee stores

which has allowed Starbucks to establish many outlets not only in the United States but most major cities in the world. These firm-specific assets may include product design and branding leading to product differentiation. Other assets include special production techniques, access to unique inputs and lower production costs. Typically, these assets are superior technology and innovative capacity manifested as skilled expertise and often protected by patents and trademarks.

Caves (1971) elaborates on the characteristics of these firm-specific assets. He identifies knowledge as an example of firm-specific asset. To some extent, knowledge can be characterized as non-rival and non-excludable; characteristics which define knowledge as a public good. Just like any public good, the fixed cost of creating knowledge is high and sometimes prohibitive. But once the good is made available, it can be productively applied anywhere without incurring additional costs. When these unique and intangible assets are effectively employed, the goods produced fetches marginal revenue product over and above costs. In turn, this enables the MNE to offset any disadvantages it faces when operating in a foreign business environment. The full benefits of the assets are reaped especially when the MNE controls and directly applies its unique knowledge to the good.

To gather support of firm-specific assets as factors motivating FDI, Caves (1974) conducts empirical tests. He assumed firm-specific assets to be intangible capital measured as advertising and R&D expenditures, scale economies, and entrepreneurial resources. Using statistical tests on data of FDI

in manufacturing industries of Canada and the United Kingdom, Caves (1974) showed significant support for firms' intangible capital as a major determinant explaining FDI.

2.2 Internalization of Market Mechanism

When an MNE possesses enough advantages in the form of firm-specific assets, the business enterprise in the foreign country is usually profitable (Hymer, 1960). Because international operations are motivated by profits, FDI occurs independently of interest-rate movements. The possession of firm-specific assets by an MNE is sufficient for FDI flows to occur. It is, however, not a necessary condition. International operations can take place even without any FDI flows. There are other ways firms can operate internationally and also adequately exploit their firm-specific advantages. One way is for firms to produce at home and export their products broad. Another way is for firms to sell or license their firm-specific intangible assets. Selling and licensing can be profitable ventures, yet they do not result in overseas operations. However, when a licensing agreement is established, firms can lose control of their firm-specific assets.

When an MNE engages in FDI instead of licensing its firm-specific assets, it retains control and application of its firm-specific assets. In doing so, the MNE internalizes the cross-border market transactions of its firm-specific assets. This situation arises because firm-specific intangible assets possess the quality of a "public good" and market transactions lead to less than optimum

returns. The internal administrative control substitutes for the market mechanism and becomes a better avenue to maximize profits.

Teece (1986) and Markusen (1995) examine the motivation for internalizing market transactions. They note various difficulties in negotiating licensing agreements between MNEs and independent foreign firms. In the presence of information asymmetries, transaction of firm-specific intangible assets could result in market failure. When the seller (MNE) presents its intangible assets for lease or sale, the buyer (licensee) may not have sufficient information to assess the value of the assets. As a consequence, the buyer can pay more than the assets are worth because the seller exaggerated the representation of the assets' properties. Alternatively, if the firm-specific asset is a knowledge product, the seller may risk disclosing knowledge information in the process of convincing the buyer of the true value; thereby giving the product away. When this happens, the buyer acquires the product without payment.

Furthermore, a newly created knowledge product yet to be commercially successful usually does not have industrial standards to benchmark its deliverables. This makes it impossible to write specifications into a contract even as contractual terms and conditions must be explicitly stated. Furthermore, the contract when in force requires policing and enforcement. In employing resources to ensure compliance of contractual terms, additional costs are incurred. The more complex contracts are, the

higher the costs of enforcement, which otherwise could have been avoided had there been no contractual agreement.

Assuming that contract enforcement is possible and the associated costs are negligible, the use and application of the product require users to be sufficiently proficient in the knowledge. Otherwise, product benefits are not fully reaped. A case in point is the sale of a software program that improves production capability but requires proficiency in its use to reap the desired benefits. Alternatively, the seller may provide the relevant training so labor can acquire the necessary knowledge. Otherwise, the presence of knowledge asymmetry between the seller (MNE) and the buyer (the foreign firm) may hinder market exchange of complex knowledge products.

Even if the contract is well-executed, after each contractual period, the MNE is exposed to possible high switching costs. This happens when the licensee defects after acquiring full knowledge of the firm-specific assets and the MNE is left to source for a new licensee. Consequently, the proprietary assets owned by the MNE may be dissipated as the previous licensee could set up a firm to compete directly in the market.

The public good quality of firm-specific intangible assets and the presence of information asymmetry can result in incomplete contracting and market failure. Unless the terms and conditions in licensing agreements can be made sufficiently explicit and transparent, FDI remains the preferred mode of maximizing profits from the owning firm-specific advantages.

2.3 Locating Foreign Operations

Internalized transfer of firm-specific intangible assets explains why FDI occurs. Capital flow serves as a platform facilitating the transfer. Because the transfer takes place internally within the MNE, control of resources over their usage is retained. This internal transfer of firm-specific assets leads to the establishment of an affiliate of the MNE located in a foreign country.

In locating its foreign affiliate, the MNE is concerned with where it can best exploit its firm-specific assets. Because firm-specific assets are utilized together with location-specific factor inputs in the foreign country, input cost is important in determining foreign location of operations. These include costs of labor, infrastructure, land and telecommunication. Other relevant costs are related to transportation, trade barriers and taxes. In addition to costs, the MNE considers the productivity of inputs. The higher costs may be justified by an even higher productivity of inputs. Hence, the MNE measures costs of inputs relative to productivity. This measure is known as relative input costs. In deciding where to locate, relative input costs are more relevant to the MNE than total input costs.

Besides input costs, the MNE considers the size of the foreign market as an important factor in deciding where to locate its foreign operations. As direct investment in a foreign country implies large fixed costs, MNEs are willing to establish foreign operations if prospective sales in the foreign country are sufficiently large.

2.4 Sizable Multinational Enterprise

Caves (1971) notes the ability to produce successful product varieties shield the MNE from competition. As entry barriers are erected, only a few firms remain in the market. Consequently, Caves (1971) infer that MNEs engaged in FDI that operate in oligopoly markets with differentiated products. Selling differentiated products enables the MNE to exhibit market influence resulting in sufficiently larger market share. All in all, it implies that MNEs tend to be usually large in size.

Horst (1972) identifies large firm size as the key determinant of FDI flows. In establishing foreign operations, the MNE incurs fixed costs. Large firms with better credit risk compared to smaller firms have better opportunities at financing foreign operations. Because foreign investments are inherently risky, larger firms are in a better position to undertake risks. Horst (1972) further reasons that if an MNE holds a large market share in the home country, its foreign affiliates are likely to obtain substantial market share in the foreign country. This is because both the MNE and its foreign affiliates employ the same technologies and marketing capabilities. Success in the home market is positively associated with success abroad. However, the emphasis on large firm size as an explanatory factor of FDI flows does not preclude the importance of other explanatory variables of FDI flows.[6] While Horst recognizes the importance of these additional factors, he assumes that the effects of the other explanatory variables are included in the firm size variable.

[6] Horst (1972) mentions other explanatory factors such as profitability, R&D and advertising efforts as well as product diversity are equally important in determining FDI flows.

Using total sales and assets as measures of firm size, Horst (1972) conducts empirical tests to distinguish among the characteristics of US manufacturing corporations with foreign investments in Canada. Other than firm size, he included as regressors net profits, labor costs, R&D expenditures and advertising expenditures and dummy variables to control for industrial characteristics. His results show strong support for the hypothesis that larger firms are more likely to invest abroad than smaller firms. After controlling inter-industry differences, Horst (1972) further shows that the only significant factor influencing US foreign investment decision is the size of the firm.

When increasing firm size raises the likelihood of multi-national activities, firm-specific assets provide MNEs economies of scale as they locate production overseas. Sources of scale economies are derived from firm-specific intangible assets because of the public good quality of these assets. Hence, no increase in firm-specific assets is necessary for the MNE to increase production across national boundaries.

These firm-level intangible assets which include scientific know-how, patents, management skills and brand name are important to the MNEs. However, they do not require replication when the MNEs expand overseas because they contribute to firm-level economies of scale. As the MNE expands and establishes a foreign affiliate, a part of the production process is duplicated. This requires the MNE to establish a new assembly plant to serve the foreign market. The duplication of activity means that some economies of scale are foregone, but they are those that occur at the plant level. The

distinction between firm-level economies of scale and plant-level economies of scale is important. High firm- level scale economies suggest that firms will be large and are likely to engage in FDI. Alternatively, high plant-level scale economies suggest that splitting production into separate units is not beneficial.

Brainard (1997) examines the effect of firm-level and plant-level scale economies on FDI. She uses the number of production employees in the median US plant as an industry measure of plant-level scale economies, and the number of non-production employees in the average US-based firm as an industry measure of firm-level scale economies. The empirical evidence shows strong support of the hypothesis that high firm-level scale economies combined with relatively low plant-level scale economies are likely to promote FDI.

2.5 Ownership-Location-Internalization Framework

Considering the varied explanations of FDI ranging from firm-specific determinants to country-specific determinants, Dunning (1981) develops a paradigm of international production. He asserts that a firm will engage in foreign value-adding operations when the following three conditions are satisfied:

1. The firm owns firm-specific intangible assets capable of generating rent yielding income;

2. Assuming condition (1) is satisfied, it is more profitable to internalize the market transaction of these firm-specific assets as opposed to selling or leasing them to a foreign firm; and
3. Assuming conditions (1) and (2) are satisfied, the firm's foreign operations are dispersed and located in countries where it can efficiently exploit its firm-specific assets.

Dunning's paradigm, widely known as the Ownership-Location-Internalization (OLI) framework forms the premise of a generic explanation of international production. It has since become the basic building block of research in FDI. An extension of Dunning's OLI framework can incorporate a time dimension to explain FDI by comparing between FDI and international trade.

The link between FDI and trade is also addressed in Hymer (1960). He notes that international operations often occur in industries in which international trade was or is important. In some cases, international operations occur because there is actual or potential trade. A firm with firm-specific assets may choose to export the product which embodies these firm-specific advantages. Through export activities, the firm is able to establish distribution channels in the foreign market. In understanding the market better through export activities, the firm is able to innovate and improve its product to suit the taste and preferences of the foreign market it serves. When production abroad becomes more profitable due to a change in cost conditions, the firm who still owns rent-yielding firm-specific assets may consider establishing

foreign operations. When this happens, not only do firm-specific advantages lead to trade but they also lead to FDI and further trade.

2.6 Dynamic Process of International Operations

An association between international trade and FDI seems obvious but it was Vernon (1966) who formally integrates international trade and FDI as different stages of the product cycle. Using the US economy as an example of a large domestic market with advanced technology, the product cycle theory highlights the importance of the timing of innovation, the effects of scale economies and the role of uncertainty.

In the first stage of the product cycle, a newly created product requires an entrepreneur to identify market opportunities and undertake risks to market the product. Before the product can become commercially successful, the entrepreneur needs to be responsive to market opportunities. In the early stage of launching the new product, the entrepreneur has to test the market for product acceptance. It requires the entrepreneur to be flexible in using factor inputs during production. In addition, the entrepreneur needs to communicate swiftly and effectively with customers, suppliers and even competitors to remain responsive to the market. Being close to the market is therefore beneficial to the entrepreneur who decides to produce in the home country.

In the second stage of the product cycle, the demand for the product grows. As the product gains acceptance, demand expands beyond the domestic market. With a maturing product, the need for flexible production processes

declines as the product acquires standardization. Mass production is possible in the presence of economies of scale, achieved by a commitment to establish product standards. With some degree of large scale production, exports take place. International trade follows. With growing demand of the product, plant-level scale economies will be exhausted at some point in time. To meet growing foreign demand the entrepreneur has to consider production beyond the home country. According to Vernon (1966), if the marginal cost of domestic production and the transport cost of exporting the goods exceed the average cost of prospective production in the foreign market, the entrepreneur will establish foreign production facilities. FDI ensues. Among competing production locations, the choice is determined by relative factor costs and economies of scale.

In the third and last stage of the product cycle, the product becomes highly standardized. The high output volume and low degree of uncertainty justify investment in relatively inflexible production facilities. Highly standardized products manufactured with exacting specifications tend to sell on the basis of price. Hence, production is based on cost minimization. As the production process does not require any sophisticated industrial environment, international production location shifts to less developed countries. The low cost production locations can serve as platforms for exports of highly standardized products to the rest of the world.

Following Vernon's product cycle theory, empirical research considers exports and FDI as alternative methods of serving foreign markets. Using data

on Swedish exports and FDI, Swedenborg (1979) found significant correlation between exports and FDI. However, industries characterized by high level economies of scale tend to export rather than invest abroad. This confirms the earlier discussion that plant-level scale economies encourage centralized production. She also notes that both exports and FDI are positively related to indicators of firm-specific assets such as R&D activities and skills of workers.

In a similar vein of research, Brainard (1997) examines a cross section of bi-directional trade data between United States and 27 other countries and US FDI outflows to these 27 countries. The data are disaggregated by industry and country. She finds that multinational production relative to exports decreases with plant-level scale economies and increases significantly with transport costs, trade barriers in the foreign market and the host country's openness to FDI. Her findings confirm the trade-off faced by the MNE between cost savings from concentrating production in one location and transport and trade barrier costs incurred in exporting to other locations.

CHAPTER THREE

EXCHANGE RATES AND FDI IN THE UNITED STATES

When major industrial countries left the Bretton Woods system of fixed exchange rates, exchange rates were permitted to float. As exchange rates became more flexible, the role of exchange rates in explaining FDI flows began to gain importance. The chapter aims to discuss the developments of FDI explanations, focusing on exchange rates as the key determinant. Early studies using exchange rate as a regressor to explain FDI flows established the association between exchange rates and FDI but could not explain why a depreciation of a currency attracts FDI. It was Froot and Stein (1991) who explain why a depreciation of the currency attracts FDI. They do so by assuming asymmetric information and name the exchange rate effect on FDI, the relative wealth effect. Together with firms' unequal access to credit, the relative wealth effect will be examined in the context of Japanese FDI in the United States in later chapters.

3.1 The Role of Exchange Rates

In maximizing profits, the MNE must examine both revenues and costs. In considering costs of establishing foreign production, exchange rate affects both the magnitude and timing of FDI decisions. Early research on exchange rates and FDI flows was conducted when exchange rates were relatively fixed but were occasionally adjusted to ease disequilibrium positions. Kohlhagen

(1977) develops a model of firms' profit-maximizing behavior in various production locations. The model shows that when an MNE anticipates a discrete foreign currency devaluation, FDI is deferred until the devaluation has occurred. A devalued foreign currency enables the MNE to purchase more foreign inputs with the same amount of home currency. Timing FDI when exchange rates are expected to change becomes important.

As exchange rates became more flexible after the Bretton Woods system of fixed exchange rates was abandoned, interest in the relationship between exchange rates and FDI grew. An early study using flexible exchange rates was conducted by Cushman (1985). He develops a profit-maximizing function of an MNE to examine how real exchange rate levels, real exchange rate changes and exchange rate expectations affect FDI flows. In a two-country world where the MNE decides where to buy inputs, obtain financial resources, produce and sell its output, he shows the interactions of the MNE's financing options, trade linkages and exchange rate expectations on foreign investment decisions. Four possible arrangements of international production are considered:

I Foreign production and sales using financial resources from either the foreign country or the home country;

II Foreign production and sales using financial resources and an input from the home country;

III Domestic production and sales using financial resources from the home country and an intermediate input from the foreign affiliate; and

IV Domestic production for exports or foreign production and sales using financial resources from the home country using localized inputs.

An expected appreciation of the real exchange rates has a direct effect of increasing current FDI flows because current foreign input costs will be lower than future foreign input costs. However, different international production arrangements can result in ambiguous effects on FDI flows for changes in real exchange rates.

When an MNE imports an intermediate input from the foreign affiliate for domestic production (Case III), the appreciation of the foreign currency relative to domestic currency leads to increased cost of the foreign intermediate input. As a result, imports of intermediate inputs from its foreign affiliate for domestic production decreases. Decreased imports and production of foreign intermediate input would require less financial resources from the home country resulting in reduced FDI flows. However, the foreign currency appreciation also raised the foreign affiliate's retained earnings [7] when expressed in domestic currency. The foreign exchange rate appreciation that results in relatively cheaper foreign capital from retained earnings of the

[7] Retained earnings from the foreign affiliate constitute part of FDI. The other components of FDI include equity flows and debt financing from the parent firm to its foreign affiliate.

foreign affiliate can finance production of more foreign intermediate inputs thereby increasing FDI. Hence, depending on the magnitude of the individual effects, the resultant net effect on FDI is ambiguous.

The reaction to expected and actual changes in exchange rates is uniquely determined by the international production arrangement of an MNE. Different production arrangements results in a variety of responses from a change in the exchange rate. At the aggregate level, the exchange rate effects on FDI flows are ambiguous.

As exchange rate effects on FDI decisions of MNEs are conditioned on international production arrangements, Campa (1993) confines his sample to the US wholesale trade industries. He models FDI decisions of MNEs after Dixit (1989) who uses the option pricing theory to analyze investment decisions. The holder of an option has the right to buy or sell a specified quantity of the underlying asset in the future at an agreed price known as the exercise price. In Campa's model, a foreign firm holds an option to enter the US market or defer entry until the next period. Upon exercising the option to enter the market, the foreign firm establishes production operations and incurs sunk cost. The sunk cost is the exercise price of the option. After the option has been exercised, the expected present discounted future profits from production and sales in the US market constitute the returns. When expressed in the currency of the foreign firm, the returns fluctuate with changes in the exchange rate.

As in the options pricing theory, the option owned by the foreign firm has a value. The value of the option increases with increased volatility of the underlying stock. Consequently, the value of the option to enter the US market increases with the volatility of returns from FDI which is in turn determined by the volatility of exchange rates. As long as the expected change in the option value is higher than the expected returns from entry for the period, the firm will not exercise the option. Entry will be deferred for another period.

Hence a foreign firm's decision to enter the US market depends positively on the level and rate of change of US exchange rate. An appreciating US dollar leads to higher FDI returns and higher expected future profits when expressed in terms of the investors' home currency. Conversely, exchange rate volatility, high investment sunk costs, and labor cost are likely to deter foreign firms' entry into the US market.

Campa (1993) uses the Tobit model to conduct empirical tests on foreign firms' FDI decisions in the United States. The results show that the US dollar is positively correlated to increased US FDI inflows for the period 1981 to 1987. Campa (1993) also notes an association between lower likelihood of FDI projects and higher exchange rate volatility. Increased uncertainty about future exchange rate deters FDI because firms find it worthwhile to wait until exchange rates are more stable before entering the market.

Adopting Campa's (1993) option pricing FDI model, Tomlin (2000) uses the zero-inflated Poisson (ZIP) model to test the importance of exchange rate volatility on FDI decisions. Besides non-negative integer values, the ZIP

model takes into account the large number of zero values in the FDI count data set. To compare between the Tobit model and the ZIP model, Tomlin (2000) uses the same variables in Campa (1993) but extended the sample period from 1982 to 1993.

Contrary to Campa (1993), Tomlin (2000) finds no statistically significant relationship between exchange rate volatility and FDI flows. She concludes that Campa's estimates are sensitive to empirical specification and reasons that Japanese investment in wholesale distribution channels is a result of heavy Japanese export activities rather than exchange rate changes. This is consistent with Yamawaki (1991) who reports that Japanese exports are accompanied by massive investments in wholesale distribution channels and brand name development.

Where distribution channels are established to support export activities, FDI decision can be viewed as part of a dynamic process in which the option to shift into manufacturing and production will arise under favorable economic conditions. Kogut and Chang (1996) suggest that early export activities and investment in distribution channels can serve as platforms for future expansion in the foreign market. As a means to transfer firm-specific intangible assets across borders, exports pave the way for future expansion of international operations and FDI flows. The timing of FDI decisions depends on exchange rate movements. When the foreign currency depreciates, firms are likely to switch from export activities to FDI.

The platform entry argument by Kogut and Chang (1996) implies sequencing of FDI activity where FDI constitutes part of a dynamic process of serving the foreign market. When exchange rate shocks affect export revenue, firms expand by adding foreign production facilities. According to Yoshikawa (1990), as the Japanese yen appreciated in the 1980s, the proportion of Japanese FDI shifted from non-manufacturing to manufacturing industries.

The exchange rate movements within the broad traditional explanations of FDI enable firms to time their investments. The platform entry hypothesis in Kogut and Chang (1996) postulates increased FDI outflows because of foreign currency depreciation while the options pricing hypothesis in Campa (1993) predicts increased FDI outflows because of currency appreciation that leads to higher expected investment returns.

3.2 Relative Wealth Hypothesis

However, the fluctuations of US inward FDI between the late 1970s and the early 1990s prompted the search for additional explanations of FDI. Using an alternative proposition in a globally integrated market subject to asymmetric information, Froot and Stein (1991) propose the relative wealth hypothesis. Their explanation aptly demonstrates an unambiguous negative relationship between exchange rates and FDI flows.

Capital market imperfection results when investment returns are subject to information asymmetry. Lenders who are unable to observe their returns on information-intensive investments need to acquire information.

Acquiring information incurs costs. The costs of monitoring investments cause externally generated funds to be more expensive than internally generated funds. As a result, firms financing FDI entirely with external funds will find it relatively more costly. The more internal funds a firm can bring into FDI financing, the lower will be its total capital costs. While firms may wish to keep total capital costs as low as possible, in some cases, they may be constrained by a shortage of internal funds. Raising funds externally becomes the choice for as long as these firms find it worthwhile to bear the increasing costs.

If foreign firms hold a higher proportion of their wealth in non-US-dollar denominations, the external financing constraint caused by imperfect capital markets prevents foreign firms from bidding as much as their willingness to pay for US assets. In the event of a depreciation of the US dollar, foreign firms are able to raise their bids using the same amount of foreign currency. Conversely, US firms who are competing in the bid for US assets remain unaffected by the US dollar depreciation.

The US currency depreciation induces a relative wealth increase that eases the borrowing constraints faced by foreign firms. As a result, foreign firms can offer relatively higher bids for US assets. However, foreign firms' willingness to pay should not exceed the expected present discounted value of profits from FDI in United States. Because the US dollar depreciation reduces the value of expected profit stream when expressed in foreign currency, the

US dollar movements only create differential wealth effects between foreign and domestic bidders.

In establishing empirical support, Froot and Stein (1991) compare the behavior of FDI with other types of capital inflows to the United States between 1973 and 1988. They find that FDI is the only type of capital inflow that is negatively correlated to the value of the US dollar. This result is not surprising since passive portfolio investments including corporate stocks and bonds are by nature not information-sensitive. With negligible monitoring costs, relative wealth effects do not affect information-insensitive foreign investments.

Besides exchange rate changes resulting in relative wealth increase of MNEs, Klein and Rosengren (1994) consider stock price movements as another channel in which relative wealth can affect FDI. Using the stock market index as a measure of relative wealth, Klein and Rosengren (1994) compare the relative wealth hypothesis with the relative labor cost hypothesis. In the relative labor cost hypothesis, FDI represents capital seeking relatively cheap labor inputs. A depreciation of a country's currency leads to lower labor costs that encourages FDI inflows. To determine the effects of relative wealth and relative labor cost on FDI, Klein and Rosengren (1994) conducted empirical tests. Their results fail to support the relative labor cost hypothesis but provide strong support for relative wealth as a significant determinant of FDI.

Harris and Ravenscraft (1991) assess the effects of cross-border takeovers on share prices and presented evidence of exchange rate induced wealth effects on FDI flows. Their empirical results demonstrate that wealth gains measured by abnormal shareholder returns are significantly higher in cross-border takeovers than domestic takeovers of firms in the United States. The strong cross-border effect suggests that foreign buyers consistently pay higher premiums for US firms compared to US domestic buyers. Upon further examination, Harris and Ravenscraft (1991) find that wealth gains are significantly higher when the buyer's currency is stronger relative to the US dollar.

In another study, Swenson (1994) analyzes US currency movements and its effects on shareholder wealth gains in foreign acquisition of US firms. Consistent with results in Harris and Ravenscraft (1991), when the US dollar is relatively weak, shareholder wealth gains in foreign acquisitions of US firms are much larger than domestic acquisitions of US firms. In fact, foreign acquisitions generated shareholder wealth gains of approximately 10 percent above similar US domestic acquisitions. In contrast, US domestic acquisitions show no significant shareholder wealth gains. The results are consistent with the exchange-rate-induced wealth effects that are relevant to FDI flows[8].

[8] Harris and Ravenscraft (1991) show foreign acquisitions of US firms in R&D intensive industries while Swenson (1994) show foreign acquisitions of US firms that are motivated by the presence of intangibles. Intangible assets such as market share reflect the willingness of firms to pay for high premiums in foreign acquisitions. When it is more costly for foreign firms to develop market share in the host country, acquisition FDI is favored.

Blonigen (1997) by assuming goods market imperfection provides another explanation why exchange rate changes affect FDI inflows. If a firm-specific asset is transferable within the firm across many markets, a firm after acquiring the foreign firm-specific asset can increase production levels in all its manufacturing plants located around the world. In terms of foreign currency, the firm pays a lower price for the US asset when the US dollar depreciates. However, the firm's returns from the US asset may not be lower because the returns from increased production levels in other locations need not be realized in US dollars. Because the application of firm-specific asset is not location-bound, the returns in the form of immediate increase in production levels and sales can be realized in different currencies and locations.

Furthermore, when markets are segmented resulting in unequal market access, a foreign firm will value a US firm-specific asset that can be used in other foreign markets where US firms have limited market access. In this regard, the Japanese market has been insulated from foreign imports and FDI. Thus, Japanese firms after acquiring US firm-specific assets can reap returns not only in the US market but in the Japanese market as well. US firms compared to Japanese firms have limited access to the Japanese market. The potential returns from using US assets in the Japanese market encourage Japanese firms to bid more aggressively for US assets when the US dollar depreciates.

CHAPTER FOUR

JAPANESE FDI IN THE UNITED STATES

Given the evidence that FDI activities are strongly correlated to exchange rate movements, changes in the relative wealth of investing firms can explain fluctuations in FDI flows. This chapter discusses Japanese FDI in the United States during the 1980s and the early 1990s with an emphasis on the main bank system and industrial groupings in Japan. The discussion centers on the declining Japanese FDI in the United States in the context of weakening financial positions of banks in Japan. In doing so, it builds on the relative access to credit hypothesis proposed in Klein, Peek and Rosengren (2002) and motivates the empirical studies that are presented in chapters six and seven.

Between 1984 and 1987, the number of Japanese FDI projects in the United States on average increased by 49%. The figures are presented in table 4.1. Much of the increase in the number of FDI projects that are concentrated in the manufacturing industries can be explained by the appreciation of the Japanese yen and asset prices. [9]

[9] Appendix A shows the list of Japanese firms in the respective industries that engaged in at least one FDI project in the United States between 1987 and 1994.

Table 4.1
Percentage Change in the Number of Japanese FDI Projects in the United States

Year	Number of Japanese FDI Projects in the United States	Percentage Change in the Number of FDI Projects
1980	154	-
1981	132	-14.3
1982	147	11.4
1983	108	-26.5
1984	198	83.3
1985	216	9.1
1986	351	62.5
1987	490	39.6
1988	419	-14.5
1989	474	13.1
1990	460	-3.0
1991	333	-27.6
1992	195	-41.4
1993	153	-21.5
1994	212	38.6

Source: International Trade Administration, United States

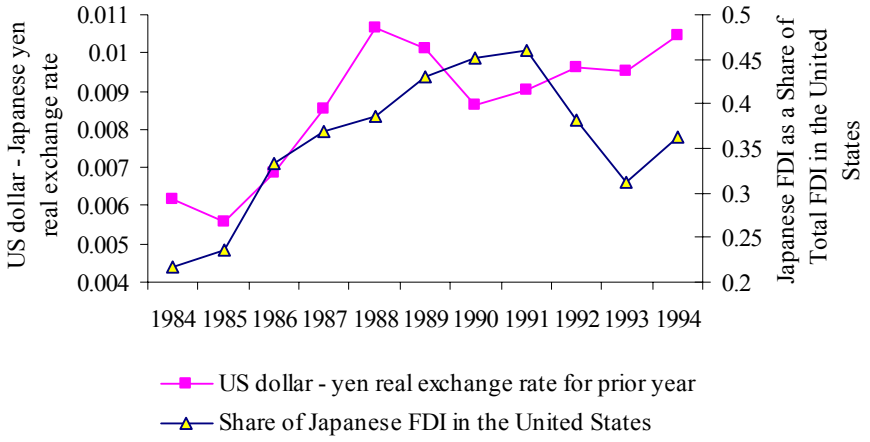
However, between 1990 and 1991 the number of Japanese FDI projects in the United States fell by 28% and between 1991 and 1992 it fell by a further 41%. The dramatic decline of Japanese FDI in the early 1990s clearly contrasts with the phenomenal increase that occurred in the 1980s.

Furthermore, the decline in Japanese FDI that began after 1990 cannot be fully explained by the relative wealth hypothesis. Figure 4.1 shows the real US dollar-yen exchange rate and the share of Japanese FDI in the United States between 1984 and 1994. The real exchange rate and the share of Japanese FDI in the United States rose in tandem from 1984 to 1990. The rising Japanese FDI was accompanied by the appreciating Japanese yen

relative to the US dollar. After 1990, despite the continued appreciation of the Japanese yen, there was a sharp decline in Japanese FDI.

Figure 4.1

Share of Japanese FDI into the United States and the Real US dollar – Japanese yen exchange rate



Notes: US dollar – Japanese yen real exchange rate is calculated by multiplying the bilateral US dollar – yen exchange rate by US CPI and dividing by the Japanese CPI. The exchange rate and CPI data are from International Financial Statistics, International Monetary Fund (IMF). The number of Japanese FDI projects is from the United States Department of Commence, International Trade Administration's publication Foreign Direct Investments in the United States: Transactions.

4.1 Relative Access to Credit Hypothesis

To explain Japanese firms' FDI behavior after 1990, Klein, Peek and Rosengren (2002) propose a hypothesis. They recognized that internal financing is cheaper than external financing when capital markets are imperfect and external funds are raised to the extent that firms are willing to bear the increasing costs. However, when lenders are unable to provide credit, firms will be further constrained by their inability to obtain external financing.

Resultantly, the availability of external funds influences the opportunity of firms to engage in FDI. Klein, Peek and Rosengren (2002) term the explanation the relative access to credit hypothesis.

Klein, Peek and Rosengren (2002) postulate many bank-dependent Japanese firms reduced their FDI flows to the United States in the early 1990s because of credit constraints caused by their affiliated banks' worsened financial health. Although the Japanese yen has continued to appreciate during the early 1990s, the reduction of Japanese FDI into the United States has fallen by a significant amount. The results suggest a significant role in firms' relative access to credit in explaining the decline of Japanese FDI after 1990. The decrease in Japanese FDI flows to the United States results from firms' reduced access to credit because of a collapse in the Japanese banking industry.

4.2 The Japanese Main Bank System and Industrial Groupings

Firms in Japan traditionally maintain a long-term relationship with a particular bank known as the main bank from which they obtain their largest share of borrowings. While the provision of bank credit is one of the key aspects of the main bank relationship, another important aspect is the role of the main bank in monitoring the performance of firms and intervening when the need arises. The main bank as a major source of funds for financing investments has its roots from the period before World War II. It developed and evolved within a historical context as a response to the cost of monitoring

in an environment with asymmetric information and to the overall institutional structure of the Japanese economy (Aoki, Patrick and Sheard, 1994).

The banking system in Japan before 1927 consisted of many small and medium banks which grew in a free, competitive and unregulated market environment.[10] Although there were large zaibatsu banks that were closely connected to groups of industrial firms by cross ownership and credit relations, some of the small banks were family owned and often closely tied to their own firms.[11] A lack of ex ante monitoring of long-term loans exposed the banks to excessive risks that led to a series of bankruptcies in the 1927 banking crisis. This left a profound effect on policymakers which implemented financial regulations that were in favor of stability over competition.

Throughout the 1930s mergers and acquisitions were promoted and the number of commercial banks decreased from 1,515 in 1928 to 65 in 1945. During the process, the market shares of zaibatsu banks in total deposits and in credits grew. At the same time, a banking system in which a firm will hold its deposit and loan accounts with a designated bank is introduced. As the Japanese banking system developed from a relatively decentralized banking system to a quasi-state banking system with a reduction in the number of banks and the introduction of the designated banking system, it sets the initial conditions for the subsequent development of the main bank system in the post-war period.

[10] Details of the Japanese main bank system are found in Aoki, Patrick and Sheard (1994), Horiuchi, Packer and Fukuda (1988) and Patrick (1994).
[11] Zaibatsu refers to family-controlled industrial groupings of Japanese firms that existed before World War II.

Although dramatic changes were made to the Japanese banking industry, the characteristics of the banking system remain fundamentally preserved. The primary function of private banks continued to be the provision of long-term credits. As the financial market after the war was heavily regulated and most firms were badly in need of funds, forming a close relationship with a bank was therefore essential. The resultant heavy reliance of firms on their main banks for external financing became the main source of growth and expansion for even the largest firms.

Although zaibatsu control of banks was removed with the dissolution of the zaibatsu after the war, bank shareholdings in non-financial firms continued to be permitted. This was instrumental in subsequently reviving old zaibatsu connections based on mutual shareholding that led to the post-war keiretsu system of bank-centered industrial groupings. As the zaibatsu were dissolved, stock transfers from the zaibatsu and their holding companies to the government took place during the stock market closure between 1945 and 1949. These stock holdings were subsequently sold to individuals who in turn sold the shares at higher prices back to the firms. Together with the easing of the Anti-Monopoly Act in 1951 where banks' equity holdings in non-financial firms was raised from 5 percent to 10 percent, a system of stable cross-shareholdings within industrial groupings of firms centered on a main bank developed into an integral part of the Japanese financial system and industrial organization.

Although the main bank relationship is implicit without any legal status, according to Sheard (1989), there are two distinguishing characteristics that could be used to define a firm's main bank.

The main bank among other banks maintains the largest loan share to a firm. According to Sheard (1989), the main bank was the primary source of borrowing for over two-thirds of Japan's 873 non-financial firms listed in the first section of the Tokyo Stock Exchange in 1982. Among the largest Japanese banks, four stood out as main banks to the industry. They are Mitsui, Mitsubishi, Sumitomo and Fuji. Each serves as the main bank to over 100 firms implying that approximately half of the largest firms in Japan use one of the four major banks as their main bank. Two other large banks Sanwa and Dai-ichi Kangyo Bank (DKB) have main-bank relationships with another 71 firms and 51 firms respectively. If the Industrial Bank of Japan is included, the seven most important banks in Japan are main banks to about 70 percent of the largest Japanese firms.

In addition, the main bank is typically a principal shareholder of the firm. Main bank equity holding of the firm make information sharing between the main bank and the firm the cornerstone of the main bank system. The firm often consults the main bank on its business plans and provides the bank with regular reports on its performance. This process of information exchange is further formalized by having senior executives of the main bank on the firm's board of directors. The bank's access to the internal decision-making of the firm allows the bank to be informed about the firm and its management at

relatively low costs. The reduced monitoring costs enable firms to receive better terms of credit from its main bank because information on the firm's creditworthiness is already at the bank. Thus when a firm needs an unusually large loan amount for an FDI project in the United States, a bank employee who is also a board member of the firm would be able to recommend if the project is potentially profitable. Of the publicly listed Japanese firms that had bank borrowings in 1980, Sheard (1989) reported that half of these firms had at least one representative from the main bank on the firms' board of directors.

The cross-shareholding arrangement among firms and their main banks evolved from the revival of zaibatsu connections. Although the zaibatsu were dissolved after the war, bank shareholding in firms continued to be permitted. Even as shares from the zaibatsu were transferred to individual investors, they were purchased at higher prices by the firms. As a result, former zaibatsu groups of Mitsui, Sumitomo and Mitsubishi were re-established as a new form of horizontally integrated industrial groupings or horizontal keiretsu.[12] Apart from the pre-war zaibatsu that uses the same names, the other three large bank-centered industrial groupings are Fuyo, Dai-Ichi Kangyo and Sanwa with relations to the Fuji bank, Dai-Ichi Kangyo Bank and Sanwa Bank. Besides the main bank, each industrial grouping has at its nucleus other financial institutions which usually include a trust bank, a life insurance company and a

[12] The other form of industrial groupings of firms prevalent in the automobile and electronics industries is known as vertical keiretsu where upstream suppliers revolve around a large downstream manufacturer. The final goods produced by the main manufacturing firm would be moved out to the market through a distribution network of wholesalers and retailers. Thus a vertical keiretsu consists of a production keiretsu and a distribution keiretsu. In a vertical keiretsu the designated main bank as a supplier of credit performs a less important role than in a horizontal keiretsu. An insightful discussion of industrial groupings in Japan is detailed in Miyashita and Russell (1994).

general insurance company as well as the group's trading firm. Apart from the six largest industrial groupings, other significant groups arose around the Industrial Bank of Japan (IBJ), the largest of the long-term credit banks, and the Tokai Bank, based in the Nagoya region. There are also smaller industrials groupings with a strong regional base that are associated with smaller banks.

Each of the six major bank-centered industrial groupings has a regular forum in which top executives of firms within each industrial grouping and their main bank meet. Although this president's club has no formal decision-making power, it provides a further avenue for information exchange and coordination of business decisions.

The historical development of the banking industry and the role of the main bank in corporate finance have left Japanese banks in an important position. The decline in the financial health of Japanese banks could severely impact firms' ability to finance investment. According to Hoshi and Kashyap (1999), trouble in the Japanese banking industry began with the deregulation of the financial markets in the 1980s. The problems did not result from the financial deregulation per se but evolved from the failure of the Japanese authorities to adjust the supervision and regulatory system in view of the financial deregulation. In particular, the introduction of non-bank intermediaries led to heightened competition with banks. As a result, the banks lost high quality borrowers within a short time. They responded by moving into riskier ventures with excessive lending to the manufacturing and real estate sectors. The escalating prices of the real estate and the stock market

fueled further risk-taking by the banks as well as their borrowers. Together with lax supervision of banks, non-performing loans began to accumulate. When the asset bubble burst in 1990, the Japanese banks suffered severely from heavy loan losses which resulted in the deterioration of the Japanese banks' financial position.

Gibson (1995) examines the weakened financial condition of banks between 1991 and 1992 on domestic investments in Japan. He finds that investment of firms with one of the lowest rated banks as their main banks is lowered by 30%. Even after controlling for stock valuation and financial health of the firm, Gibson (1995) shows that firms with unhealthy main banks invested significantly less than other firms with main banks that are in better financial positions.

4.3 Empirical Tests in Klein, Peek and Rosengren (2002)

Klein, Peek and Rosengren (2002) extend the results in Gibson (1995) to explain reduced Japanese FDI in United States when banks in Japan were financially weakened. They show that unequal access to credit by Japanese firms can explain declining Japanese FDI in the United States. Their empirical tests use separate estimating equations on two data sets. The first uses a bank-level data set obtained by pooling together all FDI projects of Japanese firms using the same main bank. The aggregated bank-level empirical test aims to determine the extent of firms' decline in FDI resulting from varying declines in the financial positions of associated main banks. The change in the number

of FDI projects of all firms associated with a main bank in a specific year is the dependent variable. The explanatory variables include the change in Moody's bank ratings indicating the change in the financial positions of main banks. Also included in the equation to control for firms' financial health is the change in the profitability of firms associated with each main bank. Other explanatory variables indicating changes in relative wealth and economic conditions in both countries complete the first estimating equation.

Linear regression analysis in Klein, Peek and Rosengren (2002) show evidence of a decline in Japanese FDI outflows as bank-dependent firms experience reduced access to credit resulting from the decline in the financial positions of banks. The effects of deteriorating bank financial position on FDI are significant even after controlling for firms' profitability and macroeconomic activities in both countries.

As differences among firms that share the same main bank are not captured in aggregated bank-level data, the second estimating equation in Klein, Peek and Rosengren (2002) used firm-level data. In the second estimating equation, the dependent variable uses a limited dependent variable to determine whether the probability of a firm's engagement in an FDI project is affected by each firm's access to credit. It takes a value of one if the firm engaged in at least one FDI project in a year and a zero value otherwise. To be consistent with the measure in the dependent variable indicating level of FDI projects, the firm-level data estimating equation uses level measures in the explanatory variables.

The empirical results in the second estimating equation using a logit model show significant negative effects of declines in bank health on the probability of investing in FDI projects. While the likelihood of FDI is estimated in the logit model, the change in FDI is examined in the first estimating equation using aggregated bank-level data. The empirical results using aggregated bank-level data showed a lack of support for the relative wealth effect.

There could be two reasons why the relative wealth coefficients are insignificant. Firstly, testing relative wealth effects of firms on FDI uses aggregated data at the bank level. Data aggregation conceals important heterogeneous firm-level effects. If firm-level data could be used to test both hypotheses, it may reveal more conclusive evidence of firms' behavior on FDI. Secondly, the empirical tests use separate estimating equations which could result in the loss of information and incomplete data analysis. A single statistical model which can simultaneously test both hypotheses by including all available information may provide improved estimates.

CHAPTER FIVE

FOREIGN DIRECT INVESTMENT COUNT DATA AND COUNT DATA METHODS

This chapter provides a discussion on data construction explaining how our FDI data set is put together, along with an overview of count data methods. We introduce the basic framework of count data analysis with a discussion on techniques used to overcome departures from the restrictive assumptions of the standard model. The introduction on count data methods sets the ground work for count data models that would be used in the empirical studies.

The FDI data set we constructed uses the International Trade Administration (ITA) publication that provides the Japanese FDI firms. The names of the Japanese firms are matched with the firms in the Japan Company Handbook to identify the main banks of these FDI firms. In cases where the historical development of firms needs to be traced, the Osiris database is used. Appendix B provides further details of databases, descriptive statistics of original data and explanations of data variables

5.1 Construction of Foreign Direct Investment Count Data

We use a representative sample of Japanese firms to investigate the impact of Japanese firms' relative wealth positions and associated banks' financial conditions on FDI flows into the United States. Unlike the main data set in Klein, Peek and Rosengren (2002) which includes FDI firms in the first

and second sections of major stock exchanges in Japan[13], our sample includes only firms in the first section of Japan stock exchanges because firms listed in the first section constitute the largest and most important firms in Japan. To maintain listing in the first section, firms must fulfill a set of assignment criteria[14] on a yearly basis, two of which are related to a minimum average monthly trading volume and a minimum number of share issues. If firms do not meet the assignment criteria for listing in the first section, they will be assigned to the second section of the stock exchanges of which the assignment criteria are those used for the initial listing of domestic firms. Hence, first section firms in the stock exchanges are the most established firms, consisting of all major firms in Japan.

The Japanese firms in our sample that engaged in FDI in the United States between 1987 and 1994 use one of the eleven Japanese banks identified in Klein, Peek and Rosengren (2002) as their main banks. Each main bank has a strong historical relationship with the Japanese firms it serves. In addition to supplying funds to finance firms' investment activities as well as performing other normal banking services, the main bank also acts as an agent that collects, evaluates and transmits information about firms and their managements.

The main bank of each firm is identified using the Japan Company Handbook (JCH) which lists the first bank among other banks as each firm's

[13] The major stock exchanges in Japan are the Tokyo, Osaka and Nagoya stock exchanges.
[14] The Tokyo Stock Exchange Fact Book contains a complete listing of the assignment criteria.

main bank. Following Klein, Peek and Rosengren (2002), the eleven banks identified as the main banks of Japanese FDI firms during the sample period 1987 to 1994 are Industrial Bank of Japan, Dai-Ichi Kangyo Bank, Sakura Bank, Mitsubishi Bank, Fuji Bank, Sumitomo Bank, Sanwa Bank, Tokai Bank, Asahi Bank, Long-Term Credit Bank and Daiwa Bank.

Among the eleven banks, six are main banks to the largest horizontal keiretsu during the sample period. They are Dai-Ichi Kangyo Bank, Sakura Bank, Mitsubishi Bank, Fuji Bank, Sumitomo Bank and Sanwa Bank. Besides the main bank, a life insurance firm, a general insurance firm and a trust bank as well as a trading firm or one or two other flagship firms form the nucleus of each horizontal keiretsu. Together with other firms that are often in unrelated industries, they form the core members of the horizontal keiretsu. Top executives of firms that are core members of the keiretsu constitute the presidential council that meets regularly to exchange information and coordinate business decisions. Although there are other large Japanese firms that are not core members of the keiretsu, they could be affiliated in varying degrees to the keiretsu. Hence the set of Japanese FDI firms that have one of the keiretsu main banks as their main banks could be either a core member of the keiretsu or at least affiliated to some degree with the keiretsu.

In addition to horizontal keiretsu, another form of industrial grouping of firms is the vertical keiretsu that is not centered on a bank. They are prevalent in the automobile and the electronics industries and although they maintain a main bank relationship with one of the banks, they may not borrow

heavily from the main bank. As mentioned in Klein, Peek and Rosengren (2002), Toyota is an example. In fact, Toyota is a vertical keiretsu with up stream suppliers of manufacturing parts and assemblers and downstream network of distribution channels. According to Miyashita and Russell (1994), the Toyota group is a member of the Mitsui group with Sakura Bank as the main bank but it remains very independent. Other important vertical keiretsu in the sample period include Nissan, Honda, Matsushita, Hitachi and Toshiba.

Japanese firms that operate within a network of interdependent relationships within the keiretsu with varying degrees of affiliation implies that the set of observational units in the FDI data is likely to contain a set of firms that are heterogeneous with FDI decisions that are likely to depend on group affiliation.

The data on Japanese FDI in the United States are obtained from the United States International Trade Administration (ITA) publication, Foreign Direct Investment in the United States: Transactions[15]. The ITA publication includes the name and nationality of the foreign investor, the type of investment and the value of investment. The type of investment includes merger and acquisition, equity increase, joint venture, new plant, plant expansion, real estate and others[16]. Because of missing observations on the values of FDI projects in the ITA publication, we use observations on the

[15] An alternative source of FDI data is the Bureau of Economic Analysis (BEA) from the US Department of Commerce which conducts confidential surveys on US FDI. Although the FDI data from BEA are more comprehensive due to different definition and data collection methods, Klein and Rosengren (1994) note that the correlation between FDI data from both sources is high.

[16] When the type of FDI is classified as "others", it includes unidentified transactions which are not limited to new companies, headquarters, subsidiaries, branches, agencies, representative offices, stores, outlets and warehouses.

number of FDI projects in examining the firm-level Japanese FDI in the United States.

From 1987 to 1994, we identify 317 Japanese firms listed in the first section of the Japanese stock exchanges that engaged in at least one FDI project in the United States and were associated with one of the eleven main banks. Japanese FDI firms in the ITA publication were matched with firms in the Japan Company Handbook that also contains information on the firm's main bank. Appendix A lists the sample of 317 Japanese firms. The number of firms in the sample associated with each of the 11 main banks is shown in Table 5.1. Although rare, a handful of firms switched main banks during the sample period. As long as the change of main bank is within the set of eleven banks, the firms remain in the sample.

Table 5.1
Main Bank Distribution of First Section Japanese FDI Firms

Number of Firms Associated with Each Main Bank in Each Year								
Bank	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Industrial Bank of Japan	30	32	32	33	33	33	33	33
Dai-Ichi Kangyo Bank	43	42	42	42	42	42	42	42
Sakura Bank	50	48	48	48	49	50	50	50
Mitsubishi Bank	40	41	40	42	42	40	40	40
Fuji Bank	35	36	38	37	37	38	38	38
Sumitomo Bank	49	49	47	47	46	46	46	46
Sanwa Bank	35	35	35	33	33	33	33	33
Tokai Bank	14	15	15	15	15	15	15	15
Asahi Bank	14	12	12	12	12	12	12	12
Long-Term Credit Bank	2	2	3	3	3	3	3	3
Daiwa Bank.	5	5	5	5	5	5	5	5

Source: Japan Company Handbook, various issues

There are firms which did not remain in the first section of Japan stock exchanges during the sample period. To maintain consistency in the sample selection, these firms were removed. There are cases in which firms were reorganized and had their firm names changed during the sample period. To ensure that firms with different names in different time period are indeed the same firm, the Osiris database which provides detailed information of publicly listed firms is used to trace and verify the historical development of the firms. An overview of the databases that provides the original data and the construction of variables used in regression analysis are detailed in Appendix B.

With 317 firms over an 8-year sample period, we derive 2,536 observations of which 811 are non-zero FDI entry counts. In other words,

between 1987 and 1994, there were at least 811 FDI projects undertaken by Japanese firms in the United States. Because a number of firms engaged in more than one FDI project in a given year, the total number of Japanese FDI projects in the US market between 1987 and 1994 is 1,423. Table 5.2 shows the frequency distribution of FDI entry counts in our sample. The FDI entry counts vary from zero to 17 with 68 percent of FDI entry counts being zero.

Table 5.2
Frequency Distribution of FDI Entry Counts between 1987 and 1994

FDI Entry Counts	Number of observations
0	1725
1	537
2	141
3	52
4	34
5	19
6	10
7	6
8	6
9	1
10	3
11	1
17	1
Total	2,536

Source: International Trade Administration, United States.

In the regression analysis using count data models that are reported in the chapters six and seven; the final data set has 2,057 observations. These observations are 479 less that the 2,536 observations over the 8-year period for 317 firms. Of the 479 observations that are excluded, 317 were observations in the first period that were lost as a result of transforming data in first difference.

Further to this, we use one-year lag values in the regressors to explain FDI projects undertaken by firms because the decision to undertake FDI is often regarded as a time-consuming process. In undertaking FDI, a firm often incurs large sunk costs that are related to investments in fixed assets, information and advertising (Dixit, 1989 and Campa, 1993). Using lag values in regressors to explain FDI in the current period is consistent with widely held observation that FDI in the current period responds to events in the prior period.

An additional 154 observations were lost because selected main banks in the earlier years did not yet have a Moody's rating. The Moody's ratings of main banks that were not available are shown in table 5.3.[17] The remaining 8 observations that were excluded in the final data set came from firms whose main banks had a Moody's rating of A3. Because of the very small number of observations, the coefficient of the dummy variable for A3 had a very large standard error. Thus, the 8 observations were excluded in the regression analysis.

[17] Klein, Peek and Rosengren (2002) encounter similar issues. One year of observations were removed in transforming data in first difference to explain the change in FDI. They also reported that observations were lost because some main banks did not have a Moody's rating.

Table 5.3
Moody's Long Term Deposit Ratings

	Rating as of December 31st								
Bank	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Industrial Bank of Japan	Aaa	Aaa	Aaa	Aaa	Aaa	Aa2	Aa3	Aa3	A1
Dai-Ichi Kangyo Bank	Aaa	Aaa	Aaa	Aaa	Aa1	Aa1	Aa3	A1	A1
Sakura Bank	N.A.	N.A.	Aa2	Aa3	Aa3	A1	A1	A2	A2
Mitsubishi Bank	Aaa	Aaa	Aaa	Aaa	Aa1	Aa1	Aa3	Aa3	Aa3
Fuji Bank	Aaa	Aaa	Aaa	Aaa	Aa1	Aa3	Aa3	A1	A1
Sumitomo Bank	Aaa	Aaa	Aaa	Aaa	Aa1	Aa3	Aa3	A1	A1
Sanwa Bank	Aaa	Aa1	Aa1	Aa1	Aa1	Aa1	Aa3	Aa3	Aa3
Tokai Bank	N.A.	Aa2	Aa2	Aa2	Aa3	Aa3	A1	A2	A2
Asahi Bank	N.A.	N.A.	Aa3	Aa3	Aa3	Aa3	A1	A2	A2
Long-Term Credit Bank	Aaa	Aa2	Aa2	Aa2	A1	A2	A2	A3	A3
Daiwa Bank.	N.A.	N.A.	N.A.	Aa3	Aa3	Aa3	Aa3	A3	A3

Source: Moody's Investor Services, Inc. and Klein, Peek and Rosengren (2002)

Data on size, profitability and market values of Japanese firms are obtained from Pacific-Basin Capital Markets Databases (PACAP) (2001). Occasional missing values occur for some explanatory variables obtained from the PACAP database. If these missing values appear only once per variable and they do not occur in consecutive years, these values are estimated by interpolation. Otherwise the firm is removed from our sample. International Financial Statistics provides the US dollar-Yen bilateral exchange rates and the US unemployment rates. Bloomberg gives the data on S&P 500 index. The Monthly Report of Employment Security Business published by the Employment Security Bureau of the Ministry of Labor in Japan provides the data on Japanese new job offers to applications ratio. Further description of data is in Appendix B including descriptive statistics of all original data.

5.2 Count Data Methods

Using Japanese firm-level FDI count data, we examine both the relative wealth hypothesis and relative access to credit hypothesis. Because the ITA publication does not report on values of 51% of FDI projects in the United States, we use observations on the number of FDI projects in examining firm-level Japanese FDI in the United States.[18] Hence, the dependent variable is a non-negative integer value that considers the number of FDI projects by a Japanese firm in the United States for a given year. Unlike binary variables that assume either a value of zero or one, count variables that assume integer values represent a quantity measure.

Because count data are discrete integer values constrained to be non-negative, they introduce complications of discreteness and heteroskedasticity. Even in large samples, residuals obtained from the difference between observed and predicted values are asymmetric and heteroskedastic (Cameron and Trivedi, 1998). Thus normality of residuals and linear adjustment of data that form the basic assumptions in linear regression analysis no longer hold. Using conventional linear regression models in dealing with count data that generates non-linearities would be inappropriate. In particular, ordinary least squares (OLS) regression leads to inaccurate estimates that can produce

[18] Because of confidentiality agreements with firms, ITA does not report values of FDI projects in 51 % of the observations and using the remaining 49% of the observations can result in selection bias. Hence, instead of values of FDI projects, we use the number of FDI as our dependent variable. Similarly, Campa (1993), Blonigen (1997), Tomlin (2000), List (2001) and Klein, Peek and Rosengren (2002) use the number of FDI projects rather than value of FDI projects from the same ITA data set. Swenson (2004) is the exception but her results could have selection bias.

negative counts. The OLS estimates are also inefficient because they fail to consider the heteroskedastic nature of count data.

Within the framework of non-linear regression, the basic model for count data analysis uses the Poisson distribution. The Poisson process generates project counts under the following assumptions:

1 Each FDI entry in a given interval of time occurs independently of time and of other FDI projects in any time interval; and

2 The rate of FDI projects is constant.

These conditions imply that the FDI project counts are independently and identically distributed (iid).

5.2.1 The Poisson Regression Model

In the regression analysis, the variable of interest FDI_i is the number of FDI projects undertaken by a Japanese firm in the United States in a year. It can be affected by the relative wealth of the firm and the relative access to bank credit. These explanatory factors together with other control variables are represented by a vector of linearly independent observable variables $\mathbf{x}_i$ that influence the conditional distribution of Japanese FDI entry counts. The basic Poisson regression model therefore specifies the following:

$$(5.1) \quad f\left[FDI_i \middle| \mathbf{x}_i\right] = \frac{e^{-\lambda_i}(\lambda_i)^{FDI_i}}{FDI_i!}, \qquad FDI_i = 0,1,2,...$$

It follows that the distribution of FDI_i is conditioned on a k-dimensional vector of explanatory variables, $\mathbf{x}_i = [x_{1i},...x_{ki}]$ and k times 1 vector of parameters β such that the conditional mean, $\mathrm{E}[FDI_i|\mathbf{x}_i] = \lambda_i = \exp(\mathbf{x}_i'\beta)$.

The iid assumption of the Poisson distribution implies that the conditional mean and conditional variance must be equal in the Poisson regression model:

(5.2) $\mathrm{E}[FDI_i|\mathbf{x}_i] = \mathrm{V}[FDI_i|\mathbf{x}_i] = \lambda_i = \exp(\mathbf{x}_i'\beta)$

The restriction in equation 5.2 is analogous to the assumption of homoskedasticity in the linear regression model. However, observed count data often do not satisfy the mean-variance equality.

Failure of the Poisson assumption of conditional mean-variance equality has similar qualitative consequences to the failure of homoskedasticity in the linear regression model. Although the parameter estimates remain consistent, the standard errors are inconsistent leading to misleading statistical inferences. When $\mathrm{V}[FDI_i|\mathbf{x}_i] < \mathrm{E}[FDI_i|\mathbf{x}_i]$, underdispersion occurs and when $\mathrm{V}[FDI_i|\mathbf{x}_i] > \mathrm{E}[FDI_i|\mathbf{x}_i]$, overdispersion occurs. Overdispersed count data are more frequently encountered than underdispersed count data (Cameron and Trivedi, 1998). In many count data applications, overdispersion occurs when the Poisson mean parameter is insufficient to describe the dependent variable of interest because of non-independent observations known as contagion or unobserved heterogeneity.

5.2.2 The Negative Binomial Regression Model

One way to model unobserved heterogeneity that results in overdispersed data is to introduce an error term μ_i to represent unobserved heterogeneity in the Poisson conditional mean function.

(5.3) $\mathrm{E}\left[FDI_i \middle| \mathbf{x}_i, u_i\right] = \exp(\mathbf{x}_i'\beta + u_i)$

Because of unobserved heterogeneity, the true Poisson mean is not observed perfectly. This implies that firms in the FDI data differ in a manner not fully accounted for by the observed explanatory variables. We can view μ_i as a random effect. Although we do not observe μ_i, the traditional approach is to assume that μ_i follows a gamma distribution:

(5.4) $\exp(u_i) \sim \text{Gamma}\,(\frac{1}{\alpha}, \alpha)$ where α is the overdispersion parameter;

(5.5) $\mathrm{E}[u_i] = 1$ and $\mathrm{V}[u_i] = \alpha$

From the Poisson-gamma mixture we can derive a parametric model known as the negative binomial regression model[19]:

(5.6) $$f(FDI_i \mid \lambda_i, \mu_i) = \frac{\Gamma(FDI_i + \alpha^{-1})}{\Gamma(FDI_i + 1)\Gamma(\alpha^{-1})}\left(\frac{\alpha^{-1}}{\alpha^{-1} + \lambda_i}\right)^{\alpha^{-1}}\left(\frac{\lambda_i}{\lambda_i + \alpha^{-1}}\right)^{FDI_i}$$

with conditional mean and conditional variance given as:

(5.7) $\mathrm{E}[FDI_i \mid \lambda_i, \alpha] = \lambda_i$

(5.8) $\mathrm{V}[FDI_i \mid \lambda_i, \alpha] = \lambda_i(1 + \alpha\lambda_i) > \lambda_i$ if $\lambda_i > 0$

[19] Greenwood and Yule (1920) first derived the negative binomial distribution as a Poisson-gamma mixture which has been widely used as a standard model to accommodate unobserved heterogeneity and non-independent observations.

When the dispersion parameter, α is small and close to zero, the negative binomial model becomes the Poisson model. The Poisson model that is a special case of the negative binomial model operates under more restrictive assumptions. The negative binomial model as a general case of the Poisson regression model can account for overdispersed count data. Greater overdispersion corresponds to larger values of α. As shown in equation 5.8 the variance is greater than the mean and it is positively dependent on the mean implying heteroskedasticity. Cameron and Trivedi (1986) by modifying the variance in equation 5.8, consider a more general class of negative binomial models. They use the following variance function:

(5.9) $$\mathrm{V}[FDI_i|\lambda_i,\alpha] = \lambda_i + \alpha\lambda_i^{\,p} > \lambda_i \qquad \text{if } \lambda_i > 0$$

p is usually set to 1 or 2. When $p = 2$ the variance in equation 5.9 becomes the variance in equation 5.8. Other modification of the variance function includes estimating the value of p rather than setting a specific value of p. Yet another variation in negative binomial models is to allow the overdispersion parameter, α to depend on regressors. This model is used if there are observable, systematic factors that explain the variance of the count variable and it is called the generalized negative binomial model. Because the negative binomial model with the variance function in equation 5.8 is most robust to distribution misspecification, it is the most widely used variant of the negative binomial models. We use this variant of the negative binomial distribution in our regression analyses.

A similar distribution to the negative binomial distribution – the continuous parameter binomial (CPB) distribution is used to model underdispersed data i.e. V $\left[FDI_i|\mathbf{x}_i\right]$ < E $\left[FDI_i|\mathbf{x}_i\right]$. As before, $\mathrm{E}\left[FDI_i|\mathbf{x}_i\right]=\lambda_i=\exp(\mathbf{x}_i'\beta)$ but the variance is $\mathrm{V}[FDI_i|\lambda_i,\alpha]=\alpha\lambda_i$ with 0 < α < 1. The CPB model eventually becomes the Poisson model when α = 1. With underdispersion, initial events reduce the probability of future events due to negative contagion and therefore, also reduce the maximum number of events that could occur in a period. Thus the CPB model imposes a theoretical 'upper limit' on the count variable. This limit is due to the fact that the variability of the dependent count variable is constrained by the dispersion parameter α .

5.2.3 Test of Overdispersion

Data is overdispersed when the variance conditioned on the effects of the regressors exceed the conditional mean. When regressors are introduced into the variance and mean, they factor out some of the heterogeneity in the data. An indication of the magnitude of overdispersion or underdispersion can be obtained by comparing the sample mean and variance of the dependent count variable. Subsequent regression decreases the conditional variance to some extent. According to Cameron and Trivedi (1998), if the sample variance is more than twice the sample mean, the data are likely to remain overdispersed even after the inclusion of regressors. This is more likely for

cross-section data for which regressors usually explain less than half of the variation in the data. As noted in Cameron and Trivedi (1998), a sound practice is to estimate both the Poisson and negative binomial models.

Formal tests for overdispersion often involve testing for the presence of the dispersion parameter, α. As the Poisson is the special case of the negative binomial with $\alpha = 0$, the null hypothesis of $\alpha = 0$ can be tested against the alternative $\alpha > 0$ using the classical statistical techniques for testing hypothesis – likelihood ratio, Wald and Lagrange multiplier (or score) tests.

5.2.4 Excess Zero FDI Project Counts with Latent Variables

In explaining overdispersion, the reasons are not limited to unobserved heterogeneity and non-independent observations. Overdispersion can result from higher than expected incidence of zero counts relative to the standard Poisson distribution. Because of high sunk costs in undertaking FDI, Japanese FDI firms at certain intervals in time have no intention to undertake FDI. While there are Japanese firms with the intention to enter the US market, these firms may not realize their FDI plans in the current time interval. Resulting from two distinct but unobservable (latent) behavioral traits of firms, zero counts are observed in excess than would be expected in the standard Poisson distribution. In other words, a proportion of observed zero counts belongs to firms with no intention to undertake FDI and the other proportion belongs to firms with the intention to undertake FDI but may not do so at the current time

interval. This is the distinction between structural zeros which are inevitable and sampling zeros which occur by chance.

In the final FDI data set, the 69.5 percent (1,430 zeros of 2,057 total observations) of zero FDI project counts in our sample that shows high incidence of zero value implies that the data contain significantly more zeros than would be expected in the Poisson distribution.[20] The sample mean number of FDI projects in the final data is 0.52. Under the Poisson distribution, the expected number of zero FDI projects with a mean of 0.52 is $(2{,}057)\frac{e^{-0.52}0.52^{0}}{0!}$ = 1,223. The observed frequency of 1,430 zero FDI projects show that it is 117% of what is expected, giving us cause for concern that the Poisson distribution is not the optimal distribution for the data.

The additional 17% more zeros suggest that the FDI data contain a sample mixture exhibiting two distinct but unobserved (latent) behavioral traits of Japanese firms. The first type of behavioral trait belongs to firms with no intention to undertake FDI. They will always contribute a zero FDI count in the data. The second type of behavioral trait belongs to firms with the intention to engage in FDI but their investment plans may not materialize. In the presence of Japanese firms with no intention to engage in FDI, these firms contribute additional mass at the zero value resulting in high incidence of zero counts than is consistent with the standard Poisson regression model. However

[20] Selected studies that have used zero-inflated count models include Tomlin (2000); Campolieti (2002); McNamara and Lee (2004); and Clark, Peters and Tomlinson (2005). The percentage of zeros in their count data sets are 57.8%, 49.8%, 88.7% and 70.5% respectively.

when we observe a zero FDI project count, it is not at all obvious whether the zero value belongs to a firm with or without the intention to engage in FDI. Unless we can distinguish among firms according to their intention to invest in the United States, we would underestimate the rate of Japanese FDI in the United States.

To distinguish among firms according to their intention to engage in FDI, we use a zero-inflated count data model. In the model, the observed final outcome of a Japanese FDI in the United States can be analyzed as two separate stages of the firm's investment decision process. The first stage occurs when a certain firm shows no intention to engage in FDI and FDI typically will not occur. The same firm may not always be in the first stage without any intention to engage in FDI. At some interval in time when conditions become favorable, the firm becomes prepared for FDI and makes plans to engage in FDI. When the firm plans to engage in FDI, it moves to the second stage where FDI will occur at some rate.

The observed dependent variable FDI_i indicating the number of FDI project counts of firm i assumes a value of zero for all observations that remain in the first stage. The probability that firm i will remain in the first stage is $1\text{-}P_i$. When firm i intends to engage in FDI, it crosses over to the second stage of the investment decision process. The probability that the firm will stay in the second stage is P_i. Conditioned on the intention to engage in FDI, the number of observed FDI entry counts in the second stage assumes a

Poisson distribution with a mean FDI rate equals to λ_i. At some other time interval, it is plausible that firm *i* no longer has the intention to engage in FDI and navigates from the second stage to the first stage. In any case, it is not the firms but the behavior of firms in regard to FDI that defines the sample mixture resulting in more zeros than would be expected in the standard Poisson distribution.

A characteristic of this process is that we only observe the FDI project count, which is only partially informative about the first stage investment decision process. Following Greene (1994), we regard zero-inflated models as models of "partial observability" in which only the product of two latent variables is observed:

(5.10) $FDI_i = D_i FDI_i^*$

where D_i is a binary (0/1) variable representing a firm's non-intention or intention to engage in FDI and FDI_i^* is distributed as Poisson with mean λ_i. The probability of observing a zero count is:

(5.11) Prob ($FDI_i = 0$) = Prob ($D_i = 0$) + Prob ($D_i = 1$, $FDI_i^* = 0$)

$= 1\text{-}P_i + (P_i)\ e^{-\lambda_i}$

The probability of observing a non-zero count is:

(5.12) Prob ($FDI_i = \mathrm{k}$) = Prob ($D_i = 1$, $FDI_i^* = \mathrm{k}$)

$$= (P_i)\ \frac{e^{-\lambda_i}(\lambda_i)^k}{k!}, \qquad \mathrm{k} = 1, 2, 3,\ldots$$

The Zero-Inflated Poisson (ZIP) model allows each process to be analyzed separately. Following Lambert (1992) and Greene (1994), the probability that a firm without the intention to engage in FDI, 1-P_i is computed as:

$$(5.13)\quad 1\text{-}P_i = \frac{\exp(\mathbf{x_i}'\beta)}{1+\exp(\mathbf{x_i}'\beta)}$$

1-P_i can be parameterized to follow a logit distribution which maps onto the Poisson regression model with mean λ_i. In this way, only firms with the intention to invest in the United States are included in the estimated rate of FDI.[21] In accounting for the excess zeros in FDI count data, zero-inflated models can use either the Poisson distribution or the negative binomial distribution.

5.2.5 Tests for Zero-inflated Models

The zero-inflated Poisson (ZIP) and the zero-inflated negative binomial (ZINB) models are modified to consider sample mixtures in distributions: additional mass at zero and a distribution that allows positive integer outcomes. While excess zeros contribute to overdispersion shown as conditional variance exceeding the condition mean, tests of overdispersion examining the condition of mean-variance equality are generally unsuitable for zero-inflated data. The large number of zeros makes these tests invalid. As the excess zeros lead these tests to indicate the presence of overdispersion, dispersion could be absent on controlling for the two-stage transition process

[21] If we include only firms with FDI in the United States, we would overestimate the rate of a firm's FDI.

in the zero-inflated data. In other words, because the tests rely on the initial estimation of a mis-specified Poisson model and fail to account for the nature of the count variable, these tests become invalid when the data generating process takes on a two stage process.

Greene (1994) adapts a test of non-nested models developed by Vuong (1989) to test the Poisson against the ZIP and the negative binomial against the ZINB models. The primary advantage of the Vuong (1989) test statistic is that it makes use of information about the entire distribution and not just the zero outcomes. As described in Long (1997), this statistic has a standard normal distribution with large positive values favoring the zero-inflated model and with large negative values favoring the nonzero-inflated version. Values close to zero in absolute value favor neither model. We use Greene's adaptation of Vuong (1989) to test the Poisson against the ZIP as the alternative.

Although the ZIP model is more general than the standard Poisson distribution, it remains rather inflexible. In practice, count data are often overdispersed and alternative distributions, such as the zero-inflated negative binomial negative binomial distribution may be more appropriate than the zero-inflated Poisson. In the context of standard Poisson regression, Cox (1983) show that overdispersion has little effect on parameter estimates but leads to underestimation of standard errors which may be corrected by the use of quasi-likelihood methods. For zero-inflated models, Ridout, Hinde and Demétrio (2001) argue that these models depend explicitly on the probability

of a zero count in the underlying distribution. If the underlying distribution is assumed to be Poisson but is in fact negative binomial, the incorrect functional form will be used for the zero probability and this in turn will lead to inconsistent parameter estimates. The issue of overdispersion is more important in zero-inflated than in standard models.

In this regard, Ridout, Hinde and Demétrio (2001) develop a score test used specifically within the context of zero-inflated models for testing a zero-inflated Poisson regression model against a zero-inflated negative binomial alternative. The application of zero-inflated count models using FDI data are detailed in chapters seven and eight.

CHAPTER SIX

RELATIVE ACCESS TO CREDIT, RELATIVE WEALTH AND FDI: FIRM-LEVEL EVIDENCE FROM JAPANESE FDI INTO THE UNITED STATES

6.1 Introduction

Foreign direct investment (FDI) flows into the United States have shown large fluctuations in the 1980s and the 1990s. These fluctuations cannot be explained by traditional theories of FDI.[22] The traditional theories use industrial organization motives to explain FDI based on benefits that firms derive from transferring firm-specific advantages across countries within their organizations rather than selling these advantages to firms based in other countries.[23] Firm-specific advantages could be from better management or marketing skills or better technology of firms. Dunning (1988) also emphasizes the interaction of both firm-specific factors and location-specific factors such as market size and lower input costs in explaining FDI. In addition, firms could gain advantages from producing across countries by internalizing the transaction costs of exporting or of entering into licensing agreements in specific locations.[24] By producing across countries, firms avoid

[22] Froot and Stein (1991), Blonigen (1997) and Klein, Peek and Rosengren (2002) are some of the recent studies which contend that traditional theories inadequately explain the large fluctuations in FDI flows into the United States.
[23] Caves (1971) and Graham and Krugman (1995) review theories based on the industrial-organization motives for FDI.
[24] The transaction costs could be due to market imperfections such as costs associated with trade barriers in exporting and costs associated with weak contract enforcement or poor maintenance of quality in licensing.

transactional costs and gain internalization advantages. Because firm-specific, location-specific and internalization advantages of firms are unlikely to fluctuate in the short run, traditional theories cannot adequately explain the large fluctuations of FDI flows into the United States in the 1980s and the 1990s.

An alternative explanation of the fluctuations of FDI flows in the United States emphasizes the effect of real exchange rates on FDI. Froot and Stein (1991) propose the link between US FDI inflows and real exchange rates by assuming asymmetric information on assets' payoffs.[25] They argue that owners of assets know the assets' realized payoffs without cost but external creditors can verify the payoffs only with costs. This makes external finance more expensive than internal finance so foreign firms who wish to bid for US assets must raise most of their funds internally. Because internal funds of foreign firms are denominated in foreign currency, a depreciation of the US dollar increases foreign firms' relative wealth and allows them to bid more aggressively for US assets. Hence, a depreciation of the US dollar increases FDI into the United States.

Froot and Stein's proposition seems to be supported by the evidence in the 1970s and the early 1990s: the US FDI inflows rose when the US dollar

[25] Assuming segmented goods markets and limited access of US firms in foreign markets, Blonigen (1997) develops a model linking exchange rates to the foreign acquisition of a US firm. Foreign firms value more firm-specific assets of a US firm because of the usefulness of US assets in gaining an advantage in foreign markets. When the US dollar depreciates, foreign firms' reservation prices (in foreign currency) increase relative to the other US firms' reservation prices (in US dollars) in bidding for US assets. Hence, the depreciation of the US dollar allows foreign firms to outbid US firms for US assets. Blonigen (1997) also shows the strong correlation between exchange rates and Japanese acquisitions of US assets in high-technology industries with segmented markets.

real exchange rate depreciated and it declined when the US dollar appreciated.[26] However, after the early 1990s, US FDI flows declined despite the depreciation of the US dollar. The decline has been especially large for US FDI inflows from Japan. To explain the sharp decline of Japanese FDI into the United States in the 1990s, Klein, Peek and Rosengren (2002) propose the relative access to credit hypothesis assuming firms have unequal access to external credit. They argue that in the mid-1990s, Japanese firms could have been constrained in investing in the United States by their balance sheet positions as the asset prices collapsed and by the reduction of available credit from their associated banks as the banks' finances weakened.[27]

Klein, Peek and Rosengren (2002) test the relative access to credit hypothesis using two different estimating equations: one equation for data aggregated at the bank level and another equation for data at the firm level. Firm data consist of 1987 to 1994 FDI to the United States of Japanese firms associated with eleven Japanese banks. Using aggregated data, they ran a linear regression to determine the factors affecting the change in the number of FDI projects of firms associated with each of the eleven banks. They show that the number of FDI projects of the bank's client firms declined with the worsening of the bank's credit rating. Using firm-level data, they use a logit model to determine the factors affecting the probability of a Japanese firm

[26] From the 1980 to 1991, Froot and Stein (1991) and Klein and Rosengren (1994) find evidence linking exchange rates and US FDI.
[27] Gibson (1995) examines the effect of bank health on domestic investment in Japan.

investing in the United States. They also show that relative access to credit affects the probability of firms undertaking FDI.

While Klein Peek and Rosengren (2002) show that relative access to credit affects FDI of the bank's client firms and the probability of a firm undertaking FDI - a measure of likelihood, they do not show the extent in which relative access to credit affects the Japanese firm's actual rate of FDI - a measure of quantity. This distinction is important for two reasons: First, firms often deal with multiple banks and have access to financial markets.[28] If a troubled bank restricts lending to client firms, some firms may borrow from other banks or raise funds in financial markets so they would be unaffected by lending restrictions of the troubled bank. Only firms without alternative financing would reduce FDI but these firms may not be representative of a typical Japanese firm. Hence, the impact of relative access to credit on FDI should be determined not only at the bank level but also at the firm level. Second, the probability of undertaking FDI is distinct from the extent or the actual rate of FDI. While certain factors may make a firm more likely to undertake FDI, a firm with a high probability of undertaking FDI may still decide not to actually undertake FDI. Therefore, it is worthwhile to examine the effect of relative access to credit on both the probability of the firm undertaking FDI and the extent or the actual rate of the firm's FDI.

[28] Japanese firms list multiple reference banks in the first section of the Japan Company Handbook (JCH). While the first reference bank or the main bank holds the largest proportion of the firm's loan, the firm also has loans from other reference banks.

To examine the effect of relative access to credit on a Japanese firm's FDI to the United States, we investigate the factors that affect the rate of FDI of a firm with intention to invest in the United States and the factors that affect the probability that a Japanese firm has no intention to invest in the United States. We consider 317 Japanese firms listed in the first section of the Japan Company Handbook (JCH) and associated with one of the eleven Japanese banks identified by Klein, Peek and Rosengren (2002). From the 317 firms over a period 1987 to 1994, we construct a data set with 2,057 observations in which 627 observations have positive numbers of FDI projects that range from one to seventeen and 1430 observations have zeros – these are periods when the United States International Trade Administration (ITA) has no record of the 317 firms undertaking FDI.

Our sample of FDI projects has a mean of 0.52 and a variance of 1.28. Because the sample variance significantly exceeds the sample mean, it suggests that the probability distribution of the number of FDI projects is more likely a negative binomial instead of a Poisson distribution. Because our sample has a large number of zeros, the excess zeros suggest that the FDI data contain a sample mixture exhibiting two different behavioral traits. The distinction could arise from the different behavior of Japanese firms at any point in time. The first type of behavioral trait belongs to firms with no intention to engage in FDI during a particular period. They will always contribute a zero FDI entry count in the data. The second type of behavioral trait belongs to firms with intention to engage in FDI but their investment

plans may not materialize. In the presence of Japanese firms with no intention to engage in FDI for a given period, these firms add additional mass at the zero value resulting in high incidence of zero counts than is consistent with the standard negative binomial regression model. However when we observe a zero FDI entry, it is not at all obvious whether the zero value belongs to a firm with or without intention to engage in FDI. Unless we can distinguish among firms according to their intention to invest in the United States, we would be underestimating the rate of FDI in the United States.

To analyze the firm's rate of FDI, we use the zero-inflated negative binomial (ZINB) model assuming the firm's intention to invest to be a partially observable binary random variable in which the firm either has or has no intention to undertake FDI.[29] In estimating the probabilities of the firm's intention to invest in the United States, the model uses a logit function based on a vector of determinants. These determinants are similar to those used by Klein, Peek and Rosengren in their logit regressions. Moreover, the model estimates the rate of FDI for a firm with intention to undertake FDI as an exponential function based on firm-level determinants as defined by Klein, Peek and Rosengren.[30] Note that the rate of FDI for any firm is equal to the

[29] The intention to invest is only partially observable because we would know that the firm had planned and intended to invest only after it makes the investment. As we explain in the next paragraph, some firms may intend to invest but may eventually decide not to invest. When a firm has no FDI, we cannot observe its intention so we assume that the firm's intention to invest is a partially observable binary random variable. This is formally stated in equation (1).

[30] Klein, Peek and Rosengren aggregated the firm-level determinants at the bank level. They run a regression with the number of FDI and the aggregated variables together with macroeconomic variables.

rate of FDI for a firm with intention to undertake FDI multiplied by the probability of the firm's intention to invest in the United States.[31]

The ZINB model may be interpreted as two separate stages of the firm's investment process. The first stage occurs at the beginning of an investment period when a particular firm has to decide whether to engage in FDI in the United States. If a firm finds the conditions unfavorable and decides not to invest during a particular period, it is assumed that the firm will have no FDI project at the end of this period. On the other hand, if a firm finds the initial conditions favorable and intends to invest during a particular period, the firm is then at the second stage where it needs to decide the number of FDI projects for the period. However, at the end of this period, the number of FDI projects actually undertaken by the firm is uncertain and may range from zero to any positive number. For example, a firm with intention to engage in FDI could find the conditions to be even more favorable after some interval of time so it undertakes more than one FDI. In contrast, a firm may have the intention to engage in FDI but after some interval of time, it finds that conditions have changed from favorable to unfavorable so it decides not to undertake FDI. In this case, the firm may have the intention to undertake FDI but it may still result in no FDI project at the end of the period. Hence, at the end of a particular period, the number of FDI projects undertaken by a firm with

[31] In contrast, the negative binomial (NB) model does not calculate the probabilities of the firm's intention to undertake FDI in calculating the firm's rate of FDI. Using the NB instead of the ZINB model underestimates the firm's rate of FDI. We would be making incorrect inferences on the firm's rate of FDI. We formally present the ZINB model in Section 6.3.

intention to invest is random and is assumed to follow a negative binomial probability distribution.

We consider factors affecting the rate of FDI of the Japanese firm with intention to invest in the United States such as the change in the financial-health rating of a firm's main bank, and the changes in firm characteristics such as the profitability, firm size and relative wealth. At the same time, we consider factors affecting the probability that the Japanese firm does not intend to invest in the United States such as the financial rating of the firm's main bank and firm characteristics such as profitability, relative wealth and firm size. Unlike Klein, Peek and Rosengren, we do not include as regressors macroeconomic variables that measure business cycles in Japan and in the United States. These macroeconomic variables are included to control for factors that could affect firms' FDI decisions to seek available business opportunities during economic upturns. They take the same values for all firms in the sample and they are significantly correlated not only with each other but also with the other variables such as bank health, relative wealth and firm profitability. As Moulton (1990) cautioned the use of aggregate explanatory variables on firm-level dependent and independent variables, we therefore exclude the aggregate variables in our empirical model.

We find that relative access to credit affects the extent or the rate of a firm's FDI for our full sample and sub-samples of firms with the lowest 80% of bonds-to-liabilities ratio, firms with the highest 20% of bonds-to-liabilities and firms that undertake FDI in multiple years. In contrast, we find that the

probability of Japanese firms not intending to invest in the United States is affected by a lower bank rating only for the full sample and the sub-sample of firms with multi-year FDI. We also find that relative wealth affects the rate of FDI only for a sub-sample of firms with the lowest 80% of bonds-to-liabilities ratio even though relative wealth significantly affects the probability that a firm does not intend to invest in the United States for firms with the highest 20% of bonds-to-liabilities ratio and for multi-year FDI firms. These results highlight the importance of distinguishing the extent or actual rate of the firm's FDI from the probability of the firm undertaking FDI.

The paper is organized as follows: in section 6.2, we discuss the firm-level FDI data and the model specification; in section 6.3, we discuss the rationale of the determinants of FDI; in section 6.4, we discuss the empirical results; and in section 6.5, we discuss the conclusions.

6.2 Firm-level FDI Data and Model Specification.

We consider all firms listed in the first section of the Japan Company Handbook (JCH) with at least one FDI in the United States from 1987 to 1994 and with one of the 11 Japanese banks as their main bank. We follow Klein, Peek and Rosengren (2002) who identify the eleven banks as the Industrial Bank of Japan, Dai-Ichi Kangyo Bank, Sakura Bank, Mitsubishi Bank, Fuji Bank, Sumitomo Bank, Sanwa Bank, Tokai Bank, Asahi Bank, Long-Term Credit Bank and Daiwa Bank. One of the eleven banks is the firm's main bank if it is the first bank among reference banks listed in the JCH for the firm.

From 1987 to 1994, 317 firms in the JCH with at least one FDI in the United States are associated with one of the 11 banks. These firms invested in 94% of all FDI projects in the United States undertaken by firms associated with the 11 banks.

We construct a data set with 2,057 observations for 317 firms from 1987 to 1994. Each observation records the number of FDI projects that a firm undertakes for a given year. We compile the number of FDI projects of the 317 firms over our sample period from the United States International Trade Administration (ITA) publication, "Foreign Direct Investment in the United States: Transactions." Because of missing observations on the values of FDI projects in the ITA publication, we use observations on the number of FDI projects in examining the firm-level Japanese FDI in the United States.[32]

Based on the data compiled from the ITA, 627 observations are non-zeros with each observation varying from one to seventeen FDI projects and with a total of 1,070 FDI projects for 317 firms from 1987 to 1994. However, it is not every year that the ITA records a firm as having an FDI project. When ITA has no record of a firm having an FDI project for a period, we assume the firm has no FDI project for that period and we enter a zero as our observation for the firm. From a sample size of 2,057 observations, 1,430 observations are

[32] Campa (1993), Blonigen (1997) and Klein, Peek and Rosengren (2002) use the number rather than the value of FDI from the ITA data set. More recently, Swenson (2004) use the value of FDI from the ITA data set. The ITA also lists the name and nationality of the foreign investor and the type of investment from 1973 to 1994. However, following Klein, Peek and Rosengren (2002), we use only data from 1987 to 1994.

zeros, which account for 69.5% of all the observations.[33] Table 5.1 reports the frequency distribution of FDI projects.

Table 6.1
Frequency Distribution of FDI Projects

Number of FDI projects	0	1	2	3	4	≥ 5
Number of observations	1430	422	108	38	27	32

Even though a firm has no FDI project for a given year, it does not mean that the firm has no intention to invest in the United States for that year. A firm may have the intention to invest but for whatever reason, it may not undertake FDI. Hence, we distinguish among firms according to their intention to invest in the United States by defining a partially observable binary random variable D_i as follows:

$$(6.1) \quad D_i = \begin{cases} 0 & \text{if firm } i \text{ does not intend to invest in the USA; and} \\ 1 & \text{if firm } i \text{ intends to invest in the USA.} \end{cases}$$

The probability that firm i does not intend to invest in the United States is given by:

$$(6.2) \quad P_i \equiv \Pr(D_i = 0) = \frac{\exp(\tilde{\beta}' Z_i)}{1 + \exp(\tilde{\beta}' Z_i)} \equiv \text{logit}\,(\tilde{\beta}' Z_i),$$

where P_i is a logit function of a vector of regressors (Z_i).

[33] The excess zeros in count data occur because the sample contains a mixture of distributions. The excess zeros can be accounted for by modeling the counts as a mixture of two distributions: additional mass at zero and a distribution that allows positive integer outcomes. Selected studies that have used zero-inflated count models include Tomlin (2000); Campolieti (2002); McNamara and Lee (2004); and Clark, Peters and Tomlinson (2005). The percentage of zeros in their count data sets are 57.8%, 49.8%, 88.7% and 70.5% respectively.

If firm *i* has no intention to invest in the United States ($D_i = 0$) for a given year, we are sure that it has no FDI project. However, if firm *i* has intention to invest in the United States ($D_i = 1$), we assume that the number of its FDI projects follows a negative binomial distribution with a mean of λ_i and dispersion parameter $\alpha > 0$. Thus, the probability of having an observation of a zero FDI project can be stated as:

$$\text{Prob}[FDI\_observation_i = FDI_i = 0] = P_i + (1 - P_i)\,\text{negativebinomial}(0; \lambda_i, \alpha) \tag{6.3}$$

and the probability of an observation having a non-zero FDI project is given by:

$$\text{Prob}[FDI\_observation_i = FDI_i > 0] = (1 - P_i)\,\text{negativebinomial}(FDI_i; \lambda_i, \alpha) \tag{6.4}$$

The mean of the negative binomial distribution (λ_i) is the firm *i*'s rate of FDI, which can be expressed as an exponential function of the vector of regressors X_i:

$$\lambda_i = e^{\beta' X_i} \tag{6.5}$$

For a firm with intention to invest in the United States, the conditional mean of FDI_i is given by:

$$E(FDI_i \mid D_i = 1) = \lambda_i \tag{6.6}$$

The conditional variance of FDI_i for firm *i* with intention to invest in the United States is given by:

$$Var\,(FDI_i \mid D_i = 1) = \lambda_i + \alpha\lambda_i^2 \tag{6.7}$$

Equations 6.6 and 6.7 indicate that among firms with intention to invest in the United States, the model can account for the extra variation in FDI projects relative to the Poisson distribution. The model is called the zero-inflated negative binomial (ZINB) regression model. The ZINB model reduces to a zero-inflated Poisson (ZIP) model as the limit of α approaches zero.[34] To determine whether the conditional distribution is Poisson or negative binomial, we use the score test developed by Ridout, Hinde and Demétrio (2001).

6.3 Determinants of FDI

In equation 6.2, the regressors in the vector Z_i are determinants from Klein, Peek and Rosengren (2002), namely the past year's rating of the firm's main bank and the firm's size, profits and relative wealth. These determinants affect the probability that a Japanese firm has no intention to invest (P_i) in the United States. As we mentioned above, we do not include the macroeconomic variables representing business cycles in the United States and Japan because they are the same for all firms and they are significantly correlated with each other and with the included regressors. Using the Pearson tests for correlation, we find the US unemployment rate is negatively correlated with Japan job-offers-to-applicants ratio and the firm's relative wealth and size at the 1% level of significance. Similarly, the Japan job-offers-to-applicants ratio is negatively correlated with the firm's relative wealth but it is positively

[34] The Poisson and the negative binomial regression models are discussed in Greene (2003). Greene (1994) and Freund, Kniesner, LoSasso (1999) discuss dealing with excess zeros in count data.

correlated with firm profitability at the 1% significance level. These findings indicate that including the macroeconomic variables in the regressions could create problems of multicollinearity among the regressors.[35]

The financial health of the firm's main bank is measured by the rating according to Moody's long-term deposit ratings, which are, from best to worst, Aaa, Aa1, Aa2, Aa3, A1 and A2.[36] Except for the best rating of Aaa, each Moody's rating is assigned a dummy variable of either one for that rating or zero otherwise. Hence, the coefficient of the dummy variable indicates the impact of the rating of the firm's main bank relative to the best rating of Aaa on the probability that the firm has no intention to invest in the United States (P_i). In other words, a positive coefficient would show a higher probability that the firm would have no intention to invest in the United States when the firm's main bank has a rating lower than the best rating.

The effect of firm size on P_i considers the traditional explanations of the impact of firm characteristics on FDI. Among industrial countries, traditional theories explain the importance of firm size in horizontal FDI. Horizontal FDI occurs when Japanese firms invest in the United States to sell the same general line of products that they sell in Japan. To enter the US markets, Japanese firms must incur high fixed costs of gathering information

[35] Although we do not report the results, we ran regressions with the business cycle variables in the model. As expected of regressions with multicollinearity problems, the coefficients of the regressors had large standard errors with the wrong signs.

[36] Klein, Peek and Rosengren (2002) summarize Moody's long-term deposit ratings for the eleven banks from 1986 to 1994 (Table 2, page 670) including the lowest rating of A3. In our case, out of 2065 observations, there are only 8 observations in which a firm's main bank had a rating of A3. Because of the very small number of observations for a rating of A3, the coefficient of the dummy variable for A3 had a very large standard error. Hence, we exclude these observations in our analysis.

on US markets even though the information may be freely available to US firms. Because of the high fixed costs of undertaking FDI, Japanese firms who intend to invest in the United States are usually large and dominant firms in Japan. These firms dominate Japanese markets with their economies of scale, marketing skills and technological advantages. Large firms also gain additional advantages in FDI because they can internalize licensing or exporting costs. By producing in the United States, large Japanese firms avoid licensing or exporting costs and gain internalization advantages. These advantages enable large Japanese firms to undertake FDI.[37] With firm size measured as the logarithm of the inflation-adjusted value of the firm's assets, it would be inversely related to P_i.

Consistent with traditional theory, firm profitability could affect P_i. The firm's advantages could result in lower costs and higher sales. Hence, the firm investing in FDI tends to be profitable. With profitability measured as the firm's profit-to-asset ratio, it would be inversely related to P_i.

P_i could be determined by relative wealth. Relative wealth is calculated by multiplying the stock price index of the Japanese firm by the nominal US dollar-yen exchange rate and dividing by the S&P 500 index. It captures the effects of exchange rate and relative stock price movements on P_i. Froot and Stein (1991) explain the effects of exchange rates and relative stock prices on FDI by assuming asymmetric information on payoffs of assets. Asymmetric

[37] The importance of firm size in FDI is explained in Caves (1971) and in Horst (1972). Both authors note that firm size is an important determinant of FDI.

information makes internal finance cheaper than external finance so Japanese firms would have to raise funds internally to bid for assets in the United States. Since Japanese firms must raise funds internally, they can bid a higher price for US assets when their stock prices increase relative to US stock prices and when the US dollar depreciates relative to the Japanese yen. Hence, higher relative wealth reduces P_i so relative wealth is inversely related P_i.

For firms with intention to invest in the United States, the conditional rate of firm *i*'s FDI (λ_i) is determined by the change in the rating of the firm's main bank and the annual changes in the firm's relative wealth, size and profitability. These determinants are included in the ZINB model as regressors in the vector X_i of equation 6.5. As in P_i above, we exclude the macroeconomic variables here because they cause multicollinearity among the regressors.[38]

Following Klein, Peek and Rosengren (2002), we examine how the weakness in the firm's main bank affects the rate of FDI using the changes in the Moody's ratings of the firm's main bank. We measure these changes using two dummy variables for single downgrade and multiple downgrades in the rating of the firm's main bank. The dummy variable for a single downgrade has a value of one if the rating of a firm's main bank is downgraded by one

[38] In contrast, Klein, Peek and Rosengren (2002) consider the number of FDI per year of firms associated with each of the eleven Japanese banks to be determined by the following: the change in the Moody's rating of each bank; the change in the sum of profits of firms associated with each bank; and the change in relative wealth measured as the percentage change in the nominal Nikkei stock index minus the percentage change in the US S&P 500 stock index plus the percentage change in the US dollar-yen exchange rate. Klein, Peek and Rosengren focus on first differences in the variables in order to capture the impact of the changes in these variables – particularly the changes in the financial conditions of banks – on the changes in the pattern of FDI.

level in a given year and a value of zero otherwise. The dummy variable for multiple-downgrades has a value of one if the rating of a firm's main bank is downgraded by two or more levels in a given year and a value of zero otherwise. Downgrades in the rating of the firm's main bank should be negatively related to λ_i .

Consistent with our firm-level specification, we include three firm-level variables as determinants of the rate of FDI (λ_i) namely, the annual changes in the firm's relative wealth, size and profitability. A higher relative wealth could increase the rate of FDI of Japanese firms with intention to invest in the United States. This follows Froot and Stein's (1991) proposition in which a higher relative wealth allows Japanese firms to bid more aggressively for US assets. Hence, relatively wealth could be positively related to λ_i . We also follow the traditional theories' rationale on the impact of profitability and firm size on FDI. As mentioned above, large and profitable firms usually have both firm-specific and internalization advantages that allow them to undertake FDI. Larger and more profitable firms should have a higher rate of FDI. Hence, changes in firm size and profitability would be positively related to λ_i

The data on bank ratings are from Moody's long-term deposit ratings. Data on firm characteristics are from the Pacific-Basin Capital Markets Databases (PACAP). The US dollar-yen exchange rate is from the International Financial Statistics. The S&P 500 index is from Bloomberg.

6.4 Empirical Results

Table 6.2 to 6.5 show the regression estimates, the log-likelihood and the Vuong statistics of the zero-inflated Poisson (ZIP) models. The results are presented in table 6.2 for the sample of all firms; in table 6.3 for the sample of firms in the lowest 80% bonds-to-liabilities ratio; in table 6.4 for the sample of firms in the highest 20% of bonds-to-liabilities ratio; and in table 6.5 for firms with FDI projects in multiple years. We split our sample of firms according to their bonds-to-liabilities ratios because firms that issue more bonds could be less affected by rating downgrades of their main banks. Selecting a sub-sample of firms that undertake FDI in multiple years is another test of robustness. Firms that undertake FDI more frequently are expected to be more affected by relative wealth and unequal access to credit than firms that undertake FDI only once. In addition, firms that undertake FDI infrequently may not actively seek FDI opportunities and thus may not have the intention to undertake FDI. The rationale follows from Klein, Peek and Rosengren (2002) who reason that by including FDI firms that undertake FDI projects in a single year, it could add more noise than information; given that their non engagement in FDI in any year could be unrelated to relative wealth effects and availability of credit. Thus the sub-sample of firms that have FDI projects in multiple years during the period in sample serves as a further test of robustness.

Table 6.2
Estimates of Zero-Inflated Poisson (ZIP) Regression: All FDI Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**0.2150**	0.0443	**0.0000**
Single downgrade $_{t-1}$	-0.1058	0.0740	0.1528
Multiple downgrades $_{t-1}$	**-0.7035**	0.1695	**0.0000**
Δ Relative wealth $_{t-1}$	**0.2461**	0.0860	**0.0042**
Δ Firm profitability $_{t-1}$	1.6641	3.6230	0.6460
Δ Firm size $_{t-1}$	0.4096	0.2980	0.1694
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**5.5373**	1.5766	**0.0004**
Aa1	**0.5483**	0.2017	**0.0066**
Aa2	-0.0544	0.4219	0.8974
Aa3	**0.5931**	0.2095	**0.0046**
A1	**0.5794**	0.2714	**0.0328**
A2	**0.7202**	0.3806	**0.0585**
Relative wealth $_{t-1}$	**-0.5428**	0.2181	**0.0128**
Firm profitability $_{t-1}$	-5.7016	3.9040	0.1442
Firm size $_{t-1}$	**-0.7043**	0.0695	**0.0000**
Log-likelihood	-1939.12		
Vuong Test Statistic	**20.76**		**0.000**
Number of Firms	317		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.3
Estimates of Zero-Inflated Poisson (ZIP) Regression:
80% of Lowest Bonds to Liabilities Ratio of All Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**0.2921**	0.0489	**0.0000**
Single downgrade $_{t-1}$	-0.1097	0.0810	0.1756
Multiple downgrades $_{t-1}$	**-0.7041**	0.1838	**0.0001**
Δ Relative wealth $_{t-1}$	**0.2610**	0.0902	**0.0038**
Δ Firm profitability $_{t-1}$	1.3146	3.7663	0.7270
Δ Firm size $_{t-1}$	**0.6678**	0.3392	**0.0490**
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**6.9252**	1.7203	**0.0001**
Aa1	**0.3953**	0.2120	**0.0622**
Aa2	0.1286	0.4478	0.7739
Aa3	**0.3835**	0.2271	**0.0913**
A1	0.4258	0.2963	0.1506
A2	**0.7804**	0.4213	**0.0640**
Relative wealth $_{t-1}$	-0.3624	0.2329	0.1197
Firm profitability $_{t-1}$	**-8.5679**	4.2692	**0.0448**
Firm size $_{t-1}$	**-0.7090**	0.0717	**0.0000**
Log-likelihood	-1610.82		
Vuong Test Statistic	**19.88**		**0.0000**
Number of Firms	254		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.4
Estimates of Zero-Inflated Poisson (ZIP) Regression:
20% of Highest Bonds to Liabilities Ratio of All Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**-0.3932**	0.1651	**0.0172**
Single downgrade $_{t-1}$	-0.1507	0.2887	0.6016
Multiple downgrades $_{t-1}$	**-0.8504**	0.4830	**0.0783**
Δ Relative wealth $_{t-1}$	-0.1236	0.3705	0.7386
Δ Firm profitability $_{t-1}$	1.5893	17.1649	0.9262
Δ Firm size $_{t-1}$	0.5921	1.0477	0.5720
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	-9.3888	6.6787	0.1598
Aa1	1.3487	1.0181	0.1852
Aa2	-0.3275	1.8496	0.8595
Aa3	1.4149	0.9250	0.1216
A1	1.0088	1.1057	0.3615
A2	0.2214	1.4908	0.8819
Relative wealth $_{t-1}$	**-2.7026**	1.1009	**0.0141**
Firm profitability $_{t-1}$	11.5626	16.6732	0.4880
Firm size $_{t-1}$	**-0.6940**	0.2763	**0.0120**
Log-likelihood	-304.29		
Vuong Test Statistic	**5.73**		**0.0000**
Number of Firms	63		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.5
Estimates of Zero-Inflated Poisson (ZIP) Regression: Multi-year FDI firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**0.3625**	0.0615	**0.0000**
Single downgrade $_{t-1}$	-0.1267	0.0961	0.1872
Multiple downgrades $_{t-1}$	**-0.6384**	0.1710	**0.0002**
Δ Relative wealth $_{t-1}$	**0.2131**	0.1091	**0.0508**
Δ Firm profitability $_{t-1}$	**6.9331**	3.2499	**0.0329**
Δ Firm size $_{t-1}$	0.4400	0.3728	0.2378
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**3.8658**	2.2643	**0.0878**
Aa1	**0.7102**	0.2791	**0.0109**
Aa2	0.1256	0.5404	0.8163
Aa3	**0.9151**	0.2941	**0.0019**
A1	**0.7183**	0.3674	**0.0505**
A2	**1.3278**	0.4835	**0.0060**
Relative wealth $_{t-1}$	**-0.6284**	0.3088	**0.0418**
Firm profitability $_{t-1}$	0.2096	4.9674	0.9663
Firm size $_{t-1}$	**-0.6680**	0.0988	**0.0000**
Log-likelihood	-1474.58		
Vuong Test Statistic	**12.01**		**0.0000**
Number of Firms	185		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

In the ZIP regressions, we use the Vuong statistic as a measure of the relevance of accounting for excess zeros in our sample. The Vuong test has a null that the Poisson model cannot be rejected in favor of the ZIP model and an alternative that the Poisson model is rejected in favor of the ZIP model. For the full sample and the sub-samples of firms, the Vuong statistics reject the Poisson model in favor of the ZIP model at the 1% level of significance.

Tables 6.6 to 6.9 show the regression and log-likelihood estimates, and the score test statistics of the zero-inflated negative binomial (ZINB) model for our full sample and sub-samples of firms. We use the score test, as developed by Ridout, Hinde and Demétrio (2001), to determine whether the Poisson or the negative binomial distribution is the more appropriate distribution of FDI projects for firms with intention to invest in United States. The score test has a null hypothesis that the conditional distribution of FDI projects is Poisson against an alternative hypothesis that the conditional distribution is negative binomial. The score test statistics show that the null of Poisson distribution can be rejected in favor of the negative binomial distribution for all firms in our full sample and for sub-samples of firms with the lowest 80% of bonds-to-liabilities ratio and of firms with multi-year FDI. However, the null hypothesis cannot be rejected in favor of the alternative hypothesis for firms with the highest 20% of bonds-to-liabilities ratio. The results show that the ZINB model is more appropriate for our full sample and sub-samples of firms with the lowest 80% of bonds-to-liabilities ratio and of

firms with multi-year FDI but the ZIP model is more appropriate for the sub-sample of firms with the highest 20% of bonds-to-liabilities ratio.

According to Hoshi and Kashyap (1999), when the bond market in Japan began to develop in the 1980s, it was the largest firms that were amongst the first to use bonds as an alternative debt instrument. Firms with the highest 20% of bonds-to-liabilities ratio in the sample could be these large firms in Japan. They are likely to be dominant leaders in the Japanese market and as a sub-sample could be more homogeneous than all firms in the full sample. As a result of more homogeneous firms in the sub-sample, it satisfies the condition of mean-variance equality making the sub-sample of firms with the highest 20% of bonds-to-liabilities ratio appropriate for the ZIP model.

Table 6.6
Estimates of Zero-Inflated Negative Binomial (ZINB) Regression: All FDI Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**0.2081**	0.0738	**0.0048**
Single downgrade $_{t-1}$	-0.0994	0.1029	0.3343
Multiple downgrades $_{t-1}$	**-0.6969**	0.1775	**0.0001**
Δ Relative wealth $_{t-1}$	**0.2491**	0.1270	**0.0498**
Δ Firm profitability $_{t-1}$	1.7841	3.3403	0.5933
Δ Firm size $_{t-1}$	0.4715	0.5514	0.3925
Log (alpha)	**-1.1238**	0.1539	**0.0000**
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**5.5530**	1.6088	**0.0006**
Aa1	**0.5472**	0.2067	**0.0081**
Aa2	-0.0536	0.4168	0.8976
Aa3	**0.5920**	0.2191	**0.0069**
A1	**0.5808**	0.2841	**0.0409**
A2	**0.7219**	0.4128	**0.0804**
Relative wealth $_{t-1}$	**-0.5391**	0.2297	**0.0189**
Firm profitability $_{t-1}$	-5.6220	4.0865	0.1689
Firm size $_{t-1}$	**-0.7039**	0.0603	**0.0000**
Log-likelihood	-1894.98		
Score Test Statistic	**24.05**		**0.0000**
Number of Firms	317		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.7
Estimates of Zero-Inflated Negative Binomial (ZINB) Regression: 80% of Lowest Bonds to Liabilities Ratio of All Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**0.2814**	0.0845	**0.0009**
Single downgrade $_{t-1}$	-0.0994	0.1131	0.3793
Multiple downgrades $_{t-1}$	**-0.6947**	0.1896	**0.0002**
Δ Relative wealth $_{t-1}$	**0.2703**	0.1375	**0.0493**
Δ Firm profitability $_{t-1}$	1.2526	3.6605	0.7322
Δ Firm size $_{t-1}$	0.7639	0.7452	0.3053
Log (alpha)	**-1.1092**	0.1619	**0.0000**
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**6.9453**	1.7391	**0.0001**
Aa1	**0.3936**	0.2221	**0.0763**
Aa2	0.1282	0.4626	0.7817
Aa3	0.3817	0.2413	0.1137
A1	0.4263	0.3099	0.1690
A2	**0.7813**	0.4594	**0.0890**
Relative wealth $_{t-1}$	-0.3588	0.2458	0.1443
Firm profitability $_{t-1}$	**-8.5541**	4.4667	**0.0555**
Firm size $_{t-1}$	**-0.7088**	0.0639	**0.0000**
Log-likelihood	-1568.62		
Score Test Statistic	**22.37**		**0.0000**
Number of Firms	254		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.8
Estimates of Zero-Inflated Negative Binomial (ZINB) Regression: 20% of Highest Bonds to Liabilities Ratio of All Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**-0.3928**	0.1948	**0.0437**
Single downgrade $_{t-1}$	-0.1534	0.2632	0.5600
Multiple downgrades $_{t-1}$	**-0.8510**	0.5147	**0.0982**
Δ Relative wealth $_{t-1}$	-0.1244	0.3552	0.7263
Δ Firm profitability $_{t-1}$	1.4837	9.6415	0.8777
Δ Firm size $_{t-1}$	0.5919	1.0649	0.5783
Log (alpha)	**-2.4499**	0.9485	**0.0098**
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**-9.3959**	4.8435	**0.0524**
Aa1	**1.3460**	0.5964	**0.0240**
Aa2	-0.3294	0.9467	0.7278
Aa3	**1.4122**	0.6202	**0.0228**
A1	1.0030	0.8133	0.2175
A2	0.2137	1.1358	0.8508
Relative wealth $_{t-1}$	**-2.7054**	0.7386	**0.0002**
Firm profitability $_{t-1}$	11.4904	13.8544	0.4069
Firm size $_{t-1}$	**-0.6945**	0.2093	**0.0009**
Log-likelihood	-304.00		
Score Test Statistic	1.40		0.1615
Number of Firms	63		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.9
Estimates of Zero-Inflated Negative Binomial (ZINB) Regression: Multi-year FDI Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**0.3579**	0.0775	**0.0000**
Single downgrade $_{t-1}$	-0.1191	0.1137	0.2949
Multiple downgrades $_{t-1}$	**-0.6258**	0.1880	**0.0009**
Δ Relative wealth $_{t-1}$	0.2199	0.1470	0.1346
Δ Firm profitability $_{t-1}$	7.7728	4.9357	0.1153
Δ Firm size $_{t-1}$	0.4701	0.5147	0.3610
Log (alpha)	**-1.2059**	0.1662	**0.0000**
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**3.8704**	2.3195	**0.0952**
Aa1	**0.7071**	0.2759	**0.0104**
Aa2	0.1372	0.5111	0.7884
Aa3	**0.9138**	0.2930	**0.0018**
A1	**0.7198**	0.3678	**0.0503**
A2	**1.3334**	0.4948	**0.0070**
Relative wealth $_{t-1}$	**-0.6251**	0.3162	**0.0480**
Firm profitability $_{t-1}$	0.4921	5.3250	0.9264
Firm size $_{t-1}$	**-0.6673**	0.0840	**0.0000**
Log-likelihood	-1436.57		
Score Test Statistic	**20.30**		**0.0000**
Number of Firms	185		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

For our full sample, the estimates of the ZINB model show that the probability that a firm has no intention to invest in the United States (P_i) is positively related to the dummy variables for the ratings of Aa1, Aa3, A1 and A2 at the 10% and higher levels of significance. Hence, a firm is less likely to have the intention to invest in the United States when the rating of its main bank is lower than a rating of Aaa. For the full sample, the estimates of the ZINB model show that the probability that a firm has no intention to invest in the United States (P_i) is positively related to the dummy variables for the ratings of Aa1, Aa3, A1 and A2 at the 10% and higher levels of significance. Hence, a firm is less likely to have the intention to invest in the United States when the rating of its main bank is lower than a rating of Aaa, and has a lower rate of FDI.

From the coefficient estimates, we compute the marginal effects of regressors on the probability and rate of investment.[39] For declines in the main bank rating from Aaa to A2, the probability that a firm with the intention to invest declines by 0.19. In other words, a firm is 0.19 less likely to undertake FDI for bank rating declines from Aaa to A2. For declines in the main bank rating from Aaa to A1, the probability that a firm with the intention to invest declines by 0.17. For declines in the main bank rating from Aaa to Aa3 and from Aaa to Aa1, the probability that a firm with the intention to invest declines by 0.15 in both cases.

[39] For the computation and interpretation of the marginal effects of the regressors on the expected rate of FDI and the probability of investment, the reference is in Long and Freese (2001).

The probability that a firm has no intention to invest in the United States is negatively related to the firm's relative wealth and size at 5% or higher levels of significance. For a 1% decrease in relative wealth, the probability that a firm do not intend to undertake FDI increases by 0.11. For a 1% decrease in firm size, the probability that a firm do not intend to undertake FDI increases by 0.18. Therefore, large firms and firms with high relative wealth are more likely to have the intention to invest in the United States, and have higher rates of FDI.

These relationships also hold for the sub-samples of firms with the lowest 80% of bonds-to-liabilities ratio and of firms with multi-year FDI. The results are robust to splitting the full sample into sub-sample of firms with the lowest 80% of bonds-to-liabilities ratio and firms with multi-year FDI.

As shown in the estimates of the ZIP model for the firms with the highest 20% of bonds-to-liabilities ratio, the probability of having no intention to invest in the United States is strongly and negatively related only with firm size and relative wealth. While these results are similar to those mentioned above for the full sample and the other sub-samples, the effect of relative access to credit on the probability of having no intention to invest is insignificant even at the 10% significant level for firms with the highest 20% of bonds-to-liabilities ratio. Hence, for this sub-sample of firms, the probability that the firm has no intention to invest does not depend on the financial health of the firm's main bank. The result is not surprising given that firms with more issues of bonds, an alternative debt financing instrument, are

less dependent on banks for funds. Therefore they are less affected by deteriorating financial positions of banks.

For our full sample, the estimates of ZINB model show that the average rate of FDI projects of a firm with intention to invest in the United States (λ_i) is negatively related to multiple downgrades of a firm's main bank at the 1% level of significance. Conditioned on a firm's intention to invest, multiple downgrades of bank ratings is associated with a decline in the expected rate of FDI by 0.30 FDI projects per year. The inverse relationship is confirmed by the two other ZINB models for firms with the lowest 80% of bonds-to-liabilities ratio and for firms with multi-year FDI, as well as the ZIP model for the firms with the highest 20% of bonds-to-liabilities ratio. This implies that for firms with the intention to invest in the United States, a severe deterioration in the financial health of firm's main bank adversely affects the rate of FDI projects.

For our full sample, the estimates of ZINB model show that the average rate of FDI projects of a firm with intention to invest in the United States (λ_i) is positively related to the change in the firm's relative wealth at the 5% level of significance. Conditioned on the firm's intention to invest, an average 1% increase in relative wealth is associated with an increase in the expected rate of FDI by 0.14 FDI projects per year. It suggests that an increase in the firm's relative wealth results in a higher rate of FDI projects. The result also holds under the ZINB model for firms with the lowest 80% of bonds-to-

liabilities ratio. However, the same result does not hold in the ZINB model for firms with multi-year FDI and in the ZIP model for the firms with the highest 20% of bonds-to-liabilities.

During the sample period, a sizable proportion of Japanese FDI in the United States was in the manufacturing industries.[40] As Graham and Krugman (1996) show, the assets of Japanese-controlled manufacturing firms in the United States relative to all US manufacturing firms, grew from 5.9% in 1986 to 15.5% in 1991. Of the 317 Japanese firms in sample, 245 belong to the manufacturing industries and they engaged in 76% of Japanese FDI in the sample. The distribution of Japanese FDI firms across industries is shown in Table B.5 at Appendix B. Because a large proportion of Japanese FDI activities resulted from firms in the manufacturing industries, we perform ZIP and ZINB regression analysis on the sub-sample of firms in the manufacturing industries.

Table 6.10 and 6.12 show the regression estimates of ZIP and ZINB models on the sub-sample of manufacturing firms. The regression estimates in both models are qualitatively and quantitatively similar to the estimates in tables 6.2 and 6.6 using the sample of all firms. Multiple downgrades of main banks significantly affected the rate of FDI of manufacturing firms. Consistent with results in the sample of all firms, the change in relative wealth significantly influences the rate of FDI of manufacturing firms. In addition,

[40] We thank an anonymous examiner for suggesting manufacturing firms as a sub-sample to test for effects of relative wealth and relative access to credit on Japanese FDI the United States.

the change in the relative wealth estimate is slightly larger in magnitude for manufacturing firms than for all firms and for multi-year firms, suggesting that relative wealth effects could be more important to manufacturing firms. The results are consistent with Froot and Stein (1991) who show that the strongest exchange rate effects appear in the manufacturing industries.

Aside from firms in the manufacturing industries, we perform ZIP and ZINB regression analysis on the remaining 72 firms in the non-manufacturing industries. These firms are in the wholesale and retail, insurance and non-bank finance, transportation and communication, electric power and gas, construction and services industries. They constitute 23% of the sample of 317 firms. The results from the regression analysis are presented in tables 6.11 and 6.13. Similar to the results on the sub-sample of firms in the manufacturing industries, deteriorating financial positions of main banks has similar effects on the probability of a firm's intention to invest and the firm's rate of investment for firms in the non-manufacturing industries.

Table 6.10
Estimates of Zero-Inflated Poisson (ZIP) Regression: Manufacturing Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**0.1707**	0.0704	**0.0150**
Single downgrade $_{t-1}$	-0.0709	0.1073	0.5090
Multiple downgrades $_{t-1}$	**-0.6232**	0.1789	**0.0000**
Δ Relative wealth $_{t-1}$	**0.2871**	0.1252	**0.0220**
Δ Firm profitability $_{t-1}$	0.1043	3.2396	0.9740
Δ Firm size $_{t-1}$	0.5399	0.4557	0.2360
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**8.6971**	1.8820	**0.0000**
Aa1	**0.6993**	0.2354	**0.0030**
Aa2	0.1315	0.4744	0.7820
Aa3	**0.5671**	0.2490	**0.0230**
A1	**0.7117**	0.3242	**0.0280**
A2	0.6851	0.4699	0.1450
Relative wealth $_{t-1}$	-0.2845	0.2571	0.2680
Firm profitability $_{t-1}$	**-9.2170**	4.5898	**0.0450**
Firm size $_{t-1}$	**-0.8385**	0.0783	**0.0000**
Log-likelihood	-1477.96		
Vuong Test Statistic	**6.79**		**0.0000**
Number of Firms	245		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.11
Estimates of Zero-Inflated Poisson (ZIP) Regression: Non-Manufacturing Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	**0.3924**	0.1132	**0.0150**
Single downgrade $_{t-1}$	-0.2245	0.1722	0.5090
Multiple downgrades $_{t-1}$	**-1.0519**	0.4327	**0.0000**
Δ Relative wealth $_{t-1}$	**0.0454**	0.2080	**0.0220**
Δ Firm profitability $_{t-1}$	25.8668	10.3054	0.9740
Δ Firm size $_{t-1}$	0.2312	0.6188	0.2360
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**-2.2679**	3.4111	**0.0000**
Aa1	**0.3497**	0.4075	**0.0030**
Aa2	-0.2807	1.0513	0.7820
Aa3	**0.9322**	0.4386	**0.0230**
A1	**0.0506**	0.5588	**0.0280**
A2	1.1848	0.8163	0.1450
Relative wealth $_{t-1}$	-1.2466	0.4844	0.2680
Firm profitability $_{t-1}$	**17.4239**	10.2302	**0.0450**
Firm size $_{t-1}$	**-0.4356**	0.1183	**0.0000**
Log-likelihood	-490.23		
Vuong Test Statistic	**3.87**		**0.0000**
Number of Firms	72		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.12
Estimates of Zero-Inflated Negative Binomial (ZINB) Regression: Manufacturing Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	-0.0701	0.0916	0.4440
Single downgrade $_{t-1}$	-0.0790	0.1246	0.5260
Multiple downgrades $_{t-1}$	**-0.6279**	0.1929	**0.0010**
Δ Relative wealth $_{t-1}$	**0.3137**	0.1481	**0.0340**
Δ Firm profitability $_{t-1}$	-0.4599	3.8591	0.9050
Δ Firm size $_{t-1}$	0.6521	0.5467	0.2330
Log (alpha)	**-0.5631**	0.2010	**0.0050**
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	**10.1866**	2.4859	**0.0000**
Aa1	**0.8723**	0.3162	**0.0060**
Aa2	0.1404	0.6760	0.8350
Aa3	**0.6837**	0.3275	**0.0370**
A1	**0.8674**	0.4257	**0.0420**
A2	0.7348	0.6087	0.2270
Relative wealth $_{t-1}$	-0.2463	0.3333	0.4600
Firm profitability $_{t-1}$	**-11.9727**	6.2032	**0.0540**
Firm size $_{t-1}$	**-0.9913**	0.1092	**0.0000**
Log-likelihood	-1444.02		
Score Test Statistic	**67.89**		**0.0000**
Number of Firms	245		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

Table 6.13
Estimates of Zero-Inflated Negative Binomial (ZINB) Regression: Non-Manufacturing Firms

Variable	Parameter Estimate	Standard Error	P-value
Dependent variable: rate of FDI_i (conditional on firm *i* intending to invest in FDI)			
Constant	0.0546	0.1452	0.7070
Single downgrade $_{t-1}$	-0.1631	0.2174	0.4530
Multiple downgrades $_{t-1}$	**-1.1422**	0.4241	**0.0070**
Δ Relative wealth $_{t-1}$	-0.0333	0.2720	0.9030
Δ Firm profitability $_{t-1}$	**29.1719**	**13.9663**	**0.0370**
Δ Firm size $_{t-1}$	0.1703	0.7117	0.8110
Log (alpha)	-0.1353	0.2490	0.5870
Dependent variable: probability that firm *i* does not intend to invest in FDI (P_i)			
Constant	-8.9945	6.6015	0.1730
Aa1	0.8709	0.8145	0.2850
Aa2	-10.7854	516.8086	0.9830
Aa3	**1.4291**	**0.7653**	**0.0620**
A1	0.3304	0.9155	0.7180
A2	**2.0033**	1.1671	**0.0860**
Relative wealth $_{t-1}$	**-2.4998**	**0.9382**	**0.0080**
Firm profitability $_{t-1}$	**32.9679**	**14.8909**	**0.0270**
Firm size $_{t-1}$	**-0.6327**	**0.2115**	**0.0030**
Log-likelihood	-464.09		
Score Test Statistic	**52.28**		**0.0000**
Number of Firms	72		

Notes: Δ indicates that the variable is in first difference form. Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States.

However, for firms in the non-manufacturing industries, relative wealth significantly affects only the probability of a firm's intention to invest but not the rate of FDI. The rate of FDI for non-manufacturing firms is significantly affected only by firm profitability. The result suggests that profitable firms with sufficient cash flow are less reliant on external finance. Therefore they are less influenced by relative wealth changes. The contrasting effects of relative wealth on FDI between non-manufacturing and manufacturing firms could also be due to the nature of the firms' activities in both industries. Manufacturing firms require large investments in physical capital. As a result, FDI in the manufacturing industries would need larger capital outlays than FDI in the non-manufacturing industries. With large capital outlays, using external loans to finance FDI becomes inevitable. Thus a change in relative wealth can significantly impact a manufacturing firm's rate of FDI.

In summary, our results show significant and negative effect of firm size on P_i and the significant and negative effect of multiple downgrades of the firm's main bank on λ_i. These results are robust to splitting our full sample according to the bonds-to-liabilities ratio, single- or multi-year FDI firms; and firms in the manufacturing and non-manufacturing industries. The results also show that for the full sample or the split samples, the average rate of the firm's FDI conditional on firms with intention to invest in the United States is not affected by a single downgrade of the firm's main bank. The

change in firm profitability is also not an important factor in explaining the average rate of the firm's FDI with the exception of firms in the non-manufacturing industries which require relatively less outlay in physical capital and tangible assets.

6.5 Conclusions

We examine the impact of relative access on the Japanese firm's rate of FDI to the United States. We find that the firm's rate of FDI is significantly affected by the multiple rating downgrades of the firm's main bank. This result holds even after splitting the sample into firms with the lowest 80% and highest 20% of bonds-to-liabilities ratio and firms that undertake FDI in multiple years. The effect is quite prevalent considering that eight of the 11 main banks in our study experienced multiple downgrades during our sample period. The prevalent effect of multiple downgrades on the firm's FDI is not surprising bearing in mind the close relationship between banks and firms in Japan. Klein, Peek and Rosengren mention anecdotal evidence that even large firms such as Toyota who has little need of a bank loan could still depend on their main banks for other banking functions. However, they are unable to confirm this using a logit regression for a sub-sample of firms with the highest 20% of bonds-to-liabilities ratio. In contrast, our results strongly confirm the impact of the financial crisis in Japan on the firm's rate of FDI even among firms with access to bond financing. Our evidence from the firm-level rate of

Japanese FDI gives stronger support to Klein, Peek and Rosengren's (2002) relative access to credit hypothesis.

Evidence of relative to credit hypothesis implies a role for managing access to credit for FDI firms. In the case of Japan, firms' ability to raise external financing was impaired by the deteriorating financial conditions of Japanese banks. The difficulty in obtaining alternative financing when the firms' main bank is unable to provide additional financing suggest possibilities of adverse effects on FDI when firms become heavily reliant on the bank as the main source of external funds. Attempts for economic policies to encourage the development of alternative sources of funds for FDI may be able to ameliorate dramatic declines in FDI due to reduced access to credit. The alternative forms of financing can include equity, venture capital in addition to bonds.

Unlike Klein, Peek and Rosengren's (2002) findings, we find that the change in relative wealth significantly affects the firm's rate of FDI for all firms in our sample and for firms with the lowest 80% of bonds-to-liabilities ratio. The difference in findings may be explained by Klein, Peek and Rosengren's use of aggregate data as a measure of relative wealth. In aggregation, heterogeneous firm effects could be lost, which in turn could lead to insignificant estimates.[41] Hence, the evidence at the firm level shows some

[41] It is possible that multicollinearity caused an upward bias in the standard error of the relative wealth coefficient in Klein, Peek and Rosengren's regressions.

support to the contention in Froot and Stein (1991) that relative wealth affects the firm's rate of FDI.

Firm-level evidence shows that both relative wealth and relative access to credit could explain the large fluctuations in Japanese FDI into the United States. The surge in Japanese FDI in the 1980s could be explained by the appreciation of the yen and the rise in stock prices while the large drop in Japanese FDI in the 1990s could be attributed to the stock market crash and the banking crisis in Japan. These explanations have important implications on the future trend in Japanese FDI because even if Japan has yet to recover from the banking crisis in the 1990s.[42] For instance, in terms of yen, Japanese FDI into the United States rose by 51% from 1993 to 1997. This was preceded by a rise in relative wealth of 27% from 1992 to 1994. The rise in Japanese FDI outflows to the rest of the world over the same period is even more impressive. It rose by 65% and, excluding OECD countries, it rose by 95% from 1993 to 1997.[43] While both Japanese FDI and relative wealth have trended downward from 1999 to 2005, a sustained rise in relative wealth could reverse the decline in Japanese FDI outflows.[44] The rise in the relative wealth of Japanese firms could also provide a stimulus for Japanese FDI not just in developed economies but in developing economies as well.

[42] Peek (2004) discusses bank restructuring in Japan in the 1990s.
[43] Aggregate FDI data for Japan are from SOURCE OECD database "International direct investment by country, vol 2005." The yen-US dollar exchange rate and Japanese and US share prices are from International Financial Statistics (IFS), on-line, April 2006.
[44] The Wall Street Journal reports that for the fiscal year that ended March 31, 2006, the Topix rose 47% while the Nikkei 225 rose 46% (Miyazaki, J., (2006), Japan's corporate profits bode well for stock prices, Wall Street Journal, April 3, 2006). We confirm this using IFS data to calculate a 20% rise in relative wealth from January 2005 to January 2006.

This may be the case when FDI from industrial countries is a significant source of economic growth for small countries, developing countries or economies in transition. The gains from FDI in the form of technology spillovers and training of workers in the host economy have been widely acknowledged in the FDI literature. Given the results of our study, evidence suggests that there is scope for macroeconomic policies in managing changes in exchange rates that contribute to changing relative wealth of FDI firms. Indeed, FDI can be determined by real exchange rates between the currency of the host country and that of the source country. A relative real appreciation in the currency of a host country can reduce its FDI inflows and divert investments to other countries. On the contrary, a relative real depreciation of the currency of the host country can increase its FDI inflows. In cases of currency crisis in the host country, FDI firms can undertake even more FDI because the depreciating currency lowers the total cost of capital in the host country.

Notwithstanding policy implications, our investigation following Klein, Peek and Rosengren, is an empirical study of the impact of relative wealth and relative access to credit on the firm's rate of FDI. An interesting area of future research is to build a structural model to determine how relative wealth and relative access to credit affect the firm's rate of FDI. The theoretical relationships among the structural parameters will allow us to show the

quantitative importance of relative wealth and relative credit in firm-level FDI.[45]

[45] We thank an anonymous referee for suggesting to us this interesting line of future research.

CHAPTER SEVEN

ACQUISITION AND MERGER FDI, RELATIVE WEALTH AND RELATIVE ACCESS TO BANK CREDIT: EVIDENCE FROM A BIVARIATE ZERO-INFLATED COUNT MODEL

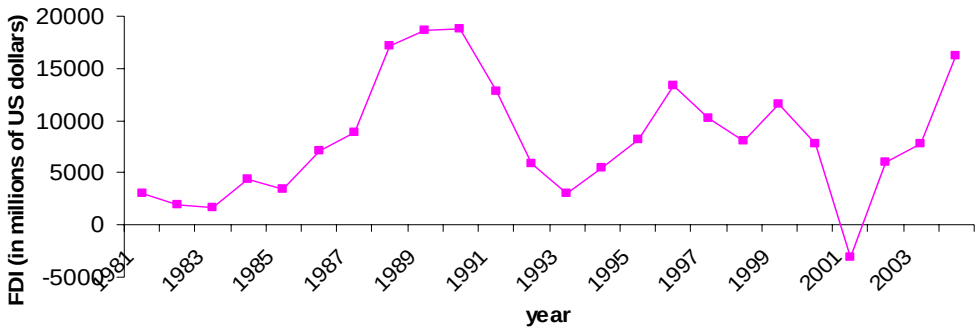
7.1 Introduction

Explaining why foreign direct investment (FDI) occurs, Hymer (1960) and Caves (1971) focus on advantages arising from firm-specific assets that allow firms to remain competitive in a foreign country.[46] However, the ownership of firm-specific assets does not explain why FDI occurs in waves. Fluctuations in US inward FDI occur in the 1980s and the 1990s. Much of the rise that started in the mid 1980s and the subsequent decline that ended in the early 1990s can be attributed to Japanese FDI in the United States. Figure 7.1 shows Japanese FDI flows in the United States rose significantly after 1987 but plunged sharply after 1991.

[46] These advantages include advance technology, superior management skills and marketing abilities.

Figure 7.1

Japanese FDI flows into the United States



Source: UNCTAD FDI Statistics, www.unctad.org

To explain fluctuations in US inward FDI, Froot and Stein (1991) assume imperfect capital markets with asymmetric information. The cost of acquiring information leads to costly external financing so foreign firms finance the acquisitions of US assets using their own wealth. Since the foreign firms' wealth are denominated in their home currency, a depreciation of the US dollar means that they can change more in US currency the same value of their wealth in their home currency. In effect, relative wealth of foreign firms increases allowing them to bid more aggressively for US assets. The rise in the firms' relative wealth therefore could lead to increased FDI in the United States. To have a better measure of relative wealth, Klein and Rosengren (1994) consider both exchange rate and relative stock price movements. They

find that their measure of relative wealth can also explain fluctuations in FDI flows.

While relative wealth can explain Japanese FDI into the United States in the 1980s, the positive correlation between Japanese relative wealth and Japanese FDI in the United States did not hold for the 1990s. To explain the sharp decline of Japanese FDI in the United States during the 1990s, Klein, Peek and Rosengren (2002) propose the relative access to credit hypothesis. They hypothesize that Japanese firms in the 1990s encountered loan constraints because of the banking crisis. When banks restrict lending, they hamper FDI activities since many Japanese firms rely heavily on bank loans as the main source of external financing. Using Moody's bank rating as an indicator of the financial position of Japanese banks, Klein, Peek and Rosengren use a logit regression to show that lower Moody's ratings of main banks are associated with lower probabilities that Japanese firms will undertake FDI. In a separate regression using aggregated bank-level data, they find that Moody's bank rating downgrades reduce Japanese FDI in the United States.

In contrast to Klein, Peek and Rosengren (2002), we use a bivariate zero-inflated negative binomial model to evaluate the effects of relative wealth and relative access to bank credit on Japanese FDI in the United States. In the model, the observed final outcome of a Japanese FDI in the United States can be analyzed as two separate stages of the firm's investment process. The first stage occurs when the firm shows no intention to engage in FDI and FDI

typically will not occur. The same firm may not always be in the first stage without any intention to engage in FDI. At some interval in time when conditions become favorable, the firm becomes prepared for FDI and makes plans to engage in FDI. When the firm plans to engage in FDI, it moves to the second stage where the firm may undertake FDI by acquisition and merger (AM) and/or FDI other than AM (non-AM).

An AM offers advantages that differ from those of a new plant (NP) or a joint venture (JV). The advantages include acquired market share, brand name and firm-specific assets that are immediately beneficial to the investing firm in the foreign market. As long as the investing firm finds acquiring firm-specific assets to be complementary, entry using AM is one of the fastest ways to establish itself in the foreign market. However, assets are usually imperfectly divisible. To utilize indivisible assets more efficiently, the investing firm may find it necessary to undertake additional FDI of a different type. For example, the acquired physical assets when used with superior organizational procedures of the investing firm may require further plant expansion or additional office space in order to optimize production levels and to reap greater efficiency.[47] Thus, an AM FDI that is complemented by another FDI of a different type would imply a positive correlation between AM FDI and other types of FDI.

[47] This idea was proposed by Penrose (1959) for firm diversification and discussed by Teece (1980) for firms undertaking FDI. We elaborate on the role of indivisible assets in the expansions of firms in section 2.

7.2 Acquisition and Merger FDI

The various modes of market entry are generally classified into three types. Firms can establish new plants (NPs), form joint ventures (JVs) or undertake acquisitions and mergers (AMs). By undertaking an AM, a firm obtains sufficient equity to control operations. Apart from corporate control, an AM is associated with special advantages when the investing firm acquires technology, brand name and market share. These acquired assets provide the firm with a competitive advantage in the foreign market. Provided the acquired firm-specific assets are complementary, an AM is one of the fastest ways for the investing firm to enter the foreign market. In contrast, a NP involves building new facilities that would take time to establish operations in the foreign market. To share tacit but distinct firm-specific assets, a JV between firms is the preferred mode of market entry. However, firms in a JV require continuous negotiation of shared resources which may lead to less than efficient use of assets.

Employing optimal use of firm-specific assets in FDI is one objective that a firm pursues in order to maximize profits. However, assets that are imperfectly divisible can result in excess capacity and less than optimal levels of production. To optimize production, the firm expands by undertaking additional FDI to make better use of its acquired assets. The idea was first proposed by Penrose (1959) in the theory of firm diversification and further discussed by Teece (1980) within the context of firms undertaking FDI. Both authors argue that indivisible firm-specific assets could yield economies of

scope. It occurs when these assets are used as a common resource in more than one production process. As the firm expands and utilizes common resources better, it achieves greater efficiency.

Teece (1980) identifies indivisibilities associated with information. It could be illustrated by the acquisition of Columbia Pictures by Sony in 1989 and MCA Universal Studios by Matsushita in 1990. In this case, Japanese firms acquired US firms to enter into the US movie-making industry. Long before entering the movie-making industry, Sony and Matsushita had entered the US electronics manufacturing industry by building new plants and expanding existing plants and through AM. In undertaking FDI and in operating in the US market, both Japanese firms must have gained valuable information, which would have been useful in acquiring US firms in the movie-making industry.[48] Hence, Sony and Matsushita could have used information as an indivisible asset to undertake AM FDI in a different industry.

Besides information as an indivisible asset, physical assets could also be imperfectly divisible. For example, in the year that Bridgestone Corporation of Japan acquired Firestone, Bridgestone expanded its plant.[49] The expansion in plant facilities raised the production of synthetic rubber, which is a core product of Firestone. To optimize resource use, firms jointly undertake AM FDI with FDI in other entry modes.

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[48] The ITA records 21 FDI projects by Sony and 32 FDI projects by Matsushita in the US electronics manufacturing industry priori to the acquisition of Columbia Pictures by Sony in 1989 and MCA Universal Studio by Matsushita in 1990.

[49] Nevin (1990) notes the acquisition and merger of Firestone by Bridgestone in 1988 was preceded by a joint venture with Firestone.

As firms undertake AM FDI they acquire imperfectly divisible assets from which they undertake other types of FDI to optimize their use. As a result, AM FDI and other types of FDI are likely to be correlated. Therefore, we consider Japanese FDI in AM jointly with other types of FDI in examining the impact of unequal access to bank credit and relative wealth on Japanese FDI into the United States.

Japanese FDI in the United States that surged in the 1980s can be explained by the increase in relative wealth of Japanese firms as Japan experienced an appreciating exchange rate and rising stock prices. Froot and Stein (1991) propose the relative wealth hypothesis by comparing the behavior of different capital flows in the United States using real exchange rate as an explanatory variable. They show the value of the US dollar to be significantly correlated with FDI flows. Among various types of FDI, the coefficient estimate on AM shows the largest magnitude. As the foreign currency appreciates against the US dollar, foreign firms can bid aggressively for US firms and expand their US operations quickly through AM FDI. Hence, an appreciating foreign currency or rising relative wealth could exert a greater effect on AM FDI than FDI in other entry modes.

Klein and Rosengren (1994) include in the measure of relative wealth the stock market values of foreign countries relative to the United States. Following Froot and Stein (1991), the effect of the rise in relative stock prices could be greater on AM FDI than non-AM FDI. As Oster (1990) reasons, firms prefer an AM when there are “bargains”. It occurs when stock prices of

target firms are depressed making an AM more attractive than establishing a New Plant or entering a Joint Venture. Chatterjee (1990) hypothesizes that large firms can take advantage of high stock prices by exchanging it for the acquired firm's stock. The exchange of the investing firm's high price stocks for the acquired firm's stock provides an additional method of financing AM FDI apart from cash. However, Blonigen (2005) finds that evidence of larger relative wealth effect on AM FDI than other types of FDI largely inconclusive.

The effect of relative wealth on AM FDI may be inconclusive because acquiring firms do not always choose to pay for the acquired firms using stocks. Faccio and Masulis (2005) examine the choice of payment methods in European AMs. They reason that the higher price of acquiring firms' stocks may not result in more AM FDI because stock payments have advantages and disadvantages. On one hand, stock payment for AM FDI allow an acquiring firm to overcome its financing constraint that arises from the firm's limited debt capacity. This implies rising relative wealth would have a greater impact on AM FDI than other types of FDI. On the other hand, stock payment for AM FDI could dilute corporate control so it is an unattractive payment option for an acquiring firm who desires to preserve corporate control. In this case, higher relative wealth would not have a greater effect on AM FDI than other types of FDI.

In examining financing options of European AM, Faccio and Masulis (2005) also reason that cash financing of AM FDI is more likely when an investing firm has special access to bank borrowing due to close firm-bank

relationship. This may be the case in Japan as firms traditionally maintain a close and long-term relationship with a particular bank known as the main bank from whom they obtain their largest share of borrowings. Besides providing firms with loans, the main bank is also the firm's principal shareholder. Since the main bank holds sufficient equity of the firm, it easily exchanges information and maintains close ties with the firm (Aoki, Patrick and Sheard, 1994).

Because of the close firm-bank relationship in Japan, the banks occupy an important position in financing investments. A decline in the financial health of banks could severely affect Japanese firms' ability to undertake investments. According to Hoshi and Kashyap (1999), trouble in the Japanese banking industry began with the deregulation of the financial markets in the 1980s. The introduction of non-bank intermediaries led to heightened competition. When the banks lost high quality borrowers in a short time, they responded by moving into riskier ventures with excessive lending to the manufacturing and real estate sectors. The escalating prices of the real estate and the stock market fueled further risk-taking by the banks as well as their borrowers. Together with lax supervision of banks, non-performing loans began to accumulate. When the asset price bubble burst in 1990, the Japanese banks suffered severely from heavy loan losses resulting in the deterioration of the Japanese banks' financial position.

When Japanese firms' access to bank credit declined, Klein, Peek and Rosengren (2002) show that Japanese FDI in the United States significantly

decreased. We examine both relative access to credit and relative wealth hypotheses by extending Klein, Peek and Rosengren (2002) to include two positively correlated modes of market entry. They are FDI in AM and FDI in other entry modes which we denote as non-AM.[50]

7.3 FDI Data and the Bivariate Zero-inflated Negative Binomial Model

Our sample consists of all firms listed in the first section of the Japan Company Handbook (JCH) with at least one FDI in the United States from 1987 to 1994. Each firm has as their main bank one of the 11 Japanese banks. We follow Klein, Peek and Rosengren (2002) who identify the eleven banks as the Industrial Bank of Japan, Dai-Ichi Kangyo Bank, Sakura Bank, Mitsubishi Bank, Fuji Bank, Sumitomo Bank, Sanwa Bank, Tokai Bank, Asahi Bank, Long-Term Credit Bank and Daiwa Bank. Each bank is the firm's main bank if it is listed in the JCH as the first bank among the firm's reference banks. From 1987 to 1994, 317 firms with at least one FDI in the United States in the JCH are associated with one of the 11 banks. These firms invested in 94% of all FDI projects in the United States.

We construct a data set with 2,057 observations from 1987 to 1994. Each observation records the number of FDI projects that a firm undertakes for a given year. The number of FDI projects that a firm undertakes is

[50] Non-AM denotes FDI entry modes that are classified by the International Trade Administration (ITA) as new plants, joint ventures, plant expansion, equity increase, real estate and others. The various modes of FDI are defined in the ITA publication.

compiled from the United States International Trade Administration (ITA) publication, "Foreign Direct Investment in the United States: Transactions." Because of missing observations on the values of FDI projects in the ITA publication, we use observations on the number of FDI projects in examining the firm-level Japanese FDI in the United States.[51]

The FDI data have 627 non-zero observations. Each observation records the number of FDI projects undertaken by a firm which varies from one to seventeen. A total of 1,070 FDI projects were undertaken by 317 firms from 1987 to 1994. Of the 1,070 FDI projects, 274 are AMs. The remaining 796 FDI projects which we categorize as non-AM FDI are classified by the ITA as new plants, plant expansion, joint venture, real estate, equity increase and others. It is not every year that the ITA records a firm as having an FDI project. When the ITA has no record of a firm having an FDI project for the year, we record the observation for the firm as a zero. From a sample size of 2,057 observations for total FDI projects of a firm, 1,430 observations are zeros constituting 69.5% of all the observations. For AM FDI, 89.4% of 2,057 observations are zeros with the sample mean and variance 0.13 and 0.43 respectively; and for non-AM FDI 75.6% of 2,057 observations are zeros with the sample mean and variance 0.39 and 0.95 respectively. There is evidence of overdispersion in the data with high proportions of zero counts since the sample variances exceed the sample means. To account for overdispersion, we

[51] The ITA also lists the name and nationality of the foreign investor and the type of investment indicating entry modes from 1973 to 1994. Following Klein, Peek and Rosengren (2002), we use only data from 1987 to 1994.

use the bivariate negative binomial model considering the excess zeros in the observations.

We distinguish among firms according to their intention to invest in the United States by defining a partially observable binary random variable D_i:

$$(7.1) \quad D_i = \begin{cases} 0 & \text{if firm } i \text{ does not intend to invest in the United States; and} \\ 1 & \text{if firm } i \text{ intends to invest in the United States.} \end{cases}$$

Following Wang (2003), P_{0i} is the probability that firm i does not intend to invest in the United States and it could be expressed as:

$$(7.2) \quad P_{0i} \equiv P(D_i = 0) = \frac{\exp(\tilde{\beta}' Z_i)}{1 + \exp(\tilde{\beta}' Z_i)} \equiv \text{logit}\,(\tilde{\beta}' Z_i) \ ,$$

where P_{0i} is a logit function of a vector of regressors (Z_i) and $\tilde{\beta}$ is a vector of unknown parameters. P_{1i} is the probability that firm i intends to invest in the United States and is defined as:

$$(7.3) \quad P_{1i} \equiv P(D_i = 1) = 1 - P_{0i} \ .$$

If firm i does not intend to invest in the United States ($D_i = 0$) for a given year, there is no FDI project for the period. However, if firm i intends to invest ($D_i = 1$) and actually enters the US market, it can do so by AM FDI and/or non-AM FDI. Alternatively, the firm may have intended to invest but for one reason or another, it does not enter the US market for that year. Hence, denoting the observed number of FDI projects of firm i as Y_{ji} and the subscript j as $j=1$ for AM FDI and $j=2$ for non-AM FDI, then when $D_i = 0$

there are no FDI projects for firm *i*, i.e., $(Y_{1i}, Y_{2i}) \equiv (0,0)$, while when $D_i = 1$ (Y_{1i}, Y_{2i}) is assumed to follow a bivariate negative binomial distribution with mean and variance given by:

(7.4) $$E(Y_{ji} \mid X_i) = (1 - P_{0i})\lambda_{ji}$$

(7.5) $$Var(Y_{ji} \mid X_i) = (1 - P_{0i})\lambda_{ji}[1 + \lambda_{ji}(P_{0i} + \alpha^{-1})]$$

where $\lambda_{ji} = \exp(\beta_j' X_i)$ are the conditional rates of AM and non-AM FDI projects respectively given the firm's intention to undertake FDI, β_j (*j=1,2*) are two vectors of unknown parameters for AM and non-AM FDI respectively, X_i is a vector of regressors, and α is the dispersion parameter of the bivariate negative binomial distribution. According to the bivariate zero-inflated negative binomial model, the numbers of AM and non-AM FDI projects for a firm are positively correlated with the correlation coefficient defined by:

(7.6) $$\rho(Y_{1i}, Y_{2i}) = \frac{1 + \alpha P_{0i}}{\sqrt{(1 + \alpha P_{0i} + \alpha / \lambda_{1i})(1 + \alpha P_{0i} + \alpha / \lambda_{2i}}}$$

The maximum likelihood estimates are obtained using the EM and quasi-Newton algorithms.[52]

7.4 Determinants of FDI

Following Klein, Peek and Rosengren (2002), the regressors in equation 7.2 are the Moody's rating of the firm's main bank in the previous year, firm size, profits and relative wealth. These determinants affect the

[52] Please refer to Wang (2003) for details of the bivariate zero-inflated negative binomial model.

probability that a Japanese firm does not invest (P_{0i}) in the United States. Unlike Klein, Peek and Rosengren, however, we exclude macroeconomic variables that represent business cycles of the United States and Japan because we use firm level data instead of aggregated data. Moulton (1990) cautions the practice of including macroeconomic variables as regressors with firm-level data. He reasons that macro data with grouped structure used with micro data can lead to standard errors that are biased.

The financial health of the firm's main bank is measured by the rating according to Moody's long-term deposit ratings, which are, from best to worst, Aaa, Aa1, Aa2, Aa3, A1 and A2.[53] Except for the best rating of Aaa, each Moody's rating is assigned a dummy variable of one for that rating or zero otherwise. Hence, the coefficient of the dummy variable indicates the impact of the rating of the firm's main bank relative to the best rating of Aaa on the probability that the firm does not invest in the United States (P_{0i}). In other words, a positive coefficient would show a higher probability that a firm does not intend to invest in the United States when the firm's main bank has a rating lower than the best rating.

Besides the financial health of the firm's main bank, relative wealth of the firm determines P_{0i}. Relative wealth is calculated by multiplying the stock price index of the Japanese firm by the nominal US dollar-yen exchange rate

[53] Klein, Peek and Rosengren (2002) summarize Moody's long-term deposit ratings for the eleven banks from 1986 to 1994 (Table 2, page 670) including the lowest rating of A3. In our case, out of 2065 observations, there are only 8 observations in which a firm's main bank had a rating of A3. Because of the very small number of observations for a rating of A3, the coefficient of the dummy variable for A3 had a very large standard error. Hence, we exclude these observations in our analysis.

and dividing by the S&P 500 index. It captures the effects of exchange rate and relative stock price movements on P_{0i}. As explained in Froot and Stein (1991), monitoring cost makes external finance more costly than internal finance. While Japanese firms are willing to bear the cost of external funds in bidding for assets in the United States, they can place higher bids for US assets when the US dollar depreciates relative to the Japanese yen. When stock prices of Japanese firms increase relative to US stock prices, they contribute to higher relative wealth, which reduces P_{0i}. Thus relative wealth could be inversely related to P_{0i}.

As firm profitability is related to the availability of internal funds, it could affect P_{0i}. Internal funds generated from profits indicate sufficient firm-specific advantages that could lead to higher revenue and lower costs. Hence, firms undertaking FDI tends to be profitable. With profitability measured as the firm's profit-to-asset ratio, it is expected to be inversely related to P_{0i}.

The effect of firm size on P_{0i} considers the characteristics of the firm in explaining FDI. Among industrial countries, the size of the firm is an important determinant of horizontal FDI. Horizontal FDI occurs when Japanese firms invest in the United States to sell the same general line of products that they sell in Japan. To enter the US markets, Japanese firms need to gather information on US markets even though the information is freely available to US firms. Gathering information is costly. Together with the cost of complementary inputs, it implies that Japanese firms must have sufficient internal wealth or unused debt capacity collateralized with tangible assets to

bear the costs of undertaking FDI. All these indicate that Japanese firms which undertake FDI in the United States are usually large, dominating the Japanese markets with their economies of scale, marketing skills and technological advantages. With firm size measured as the logarithm of the inflation-adjusted value of the firm's assets, it would be inversely related to P_{0i}.

For firms that invest in the United States, we consider two positively correlated FDI entry modes of Japanese firms in the United States. They are AM FDI and non-AM FDI. Because assets are imperfectly divisible, Japanese firms acquire them in discrete amounts. As firms have the incentive to optimize the use of acquired indivisible assets, they undertake AM FDI jointly with other types of FDI.

Furthermore, it is possible for large and diversified Japanese firms to enter the US market in more than one industry using different modes of entry. Hennart and Park (1993) note that large Japanese firms operating in industries in which they own firm-specific advantages prefer to establish new plants. Without post-merger integration costs, higher efficiency is achieved. However, when large firms choose to diversify into industries in which they do not own sufficient advantages, they may acquire US firms for their brand names and market shares. Hence large and diversified firms can undertake multiple FDI projects in different industries using different modes of entry. With possible correlation between AM FDI and non-AM FDI, it is important to consider AM FDI and non-AM FDI jointly.

The conditional rate of firm *i*'s FDI in either mode of US market entry (λ_{ji}) is determined by the change in the rating of the firm's main bank and the annual changes in the firm's relative wealth, size and profitability. These determinants are included in the bivariate zero-inflated negative binomial model as regressors in equation 7.4. As in P_{0i} and for the reasons discussed above, we exclude the macroeconomic variables.[54]

Following Klein, Peek and Rosengren (2002), we examine how the weakness in the firm's main bank affects the rate of AM FDI and non-AM FDI using the changes in the Moody's ratings of the firm's main bank. We measure these changes using two dummy variables for single downgrade and multiple downgrades in the rating of the firm's main bank. The dummy variable for a single downgrade has a value of one if the rating of a firm's main bank is downgraded by one level in a given year and a value of zero otherwise. The dummy variable for multiple-downgrades has a value of one if the rating of a firm's main bank is downgraded by two or more levels in a given year and a value of zero otherwise. Downgrades in the rating of the firm's main bank should be negatively related to both $\lambda_{AM,i}$ or $\lambda_{non\_AM,i}$.

Consistent with our firm-level specification, we include three firm-level variables as determinants of the rates of AM FDI ($\lambda_{AM,i}$) and non-AM

[54] Klein, Peek and Rosengren (2002) consider the number of FDI per year of firms associated with each of the eleven Japanese banks to be determined by the following: the change in the Moody's rating of each bank; the change in the sum of profits of firms associated with each bank; and the change in relative wealth measured as the percentage change in the nominal Nikkei stock index minus the percentage change in the US S&P 500 stock index plus the percentage change in the US dollar-yen exchange rate. Klein, Peek and Rosengren focus on first differences in the variables in order to capture the impact of the changes in these variables – particularly the changes in the financial conditions of banks – on the changes in the pattern of FDI.

FDI ($\lambda_{non\_AM,i}$) namely, the annual changes in the firm's relative wealth, profitability and size. Following Froot and Stein's (1991) proposition in which a higher relative wealth allows Japanese firms to bid more aggressively for US assets, a higher relative wealth could increase the rates of FDI ($\lambda_{AM,i}$ and $\lambda_{non\_AM,i}$). For AM FDI, as mentioned above, the relationship is complicated by the use of stock payments in acquisition and mergers. This method of payment could be attractive for acquiring firms with high stock values. In this case, relative wealth may have a stronger effect on $\lambda_{AM,i}$ than $\lambda_{non\_AM,i}$. Payment by stocks, however, may come with the loss of corporate control. If preserving corporate control is important for the acquiring firm, relative wealth may have a weaker effect on $\lambda_{AM,i}$ than $\lambda_{non\_AM,i}$.

We include traditional theories' rationale on the effect of profitability and firm size on FDI. Profitable firms usually own sufficient firm-specific and internalization advantages that allow them to undertake FDI resulting in higher rates of FDI. When firms are profitable, it also provides firms with the option of using internal funds to finance FDI. Hence the change in firm profitability would be positively related to $\lambda_{AM,i}$ and $\lambda_{non\_AM,i}$.[55]

Among various entry modes, the effect of firm size could be larger and more significant on AM FDI than non-AM FDI. Hennart and Park (1993) find

[55] Profitability indicates the financial health of firms. Whether financially healthier firms will undertake more or less AM FDI than non-AM FDI is not clear in the FDI literature. Among various financing instruments, firms can choose to use debt, equity or free cash flow from profits to finance their FDI activities. In the case of firms in Japan, it is further complicated by the roles that main banks perform and the corporate structure within which firms operate. We expect profitability to have neither a larger or smaller effect for AM FDI than non-AM FDI.

Japanese firms that are more likely to enter the US market by AM tend to be diversified and large. Their results are consistent with Caves and Mehra (1986) who show that size of the foreign firm and diversity of its product range exert a positive and significant influence on the decision of non-US firms to acquire US firms.[56] Hence, changes in firm size could be positively related to $\lambda_{AM,i}$ and $\lambda_{non\_AM,i}$ but the effect is expected to be greater for $\lambda_{AM,i}$.

The data on bank ratings are from Moody's long-term deposit ratings. Data on firm characteristics are from the Pacific-Basin Capital Markets Databases (PACAP). The US dollar-yen exchange rate is from the International Financial Statistics. The S&P 500 index is from Bloomberg.

7.5 Empirical Results

Table 7.1 shows the log-likelihood statistic and regression estimates of the bivariate zero-inflated negative binomial model. The probability that a firm does not intend to undertake FDI in the United States (P_{0i}) is positively related to the dummy variables for the ratings of Aa1, Aa3, A1 and A2 at 5% and higher levels of significance. The estimates increase in magnitude as the ratings deteriorate indicating that a firm is not likely to have the intention to invest in the United States the worse the financial health of its main bank relative to the best rating. Furthermore, the probability that a firm does not intend to invest in the United States is negatively related to the firm's relative

[56] Firm size and diversity of product range to explain acquisition and merger FDI are used in Kogut and Singh (1988), Zejan (1990) and Brouthers and Brouthers (2000).

wealth and size at the 1% significance level as well as firm profitability at the 5% significance level. In other words, large firms and firms with high relative wealth are more likely to have the intention to invest in the United States. These results are consistent with the literature.

The average rate of FDI projects of a firm regardless of entry mode ($\lambda_{AM,i}$ and $\lambda_{non\_AM,i}$) is negatively related to multiple downgrades of a firm's main bank at the 1% level of significance. The magnitude of the estimates on multiple downgrades of the firm's main bank is larger for AM FDI than non-AM FDI although the difference is not statistically significant.[57] The result suggests that Japanese firms investing in the US market by AM are more dependent on bank loans than firms entering the US market in other modes of entry. These results are generally consistent with Klein, Peek and Rosengren (2002).

[57] The 95% confidence interval for AM estimate on multiple downgrades is (-1.485, -0.315) and for non-AM estimate, it is (-1.011, -0.349). The standardized difference between the estimates for AM and non-AM FDI is 0.64 indicating statistical insignificance of the difference between the estimates.

Table 7.1
Estimates of the Bivariate Zero-inflated Negative Binomial Model

Variable	Parameter Estimate	Standard Error	P-value
AM FDI (conditional on firm intending to invest in FDI)			
Constant	-1.5882	0.0648	0.0000
Single downgrade	-0.2234	0.1407	0.1124
Multiple downgrades	**-0.9006**	0.2983	**0.0025**
Change in relative wealth	0.0943	0.1860	0.6122
Change in profitability	**9.0717**	4.9439	**0.0665**
Change in firm size	**2.2335**	0.4332	**0.0000**
Non-AM FDI (conditional on firm intending to invest in FDI)			
Constant	-0.3481	0.0439	0.0000
Single downgrade	-0.0820	0.0895	0.3599
Multiple downgrades	**-0.6803**	0.1690	**0.0001**
Change in relative wealth	**0.3267**	0.1248	**0.0089**
Change in profitability	-1.2631	2.7923	0.6510
Change in firm size	-0.1433	0.3390	0.6726
Probability that firm does not intend to invest in FDI			
Constant	7.4908	0.0985	0.0000
Aa1	**0.7718**	0.2074	**0.0002**
Aa2	-0.2460	0.7509	0.7432
Aa3	**0.7600**	0.1835	**0.0000**
A1	**0.8304**	0.2627	**0.0016**
A2	**0.9290**	0.4625	**0.0446**
Relative wealth	**-0.5817**	0.0160	**0.0000**
Firm profitability	**-7.2824**	3.5836	**0.0421**
Firm size	**-0.9533**	0.0081	**0.0000**
Number of firms			317
Log-likelihood			-2352
Sample average correlation			0.3516

Notes: Relative wealth is the log of the firm's market value plus the log of the US dollar-Japanese yen exchange rate minus the log of the S&P 500 index. Firm profitability is the ratio of the firm's profit to assets. Firm size is the log of the firm's assets deflated by the wholesale price index. The probability of the firm intending to invest in the United States equals one minus the probability of a firm not intending to invest in the United States. Numbers in brackets are the standard errors.

The firm's average rate of AM FDI is significantly influenced by changes in firm profitability and firm size. The results suggest Japanese firms undertaking AM FDI in the United States tend to be large and profitable implying Japanese acquisitions of US firms can be explained by industrial

organization motives of FDI. While industrial organization motives of FDI may apply more to non-AM FDI, specifically new plant FDI; our sample of non-AM FDI include other types of FDI such as joint ventures, increase in equity, expansion of plant, real estate and an "other" category besides new plant FDI.[58] New plant FDI in the sample constitutes 21.2% of non-AM FDI and the relatively small proportion of 21.2% may not be enough for industrial organization motives to exert a significant effect on non-AM FDI.

Changes in relative wealth of a firm do not influence the firm's average rate of AM FDI. Favorable exchange rates and high stock prices do not lead to higher rates of Japanese FDI in AM. Although the results are inconsistent with Oster (1990) and Chatterjee (1990), they are consistent with Faccio and Masulis (2005). While higher relative price of stocks encourage payment for acquisitions by stocks, stock payment can dilute shareholders' voting power. The desire to preserve control of the firm discourages stock payment. Moreover, cross-shareholding arrangement prevalent among Japanese firms implies ownership of firms in industrial groupings is highly concentrated among a few large firms. This makes payment using stocks an unlikely method. To the extent that Japanese firms use cash generated from profits and bank loans rather than stocks to pay for acquisition of US firms,

[58] Empirical support that industrial organization motives of FDI apply more to new plant FDI than AM FDI for Japanese FDI in the United States is found in Hennart and Park (1993).

our results show that preserving corporate control in Japanese firms is important even as they seek complementary assets in the United States.[59]

In contrast, the average rate of non-AM FDI is significantly influenced by relative wealth but insignificantly affected by firm size and profitability. It suggests that Japanese firms regardless of size and profitability undertake non-AM FDI and when they do, they take advantage of rising relative wealth to expand operations in the US markets. In the case of new plants and joint ventures, investing firms purchase land, equipment and machinery before production can begin. When the exchange rate moves in favor of investing firms, the increased relative wealth allows investing firms to use the same amount of home currency to purchase more inputs in the foreign country. The results are consistent with Froot and Stein (1991).

Between AM FDI and other types of FDI, the average correlation coefficient is 0.35 indicating Japanese firms that engaged in AM FDI also engaged in other types of FDI. When Japanese firms make an acquisition, they find it necessary to engage in other types of FDI in order to reap efficiency gains because of asset indivisibility. As a Japanese firm acquires a US firm or a division of a US firm the expansion is facilitated either by a new plant, a

[59] Discussion in Ballon and Tomita (1988) suggest that corporate financing by Japanese firms in the 1980s use mainly internal funds, debt and equity. Equity financing in Japan developed along vertical and horizontal lines of business interdependence. Firms are related through affiliation in the industrial grouping with stable cross-holdings of shares prevalent throughout the system. Considering the corporate structure of firms in Japan, it implies that stock payment for foreign acquisitions of firms is rare. Minebea, a manufacturer of electronic and machinery components and one of the FDI firms in sample; financed their acquisitions in the mid-1980s by raising funds in the domestic capital markets (Ballon and Tomita, 1988). Also cited in (Ballon and Tomita, 1988), large manufacturing firms in the 1980s, among them Nippon Steel, offered shares in the Japanese stock market to raise cash.

plant expansion or a new office building to optimize production. Incidentally, the positive correlation between AM FDI and non-AM FDI could imply entry modes into different industries using information and knowledge as part of indivisible firm specific assets that were first acquired when Japanese firms entered the US market (Teece, 1980). As in our earlier illustration, these large and diversified Japanese conglomerates own firm-specific advantages that enable them to expand into foreign markets by establishing new plants. At the same time, these large and diversified Japanese conglomerates may diversify into other industries in which they do not possess sufficient advantages by acquiring US firms.

7.6 Conclusions

We re-examine the impact of relative wealth and relative access to bank credit on Japanese FDI in the United States using firm level data. Distinguishing between AM FDI and non-AM FDI that are positively correlated with one another, we use the bivariate zero-inflated binomial model. Our results show that multiple rating downgrades of the firm's main bank significantly reduce a firm's rate of FDI regardless of FDI entry modes. While firms' unequal access to credit hampers FDI regardless of market entry modes, relative wealth that exerts a significant impact on the rate of non-AM FDI but it does not significantly affect the rate of Japanese AM FDI in the United States. However, AM FDI is significantly influenced by firm size and profitability implying that Japanese firms acquiring US firms between 1987

and 1994 are the largest and most profitable business enterprises, possessing sizable financial resources to expand operations in the United States.

Because Japanese firms that undertake AM FDI are sizable and profitable, relative wealth increase allowing investing firms to place higher bids on US assets is insignificant. The results suggest that profits from firms generated the cash flow for financing Japanese FDI projects in the United States. With sufficient internal funds, firms become less reliant on external funds and relative wealth changes do not affect FDI activities. While stocks can be used as an alternative method of payment for AM FDI, stock payment in Japan is rarely used. As firms in Japan operate within industrial groupings with stable cross-holding of shares among member firms, the network of ownership concentration makes stock payment of AM FDI unlikely. If stocks were used to pay for an acquisition it would require approval from the board of directors of member firms. Notwithstanding the inter-locking relationship among firms within industrial groupings, the results also suggest that preserving corporate control remains an inherent feature of the way industrial groupings of firms in Japan operate.

Conversely Japanese non-AM FDI in the United States is not affected by firm size and profitability but they are significantly influenced by changes in relative wealth. When the Yen appreciates against the US dollar, firms establish new plants and joint ventures by using the same amount of Japanese Yen to purchase directly more of the complementary inputs in the US market. The result is consistent with Froot and Stein (1991) explaining why an

increase in relative wealth leads to higher levels of non-AM FDI in imperfect markets. In contrast, Japanese AM FDI involves indirectly purchasing complimentary inputs when Japanese firms acquire US firms. Because interlocking share ownership and corporate control are important concerns of Japanese firms, Japanese AM FDI is not influenced by relative wealth changes. The result is consistent with Faccio and Masulis (2005) indicating corporate control concerns of issuing equity in AM FDI.

The results of the study suggests that Japanese AM FDI and non-AM FDI in the United States are motivated by contrasting explanations and they highlight the importance of examining AM FDI jointly with other types of FDI. As the survey of FDI literature in Blonigen (2005) reveals, issues on FDI are complex enough that the determinants of FDI may or may not become important under different conditions. As such, testing broad and general hypothesis using aggregated data would not reveal when determinants of FDI matter and when they do not matter. Our results show the importance of testing relative access to credit and relative wealth at the firm level jointly considering AM FDI and non-AM FDI.

CHAPTER EIGHT

CONCLUSIONS

8.1 Concluding Discussion

The thesis examines Japanese FDI flows in the United States between 1987 and 1994. Using the US dollar - Japanese yen exchange rate and the Japanese firm's relative stock price as an index of relative wealth, we test the relative wealth hypothesis on Japanese FDI in the United States. Because the relative wealth hypothesis cannot fully explain the sharp drop in Japanese FDI after 1990, we test the relative access to credit hypothesis on bank-dependent firms to determine the decline of Japanese FDI in the United States.

Using firm-level count data we test for effects of relative wealth and relative access to credit using the zero-inflated Poisson (ZIP), the zero-inflated negative binomial (ZINB) and the bivariate zero-inflated negative binomial (BZINB) models. The count data models differ from previous approaches of examining effects of relative wealth and relative access to credit on FDI by distinguishing among firms' intention to undertake FDI. To differentiate a firm's intention to undertake FDI, we use a latent variable that contributes a binary outcome. Two distinct stages constitute the firm's intention to undertake FDI. The first stage occurs when the firm shows no intention to engage in FDI and FDI typically will not occur. When conditions become favorable, the firm plans to undertake FDI and moves to the second stage where the firm will either undertake FDI. For firms without the intention to

engage in FDI, we estimate the probability that a firm does not intend to engage in FDI. For firms with the intention to engage in FDI, we estimate a quantity outcome that shows a firm's rate of FDI.

The firm-level evidence from the univariate ZIP and ZINB models show that the firm's rate of FDI is significantly affected by the multiple rating downgrades of the firm's main bank. Consistent with Klein, Peek and Rosengren (2002), the result holds even after considering firms with the highest 20% and lowest 80% of bonds-to-liabilities ratio and firms that undertake FDI in multiple years. However, unlike Klein, Peek and Rosengren (2002), the change in relative wealth significantly affects the rate of the firm's FDI for all firms in our sample and for firms with the lowest 80% of bonds-to-liabilities ratio. The use of aggregate data in the measure of relative wealth could explain the difference in results. Aggregation results in the lost of heterogeneous firm effects that could lead to insignificant estimates. Hence, the evidence at the firm level shows support of Froot and Stein's (1991) contention that relative wealth affects the firm's rate of FDI.

We also examine the relative access to credit hypothesis and the relative wealth hypothesis using a bivariate zero-inflated negative binomial (BZINB) model. The BZINB model considers the positively correlated bivariate dependent variables which are the number of acquisition and merger (AM) FDI and non-AM FDI projects undertaken by a firm. Because of imperfectly divisible asset, investing firms undertake other types of FDI as

they engage in AM FDI in order to optimize resource use. Hence FDI in other entry modes complements FDI in AM.

Regardless of market entry modes, we find that Japanese firms' unequal access to credit hampers FDI. However, relative wealth of Japanese firms influences only the rate of a firm's non-AM FDI but not the firm's rate of AM FDI. Japanese AM FDI in the United States is significantly influenced by firm size and profitability implying Japanese firms that acquire US firms between 1987 and 1994 are the largest and most profitable business enterprises. By possessing sizable financial resources, it enables them to expand operations in the United States. The results are consistent with traditional theories that show Japanese FDI firms are motivated by US firm-specific assets that complement their intention to expand operations in the United States.

The results also show the relative wealth measure that includes relative price appreciation of Japanese stocks does not affect Japanese AM FDI. While stock payment as a form of financing AM FDI can be used to pay for acquisitions, the practice is not widely adopted by firms in Japan.

We show in both empirical papers results that are broadly consistent with hypotheses in Froot and Stein (1991) and Klein, Peek and Rosengren (2002). However we find Japanese AM FDI and non-AM FDI in the United States are motivated by contrasting explanations when they are jointly examined jointly in the BZINB model. The contrasting results between AM and non-AM FDI highlight the importance of how different types of FDI can

respond to the same conditions in varying degrees of magnitude and significance.

8.2 Future Research

The investigation of Japanese FDI in the United States uses models for cross-section regression on univariate and bivariate count dependent variables. These regressions are performed on firm-level data of 317 firms over an 8-year period. Given the panel nature of the FDI data set, future research can consider using count panel models. The key advantage in panel data models is that they allow for more general types of individual heterogeneity, thereby distinguishing among the different types of non-independence. One such type of non-independence occurs between successive events. For example, whether a firm would undertake a FDI project depends on whether the firm has undertaken FDI projects in the previous periods. The experience from engaging in a FDI project, makes engaging in another FDI project in future periods a highly likely undertaking.

Another type of non-independence arises from units sampled from a heterogeneous population. In the case of Japanese firms operating within industrial groupings, a manufacturing firm that undertakes FDI may require supplies of manufacturing components from another firm within the same industrial grouping. Hence the firm that supplies manufacturing components may undertake a FDI project in the United States. The FDI projects that are undertaken by firms support the same manufacturing process of final goods

and the observed FDI projects in the United States did not occur independently of each other. With panel data models, one can additionally include a firm-specific term for unobserved firm-specific propensity to engage in FDI. There are definite benefits from using panel models and we will explore this line of research as an extension of our current research.[60]

Apart from introducing a dimension of time in the regression model, one can consider the spatial distribution of Japanese FDI firms in the United States. The location of FDI activities in neighboring regions can affect the decisions of firms to locate FDI activities within close proximity.[61] This spatial dependence of existing FDI activities can influence firms' decision to locate FDI activities. Because of positive spillover effects, agglomeration can lead to higher levels of FDI in adjacent states. However, if competition for resources results in the displacement of FDI in neighboring regions, agglomeration effects do not spill over. When this happens FDI located in a region may negatively influence the location of FDI in neighboring regions. Furthermore, considerations of topographical characteristics such as mountain ranges and rivers could affect the desirability of locating FDI in neighboring states.

[60] We thank an anonymous examiner of the thesis for suggesting the use of count panel models.
[61] Examples of studies on location decisions of FDI firms include Head, Ries and Swenson (1995), Co and List (2004) and Blonigen, Ellis and Fausten (2005).

APPENDIX A

LIST OF JAPANESE FIRMS IN SAMPLE

	Japanese Firms	Industry
1	ADVANTEST CORP.	Manufacturing --- Electric Machinery
2	AISIN SEIKI	Manufacturing --- Transportation Equipment
3	AIWA	Manufacturing --- Electric Machinery
4	AJINOMOTO CO. INC.	Manufacturing --- Foods
5	AKEBONO BRAKE INDUSTRY	Manufacturing --- Transportation Equipment
6	ALL NIPPON AIRWAYS CO. LTD.	Transportation --- Air
7	ALPS ELECTRIC	Manufacturing --- Electric Machinery
8	AMADA	Manufacturing --- Machinery
9	AMANO	Manufacturing --- Machinery
10	AOKI CORPORATION	Construction
11	ASAHI BREWERIES	Manufacturing --- Foods
12	ASAHI DENKA KOGYO K.K.	Manufacturing --- Chemicals
13	ASAHI DIAMOND INDUSTRIAL	Manufacturing --- Machinery
14	ASAHI GLASS	Manufacturing --- Glass and Ceramics
15	ASICS CORPORATION	Manufacturing --- Other Manufacturing
16	BANDO CHEMICAL INDUSTRIES	Manufacturing --- Rubber
17	BRIDGESTONE CORP.	Manufacturing --- Rubber
18	BROTHER INDUSTRIES	Manufacturing --- Machinery
19	C. ITOH & CO. LTD.	Wholesale
20	CANON INC.	Manufacturing --- Electric Machinery
21	CASIO COMPUTER	Manufacturing --- Electric Machinery
22	CHUGAI PHARMACEUTICAL	Manufacturing --- Chemicals
23	CITIZEN WATCH	Manufacturing --- Precision Equipment
24	CKD	Manufacturing --- Machinery
25	CLARION	Manufacturing ---

	Japanese Firms	Industry
		Electric Machinery
26	DAI NIPPON PRINTING	Manufacturing --- Other Manufacturing
27	DAICEL CHEMICAL INDUSTRIES	Manufacturing --- Chemicals
28	DAIDO STEEL	Manufacturing --- Iron and Steel
29	DAIEI INC., THE	Retail
30	DAIFUKU CO. LTD.	Manufacturing --- Machinery
31	DAIHATSU MOTOR	Manufacturing --- Transportation Equipment
32	DAIKEN TRADE & INDUSTRY CORP.	Manufacturing --- Other Manufacturing
33	DAIKIN INDUSTRIES	Manufacturing --- Machinery
34	DAINIPPON INK & CHEMICALS	Manufacturing --- Chemicals
35	DAINIPPON SCREEN MFG.	Manufacturing --- Precision Equipment
36	DAISHOWA PAPER MFG.	Manufacturing --- Pulp and Paper
37	DENKI KAGAKU KOGYO	Manufacturing --- Chemicals
38	DESCENTE	Manufacturing --- Textiles
39	DOWA MINING	Manufacturing --- Nonferrous Metals
40	D'URBAN INC.	Manufacturing --- Textiles
41	DYNIC CORP.	Manufacturing --- Textiles
42	EBARA CORPORATON	Manufacturing --- Machinery
43	EISAI CO. LTD.	Manufacturing --- Chemicals
44	EZAKI GLICO CO. LTD.	Manufacturing --- Foods
45	FANUC LTD.	Manufacturing --- Machinery
46	FIRST BAKING CO. LTD.	Manufacturing --- Foods
47	FUJI ELECTRIC	Manufacturing --- Electric Machinery
48	FUJI HEAVY INDUSTRIES	Manufacturing --- Transportation Equipment
49	FUJI OIL	Manufacturing --- Foods
50	FUJI PHOTO FILM	Manufacturing --- Chemicals
51	FUJI SPINNING	Manufacturing ---

	Japanese Firms	Industry
		Textiles
52	FUJIKURA	Manufacturing --- Nonferrous Metals
53	FUJIREBIO INC.	Manufacturing --- Chemicals
54	FUJISAWA PHARMACEUTICAL	Manufacturing --- Chemicals
55	FUJITA CORPORATION	Construction
56	FUJITEC	Manufacturing --- Machinery
57	FUJITSU	Manufacturing --- Electric Machinery
58	FURUKAWA ELECTRIC	Manufacturing --- Nonferrous Metals
59	GENERAL SEKIYU	Manufacturing --- Petroleum
60	GREEN CROSS	Manufacturing --- Chemicals
61	GUNZE LTD.	Manufacturing --- Textiles
62	HANWA CO. LTD.	Wholesale
63	HAZAMA-GUMI CORPORATION	Construction
64	HITACHI CABLE	Manufacturing --- Nonferrous Metals
65	HITACHI CHEMICAL	Manufacturing --- Chemicals
66	HITACHI LTD.	Manufacturing --- Electric Machinery
67	HITACHI METALS	Manufacturing --- Iron and Steel
68	HITACHI SEIKI	Manufacturing --- Machinery
69	HITACHI ZOSEN CORP.	Manufacturing --- Transportation Equipment
70	HONDA MOTOR	Manufacturing --- Transportation Equipment
71	HONSHU PAPER	Manufacturing --- Pulp and Paper
72	HORIBA LTD.	Manufacturing --- Electric Machinery
73	HOUSE FOOD INDUSTRIAL	Manufacturing --- Foods
74	HOYA CORP.	Manufacturing --- Glass and Ceramics
75	IBIDEN CO. LTD.	Manufacturing --- Chemicals
76	ICHIKOH INDUSTRIES	Manufacturing --- Transportation Equipment
77	INAGEYA	Retail
78	INAX CORP.	Manufacturing --- Glass and Ceramics

	Japanese Firms	Industry
79	ISETAN	Retail
80	ISUZU MOTORS	Manufacturing --- Transportation Equipment
81	ITOHAM FOODS INC.	Manufacturing --- Foods
82	ITO-YOKADO	Retail
83	IWATA AIR COMPRESSOR MFG.	Manufacturing --- Machinery
84	IWATANI INT'L CORP.	Wholesale
85	JAPAN AIRLINES CO. LTD.	Transportation --- Air
86	JAPAN METALS & CHEMICALS	Manufacturing --- Iron and Steel
87	JAPAN PULP & PAPER	Wholesale
88	JAPAN STEEL WORKS	Manufacturing --- Machinery
89	JAPAN STORAGE BATTERY	Manufacturing --- Electric Machinery
90	JAPAN SYNTHETIC RUBBER CO. LTD.	Manufacturing --- Chemicals
91	JUSCO CO. LTD.	Retail
92	KAGOME CO. LTD.	Manufacturing --- Foods
93	KAJIMA CORPORATION	Construction
94	KAKEN PHARM.	Manufacturing --- Chemicals
95	KAMIGUMI	Transportation --- Warehousing and Wharfing
96	KANEBO	Manufacturing --- Textiles
97	KANSAI ELE POWER	Electric Power and Gas
98	KAO CORP.	Manufacturing --- Chemicals
99	KAWASAKI HEAVY IND.	Manufacturing --- Transportation Equipment
100	KAWASAKI KISEN	Transportation --- Shipping
101	KAWASAKI STEEL	Manufacturing --- Iron and Steel
102	KAYABA INDUSTRY	Manufacturing --- Transportation Equipment
103	KIKKOMAN CORP.	Manufacturing --- Foods
104	KIMMON MFG.	Manufacturing --- Precision Equipment
105	KIORITZ	Manufacturing --- Machinery
106	KIRIN BREWERY	Manufacturing --- Foods
107	KOBE STEEL	Manufacturing --- Iron and Steel

	Japanese Firms	Industry
108	KOITO MFG.	Manufacturing --- Transportation Equipment
109	KOMATSU	Manufacturing --- Machinery
110	KOMATSU FORKLIFT	Manufacturing --- Transportation Equipment
111	KONICA CORP.	Manufacturing --- Chemicals
112	KOYO SEIKO	Manufacturing --- Machinery
113	KUBOTA CORPORATION	Manufacturing --- Machinery
114	KUMAGAI GUMI CO. LTD.	Construction
115	KURARAY	Manufacturing --- Textiles
116	KUREHA CHEMICAL	Manufacturing --- Chemicals
117	KYOCERA CORP	Manufacturing --- Electric Machinery
118	KYOTARU CO.	Retail
119	KYOWA HAKKO KOGYO CO.	Manufacturing --- Chemicals
120	LION	Manufacturing --- Chemicals
121	MAKINO MILLING MACHINE	Manufacturing --- Machinery
122	MAKITA ELECTRIC WORKS LTD.	Manufacturing --- Electric Machinery
123	MARUBENI CORP.	Wholesale
124	MARUDAI FOOD CO. LTD.	Manufacturing --- Foods
125	MATSUO BRIDGE	Manufacturing --- Metal Products
126	MATSUSHITA ELEC. IND.	Manufacturing --- Electric Machinery
127	MATSUSHITA ELECTRIC WORKS	Manufacturing --- Electric Machinery
128	MAZDA MOTOR CORP.	Manufacturing --- Transportation Equipment
129	MEIJI SEIKA	Manufacturing --- Foods
130	MINEBEA CO. LTD.	Manufacturing --- Machinery
131	MINOLTA CAMERA CO. LTD.	Manufacturing --- Precision Equipment
132	MISAWA HOMES	Construction
133	MITSUBISHI CHEMICAL INDUSTRIES	Manufacturing --- Chemicals
134	MITSUBISHI CORP.	Wholesale
135	MITSUBISHI ELECTRIC	Manufacturing --- Electric Machinery

	Japanese Firms	Industry
136	MITSUBISHI ESTATE	Real Estate
137	MITSUBISHI HEAVY IND.	Manufacturing --- Transportation Equipment
138	MITSUBISHI RAYON	Manufacturing --- Textiles
139	MITSUBISHI STEEL MFG.	Manufacturing --- Iron and Steel
140	MITSUBOSHI BELTING	Manufacturing --- Rubber
141	MITSUI & CO.	Wholesale
142	MITSUI ENG & SHIPBUILDING	Manufacturing --- Transportation Equipment
143	MITSUI MINING & SMELTING	Manufacturing --- Nonferrous Metals
144	MITSUI MINING CO. LTD.	Agriculture --- Mining
145	MITSUI O.S.K. LINES	Transportation --- Shipping
146	MITSUI PETROCHEMICAL INDUSTRIES LTD.	Manufacturing --- Chemicals
147	MITSUI TOATSU CHEMICALS	Manufacturing --- Chemicals
148	MITSUI WAREHOUSE CO. LTD.	Transportation --- Warehousing and Wharfing
149	MITSUKOSHI	Retail
150	MIZUNO CORPORATION	Manufacturing --- Other Manufacturing
151	MUTOH INDUSTRIES	Manufacturing --- Electric Machinery
152	NACHI-FUJIKOSHI CORP.	Manufacturing --- Machinery
153	NEC CORP.	Manufacturing --- Electric Machinery
154	NGK INSULATORS	Manufacturing --- Glass and Ceramics
155	NGK SPARK PLUG	Manufacturing --- Glass and Ceramics
156	NHK SPRING	Manufacturing --- Transportation Equipment
157	NICHII CO. LTD.	Retail
158	NICHIMEN CORP.	Wholesale
159	NICHIREI	Manufacturing --- Foods
160	NIFCO INC.	Manufacturing --- Transportation Equipment
161	NIHON KOHDEN CORP.	Manufacturing --- Precision Equipment
162	NIKKO	Manufacturing --- Machinery
163	NIKKO SECURITIES	Financial --- Securities

	Japanese Firms	Industry
164	NIPPON COLUMBIA	Manufacturing --- Electric Machinery
165	NIPPON EL. GLASS	Manufacturing --- Glass and Ceramics
166	NIPPON FLOUR MILLS	Manufacturing --- Foods
167	NIPPON LIGHT METAL	Manufacturing --- Nonferrous Metals
168	NIPPON METAL INDUSTRY	Manufacturing --- Iron and Steel
169	NIPPON OIL CO. LTD.	Manufacturing --- Petroleum
170	NIPPON PAINT	Manufacturing --- Chemicals
171	NIPPON SANSO	Manufacturing --- Chemicals
172	NIPPON SHEET GLASS	Manufacturing --- Glass and Ceramics
173	NIPPON SHINPAN	Financial --- except Banks, Securities and Insurance
174	NIPPON SHOKUBAI CO. LTD.	Manufacturing --- Chemicals
175	NIPPON STEEL	Manufacturing --- Iron and Steel
176	NIPPON SUISAN	Agriculture --- Fishery
177	NIPPON SYNTH CHEMICAL	Manufacturing --- Chemicals
178	NIPPON YUSEN	Transportation --- Shipping
179	NIPPON ZEON	Manufacturing --- Chemicals
180	NIPPONDENSO CO. LTD	Manufacturing --- Transportation Equipment
181	NISSAN CHEMICAL INDUSTRIES	Manufacturing --- Chemicals
182	NISSAN MOTOR	Manufacturing --- Transportation Equipment
183	NISSHIN STEEL	Manufacturing --- Iron and Steel
184	NISSHINBO INDUSTRIES	Manufacturing --- Textiles
185	NISSHO-IWAI	Wholesale
186	NISSIN FOOD PRODUCTS	Manufacturing --- Foods
187	NITSUKO	Manufacturing --- Electric Machinery
188	NITTO BOSEKI	Manufacturing --- Textiles
189	NITTO ELECTRIC INDUSTRIAL	Manufacturing --- Electric Machinery

	Japanese Firms	Industry
190	NOMURA SECURITIES	Financial --- Securities
191	NTN TOYO BEARING CO. LTD.	Manufacturing --- Machinery
192	OHBAYASHI CORPORATION	Construction
193	OKAMOTO INDUSTRIES INC.	Manufacturing --- Rubber
194	OKI ELECTRIC	Manufacturing --- Electric Machinery
195	OKUMA MACHINERY WORKS LTD.	Manufacturing --- Machinery
196	OKURA	Wholesale
197	OLYMPUS OPTICAL	Manufacturing --- Precision Equipment
198	OMRON TATEISI ELECTRONICS CORP.	Manufacturing --- Electric Machinery
199	ONODA CEMENT	Manufacturing --- Glass and Ceramics
200	ORIENT LEASING CO. LTD.	Financial --- except Banks, Securities and Insurance
201	OSAKA GAS	Electric Power and Gas
202	PILOT PEN CORPORATION	Manufacturing --- Other Manufacturing
203	PIONEER ELECTRONIC CORP.	Manufacturing --- Electric Machinery
204	PRESS KOGYO	Manufacturing --- Transportation Equipment
205	Q.P. CORP.	Manufacturing --- Foods
206	RICOH CO. LTD.	Manufacturing --- Precision Equipment
207	RIKEN CORP.	Manufacturing --- Transportation Equipment
208	RIKEN VINYL INDUSTRY	Manufacturing --- Chemicals
209	ROHTO PHARMACEUTICAL	Manufacturing --- Chemicals
210	ROYAL CO. LTD.	Retail
211	RYOBI	Manufacturing --- Nonferrous Metals
212	S M K	Manufacturing --- Electric Machinery
213	SANDEN CORP.	Manufacturing --- Transportation Equipment
214	SANKEN ELECTRIC	Manufacturing --- Electric Machinery
215	SANKYO SEIKO	Manufacturing --- Textiles
216	SANKYU INC.	Transportation --- Land

	Japanese Firms	Industry
217	SANYO ELEC.	Manufacturing --- Electric Machinery
218	SAPPORO BREWERIES	Manufacturing --- Foods
219	SASAKI GLASS	Manufacturing --- Glass and Ceramics
220	SATO KOGYO CO. LTD.	Construction
221	SECOM CO.	Services
222	SEIBU RAILWAY	Transportation --- Land
223	SEIYU LTD.	Retail
224	SEKISUI CHEMICAL	Manufacturing --- Chemicals
225	SEKISUI HOUSE LTD.	Construction
226	SEKISUI JUSHI CORP.	Manufacturing --- Chemicals
227	SETTSU CORPORATION	Manufacturing --- Pulp and Paper
228	SHARP CORPORATION	Manufacturing --- Electric Machinery
229	SHIMADZU CORP.	Manufacturing --- Precision Equipment
230	SHIMANO INDUSTRIAL CO. LTD.	Manufacturing --- Transportation Equipment
231	SHIMIZU CORPORATION	Construction
232	SHIN-ETSU CHEMICAL CO.	Manufacturing --- Chemicals
233	SHIONOGI	Manufacturing --- Chemicals
234	SHISEIDO	Manufacturing --- Chemicals
235	SHOKO CO.	Wholesale
236	SHOWA ELEC WIRE & CABLE	Manufacturing --- Nonferrous Metals
237	SHOWA MFG. CO. LTD.	Manufacturing --- Transportation Equipment
238	SHOWA SANGYO	Manufacturing --- Foods
239	SOGO CO. LTD.	Retail
240	SONY CORPORATION	Manufacturing --- Electric Machinery
241	STANLEY ELECTRIC	Manufacturing --- Transportation Equipment
242	SUMITOMO BAKELITE	Manufacturing --- Chemicals
243	SUMITOMO CEMENT	Manufacturing --- Glass and Ceramics
244	SUMITOMO CHEMICAL	Manufacturing --- Chemicals
245	SUMITOMO COAL MINING CO.	Agriculture --- Mining

	Japanese Firms	Industry
246	SUMITOMO CORPORATION	Wholesale
247	SUMITOMO ELECTRIC IND.	Manufacturing --- Nonferrous Metals
248	SUMITOMO HEAVY IND.	Manufacturing --- Transportation Equipment
249	SUMITOMO METAL INDUSTRIES	Manufacturing --- Iron and Steel
250	SUMITOMO METAL MINING	Manufacturing --- Nonferrous Metals
251	SUMITOMO REALTY & DEVELOP	Real Estate
252	SUMITOMO RUBBER	Manufacturing --- Rubber
253	SUMITOMO WAREHOUSE	Transportation --- Warehousing and Wharfing
254	SUZUKI MOTOR	Manufacturing --- Transportation Equipment
255	TAISEI CORPORATION	Construction
256	TAIYO FISHERY CO. LTD.	Agriculture --- Fishery
257	TAIYO YUDEN	Manufacturing --- Electric Machinery
258	TAKARA SHUZO CO.LTD.	Manufacturing --- Foods
259	TAKASAGO INTERNATIONAL	Manufacturing --- Chemicals
260	TAKASHIMAYA	Retail
261	TAKEDA CHEMICAL	Manufacturing --- Chemicals
262	TAMURA SEISAKUSHO CORPORATION	Manufacturing --- Electric Machinery
263	TANABE SEIYAKU	Manufacturing --- Chemicals
264	TDK CORP.	Manufacturing --- Electric Machinery
265	TEIJIN	Manufacturing --- Textiles
266	TEIJIN SEIKI	Manufacturing --- Machinery
267	TERUMO CORP.	Manufacturing --- Precision Equipment
268	TOAGOSEI CHEMICAL INDUSTRY CO. LTD.	Manufacturing --- Chemicals
269	TOBISHIMA CORPORATION	Construction
270	TOHO GAS	Electric Power and Gas
271	TOHOKU ELE POWER	Electric Power and Gas
272	TOKAI CARBON	Manufacturing --- Glass and Ceramics
273	TOKICO	Manufacturing --- Transportation Equipment
274	TOKIO MARINE AND FIRE	Financial --- Non-life Insurance

	Japanese Firms	Industry
275	TOKO	Manufacturing --- Electric Machinery
276	TOKUYAMA SODA CORPORATION	Manufacturing --- Chemicals
277	TOKYO ELECTRON	Manufacturing --- Electric Machinery
278	TOKYO KIKAI SEISAKUSHO	Manufacturing --- Machinery
279	TOKYO NISSAN AUTO SALES	Retail
280	TOKYO TATEMONO	Real Estate
281	TOMOKU CO. LTD.	Manufacturing --- Pulp and Paper
282	TOPPAN PRINTING	Manufacturing --- Other Manufacturing
283	TORAY INDUSTRIES	Manufacturing --- Textiles
284	TOSHIBA CERAMICS	Manufacturing --- Electric Machinery
285	TOSHIBA CORP.	Manufacturing --- Electric Machinery
286	TOSHIBA TUNGALOY	Manufacturing --- Machinery
287	TOSHOKU LTD.	Wholesale
288	TOTO LTD.	Manufacturing --- Glass and Ceramics
289	TOYO ALUMINIUM	Manufacturing --- Nonferrous Metals
290	TOYO MENKA KAISHA LTD	Wholesale
291	TOYO RADIATOR	Manufacturing --- Transportation Equipment
292	TOYO SUISAN	Manufacturing --- Foods
293	TOYO TIRE & RUBBER	Manufacturing --- Rubber
294	TOYODA MACHINE WORKS	Manufacturing --- Machinery
295	TOYOTA MOTOR	Manufacturing --- Transportation Equipment
296	TOYOTA TSUSHO	Wholesale
297	TSUBAKIMOTO CHAIN	Manufacturing --- Machinery
298	TSUGAMI CORP.	Manufacturing --- Machinery
299	TSUMURA JUNTENDO INC.	Manufacturing --- Chemicals
300	TSUTSUNAKA PLASTIC	Manufacturing --- Chemicals
301	UBE INDUSTRIES	Manufacturing --- Chemicals
302	USHIO INC.	Manufacturing --- Electric Machinery

	Japanese Firms	Industry
303	VICTOR COMPANY OF JAPAN	Manufacturing --- Electric Machinery
304	WACOAL CORP.	Manufacturing --- Textiles
305	YAMAHA MOTOR	Manufacturing --- Transportation Equipment
306	YAMANOUCHI PHARM.	Manufacturing --- Chemicals
307	YAMATO KOGYO	Manufacturing --- Iron and Steel
308	YAMATO TRANSPORT	Transportation --- Land
309	YAMAZAKI BAKING	Manufacturing --- Foods
310	YAOHAN DEPARTMENTALSTORE CORP.	Retail
311	YASKAWA ELECTRIC CORP.	Manufacturing --- Electric Machinery
312	YASUDA FIRE AND MARINE	Financial --- Non-life Insurance
313	YOKKAICHI WAREHOUSE CO. LTD.	Transportation --- Warehousing and Wharfing
314	YOKOGAWA ELECTRIC	Manufacturing --- Electric Machinery
315	YOKOHAMA RUBBER	Manufacturing --- Rubber
316	YUASA BATTERY CORP.	Manufacturing --- Electric Machinery
317	ZENCHIKU CO. LTD.	Wholesale

APPENDIX B

DATA DESCRIPTION AND SUMMARY STATISTICS

Table B.1
Data Source and Data Variables

Source	Original Data	Variable of interest
International Trade Administration, US Department of Commerce. *Foreign Direct Investment in the United States*. Washington, DC: US Government Printing Office The ITA data presents a transaction roster of all FDI in the United States classified into acquisition and mergers (AM), increases in equity, joint ventures, new plants, plant expansions, real property and an "all other" category that includes but not limited to headquarters, representative offices, stores, outlets, warehouses and unidentified transactions. Apart from the type of FDI, the name of the foreign firm, the name of the foreign affiliate in the United States, the location of investment and the value of investment in approximately 49% of all recorded transactions are available in the ITA publication.	**Japanese FDI Projects in the United States**	**Number of FDI projects undertaken by a Japanese firm in the United States in a given year.**

Table B.1
Data Source and Data Variables

Source	Original Data	Variable of interest
Japan Company Handbook published by Toyo Keizai Inc., reports on financial information of Japanese firms listed in the Tokyo, Osaka and Nagoya stock exchanges. The information also includes a list of the principal banks that have business dealings with each firm. The banks are listed in the order of the largest balance of loans that they have with the firm. The first named bank in which the firm has the largest loan balance is regarded as the firm's main bank.	**Main bank of a Japanese firm**	
Osiris database provided by Bureau van Dijk gives historical and current financial information of publicly listed firms. The database is used to trace Japanese firms in the ITA publication which have re-organized and changed names during the sample period. The information is linked to names of firms in the Japan Company Handbook. The Osiris database is also used to verify that the names used refer to the same firms found in all data sources: Japan Company Handbook, ITA publication and PACAP database.	**Verification of firm names**	

Table B.1
Data Source and Data Variables

Source	Original Data	Variable of interest
Pacific-Basin Capital Markets (PACAP) databases are developed by the Sandra Ann Morsilli Pacific-Basin Capital Markets Research Center, College of Business Administration at the University of Rhode Island. It contains historical capital markets data for eight countries in the Pacific-Basin region including Japan.	**Market value of Japanese firm** Represents the market value of firm's stock taken in December of each year	**Relative Wealth** It is measured as the market value of firm *i* indexed to 100 in 1992, divided by the nomial S&P 500 index and multiply by the nominal US dollar – Yen exchange rate. The measure is expressed in natural logarithm.
International Financial Statistics provided by International Monetary Fund	**US dollar- Japanese Yen exchange rates** Nominal bilateral market exchange rates taken in December of each year	
Bloomberg	**S&P 500 composite index** Closing price of the index taken in December of each year	

Table B.1
Data Source and Data Variables

Source	Original Data	Variable of interest
PACAP	**Profit of firm** After-tax profit of the firm as reported in the firm's financial statements **Assets of firm** Book value of firm's assets as reported in the firm's financial statements	**Profitability of firm**: Firm's profits to assets expressed as a ratio.
PACAP	**Assets of firm** Book value of firm's assets as reported in the firm's financial statements **Japan's wholesale price index** Base year is 1992	**Size of firm:** The value of each firm's assets is deflated by the Japanese wholesale price index. It is a measure of the real value of the firm's assets expressed in natural logarithm.

Table B.1
Data Source and Data Variables

Source	Original Data	Variable of interest
Moody's Investor Services, Inc	**Moody's ratings of main banks** Ratings are taken in December of each year	Ratings ordered from best to worst as **Aaa, Aa1, Aa2, Aa3, A1, A2 and A3**.
PACAP	**Industry Classification**	See Appendix A
International Financial Statistics	**US Unemployment Rate**	**US Unemployment Rate**
Employment Security Bureau, **Ministry of Labor**, **Japan**: Monthly Report of Employment Security Business	**Japan's New Job Offers to Applications Ratio** Economic conditions directly affect the number of new job offers. More jobs are offered as the economy expands. Job applications include the unemployed and those seeking for a change in employment. The ratio of new job offers to applications reflects macroeconomic business cycles in Japan.	**Japan's New Job Offers to Applications Ratio**

Table B.1
Data Source and Data Variables

Source	Original Data	Variable of interest
PACAP	**Bonds**	**Ratio of firm's bonds to its liabilities** The variable is not used in the data analysis as a regressor. Instead, the ratio is used to separate firms by the extent that the firms use bonds for their liabilities. The larger the share of bonds in total liabilities, the less dependent is the firm on bank loans.
PACAP	**Liability**	

Table B.2
Descriptive Statistics of Data Variables

Variable	Mean	Standard Deviation	Maximum Value	Minimum value
Number of Japanese FDI projects in the United States (317 firms over 8-year period)	0.56	1.19	17	0
Market value of Japanese firm (in millions of Yen)	497, 448	758, 841	7,824, 140	15, 362
Profit of Japanese firm (in millions of Yen)	9, 443	22, 546	360, 803	-201, 355
Assets of Japanese firm (in millions of Yen)	670, 564	1, 133, 719	8, 959, 245	17, 162
US dollar- Japanese Yen exchange rates	123.59	13.24	143.45	99.74
S&P 500 composite index	373.37	83.84	466.45	247.08
Japan's wholesale price index (base year in 1992)	99.08	2.40	102.23	95.14

Table B.2
Descriptive Statistics of Data Variables

Variable	Mean	Standard Deviation	Maximum Value	Minimum value
US Unemployment Rate (in percentage per annum)	6.22	0.76	7.50	5.30
Japan's New Job Offers to Applications Ratio	1.56	0.41	2.07	0.91
Bonds (in millions of Yen)	83, 377	150, 934	1, 834, 467	0
Liability (in millions of Yen)	176, 249	481, 555	4, 823, 239	0

Table B.3
Moody's Long Term Deposit Ratings

Bank	1986	1987	1988	1989	1990	1991	1992	1993	1994
Industrial Bank of Japan	Aaa	Aaa	Aaa	Aaa	Aaa	Aa2	Aa3	Aa3	A1
Dai-Ichi Kangyo Bank	Aaa	Aaa	Aaa	Aaa	Aa1	Aa1	Aa3	A1	A1
Sakura Bank	N.A.	N.A.	Aa2	Aa3	Aa3	A1	A1	A2	A2
Mitsubishi Bank	Aaa	Aaa	Aaa	Aaa	Aa1	Aa1	Aa3	Aa3	Aa3
Fuji Bank	Aaa	Aaa	Aaa	Aaa	Aa1	Aa3	Aa3	A1	A1
Sumitomo Bank	Aaa	Aaa	Aaa	Aaa	Aa1	Aa3	Aa3	A1	A1
Sanwa Bank	Aaa	Aa1	Aa1	Aa1	Aa1	Aa1	Aa3	Aa3	Aa3
Tokai Bank	N.A.	Aa2	Aa2	Aa2	Aa3	Aa3	A1	A2	A2
Asahi Bank	N.A.	N.A.	Aa3	Aa3	Aa3	Aa3	A1	A2	A2
Long-Term Credit Bank	Aaa	Aa2	Aa2	Aa2	A1	A2	A2	A3	A3
Daiwa Bank.	N.A.	N.A.	N.A.	Aa3	Aa3	Aa3	Aa3	A3	A3

Source: Moody's Investor Services, Inc. and Klein, Peek and Rosengren (2002)

Table B.4
Change in Moody's Long Term Deposit Ratings

	Change in Ratings from previous year							
Bank	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Industrial Bank of Japan	0	0	0	0	-2	-1	0	-1
Dai-Ichi Kangyo Bank	0	0	0	-1	0	-2	-1	0
Sakura Bank	N.A.	N.A.	-1	0	-1	0	-1	0
Mitsubishi Bank	0	0	0	-1	0	-2	0	0
Fuji Bank	0	0	0	-1	-2	0	-1	0
Sumitomo Bank	0	0	0	-1	-2	0	-1	0
Sanwa Bank	-1	0	0	0	0	-2	0	0
Tokai Bank	N.A.	0	0	-1	0	-1	-1	0
Asahi Bank	N.A.	N.A.	0	0	0	-1	-1	0
Long-Term Credit Bank	-2	0	0	-2	-1	0	-1	0
Daiwa Bank.	N.A.	N.A.	N.A.	0	0	0	-3	0

Notes: "0" indicates no change in rating, "-1" indicates a single downgrade, "-2" indicates a double downgrade, "-3" indicates a triple downgrade.
Source: Computed from Table B.3

Table B5
Industrial Distribution of Japanese Firms in the Sample

Industry	Number of Firms	Percentage of all firms
Agriculture --- Fishery	2	0.6
Agriculture --- Mining	2	0.6
Construction	12	3.8
Electric Power and Gas	4	1.3
Financial --- except Banks, Securities and Insurance	2	0.6
Financial --- Non-life Insurance	2	0.6
Financial --- Securities	2	0.6
Manufacturing --- Chemicals	46	14.5
Manufacturing --- Electric Machinery	41	12.9
Manufacturing --- Foods	21	6.6
Manufacturing --- Glass and Ceremics	12	3.8
Manufacturing --- Iron and Steel	11	3.5
Manufacturing --- Machinery	29	9.1
Manufacturing --- Metal Products	1	0.3
Manufacturing --- Nonferrous Metals	11	3.5
Manufacturing --- Other Manufacturing	6	1.9
Manufacturing --- Petroleum	2	0.6
Manufacturing --- Precision Equipment	9	2.8
Manufacturing --- Pulp and Paper	4	1.3
Manufacturing --- Rubber	7	2.2
Manufacturing --- Textiles	14	4.4
Manufacturing --- Transportation Equipment	31	9.8
Real Estate	3	0.9
Retail	14	4.4
Services	1	0.3
Transportation --- Air	2	0.6
Transportation --- Land	3	0.9
Transportation --- Shipping	3	0.9
Transportation --- Warehousing and Wharfing	4	1.3
Wholesale	16	5.0
Total Number of Japanese Firms in Sample	**317**	**100**

Source: Pacific-Basin Capital Markets (PACAP) databases

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