Troubled Banks, Impaired Foreign Direct Investment: The Role of Relative Access to Credit

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During the 1980's, theories were developed to explain the striking correlation between real exchange rates and foreign direct investment (FDI). However, this relationship broke down for Japanese FDI in the 1990's, as the real exchange rate appreciated while FDI plummeted. We propose the relative access to credit hypothesis and show that unequal access to credit by Japanese firms contributes to the explanation of declining Japanese FDI. Using bank-level and firm-level data sets, we find that financial difficulties at banks were economically and statistically important in reducing the number of FDI projects by Japanese firms into the United States. (*JEL* G21, F36)

For many years, most theories of the determination of foreign direct investment (FDI) focused on industrial organization motives. While these traditional models of FDI could explain industry-specific patterns, these models alone were not sufficient to explain the striking correlation between real exchange rates and FDI that developed during the 1980's. Foreign direct investment into the United States surged in the wake of the steep dollar depreciation beginning in late 1985. To explain this correlation, the FDI literature was expanded to include the role of imperfect capital markets in describing the pattern of movements in FDI among industrial countries. In particular, a key contribution provided by Kenneth A. Froot and Jeremy C. Stein (1991) is a parsimonious model based on informational imperfections that generates a link between economywide FDI and aggregate variables, such as the real exchange rate. A depreciation of the domestic currency increases the relative wealth of foreign firms, enabling them to outbid domestic firms in acquiring corporate assets.

Just as events in the 1980's indicated a need for richer explanations than could be provided solely by industrial organization models, events in the 1990's motivate relaxing one of the assumptions underlying the Froot and Stein model, that of equal access by all firms to external borrowing facilities. Relaxing this assumption helps explain one of the most dramatic swings in FDI during the 1990's, the collapse of outward direct investment into the United States by Japan. The value of Japanese FDI as a share of total FDI into the United States reached a peak of 30 percent in 1990, and then declined through much of the 1990's, falling to only 1 percent of total FDI into the United States by 1998. While movements in the real exchange rate can explain the dramatic increase in Japanese outward FDI during the 1980's, as well as the initial decline after the Japanese asset-price bubble burst, it does not explain why Japanese FDI continued to decline even as the yen appreciated significantly during the mid-1990's.

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The hypothesis proposed in this paper highlights imperfect capital markets, focusing on the constraints faced by bank-dependent firms when their lenders reduce credit availability. This hypothesis, in conjunction with the relative wealth hypothesis, provides an explanation consistent with the recent Japanese FDI experience. While firms may be constrained by their balance sheet positions, they may also be constrained by a reduction in the willingness of lenders to provide credit, in particular, by an inward shift in loan supply caused by a deterioration in bank health. This relative access to credit hypothesis (RAC) implies that firms' ability to engage in FDI will be influenced by their ability to raise external funds. Thus, RAC can explain the continuing collapse in Japanese FDI into the United States by focusing on one of the most striking aspects of the Japanese economy in the 1990's, the collapse of its banking sector. Not only can RAC explain this reduction in FDI despite a substantial appreciation in the real value of the yen, but it also provides a richer set of implications at the micro firm level: Individual firms associated with less healthy banks should be less likely to engage in FDI.

The environment and events in Japan provide a "natural experiment" that allows empirical tests that can distinguish RAC from the relative wealth hypothesis. First, because of the importance of the main bank system, many Japanese firms rely heavily on bank finance. Second, Japan experienced a dramatic collapse in the financial condition of its banking system in the early 1990's. Third, suitable data are available to construct a unique data set that links individual firms engaged in FDI to their main bank, so that hypotheses can be tested on bank- and firm-level data. Finally, the unusually large shifts in Japanese stock prices, exchange rates, and bank health experienced over the past two decades are not perfectly coincident, providing a natural experiment suitable for testing alternative hypotheses about the determinants of FDI.

We find strong support for RAC, since financial difficulties at Japanese banks are economically and statistically important determinants of Japanese FDI into the United States, even after controlling for the relative wealth movements caused by fluctuations in stock prices and exchange rates. In fact, we find that a single Moody's downgrade of a Japanese bank results, on average, in a decline of about one-third in the number of FDI projects into the United States by Japanese firms that use that bank as their main bank. With foreign-owned firms accounting for 5 percent of all U.S. employment and 6 percent of goods and services produced here (William J. Zeile, 1999), major declines in their participation in the U.S. economy can have significant long-run effects, even though the U.S. economy is relatively large and insular. The effects of the collapse of Japanese FDI into other countries, especially those in East Asia that are more dependent on Japanese direct investment, are potentially far more dire.

In addition to the insights it provides on the determination of FDI, our analysis of the relative access to credit hypothesis also contributes to the debate on the importance of the credit channel. A challenge for tests of the credit channel is to isolate shocks to the supply of loans from shocks to the demand for loans. Our analysis offers a natural experiment in this area as well, since problems at Japanese banks that led to the reduction of Japanese FDI into the United States is unrelated to the attractiveness of United States assets. At the time when troubles at Japanese banks led to a decline in direct investment by Japanese firms into the United States, FDI by other countries into the United States was rising. Thus, we provide evidence of the real effects of a loan supply shock, since Japanese firms that relied on the most troubled banks were less likely to engage in FDI into the United States, controlling for the profitability and stock valuation of the firm.

The next section of this paper provides some background on FDI. The second section describes our data set and offers some initial statistics on the health of Japanese banks, as measured by Moody's ratings, as well as on FDI by Japanese firms. Section III describes our empirical test of the relative access to credit hypothesis and the evidence supporting the hypothesis using bank-level data, formed by aggregating all FDI projects by firms using a particular main bank. Section IV provides further empirical evidence documenting the link between bank health and FDI using a panel logit regression specification with firm-level data. The final section offers some concluding remarks.

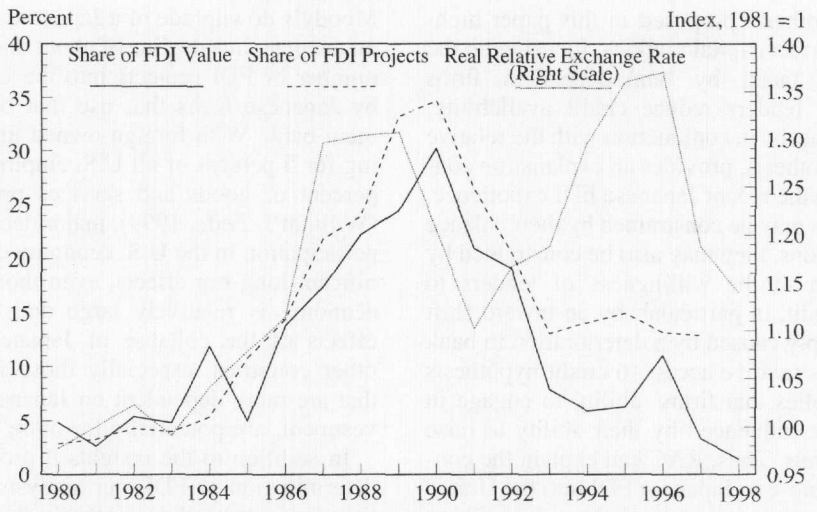

FIGURE 1. JAPANESE FOREIGN DIRECT INVESTMENT INTO THE UNITED STATES AND THE RELATIVE EXCHANGE RATE

Notes: The real relative exchange rate equals the real broad trade-weighted exchange value of the U.S. dollar divided by the real yen/dollar exchange rate, for the prior year. The number and value of FDI are calculated as a proportion of all inward U.S. foreign direct investment.

Sources: U.S. Bureau of Economic Analysis, Haver Analytics, Inc.

I. Background

To determine why a foreign firm would value domestic assets more highly than would a domestic firm, much of the literature has focused on synergies generated by managerial advantages, superior marketing ability, or technological advantages, as summarized, for example, in Richard E. Caves (1971) and Edward M. Graham and Paul R. Krugman (1995). Given the focus on direct investment flows from developed to less developed countries, the literature tended to emphasize relative labor costs (David O. Cushman, 1987) and policy influences on FDI through fiscal powers, such as tax incentives (Joel Slemrod, 1989; Deborah Swenson, 1994).

None of these earlier papers provided a theoretical justification for the correlation between aggregate FDI and real exchange rates for industrial countries. However, by the early 1990's, the observed strong correlation between the surge of FDI into the United States and the depreciation of the dollar suggested that new theoretical extensions to the standard theory were required. Froot and Stein (1991), by relaxing the assumption of perfect capital markets, provided the first theoretical model that could explain this empirical observation. In their model, imperfect information about investment opportunities causes lenders to impose leverage requirements on borrowers. They reasoned that FDI could be modeled as an auction for assets between foreign and domestic firms. An increase in the wealth of foreign bidders relative to domestic bidders, for example through a depreciation in the value of the domestic currency, would allow foreign firms to bid more aggressively for domestic assets. Froot and Stein (1991) were able to generate their results from a stylized model that assumed that all firms have equal access to credit markets, and thus they were able to obtain their results without having to rely on another important dimension of imperfect capital markets: the fact that the availability of external finance varies across firms and across time.

Nonetheless, developments in the 1990's provided an anomaly with respect to movements in FDI and real exchange rates. Figure 1 shows the proportion of Japanese FDI in total inward U.S. FDI, measured by value (solid line) and by number of projects (dashed line), along with a measure of the relative exchange rate for Japan

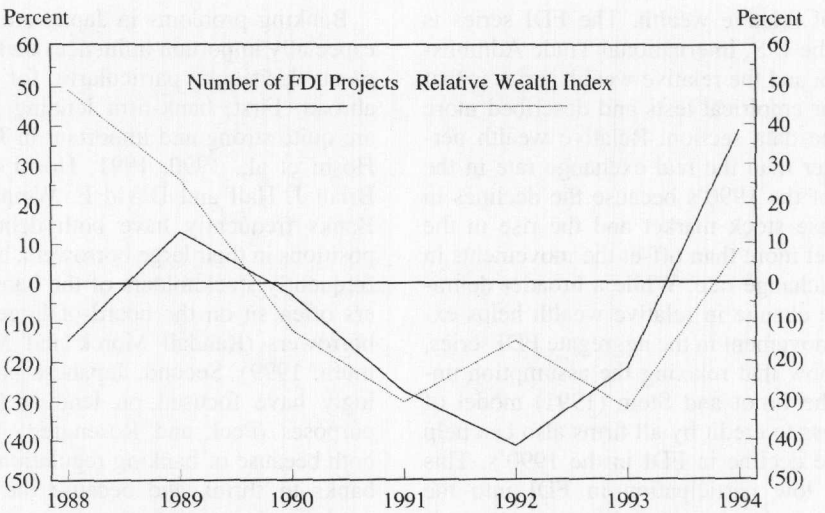

FIGURE 2. PERCENTAGE CHANGE IN JAPANESE FOREIGN DIRECT INVESTMENT INTO THE UNITED STATES AND THE RELATIVE WEALTH INDEX

Notes: The relative wealth index equals the percentage change in the Nikkei index, plus the percentage change in the dollar/yen exchange rate, minus the percentage change in the S&P 500 index, for the prior year.

Sources: U.S. International Trade Administration, Haver Analytics, Inc.

(dotted line). The relative exchange rate is calculated as the real trade-weighted exchange rate of the dollar divided by the real yen/dollar exchange rate. The relative exchange rate series in the figure has been lagged one year, since FDI likely does not react instantaneously to changes in the real exchange rate. The real relative exchange rate and the two measures of the share of Japanese FDI in total inward FDI, at least until 1991, exhibit the strong positive correlation that motivated the Froot and Stein (1991) study.[1] As the relative values of the yen and the Japanese stock market each rose during the 1980's, so did the Japanese share of inward U.S. FDI. Similarly, both measures of Japanese FDI fell as the asset-price bubble burst and as the relative value of the yen declined at the turn of the decade. After 1991, however, the correlation changes. The value of the yen rose dramatically in the early to mid-1990's, yet the Japanese proportion of the number and value of FDI projects remained very low.

While Froot and Stein (1991) motivate and test their relative wealth hypothesis using aggregate inward FDI and multilateral real exchange rate data, changes in real exchange rates represent a narrow definition of changes in relative wealth. Klein and Rosengren (1994) provide a broader test of the relative wealth hypothesis. They use panel data for a set of seven countries that provide additional support for the relative wealth hypothesis, finding that both bilateral real exchange rates and a measure of relative stock market wealth contribute to the explanation of FDI into the United States. Figure 2 shows the relationship between the percent change in the number of Japanese FDI projects and the percent change in the aggregate

[1] Bruce A. Blonigen (1997) noted a second empirical observation concerning the correlation between FDI and the real exchange rate, that FDI was concentrated in industries with firm-specific assets, such as high technology firms. Rather than assuming imperfect capital markets, he assumed imperfect goods markets. If goods markets were segmented, with U.S. firms having limited access to foreign markets, foreign firms will value more highly firm-specific assets in the United States that can be extended to their operations abroad. He shows that the association between FDI and exchange rates is particularly strong for explaining Japanese FDI, where the goods markets may be segmented and where the acquisitions have been focused on firms in high technology. As with Froot and Stein (1991), Blonigen (1997) is able to provide a mechanism for motivating the link between real exchange rates and FDI with a stylized model that assumes that firms have equal access to credit markets.

measure of relative wealth. The FDI series is based on the U.S. International Trade Administration data and the relative wealth series is that used in our empirical tests and described more fully in the data section. Relative wealth performs better than the real exchange rate in the first half of the 1990's because the declines in the Japanese stock market and the rise in the U.S. market more than offset the movements in the real exchange rate. While a broader definition of the change in relative wealth helps explain the movement in the aggregate FDI series, we will show that relaxing the assumption underlying the Froot and Stein (1991) model of equal access to credit by all firms also can help explain the decline in FDI in the 1990's. This period of low participation in FDI into the United States by Japanese firms corresponds with the period of increasingly severe financial difficulties experienced by Japanese banks. The low proportion of Japanese FDI into the United States in the 1990's, despite a period of substantial yen appreciation, can be explained by Japanese firms having relatively limited access to credit, as the financial positions of Japanese banks deteriorated and as Japanese government enforcement of banking regulations became more stringent.

The relative access to credit hypothesis implies that firms' ability to engage in FDI will be influenced by their ability to raise external funds. If firms are highly dependent on obtaining funds from banks with which they have an historical relationship, then a firm's ability to finance foreign investments will depend, in part, on the financial condition of its main bank. The consequences of the deterioration in the balance sheets of the financial intermediaries that provide credit to the firms, as well as the deterioration in the balance sheets of the firms themselves, are consistent with a large and growing literature on the importance of bank financing for firm investment (Steven M. Fazzari et al., 1988; Anil K Kashyap et al., 1993; Mark Gertler and Simon Gilchrist, 1994; Kashyap et al., 1994). While bank-borrower relationships have been found to be important in the United States (for example, Mitchell A. Petersen and Raghuram G. Rajan, 1994), such links are likely to be even more important in a country that is far more reliant on bank financing, such as Japan.

Banking problems in Japan are likely to be especially important influences on firms' investment decisions, particularly for investments abroad. First, bank-firm lending relationships are quite strong and important in Japan (Takeo Hoshi et al., 1990, 1991; Hoshi et al., 1993; Brian J. Hall and David E. Weinstein, 1997). Banks frequently have both debt and equity positions in their large borrowers, borrowers are frequently stockholders of the bank, and bankers often sit on the board of large or troubled borrowers (Randall Morck and Masao Nakamura, 1999). Second, Japanese banks increasingly have focused on lending for domestic purposes (Peek and Rosengren, 1997, 2000), both because of banking regulations that forced banks to shrink and because the government used moral suasion to encourage domestic lending to avoid a credit crunch. Third, while the Japanese bond market has begun to develop (Hoshi and Kashyap, 2000), bank lending remains a very important source of debt financing, even for many relatively large firms. Finally, virtually all the major Japanese banks have required substantial capital infusions from the government and continue to be handicapped by severe loan loss problems. Thus, RAC is consistent with the persistent decline in Japanese FDI associated with the sharp deterioration in the health of the banking sector, which caused Japanese banks to reduce the supply of credit to Japanese firms and made it more difficult for these firms to finance FDI projects.

II. The Data

The focus of our study is the possible link between FDI in the United States by Japanese firms and the health of the respective firms' main banks in Japan. We are able to analyze this question with a new data set that includes time series for the number of FDI projects by individual Japanese firms and identifies each firm's main bank. This data set enables us to isolate the role of the relative health of individual banks and to distinguish the relative access to credit hypothesis from other possible explanations for the decline in Japanese FDI in the 1990's.

We use firm-level FDI data from the United States International Trade Administration (ITA). The ITA provides a transactions roster of all

publicly disclosed investments that identifies the investing company, the name and the SIC code of the target company, and, when made publicly available (about half of all cases), the value of the acquisition.[2] The ITA does not include retained earnings but does include mergers and acquisitions, greenfield investments, plant expansions, additional equity investments, and joint ventures. Ideally, we would analyze the value as well as the number of FDI projects. Unfortunately, the ITA sample of FDI projects that includes the value information is too small, forcing us to focus on the number of FDI projects. The ITA data for our sample begin in 1987 and end in 1994, when the ITA stopped collecting FDI data on a bilateral basis.

Firm characteristics, such as size, profitability, market value, and industry, are taken from the Pacific-Basin Capital Markets Databases (PACAP) (1999). We identify the primary bank for each firm in our data set using information from the *Japan Company Handbook* (JCH). The main (primary) bank is the first bank listed among reference banks for each firm.[3] Note that Japanese firms designate a primary bank even though they may have a very small amount of (or even no) bank loans—for example, Toyota. This reflects the use of banks for other banking functions, such as payroll, letters of credit, lock box facilities, or ties through cross-shareholdings. The empirical section includes robustness tests that restrict the sample of firms to those that are most likely to require bank financing.

We focus on firms associated with one of the 11 banks that had at least one firm with a main bank relationship engaged in FDI in each year. The 11 banks in our sample are the Industrial Bank of Japan (IBJ), Sakura Bank, Fuji Bank, Mitsubishi Bank, Sanwa Bank, Asahi Bank, Tokai Bank, Sumitomo Bank, Long-Term Credit Bank (LTCB), Daiwa Bank, and Dai-Ichi Kangyo Bank (DKB).[4] With the exception of IBJ and LTCB, which were the largest of Japan's long-term credit banks during our sample period, all of the banks were among the largest city banks in terms of total assets. There are a very small number of firms that switch main banks during the sample period. For each year, we use as the main bank the one that is listed in the JCH for the firm's previous fiscal year.

Table 1 shows the number of FDI projects by Japanese firms grouped by the firm's main bank. For each bank and each year, we include the total number of FDI projects by firms associated with that bank. The pattern of FDI across the banks indicates robust FDI through the late 1980's, generally peaking in 1989, and then declining to much lower levels for the early 1990's.

The timing of the general decline in FDI corresponds with the collapse of the Japanese banking sector. However, by looking at the relative timing and magnitudes of the deterioration in the financial health at individual banks, we can exploit the information that reflects heterogeneity across banks, as opposed to only that reflecting the overall weakness of the Japanese banking sector. One simple indicator that can be used to gauge the relative changes in financial conditions across Japanese banks is the time series of rating downgrades for individual banks.[5] For the 1986–1994 period, Table 2 presents

[2] The ITA data differ from the data collected by the U.S. Bureau of Economic Analysis (BEA) because the BEA data are based on a confidential survey, while the ITA data use publicly available information. However, the two series are highly correlated. Klein and Rosengren (1994) find the correlation between total BEA outlays and total FDI as reported by the ITA to be 86 percent. Similarly, the correlation between the number of FDI projects by Japanese firms into the United States as measured by the BEA and by the ITA is 80 percent.

[3] Michael S. Gibson (1995) has shown that virtually the same primary lender-borrower relationships are obtained using the first listed reference bank from the JCH, the bank with the largest equity shareholding in the firm, or the bank with an employee on the firm's board of directors. The Japan Development Bank and Norinchukin Bank (The Central Co-operative Bank for Agriculture, Forestry, and Fisheries) are not considered to be main banks. In the few instances in which they are listed as the first reference bank, we used the first listed nongovernmental bank.

[4] Sakura was created from the merger of Mitsui Bank and Taiyo Kobe Bank in 1990. Likewise, Asahi Bank was the result of the merger of Kyowa Bank and Saitama Bank in 1991. For consistency over the sample period, each set of banks was force-merged in the periods prior to their respective mergers.

[5] We use Moody's long-term deposit ratings. All of the rating changes during our sample period (from 1987 to 1994) were downgrades. Using an independent assessment of bank financial health, such as the Moody's ratings, is preferable to financial ratios based on balance sheet and income statements reported by the banks, given the well-known lack of accounting transparency in Japan. For the

TABLE 1—JAPANESE FOREIGN DIRECT INVESTMENT INTO THE UNITED STATES

Number of Investment Projects per Year by Firms Associated with Each Reference Bank									
Bank	1987	1988	1989	1990	1991	1992	1993	1994	Total
Industrial Bank of Japan	36	29	33	21	25	9	11	23	187
Dai-Ichi Kangyo Bank	41	30	42	29	29	18	12	25	226
Sakura Bank	39	32	56	37	43	20	17	21	265
Mitsubishi Bank	42	50	46	55	24	19	17	19	272
Fuji Bank	26	36	46	33	24	14	8	16	203
Sumitomo Bank	41	55	41	32	29	15	15	24	252
Sanwa Bank	30	11	19	21	12	6	3	11	113
Tokai Bank	7	16	11	11	3	9	4	6	67
Asahi Bank	12	10	10	5	2	5	2	4	50
LTCB	2	1	3	5	2	2	2	2	19
Daiwa Bank	5	1	2	3	2	1	1	1	16
Total	281	271	309	252	195	118	92	152	1,670

TABLE 2—MOODY'S LONG-TERM DEPOSIT RATINGS

Rating as of December 31									
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
LTCB	Aaa	*Aa2*	Aa2	Aa2	*A1*	**A2**	A2	**A3**	A3
Daiwa Bank	N/A	N/A	N/A	Aa3	Aa3	Aa3	Aa3	*A3*	A3

Notes: The ordering of these ratings, from best to worst, is as follows: Aaa, Aa1, Aa2, Aa3, A1, A2, A3. Bold figures indicate the bank's rating fell by one level in that year. The italicized figures indicate the bank's rating fell by more than one level.

the year-end values for Moody's long-term deposit ratings for the 11 Japanese banks that were the most active lenders to Japanese firms engaged in FDI into the United States. Each of the banks that had a Moody's long-term deposit rating in 1986 enjoyed the highest rating, Aaa. From that point on, however, the fortunes of these banks diverged. Although only three banks experienced rating downgrades prior to 1990, a wave of downgrades occurred in 1990. Ratings dropped by one level for DKB, Mitsubishi Bank, Fuji Bank, Sumitomo Bank, and Tokai Bank, and by two levels for LTCB. In subsequent years, downgrades affected each bank in this sample, with five banks downgraded in 1991 (with three of those banks dropping by two levels), six banks downgraded in 1992 (three dropping by two levels), seven banks downgraded in 1993 (Daiwa by three levels), and one bank downgraded in 1994. From 1990 through 1994, one bank was downgraded by four levels, four banks were downgraded three levels, and six banks were downgraded two levels. In addition, there are substantial cross-sectional differences in bank health, with a two- to four-level difference

force-merged banks, there were two instances of ratings variation, both occurring in 1988. For Sakura Bank, the rating of Mitsui Bank was Aa2, while that of Taiyo Kobe Bank was Aa3. Since Sakura is treated as a continuation of Mitsui in the JCH, we used the Aa2 rating for the force-merged entity in 1988. For Asahi Bank, we assigned Saitama Bank's rating of Aa3 in 1988, since Kyowa Bank was not assigned an initial rating (which was Aa3) until 1989.

between the healthiest and weakest banks in each year after 1986.

We have constructed a new data set that contains a comprehensive list of publicly available data on FDI into the United States by the 446 Japanese firms during the period 1987 to 1994 that identify one of the 11 banks in our sample as their main bank. The cross-sectional and time-series variations in these data enable us to isolate the effect of bank health on FDI, while controlling for aggregate and firm-specific factors that affect FDI. We use these data to perform two sets of empirical tests. First, we test the relative access to credit hypothesis using a bank-level data set formed by aggregating the firm-level data, combining FDI projects for all firms that are associated with the same main bank. We use these data to investigate the determinants of the change in the number of FDI projects of firms associated with a specific main bank. Second, we test RAC using a logit specification with the firm-level data in order to investigate the determinants of the probability that a firm will undertake FDI in a given year.

Another benefit provided by this new data set for testing the relative access to credit hypothesis is its potential ability to overcome the common difficulty in the literature with isolating loan supply shocks from shocks to loan demand, since bank financing problems in Japan are not coincident with declines in the demand for investments in the United States. Identification of financial constraints affecting a firm's investment decisions has been problematic, with much of the evidence indirect and not relying on firm-level data that connect the firm to its sources of financing. Furthermore, identifying the role of disruptions in bank financing is often difficult, because one cannot distinguish convincingly between loan supply and loan demand shocks. For example, the deterioration of banks' balance sheets and firms' prospects may occur contemporaneously, so that the data may not permit unambiguous identification of the source of a reduction in investment.

III. Specification and Empirical Results—Bank-Level Data

The empirical test using bank-level data examines the extent to which the declines in FDI occur disproportionately at firms whose banks suffered the greatest financial difficulties. While all major Japanese banks experienced some difficulties during the early 1990's, the timing and the degree of the deterioration in their financial health varied across banks. The most troubled banks would be expected to restrict lending most dramatically to their customers. Thus, other things equal, it is the firms that rely on the most troubled banks that would be most limited in their ability to obtain debt financing for expansion abroad.

To capture this effect, we estimate the following equation:

$$(1)\quad \mathrm{DFDI}_{i,t} = \alpha_0 + \alpha_1 \mathbf{DRATING}_{i,t-1} + \alpha_2 \mathrm{DPROFIT}_{i,t-1} + \alpha_3 \mathbf{DMACRO}_{t-1} + \varepsilon_{i,t}.$$

The dependent variable, $\mathrm{DFDI}_{i,t}$, is obtained by first collapsing the firm-level data set, in which each observation represents the number of FDI projects by an individual firm in a particular year, into a data set in which we count the number of FDI projects by all firms associated with a particular main bank in a given year. DFDI is the percentage change between year $t-1$ and year t in the number of FDI projects by firms that use bank i as their main bank.[6] We focus on the first difference of FDI to capture how changes in the financial conditions of the banks influence changes in FDI patterns by firms associated with those banks. A specification in terms of the levels of FDI would be inappropriate in this case, since much of the variation across banks in the levels of FDI is related to the size of the bank and the composition of its borrowers. These factors change little over time and net out when taking first differences.

$\mathbf{DRATING}_{i,t-1}$ contains measures of changes (downgrades) of Moody's long-term deposit

[6] Some specifications use the proportional change rather than the percentage change for the dependent variable. We calculate the proportional change giving equal weight to the beginning and ending values of the level of FDI in the denominator: $\mathrm{DFDI}_{i,t} = 100 \times (\mathrm{FDI}_{i,t} - \mathrm{FDI}_{i,t-1})/(0.5 \times (\mathrm{FDI}_{i,t} + \mathrm{FDI}_{i,t-1}))$, where $\mathrm{FDI}_{i,t}$ is the number of investments by firms associated with bank i in year t. Rather than giving all the weight in the denominator to the beginning-of-period value, we use this formulation because the number of firms engaging in FDI for some banks is zero for some years when we consider subsets of our sample of firms.

ratings for the individual Japanese banks during the prior year. The measure of Moody's downgrades uses two separate (0,1) dummy variables. Single Downgrade has a value of 1 if the bank's rating is downgraded one level in a given year and 0 otherwise. Multiple Downgrades has a value of 1 if the bank is downgraded two or more levels in a given year and 0 otherwise.[7] Thus, while the deterioration in the financial condition of all banks may have influenced FDI into the United States by Japanese firms, this specification will allow us to exploit the cross-sectional variation in the timing and degree of the deterioration in the health of individual Japanese banks. By focusing on cross-sectional differences in bank health rather than on the macroeconomic variables that have been the focus of much of the recent work on FDI (Froot and Stein, 1991; Klein and Rosengren, 1994), we can identify an additional determinant of Japanese FDI that may have been an important factor in its decline in the 1990's, the effects of loan supply shocks.

The variable DPROFIT is intended to control for the weakening of the health of firms that engage in FDI. If the weakening of the FDI firms contributed to the deterioration in bank health, this weakening could serve as the cause of the declines in both bank health and FDI. Consequently, we control for the average health of the FDI firms associated with each main bank. DPROFIT is based on the profitability of the set of firms associated with a particular main bank that engaged in FDI at any time during our sample period. It is calculated for each main bank as the change in the sum of profits during the prior year for the set of FDI firms associated with each bank, scaled by the sum of their assets, using unconsolidated firm data from PACAP.[8]

The third vector, **DMACRO,** contains a set of three macroeconomic variables intended to control for differences in wealth and economic activity between Japan and the United States. These are time-series variables that are not bank specific, having the same value for each bank in a given year. In each instance, they are measured over the prior year. The first variable is Relative Wealth, measured as the percentage change in the nominal Japanese Nikkei stock index, plus the percentage change in the nominal (dollar/yen) exchange rate, minus the percentage change in the nominal U.S. S&P 500 stock index.[9] The Relative Wealth variable incorporates into our specification the hypothesis suggested by Froot and Stein (1991), and tested in Klein and Rosengren (1994), that exchange rate movements and relative stock prices may be important in explaining movements in FDI because of capital market imperfections. Froot and Stein (1991) posit that favorable currency and stock price movements will alter the amount a firm will be able to bid for foreign assets. If so, the estimated coefficient on Relative Wealth should be positive. We also include the change in the U.S. unemployment rate and the change in the Japanese job-offers-to-applicants ratio to control for the macroeconomic business cycle in each country. We estimate each equation using ordinary least squares (OLS), with robust standard errors calculated by relaxing the assumption of independence of the observations for a given year.[10]

Table 3 contains the results for equation (1). Japanese firms that engaged in FDI for any year during the sample period have been aggregated by their associated main bank. The regression

[7] Diawa Bank is the only instance in which a bank is downgraded by more than two levels in a single year. It declined by three levels in 1993.

[8] A second measure of firm health, Firm Market Value, was included in some specifications. It is calculated for each main bank as the percent change in an index of the sum of market values at the end of the prior year of all firms associated with that bank, deflated by the Japanese wholesale price index. However, we do not report the results for this variable. It did not affect the results for the ratings downgrade variables and it tended to be correlated with the relative wealth and profitability variables. We do include firm market value in the next section, where we investigate the determinants of the probability that individual firms engage in FDI.

[9] This is equivalent to using real measures of the Japanese Nikkei stock index, the (dollar/yen) exchange rate, and the U.S. S&P 500 stock index, since the price indexes would cancel.

[10] The use of aggregate regressors, represented by **DMACRO,** suggests a likely correlation among regression errors within a particular year. Failure to account for within-year correlation when computing coefficient standard errors would result in incorrect t-statistics (Teun Kloeck, 1981; Brent R. Moulton, 1990). We compute robust standard errors allowing for dependence of regression errors within years to adjust for this bias.

TABLE 3—DETERMINANTS OF THE CHANGE IN THE NUMBER OF JAPANESE FDI PROJECTS

	All FDI firms		Multiple-year FDI firms	
Independent variable	Percentage change, 11 banks	Proportional change, 11 banks	Proportional change, 11 banks	Proportional change, 9 banks
Single Downgrade$_{t-1}$	−30.184**	−26.988**	−37.269**	−36.267**
	(11.259)	(9.718)	(11.575)	(12.400)
Multiple Downgrades$_{t-1}$	−68.022**	−59.523**	−82.971*	−63.127**
	(21.340)	(14.938)	(32.268)	(17.355)
Relative Wealth$_{t-1}$	0.857	0.348	0.026	0.606
	(0.722)	(0.448)	(0.626)	(0.660)
Firm Profitability$_{t-1}$	0.432	−0.673	−11.230	−9.590
	(26.253)	(14.749)	(22.199)	(21.911)
U.S. Unemployment Rate$_{t-1}$	−10.285	−22.329**	−19.452	−6.820
	(8.381)	(6.622)	(11.245)	(8.002)
(Japan Job Offers/Applications)$_{t-1}$	−102.006	−62.091	−30.924	−65.144
	(107.843)	(57.665)	(93.608)	(92.754)
Constant	27.796*	8.102	8.875	8.606
	(12.005)	(6.986)	(8.389)	(8.595)
N	73	73	73	61
R^2	0.263	0.334	0.240	0.310
Root MSE	60.426	45.305	62.561	50.591

Notes: Relative Wealth is measured as the percentage change in the Nikkei index, plus the percentage change in the (dollar/yen) exchange rate, minus the percentage change in the S&P 500 index. Firm Profitability is calculated as the change in the sum of profits for the set of FDI firms associated with each bank, as a percentage of the sum of their beginning-of-period assets. The U.S. Unemployment Rate and the Japanese Job-Offers-to-Applications ratio are in first-difference form. Daiwa Bank and LTCB are omitted from the sample for the regression reported in column 4. Below each estimated coefficient, we report the associated robust standard error calculated by relaxing the assumption of independence of the observations for a given year.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

includes observations for the 11 banks that have at least one FDI project associated with its firms in each year. Annual observations for the 1988 to 1994 period for the 11 banks provide 73 observations for the full sample.[11]

The first column contains the results for the specification with the percentage change in the number of FDI projects for the set of firms associated with a given bank as the dependent variable. The Moody's downgrade variables distinguish between single and multiple downgrades in a given year. The estimated coefficient on Single Downgrade is negative and significant, indicating that a downgrade of a bank by a single level in the prior year produces a 30-percent reduction in the number of FDI projects by firms that use the bank as their main bank. A multiple downgrade, in all but one instance representing a two-level downgrade, causes a reduction in FDI projects that is statistically significant and slightly more than double the effect of a single downgrade, a decline of about two-thirds in the number of projects undertaken by firms associated with that main bank. Thus, it appears that multiple downgrades in the same year increase the pressure on banks a little more than proportionately, with the result that the firms associated with the bank sharply cut back the number of FDI projects.

Among the firm and macroeconomic control variables, the estimated coefficients on both Relative Wealth and Firm Profitability are positive, as predicted, but not statistically significant. The estimated coefficients on both the change in the U.S. unemployment rate and the change in the Japanese Job Offers/Applications ratio are negative, but not statistically significant.

Column 2 serves as a robustness check and as a transition to the specifications shown in

[11] We have eight years of ITA data that provide seven observations per bank for the change in FDI. We lose four observations at the beginning of the sample because some banks did not yet have a Moody's rating.

columns 3 and 4. This specification replaces the percentage change in the number of FDI projects with the proportional change for the dependent variable. This limits the range of values for the dependent variable, which may become important when the number of FDI projects associated with a particular bank approaches zero. The column 2 results show that using proportional changes in place of percentage changes produces estimates for the two downgrade variable coefficients that are quite similar to those in column 1. Although the estimated coefficients are slightly smaller, their associated t-statistics are larger. The estimated coefficient on Relative Wealth is now much smaller and that on Firm Profitability is now negative, although not statistically significant. The estimated coefficient on the change in the U.S. unemployment rate remains negative, but is now statistically significant. Thus, a slowdown in economic activity in the United States would reduce inward FDI there, as would be expected. The estimated coefficient on Japan Job Offers/Applications remains negative and insignificant.

The third and fourth columns examine the subsample of FDI firms that engaged in FDI in multiple years. This eliminates firms that engaged in FDI in only one year over the eight-year period. Because the latter firms engage in FDI into the United States only infrequently, they may not be as committed to actively pursuing FDI opportunities and thus may not be regularly looking for them. Including these firms in the sample may add more noise than information, insofar as their nonparticipation in FDI in any given year is unrelated to the availability of credit.

Because restricting our sample to firms engaged in FDI in multiple years reduces the number of FDI projects, in some cases to zero for a particular bank in a given year, we report only the results for the proportional change specification of the dependent variable. The use of percentage changes would force the omission of some observations for which the dependent variable is undefined and would introduce additional volatility associated with fluctuations in the number of FDI projects associated with banks, since those numbers become quite small in some years. The estimates in column 3 indicate that both Single Downgrade and Multiple Downgrades retain their significant negative estimated coefficients. Furthermore, compared to column 2, the estimated coefficients are now somewhat larger.

As an additional robustness test, the fourth column contains results for the subset of the nine banks that have the most FDI projects by firms that use them as their main bank. The two omitted banks, Daiwa and LTCB, have as few as one firm engaged in FDI in some years and, with the multiple-year FDI sample, the number falls to zero in some years. Omitting these two banks eliminates observations in which a few FDI projects can account for a large proportional change in the dependent variable. On the other hand, because these two banks are also the weakest banks in our sample, they may be the banks for which deteriorating health would be expected to have the largest impact on FDI.

The results in column 4 indicate that the estimated effects of the ratings downgrade variables are slightly smaller (in absolute value) when the sample is reduced to this set of nine banks. However, the estimated coefficients are still larger than those in column 2 that include the projects of all FDI firms. Thus, the estimates in column 4 indicate that our results are robust, and are not being driven by the observations associated with the two banks that are the weakest and that have the fewest FDI firms associated with them.

We interpret our evidence as indicating that the substantial decline in Japanese bank health caused Japanese firms that rely on those banks for credit to cut back on FDI projects in the United States. Because we find significant effects for the ratings downgrade variables even after controlling for relative wealth, firm profitability, and economic activity in both the United States and Japan, we conclude that our results are not due to a weakening in the health of firms engaged in FDI being correlated with, or even causing, the deterioration in bank health in Japan. Rather, the decline in FDI into the United States associated with deteriorating bank health occurred for healthy as well as unhealthy FDI firms, as the firms' main banks reduced credit availability in response to the adverse shock to the banking industry.

IV. Specification and Empirical Results—Firm-Level Data

The previous section documents that Moody's downgrades of a bank have an economically large and statistically significant effect on FDI projects by firms associated with that bank. While such an analysis provides a good aggregate measure of the impact on FDI of a deterioration in bank health, the aggregation by bank makes it difficult to control for differences across firms that have the same main bank. This section addresses that issue by examining firm-level data to determine whether the probability that an individual firm engages in FDI is affected by a deterioration in bank health. Such a specification provides an alternative method for examining the importance of unequal access to credit for firms that engage in FDI. This specification uses firm-level data rather than bank-level data, and focuses on the probability of a firm engaging in FDI, rather than on changes in the number of FDI projects. The samples of individual firms used here include the set of firms that engaged in FDI into the United States in more than one year during our sample period, the preferred sample used in the previous section, as well as broader samples described below that demonstrate the robustness of our results.

The basic equation to be estimated is:

$$(2)\quad \Pr(\mathrm{FDI}_{i,t}) = \ell_0 + \ell_1 \mathbf{RATING}_{i,t-1} + \ell_2 \mathbf{FIRM}_{i,t-1} + \ell_3 \mathbf{MACRO}_{i,t-1} + u_{i,t}.$$

The dependent variable, $\Pr(\mathrm{FDI}_{i,t})$, is a limited dependent variable that has a value of one if firm i engaged in at least one FDI project into the U.S. in year t, and zero otherwise. While the bank-level regressions focused on whether changes in FDI were affected by changes in bank health, the firm-level specification asks whether the health of the firm's main bank is related to the firm's decision to engage in FDI. Thus, the probability of a firm undertaking FDI needs to be matched to the levels rather than the changes of the independent variables.

$\mathbf{RATING}_{i,t-1}$ contains measures of the level of Moody's long-term deposit rating for the individual Japanese bank identified as the main bank for firm i in December of the prior year. The proxies for the Moody's ratings are a set of six (0,1) dummy variables, one for each of the individual ratings from Aa1 through A3, with Aaa being the omitted rating. Thus, the estimated coefficients on these ratings dummy variables indicate the effect relative to that when the firm's main bank has a Moody's Aaa rating.

The second vector, **FIRM,** includes variables to control for firm size, for the firm's industry, and for the health of the individual firms that engage in FDI. It is important to control for firm health, insofar as the weakening of the FDI firms may have contributed to the deterioration in bank health. If so, the weakening of FDI firms could serve as the cause of the declines in both bank health and FDI. We use two measures to control for the health of the FDI firms: Relative Wealth and Firm Profitability. The first measure is based on the stock price of the firm, measured as the market value of firm i indexed to 100 in 1992, times the nominal dollar/yen exchange rate, divided by the nominal S&P 500 index.[12] Our measure is constructed as the natural logarithm of this variable, measured in December of the prior year. This is similar to the Relative Wealth variable constructed in the previous section, except that now it is constructed using the firm's individual stock price rather than the Nikkei index to measure changes in the amount a Japanese firm will be able to bid for U.S. assets. If a higher stock price and a higher value of the yen enhance the ability of the firm to bid for foreign assets, as posited by Froot and Stein (1991), the estimated coefficient on Relative Wealth should be positive. The second measure of firm health, Firm Profitability, is calculated as the profits-to-assets ratio of the firm, measured in the prior year. Again, we expect a positive coefficient. We also include a variable, Firm Size, which is the logarithm of the real value of the firm's assets in the prior year, using the Japanese wholesale price index as the deflator. Because larger firms are more likely to engage in international activities and have the funding capacity to undertake FDI, we anticipate a positive coefficient. Finally, we include a set of industry dummy variables to control for differences across industries in the

[12] This is equivalent to using real values for each of the variables, since the price indexes would cancel.

TABLE 4—DETERMINANTS OF JAPANESE FDI FOR INDIVIDUAL FIRMS
(MULTIPLE-YEAR FDI FIRMS; ESTIMATION METHOD: LOGIT)

Independent variable	Ratings only	Full specification	Non-autos, non-steel
Aa1	−0.665**	−0.454	−0.437
	(0.209)	(0.260)	(0.297)
Aa2	−0.277	−0.268	−0.210
	(0.312)	(0.242)	(0.290)
Aa3	−1.091**	−0.795**	−0.929**
	(0.145)	(0.241)	(0.256)
A1	−0.788**	−0.577**	−0.616**
	(0.175)	(0.195)	(0.203)
A2	−1.181**	−1.091**	−1.066**
	(0.119)	(0.274)	(0.275)
A3	−2.045**	−1.671**	−1.651**
	(0.063)	(0.205)	(0.206)
Relative Wealth$_{t-1}$		0.162	0.285
		(0.123)	(0.168)
Firm Profitability$_{t-1}$		0.860	−0.237
		(0.904)	(0.878)
Firm Size$_{t-1}$		0.486**	0.449**
		(0.041)	(0.049)
U.S. Unemployment Rate$_{t-1}$		−0.379**	−0.321**
		(0.087)	(0.100)
(Japan Job Offers/Applications)$_{t-1}$		−0.506*	−0.405
		(0.256)	(0.272)
Constant	0.253**	1.162	2.359
	(0.064)	(1.475)	(1.704)
N	1,538	1,538	1,313
Pseudo R^2	0.038	0.108	0.105
Log-likelihood	−1,008.204	−935.343	−796.048

Notes: Relative Wealth is calculated as the logarithm of the following value: the firm's market value (indexed to 1992) multiplied by the (dollar/yen) exchange rate, divided by the S&P 500 index. Firm Profitability is measured as the firm's profits-to-assets ratio. Firm Size is measured as the logarithm of the real value of the firm's assets, using the Japanese wholesale price index as the deflator. The specifications in columns 2 and 3 also include a set of dummy variables for the nine industry groupings. Below each estimated coefficient, we report the associated robust standard error calculated by relaxing the assumption of independence of the observations for a given year.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

proclivity to engage in FDI, although their estimated coefficients are not reported in the tables in order to conserve space.[13]

The third vector, **MACRO,** contains a set of two macroeconomic variables intended to control for differences in economic activity between Japan and the United States. The U.S. unemployment rate and the Japanese job-offers-to-applicants ratio should control for the macroeconomic business cycle in each country. These are time-series variables that are not firm specific, having the same value for each firm in a given year. In each instance, they are measured over the prior year. Again, we adjust estimated coefficient standard errors to account for the presence of aggregate regressors.

Table 4 shows the results of estimating the firm-level logit regressions for the set of

[13] We estimate a fixed-effects logit for panel data models following Gary Chamberlain (1980). The nine industry groupings, based on the PACAP classifications, are: agriculture, forestry, fishery and mining; construction; manufacturing; wholesale and retail; financial and insurance; real estate; transportation and communication; electrical power and gas; and services.

multiple-year FDI firms. The first column reports estimates for the probability of a firm undertaking one or more FDI projects, using only the set of dummy variables for the level of the Moody's rating for the firm's main bank as explanatory variables. As expected, each of the estimated coefficients is negative, and five of the six coefficients are statistically significant, indicating that firms associated with main banks whose ratings have declined below Aaa have a lower probability of engaging in FDI. In addition, the estimated coefficients on the two lowest ratings are much larger in absolute value than those for the highest two ratings, indicating that the more troubled the firm's main bank, the less likely the firm will undertake FDI.

The specification in the second column adds the firm and macroeconomic control variables to the set of Moody's ratings variables. With the inclusion of the additional explanatory variables, each of the six estimated coefficients on the bank rating dummy variables remain negative, with four of the estimated coefficients remaining statistically significant at the 1-percent level. Again, the probability of undertaking FDI is the lowest if the firm's main bank has one of the two lowest ratings, other things equal. The other explanatory variables are each correctly signed. The probability of engaging in FDI is positively related to the firm's market value measured relative to that of U.S. stocks and the firm's profitability, although neither effect is statistically significant. Larger firms have a higher probability of engaging in FDI, and the effect is statistically significant. The probability of the firm undertaking FDI is reduced by a higher unemployment rate in the United States and by a higher value of the Japanese job-offers-to-applicants ratio, with both effects being statistically significant.

The third column addresses the robustness of our results. It contains results for a sample that omits those firms in the auto and the iron and steel industries, the two industries most affected by the threat of U.S. trade restrictions. It is possible that firms in these two industries were forced to invest in the United States by trade barriers, and that the investment patterns by these firms may be spuriously correlated with the condition of their banks. The evidence in the third column indicates that the results are not sensitive to the exclusion of firms in these two industries. The estimated coefficients on the ratings dummy variables and their significance levels are very similar to the estimates in column 2.

Our preferred sample includes those firms that have engaged in FDI projects in multiple years of our sample period. However, one might be concerned that our results are affected by sample selection bias. To address this issue, we have reestimated the column 2 specification in Table 4 with two alternative enlarged sets of firms. The results are shown in Table 5, which indicates that our results are robust to other sample selection criteria. The first column replicates column 2 of Table 4 to facilitate comparisons with the alternative specifications. The specification in the second column uses the set of firms that engaged in FDI in any year during our sample period. Thus, this selection criterion adds to our sample those firms that engaged in FDI in only one year during our sample period. The results are qualitatively similar to those based on the sample of multiple-year FDI firms. The estimated coefficients on each of the six ratings variables are negative, with those for the four lowest rating categories being statistically significant. With this larger sample of firms, the pattern of relative effects across the ratings variables is quite similar, although the estimated coefficients now tend to be slightly smaller.

The specification in the third column investigates the link between bank health and FDI among an even wider set of firms, one that includes all firms for which we can obtain the relevant data, regardless of whether they engaged in FDI at any time during our sample period. A potential concern with the previous results is that, by selecting only those firms that engaged in FDI, we are using a nonrepresentative sample. To address this concern, this specification includes the set of all first-section, second-section, and over-the-counter firms for which we could identify a main bank and obtain values for the other explanatory variables. This wider sample has more than five times the number of observations of the multiple-year FDI firm sample, and more than triple the number of observations for the sample of firms that engaged in FDI in at least one year of our sample period. However, note that each of the additional 5,656 observations for the firms that did not engage in FDI has a zero value for the

TABLE 5—DETERMINANTS OF JAPANESE FDI FOR INDIVIDUAL FIRMS (ALTERNATIVE SAMPLES; ESTIMATION METHOD: LOGIT)

Independent variable	Multiple-year FDI firms	All FDI firms	All OTC, first- and second-section firms
Aa1	−0.454	−0.440	−0.319
	(0.260)	(0.260)	(0.265)
Aa2	−0.268	−0.239	−0.150
	(0.242)	(0.264)	(0.252)
Aa3	−0.795**	−0.652*	−0.586
	(0.241)	(0.291)	(0.348)
A1	−0.577**	−0.614*	−0.672
	(0.195)	(0.295)	(0.350)
A2	−1.091**	−0.861**	−0.892**
	(0.274)	(0.282)	(0.297)
A3	−1.671**	−1.011**	−1.117**
	(0.205)	(0.263)	(0.271)
Relative Wealth$_{t-1}$	0.162	0.115	0.246**
	(0.123)	(0.125)	(0.087)
Firm Profitability$_{t-1}$	0.860	2.916**	0.929
	(0.904)	(1.092)	(0.926)
Firm Size$_{t-1}$	0.486**	0.560**	1.002**
	(0.041)	(0.030)	(0.029)
U.S. Unemployment Rate$_{t-1}$	−0.379**	−0.393**	−0.334*
	(0.087)	(0.106)	(0.139)
(Japan Job Offers/Applications)$_{t-1}$	−0.506**	−0.554*	−0.709*
	(0.256)	(0.277)	(0.334)
Constant	1.162	−0.589	−4.096**
	(1.475)	(1.241)	(1.162)
N	1,538	2,653	8,309
Pseudo R^2	0.108	0.116	0.256
Log-likelihood	−935.343	−1,433.581	−1,952.246

Notes: Relative Wealth is calculated as the logarithm of the following value: the firm's market value (indexed to 1992) multiplied by the (dollar/yen) exchange rate, divided by the S&P 500 index. Firm Profitability is measured as the firm's profits-to-assets ratio. Firm Size is measured as the logarithm of the real value of the firm's assets, using the Japanese wholesale price index as the deflator. Each specification also includes a set of dummy variables for the nine industry groupings. Below each estimated coefficient, we report the associated robust standard error calculated by relaxing the assumption of independence of the observations for a given year.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

dependent variable. While this has the potential to add noise rather than precision to our estimates, the results in the final column of Table 5 show that each of the six estimated coefficients on the ratings variables is negative, with those for the two lowest ratings being statistically significant at the 1-percent level. In addition, except for the coefficient on Aa2, the (absolute value of the) effect rises with each reduction in the rating. Thus, even when we include a large number of observations for firms that have shown no inclination to engage in FDI, the results are only slightly weaker.

It is likely that the health of the main bank would most affect the FDI decisions of those firms that had few alternative sources of financing. Table 6 provides estimates for two cuts of our multiple-year FDI firm sample that focus on attempting to separate our set of firms based on the degree of their dependence on banks for their external funds. The first cut distinguishes firms by the extent that they access the bond market for their liabilities, assuming that the larger the share of bonds in total liabilities, the less dependent is the firm on bank loans. The second cut distinguishes firms by their size, assuming that smaller firms tend to be more bank dependent. The first specification is our preferred method for better isolating those firms that are not bank dependent, since it identifies those firms that do have access to the bond market as an alternative to bank finance and that

TABLE 6— DETERMINANTS OF JAPANESE FDI FOR INDIVIDUAL FIRMS
(MULTIPLE-YEAR FDI FIRMS; ESTIMATION METHOD: LOGIT)

Independent variable	Excluding firms with largest bonds/liabilities	Firms with largest 20 percent bonds/ liabilities	Excluding largest firms	Largest 20 percent of firms
Aa1	−0.401	−0.530	−0.461	−0.098
	(0.251)	(0.443)	(0.275)	(0.512)
Aa2	−0.163	−0.957	−0.173	−0.635
	(0.361)	(0.571)	(0.247)	(0.533)
Aa3	−0.752**	−0.626	−0.698**	−0.892
	(0.250)	(0.398)	(0.240)	(0.495)
A1	−0.497**	−0.436	−0.516**	−0.487
	(0.181)	(0.385)	(0.175)	(0.481)
A2	−1.285**	−0.406	−1.026**	−1.089**
	(0.433)	(0.351)	(0.281)	(0.372)
A3	−1.489**		−1.439**	
	(0.190)		(0.158)	
Relative Wealth$_{t-1}$	0.358*	−0.716*	0.087	0.842
	(0.145)	(0.362)	(0.134)	(0.717)
Firm Profitability$_{t-1}$	1.982	−1.932	1.176	4.722
	(1.066)	(5.257)	(1.098)	(5.844)
Firm Size$_{t-1}$	0.520**	0.331**	0.374**	0.165
	(0.047)	(0.052)	(0.055)	(0.282)
U.S. Unemployment Rate$_{t-1}$	−0.265**	−1.056**	−0.321**	−0.519**
	(0.088)	(0.132)	(0.101)	(0.164)
(Japan Job Offers/Applications)$_{t-1}$	−0.667*	0.123	−0.468	−0.999*
	(0.278)	(0.281)	(0.283)	(0.395)
Constant	2.261	−2.313	0.551	13.635
	(1.789)	(3.251)	(1.345)	(8.434)
N	1,230	299	1,227	310
Pseudo R^2	0.118	0.092	0.062	0.196
Log-likelihood	−746.165	−173.673	−758.781	−163.471

Notes: Relative Wealth is calculated as the logarithm of the following value: the firm's market value (indexed to 1992) multiplied by the (dollar/yen) exchange rate, divided by the S&P 500 index. Firm Profitability is measured as the firm's profits-to-assets ratio. Firm Size is measured as the logarithm of the real value of the firm's assets, using the Japanese wholesale price index as the deflator. Column 1 excludes the 20 percent of the observations with the largest values for the ratio of bonds to liabilities. Column 2 includes only those observations omitted from the column 1 sample. Column 3 excludes the 20 percent of the observations for each year with the largest values for firm assets. Column 4 includes only those observations omitted from the column 3 sample. Each specification also includes a set of dummy variables for the nine industry groupings. Below each estimated coefficient, we report the associated robust standard error calculated by relaxing the assumption of independence of the observations for a given year.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

have taken the most advantage of that access. Firm size is a more indirect method of isolating those firms that are least bank dependent, since some quite large firms may have quite limited (or no) access to the bond market, for example, because of poor financial health.

The results in the first column are for a sample that excludes those observations for which firms are in the highest two deciles when ordered by the ratio of the firm's bonds outstanding to its total liabilities. Consistent with our results for the full sample of multiple-year FDI firms, each of the ratings variables has a negative estimated coefficient, with those for the four lowest ratings being statistically significant at the 1-percent level. Furthermore, each of the estimated coefficients on the other explanatory variables is of the predicted sign and only that for Firm Profitability fails to be statistically significant. In contrast, the results in column 2 for the ratings variables for those observations for which firms rely most on bonds relative to

bank loans for their external funds are much weaker. Although each of the five estimated coefficients is negative, none are statistically significant.[14]

Columns 3 and 4 provide results similar to those in the first two columns. When the observations for the largest 20 percent of firms (as measured by total constant-yen assets) in each year are omitted from the sample, the estimated coefficients for the six ratings variables are little affected, with each coefficient being negative, and those for the four lowest ratings being statistically significant at the 1-percent level. In contrast, while all five estimated coefficients for the ratings variables are negative for the set of observations for the largest firms, only that for the lowest rating is statistically significant.

The results for the firm-level logit specifications provide strong support for the relative access to credit hypothesis, in line with the bank-level regression results. A firm's FDI is positively associated with the financial condition of its main bank, as measured by the main bank's Moody's ratings. The results are robust to examining changes in FDI using bank-level data that aggregates firms associated with specific main banks or to examining levels of FDI using firm-level data in a logit regression. Both sets of results are robust to alternative specifications and provide strong evidence that part of the dramatic decline in Japanese FDI into the United States during the 1990's can be attributed to the deteriorating health of Japanese banks.

V. Conclusion

In this paper, we propose the relative access to credit hypothesis (RAC) to explain a major puzzle in the pattern of foreign direct investment, the continued decline of Japanese FDI into the United States in the early and mid-1990's as the Japanese yen was appreciating dramatically. Unlike the relative wealth hypothesis, which focuses on imperfect information generating imperfect capital markets, we relax the assumption that firms have equal access to credit. We show that firms' ability to raise external financing was impaired by the deteriorating financial condition of Japanese banks, so that FDI declined most for firms that were reliant on the most troubled Japanese banks. Even as the historically close ties between Japanese firms and Japanese banks are beginning to break down (Hoshi and Kashyap, 1999), Japanese firms remain highly leveraged and far more dependent on bank financing than firms in the United States. Thus, many Japanese firms are still likely to have great difficulty obtaining alternative financing if their main bank is unable, or unwilling, to provide additional financing.

Not only is Japan a particularly good laboratory for exploring RAC because of the collapse of major Japanese banks in the 1990's, the particularly strong relationships between firms and banks, and the importance of outward Japanese FDI for the rest of the world, but also because data are available that enable us to construct a unique data set ideally suited for testing RAC. Unlike in the United States, firm-bank relationships can be clearly identified in Japan and annual FDI investments by particular Japanese firms are available. Evidence based both on bank-level panel data linking FDI by firms to their main bank and on a panel data set of individual firms strongly support the RAC hypothesis, indicating a statistically and economically important relationship between bank health and the ability of Japanese firms to invest in the United States.

Japanese FDI into the United States provides a particularly good test of RAC, but the RAC hypothesis should have much broader ramifications. While much of the power of our test is based on cross-sectional differences among Japanese banks, the financial condition of all Japanese banks deteriorated, indicating that Japanese firms were likely disadvantaged relative to U.S. and European firms operating in Asia and Europe, as well as in the United States. The Japanese have been a major source of FDI into the United States, peaking at 30 percent of all FDI in 1990, but the effects of any decline in

[14] Column 2 and column 4 have no estimate for the A3 rating. In each case, there is only a single observation with a main bank with an A3 rating, and that observation is dropped because it perfectly predicts FDI. In column 2, eight other observations are dropped due to the same problem with the industry dummy variables. Thus, the numbers of observations in column 1 plus column 2 and in column 3 plus column 4 are each less than the total number of observations in the multiple-year FDI firm sample.

FDI would likely be much more severe for small, newly developed countries that rely heavily on FDI. In particular, for those countries that are heavily dependent on FDI from Japan, this transmission mechanism indicates why these countries have been so concerned about the slow pace of recovery for Japanese banks.

REFERENCES

Blonigen, Bruce A. "Firm-Specific Assets and the Link between Exchange Rates and Foreign Direct Investment." *American Economic Review,* June 1997, *87*(3), pp. 447–65.

Caves, Richard E. "International Corporations: The Industrial Economics of Foreign Investment." *Economica,* February 1971, *38*(149), pp. 1–27.

Chamberlain, Gary. "Analysis of Covariance with Qualitative Data." *Review of Economic Studies,* January 1980, *47*(1), pp. 225–38.

Cushman, David O. "The Effects of Real Wages and Labor Productivity on Foreign Direct Investment." *Southern Economic Journal,* July 1987, *54*(1), pp. 174–85.

Fazzari, Steven M.; Hubbard, Robert Glenn and Petersen, Bruce C. "Financing Constraints and Corporate Investment." *Brookings Papers on Economic Activity,* 1988, (1), pp. 141–95.

Froot, Kenneth A. and Stein, Jeremy C. "Exchange Rates and Foreign Direct Investment: An Imperfect Capital Markets Approach." *Quarterly Journal of Economics,* November 1991, *106*(4), pp. 1191–217.

Gertler, Mark and Gilchrist, Simon. "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms." *Quarterly Journal of Economics,* May 1994, *109*(2), pp. 309–40.

Gibson, Michael S. "Can Bank Health Affect Investment? Evidence from Japan." *Journal of Business,* July 1995, *68*(3), pp. 281–308.

Graham, Edward M. and Krugman, Paul R. *Foreign direct investment in the United States,* 3rd Ed. Washington, DC: Institute for International Economics, January 1995.

Hall, Brian J. and Weinstein, David E. "Do Banking Relationships Reduce Corporate Myopia? Evidence from Japan." Mimeo, April 1997.

Hoshi, Takeo and Kashyap, Anil. "The Japanese Banking Crisis: Where Did It Come From and How Will It End?" in Ben S. Bernanke and Julio J. Rotemberg, eds., *NBER macroeconomics annual 1999.* Cambridge, MA: MIT Press, 2000, pp. 129–201.

Hoshi, Takeo; Kashyap, Anil and Scharfstein, David. "The Role of Banks in Reducing the Costs of Financial Distress in Japan." *Journal of Financial Economics,* September 1990, *27*(1), pp. 67–88.

_____. "Corporate Structure, Liquidity, and Investment: Evidence from Japanese Industrial Groups." *Quarterly Journal of Economics,* February 1991, *106*(1), pp. 33–60.

Hoshi, Takeo; Scharfstein, David S. and Singleton, Kenneth J. "Japanese Corporate Investment and Bank of Japan Guidance of Commercial Bank Lending," in David S. Scharfstein and Kenneth J. Singleton, eds., *Japanese monetary policy.* Chicago: University of Chicago Press, 1993, pp. 63–94.

International Trade Administration, U.S. Department of Commerce. *Foreign direct investment in the United States.* Washington, DC: U.S. Government Printing Office, various years.

Japan company handbook. Tokyo: Toyo Keizai Inc., various issues.

Kashyap, Anil K; Lamont, Owen A. and Stein, Jeremy C. "Credit Conditions and the Cyclical Behavior of Inventories." *Quarterly Journal of Economics,* August 1994, *109*(3), pp. 565–92.

Kashyap, Anil K; Stein, Jeremy C. and Wilcox, David W. "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance." *American Economic Review,* March 1993, *83*(1), pp. 78–98.

Klein, Michael W. and Rosengren, Eric S. "The Real Exchange Rate and Foreign Direct Investment in the United States: Relative Wealth vs. Relative Wage Effects." *Journal of International Economics,* May 1994, *36*(3–4), pp. 373–89.

Kloeck, Teun. "OLS Estimation in a Model Where a Microvariable is Explained by Aggregates and Contemporaneous Disturbances are Equicorrelated." *Econometrica,* January 1981, *49*(1), pp. 205–07.

Moody's Investor Services, Inc. www.moodys.com.

Morck, Randall and Nakamura, Masao. "Banks and Corporate Control in Japan." *Journal of Finance,* February 1999, *54*(1), pp. 319–39.

Moulton, Brent R. "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Unit." *Review of Economics and Statistics,* May 1990, *72*(2), pp. 334–38.

Pacific-Basin Capital Markets Databases. Sandra Ann Morsilli Pacific-Basin Capital Markets Research Center, University of Rhode Island, Kingston, RI, 1999.

Peek, Joe and Rosengren, Eric S. "The International Transmission of Financial Shocks: The Case of Japan." *American Economic Review,* September 1997, *87*(4), pp. 495–505.

_____. "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States." *American Economic Review,* March 2000, *90*(1), pp. 30–45.

Petersen, Mitchell A. and Rajan, Raghuram G. "The Benefits of Lending Relationships: Evidence from Small Business Data." *Journal of Finance,* March 1994, *49*(1), pp. 3–37.

Slemrod, Joel. "Tax Effects on Foreign Direct Investment in the U.S.: Evidence from a Cross-Country Comparison." National Bureau of Economic Research (Cambridge, MA) Working Paper No. 3042, July 1989.

Swenson, Deborah. "The Impact of U.S. Tax Reform on Foreign Direct Investment in the United States." *Journal of Public Economics,* June 1994, *54*(2), pp. 243–66.

U.S. Bureau of Economic Analysis, Department of Commerce. *Survey of Current Business.* Washington, DC: U.S. Government Printing Office, various issues.

Zeile, William J. "Foreign Direct Investment in the United States: Preliminary Results from the 1997 Benchmark Survey." *Survey of Current Business,* August 1999, *79*(8), pp. 21–54.