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The Exchange Rate Exposure of U.S. and Japanese Banking Institutions

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The Working Paper Series is made possible by a generous grant from the Alfred P. Sloan Foundation

The Exchange Rate Exposure of U.S. and Japanese Banking Institutions [1]

First Version: July 1996

Abstract: In this paper, we examine the foreign exchange exposure of a sample of U. S. and Japanese banking firms. Using daily data, we construct estimates of the exchange rate sensitivity of the equity returns of the U.S. bank holding companies and compare them to those of the Japanese banks. We find that the stock returns of a significant fraction of the U. S. companies move with the exchange rate, while few of the Japanese returns that we observe do so. We next examine more closely the sensitivity of the U.S. firms by linking the U.S. estimates cross-sectionally to accounting-based measures of currency risk. We suggest that the sensitivity estimates can provide a benchmark for assessing the adequacy of existing accounting measures of currency risk. Benchmarked in this way, the reported measures that we examine appear to provide a significant, though only partial, picture of the exchange rate exposure of U. S. banking institutions. The cross-sectional evidence is also consistent with the use of foreign exchange contracts for the purpose of hedging.

JEL Classification: F31, F23, G21, G28

Keywords: Foreign Exchange Risk, Banking, Market Risk

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This paper was presented at the Wharton Financial Institutions Center's conference on Risk Management in Banking, October 13-15, 1996.

The Exchange Rate Exposure of U. S. and Japanese Banking Institutions'

1. Introduction

This paper studies the exchange rate exposure of firms in the banking industry. Like many firms, banks can be affected by exchange rate fluctuations. Exchange rates affect most directly those banks with foreign currency transactions and foreign operations. Even without such activities, exchange rates can affect banks indirectly through their influence on the extent of foreign competition, the demand for loans, and other aspects of banking conditions. The purpose of this paper is to examine the size and significance of the exchange rate exposure in the banking industry and to investigate its relationship to various accounting measures of risk. To that end, we first estimate the exchange rate sensitivity of the equity returns of a sample of U. S. bank holding companies. We then compare the U. S. estimates to similar estimates that we construct for Japanese banks. We find that the stock returns of a significant fraction of the U.S. banking firms move with the exchange rate, while few of the Japanese returns that we observe do so. We next examine more closely the exchange rate sensitivity of U. S. banking firms by linking the U. S. estimates cross-sectionally to accounting indicators of foreign exchange exposure.

While the exchange rate can influence the value of firms in many industries, our focus on banks stems in part from the growing international interest in monitoring banks' market risks, including foreign exchange risk. Through the aegis of the Basle Committee on Banking Supervision, central bankers from Europe, Japan, and North America in 1993 proposed uniform

a. The authors thank the Federal Reserve Bank of San Francisco and Ernst and Young of San Jose for research support. We also thank Elizabeth Laderman and Mark Levonian for their thoughtful comments. Finally, we are grateful to Barbara Rizzi of the Federal Reserve Bank of San Francisco for her thorough and conscientious research assistance.

measures of various types of market risk. [1] According to the proposal, foreign exchange risk would be measured by tallying up net open positions across currencies, including positions arising both from foreign assets and liabilities, and from off-balance sheet instruments.

More recently, the central bankers altered the proposal and agreed to implement it by the end of 1997. The alteration gives banks the choice of assessing their exposure either through the building block approach or through their own internal risk management tools. This added flexibility is potentially very important because the building block approach by itself can provide only a narrow measure of a bank's exchange rate sensitivity. The building block approach uniformly treats foreign exchange holdings as if they add to currency risk; but if a bank chooses its currency holdings to offset the exposure arising from its other activities, such a treatment is inappropriate. In that case, the bank's holdings reduce, rather than increase, its risk. By giving banks broader scope in assessing their own exposure, the Committee enables them to incorporate the links between their foreign exchange holdings and their other activities. In this paper, we also take a broad view of foreign exchange risk: we gauge the exchange rate exposure of banks in terms of the sensitivity of the bank's total value to changes in the exchange rate. This allows us to appropriately incorporate the covariances among all of the activities of the bank into a gauge of its overall exchange rate exposure.

By focusing on firm value, our work follows in the tradition of Adler and Dumas (1980), who define exchange rate exposure in terms of a regression of asset value on the exchange rate. Our work also builds closely on more recent studies of the market risks faced by banks. Most

1. The Basle Committee originally established international risk-based capital standards in its 1988 Accord. The proposal described here was adopted in 1995 as an amendment to the Accord. It broadens the scope of the Accord to reflect banks' exposure to fluctuations in market prices, such as interest rates, securities prices, and exchange rates.

such studies -- including Flannery and James (1984), Chen and Chan (1989), Mitchell (1989), and Collins and Venkatachalam (1996) -- have focused on banks' interest rate exposure. Several other studies have explored the exchange rate exposure of nonbank firms, but we are aware of only one -- by Choi, Elyasiani and Kopecky (1992) -- that examines the exchange rate exposure of banks.[2] Choi, Elyasiani and Kopecky find evidence of foreign exchange exposure when they aggregate bank returns. However, their aggregation precludes them from linking the estimated exchange rate exposure to individual firm characteristics.

Our paper contributes to this literature in three ways. First, we are able to discern exchange rate exposure among individual U.S. bank holding companies. This evidence of exposure at the individual firm level contrasts with earlier studies of both bank and nonbank firms. We attribute our new findings to the use of daily data, which increases the power of our tests vis-à-vis the use of monthly data. Second, we link our estimates from the daily data to cross-sectional data collected from required bank holding company reports. Some authors, such as Collins and Venkatachalam, have linked cross-sectional data to interest rate risk, but the links to exchange rate risk remain largely unexplored. Our results provide some insight both into the usefulness of accounting indicators of exposure and into the currency risk management practices of large U.S. banks. Finally, we estimate the exchange rate exposure for Japanese banks, and we compare it to U.S. exposure. While we are unable to examine the accounting disclosures of Japanese banks, the comparison nevertheless provides a necessary first step to understanding international differences in foreign exchange exposure.

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2. Some nonbank studies include: Adler and Dumas (1980), Jorion (1990), Bodnar and Gentry (1 993), and Bartov and Bodnar (1994).

To examine exchange rate exposure and its link to existing accounting indicators, we first estimate the sensitivity of equity returns to changes in the exchange rate. Section 2 describes this step in detail. The subsequent sections discuss the relationship between the measure of overall foreign exchange exposure and available accounting indicators. Section 3 provides a discussion of some important data considerations. Section 4 presents the cross-sectional analysis, and the final section concludes.

2. Estimation of Foreign Exchange Exposure

We estimate the sensitivity of returns to the exchange rate in the context of an augmented market model. While we suggest that the exchange rate may be a significant factor in determining bank returns, we use an augmented market model because the exchange rate is not the only factor, or even necessarily the most important one. We would be unlikely to get a good estimate of a firm's exchange rate sensitivity by estimating it in an equation that leaves unexplained the preponderance of the variability in the return. Following Jorion and others, we include the market return in the estimating equations. We also extend the estimating equation to include a bank portfolio return. This provides some control for other industry-wide sources of variation in returns, such as interest rate changes.[3] Specifically, we regress the return of each bank or bank holding company, r_i, on a market return, r_m, on a portfolio of bank returns, r_b, and on the appreciation of the exchange rate, s. We measure the exchange rate exposure of the i* banking firm using the estimated coefficients, β_{is}, from the following time-series regression:

[3]To verify that our results are not an artifact of our inclusion of that portfolio return, we also estimate the equation without the bank portfolio. The results we report here are little changed by the alternative specification.

$$(1) \qquad r_{it} = \beta_{i0} + \beta_{im} r_{mt} + \beta_{ib} r_{bt} + \beta_{is} s_t + u_{it},$$

where t indexes time, and β_{i0} is a constant that varies across banks. Because s_t is expressed in terms of the domestic currency, a banking firm with a net long foreign currency position (inclusive of both its portfolio of foreign exchange instruments and the position implicit in its other operations) would have a negative exchange rate coefficient, β_{is}. The opposite would be true of a firm with a short foreign currency position. Thus, β_{is} may vary across firms. Ultimately, we will be interested in both the sign and the size of β_{is}.

We estimate the equation at both daily and monthly frequencies, and the returns and the exchange rate appreciation are correspondingly defined. In constructing the U. S. sample, we began with the largest 100 U.S. bank holding companies, as measured by asset size and reported by *American Banker* (1993). We then narrowed the sample to include only those banking firms that were traded over the entire sample period on the NYSE or the AMEX and for which we were able to obtain Y-9 reports. This procedure yielded a sample of thirty bank holding companies. We restrict our initial group of firms to large U.S. banking firms for three reasons. First, the largest firms are arguably the most likely to have substantial international activities. Second, they are closer to being comparable in size to the most active international banks of other industrialized countries.[4] Finally, they are likely to be perceived as potentially important contributors to systemic risk and hence worthy of greater regulatory scrutiny. Appendix A provides a list of the bank holding companies included in the sample. Both the daily and the

[4]U.S. banks are typically much smaller than the banks of other major industrialized countries. For example, according to American Banker's 1993 asset rankings, the largest U.S. bank (Citibank) is only the thirtieth in size internationally.

monthly stock returns of these companies are compiled from CRSP files.

For the Japanese bank sample, we include monthly observations of the largest 110 Japanese banks, also as measured in terms of assets size.[5] These banks are listed in Appendix B. Monthly Japanese stock returns are taken from WorldScope data.[6] Daily Japanese bank returns are taken from Extel Research data, and the complete daily sample includes 89 Japanese banks.

As gauges of the market return, r_m, we use the CRSP value-weighted index for the United States and the Nikkei 225 index, obtained from DRI, for Japan. We obtain the banking industry return, r_b, from the NYSE financial index for the United States and the Nikkei's bank index for Japan, as reported by DRI.

In choosing the appropriate exchange rate appreciation measure, s_t, three issues arise: whether to measure the exchange rate in real or nominal terms, how to choose among the many bilateral and multilateral exchange rates, and how to distinguish between its anticipated and unanticipated components.' With regard to the distinction between real and nominal exchange rates, we note that while the distinction may matter in principle, there is little difference between the two in practice because they are extremely highly correlated. Moreover, real exchange rate data are unavailable at the daily frequency. So, we estimate Equation 1 using nominal exchange rates only. With regard to choosing among the many bilateral and multilateral exchange rates, we first estimate the equation using trade-weighted foreign exchange rates, then were-estimate it

[5]These are all of the Japanese banks included in ***American Banker's "The*** Top 500 Banks in the World."

[6]Because WorldScope does not report ex-dividend dates, the Japanese monthly returns do not included dividends, However, the average annual dividend yield for the included firms is less than 1 percent. So, the omission is of little consequence. The daily Japanese returns include dividends.

[7]A bank's sensitivity to the two might be different. For example, one might argue that it is easier to hedge open nominal exchange rate positions than to assess and hedge the exposure associated with real exchange rates.

with several other of the major bilateral rates. The findings are qualitatively robust to these alternative specifications, so we focus the discussion on the estimates found using the trade-weighted foreign exchange rate measure.

The third issue, distinguishing between unanticipated and anticipated exchange rate changes, arises from the empirical framework provided by the augmented market model. The model calls for using *unanticipated* changes in the exchange rate. *Expected* changes over each period should not affect returns, since they should be reflected already in the stock price. We rely on the robust finding of Meese and Rogoff (1983) that the current exchange rate outperforms standard exchange rate models in predicting the future exchange rate.[8] That is, actual exchange rate changes are largely unpredictable. So, we use the actual changes as an indicator of the unanticipated changes. All exchange rate measures are obtained from DRI.

Table 1 summarizes the results of the estimation. The table provides statistics that describe the distribution of the estimated exchange rate exposure measures, β_{is}, including the mean and median estimates and the standard deviation of the estimates, some aspects of its range, and the number of firms whose exposure is found to be statistically significant.

The first two columns present the results for the monthly and daily estimates for the U.S. bank holding companies, and the last two columns present the results for the Japanese firms. Recall that we would expect the exchange rate exposure, β_{is}, to vary across firms. Indeed, the estimates of β_{is} include both positive and negative values for both countries and both frequencies. For the U.S. firms, the exposure measures range from -0.12 to 0.28 at the monthly frequency, and

[8] Meese (1990) reviews additional supporting evidence, and Chinn and Meese (1995) reaffirm the robustness of this finding for horizons less than two years.

-0.07 to **0.20** at the daily frequency, and about two-thirds of the point estimates are positive. The range of estimates for the Japanese firms is even greater: -0.96 to 0.65 at the monthly frequency, and -0.18 to 0.33 at the daily frequency.

The table also presents the number of firms in each sample for which we can reject at the 5 percent and 10 percent significance levels the null hypothesis that the coefficient on the exchange rate is zero.[9] As the table shows, the number of such firms rises in all cases as we move from monthly to daily data. In addition, the fraction of such firms is always greater in the U.S. sample than in the Japanese sample. Consider the estimates from the monthly data first. At the 5 percent level, we can reject the hypothesis that the coefficient is zero for five of the U.S. firms and for eight of the Japanese firms. This represents about 17 percent of the U. S. sample and about 7 percent of the Japanese sample. At the 10 percent level, the numbers rise to nine U.S. firms and ten Japanese firms, representing 30 percent of the U.S. firms and only about 9 percent of the Japanese firms.

At the daily frequency, the number of banking firms for which we can reject the hypothesis that β_{is} equals zero rises. At the 5 percent level, it rises to nine U.S. and nine Japanese firms. This represents 30 percent of the U.S. firms, but only about 10 percent of the Japanese firms. At the 10 percent level, we are able to reject the hypothesis for eleven U. S. firms and for sixteen Japanese firms, representing about 37 percent of the U.S. sample and about 18 percent of the Japanese sample.

The finding that Japanese banks less frequently exhibit sensitivity to exchange rates than do U.S. banks could bean artifact of our sample selection procedure. Specifically, the U.S. sample is

[9] White-adjusted standard errors are used in these tests.

weighted more heavily by money center and dealer banks than is the Japanese sample; nearly one-third of the U.S. sample is made up of money center banks, whereas only about one-fifth of the Japanese banks would be characterized as money center institutions. To alleviate concerns about this, we calculate the percentage of significant exchange rate parameters for nineteen major city, trust, and long-term credit banks in Japan identified by Campbell and Hamao [1993] .10 Among this more focused sample of banks, 21 percent (four banks) have exchange rate parameters that differ significantly from zero at the 10 percent level. This is only slightly higher than the 18 percent found in the full sample. In contrast, 88 percent (seven out of the eight included in the sample) of the U. S. money center banks have significant coefficients at the 10 percent level. Thus, we do not attribute the difference in the findings to the sample selection procedure. Instead we suggest that it arises from fundamental differences in the operations of the firms in the two countries. These differences may reflect a number of factors, such as differences in the structure of ownership, in securities and derivatives laws, in supervision, in the extent of foreign ownership, or in hedging policies. Of particular note is the fact that Japanese banks typically have a much larger share of foreign assets than do U.S. institutions. [11]

Since the foreign currency positions of the banks could change from year to year, we might expect exposure parameters to change by year. So, we re-estimate Equation 1 year by year. Unfortunately, splitting the sample into five parts raises the standard errors substantially. As

[10] These include Asahi Bank, Bank of Tokyo, Dai-Ici Kangyo Bank, Daiwa Bank, Fuji Bank, Hokkaido-Takushoku Bank, Industrial Bank of Japan, Long-Term Credit bank of Japan, Mitsubishi Bank, Mitsubishi Trust and Banking, Mitsui Trust Bank, Nippon Credit Bank, Sakura Bank, Sanwa Bank, Sumitomo Trust and Banking, Tokai Bank, Toyo Trust Bank. and Yasuda Trust Bank.

[11] According to Zenginkyo (1995), approximately 15 percent to 20 percent of Japanese assets were held in the form of overseas assets during the period we examine.

would be expected, the number of firms for which we can reject the hypothesis that the exchange rate coefficient is zero falls dramatically. The results of this exercise are summarized in Appendix C.

Past studies have often failed to reject the hypothesis that the exchange rate coefficient is zero. In trying to interpret the past failures to reject at the individual firm level, it has sometimes been suggested that the exchange rate coefficient appears indistinguishable from zero because firms largely hedge their exchange rate exposure. The findings presented here are less indicative of complete hedging. Instead, they lend some support an alternative explanation, namely, that some of the failures to reject have come from tests with low power. Moving from monthly to daily data made it easier to discern firm level exchange rate exposure. [12] The use of higher frequency data might also be well-suited to similar studies of other types of firms.

3. Measures of the Determinants of Foreign Exchange Exposure

There are many potential sources of foreign exchange exposure. The most obvious source of currency risk comes from having assets or liabilities with net payment streams denominated in a foreign currency .13 This explicit source of currency risk is the easiest to identify, and it is the

[12] Using monthly data, Choi, Elyasiani, and Kopecky were unable to reject the hypothesis that the exchange rate coefficients were zero for individual banks. However, they were able to reject it by combining the banks and restricting the coefficients to be the same. We confirm their finding. We estimated a variant of Equation 1 (replacing the portfolio of bank returns with the treasury bill rate) and obtain an estimate of the exchange rate of exposure of 0.049, with a standard error of 0.014, which is significant at all conventional confidence levels. While this imposes the unappealing assumption that exchange rate exposure is the same across all the banks, it additional support for the notion that it is a lack of power that leads to the failure to reject no exchange rate exposure.

[13] Fr example, a U.S. bank may own, say, a yen-denominated bond, with payments to be made in yen. A nominal appreciation of the dollar against the yen would decrease the dollar value of that asset. If the bank has no offsetting yen-denominated obligations (such as yen-dollar currency swap, or interest payments on yen deposits), then the dollar value of its portfolio will rise or fall when the exchange rate changes.

most easily hedged. [14] Other sources of currency risk are more subtle but just as important. A bank without any foreign assets or liabilities can be exposed to currency risk because the exchange rate can affect the profitability of its domestic banking operations. For a simple example, consider the value of a bank's loan to an exporter. Since the exchange rate can affect the exporter's profitability, it can affect the probability of loan default and, correspondingly, the value of the loan and the profitability of the bank. [15] The estimates of exchange rate exposure provided in Section 2 implicitly treat all sources of exposure the same. In this section, we discuss some of the explicit sources of exposure -- those that can be discerned from accounting data. In Section 4, we examine how these potential sources of exposure are linked to the estimated overall exposure of each banking institution.

This study uses the data contained in U.S. bank holding companies' regulaton financial statements, known as Y-9 reports, to form accounting indicators of exposure. The Y-9 reports are prepared according to regulatory accounting rules that are mostly consistent with those used to generate annual reports for shareholders, known as Generally Accepted Accounting Principles (GAAP). The Y-9 reports are particularly useful because they disclose the assets and liabilities from foreign countries, items that are not disclosed under GAAP. [16] In terms of balance sheet

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[14] Payment streams in the major currencies can be converted into domestic currency using currency swaps, for example.

[15] If the dollar appreciates, it might become more difficult for the domestic (U.S.) firm to compete against foreign firms. A stronger dollar then would imply a higher probability of default by the U.S. firm. The bank consequently would suffer from a dollar appreciation. In this case, the bank is exposed to currency risk: it essentially is "short" dollars against foreign currency.

[16] Some authors such as Jorion [1990] have relied on disclosures in annual reports to shareholders. Under GAAP's Financial Accounting Standard (FAS) 14, annual reports to shareholders provide footnotes that include geographic breakdowns of assets, revenues and a profit measure.

items, a bank holding company's Y-9 provides the dollar value of important categories of foreign assets and liabilities. The foreign assets reported include foreign debt securities, foreign equity securities, and foreign commercial loans. The liabilities include interest bearing and non-interest bearing deposits held in foreign offices. While the foreign assets and liabilities are not necessarily denominated in foreign currencies, they nevertheless provide a measure of foreign activity --a potential source of currency risk. In examining the link between foreign activity and exchange rate exposure, we use the difference between the reported foreign assets and foreign liabilities, which we call Net. [17]

Since 1990, the Y-9 reports also have provided some data on the extent of off-balance sheet foreign exchange activity, which also can be linked directly to foreign exchange exposure.[18] In our sample period, the off-balance sheet disclosures include the notional value of all foreign exchange contracts held by the institution and the market value of those contracts, when the market value is positive. As pointed out by Gorton and Rosen (1995) these data truncate the true market values, which could be either positive or negative. Gorton and Rosen also point out that there is no clear relationship between the market value and the notional value. [19] Rather than relying directly on either the truncated market value or the notional value, we construct a dummy

[17]Note that Net is not a complete measure of the bank holding company's net foreign assets and liabilities. Perhaps most importantly, it does not include foreign loans other than commercial loans.

[18]The 1990 disclosures came about because of the imposition of risk-based capital standards. The intent of the disclosures was to provide bank regulators with a measure of credit risk (i.e., the risk of a counter party failing to perform) as opposed to market risk (i.e., risk due to changes in market prices such as exchange rates).

[19]FAS 107, which has been updated by FAS 119, was adopted as GAAP in 1993 and requires all firms to provide disclosures on the market value of financial assets and liabilities, and on off-balance sheet disclosures. In principal, these disclosures might be used to form better measures of off-balance sheet activities with respect to hedging or speculating in foreign currencies than those provided by the Y-9 reports. This is essentially the tactic taken by Collins and Venkatachalam (1996) in their analysis of interest rate risk in banks.

variable that indicates whether such contracts are used at all. Then, we estimate the relationship between foreign exchange exposure and the dummy variable. The notion that such contracts are risky -- that is, they are used primarily to speculate -- would imply that the relationship between exposure and the use of contracts would be positive. In contrast, if the contracts are used to hedge, then their use should be negatively related to exposure.[20]

The Y-9 report provides two other items that might give a partial indication of a firm's foreign exchange exposure: the cumulative foreign currency translation and foreign loans charged-off. The foreign currency translation reflects the conversion to dollars of the value of assets and liabilities of a foreign business unit.[21] Examining the link between foreign loan charge-offs and foreign exchange exposure gives an indication of the importance of foreign credit risk in that exposure.

Table 2 and Figures 1 through 4 summarize the Y-9 data by year for the sample of U. S. bank holding companies from 1986 to 1992. As shown in the top panel of Figure 1 and in Table 2, these institutions substantially decreased their foreign commercial lending and their foreign deposits during the sample period. As a fraction of total assets, their median foreign commercial lending fell from almost 2 percent in 1986 to about ½ percent in 1992, and their median foreign deposits as a fraction of total assets declined from about 3 percent to about

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[20]That is, a positive estimated parameter would be negatively related to the dummy variable if contracts were used for hedging, and it would be positively related to the dummy if contracts were used for speculation.

[21] The foreign currency translation rules fall under FAS 52. If a company has a business unit whose functional currency differs from the dollar, then the company must measure each period the value of the assets and liabilities associated with that business unit in dollars. This gives rise to a gain or loss which is added to the cumulative foreign currency translation balance, which adjusts shareholder equity, but not income. When the company sells such assets and liabilities, the gain or loss then becomes a part of net income. In addition, revenues and expenses denominated in foreign currencies are also translated to dollars, effectively recognizing a gain or loss in current income. Bank Y-9 reports do not separately break out the income effects of FAS 52, only the balance sheet effects.

1½ percent. Meanwhile, they nearly doubled the percentage of their assets held in foreign debt and equity securities.

The bottom panel of Figure 1 shows the behavior of Net, the sum of foreign commercial loans and foreign debt and equity securities less foreign deposits. As shown, Net tends to be negative for the sample of bank holding companies, and it was the most negative (-2½ percent of assets) in 1988; it moved somewhat closer to zero during 1989 to 1992. To the extent that foreign assets and liabilities are denominated in foreign currency, a negative value of Net indicates a short foreign currency (long dollar) position. In the absence of complete hedging, such a position would suggest that these banking firms as a whole would suffer translation losses with a weakening dollar. This short foreign currency position, by itself also would suggest that these firms typically would have positive foreign exchange exposure parameters. The bottom panel of Figure 2 shows the mean foreign currency translation of these firms. Foreign currency translation became more negative with each year, a trend that accords with the general weakening of the dollar over this period. Table 2 also reports foreign charge-offs and foreign exchange contracts. Foreign charge-offs peaked in 1990, then fell substantially. The market value of foreign exchange contracts is only available for the period since 1990. Since then, it has averaged around 3 percent of assets.[22]

Table 2 and Figure 2 report the income and expense data that we were able to recover from the Y-9 database. Since these income statement data are less inclusive than the balance sheet data provided on the Y-9 reports, our cross-sectional tests emphasize the balance sheet data.

[22]However, recall that market values of foreign exchange contracts are measured only if positive.

4. Cross-sectional Analysis

This section uses the overall exchange rate exposure estimates provided in Section 2 and assesses the extent to which they can be explained by the accounting indicators discussed above. This analysis provides insight both into the adequacy of the accounting disclosures as indicators of foreign exchange exposure and into the risk management practices of banks. Of particular interest is whether a bank's off-balance sheet foreign exchange activity contributes to the overall exposure or diminishes it. While such activities often are thought to be risky, it is possible that they reduce risk instead: such off-balance sheet activities might be used to hedge exposure arising elsewhere within the firm. We examine this possibility below by studying how such activities are linked to the estimates of overall exchange rate exposure over the sample period as a whole.[23]

Table 3 reports the simple cot-relations of the various accounting measures and estimated exchange rate exposure. As the table shows, the estimated exposure is strongly correlated with most of the accounting measures, and it is most highly correlated with the size of the firm. The simple correlations between the estimated exposure and accounting measures of the share of foreign assets, of foreign liabilities, of Net, and of foreign charge-offs all lie (in absolute value) between 0.50 and 0.55. As one might expect, the correlations among these variables are also high, with the correlation between foreign assets and foreign liabilities equal to 0.94. The

[23]As mentioned in Section 2, the method for estimating exchange rate exposure allows for the exposure measure to change by year. In this section, we restrict the exchange rate parameters to be constant for a given firm across all seven years in our sample, as reported in Table 1. While in principle we could relate annual measures of each firm's overall exposure to its annual accounting measures, we adopted the more restrictive assumption because of concerns regarding the reliability of the year by year exchange rate exposure estimates. In accordance with the assumption that exchange rate exposures are the same across years, for a given bank, we must then also assume that the accounting measures are constant across years. Therefore, the accounting measures for each bank were averaged across the seven years in our sample.

correlation between the estimated exposure and total assets is also high: it is 0.57. The correlation between exposure and the measure of foreign currency translation and the dummy for contracts are much lower: 0.07 for the dummy, and -0.28 for translation.

Notice that the simple correlation between estimated exposure and Net is negative. This fact is consistent with the interpretation of Tables 1 and 2 discussed earlier. Recall from those tables that the estimated exposure is predominately positive, indicating overall long-dollar positions. Reducing such a position would entail acquiring foreign currency assets or decreasing foreign currency liabilities. That is, a lower exposure can come from an increase in Net.[24]

We explore these correlations more closely in a multiple regression framework. Specifically, we examine the ability of the accounting measures to explain the estimates of overall exchange exposure. Table 4 reports the results of seven regressions of the estimated foreign exchange exposure on various combinations of accounting measures. Column 1 and Column 2 report the results from univariate regressions of estimated exposure on asset size and on Net, while Column 3 reports the results from including both asset size and Net. Column 4 through Column 7 report the results from regressions that include Net and at least one other variable.

As might be expected from the correlations given in Table 3, multicollinearity precludes the separate identification of the individual effects of the accounting factors. This is shown most clearly in Columns 1 through 3 by the reduction in the t-statistics on Net and on Size which occurs when both are included in the same regression. Despite multicollinearity, the sign of the coefficient on Net is negative in all six regressions in which it is included, and it differs

[24]That is, it would require an increase in Net to the extent that foreign assets and liabilities are denominated in foreign currencies.

significantly from zero in three of them. Its estimated value ranges from -0.22 to -0.57. Hence, a 1 percent change in the short position relative to total assets implies roughly a ¼ percent to ½ percent change in the estimated exchange rate parameter. Again, the negative coefficients simply suggest that the larger the short foreign currency position a bank holds, the larger (more positive) is the exchange rate exposure parameter.

The table also suggests that exposure is reduced if the bank uses foreign exchange contracts. As shown in Column 5 and Column 7, the coefficient on the dummy indicating the reported use of foreign exchange contracts is significantly negative. This evidence is consistent with bankers' use of foreign exchange contracts to hedge foreign exchange exposure. Finally, the table reports the adjusted R* of each regression. These range from 27 percent to 40 percent, suggesting that accounting data are able to explain a non-trivial portion of the exchange rate exposure of banks.

Both Table 3 and Table 4 indicate that the largest U.S. bank holding companies have the largest foreign exchange exposure. The explanation for this finding arguably stems from the activities taken on by those banking institutions. As shown in Table 3, these are the banking institutions that seem to have the largest short positions in foreign exchange. At the same time, many of these large institutions are dealers in derivative contracts such as foreign currency swaps. Since these activities have the potential to contribute greatly to foreign exchange exposure, they offer another potential explanation of the link between size and exposure. However, the limited evidence that we are able to provide here does not support that explanation. The only data we have on such off-balance sheet foreign exchange activities is the reported use of foreign exchange contracts. As mentioned above, such contracts appear to be indicative of lower, not greater, foreign exchange exposure. We also offer no evidence that the cumulative foreign currency

translation balance provides a useful benchmark of foreign exchange exposure.[25]

That the existence of foreign exchange contracts lowers the exchange rate exposure of the banks in our sample suggests that the banks manage some of their exposure through the use of such contracts. This finding affirms the recent direction taken by the Basle Committee. The building block approach takes account of both balance sheet and off-balance sheet transactions, and allowing banks to use their own internal models further broadens the permissible gauges of exposure. Our findings emphasize that it is misleading to look at the contracts in isolation of a bank's underlying activities. The findings also suggest that accounting disclosures during the sample period fall short in that they only partially explain the exchange rate sensitivity of our sample banks. Perhaps the expanded disclosures required under the 1995 amendment to the Basle Accord will be more informative of overall foreign exchange exposure.

5. **Conclusions**

In this paper, we examine the exchange rate sensitivities of U. S. bank holding companies and of Japanese banks using both daily and monthly data. For the U.S. banking firms, we also investigate the degree to which exchange rate sensitivity can be explained by accounting measures of foreign activities. Using daily data, we find that the stock returns of approximately one-third of thirty large U.S. bank holding companies appear to be sensitive to exchange rate changes. This finding contrasts with prior studies that have uncovered little evidence of such sensitivity. We

[25]By combining the Y-9 data and the foreign income information required under FAS 52, future research may yet discern a link that we are unable to find here between the overall exchange rate exposure and the foreign currency translation balance. Without such data, we refrain from drawing conclusions regarding the usefulness of the cumulative foreign currency translation as an indicator of overall foreign exchange exposure.

attribute the relative strength of our results to the use of daily data, rather than to differences in the hedging activities of the firms in our sample. This interpretation is confirmed by comparisons of monthly and daily estimations.

In contrast, we find that relatively few Japanese bank returns appear to be sensitive to exchange rate changes. The difference between the exchange rate sensitivities of Japanese and U.S. banking firms may be attributable to a number of factors: differences in the structure of ownership, in securities and derivatives laws, in supervision, in the extent of foreign ownership, or in hedging policies. We believe that future research examining these differences will offer insight into the riskiness of firms in both countries.

Using cross-sectional analysis, we find that reported accounting indicators of foreign exchange exposure provide a significant, though only partial, picture of the exchange rate exposure of U. S. banking institutions. The accounting indicators that we examine explain roughly 25 percent to 40 percent of the estimated foreign exchange exposure. Overall, we find evidence of a negative relationship between the net foreign asset position of a bank holding company and its foreign exchange exposure. We also find that, among similar banks, those with off-balance sheet activities in foreign exchange contracts exhibit less foreign exchange exposure, not more. This finding is consistent with off-balance sheet hedging. It suggests that, by itself, an observation of the use of such contracts provides a particularly poor indicator of foreign exchange exposure. These findings emphasize the importance of a comprehensive view of the firm in evaluating its foreign exchange exposure.

Table 1
Estimated Exchange Rate Exposure for U.S. and Japanese Banking Institutions

Distribution of Estimates of β_{is} from the Regression:

$$r_{it} = \beta_{i0} + \beta_{im} r_{mt} + \beta_{ib} r_{bt} + \beta_{is} s_t + u_{it}$$

Statistic	U.S. Estimates Monthly (1)	U.S. Estimates Daily (2)	Japanese Estimates Monthly (3)	Japanese Estimates Daily (4)
Median	0.039	0.080	-0.152	0.054
Mean	0.047	0.065	-0.174	0.062
Std	0.084	0.081	0.331	0.107
Minimum	-0.120	-0.065	-0.956	-0.181
First Quartile	0.001	-0.005	-0.394	-0.008
Third Quartile	0.096	0.140	0.046	0.111
Maximum	0.281	0.201	0.649	0.332
Significant at 5 Percent				
Number of Firms	5	9	8	9
Percent of Total	16.67	30.00	7.27	10.11
Significant at 10 Percent				
Number of Firms	9	11	10	16
Percent of Total	30.00	36.67	9.09	17.98
Firms in Sample	30	30	110	89

Notes:
(1) The sample period extends from June 1986 to June 1993.

(2) The variables r_{it}, r_{mt}, and r_{bt} denote returns to the firms, to the market, and to a portfolio of bank stocks in the period *t*. The variable s_t denotes the appreciation of the trade-weighted exchange rate in period *t*.

(3) The number and percent recorded as significant at the 5 percent and 10 percent levels refer to the number of firms whose exchange rate coefficients were found to differ statistically from zero at those confidence levels using White-adjusted standard errors.

Table 2
Exposure Proxies as a Percent of Total Assets for 30 U.S. Bank Holding Companies

Panel A: Balance S beet Measures

	86	87	88	89	90	91	92
Frgn Debt and Equity [a]							
Median	0.051	0.057	0.188	0.190	0.142	0.102	0.107
Mean	0.960	1.140	1.066	1.213	1.176	1.081	0.961
Std Dev	2.149	2.520	2.135	2.356	2.435	2.215	1.728
No Obs	30	30	29	27	29	30	29
Frgn Commercial Loans							
Median	1.869	1.566	0.784	0.725	0.404	0.276	0.516
Mean	3.794	3.488	3.138	3.074	2.890	2.777	2.637
Std Dev	4.311	4.094	3.654	3.473	3.483	3.492	3.604
No Obs	27	27	26	25	26	27	26
Frgn Deposits [b]							
Median	2.966	3.424	3.134	2.197	1.373	1.684	1.428
Mean	11.130	11.716	11.093	10.884	9.437	9.785	8.855
Std Dev	13.245	13.650	12.804	12.702	12.573	12.414	11.568
No Obs	28	28	27	26	28	27	28
Net (Assets-Deposits) [c]							
Median	-1.374	-1.925	-2.572	-1.558	-0.808	-1.283	-1.468
Mean	-6.565	-7.308	-7.093	-7.023	-5.889	-6.225	-5.769
Std Dev	8.444	8.839	8.633	8.422	8.150	8.130	7.885
No Obs	27	27	26	24	26	25	26
Frgn Currency Translation [d]							
Median	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean	-0.008	-0.002	-0.003	-0.005	-0.007	-0.013	-0.022
Std Dev	0.022	0.028	0.023	0.022	0.035	0.050	0.072
No Obs	30	30	29	28	29	29	29
Frgn Income [e]							
Median	0.466	0.428	0.553	0.331	0.218	0.313	0.261
Mean	1.364	1.307	1.504	1.760	1.523	1.256	1.181
Std Dev	1.557	1.574	1.870	2.356	2.157	1.651	2.052
No Obs	28	28	27	24	28	27	28
Frgn Interest Exp [f]							
Median	0.271	0.206	0.269	0.279	0.140	0.073	0.050
Mean	0.897	0.913	0.996	1.237	1.139	0.864	0.733
Std Dev	1.047	1.092	1.235	1.498	1.547	1.202	1.317
No Obs	28	28	27	26	28	28	28

Continued on next page

Table 2 continued

Exposure Proxies as a Percent of Total Assets for 30 U.S. Bank Holding Companies

Panel B: Off-balance Sheet Foreign Exchange Contracts and Charge-offs

	86	87	88	89	90	91	92
Frgn Charge-offs							
Median	0.029	0.097	0.096	0.082	0.148	-0.026	-0.021
Mean	0.069	0.133	0.220	0.224	0.262	0.134	0.024
Std Dev	0.089	0.142	0.350	0.291	0.336	0.337	0.111
No Obs	27	27	26	23	27	27	26
FX Contracts at MV[g]							
Median					0.150	0.106	0.057
Mean					2.990	3.401	3.212
Std Dev					4.849	5.702	5.388
No Obs					29	29	29
FX Contracts < 1 yr[h]							
Median					1.857	0.943	1.027
Mean					80.408	77.961	92.924
Std Dev					129.258	124.014	149.968
No Obs					29	29	29
Fx Contract > 1 yr[i]							
Median					0.346	0.104	0.152
Mean					12.176	12.787	10.734
Std Dev					29.888	29.619	24.472
No Obs					29	29	29

[a] Dollar value of foreign debt securities and foreign equity securities held in the investment portfolio.

[b] Interest and non-interest bearing deposits held in foreign offices.

[c] The sum of foreign investment assets and foreign commercial loans less interest and non-interest bearing deposits.

[d] The cumulative translation effects of exchange rates on assets and liabilities held by the company in business units with functional currencies other than the dollar. The reported amount conforms with Financial Accounting Standard (FAS) 52.

[e] Income on foreign debt and equity securities.

[f] Interest expense paid on deposits held in foreign offices.

[g] Foreign exchange contracts reported at market value (as long as market value is not negative.)

[h] Foreign exchange contracts maturing in less than one year, reported at their notional values.

[i] Foreign exchange contracts maturing in more than one year, reported at their notional values.

Table 3
Simple Correlation of Exchange Exposure Measures

	Exchg Rate Estimate	Abs Exchg Rate Estimate	Size	Frgn Assets	Frgn Liab	Net	Frgn Charge Off	Dummy Exchg Contrcts	Frgn Curr Trnslat'n
Exchg	1	0.818	0.572	0.528	0.553	-0.507	0.553	0.070	-0.278
Rate	0	0.000	0.001	0.005	0.002	0.007	0.003	0.714	0.137
Estimate	30	30	30	27	29	27	27	30	30
Abs Exchg		1.000	0.629	0.479	0.517	-0.466	0.634	0.025	-0.3108
Rate		0	0.000	0.011	0.004	0.014	0.000	0.898	0.095
Estimate		30	30	27	29	27	27	30	30
			1	0.746	0.684	-0.590	0.692	0.297	-0.621
Size			0	0.000	0.000	0.001	0.000	0.111	0.000
			30	27	29	27	27	30	30
Frgn				1	0.938	-0.844	0.756	0.237	-0.428
Assets				0	0.000	0.000	0.000	0.234	0.026
				27	27	27	27	27	27
Frgn					1	-0.977	0.759	0.276	-0.417
Liab					0	0.000	0.000	0.147	0.025
					29	27	27	29	29
Net						1	-0.719	-0.230	0.370
						0	0.000	0.249	0.057
						27	27	27	27
Frgn							1	0.298	-0.491
Charge							0	0.131	0.009
Off							27	27	27
Dummy								1	-0.120
Exchg								0	0.528
Contrcts								30	30

Notes:

Reported is the spearman correlation, significance level, and number of observations used to calculate the correlation. All variables except Size are scaled by total assets prior to the calculation of correlations. Definitions are as follows:

Exchange Rate Estimate–The estimated β_{is} from the regression:

$$r_{it} = \beta_{i0} + \beta_{im} r_{mt} + \beta_{ib} r_{bt} + \beta_{is} s_t + u_{it}$$

Table 3–continued

Simple Correlation of Foreign Exchange Exposure Measures

Abs Exchange Rate Estimate-The absolute value of the Exchange Rate Estimate.

Size-Log of total assets.

Frgn Assets– Dollar value of foreign debt and foreign equity securities held in the investment portfolio and foreign commercial loans.

Frgn Liab- Dollar value of interest and non-interest bearing deposits held in foreign offices.

Net - Frgn Assets minus Frgn Liab.

Frgn Charge-Offs-Foreign loans charged-off.

Dummy Exchg Contrcts– Takes on a value of 1 if the company reports non-zero values of the notional value of foreign exchange contracts which mature in one year or less.

Frgn Curr Trnslat'n- The cumulative translation effects of exchange rates on assets and liabilities held by the company in business units with functional currencies Other than the dollar. The reported amount conforms with Financial Accounting Standard (FAS) 52.

Table 4

Regressions of Esitmated Exchange Rate Parameters on Accounting Indicators for 29 U.S. Bank Holding Companies

	Estimated Coefficients						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	-0.301	0.036	-0.213	0.018	0.119	0.036	0.122
	-3.00	2.14	-1.43	1.39	2.59	2.09	2.89
Size	0.036		0.025				
	3.60		1.68				
Net		-0.494	-0.309	-0.218	-0.567	-0.462	-0.231
		-2.91	-1.57	-0.93	-3.42	-2.49	-1.09
Frgn Charge Offs				21.341			27.23
				1.66			2.29
Frgn X Chng Dummy					-0.094		-0.120
					-1.92		-2.50
Frgn Currency Translation						-19.43	
						-0.462	
Number Obs	29	26	26	26	26	26	26
Adj R^2	.29	.22	.28	.27	.30	.27	.40

Reported is the estimated coefficient and its t-statistic All variables except Size are scaled by total assets prior to calculation of correlations. Definitions are as follows:

Estimated Exposure–The estimated β_{is} from the regression:

$$r_{it} = \beta_{i0} + \beta_{im} r_{mt} + \beta_{ib} r_{bt} + \beta_{is} s_t + u_{it}$$

Size -Log of the total assets of the bank holding company.

Net– Dollar value of foreign debt securities and foreign equity securities held in the investment portfolio and commerical loans minus the dollar value of interest and non-interest bearing deposits held in foreign offices.

Frgn Charge-Offs-Foreign loans charged-off.

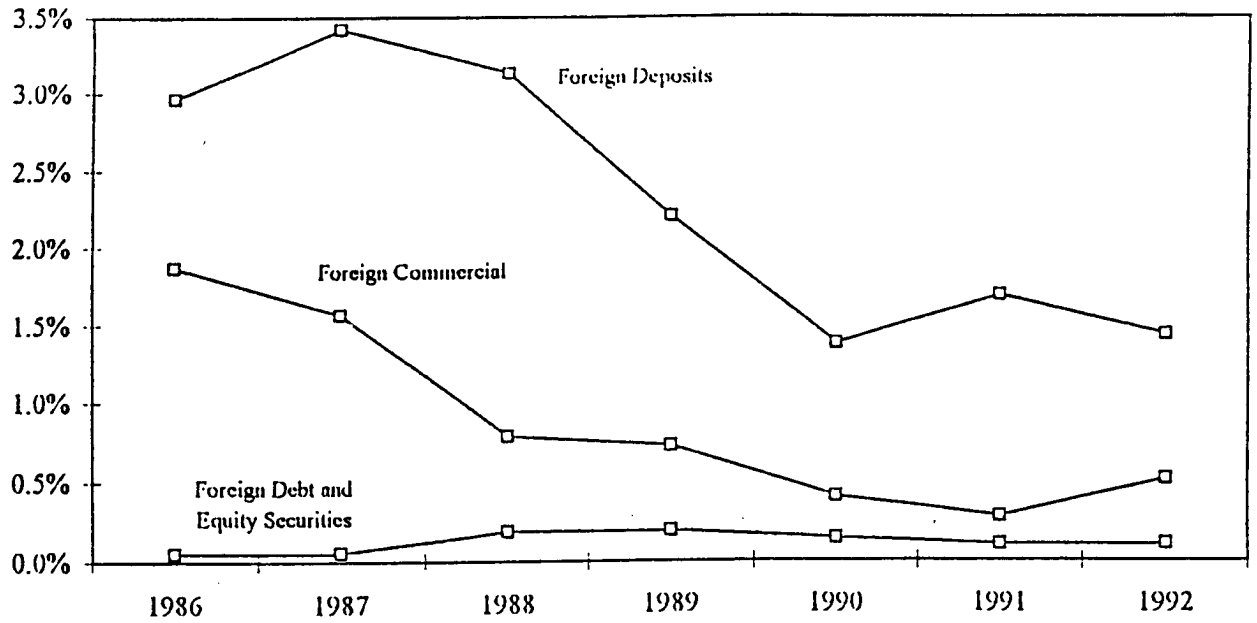
Frgn X Chng Dummy– A dummy variable taking on a value of 1 if the company has foreign exchange contracts which mature in one year or less and zero otherwise.

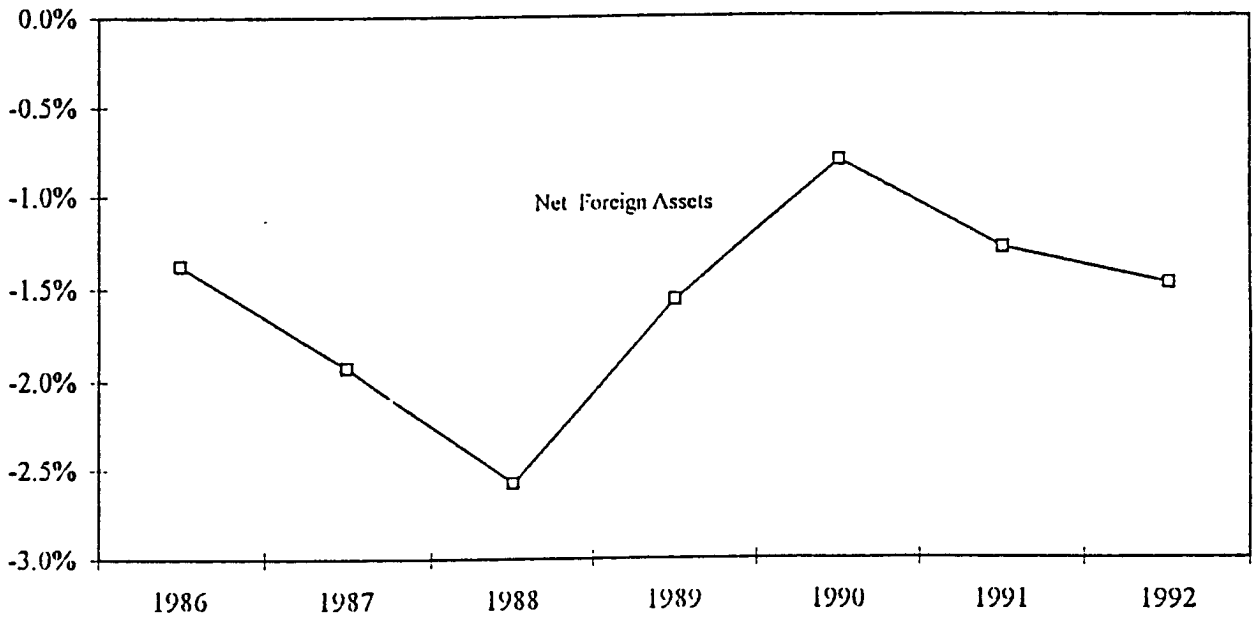
Frgn Currency Translation–The cumulative translation effects of exchange rates on assets and liabilities held by the company in business units with functional currencies other than the dollar. The reported amount conforms with Financial Accounting Standard (FAS) 52.

Figure 1

Foreign Assets and Liabilities as a Percent of Total Assets

Median Values for 30 U.S. Bank Holding Companies





Notes: Net foreign assets are the sum of foreign commercial loans and foreign debt and equity securities, less interest and non-interest bearing foreign deposits.

Figure 2

Foreign Income and Expense as a Percent of Total Assets
Median Values for 30 U.S. Bank Holding Companies

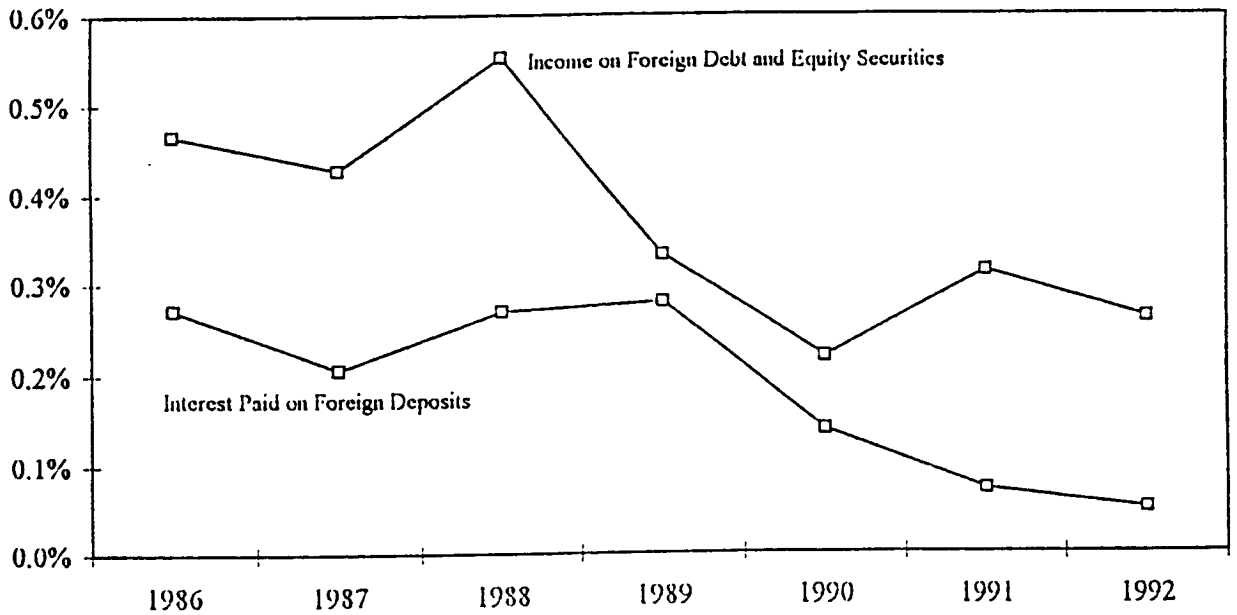


Figure 3A

Foreign Charge-offs Less Recoveries as a Percent of Total Assets
Median Values for 30 U. S. Bank Holding Companies

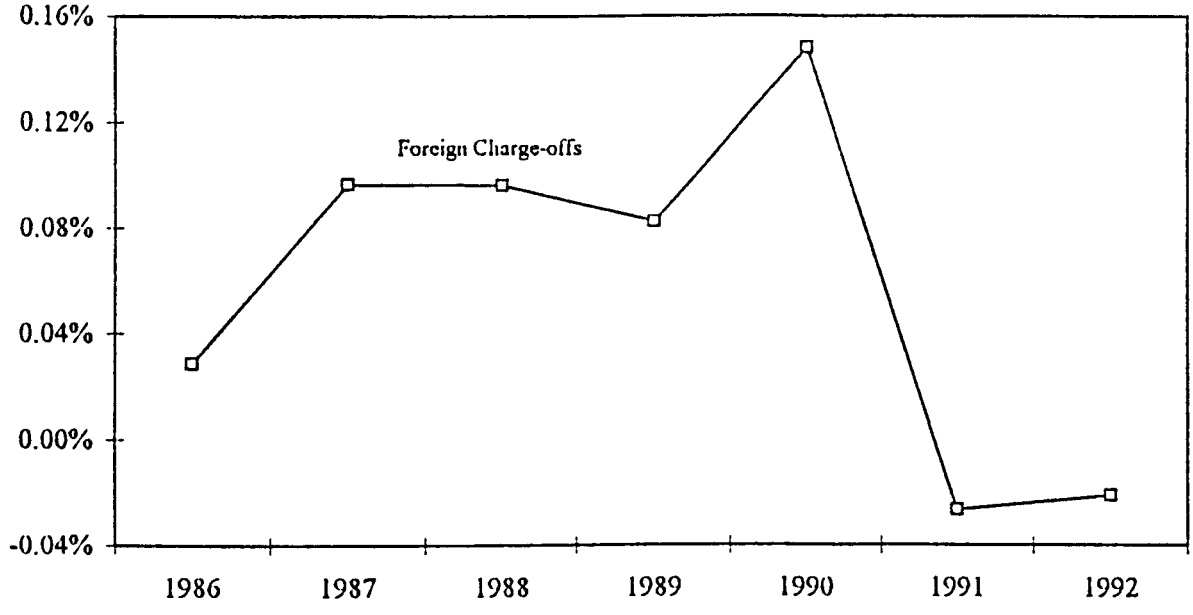
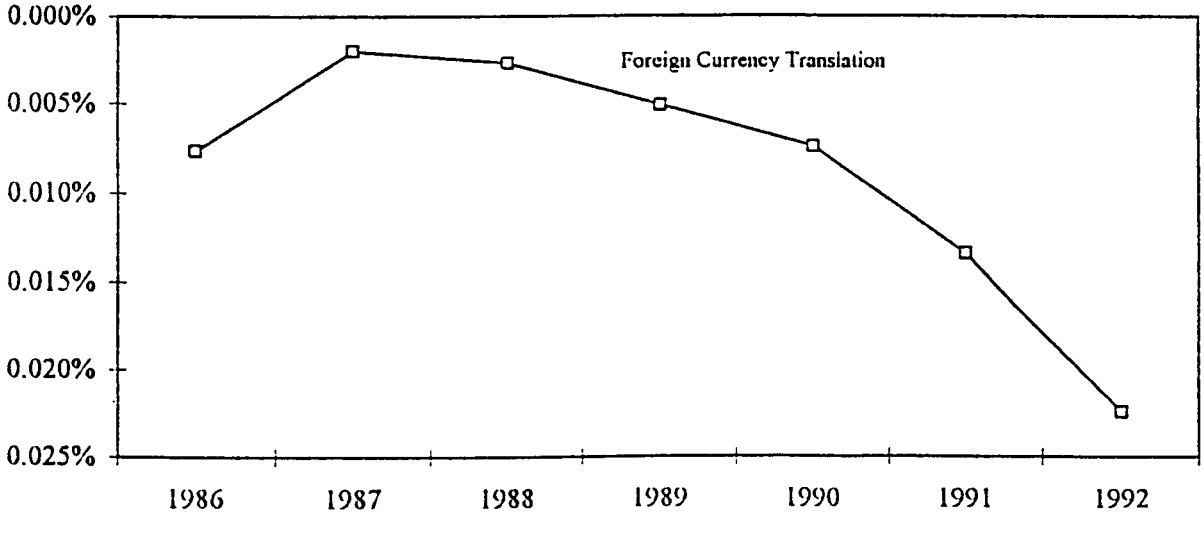


Figure 3B

Cumulative Foreign Currency Translation as a Percent of Total Assets
Mean Values for 30 U. S. Bank Holding Companies



Note: Only 13 of the 30 bank holding companies reported having cumulative foreign currency translations during the sample period. Consequently, the mcdian is zero over the entire sample, and we report the mean here.

Appendix A

U.S. Bank Holding Companies Included in Sample

Bank Holding Company	Estimated Exchange Rate Coefficient	Significance Level (White-Adjusted)
Amsouth Bankcorp	-0.048	0.247
Bank One Corp.	0.016	0.785
Bancorp Hawaii	-0.005	0.916
Bank of Boston	0.094	0.306
Bank of New Yor	0.082	0.173
Bankamerica Corp.	0.141	0.026
Bankers Trust N	0.117	0.020
Barnett Banks I	0.159	0.068
Chase Manhattan Corp.	0.201	0.002
Chemical Banking Corp.	0.145	0.039
Citicorp	0.178	0.017
Comerica Inc.	-0.047	0.371
First Bank System Inc.	0.146	0.005
First Chicago Corp.	0.190	0.002
First Commonwlth Finl.	0.003	0.970
First Fid Bancorporation	-0.051	0.408
First Union Corp (NC)	0.111	0.134
Morgan (J. P.) & Co.	0.126	0.061
NBD Bancorp Inc.	0.090	0.050
National City Corp.	0.056	0.313
North Fork Bancorporation	-0.065	0.595
PNC Bank Corp.	0.140	0.025
Republic New York Corp.	0.058	0.125
Signet Banking Corp.	0.077	0.275
Suntrust Banks Inc.	-0.011	0.852
Union Planters Corp.	-0.008	0.935
Wachovia Corp.	-0.003	0.951
Wells Fargo & Co.	-0.064	0.338
Worthen Banking Corp.	0.089	0.254
Firstar Corp.	0.037	0.415

Notes: See Table 1

Appendix B

Japanese Banks Included in the Sample

Akita
Aomori
Asahi
Ashikaga
Awa
Fukuoka
Ikeda
Iwate
Kansai
Kinki
Kyoto
Nagoya
Okinawa
Osaka
Saga
Theryukyus
Tokyo
Yokohama
Biwako
Chiba
Chibakogyo
Chugoku
Chukyo
Chuotrust
Cosmosec
Daiichikangyo
Daisan
Daishi
Daiwa
Ehime
Eighteenth
Fuji
Fukui
Fuk
Fukutoku
Gifu
Gunma
Hachijuni
Hanshin
Hanwa
Hagashinip
Higo
Hiroshima
Hirosh ogo
Hitachcredit
Hokkaido
Htakushoku
Hokkoku
Hokuetsu
Hokuriku
Hyakugo
Hyakujushi
Hyogo
Industrial boj
Iyo
Joyo
Joroku
Kagawa
Kagoshima
Kanto
Keiyo
Kitanippon
Kiyo
Kyushu
Ltcreditjapan
Michinoku
Mie
Mitsubishi
Mitsubtrust
Mitsuitr
Miyazaki
Musashino
Nanto
Niigat
Nichiboshin
Niigatachuo
Nipcredit
Niptrust
Nishinippon
Northpacific
Ogakikyoritsu
Oita
Saitama
Sakura
Saningodo
Sanwa
Senshu
Seventyseven
Shiga
Shikoku
Shimizu
Shinwa
Shizuoka
Sumitomo
Sumitomotrustin
Suruga
Taiheiyo
Taiyokobe
Tochigi
Toho
Tokai
Tokuyocity
Tokyosawa
Tokyotomin
Towa
Toyotrusting
Yamagata
Yamaguchi
Yamanashichuo
Yasuda

Appendix C

Table C -1
Year-by-Year Estimates of Exchange Rate Exposure for U.S. Bank Holding Companies

Distribution of Estimates of β_{is} from the Regression:

$$r_{it} = \beta_{i0} + \beta_{im} r_{mt} + \beta_{ib} r_{bt} + \beta_{is} s_t + u_{it}$$

	1987	1988	1989	1990	1991	1992	1993
Median	-0.028	0.000	0.101	0.161	0.111	0.054	0.049
Mean	0.035	0.101	0.142	0.177	0.069	0.055	-0.002
Std	0.339	0.324	0.241	0.165	0.221	0.120	0.214
Minimum	-0.502	-0.502	-0.343	-0.257	-0.485	-0.163	-0.479
First Quartile	-0.196	-0.098	0.018	0.072	-0.073	-0.026	-0.086
Third Quartile	0.244	0.287	0.255	0.314	0.231	0.160	0.129
Maximum	0.705	0.705	0.897	0.526	0.484	0.257	0.345
Significant at 5 Percent							
Number of Firms	1	3	3	2	3	4	3
Percent of Total	4.5	13.6	13.0	7.7	11.1	13.8	10.0
Firms in Sample	22	22	23	26	27	29	30

Notes:
(1) The variables r_{it}, r_{mt}, and r_{bt} denote daily returns to the firms, to the market, and to a portfolio of bank stocks in the period *t*. The variable s_t denotes the appreciation of the trade-weighted exchange rate in period *t*.

(2) The number and percent recorded as significant at the 5 percent level refers to the number of firms whose exchange rate coefficients were found to differ statistically from zero at that confidence levels using White-adjusted standard errors.

Table C-2
Year by Year Estimates of Exchange Rate Exposure for Japanese Banks

Distribution of Estimates of β_{is} from the Regression:
$r_{it} = \beta_{i0} + \beta_{im} r_{mt} + \beta_{ib} r_{bt} + \beta_{is} s_t + u_{it}$

	1989	1990	1991	1992	1993
Median	0.003	0.022	0.025	-0.006	0.002
Mean	0.018	0.053	0.040	0.008	0.018
StD	0.277	0.216	0.277	0.217	0.260
Minimum	-0.837	-0.567	-0.932	-0.608	-0.915
First Quartile	-0.163	-0.077	-0.020	-0.105	-0.092
Third Quartile	0.200	0.190	0.187	0.109	0.188
Maximum	0.726	0.502	0.704	0.602	0.630
Significant at 5 Percent					
Number of Firms	12	10	12	5	5
Percent of Total	12.0	10.0	12.0	5.0	5.0
Firms in Sample	100	100	100	100	100

Notes:

(1) The variables r_{it}, r_{mt}, and r_{bt} denote daily returns to the firms, to the market, and to a portfolio of bank stocks in the period *t*. The variable s_t denotes the appreciation of the trade-weighted exchange rate in period t.

(2) The number and percent recorded as significant at the 5 percent level refers to the number of firms whose exchange rate coefficients were found to differ statistically from zero at that confidence levels using White-adjusted standard errors.

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