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C O L U M B I A U N I V E R S I T Y I N T H E C I T Y O F N E W Y O R K

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. Our 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 trade 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, 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 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. 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 during the Japanese financial crises of the 1990s.

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.

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. The need to insure against credit default risk arises because exporters rarely have the capacity or willingness to evaluate default risk and usually turn to banks to provide payment insurance and guarantees. In addition, exporters need more working-capital financing than firms engaged in domestic transactions because of the longer time lags associated with international trade, especially when shipping by sea. Our results provide support for these channels by showing that declines in bank health have no impact on the exports of firms with foreign affiliates (where default risk is not an issue) or on the exports of firms in industries that ship principally by air (where the transit times and therefore working capital needs are not much different than for domestic sales).

The need for exporters to hedge against credit default risk and obtain working capital financing has resulted in a system in which virtually every exporter works with a bank or other financial institution to obtain credit or export guarantees. 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 trade credit default risk and terms.² 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. Indeed, our results show that a decline in bank health hits firms’ exports 5 times harder than their domestic sales.

The Japanese crises of the 1990s provide 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

² Note that these risks are distinct from other types of risk such as the loss of goods in transit.

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 that are common to all exporters in an industry at a moment in time to ensure that our identification is based only on firm-specific characteristics that are not shared by other firms in the industry.

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, and cash flows are positively correlated with exports. Finally, and most seriously, is the deeper problem arising from the fact that trade finance can cause trade credit to rise or fall.³

³ 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.

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 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.⁴ 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.⁵ 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, there will be 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 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 firms that are already engaged in exporting. More recently, Bricogne et al. (2009) use industry measures of

⁴ Similarly, "export factoring" (selling a discounted bill, corresponding to the export account receivable to a financial institution) and "forfeiting" (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.

⁵ Empirical papers in this line include Beck (2002, 2003), Becker and Greenberg (2007), and Berman and Héricourt (2008).

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.⁶ 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 why exporters use trade finance. Section 3 describes how the supply of trade finance can affect exporters. Section 4 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 5 describes our data. Section 6 then presents the Japanese firm-level evidence. Section 7 provides robustness checks. Section 8 discusses the economic significance of our results and section 9 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 trade finance has received scant attention in the academic literature, textbooks on international finance management describe it as “the fundamental problem in international trade” (e.g. Bekaert and Hodrick (2008)). As Bekaert and Hodrick (2008) explain:

Shipping goods across a country as large as the United States poses many complex logistical and financial problems. Shipping goods across international borders creates a host of additional complications... Either the exporter or the importer must engage in some method of financing because the goods cannot be sold immediately after production. When the shipment and sale of goods occur within a single country, there is a common jurisdiction and system of courts that adjudicates contractual disputes between buyers and sellers. When goods are shipped across borders, though, additional legal complexities arise. One such complexity relates to collecting on delinquent accounts.... p. 650.

⁶ Greenaway, Guariglia and Kneller (2007), and Muuls (2008) use financial measures based on the firm's bank balance sheets and the firm's credit ratings, which may suffer from endogeneity problems. In contrast, we rely on the bank's health to measure the supply of trade finance.

The letter of credit is the oldest and simplest means of dealing with exporters' special working capital and default insurance needs. Letters of Credit make up about 40 percent of all trade finance contracts. The letter of credit breaks the payment cycle into a number of stages and substitutes a financial institution's default risk for the importer's default risk. In the first stage of the process, the importer and exporter negotiate a sales contract that specifies all of the key parameters of the transaction – e.g. price, quantity, delivery terms, payment terms etc. The terms of the sales contract often require the importer to ask its “issuing bank” to issue a letter of credit guaranteeing payment for the imports upon certification that the exporter has met the terms of the contract. Second, using the letter of credit as collateral, the exporter will often obtain a working capital loan from its bank (often called the advising bank) to cover the production costs of the goods.

The third step in the process involves the transfer of the goods to the carrier and the title of the goods to importer's issuing bank. Assuming all of the documents are in order, the issuing bank will issue a “banker's acceptance” to the exporter guaranteeing payment at a future time, often around 90 days after the goods arrive.⁷ The exporter typically will then sell the banker's acceptance to its advising bank at a discount based on the interest rate charged by the bank. This enables the exporter to be paid upon shipping the goods and also provides the funds to the exporter to repay the working capital loan from its bank, and removes the trade credit from the exporter's balance sheet. The advising bank will then record a “foreign bill bought” on its balance sheet.⁸ After the goods arrive, the title of the goods is transferred to the importer from the issuing bank in exchange for either immediate payment or more frequently a promissory note stating that the importer will pay the issuing bank (with interest) at the same time that the banker's acceptance matures.

Banks need to raise funds from external markets at various times during this cycle. For example, the advising bank needs to raise funds to cover the working capital loan whose only collateral is the letter of credit and the exporter's ability to successfully produce and ship the goods. After the goods ship and the advising bank is repaid on the working capital loan, the bank

⁷ 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.

⁸ In US accounting, the bank will record a “banker's acceptance.”

also needs to raise money to cover the cost of payment to the exporter using the banker's acceptance as collateral. Very often it accomplishes this by selling the issuing bank's "banker's acceptance" to other investors.

Payment defaults can occur at any point in this cycle. The importer can default on its payment to the issuing bank, the issuing bank can default on the terms of the letter of credit, the advising bank can refuse to extend a working capital loan or refuse to purchase the banker's acceptance, or the exporter can default on the initial working capital loan. Because of data availability, our paper focuses on the third type of problem, i.e. the exporter's bank refusing to extend working capital loans or purchase bankers' acceptances.

As Bekaert and Hodrick (2008) argue, one 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. Much of this time is spent dealing with the paperwork and procedures associated with getting goods ready to ship internationally. 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 the 2004 Joint BIS-IMF-OECD-World Bank Statistics on External Debt, 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)). It is therefore not surprising that in the Lehman bankruptcy six of the thirty largest unsecured claims against Lehman were letters of credit (Lehman (2008)). Indeed, given that about 80 percent of

the providers of trade finance are private banks (Auboin 2009), there are many channels through which the troubles of banks can affect trade flows.⁹

3. The Trade Finance Transmission Channel

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.

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 (OIS)) 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

⁹ Financial innovation played a big role in non-banks like AIG moving into the trade finance arena by writing export credit default insurance to replace the insurance supplied by the issuing banks. These credit default guarantees enable the exporter to sell its trade credits to other financial institutions. This helps explain why export credit 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 default insurance exposure of \$1.4 trillion in 2008 (Source, <http://www.berneunion.org.uk/bu-total-data.html>).

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. 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 70, 107, and 99 basis points respectively in the second quarter of 2009 relative to the fourth quarter of 2007. Probably part of this reflected greater trade credit default rates during the crisis. Jones (2010) reports that the loss ratio for trade credit insurance (i.e. the ratio of claims to gross premiums paid in) doubled from their historic levels in 2008 so that the average insurer was paying out 85 cents in default insurance for every dollar entering the firm. These 100 basis point jumps in the trade finance spreads are particularly striking given that the typical spread on a letter of credit is 10–16 basis points (see Auboin (2009)). The IMF 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. . The deteriorations in the financial health (or outright bankruptcy) of major players in the trade finance world like Lehman, AIG, CIT Group, Citigroup, Bank of America, and Wells Fargo may have made it difficult for these banks to raise money to finance their export clients' trade credit default risk. The simultaneous collapse in the commercial paper market may have left exporters with few options other than cutting exports if their trade finance providers ran into trouble.

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, firms rely more on banks for their exports than for their domestic sales. As a consequence, financial crises are likely to affect exports more negatively 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.

4. 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.¹⁰ The major driving forces behind the crises in both periods were twin 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. (p. 276)

¹⁰ 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.

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: 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.

5. Banks and Exporters: Data

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.¹¹ 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 methodology.¹² 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. Finally, we were able to obtain data on "foreign bills bought," which is a measure of the trade finance extended by each bank from the Nikkei NEEDS FinancialQuest database.

Ultimately, we will examine whether changes in a bank's market-to-book value affect its client's future export performance. For that purpose, it is useful to define the lagged change in

¹¹ We defined the set of internationally active banks as Japan's "city banks" plus a few other prominent banks, giving us a sample of 15 banks: Asahi Bank, Bank of Tokyo, Bank of Tokyo Mitsubishi, The Dai-Ichi Kangyo Bank, The Daiwa Bank, The Fuji Bank, Hokkaido Takushoku Bank, Industrial Bank of Japan, Long Term Credit Bank of Japan, Saitama Bank, Sakura Bank, The Sanwa Bank, Sumitomo Bank, Taiyo-Kobe Bank, and The Tokai Bank. During our sample period, some banks merged and others were nationalized: Taiyo-Kobe merged with Sakura Bank in 1990; Saitama Bank merged with Dai-Ichi Kangyo Bank in 1992; The Bank of Tokyo merged with the Bank of Tokyo-Mitsubishi in 1996; The Long Term Credit Bank of Japan was nationalized in 1998; and Hokkaido Takushoku Bank failed in 1998. Thus, we start with 15 banks in 1987, but this number falls to 11 banks by 1999.

¹² 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]."

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 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.¹³ 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 bank performance in our identification strategy.

Table 1 presents sample statistics for our key variables. One of the most striking features of this table is the unimportance of trade finance relative to aggregate bank lending. Less than 1 percent of the typical bank's lending is in the form of trade finance and no bank extends more than 8 percent of its credit in the form of trade finance. Given that the typical bank in our sample extends trade finance to over fifty firms in our sample (and many more firms that are not in our sample), the data strongly suggest that the export credit exposure of any bank to any particular exporter is likely to be quite small. Similarly, the lending exposure of any bank to an exporter is also quite small. The mean share of a bank's total loans to an individual exporter is 0.01 percent,

¹³ The low export growth in 1987 is probably associated with a dramatic appreciation of the yen in 1986.

and no firm in our sample accounted for more than 0.6 percent of a bank's loans. These data indicate that the exposure of banks in our sample to either movements in any individual firm's trade finance borrowings or even aggregate borrowings was tiny.

Although trade finance is a very small share of aggregate lending by our sample of banks, the volume of this lending is very closely tied to the health of these institutions. Leaving aside issues of causality, it is straightforward to show that when banks become unhealthy, they lend less. We demonstrate this by regressing the log of a bank's total loans in a year on the log of its market-to-book ratio in the previous year as well as bank and year fixed effects. The results presented in Table 2 are in line with those in Peek and Rosengren (1995) showing that banks whose health declines cut back on lending. While Peek and Rosengren establish a causal link between declines in bank health and future lending by looking at the relationship between foreign lending and bank health, this regression demonstrates that the positive association between trade finance and bank health is also present in our data.

In column 2 of Table 2, we estimate an analogous equation using the log of foreign bills bought as the dependent variable. The elasticity of foreign bills bought with respect to changes in bank health is six times larger than the elasticity of total lending. A one percent decline in a bank's market value is associated with 0.9 percent decline in trade finance. Similarly, column 3 shows that banks whose health declined saw dramatic drops in their export credit lines relative to their domestic lending lines. One interpretation of this is that financially stressed Japanese banks could not easily raise money and therefore could not roll over short maturity financial instruments like foreign bills. Regardless of the interpretation, the results make clear that there is a positive correlation between the health of financial institutions and the amount of trade finance they supply. Moreover, deteriorations in bank health are associated with much larger declines in the supply of trade finance than in other types of lending.

Another important correlation we highlight is the strong link between trade finance provided by a bank and the exports of firms that identify that institution as a reference bank. One of the problems in conducting this analysis is that the number of exporters that are associated with a reference bank can change as firms enter or leave our sample or change banks. We therefore restricted the sample to the subset of exports conducted by a balanced panel of firms with March closing dates that were tied to a particular main bank over the full sample period, which eliminates about 30 percent of the firms in the full sample.

In column 4, we aggregate the exports of these firms together by bank and regress the change in aggregate exports associated with a bank on the change in the bank's foreign bills bought, as well as bank and year fixed effects. Here we see that exports are positively associated with that bank's provision of trade finance. In order to make sure that these results are not driven by particular banks serving particular industries, we summed together the exports of firms that are clients of a particular bank in each industry and reran the regression with industry fixed effects. The results reported in column 5 of Table 2 indicate that the exports of client firms *within an industry* are positively correlated with trade finance provision of their banks. While this does not establish causality, Table 2 makes clear that there is a link between bank health and trade finance as well as between trade finance and exports.

6. Bank Health and Exports: Estimation

The links between bank health and trade finance as well as trade finance and exports beg the question of whether we can discern a direct effect of bank health on exports. 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.¹⁴ Our basic estimating equation is:

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

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 3 presents the results from these regressions. We drop firms whose export growth is in the top and bottom one percentile.¹⁵ The first two columns present regressions of the change

¹⁴ The DBJ data divide manufacturing into 108 sectors, which comprise our industry dummies. In specifications with 13 years of data, this means that we have 1404 industry-time dummies. All standard errors are clustered at the bank level.

¹⁵ Including these outliers tends to magnify the effect of bank health on exports.

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 3, 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.¹⁶ 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 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 3. 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 tend to sell less in the domestic market, but the effect is much smaller than the effect on exports.¹⁷ The results in columns 2 and 4 indicate that the decline in the health of the bank providing trade finance causes exports to decline about 5 times more than domestic sales. Interestingly, the magnitude of this relative decline in exports to domestic sales is almost the same as the relative decline in foreign bills bought to total loans that we observed in Table 1, indicating that declines in bank health are associated with declines in the supply of trade finance to and exports by firms dependent on the troubled banks. In column 5, we replace the dependent variable with the log change in the ratio

¹⁶ The contemporaneous change in market-to-book value is also insignificant.

¹⁷ 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.

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. 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*.

One potential concern about this methodology is that there may be an endogeneity problem either through reverse causality, if export performance were driving bank performance, or through an omitted variable that might be affecting both bank health and a firm's exports. Column 5 in Table 3 suggests that it is highly unlikely that our results are being driven by reverse causality as it seems hard to argue that the health of a bank would be systematically related to changes in a borrower's export to domestic sales ratio. Nevertheless, in Table 4 we implement a number of additional robustness checks to show that endogeneity is not driving the results.

There may be some 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 1 of Table 4 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 be driving our results. Instead, a deterioration in bank health is leading to a future decline in exports that is independent of what is happening to contemporaneous export growth.

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 second column. We include the one-period lag change in a firm's log total assets and the lagged change in a firm's profitability, 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. Another omitted variable issue could arise if exposure to countries hit by the Asian crisis such as

South Korea simultaneously affected a bank's health and a firm's exports. To ensure this is not driving our results, we reestimate equation (1) for the pre-Asian crisis years up to 1996 and see from column 3 that the estimates remain unchanged.

We also correct for potential endogeneity by using an instrumental variables technique. Our first approach is to correct for a correlation that might arise between the market value of the firm and that of the bank. One could imagine this correlation arising from a number of sources. For example, future exports might be correlated with the probability of a firm loan default and hence bankruptcy.¹⁸ Alternatively, since banks may own up to 5 percent of a firm's shares in Japan, it may be the case that the bank's share price is correlated with the firm's share price. In order to make sure that there is no reverse causality arising from the health of the firm affecting the health of the bank, we use the residuals from a regression of changes in bank market-to-book values on firm share price changes (with industry-time dummies) as an instrument.¹⁹ These residuals are uncorrelated with the health of the firm or its expected profits by construction. As one can see in column 4 of Table 4, using these residuals as an instrument hardly affects the impact of bank health on firm exports. In other words, the health of the bank has an impact on the firm's exports that is independent of the firm's health.²⁰

Alternatively one could argue that declines in exports might not have much of an impact on the exporter's health, but might affect the bank's health directly because lower firm exports reduce trade finance profits for the bank. To get some sense of a main bank's exposure through this channel, we compute the present discounted value of all the profits of the bank's trade finance contracts and subtract this number from the market value of the bank in each year (see Appendix for details). We then use this adjusted market value to compute an adjusted log change in the market-to-book value as an instrument for the actual log change in the market-to-book value of the bank. This instrument can be thought of as the market-to-book value that would obtain based on all of the bank's operations except for its export finance-related ones. Column 5

¹⁸ If a decline in exports is associated with a greater probability of bankruptcy, a bank's share price might decline when a firm's exports decline. However, the bankruptcy rate of listed companies was extremely low during this period, less than 0.1 percent per year over our sample period (see Xu and Zhang (2009)). This suggests that it is highly unlikely that defaults by exporters, in general the most profitable firms in the market, should be driving our results.

¹⁹ We used change in firm share price instead of change in firm market-to-book value, because the DBJ data did not report the number of shares issued of each firm. In practice, these two measures are very highly correlated.

²⁰ Similarly, including the exporter's share price as an independent variable in equation 1 does not qualitatively affect the bank health coefficient.

of Table 4 shows that the instrumental variables estimation does not change the point estimates in the exports equation, and column 6 shows that instrumenting also leaves the results on the ratio of exports to domestic sales unchanged. These results indicate that the effect of bank health on firm exports does not arise from endogeneity but rather indicates that declines in bank health cause future deteriorations in firm exports.²¹

If trade finance does matter for the response of exporters to financial shocks, then one should expect to see certain kinds of firm heterogeneity in the data in which some firms at some times are more affected than other firms. First, it is probably much harder for a firm to find alternative forms of trade finance when a bank runs into trouble in a crisis period and many other institutions are troubled than if only the firm's bank is in trouble.²² In order to test for this effect, we interacted the change in the bank's market to book value with a dummy that equals 1 for the crisis years: 1991 (the year land prices started to fall), 1993 (the year the *jusen* losses were tied to the banks), and 1998 (the year many Japanese banks began failing). As one can see from column 1 of Table 5, firm-level exports contract by much more when an exporter's bank runs into trouble in a crisis year, relative to a non-crisis year.

Rajan and Zingales (1998) have argued that some sectors require more external finance than other sectors. Their measure of financial dependence is based on capital expenditures less cash flow as a share of capital expenditures. Since trade finance is not used for capital expenditures, there is not a clear linkage between trade finance *per se* and external finance dependence, but one might expect a link based on other loans received from an exporter's main bank. In column 2, we test this conjecture by interacting the change in market-to-book ratio with the Rajan-Zingales measure of external finance. Our results indicate that while poor bank health does not particularly affect firms with high external finance needs more during normal times (perhaps because Japanese capital markets were largely deregulated by the mid 1980's), firms in

²¹ We also tried using the residuals from a regression of the change in the bank's market-to-book value on firm share price changes *and* trade finance contract prices as an instrument. The results were qualitatively identical to those presented here.

²² 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. Moreover, it may be hard to find a new source of trade finance in the midst of a financial crisis when many institutions are under stress. 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.

these industries are particularly hard hit when there is a crisis. These results are very much in line with Chor and Manova's (2009) results that industry-level exports fell by more in sectors that were more dependent on external finance during the current crisis.

One of the problems with the Rajan and Zingales (1998) approach is that the financial dependence measure can only be computed for aggregate industries. One way to examine financial dependence at the firm level is to focus on firm size. Bernanke, Gertler, and Gilchrist (1999) argue that small firms are likely to be more financially dependent on banks than larger firms. Alternatively, if one conjectured that reverse causality were driving our results, one should expect to see a stronger relationship between the exports of larger firms and bank health than between those of small firms and bank health because one would expect that bank share prices would be more correlated with the borrowings of large firms than small firms. In order to understand which theory better explains our data, we interact the change in the bank's market-to-book value with a dummy that is equal to one if a company has fewer than 100 employees. The results indicate that declines in bank health have a much stronger impact on the exports of small firms than large firms. This result indicates that it is unlikely that reverse causality is driving our results. Instead it seems that small firms, that presumably have few alternatives to bank financing, are much more sensitive to shocks to bank health.

Thus far, we have been arguing that there are two principle reasons why firms use trade finance: international trade takes longer than domestic trade and international trade involves greater risk. We now turn to investigating these two links. Since Japan is an island, Japanese firms export goods either by air or sea. Since goods shipped by air arrive at their destinations much more rapidly than goods shipped by sea, one should expect that working capital considerations to be larger for firms shipping goods by sea relative to those exporting by air. Since we do not know the mode of transport of each firm's exports, we relied on the firm's sector.²³ We generated an air dummy variable that equaled one if a firm was in a sector in which more than 50 percent of the value of exports was shipped by air. In column 4 of Table 5, we interact that dummy with our bank health measure. The results indicate that changes in bank health matter a lot for firms in industries in which goods are predominantly shipped by sea but not for firms in industries in which goods are shipped by air. The different effects for air and sea

²³ Data on Japanese exports by mode of transport are from the Japanese Ministry of Finance website (http://www.customs.go.jp/toukei/info/tsdl_e.htm), and matched this with the industry definitions in the DBJ database.

shipping are consistent with the notion that firms whose goods are shipped more rapidly have lower working capital needs than firms whose goods remain in transit longer.

We next investigate the role played by default risk. When firms export to foreign affiliates, they do not face a default risk and therefore one should expect their trade finance needs to be less. Since approximately half of the firms in our sample have foreign affiliates, we split the sample according to whether a firm has foreign affiliates and re-estimate our basic equation. In columns 5 and 6 of Table 5, we show that exporters that transact with foreign affiliates (and therefore face no default risk on these transactions) do not experience export declines when their banks run into trouble. However, there are powerful effects for firms engaged exclusively in arms length transactions, presumably because they need the risk insurance provided by their financial institutions. These results indicate that trade finance matters principally for firms whose goods remain in transit for long periods and face trade credit default risk.

7. Robustness

In Table 6, 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 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 6, we identify the main bank as the city bank providing the largest loan to each exporter.²⁴ Then, in column 2 of Table 6, 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

²⁴ 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.

market-to-book value in column 3 of Table 6 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 6).

In Table 7, we address various sources of possible selection biases. These arise because firms that have higher average export growth rates might match with banks whose market-to-book values tend to rise on average. Thus, the correlation between export growth and growth in the market-to-book value might simply reflect the possibility that good exporters match with good banks rather than the year-to-year covariation in exports and bank health. To guard against this potential problem, we include bank fixed effects in column 1 of Table 7. These bank dummies should reflect any unobserved variation in the quality of the banks at the start of the sample that might be correlated with the average export growth rate of firms. 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.

One possible critique of this correction is that it is possible that firms with higher export growth might switch to healthier banks. This is unlikely to be a problem in our data because 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 8 percent of our sample of firms changed main banks between 1987 and 1999. Nevertheless, to make sure that those few firms that changed main banks were not driving our results, we kept the bank dummies in the specification to control for each bank’s unobserved health at the start of the sample and 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 2 of Table 7. 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 3 of Table 7 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 exporting as being related to the firm's productivity since high productivity is likely to induce entry and low productivity is likely to induce exit (see Melitz (2003)) whereas the *level* of productivity is unlikely to affect the *growth* in exports. We measure the productivity of the firm by using 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.²⁵ 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 (see the bottom of column 4 in Table 7) indicate that the probability of exporting rises with productivity as one would expect. The point estimate for the

²⁵ 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.

coefficient on the change in the bank's market-to-book ratio in column 4, however, is almost identical to that in column 1 of Table 7. Thus, selection into and out 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 5 of Table 4 leaves the results unchanged.

8. Economic Significance

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 7, column 4) gives us an implied reduction in exports due to financial shocks of 3.3 percent – about one-third of the aggregate drop in exports.²⁶ 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 share of the aggregate decline. And the results in column 5 of Table 7 confirm that exports were much harder hit than domestic sales by these financial shocks.

²⁶ We obtain an estimate of similar magnitude when we examine the 1992 stock price decline.

9. 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 greater credit default risks and longer time lags associated with international trade make exporters more dependent on 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. Moreover, we show that these effects are smaller for large firms, multinationals and firms that export mostly by air, which is precisely the type of heterogeneity that one would expect if trade finance were driving the results. Finally, we demonstrate that 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. 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. For example, the differences in the behavior of multinationals and air vs. sea shippers may ultimately help us to understand why some countries experienced much steeper declines in their exports than others. 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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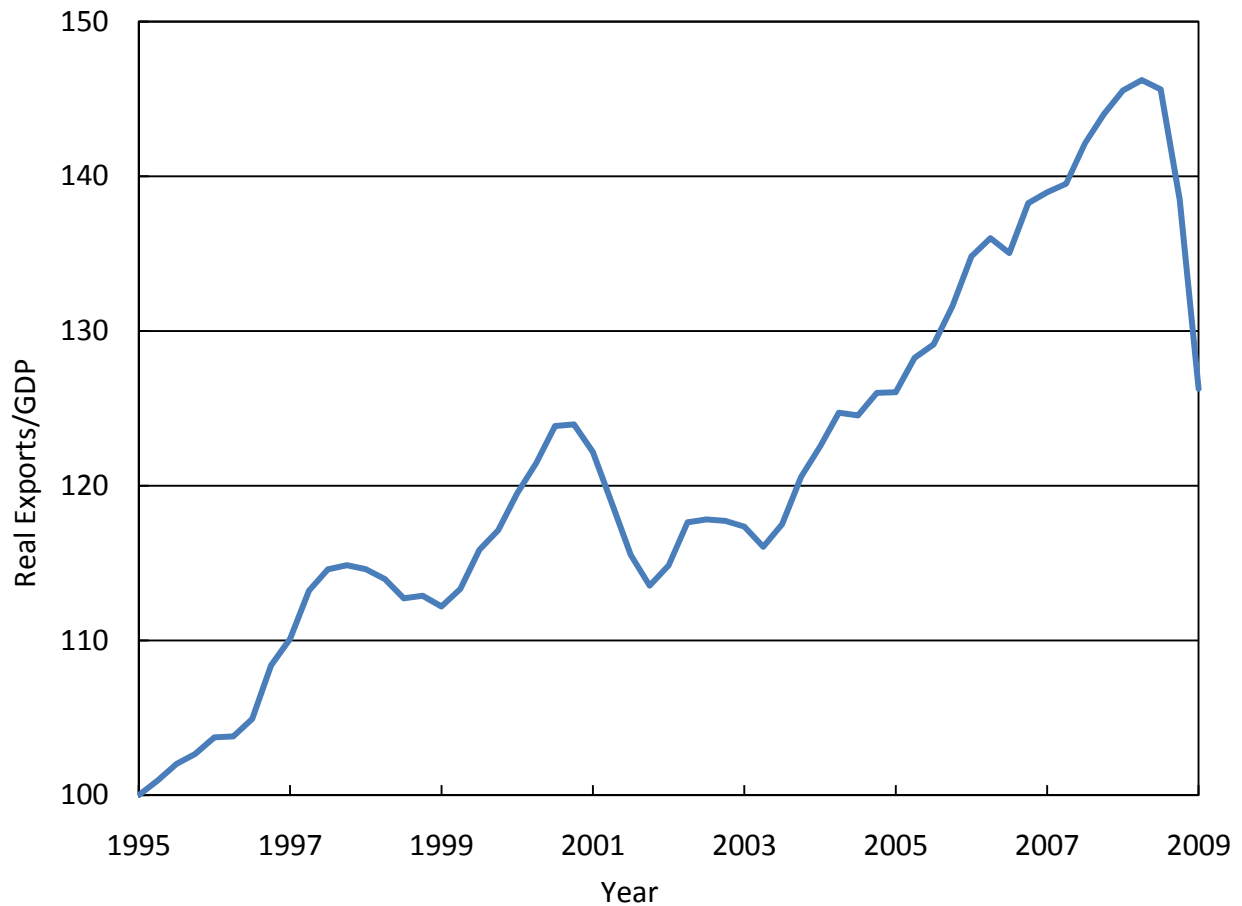
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Figure 1

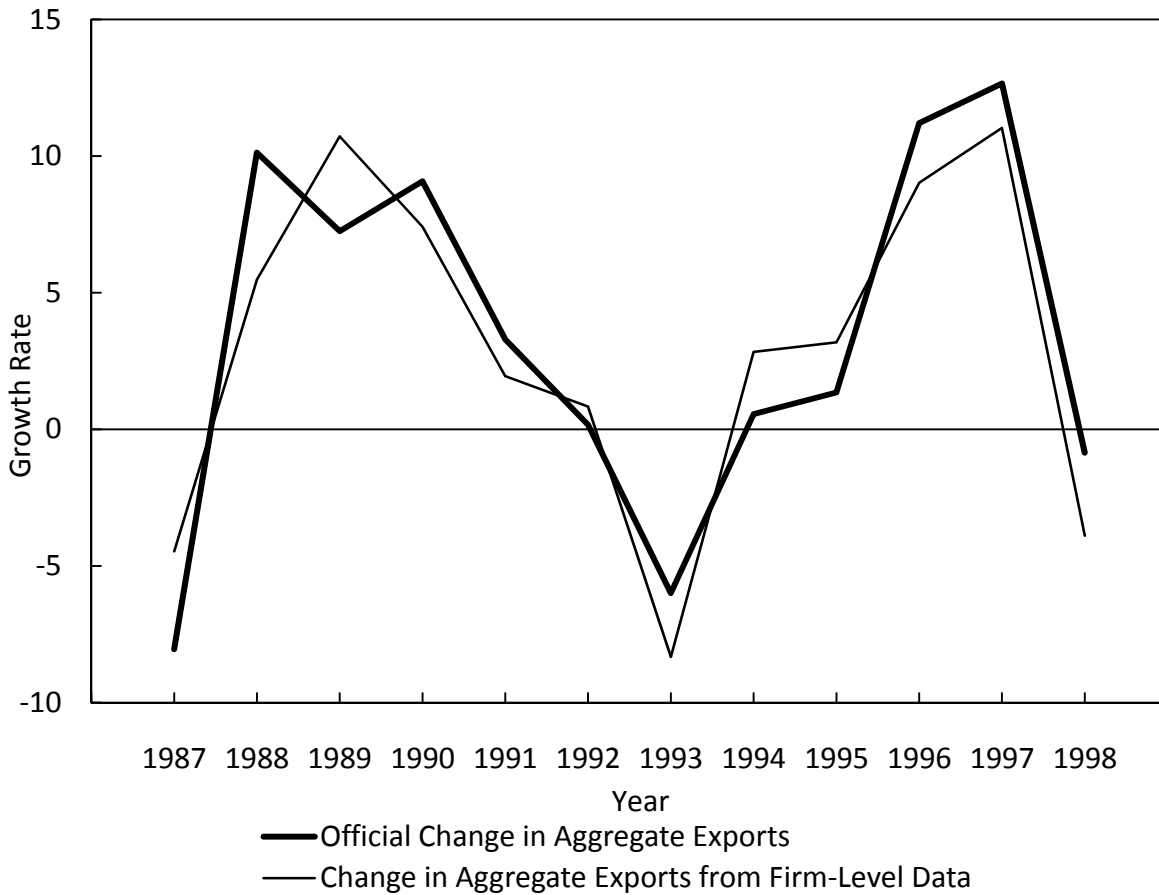
Quarterly Movements in the Ratio of World Exports to GDP, 1995–2009



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 Estadística; *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

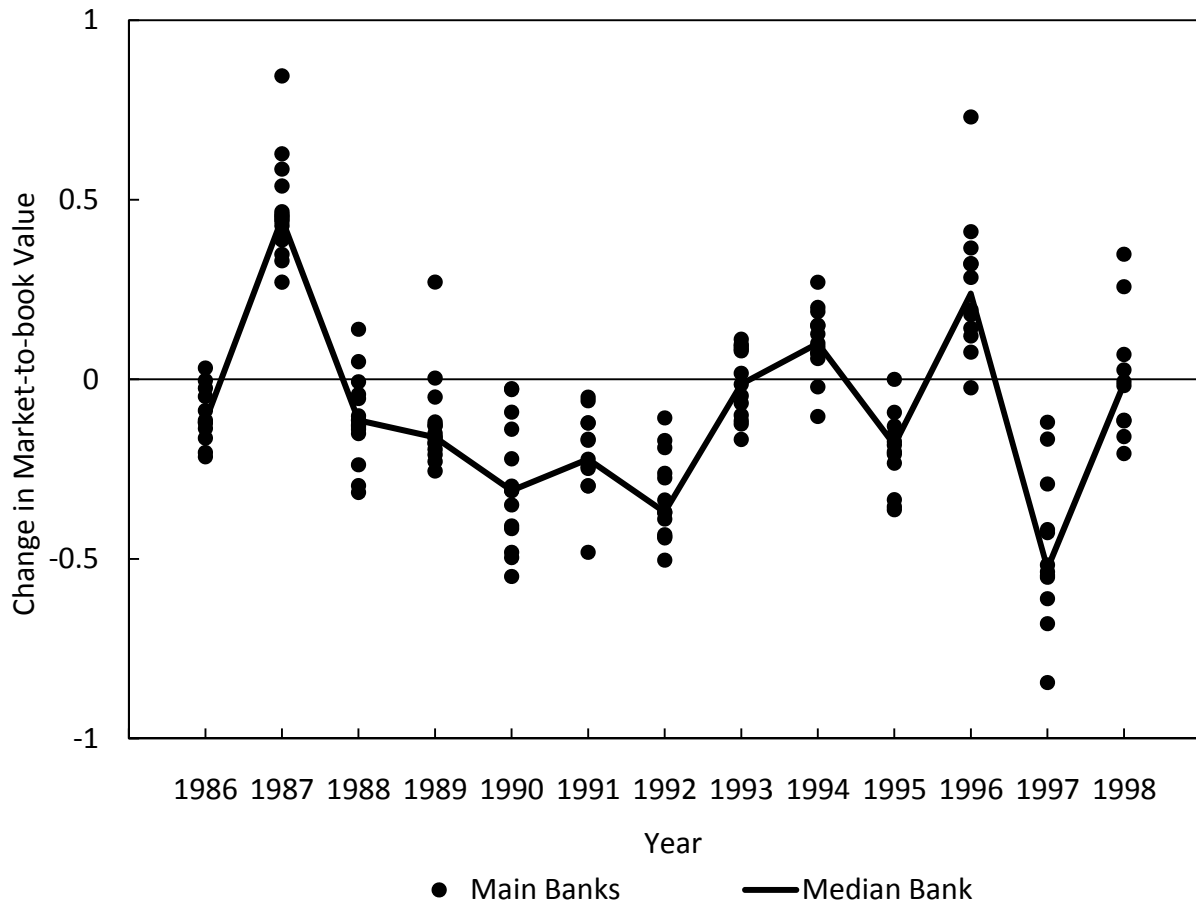
Firm-Level and Aggregate Export Growth in Japan, 1987–98



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: Summary Statistics

By banks	N	mean	median	sd	min	max
$\ln(\text{foreign bills bought})_{bt}$	174	12.008	12.278	1.008	6.295	13.661
$\Delta \ln(\text{foreign bills bought})_{bt}$	174	-0.086	-0.061	0.434	-3.837	1.724
$\ln(\text{totloans})_{bt}$	174	16.755	16.836	0.560	15.375	17.594
$(\text{foreign bills}/\text{totloans})_{bt}$	174	0.012	0.009	0.012	0.0001	0.077
$\ln(\text{foreign bills}/\text{totloans})_{bt}$	174	-4.747	-4.700	0.864	-9.300	-2.560
$\ln(\text{market value})_{b,t}$	170	14.95	15.15	1.02	6.90	16.15
$\ln(\text{market-to-book value})_{b,t-1}$	173	1.317	1.331	0.531	-0.700	2.612
$\Delta \ln(\text{market-to-book value})_{b,t-1}$	173	-0.072	-0.116	0.279	-0.844	0.845
By firms						
Number of firms _t	10,100	780	780	49	682	859
$\Delta \ln(\text{exports})_{ft}$	8,174	0.004	0.023	0.266	-1.232	0.949
$\Delta \ln(\text{domestic sales})_{ft}$	9,699	0.004	0.012	0.159	-2.207	3.269
$\Delta \ln(\text{exports}/\text{domestic sales})_{ft}$	8,018	0.0003	0.011	0.274	-1.348	1.245
$\Delta \ln(\text{market-to-value})_{f,t-1}$	8,424	-0.073	-0.114	0.294	-1.261	1.112
$\Delta \ln(\text{assets})_{f,t-1}$	9,312	0.035	0.023	0.112	-1.027	1.093
$\Delta(\text{profits})_{f,t-1}$	9,312	-0.001	-0.001	0.061	-1.770	2.226
$\Delta \ln(\text{share price})_{f,t-1}$	9,292	-0.033	-0.022	0.322	-3.060	1.674
$\Delta \ln(\text{market-to-book value adjusted for foreign bills bought})_{f,t-1}$	8,525	-0.070	-0.116	0.279	-0.847	0.848
Total loan _{fbt} /Total loan _{bt}	5,523	0.0001	0.00004	0.0002	0	0.006

Notes: Profits are defined as the ratio of after-tax net income to total assets.

Table 2: Associations between Bank Health, Trade Finance, and Exports

Dependent variable	$\ln(\text{totloans})_{b,t}$	$\ln(\text{foreign bills bought})_{b,t}$	$\ln(\text{bills/totloans})_{b,t}$	$\Delta \ln(\text{exports})_{b,t}$	$\Delta \ln(\text{exports})_{bi,t}$
				By bank	By bank/industry
	(1)	(2)	(3)	(4)	(5)
$\ln(\text{market-to-book value})_{b,t-1}$	0.157*** (0.050)	0.889** (0.425)	0.733* (0.407)		
$\Delta \ln(\text{trade finance loan})_{b,t}$				0.147*** (0.056)	0.068*** (0.021)
Fixed effects:					
Year	Yes	Yes	Yes	Yes	Yes
Bank	Yes	Yes	Yes	Yes	Yes
Industry	No	No	No	No	Yes
Observations	188	188	188	150	2,520
Adjusted R ²	0.95	0.85	0.82	0.28	0.14

Notes: Robust standard errors are in parentheses. ***Significant at the 1 percent level. **Significant at the 5 percent level. Columns 1 to 3 include the 15 city banks in our sample: Asahi Bank, Bank of Tokyo, Bank of Tokyo Mitsubishi, The Dai-Ichi Kangyo Bank, The Daiwa Bank, The Fuji Bank, Hokkaido Takushoku Bank, Industrial Bank of Japan, Long Term Credit Bank of Japan, Saitama Bank, Sakura Bank, The Sanwa Bank, Sumitomo Bank, Taiyo-Kobe Bank, and The Tokai Bank. Column 4 aggregates firm-level exports by first reference bank. Column 5 aggregates firm-level exports by first reference bank within an industry. In columns 4 and 5, we drop the first year that a bank merges to avoid big jumps in exports due to merger, we drop any firm that switches their main bank and we keep the sample balanced so it only includes firms that were in the sample for the whole sample period.

Table 3: Exports and Trade Finance

Dependent variable	$\Delta \ln(\text{exports})_{f,t}$			$\Delta \ln(\text{domestic sales})_{f,t}$	$\Delta \ln(\text{exports}/\text{domestic sales})_{f,t}$
	(1)	(2)	(3)	(4)	(5)
	Lag MTB				
$\Delta \ln(\text{market-to-book value})_{f,t-1}$	0.072*** (0.014)	0.077*** (0.018)	0.073*** (0.018)	0.016** (0.007)	0.062*** (0.021)
$\Delta \ln(\text{market-to-book value})_{f,t-2}$			-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. Our industry dummies are at the Japan industrial code 4-digit level, which comprise 108 industries in column 1. In columns 2 to 5, the 4-digit industry dummies are multiplied by each year dummy i.e. 108 times 13 years.

Table 4: Endogeneity

Dependent Variable: $\Delta \ln(\text{exports})_{f,t}$						$\Delta \ln(\text{exports}/\text{domestic sales})_{f,t}$
	With lagged dependent variable	With lagged firms' profits	Pre-Asian crisis years (1987 to 1996)	IV Instrument adjusted for firms' share prices	IV Instrument adjusted for trade finance profits	IV Instrument adjusted for trade finance profits
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln(\text{market-to-book value})_{f,t-1}$	0.072*** (0.019)	0.073*** (0.020)	0.069*** (0.028)	0.070*** (0.019)	0.066*** (0.017)	0.052** (0.023)
$\Delta \ln(\text{exports})_{f,t-1}$	-0.065*** (0.012)					
$\Delta \ln(\text{assets})_{f,t-1}$		0.226*** (0.034)				
$\Delta(\text{profits})_{f,t-1}$		-0.037 (0.063)				
Fixed effects: Year-industry	yes	yes	yes	yes	yes	yes
First-stage:						
$\Delta \ln(\text{adjusted market-to-book value})_{f,t-1}$				1.000*** (0.001)	0.927*** (0.010)	0.930*** (0.010)
F-stat				2.0e+06	48.10	48.03
Observations	6,684	6,759	5,274	6,753	7,016	6,906
Adjusted R ²	0.15	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. Profits are defined as the ratio of after-tax net income to total assets. The instrument in column 4 is the residual from a regression of the change in the bank's market-to-book value on the change in the firm's share price. The instrument in columns 5 and 6 is the change in the market-to-book value adjusted by subtracting the present discounted value of all export finance profits from market value, using a discount rate of 5 percent and a spread of 20 basis points assuming the contract of 4 month duration from the market value.

Table 5: Heterogeneous Effects

Dependent variable	$\Delta \ln(\text{exports})_{f,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
	Crisis interaction	Rajan Zingales interaction	Small interaction labor<100	With air interaction	Firms with foreign affiliates	Firms without foreign affiliates
$\Delta \ln(\text{market-to-book value})_{f,t-1}$	0.028* (0.015)	0.034* (0.19)	0.076*** (0.019)	0.104*** (0.021)	0.004 (0.022)	0.100*** (0.035)
$RZ_i * \Delta \ln(\text{market-to-book value})_{f,t-1}$		-0.018 (0.090)				
Crisis* $\Delta \ln(\text{market-to-book value})_{f,t-1}$	0.110*** (0.33)	0.082* (0.043)				
$RZ_i * \text{Crisis} * \Delta \ln(\text{market-to-book value})_{f,t-1}$		0.229* (0.132)				
Small* $\Delta \ln(\text{market-to-book value})_{f,t-1}$			0.232* (0.138)			
Small dummy _f			-0.195*** (0.036)			
Air* $\Delta \ln(\text{market-to-book value})_{f,t-1}$				-0.125*** (0.040)		
Fixed effects:						
Year-industry	No	No	Yes	Yes	Yes	Yes
Industry	Yes	Yes	No	No	No	No
Year	Yes	Yes	No	No	No	No
Observations	7,016	6,712	7,016	5,173	3,362	3,654
Adjusted R ²	0.09	0.10	0.15	0.14	0.18	0.12

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. *Significant at the 10 percent level. Crisis dummy equals 1 for years 1991, 1993, 1998. RZ indicator is at the ISIC 3 and 4 digit, comprising 27 industries. Our industry dummies are at the Japan industrial code 4-digit level which comprise 108 industries. In column 3, the small dummy equals 1 if a firm employs less than 100 workers. In column 4, the air dummy is defined as equal one if the share of trade exported by air is greater than 50 percent within that industry. Miscellaneous industries were dropped because of concordance difficulties.

Table 6: Alternative Measures of Main Bank and Market Timing

Dependent Variable: $\Delta \ln(\text{exports})_{f,t}$				
	(1)	(2)	(3)	(4)
	Alternative bank matching Loans	All banks	MTB value: 3 months average	March accounting period
$\Delta \ln(\text{market-to-book value})_{f,t-1}$	0.063*** (0.015)	0.061*** (0.015)	0.054*** (0.021)	0.060*** (0.019)
Fixed effects:				
Year-Industry	yes	yes	yes	yes
Observations	6,549	7,022	6,889	5,932
Adjusted R ²	0.13	0.15	0.14	0.16

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 7: Selection

Dependent Variable: $\Delta \ln(\text{exports})_{f,t}$					$\Delta \ln(\text{exports}/\text{domestic sales})_{f,t}$
	(1)	(2)	(3)	(4)	(5)
	Bank fixed effects	No bank switchers	Percentage change in MTB value	Heckman selection	Heckman selection
$\Delta \ln(\text{market-to-book value})_{f,t-1}$	0.077*** (0.018)	0.074*** (0.018)	0.060*** (0.019)	0.077*** (0.020)	0.068*** (0.021)
Fixed effects:					
Year-Industry	yes	yes	yes	yes	yes
Bank	yes	yes	yes	yes	yes
First stage					
Relative value added per worker $_{f,t-1}$				0.263*** (0.068)	0.225*** (0.065)
$\Delta \ln(\text{market-to-book value})_{f,t-1}$				-0.070 (0.109)	-0.095 (0.107)
Fixed effects:					
Year				yes	yes
Bank				yes	yes
LR test (rho=0)				$\chi^2(1)=44.43$	$\chi^2(1)=41.03$
Observations	7,016	6,432	7,023	8,179	8,179
R-squared	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 2, we drop any firm that switches its main bank during the sample period. In columns 4 and 5, 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 4; and 1,277 censored observations and 6,902 uncensored observations in column 5.

Appendix

Methodology for adjusting the market value of banks for profits from trade finance

Denote the trade finance issued by the bank by Foreign Bills Bought, F_b . Trade finance profits in year t , π_t , is then s , the spread on trade finance contracts (=20 basis points), multiplied by F_t or sF_t . Assume that in period 0, we have data for a bank until period k (which we set equal to 2004). In this case we can write the present value of the bank's trade finance contracts as

$$(2) \quad PV_0 = \sum_{t=1}^k \pi_t \prod_{i=1}^t \frac{1}{(1+r_i)} + E \left[\sum_{t=k+1}^{\infty} \pi_t \prod_{i=1}^t \frac{1}{(1+r_i)} \right]$$

Where r_i is the bank's time varying borrowing cost in period i . We set this interest rate equal to the average contracted interest rate on loans and discounts reported by the bank of Japan (Source: <http://www.stat.go.jp/english/data/chouki/14.htm>). This enables us to rewrite equation (2) can be rewritten as

$$(3) \quad PV_0 = \sum_{t=1}^k \pi_t \prod_{i=1}^t \frac{1}{(1+r_i)} + E \left[\sum_{t=k+1}^{\infty} \pi_k \prod_{i=1}^k \frac{1}{(1+r_i)} \prod_{i=k+1}^t \frac{1}{(1+r_i)} \right]$$

Since r_i is not stochastic for $i < k$, we can rewrite this as

$$(4) \quad PV_0 = \sum_{t=1}^k \pi_t \prod_{i=1}^t \frac{1}{(1+r_i)} + \prod_{i=1}^k \frac{1}{(1+r_i)} E \left[\sum_{t=k+1}^{\infty} \pi_t \prod_{i=k+1}^t \frac{1}{(1+r_i)} \right]$$

If we assume that $\pi_t = \pi_k$ for $t > k$, and $r_t = r_k$ for $t > k$, we have

$$(5) \quad PV_0 = \sum_{t=1}^k \pi_t \prod_{i=1}^t \frac{1}{(1+r_i)} + \prod_{i=1}^k \frac{1}{(1+r_i)} E \left[\sum_{t=k+1}^{\infty} \pi_k \prod_{i=k+1}^t \frac{1}{(1+r_k)} \right]$$

Or

$$(6) \quad PV_0 = \sum_{t=1}^k \pi_t \prod_{i=1}^t \frac{1}{(1+r_i)} + \prod_{i=1}^k \frac{1}{(1+r_i)} \sum_{t=k+1}^{\infty} \frac{\pi_k}{(1+r_k)^t}$$

If we assume that trade finance profits after period k (2004) equal those in 2004 and that the long term real interest rate is 5 percent, we have

$$(7) \quad PV_0 = \sum_{t=1}^k \pi_t \prod_{i=1}^t \frac{1}{(1+r_i)} + \frac{\pi_k}{r_k} \prod_{i=1}^k \frac{1}{(1+r_i)}$$

More generally, in period j , the PV of the bank's trade finance contracts are:

$$(8) \quad PV_j = \sum_{t=j+1}^k \pi_t \prod_{i=j+1}^t \frac{1}{(1+r_i)} + \frac{\pi_k}{r_{k+1}} \prod_{i=j+1}^k \frac{1}{(1+r_i)}$$

Thus, the market value of the bank's non-trade-finance profit stream is $MV_j - PV_j$, where MV_j is the market value of the bank. We divide $MV_j - PV_j$ by the book value of equity, and use the log change this adjusted market-to-book value as the instrument for the change in the market-to-book value of the firm.