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Exports and Financial Shocks

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Abstract:
A striking feature of many financial crises is the collapse of exports relative to output. In the 2008 financial crisis, real world exports plunged 17 percent while GDP fell 5 percent. This paper examines whether the drying up of trade finance can help explain the large drops in exports relative to output. This paper is the first to establish a causal link between the health of banks providing trade finance and growth in a firm's exports relative to its domestic sales. We overcome measurement and endogeneity issues by using a unique data set, covering the Japanese financial crises of the 1990s, which enables us to match exporters with the main bank that provides them with trade finance. Our point estimates are economically and statistically significant, suggesting that trade finance accounts for about one-third of the decline in Japanese exports in the financial crises of the 1990s.

JEL Codes: E44, E32, G21, F40

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1. Introduction

One of the most striking features of the financial crisis of 2008 was the collapse in international trade. Figure 1 plots the ratio of real world exports to real gross domestic product for a sample of the largest economies in the world.[1] As this plot shows, the decline in world exports was much greater than the decline in world GDP. Between the first quarter of 2008 and the first quarter of 2009, the real value of GDP fell 4.6 percent while exports plunged 17 percent, which amounts to a decline of $761 billion in nominal terms. Interestingly, the decline in exports was much larger than what standard gravity and macro models of trade would have predicted based on changes in supply, demand, and relative prices (see Chinn (2009); Campbell et al. (2009); Levchenko, Lewis, and Tesar (2009); and OECD (2009)).

The puzzling drop has prompted a number of observers to postulate that trade finance may be partially responsible for the decline (see Auboin (2009); Dorsey (2009); and OECD (2009)). This view is based largely on anecdotal evidence and bank surveys that indicate that finance conditions tightened during this period. As Dorsey (2009) has noted, however, it is difficult to separate cause and effect. Moreover, the standard proxies for trade finance used in the literature – trade credit or short-term credit, for example – are extremely noisy measures of trade finance, making conclusions based on these variables hard to interpret. Our study overcomes these difficulties by using unique matched firm-bank data to examine the link between finance and exports during the Japanese financial crises of the 1990s. This paper is the first to match exporters with the institutions that provide them with trade finance and thereby establish a causal

[1] We used the set of countries that report quarterly seasonally adjusted export and GDP data from national sources. These countries are Australia, Belgium, Canada, France, Germany, Hong Kong, Italy, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, Taiwan, the United Kingdom, and the United States. Jointly, they accounted for 66 percent of world GDP and 68 percent of world exports in 2008.

link between the health of these banks and export growth. Importantly, we also demonstrate that the health of banks providing finance has a much smaller effect on domestic sales than on exports, thus establishing that financial shocks affect exports and domestic sales differently. Moreover, the point estimates suggest that the partial effect of a bank crisis on exports accounts for about one-third of the dramatic drop in exports observed in the Japanese financial crises of the 1990s.

Proponents of a trade finance channel between banks and exporters note that exports are more sensitive to financial shocks due to the higher default risk and higher working capital requirements associated with international trade. In particular, exporters rarely have the capacity or willingness to evaluate counterparty default risk and usually turn to banks to provide payment insurance and guarantees. Moreover, because of the longer time lags associated with international trade, exporters need more working-capital financing than firms engaged in domestic transactions. As a result, virtually every exporter works with a bank or other financial institution to obtain credit or export guarantees. For example, Marc Auboin (2007), using data from the Joint BIS-IMF-OECD-World Bank Statistics on External Debt for 2004, estimates that 90 percent of international trade transactions involve some form of credit, insurance, or guarantee issued by a bank or other financial institution. We will henceforth refer to this nexus of financial arrangements as *trade finance* – that is, the use of financial intermediaries to manage an exporter's payment risk and terms. The fact that exporters depend so heavily on financial institutions for working capital and risk insurance suggests that if a credit crunch causes banks to limit trade finance, exports are likely to be affected more than domestic sales.

The Japanese case of the 1990s provides an interesting laboratory for understanding the role of trade finance. First, like the 2008 crisis, the Japanese crises were prompted by dual land

and equity bubbles that spread to the banking sector. Second, both crises featured defaults in short-term bank lending markets that made investors wary of lending to some banks but not others. And finally, Japan is the only country, to our knowledge, that releases matched bank-firm data that enable researchers to examine whether and how banks transmit financial shocks to exporters.

Our basic empirical strategy is to exploit the fact that some firms within an industry in a particular year relied on relatively healthy banks for trade finance, while others relied on less healthy institutions. We use this within-industry-year variation to identify how a firm's export growth changed with the health of the banks supplying it with trade finance. The use of industry-time fixed effects sweeps out all macro and industry supply-and-demand shocks to ensure that our identification is based only on the health of a firm's bank. The fact that the health of the institution providing trade finance affects firms' exports by a much larger magnitude than their domestic sales underpins our contention that financial shocks have different effects on exports and domestic sales. Moreover, the point estimates suggest that these effects are economically as well as statistically significant: firms whose banks become unhealthy experience large drops in their export-to-sales ratios, and we estimate that the partial impact of bank crises accounts for about one-third of the dramatic drops in exports observed in past Japanese financial crises.

Our paper builds on and contributes to a number of literatures. The notion that financial shocks and capital constraints matter for loan supply and investment has been well established. In seminal work, Peek and Rosengren (1997, 2000, and 2005) were able to document that when Japanese banks became unhealthy in the 1990s, they lent less in the US and that this decline resulted in lower construction activity in states that were heavily dependent on Japanese banks. This work establishes the importance of bank collateral in determining the willingness of banks to lend as hypothesized by Bernanke, Gertler, and Gilchrist (1996). Similarly, Klein, Peek, and Rosengren (2002) demonstrate that foreign direct investment flows are sensitive to the financial health of the banks supplying the firm with credit. Finally, Harrison, McMillan, and Love (2004) show that capital market restrictions negatively affect firms' financing constraints. Jointly, these papers establish a clear link between bank health, lending, and foreign investment.

A number of authors in the international finance literature have examined the possibility that trade credit or the availability of dollar-denominated short-term credit might affect exports (see Ronci (2005); Berman and Martin (2009); Iacovone and Zavacka (2009); Levchenko, Lewis, and Tesar (2009)). While some of these studies have found positive associations, others have found no association, or even negative associations. The failure to obtain consistent results is probably partially due to measurement and endogeneity issues. The first measurement issue stems from the fact that firms may obtain dollar-denominated short-term financing for reasons other than financing trade and not all trade is financed by dollar denominated short-term credit. Moreover, firm financing decisions are likely affected by expectations of changes in cash flow. Finally, and most seriously, is the deeper problem arising from the fact that trade finance can cause trade credit to rise or fall.[2] We can see the impacts of trade finance on trade credit by considering the most common form of trade finance: the letter of credit. Since a letter of credit stipulates that a bank, and not the exporter, bears the importer's default risk, making letters of credit more accessible would reduce the transaction risk for exporters. The resulting reduction in risk would make exporters more willing to accept orders and therefore accept trade credits on

[2] Although *trade credit* and *trade finance* are sometimes used interchangeably, the terms can be confusing because *trade credit* has a clear definition in accounting and a looser one in finance. In particular, whenever a firm receives an order for goods or services that will be paid later, it records a "trade credit" on the accounts receivable section of its balance sheet. This is true regardless of whether the purchaser is foreign or domestic, so that firms with a lot of trade credit on their books may not do any *international* trade. In finance, *trade credit* is also sometimes used to refer to working-capital loans used to finance international trade credits on the balance sheets of exporters. In order to avoid confusing these two senses of *trade credit*, we will always refer to trade credit in the accounting sense and refer to export working-capital loans and other means of financing these trade credits as trade finance.

their balance sheets. This channel provides a mechanism through which an increase in the supply of letters of credit could serve to increase the amount of trade credit. However, letters of credit also typically contain an export working-capital loan that specifies that the exporter will be paid when the goods are shipped as opposed to the usual 30 to 90 days after the goods arrive. The fact that letters of credit result in exporters getting paid earlier means that exporters can remove trade credits from the accounts receivable portion of their balance sheets faster thereby reducing the stock of trade credit.[3] Thus, even if one believes that trade finance is important, it is not clear whether one should expect increased availability of trade finance to increase or decrease trade credit.

As a result of the complexities involved in measuring fluctuations in the availability of trade finance, much of the international trade literature has followed Kletzer and Bardhan (1987), who have examined how long-term access to external finance affects comparative advantage. This work does not focus on high-frequency shocks to the supply of trade finance *per se* but rather on the more general supply of external finance to firms. Chaney (2005) develops a model in which firms are liquidity constrained and must pay a fixed cost in order to export. As a result, they will have suboptimal entry into the export market. Similarly, Manova (2008) provides compelling evidence that capital market liberalizations enable export sectors with needs for greater external capital to expand over the long run. Both papers are important in understanding why firm financing might matter for exporters who require external capital funds to cover fixed costs or other long-term needs, but neither paper addresses the impact of financial shocks on

[3] Similarly, "export factoring" (selling a discounted bill, corresponding to the export account receivable to a financial institution) and "forfaiting" (selling medium- to long-term receivables to a financial institution at a discount) are other major forms of trade finance that also have ambiguous effects on trade credit, depending on whether the insurance or the working-capital loan effects dominate. These forces are further complicated by the fact that risk premiums and borrowing costs may vary widely across countries, time, and industries, making it very difficult to assess whether firms with higher or lower levels of trade credit on their balance sheet have better or worse access to trade finance.

firms that are already engaged in exporting. More recently, Bricogne et al. (2009) use industry measures of external credit dependence to show that French exporters in sectors that were more dependent on external finance tended to contract more in the current crisis than those that were less dependent on external finance. This work is suggestive of a possible link between financial shocks and trade but leaves open the questions of whether external credit usage is endogenous, whether there was a distinct trade finance channel, and indeed whether the exports of these firms behaved differently from their domestic sales, the question at the center of our work.

The structure of the remainder of the paper is as follows: In section 2, we discuss the reasons why exporters might be especially sensitive to financial shocks. Section 3 discusses some basic facts about the Japanese downturn in the 1990s with the aim of establishing some important parallels between Japan's financial crisis and the recent crisis. Section 4 then presents the Japanese firm-level evidence, and section 5 concludes.

2. Why Might Trade Finance Matter?

Trade finance encompasses a series of payment methods for exporters and importers that govern the timing and security of payments. While these are concerns for domestic transactions as well, international trade differs from domestic trade in two important dimensions that make it much more sensitive to financial shocks. First, international transactions are often seen as much more risky than domestic transactions, partly because firms often have difficulty understanding and using foreign legal systems in the event of default or delayed payment (see, for example, Anderson and Marcouiller (2002)). Moreover, exporters often have much less information about counterparty risk and therefore are less willing to extend trade credit themselves. These two factors help explain why export insurance is such an enormous business. For example, according to the Berne Union, the leading association of export credit insurance providers, its members had an export credit insurance exposure of $1.4 trillion in 2008.[4] This total, of course, does not include the implied insurance guarantees contained in letters of credit and other trade finance instruments.

A second reason why exporters use trade finance is that international trade takes significantly more time to execute than domestic trade. Djankov, Freund, and Pham (2006) found in a sample of 180 countries that the median amount of time it takes from the moment the goods are ready to ship from the factory until the goods are loaded on a ship is 21 days. Similarly, the median amount of time it takes from the moment a typical good arrives in a port until the good arrives in the purchaser's warehouse is 23 days. If we couple this finding with Hummel's (2001) estimate that the typical good imported into the US by sea spends 20 days on a vessel, we can see that it is not uncommon for goods to spend approximately two months in transit. Even in OECD countries, which have the most streamlined procedures, it takes 11 days for a good to reach a port or arrive from a port. These data suggest that firms engaged in international trade are likely to be more reliant than domestic firms on working-capital financing to cover the costs of goods that have been produced but not yet delivered.

Indeed, the available data suggest that trade finance is extremely important and commonplace as a means of reducing counterparty risk and of securing working-capital funds. Although measurement problems have caused many countries to stop collecting trade finance data, the best evidence, which is based on 2004 data, suggests that 90 percent of trade transactions involve some form of credit, insurance, or guarantee issued by a bank or other financial institution (Auboin (2007)).

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[4] Source, http://www.berneunion.org.uk/bu-total-data.html.

Moreover, despite the variety of techniques used to finance trade, in the vast majority of cases the exporter does not receive payment until after the goods are delivered. According to a joint International Monetary Fund–Bankers' Association of Finance and Trade survey, in the fourth quarter of 2007 only 19 percent of all international trade transactions were done on a cash-in-advance basis. Since the remaining payment methods typically do not require the importer to pay until 30–90 days after delivery, the data strongly suggest that in most cases the exporter must find a means of obtaining working capital to finance trade. In other words, an exporter who does not secure trade finance will typically not be paid for three to five months after the goods are shipped. As a result, most exporters seek a financial institution to provide trade finance. Although exporters need not rely on private banks for this purpose, in practice, they do. For example, Auboin (2009) finds that 80 percent of the providers of trade finance are private banks.

Given that banks are the principal suppliers of trade finance, the supply of such financing is likely to be closely tied to the health of the banks. In particular, as the health of banks deteriorates, these financial institutions find it increasingly difficult to raise funds either through interbank borrowing or through the issuance of new bonds or equity. And as these sources of liquidity diminish, unhealthy institutions cut back on their lending. These cutbacks are likely to have a particularly large impact on trade finance because the short maturities of trade finance and its need for constant renewal make it particularly sensitive to a bank's ability to extend new credit. Moreover, since exports are much more dependent on finance than domestic sales for the reasons outlined above, exports are likely to be harder hit by financial shocks. This suggests the existence of a "financial accelerator" for exports akin to that described in Bernanke, Gertler, and Gilchrist (1999) because the initial shocks to the macro economy, in this case in the real estate sector, are amplified and passed on to the rest of the economy through the financial market.

Obviously, if firms can easily switch between sources of trade finance, problems in one financial institution need not create difficulties for an exporter. However, there is good reason to believe that it is difficult to find another source of financing quickly in the event that an exporter is cut off. In particular, any new financial institution interested in providing trade finance would need to examine carefully the risk of the exporter, the importer, the purchaser's financial institutions, and the reasons why the original financier refused credit. While this analysis can certainly be done, it may take some time and is likely to delay the exports. Thus, the mere fact that exporters can find alternative sources of finance does not mean that they can do so rapidly enough to prevent an interruption in their shipments.

The discussion so far suggests that financial shocks are likely to be transmitted to exporters through two channels. First, financial institutions that have difficulty raising new funds may increase their rates for trade finance. In the Japanese financial crises of the 1990s this could be seen in the jump in interbank borrowing rates charged to Japanese banks relative to foreign institutions. Similarly, in the 2008 crisis, the standard measure of the risk premium charged to banks (the difference between interbank offer rates charged to banks and the overnight indexed swap rate) jumped sharply reflecting higher bank borrowing costs.

Second, liquidity may dry up and banks may simply be unable to borrow and extend sufficient credit. For example the Bank of Japan (1998) noted that in the midst of the 1998 crisis, "lending attitudes of financial institutions, however, are becoming increasingly cautious as capital adequacy constraints have become more binding." While we don't know how much of the deterioration in bank capital resulted in higher premiums charged for trade finance in Japan in 1998, there is clear evidence that this happened in the more recent 2008 crisis. For example, an IMF-Bankers Association of Finance and Trade Survey (2009) of 88 banks in 44 countries revealed that the average spreads on letters of credit, export credit insurance, and short- to medium-term trade-related lending rose by 40, 64, and 31 basis points respectively in the fourth quarter of 2008 relative to the fourth quarter of 2007. Given that the typical spread on a letter of credit is 10–16 basis points (see Auboin (2009)), these numbers represent substantial increases in the costs of these instruments. Indeed, the same survey also revealed that 57 percent of banks believed that part of the decline in trade finance transactions was caused by a tightening of credit availability at their own institution. If credit was drying up in the crisis, this is likely to have made it more difficult for exporters or other banks to assume the risk and working-capital needs associated with an export shipment after an exporter's main bank had held back on financing.

In sum, our discussion of trade finance suggests a potentially important link between exports and the financial sector. Because of the higher risk and working-capital needs of exporting, exporters rely more on banks for their exports than for their domestic sales. As a consequence, financial crises are likely to affect exports harder than domestic sales. In order to examine this relationship, we first present an overview of the Japanese financial crises of the 1990s and then turn to the firm-level evidence to identify the connection between exports and the financial market.

3. The Japanese Credit Crunch

There are a number of reasons why Japan provides an ideal case for examining the impact of financial crises on exports. Japan's financial crises of the 1990s have a number of striking parallels to the 2008 global crisis that make it especially relevant for understanding what happened more recently.[5] The major driving forces behind the crises in both periods were twin

[5] The details of Japan's financial crises have been extensively examined elsewhere (see Hoshi and Kashyap (2001) for an excellent discussion), so we will highlight only a few of the relevant details here.

real estate and stock market bubbles. In Japan, stock prices peaked in December 1989, and real estate prices peaked in 1991. Japanese bank stock prices fell sharply in late 1991 and early 1992 as it was determined that commercial banks would end up absorbing a disproportionate share of the losses suffered by the specialized mortgage lending companies that some of these banks had founded. By 1995, Japanese stock prices had fallen 49 percent from their peak, and commercial and residential real estate prices in the six largest cities of Japan had fallen 60 and 44 percent, respectively. This drop had heterogeneous effects on financial institutions: Japanese banks that had lent heavily in the real estate sectors – the Long-Term Credit Bank (LTCB) and Nippon Credit Bank, for example – were particularly hard hit by a sudden rise in nonperforming real estate loans coupled with big losses in their equity portfolios. Similarly, banks with long-term liabilities suffered heavy losses as Japanese interest rates fell.

Initially, the disclosure of nonperforming loans and other losses was highly imperfect, but bank analysts soon began to realize that many Japanese financial institutions were insolvent. This information became much more public with the emergence of the "Japan premium" in the mid-1990s, which reflected the unwillingness of investors to extend short-term credit to Japanese banks unless the banks paid a substantial risk premium. Hoshi and Kashyap (2001) succinctly describe what happened next:

> Slowing growth in 1997 uncovered more bad loans, and in November 1997 a crisis erupted. On 3 November, Sanyo Securities, a mid-sized securities firm famous for having the world's largest trading floor during the speculative frenzy of the late 1980s, suspended part of its operations and filed for bankruptcy protection. This was the first postwar default in the overnight interbank loan market, a shocking event. Then Hokkaido Takushoku Bank…was no longer able to secure funding in the interbank market. It was forced to close on 17 November, marking the first failure of a major bank in postwar Japan. A week later, on 24 November, Yamaichi Securities, one of the Big Four security houses, collapsed following rumors (which subsequently proved true) that it had suffered huge losses. (276)

Interbank overnight loan rates in Japan skyrocketed, with the Japan premium hitting 100 basis points, as Japan's short-term credit markets seized up. These events closely mirrored the collapse in interbank liquidity markets in the US. As Peek and Rosengren (2000, 2005) convincingly document, in the massive credit crunch that followed Japanese banks were reluctant to provide new loans. With $50 billion in bad loans, the LTCB, the ninth-largest bank in the world, had to be nationalized by the end of 1998 (Tett (2004) p. xi).

As the discussion has made clear, there are important similarities between Japan in the 1990s and the crisis of 2008. Both crises were initially caused by collapses in real estate prices that caused bad loans to spread from specialized mortgage lenders to banks and other financial institutions. In both, the proximate cause of the crises came from defaults in markets used by banks to secure short-term funds: the Sanyo's default in the Tokyo interbank market in Japan and, more recently, Lehman's default in the money market. And, as we will document next, there also was a dramatic decline in Japanese exports akin to what we saw in 2008.

4. Evidence from Data on Firm-Level Exports

Our sample of firms is drawn from the Development Bank of Japan (DBJ) database of unconsolidated corporate reports. Between 1986 and 1999, the DBJ collected data on exports and loans for every firm listed on a stock exchange. The 600–700 manufacturing exporters in our sample, on average, accounted for 80 percent of all Japanese merchandise exports over this time period. In general, the Japanese fiscal year runs from April in year t until March in year $t+1$, with the accounting year of 82 percent of firms ending in March and 10 percent of firms ending in November or December. Figure 2 shows how well changes in exports of our sample of firms track those of the overall economy. In this figure, we plot the aggregate export data from the

Ministry of Finance, which is on an April–March basis, with the aggregate export data in our sample of firms. As the figure shows, aggregate export growth computed from our sample of firms follows Japanese exports from official sources quite closely. This suggests that our data are likely to capture any aggregate movements in Japanese exports.

In order to identify which financial institutions are providing these firms with trade finance, we supplement the DBJ data with data obtained from the *Japan Company Handbook,* which provides information on each firm's reference banks. These banks, listed in order of importance, handle most of the firm's transactions. For each firm in the sample, we write down its main "reference bank." In cases where a firm's main bank was a regional bank, and therefore probably not active internationally, we identified the bank most likely to provide trade finance as the first large commercial bank on the list of reference banks.[6] Although listed Japanese firms often deal with multiple banks, it is generally agreed that the main bank identified in this manner is the bank that typically handles the firm's payment settlement accounts and foreign exchange dealings (see Aoki, Patrick, and Sheard (1994)). Nevertheless, we examine alternative ways of identifying the main bank in the robustness section.

Our next task is to measure the health of banks. The major problem we face is that during the 1990s Japanese banks employed a wide variety of techniques to hide losses on their balance sheets. As a result, Peek and Rosengren (2005) argue that stock returns are much better measures of bank health than standard capital adequacy ratios, and we follow their suggested

[6] We defined the set of internationally active banks as Japan's "city banks" plus a few other prominent banks, giving us a sample of 20 banks: Dai-Ichi Kangyo Bank, Sakura Bank, Fuji Bank, Bank of Tokyo-Mitsubishi, Asahi Bank, Sanwa Bank, Sumitomo Bank, The Daiwa Bank, Tokai Bank, Taiyo-Kobe Bank, Saitama Bank, Industrial Bank of Japan, Long-Term Credit Bank, Hokkaido Takushoku Bank, Kyowa Bank, Kyowa-Saitama Bank, Mitsui Bank, Mitsui-Taiyo-Kobe Bank, Mitsubishi Bank, and the Bank of Tokyo. Because of bank mergers, there is a maximum of 15 banks in any one year in our baseline regressions.

methodology.[7] For each main bank, we computed the monthly market-to-book value as the average monthly share price multiplied by the number of shares outstanding and divided by the book value of its equity. We define the log change in the market-to-book value as the 12-month log difference of this number. All these data were taken from the Pacific Basin Capital Markets database.

Ultimately, we will examine whether changes in the market-to-book value affect future export performance. For that purpose, it is useful to define the lagged change in bank health as the lagged log change in the bank's market-to-book value over the 12-month period before the close of the company's books. This approach lets us examine whether a collapse in the market value of a bank in one year is associated with slower export growth in a subsequent fiscal year. For example, if a firm's fiscal year ends in March, we would examine whether the change in the market-to-book value of its main bank between March of 1997 and March of 1998 was associated with slower growth in exports from fiscal year 1998 to fiscal year 1999.

Figure 3 shows the dispersion in our measure of bank health over the course of our sample. We portray only the data for March-on-March changes because most of the firms in our sample close their books in that month and this keeps the figure less cluttered. The line indicates the log change in the median market-to-book value in our sample of main banks. As the figure shows, the typical bank saw its market value rise dramatically in the bubble years and fall sharply as nonperforming loans accumulated in the 1990s. The worst years for Japanese banks

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[7] Peek and Rosengren (2005) argue that "it is widely believed that Japanese bank capital ratios are substantially overstated…. For example, Bank of Japan Governor Masaru Hayami told Parliament that the capital ratios of Japanese banks in March 2001 would have been only 7 percent rather than the reported 11 percent had they been held to the U.S. standards of capital adequacy. An even lower, and likely more prudent, estimate of the state of capitalization of Japanese banks is that the reported 10-percent capital ratios of the big banks represent a capital ratio of only about 2 percent once the public funds injected into the banks, the value of deferred taxes, and the 'profits' from the revaluation of real estate holdings are subtracted from the banks' capital…. *To the extent that analysts are able to penetrate the veil of reported capital and nonperforming loan ratios, widely viewed as deviating substantially from the true extent of bank problems, stock returns should reflect the best estimates of bank health* [emphasis added]."

were 1992 (the year after land prices peaked and the first wave of bank failures began) and 1997 (as Japan was wracked by another series of bank failures). Interestingly, if we compare figures 2 and 3, we see that both these years were followed by negative export growth.[8] What is critical for our study, however, is the heterogeneity in the returns of different banks. In most years, the difference between the bank with the highest return and the bank with the lowest return was approximately one-half log unit, which suggests that, in the typical year, some banks had returns that were 65 percentage points higher than others. In other words, the real estate crash did not affect all banks equally, and there were enormous differences in bank performance. We will exploit this cross-bank variation in how nonperforming loans affected different banks in our identification strategy.

One possible concern about this methodology is that an endogeneity problem might arise if lower export levels affect bank balance sheets, an effect that might be manifest through two possible channels. First, if a firm exports less, the bank will earn less money on its trade finance contracts, and therefore the bank's profits will be lower. To get some sense of a main bank's exposure through this channel, we can multiply the typical spread on an export credit contract (reported to be around 20 basis points) by the volume of firm exports times the typical duration of a trade credit contract (0.25 years). If we deflate this number by the market value of the bank, we can get a sense of how much the stock price of a bank would move if the firm stopped exporting and hence the firm's demand for export financing fell to zero in that year.[9] In this case, the median implied movement in stock prices is only $6.4*10^{-5}$ percent. This suggests that the observed export growth rates of a firm could have only a minuscule impact on the stock price of the typical bank supplying trade finance.

[8] The low export growth in 1987 is probably associated with a dramatic appreciation of the yen in 1986.
[9] We decided to do this calculation for 1993, the midpoint of our sample.

A second possible channel for endogeneity is through firm default. If a decline in exports is associated with a greater default probability, a bank's share price might decline when a firm's exports decline. To assess this risk to the bank, we computed the median value of a main bank's loan to an exporter as a share of the main bank's market value. For our sample of firms and banks, this number came to only 0.02 percent. This means that the banks in our sample had a sufficiently diversified lending portfolio so that a default on the typical loan to any given firm would again move the bank's stock price by only a trivial amount. Therefore, the massive movements in bank stock prices that we observe in our sample could not possibly have been driven by the export growth of the firms in our sample. A much more plausible story is that the trouble experienced by Japan's banks in the 1990s was driven by the collapse in asset prices associated by the 80 percent decline in stock and land prices.

Our identification strategy, then, is to assume that nonperforming loans in Japan affected bank health, which in turn affected the ability of banks to provide trade finance. If exports are credit sensitive, then one should expect to see a relationship between the health of the institution most likely to provide the firm with trade finance and the export behavior of the firm. Obviously, a large number of other factors are related to export growth. However, most of these – industry demand, factor endowments, exchange rates, and factor prices, for example – can be thought of as common to all exporters within an industry at a moment in time. We therefore include industry-year dummies in our specifications to eliminate any bias arising from these sources.[10] Our basic estimating equation is:

(1) $$\Delta \ln\left(\text{Exports}_{fit}\right) = \alpha_{it} + \beta \Delta \ln\left(\text{MTB}_{fit-1}\right) + \varepsilon_{fit},$$

[10] The DBJ data divide manufacturing into 108 sectors, which comprise our industry dummies. All standard errors are clustered at the bank level.

where Exports$_{fit}$ corresponds to the exports of firm f in industry i at time t, MTB$_{fit}$ is the market-to-book value of the main bank for that firm, and all Greek symbols are parameters to be estimated. Our identification strategy, then, is based on how the export growth of firms within a narrowly defined industry in a particular year varies with the health of the banks providing those firms with trade finance.

Table 1 presents the results from these regressions. We drop firms whose export growth is in the top and bottom one percentile.[11] The first two columns present regressions of the change in log exports on the lag change in the log market-to-book value of the bank most likely to be supplying trade finance. In the first column, we report results with year dummies, and in the second column, we report results with industry-year fixed effects. The estimated coefficient with industry-year dummies is about 0.08, which means that when a firm's main bank suffered a 30 percent decline in its market-to-book value, the firm's annual exports declined 2.7 percent.

In column 3 of table 1, we check whether we have the correct lag structure in the change in the market-to-book value. The results indicate that a change in the market-to-book value from, say, December 1996 to December 1997, will affect export growth from the calendar year 1997 to 1998. Thus, the fall in exports occurs in the year following the slump in bank health. Column 3 shows that a two-period lagged change in market-to-book value has no effect on exports.[12] All the effects appear to be contained within the year following the change in bank health. This implies that the effects of a decline in bank health are short term, as one would expect if a decline in bank health immediately led to a decline in the ability of the bank to raise financing.

An important part of our argument supporting a link between the financial sector and exports is that exporters depend on trade finance to make sales abroad because of the greater

[11] Including these outliers tends to magnify the effect of bank health on exports.
[12] The contemporaneous change in market-to-book value is also insignificant.

risks associated with exporting coupled with the higher need for working-capital financing. In order to test whether we have identified an export-specific effect or merely a general effect applicable to all sales, we replaced the dependent variable with the log change in domestic sales for the same sample of firms in column 4 of table 1. This sample includes all firms that exported at any time during the sample period – in 10 percent of the observations domestic sales account for 100 percent of the firm's total sales and the median share of domestic sales in total sales is 88 percent. As the table shows, firms whose main bank became unhealthy tended to sell less in the domestic market, but the effect is much smaller than the effect on exports.[13]

Despite our calculations indicating that it is highly unlikely that reverse causality could be driving our results, we wish to be certain that this is not a factor in our results. Since it seems implausible to argue that the health of a bank would be systematically related to changes in a borrower's export to domestic sales ratio, in column 5 we replace the dependent variable with the log change in the ratio of exports to domestic sales. The results clearly show that the export to domestic sales ratios of firms fell after the health of banks supplying trade finance declined, which implies that our results are not driven by reverse causality. Moreover, the results in columns 2 and 4 indicate that the reason for the decline was that the health of the bank providing trade finance causes exports to decline about 5 times more than domestic sales. This strongly suggests that these results are driven by the additional financing needs of exporting relative to selling domestically *even within the same set of firms*.

In table 2, we show that the results are robust to alternative bank-matching methods and to different measures of bank health. Other researchers have used the bank providing the largest loan to a firm as the means of identifying the main bank. In order to examine the sensitivity of

[13] We dropped observations where domestic sales growth is in the top and bottom one percentile. Including these outliers leads to an insignificant positive effect of bank health on domestic sales.

the results to our method of matching firms and banks, we identified the main bank as the largest lender to the firm among “city banks,” that is, commercial banks. Because Japanese city banks are known to be involved in trade finance, firms that borrow heavily from city banks are likely to obtain trade finance from them as well. In the first column of table 2, we identify the main bank as the city bank providing the largest loan to each exporter.[14] Then, in column 2, we rerun the regression identifying the main bank as any first-listed reference bank in the *Japan Company Handbook*, even if it is a regional bank, expanding the sample of banks from 15 to 43. The results are not qualitatively different from those in our baseline specification, indicating that other reasonable methods of identifying which bank handles most of the firm’s trade finance transactions seem to yield similar results.

Our measure of bank health relies on share and equity values in the closing month of each accounting year. To address concerns that a particular month may be atypical, we define the market-to-book value in column 3 of table 2 as the average of the market-to-book value in the last three months of each accounting period, to smooth out any unusual fluctuations. We see that the results are robust to this alternative definition.

Another potential problem is that we use the same industry-year dummies for firms whose accounting years end in different months. This could potentially cause problems because not all the months fall within the same 12-month period. To make sure this variation is not causing a problem, we reestimated the baseline equation with only those observations in which the accounting year ends in March, and again we see that the results are robust (see column 4, table 2).

[14] If there was no loan in a year, we used the main bank in the previous year. If there were no loans over the whole sample period, we dropped the firm from the estimation in this column.

Another possibility is that there may be some other correlation between changes in exports and changes in a bank's market-to-book value that we have not considered. For example, if changes in contemporaneous exports are correlated with changes in a bank's market-to-book value and changes in exports are serially correlated, we might observe a spurious correlation. To check that persistence in export growth is not driving the results, we included a lagged dependent variable in column 5 and show that the coefficient on the market-to-book value remains unchanged. This indicates that even if one believes in a contemporaneous correlation between a firm's exports and a bank's health, that correlation cannot drive our results. Instead, our result must arise from a deterioration in bank health leading to a future decline in exports that is independent of what is happening to contemporaneous export growth.

In table 3, we address various sources of possible endogeneity and selection biases. In principle, it is possible that bank health may be correlated with other firm performance variables. Although we have argued that it is highly unlikely, we check that our results are robust to this possibility by following Klein, Peek, and Rosengren (2002) and include lagged firm performance measures other than exports in the first column. We include the one-period lag change in a firm's log total assets and the lagged change in a firm's log total profits, measured as the ratio of net income to assets. The coefficient on total assets is positive and significant whereas the coefficient on profits is insignificant. Moreover, the point estimate on the change in the market-to-book value is unaffected by the inclusion of these measures of firm performance.

Alternatively, it may be the case that more successful banks work with more successful exporters. This possibility would bias our results because banks with higher market-to-book value growth might be associated with firms with higher export growth on average. To guard against this potential problem, we include bank fixed effects in column 2. As we see, our results remain robust.

The data suggest that the possibility of selection bias arising from strong banks choosing to finance strong exporters is remote. Numerous studies have found that main bank relationships tend to be extremely stable over time (Aoki, Patrick, and Sheard (1994), Yafeh (1995), and Hoshi and Kashyap (2001)). In order to show this in our data, we define "switchers" as firms that change their main banks when not forced by a bank merger. The results indicate that only 7 percent of our sample of firms changed main banks between 1987 and 1999. To test whether these switchers might be driving the results, we restricted our sample of firms to those that stayed with the same main bank throughout the sample period. We report the results from this exercise in column 3 of table 3. The results are unchanged from those with the full sample, indicating that whatever selection process is at work to link firms and banks, it is not driving our results.

Another selection issue arises from the fact that, by measuring bank health as the change in the log market-to-book value, we have no measure of bank health when banks fail and their share price goes to zero. This may be desirable because it is not clear that market-to-book values are relevant if banks are nationalized. To test whether our results are sensitive to this sample selection, however, we replaced our measure of bank health with the percentage change in market-to-book value. This measure is bounded below at -1 when a bank's share price goes to zero. The results in column 4 of table 3 are almost identical to those in our main specification, indicating that the inclusion or exclusion of bank failures does not qualitatively affect our conclusions.

A final possible selection issue arises from firms that enter or exit the export market. Again, we have several reasons to believe, ex ante, that this factor will not be important for understanding our results. First, since the firms in our sample are all listed, they tend to be larger than the typical firm, and hence there is much less entry and exit than in samples drawn from census data. Second, it is hard to imagine that the inability to obtain short-term export financing from a *particular* bank would be a reason for a firm to alter a long-term decision about whether to enter an export market. Third, the inability of a firm to obtain export financing from a particular bank at a moment in time might cause a firm to lose some contracts, but it is unlikely that it would cause the firm to make the long-term decision to exit the export market altogether.

These arguments notwithstanding, we checked to see if our results were robust to the possibility that trade finance affected entry and exit by estimating a Heckman correction using maximum likelihood. We model the probability of being selected in the sample on the firm's productivity (as measured by the firm's value added per worker relative to the industry maximum each year, where the industry is defined at the three-digit level, comprising 52 industries),[15] since high productivity is likely to induce entry and low productivity is likely to induce exit (see Melitz (2003)) whereas the level of value added per worker is unlikely to affect the growth in exports. We also include the log change in the market-to-book value of its main bank, year dummies to account for macro shocks, and bank fixed effects in the probit. The results of this selection equation indicate that the probability of exporting rises with productivity as one would expect, as seen in the bottom part of column 5 in table 3. The point estimate for the coefficient on the change in the bank's market-to-book ratio in column 5, however, is almost identical to that in our baseline specification in column 2 of table 3. Thus, selection into and out

[15] We did not define the maximum productivity at the more disaggregated four-digit level because in many years and many industries there would be only one exporting firm, leading to a relative productivity measure equal to 1.

of exporting does not seem to be biasing our results. Similarly, the Heckman correction on the ratio of the log change in exports to domestic sales in column 6 of table 3 leaves the results unchanged.

Thus far, we have been largely concerned with the statistical significance and robustness of our results, but we have given scant attention to the economic significance. Our results can be thought of as the partial effect of a financial shock to banks on exports through the trade finance channel. Declines in bank health may have many additional impacts on exporting through channels that are captured in our dummies. For example, declines in bank health may be correlated with more general credit contractions, macro policies, and demand changes that could also affect exporting. Therefore, we need to emphasize that we can focus only on the direct impact of bank health on firm exports relative to the average within that industry and not on the total effects, which are likely to be larger.

Nevertheless, it is useful to get a sense of the magnitudes of our estimated changes relative to the aggregate changes in exports. As figure 2 illustrates, the banking crisis of 1997–98 coincided with a substantial decline in Japanese exports in 1998. As the Japanese banking crisis intensified, the Nikkei index of all bank stocks fell by 35 percent or 0.43 log units between December 1996 and December 1997. That decline was followed by a very sharp drop in Japanese exports. Between calendar year 1997 and calendar year 1998, real Japanese exports fell 10.5 percent. Multiplying this log change by the estimated coefficient on bank health in the Heckman correction specification (table 3, column 5) gives us an implied reduction in exports due to financial shocks of 3.3 percent – about one-third of the aggregate drop in exports.[16] Although macroeconomic factors obviously played an important role as well, our results indicate that the partial effect of trade finance on exports identified in this paper can account for a large

[16] We obtain an estimate of similar magnitude when we examine the 1992 stock price decline.

share of the aggregate decline. And the results in column 6 of table 3 confirm that exports were much harder hit than domestic sales by these financial shocks.

5. Conclusion

Traditional macro and trade models have not been able to explain why exports fall so much faster than domestic output during financial crises. This has created a puzzle regarding why exports might respond to financial crises differently than domestic output.

We address this question by first providing a number of arguments explaining why one might expect exports to be more sensitive to financial sector shocks than domestic sales. In particular, the longer time lags associated with international trade make exporters more dependent on working-capital financing for their exports than for their domestic sales. The main contribution of our paper is that we test these hypotheses using matched bank-firm data that enable us to identify the transmission mechanism from the banks that supply firms with trade finance to the export behavior of those firms, thus overcoming the measurement and endogeneity issues that have plagued previous studies. Our paper is the first to establish a causal link from shocks in the financial sector to exporters that result in exports declining much faster than output during banking crises. The size of these bank-induced export declines are of sufficient magnitude to account for about one-third of the drop in Japanese exports that occurred during the Japanese financial crises in the 1990s. At the very least, our results establish an important link between exports and the health of banks in one of the world's largest economies. Since the evidence indicates that exporters in many countries are highly dependent on trade finance, these results suggest that financial shocks are likely to play important roles in export declines in other countries as well. Moreover, in the 2008 world financial crisis when both the importers' and the exporters' financial institutions were likely compromised, one might expect even larger effects.

Our results have a number of implications for future research. First, they point to important links between the often separate fields of international trade and international finance. In addition, the important connections between exporters and their financiers may have particular relevance for countries that often suffer from financial crises. Finally, our estimates also provide strong support for an international financial accelerator that helps explain how financial shocks affect the real sector and are propagated internationally.

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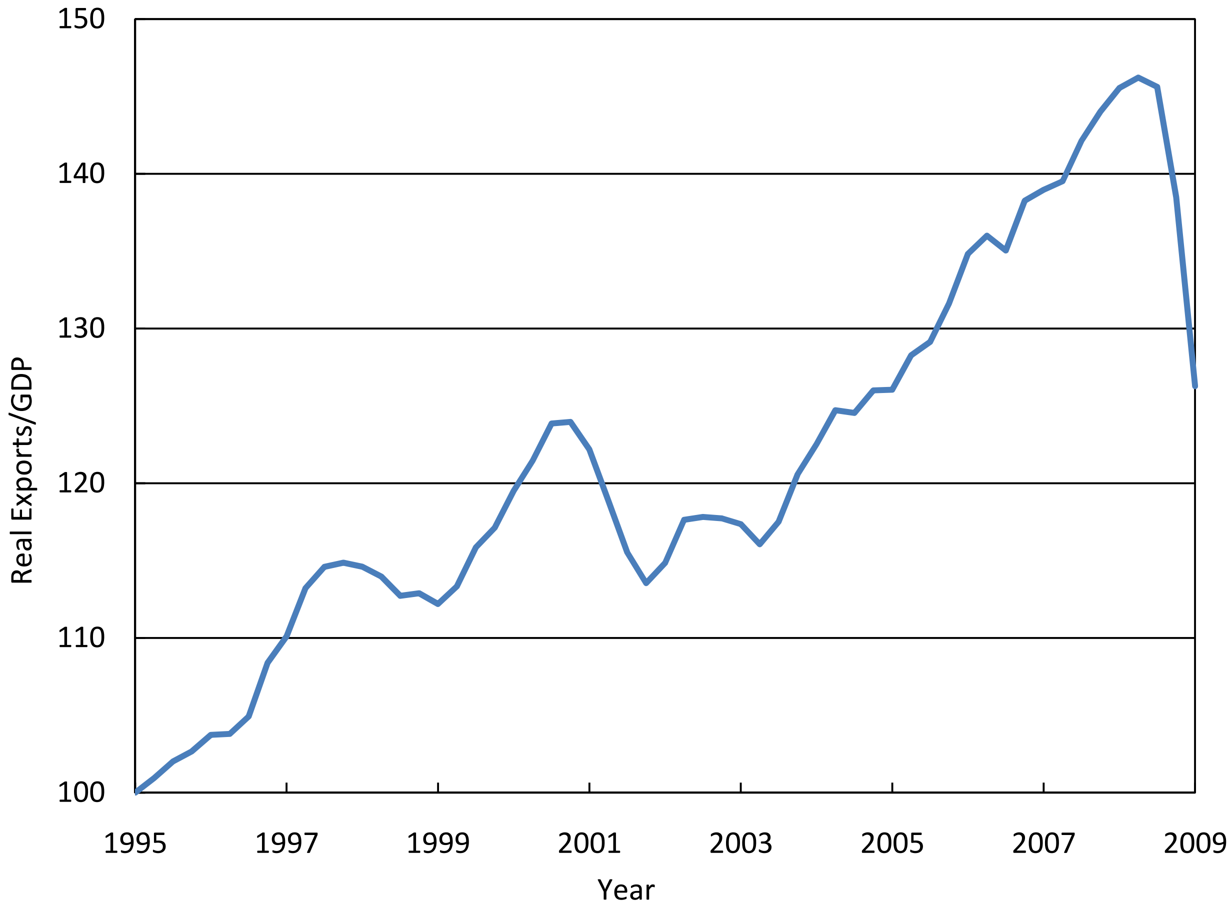
Figure 1

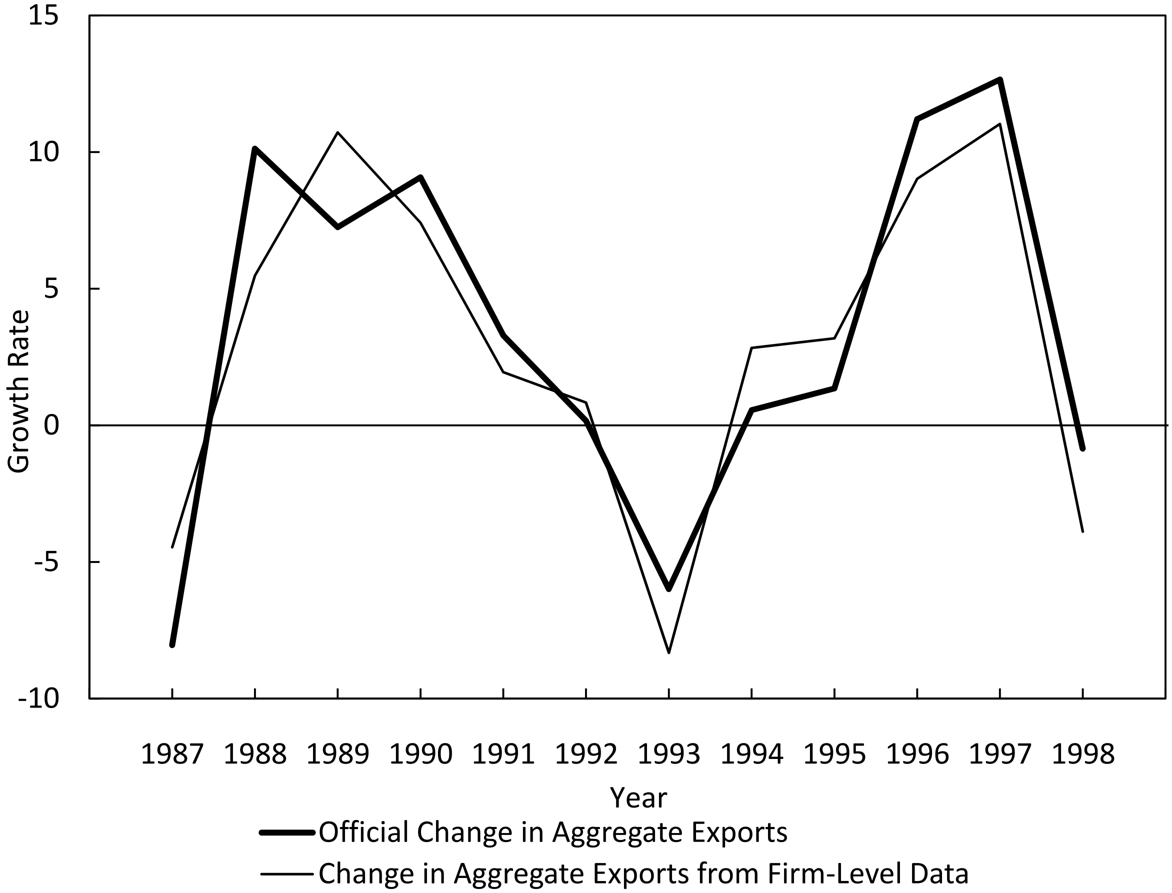
Quarterly Movements in the Ratio of World Exports to GDP, 1995–2009



Source: This figure was constructed using national sources: *Australia*, Australian Bureau of Statistics; *Belgium*, the Banque Nationale de Belgique; *Canada*, Statistics Canada; *France*, National Institute of Statistics and Economic Studies; *Germany*, Deutsche Bundesbank; *Hong Kong*, Hong Kong Census and Statistics Department; *Italy*, Istituto Nazionale di Statistica; *Japan*, Cabinet Office; *Netherlands*, Centraal Bureau voor de Statistiek; *Norway*, Statistik Sentralbyra; *South Korea*, Bank of Korea; *Spain*, Instituto Nacional de Estadistica; *Sweden*, Statistiska Centralbyran; *Switzerland*, State Secretariat for Economic Affairs; *Taiwan*, Directorate General of Budget, Accounting and Statistics; *United Kingdom*, Office of National Statistics; and *United States*, Bureau of Economic Analysis.

Figure 2

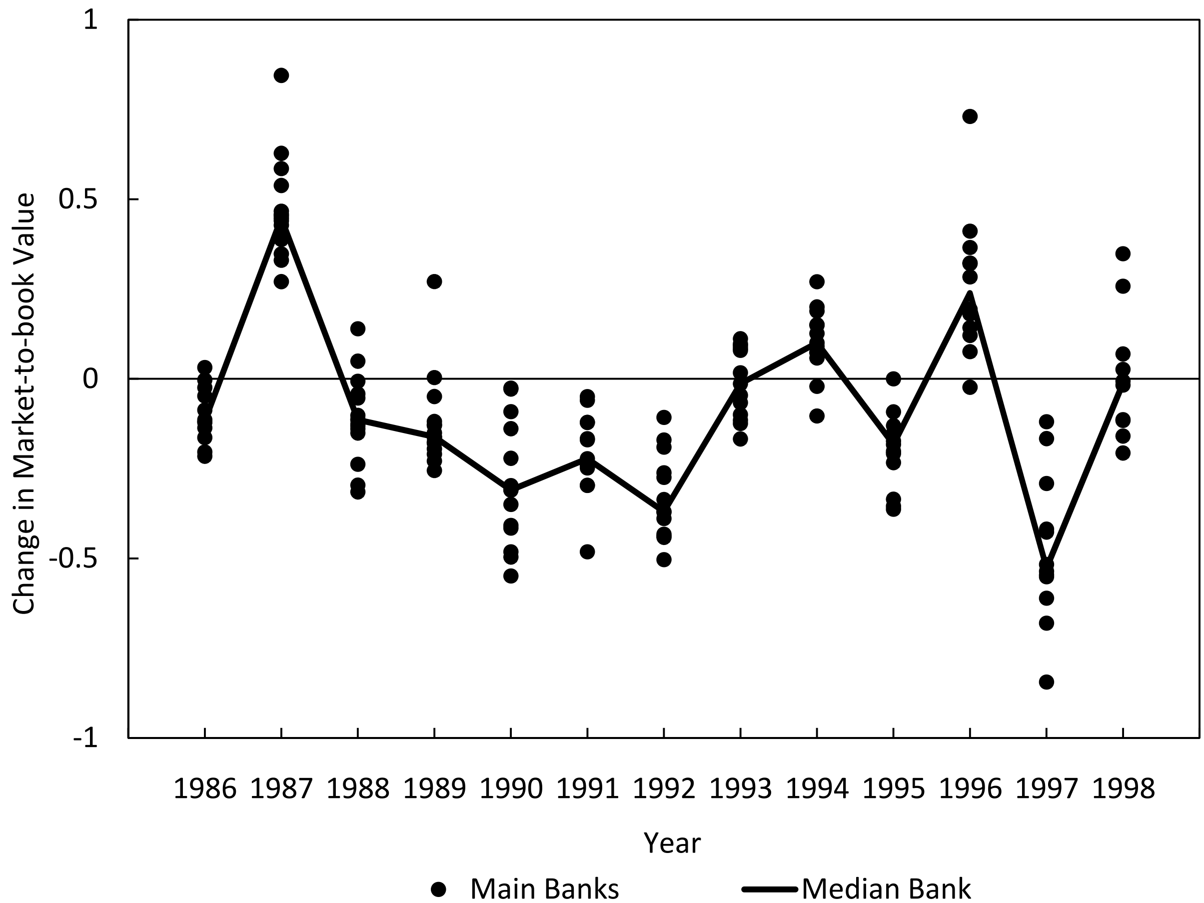
Firm-Level and Aggregate Export Growth in Japan, 1987–98



Source: Firm-level data is from the Development Bank of Japan database of unconsolidated corporate reports. The aggregate official export data for each fiscal year was downloaded from the Japanese Ministry of Finance (http://www.customs.go.jp/toukei/suii/html/time_e.htm).

Figure 3

Change in the Market-to-Book Value of Japanese Banks, 1986–98



Source: Development Bank of Japan (2004), "Corporate Finance Data Bank."

Table 1
Exports and Trade Finance

Dependent variable	**Δln(exports)$_{f,t}$**			**Δln(domestic sales)$_{f,t}$**	**Δln(exports/ domestic sales)$_{f,t}$**
	(1)	(2)	(3)	(4)	(5)
			Lag MTB		
Δln(market-to-book value)$_{f,t-1}$	0.072***	0.077***	0.073***	0.016**	0.062***
	(0.014)	(0.018)	(0.018)	(0.007)	(0.021)
Δln(market-to-book value)$_{f,t-2}$			-0.017		
			(0.023)		
Fixed effects:					
Year-industry	no	yes	yes	yes	yes
Year	yes	no	no	no	no
Observations	7,016	7,016	6,987	7,926	6,906
Adjusted R^2	0.07	0.15	0.15	0.41	0.13

Notes: Robust standard errors corrected for clustering at the bank level are in parentheses. ***Significant at the 1 percent level. **Significant at the 5 percent level.

Table 2
Alternative Measures of Main Bank and Market Timing

Dependent Variable: Δln(exports)$_{f,t}$					
	(1)	(2)	(3)	(4)	(5)
	Alternative bank matching		MTB value:	March	With lagged
	Loans	All banks	3 months average	accounting period	Dependent variable
Δln(market-to-book value)$_{f,t-1}$	0.063***	0.061***	0.054***	0.060***	0.072***
	(0.015)	(0.015)	(0.021)	(0.019)	(0.019)
Δln(exports)$_{f,t-1}$					-0.065***
					(0.012)
Fixed effects:					
Year-Industry fixed	yes	yes	yes	yes	yes
Observations	6,550	7,022	6,889	5,932	6,684
Adjusted R^2	0.13	0.15	0.14	0.16	0.15

Notes: Robust standard errors corrected for clustering at the bank level are in parentheses. ***Significant at the 1 percent level. **Significant at the 5 percent level. In column 1, we use an alternative method for matching firms to banks: we assign a city bank that was the largest loan provider that year. If the exporter had no loans from a city bank that year, we assign the previous year's city bank. In column 2, we use the first listed reference bank from the company handbooks, even if the first reference bank is not a city bank. In column 3, we define the market-to-book value as the average of the last three months of the accounting period. In column 4, we only keep observations where the accounting period ended in March.

Table 3
Heterogeneity and Selection

Dependent Variable: Δln(exports)$_{f,t}$						Δln(exports/domestic sales)$_{f,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
	With firm characteristics	Bank fixed effects	No bank switchers	Percentage change in MTB value	Heckman selection	Heckman selection
Δln(market-to-book value)$_{f,t-1}$	0.073*** (0.020)	0.077*** (0.018)	0.074*** (0.018)	0.060*** (0.019)	0.077*** (0.020)	0.068*** (0.021)
Δln(assets)$_{f,t-1}$	0.226*** (0.034)					
Δln(profits)$_{f,t-1}$	-0.037 (0.063)					
Fixed effects:						
Year-Industry	yes	yes	yes	yes	yes	yes
Bank	no	yes	yes	yes	yes	yes
<u>First stage</u>						
Relative value added per worker$_{f,t-1}$					0.192*** (0.067)	0.163*** (0.065)
Δln(market-to-book value)$_{f,t-1}$					-0.070 (0.109)	-0.096 (0.107)
Fixed effects:						
Year					yes	yes
Bank					yes	yes
LR test (rho=0)					$\chi^2(1)$=46.04	$\chi^2(1)$=42.13
Observations	7,016	7,016	6,432	7,023	8,179	8,179
R-squared	0.16	0.15	0.15	0.15		

Notes: Robust standard errors corrected for clustering at the bank level are in parentheses. ***Significant at the 1 percent level. **Significant at the 5 percent level. In column 3, we drop any firm that switches its main bank during the sample period. In column 5 and column 6, the selection is a function of relative value added (relative to three-digit industry by year), the change in market-to- book value, year effects, and bank effects. There are 1,167 censored observations and 7,012 uncensored observations in column 5; and 1,277 censored observations and 6,902 uncensored observations in column 6.