Federal Reserve Bank of New York
Staff Reports

No Guarantees, No Trade: How Banks Affect Export Patterns

Friederike Niepmann
Tim Schmidt-Eisenlohr

Staff Report No. 659
December 2013
Revised April 2014

No Guarantees, No Trade: How Banks Affect Export Patterns
Friederike Niepmann and Tim Schmidt-Eisenlohr
Federal Reserve Bank of New York Staff Reports, no. 659
December 2013
Revised April 2014
JEL classification: F21, F23, F34, G21

Abstract

This study provides evidence that shocks to the supply of trade finance have a causal effect on U.S. exports. The identification strategy exploits variation in the importance of banks as providers of letters of credit across countries. The larger a U.S. bank's share of the trade finance market in a country is, the larger should be the effect on exports to that country if the bank reduces its supply of letters of credit. We find that a shock of one standard deviation to a country's supply of letters of credit decreases exports, on average, by 2 percentage points. The effect is larger for exports to small and risky destinations and in industries that rely more on bank guarantees to settle international transactions. The results imply that banks can affect export patterns and that trade finance played a role in the Great Trade Collapse.

Key words: trade finance, global banks, letter of credit, exports, financial shocks

---

Niepmann: Federal Reserve Bank of New York (e-mail: friederike.niepmann@ny.frb.org). Schmidt-Eisenlohr: University of Illinois at Urbana-Champaign (e-mail: t.schmidteisenlohr@gmail.com). The authors especially thank Geoffrey Barnes for excellent research assistance. For helpful comments, they also thank Mary Amiti, Andrew Bernard, Gabriel Chodorow-Reich, Raluca Dragunasu, Atif Mian, and David Weinstein, as well as participants in a seminar at the Federal Reserve Bank of New York, The Federal Reserve Bank of San Francisco, LMU Munich, and the Ifo Institute Munich. The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

1 Introduction

During the Great Recession, world trade relative to global GDP collapsed by 20 percent. Since then, there has been much debate about whether and to what extent trade finance played a magnifying role in the Great Trade Collapse.[1] The hypothesis is that worsening financial conditions have a greater effect on trade than on domestic sales because trade takes longer (working capital channel) and is riskier (risk channel).[2] While previous research has focused more on the working capital channel, this paper provides evidence that the risk channel is highly relevant for aggregate trade flows.[3] Specifically, we show that a reduction in the supply of letters of credit (LCs), an instrument to reduce risk in international trade, has a large, causal effect on exports both in crisis and non-crisis times. We also document, for the first time, that trade finance affects not only the levels of trade but also trade patterns. Because LCs are destination specific and banks specialize in providing them to certain markets, an idiosyncratic bank shock has asymmetric effects across export destinations. In addition, supply shocks have stronger effects on exports to smaller and riskier countries and in industries that rely more on bank guarantees. These new results reveal that it is key to distinguish between the risk and the working capital channel and suggest a role for trade finance in explaining the trade collapse in 2008/2009, in particular with respect to trade in small and high-risk countries.[4]

Information on trade finance employed in this paper is from the FFIEC 009 Country Exposure Report that all large U.S. banks are required to file.[5] We observe banks' trade finance claims, which reflect mostly LCs in support of U.S. exports, by destination country at a quarterly frequency over a period of 15 years. The total trade finance claims of all reporting banks account for roughly 20 percent of U.S. exports in 2012. Thus, the trade finance activities captured in the report are sizable relative to trade.

Based on these data, we estimate time-varying trade finance supply shocks. This is an improvement over existing studies of the effect of financial shocks on trade, which rely on instrumental variable approaches and analyze the effect of shocks mostly during crisis periods. We largely follow the methodology in Greenstone and Mas (2012) and Amiti and Weinstein (2013) to isolate idiosyncratic supply shocks from demand shocks: trade finance growth rates at time t in country c are regressed on bank-time fixed effects α_{bt} as well as on country-time

[1] Eaton et al. (2011), Bems et al. (2010), and Levchenko et al. (2010) argue that most of the drop in trade in 2008/2009 is explained by changes in demand and compositional effects. In contrast, using data from Japan that cover an earlier crisis, Amiti and Weinstein (2011) find that bank shocks reduce international trade more than domestic sales. Ahn et al. (2011) analyze the behavior of export and import prices during the recent financial crisis, and they argue that there is a role of trade finance.

[2] Ahn (2010) and Schmidt-Eisenlohr (2013) develop theoretical models to show this.

[3] Amiti and Weinstein (2011) provide reduced-form evidence that financial shocks affect exports through both channels. However, their data do not allow them to distinguish directly between the two. Paravisini et al. (2011) use loan data to study the working capital channel. Del Prete and Federico (2012) only find evidence for the working capital channel. Works that also stress the risk channel are van der Veer (forthcoming), Ahn (2013), and Hale et al. (2013), which are discussed in detail below.

[4] In contrast to this study, Paravisini et al. (2011), who analyze the working capital channel, find uniform effects of bank shocks across export destinations.

[5] These data were first used in Niepmann and Schmidt-Eisenlohr (2013).

fixed effects β_{ct}. The estimated bank-time fixed effects α_{bt} correspond to idiosyncratic bank-level supply shocks. To address potential endogeneity concerns, we estimate bank-time fixed effects separately for each country, always dropping country i information from the sample to obtain the bank shocks that we use for country i. We show that bank shocks are positively correlated with growth in loans and changes in banks' credit default swap spreads, which is evidence that the estimated bank-time fixed effects capture idiosyncrasies in banks' business conditions.

Idiosyncratic bank shocks can have an effect on trade because exporters and importers cannot easily switch between different banks when they want to settle a transaction based on an LC. An LC is a means to reduce the risk of a trade, which works as follows: The importer asks a bank in her country to issue an LC. This letter is sent to the exporter. It guarantees that the issuing bank will pay the agreed contract value to the exporter if a set of conditions is fulfilled.[6] In addition, a bank in the exporter's country can confirm the LC, whereby the confirming bank commits to paying if the issuing bank defaults.[7] The nature of this transaction implies significant fixed costs so that the business is highly concentrated with only a few large banks. Moreover, information about counter-party banks and clients is acquired over time, and such information is not easily transferable. This should make it hard for a firm to switch to another bank when its home bank does not provide the service. When firms are not willing to trade without an LC or adjust quantities because expected profits from trading under alternative payment forms are lower, a reduction in the provision of LCs by a single bank has an effect on exports.

The identification strategy pursued in this paper exploits the variation in the importance of banks as providers of LCs across countries. The same reduction in the supply of LCs by a bank should have a bigger effect in markets where the bank has a larger share of the trade finance business. Accordingly, the shock to bank b at time t is weighted by the market share of bank b in country i at time $t-2$, and these weighted shocks are summed over all banks in the sample. The resulting country-time specific shocks are used to predict exports.

The baseline specification tests whether country-level trade finance supply shocks explain the variation in export growth rates controlling for a common time effect and a country-specific trend in the export growth rate. We find statistically and economically significant effects. A country-level shock of one standard deviation decreases exports, on average, by 2 percentage points. We show that negative shocks have larger effects than positive shocks, in line with Amiti and Weinstein (2011). Moreover, effects are present at all times: even when the recent crisis period is excluded from the sample, the effect of supply shocks is significant. We also document that shocks to the five biggest trade finance banks account for most of the aggregate effects.

The identifying assumption that establishes a causal link between supply shocks and exports is that there are no time-varying unobserved country-specific factors that are correlated with both export growth and supply shocks. Given our methodology, two conditions need

[6] For example, the issuing bank may promise to pay upon receipt of shipping documents.

[7] Many development banks provide trade finance and confirm LCs in developing and emerging countries. For example, the International Finance Corporation (IFC), an entity of the World Bank Group, runs a program to confirm LCs. See IFC (2012) for details.

to hold. First, the estimated shock to the supply of LCs by bank b, based on information from countries other than country i, is not correlated with changes in the demand for trade finance and, hence, growth in exports to country i. Second, banks with positive shocks to their supply of trade finance in period t do not sort, at time $t-2$, into markets with positive deviations from trend export growth in period t. These conditions would be violated if banks were specialized in a single industry or firm or if banks that exhibit positive shocks in period t were to increase their market shares in period $t-2$ in export destinations with positive deviations from trend growth in period t. We demonstrate that the possibility that banks specialize is rejected by the data. In addition, bank-level shocks are serially uncorrelated and results are unchanged when different lags of banks' market shares are used. These findings together rule out the systematic sorting of banks into markets and strongly suggest that the link found in this paper is indeed causal.

Our results have implications for additional strands of the literature. LCs represent a new channel through which financial conditions affect the real economy and through which global banks transmit shocks across borders. We therefore add to the growing literature on the real effects of financial shocks and the role of global banks in international spillover effects.[8] In addition, this paper is related to the literature on relationship lending, supporting the idea that firm-bank relationships matter, since firms cannot easily switch to other banks to obtain trade financing.[9]

In a quantitative exercise, we evaluate the effect of a negative shock to the trade finance supply of one large bank. Because of the high concentration of the business, a reduction that corresponds to the 10th percentile of the bank-level shock distribution leads to a 0.9-percentage-point decline in total U.S. exports. This illustrates that the behavior of a single bank can have a considerable effect in the aggregate. In this regard, this paper is also related to the literature on "granularity" started by Gabaix (2011), who shows that idiosyncratic shocks can have aggregate effects if single firms are sufficiently large.

Another key result of this paper is that banks affect export patterns. Because banks specialize in confirming and issuing LCs in certain markets, a reduction in the supply of LCs by a single bank has asymmetric effects across destination countries. We show that a shock of the same size to two different banks affects exports to different regions of the world differentially, depending on the markets in which each bank specializes. Hence, the patterns of banks' global activities determine to which markets shocks are transmitted.

In addition, we find that country-level shocks of the same size have heterogeneous effects across industries and export destinations. Industries that rely more heavily on LCs to settle trade transactions are more affected. Also, exports to riskier and smaller destinations decline more when banks reduce their supply of trade finance. This is likely because firms use LCs

[8]For papers on the real effects of financial shocks, see, e.g., Mian and Sufi (2010), Khwaja and Mian (2008), Ashcraft (2005), Rosengren and Peek (2000), and Peek and Rosengren (1997). For studies on the transmission of financial conditions through global banks, see, e.g., Bruno and Shin (2013), Cetorelli and Goldberg (2012), Kalemli-Ozcan et al. (2012), and Ongena et al. (2013).

[9]Sharpe (1990) and Williamson (1987), for example, provide theoretical models to explain why firms might not obtain financing from another bank when their home bank does not provide credit. Empirical evidence for the stickiness of firm-bank relationships is also provided in Chodorow-Reich (2014), Greenstone and Mas (2012) and Jimenez et al. (2012), for example.

more intensively and are less willing to trade without them when exporting to riskier markets. At the same time, it is more difficult for firms to obtain an LC from another bank in smaller markets, where fewer banks are active.

Paravisini et al. (2011), who study the working capital channel, do not find evidence that bank shocks affect exports differentially across destinations. This highlights the notion that the distinction between the working capital channel and the LC channel matters. A reduction in the supply of bank guarantees has a different effect on trade than a reduction in the supply of general loans. First, working capital needs are independent of destination country risk, whereas country risk determines whether an exporter demands an LC. Moreover, working capital loans are fungible and firms can internally reallocate available funds. LCs, in contrast, are destination specific and can only be obtained from a small number of banks.

The empirical strategy does not allow us to quantify the effect of aggregate LC supply shocks. However, our results strongly suggest that trade finance played a magnifying role in the Great Trade Collapse. First, the effect of supply shocks is present at all times and effects can be large. Second, supply shocks are correlated with bank-level variables, in particular with loan growth and banks' credit default swap spreads. Balance sheets deteriorated and CDS spreads widened during the crisis.[10] Therefore, while demand effects may explain a large part of the collapse in trade in 2008/2009, the LC channel may also be quantitatively relevant, in particular for trade with small and risky countries.

Literature on Finance and Trade Only a few papers study the role of financial shocks in international trade. Using Japanese matched bank-firm data from 1990 to 2010, Amiti and Weinstein (2011) show that if a bank has a negative shock to its market-to-book value, a firm that lists this bank as its main bank has a drop in exports that is larger than the observed drop in domestic sales. While the authors establish a general link between banks and trade, they cannot test for the heterogeneous effects of shocks across export destinations and cannot directly distinguish between different transmission channels due to data limitations.[11]

Paravisini et al. (2011) study the working capital channel using matched bank-firm data from Peru. The authors find that credit supply shocks reduced exports during the recent financial crisis. As discussed above, the effects do not differ across export destinations.

Del Prete and Federico (2012) employ Italian matched bank-firm data that allow them to distinguish between general loans, trade-related loans and guarantees. They report that trade is affected by changes in the supply of general loans but not by changes in the supply of trade-specific loans and guarantees. As this paper shows, the risk and the size of a destination country are of first-order importance for the risk channel. The fact that the authors cannot estimate the effect of trade finance supply shocks by destination country most likely explains why they do not find that the supply of bank guarantees matters for trade.

Three other papers also focus on the risk channel. Ahn (2013) analyzes the effect of bank balance-sheet shocks on the provision of LCs in 2008/2009 in Colombia. Similar to the

[10] See, e.g., Santos (2011), Chodorow-Reich (2014), and Cornett et al. (2011).

[11] Indirect evidence for the risk channel is provided: exports of firms that have affiliates drop less than exports of stand-alone firms.

results in this paper, he finds that bank balance-sheet items predict the variation in bank-level LC supply. He does not test for the effect of supply shocks on trade flows, however. Van der Veer (forthcoming) studies the role of trade credit insurance and finds a relationship between the supply of insurance by one large insurer and aggregate trade flows. Hale et al. (2013) document that an increase in bank linkages between countries is associated with larger bilateral exports, conjecturing that banks mitigate export risk.

Finally, by identifying one specific channel through which financial conditions affect trade patterns, our paper is also related to Beck (2003) and Manova (2013), who show how financial development can generate a comparative advantage.

The paper is structured as follows. Sections 2 and 3 give background information on banks' role in trade finance and the data, respectively. Section 4 discusses the empirical strategy. Section 5 presents the results and robustness checks. Section 6 quantifies the aggregate effects of LC supply shocks. Section 7 relates the presented results to the debate on the Great Trade Collapse. Section 8 concludes.

2 A Primer on Trade Finance and Letters of Credit

2.1 The role of banks in facilitating trade

When exporters and importers engage in a trade, they have to agree on who finances the transaction and who bears the risk. Banks help both with financing and with mitigating the risk. First, consider the financing decision. If the exporter produces first and the importer pays after receiving the goods, the exporter pre-finances the transaction, which is referred to as open account. Alternatively, if the importer pays before receiving the goods, trade is done on cash-in-advance terms, and the importer provides the working capital to the exporter. In both cases, a firm can either use funds out of its cash flows or ask for a loan from a bank to finance the working capital or the pre-payment.

Second, any transaction entails a risk that one of the trading partners will not comply. Under open account, the importer may not pay after receiving the goods. Under cash-in-advance, the exporter may not deliver the goods after receiving the payment. To address these commitment problems, banks offer LCs. Figure 1 illustrates how they work. A bank in the importing country issues an LC, which is sent to the exporter. The LC guarantees that the issuing bank will pay the agreed contract value to the exporter if a set of conditions is fulfilled. These conditions typically include delivering a collection of documents to the bank, e.g., shipping documents that confirm the arrival of the goods in the destination country. In most cases, a bank in the exporting country is also involved in the LC transaction. Because there is still a risk that the issuing bank will default on its obligation, the exporter can ask a bank in her country to confirm the LC. The confirming bank thereby agrees to pay the exporter if the issuing bank defaults. The commitment problems that arise under open account and cash-in-advance are resolved with an LC, since the exporter is paid only after delivering the goods and the importer commits to paying by making her bank issue an LC.[12]

[12] An LC roughly corresponds to settling a payment on open account with a bank guarantee. It is similar

Both the financing costs and the risk of international transactions are higher than those of domestic sales. Working capital needs are typically higher because transaction times are longer due to customs procedures and a greater distance between the seller and the buyer. Evidence in favor of this hypothesis is presented in Schmidt-Eisenlohr (2013), for example, who finds that changes in interest rates affect trade more between countries that are farther away from each other.

More importantly for this paper, international trade is riskier than domestic sales because contracts are harder to enforce across borders. In addition, less information about the reliability of trading partners may be available. Accordingly, LCs are widely used in international trade and are employed to a much smaller extent for domestic sales. Data from the SWIFT Institute on LCs show this. In 2012, around 92 percent of all LCs in support of U.S. sales were related to exports and only 8 percent to domestic activity.[13]

2.2 Market structure of the business

The trade finance business and, in particular, the market for bank guarantees is highly concentrated. Niepmann and Schmidt-Eisenlohr (2013) and Del Prete and Federico (2012) present details on the market structure for the U.S. and Italy, respectively. In 2012, the top 5 banks accounted for 92 percent of all trade finance claims in the U.S. In Italy, the business is similarly concentrated. Only ten Italian banks extend trade guarantees.

The high concentration is likely due to high fixed costs. When U.S. banks confirm LCs, they need to have contact with banks abroad as well as knowledge of their credit- and trustworthiness. They also need to be familiar with the local market and the legal environment. The business of confirming and issuing LCs is relationship intensive in the sense that information about counter-party banks and clients is acquired over time, and such information is not easily transferable.[14]

Due to the high concentration of the market, the presence of information asymmetries, and the importance of relationships, it should be difficult for a firm to switch to another bank when its home bank refuses to confirm or issue an LC. Anecdotal evidence suggests that banks provide trade financing only to their core customers, since the profit margins on LCs and similar instruments are small.

Note that there is no alternative method that reduces commitment problems to the same degree. Trade credit insurance, another option for exporters, does not reduce the risk but

to open account in that the exporter still needs to pre-finance the transaction and gets paid only after confirmation of delivery. It differs in that the risk the exporter has to bear is reduced by the guarantee of the bank. Moreover, the importer has to pay a fee to her bank in advance and the requested guarantee might reduce her available credit lines. The financial costs of an LC are therefore higher. See Schmidt-Eisenlohr (2013), Antràs and Foley (2011) and Hoefele et al. (2013) for a more detailed discussion of the three payment forms.

[13] These calculations are based on quarterly information on the number of SWIFT MT700 messages that were received by U.S. banks.

[14] Niepmann and Schmidt-Eisenlohr (2013) present evidence that fixed costs, in fact, play an important role and that only larger banks are able to cover them. They find a pecking order: smaller markets are, on average, served by larger banks.

instead shifts it to another agent, the insurer.[15] As a consequence, the price of insurance should increase more with destination country risk than the price of LCs, and insurance may be unavailable in the most risky destinations. If an LC cannot be obtained and trade insurance is very costly or cannot be bought, importers and exporters may not be willing to trade. Then a reduction in the supply of LCs has an effect on trade.[16]

3 Data Description

The data on trade finance used in this paper are from the Country Exposure Report (FFIEC 009). U.S. banks that have more than $30 million in total foreign assets are required to file this report and have to provide, country by country, information on their trade-finance-related claims with maturity of one year and under. Claims are reported on a consolidated basis; that is, they also include the loans and guarantees extended by the foreign affiliates of U.S. banks.

The statistics are designed to measure the foreign exposures of banks. This information allows regulators to evaluate how U.S. banks would be affected by defaults and crises in foreign countries. Therefore, only information on the claims that U.S. banks have on foreign parties is collected. Loans to U.S. residents and guarantees that back the obligations of U.S. parties are not recorded. Based on the reporting instructions, several trade finance instruments can be included in the data that support either U.S. exports, U.S. imports, or third-party trade, as summarized in table 1. Niepmann and Schmidt-Eisenlohr (2013) provide a detailed discussion and exploration of the data. Their analysis indicates that letters of credit that support U.S. exports constitute, by far, the largest part of the observed trade finance volumes. This is followed by working capital loans to foreign exporters through U.S. bank affiliates abroad. Loans to foreign importers as well as loans in support of trade with other countries could also be included in the data but do not represent a sizable share of the measured bank activities. This is confirmed by data from the SWIFT Institute on letters of credit advised by U.S. banks.

Transaction values and reported claims are related in the following way: Suppose that a U.S. bank confirms a letter of credit issued by a bank in Brazil. Then the U.S. bank would suffer a loss in the event that the Brazilian bank defaults on its obligation to pay. Accordingly, the U.S. bank reports claims vis-à-vis Brazil that correspond to the transaction value of the letter of credit. The value of the letter of credit is, in turn, determined by the value of the goods that the Brazilian firm buys from the U.S exporter. Similarly, if an

[15]When issuing or confirming an LC, banks actively screen documents and manage the conditional payment to the exporter and thereby resolve the commitment problem. Trade credit insurance also implies a guarantee of payment but has no direct effect on the underlying commitment problem. This difference can best be seen in a model with risk-neutral firms as in Schmidt-Eisenlohr (2013). There, firms demand LCs but have no reason to buy trade credit insurance.

[16]Note that there is an effect on trade even if all alternative contracts are available to a firm. It follows from revealed preferences that whenever LCs are used, other payment forms generate weakly lower profits. Hence, a reduction in the supply of LCs can affect both the intensive and the extensive margins of trade. Quantities decline as trade finance costs, which represent variable trade costs, go up. If costs become sufficiently large, trade becomes unprofitable.

affiliate of a U.S. bank in Brazil issues a letter of credit to a Brazilian importer, the affiliate backs the obligations of the foreign importer. Accordingly, the parent bank, which files the Country Exposure Report on a consolidated basis, reports the contract value as claims vis-à-vis Brazil.

The trade finance data are available at a quarterly frequency. The sample covers the period from the first quarter of 1997 to the second quarter of 2012.[17] Since the average maturity of a confirmed letter of credit is 70 days (see ICC (2013)), the stock of claims at the end of a quarter is highly correlated with the flow of exports in that quarter; thus, comparing growth in quarterly stocks with growth in quarterly trade flows makes sense. The data on U.S. trade in goods used in this paper are from the IMF Direction of Trade Statistics.

Figure 2 depicts the evolution of U.S. exports and banks' trade finance claims over time, as shown in Niepmann and Schmidt-Eisenlohr (2013).[18] Trade finance claims peaked in 1997/1998 during the Asian crisis and again during the financial crisis in 2007-2009.[19] Since 2010, claims have increased considerably, which is likely due to the low interest rate environment and the retrenchment of European banks from this U.S.-dollar-denominated business. The graph clearly indicates that trade finance plays an important role for U.S. firms. In 2012, total trade finance claims of U.S. banks amounted to roughly 20 percent of U.S. exports.

As Niepmann and Schmidt-Eisenlohr (2013) document, the use of letters of credit and trade finance varies substantially across destination countries. Figure 3 displays the average trade finance intensity of the top 35 countries from the first quarter of 2006 to the second quarter of 2012, defined as a country's ratio of trade finance claims to U.S. exports. Countries with intermediate levels of default risk and a large distance from the U.S. exhibit particularly high trade finance intensities. Systematic variation in the use of letters of credit across export destinations is one reason why the effect of trade finance supply shocks may be asymmetric across countries. We explore asymmetries in section 5.

4 Empirical Approach

4.1 Estimating trade finance supply shocks

In this section, we discuss the empirical strategy to identify the causal effect of letter-of-credit supply shocks on exports. The challenge in establishing a causal link is to obtain a measure of supply shocks that is exogenous to the demand for LCs. Because we have information on the trade finance claims of U.S. banks by destination country that varies over time, we

[17] Until 2005, banks' trade finance claims are reported on an immediate borrower basis; that is, a claim is attributed to the country where the contracting counter-party resides. From 2006 onward, claims are given based on the location of the ultimate guarantor of the claim (ultimate borrower basis). This reporting change does not appear to affect the value of banks' trade finance claims in a systematic way, so we use the entire time series without explicitly accounting for the change. See http://www.ffiec.gov/ for more details.

[18] The claims of one bank are excluded from the aggregates, since this bank fundamentally changed its trade finance business in the reporting period.

[19] Evidence from Italy and IMF surveys also suggests that trade finance expanded during the recent financial crisis. See Del Prete and Federico (2012) and Asmundson et al. (2011).

can estimate time-varying idiosyncratic bank-level supply shocks directly from the data.[20] In line with Greenstone and Mas (2012) and Amiti and Weinstein (2013), we estimate the following regression to disentangle supply shocks from demand shocks:[21]

$$\Delta tf_{bct} = \frac{tf_{bct} - tf_{bct-1}}{tf_{bct-1}} = \alpha_{bt} + \beta_{ct} + \epsilon_{bct}, \tag{1}$$

where tf_{bct} corresponds to the trade finance claims of bank b in country c and quarter t. Trade finance growth rates are regressed on bank-time fixed effects α_{bt} and on country-time fixed effects β_{ct}. The obtained bank-time fixed effects correspond to the idiosyncratic bank shocks. By construction, they are independent of country-time specific factors related to the demand for trade finance (and, hence, export growth) and affect all banks in the sample in the same way. To further address the concern that bank shocks might pick up demand effects, bank shocks are estimated for each country separately: the bank shock α_{ibt} for country i is obtained by estimating equation 1 without including observations of country i. Therefore, α_{ibt} reflects growth in trade finance claims by bank b in quarter t based on changes in claims in all countries except country i.

The estimated supply shocks α_{ibt} are used to construct country-specific supply shocks as follows:

$$\text{shock}_{it} = \sum_{b}^{B} \phi_{ibt-2}\alpha_{ibt}, \tag{2}$$

where $\phi_{ibt-2} = \frac{tf_{ibt-2}}{\sum_b^B tf_{ibt-2}}$. Thus, bank supply shocks are weighted by the share of bank b in the total trade finance claims of country i at time $t-2$ and are summed over all banks in the sample. In section 5.3, we show that results also hold when one- or three-period lagged market shares are used instead.

The effect of trade finance supply shocks on exports is estimated based on the following equation:

$$\Delta X_{it} = \frac{X_{it} - X_{it-1}}{X_{it-1}} = \gamma \ \text{shock}_{it} + \delta_t + \delta_i + \eta_{it}, \tag{3}$$

where X_{it} denotes U.S. exports to country i at time t. Export growth rates are regressed on the constructed country-level supply shocks as well as on country fixed effects and time fixed effects. The key coefficient of interest is γ.

Under the assumption that the computed country supply shocks are not systematically correlated with unobserved characteristics that vary at the time-country level and are correlated with exports, γ corresponds to the causal effect of trade finance supply shocks on export growth. Expressed in formulas, the identification assumption is: $E((\sum_b^B \phi_{ibt-2}\alpha_{ibt})\eta_{it}) = 0$. Under the presented strategy, the assumption is satisfied if two conditions hold. First, the

[20] This is different from previous works on the effect of finance on trade, which rely on proxy variables to identify shocks. Amiti and Weinstein (2011) use banks' market-to-book values. Paravisini et al. (2011), Del Prete and Federico (2012) and Ahn (2013) exploit the variation in banks' funding exposures.

[21] Based on a cross-section observed at two points in time, Greenstone and Mas (2012) estimate a model in log differences to obtain bank shocks. Amiti and Weinstein (2013) use a time-series, as we do, but impose adding-up constraints on the shocks.

estimated shock to the supply of LCs by bank b, based on information from countries other than country i, is not correlated with changes in the demand for trade finance and, hence, growth in exports to country i. Second, banks with positive shocks to their supply of trade finance in period t do not sort, at time $t-2$, into markets with positive deviations from trend export growth in period t. In section 5.3, we revisit these conditions and provide evidence against the hypothesis that banks specialize in certain industries or sort systematically into export markets.

To account for acquisitions, the trade finance growth rates are calculated in the period of an acquisition based on the sum of the trade finance claims of the acquired bank and the acquiring bank in the previous period. The same adjustment is made when the bank shares ϕ_{ibt-2} are calculated. If a bank acquired another bank at time $t-1$ or $t-2$, we use the country share of the two banks added up to compute bank shares. Bank supply shocks are estimated on a sample, in which observations in the first and 99th percentiles of the trade finance growth rate distribution are deleted to mitigate the influence of outliers. In the export regression (equation 3), countries with a population below 250,000, offshore financial centers and the top and bottom one percentile of the export growth rate distribution are excluded from the sample.[22]

4.2 Heterogeneity and persistence in banks' market shares

The empirical strategy in this paper requires that the importance of single banks be heterogeneous across destination markets. Otherwise, all countries would be subject to the same shock and we would not be able to identify effects. In addition, it is essential that banks have stable market shares over time, because we use lagged values to compute country shocks. If banks' market shares were very volatile, then lagged values would not contain useful information about the degree to which bank-level supply shocks affect different countries.

The upper panel of table 2 shows summary statistics of ϕ_{bit}, the share of bank b in the total trade finance claims of all U.S. banks in country i at time t, at different points in time. There is substantial heterogeneity at every date. The average bank share increased from 2000 until 2012, consistent with the observed reduction in the number of banks active in the trade finance business.[23] Bank shares range from below 0.1 percent to 100 percent. The standard deviation is 27 percent in the first quarter of 2012.

Persistence in banks' market shares can be reflected in both the intensive and the extensive margin. On the one hand, a bank should account for a stable fraction of a country's overall trade finance supply over time (intensive margin). On the other hand, there should be no frequent exit and entry of banks into markets (extensive margin).

We check whether bank shares are persistent in two different ways. First, we regress the

[22] If we include extreme growth rates, the shock coefficient γ is larger compared to the results reported in columns (1) to (3) of table 9 and statistically significant at the 10 percent level. A list of countries designated as offshore financial centers can be found in the appendix.

[23] Changes in banks' market shares over time are slow but substantial. Therefore, we cannot use market shares in the beginning of the sample period and keep them constant over time to obtain country-level shocks.

market share ϕ_{ibt} of bank b in country i at time t on country-bank fixed effects. These fixed effects alone explain more than 77 percent of the variation in bank shares, which implies that there is much cross-sectional variation in banks' market shares but little time variation. Second, we regress the current market share ϕ_{ibt} on its lagged values. Without adjusting for mergers and acquisitions, the one-quarter lagged bank share explains around 84 percent of the variation in the current share, as shown in table 3.[24] Two-period lagged values, which are used to construct country supply shocks, still explain around 77 percent of the variation.

A similar exercise can be conducted for the number of banks n_{it} that are active in a given market i. The lower panel in table 2 shows statistics for this variable. The number of banks operating in a given country fell over the sample period. In the first quarter of 2012, there were at most 14 banks active in a single country. The mean of the variable is 3.6 and the standard deviation is 2.8 in the same quarter.

A regression of the number of banks in country i at time t on country and time fixed effects accounts for more than 76 percent of the variation. As an alternative, similar to before, the number of banks in period t is regressed on its lagged values. Table 4 displays the results. The two-quarter lagged number of active banks explains approximately 92 percent of the variation in this variable.

4.3 Validation of bank supply shocks

There are a total of 101 different banks in the sample for which we obtain trade finance supply shocks. In the third quarter of 1997, bank shocks for 52 different banks are estimated, down to 15 banks in the second quarter of 2012 due to consolidation in the banking sector. In total, 35,919 time-country-varying bank shocks are observed over the sample period from 1997 q2 until 2012 q2. Figure 4 shows the distribution of bank shocks, which exhibits significant variation and is centered around zero. Table 5 provides the corresponding summary statistics. Figure 5 displays the median and mean bank shock over time.

To check that the estimated bank shocks make sense, we verify that they are correlated with meaningful bank-level variables.[25] To that end, the mean bank shock $\bar{\alpha}_{bt}$, which corresponds to the value of α_{ibt} averaged over all countries, is regressed on deposit growth, loan growth, growth in real estate charge-offs and the credit default swap spread on senior unsecured debt of bank b at time t. Results are displayed in table 6. In columns (1) to (5), time fixed effects are included to control for a common time trend in the growth of banks' balance sheets. In column (6), bank fixed effects are estimated to account for systematic differences in the level of banks' CDS spreads. In all columns, standard errors are clustered at the bank level.

The results in column (1) of table 6 indicate that the average bank shock is larger if banks' deposit growth is higher, although the coefficient is not significant at standard significance levels. Columns (2) and (3) show that the bank shocks are also positively correlated with loan growth and negatively correlated with growth in real estate charge-offs. This is

[24] If we adjusted for M&As, then persistence would be even higher.

[25] Balance-sheet information for banks in the sample comes from the Y9c and FFIEC 031 reports. Credit default swap spreads are taken from Markit.com.

confirmed in columns (4) and (5), in which two or three balance-sheet variables are included simultaneously as regressors. Finally, there is evidence that the bank shocks are negatively correlated with banks' credit default swap spreads, an implicit measure of banks' funding costs. Banks apparently reduce their supply of trade finance as funding conditions worsen. These results suggest that, among others, the estimated supply shocks capture idiosyncrasies in banks' business situations.

Next, we check whether the bank shocks, which are estimated without the use of information on country i, predict trade finance growth in country i. We run the following regression:

$$\Delta tf_{ibt} = \alpha_{ibt} + \xi_t + \xi_i(+\xi_{it}) + \eta_{ibt}, \tag{4}$$

where Δtf_{ibt} represents the growth rate of the claims of bank b in country i in quarter t observed in the data. α_{ibt} is the bank shock of bank b at time t that was estimated based on equation 1 without including Δtf_{ibt} in the sample. The regression results are displayed in table 7. The first column excludes fixed effects; the second column includes both time fixed effects ξ_t and country fixed effects ξ_i. The third column controls for country-time fixed effects ξ_{it}. Standard errors are clustered at the bank-time level. The coefficient on the bank shock is highly significant and positive in all three columns. This shows that the estimated bank shocks based on developments in other countries have strong predictive power for the actual growth of trade finance claims of bank b in country i at time t, although they do not explain much of the variation as the low R^2 in column (1) indicates.

Finally, we investigate whether bank supply shocks are serially correlated.[26] Table 8 displays results from a regression of the average bank shock $\bar{\alpha}_{bt}$ on its lagged values and time fixed effects. The regression in column (1) includes only the one-quarter lagged bank shock. In column (2), the two-quarter lagged shock is added as a regressor. Column (3) includes one- to four-quarter lagged values of $\bar{\alpha}_{bt}$. In all three columns, the coefficients of the lagged bank shocks are always insignificant. Realizations of bank shocks in the past do not predict future shocks.

4.4 Distribution of country supply shocks

In a next step, details on the computed country-level supply shocks Δtf_{it} are given. In total, we obtain country shocks for 159 different countries. Table 5 displays the summary statistics for this variable.

The regressions that are run to estimate the effect of trade finance supply shocks on trade include country fixed effects. Therefore, we control for time-invariant country characteristics that are correlated with export growth and trade finance supply shocks. However, results do not change when country fixed effects are left out as we show in the next section. This is because supply shocks are randomly distributed across countries. To illustrate this, figure 6 plots the distribution of the average value of a dummy variable d_{it} that takes value 1 if the supply shock to country i in period t is above the period-t median and zero otherwise.

[26] We use the result of this exercise in section 5.3, in which we discuss our identification strategy and endogeneity concerns in detail.

In the limit, where time goes to infinity, random assignment implies that the mean of the dummy goes to 0.5 for every country. In any finite sample, the dummy should be distributed symmetrically around 0.5. Figure 6 shows that this is the case. A correlation between country-level shocks and country characteristics could only arise if banks with above or below median shocks were associated with particular countries. Figure 6 indicates that this is not the case and, therefore, that there is no correlation between banks' market shares ϕ_{ibt} and the estimated bank-level shocks α_{ibt}.

5 Results

5.1 Baseline results

Table 9 presents the baseline regression results obtained from estimating equation 3. Unless stated otherwise, standard errors are clustered at the country level for all regressions in this section. In column (1), export growth is regressed on trade finance supply shocks and time fixed effects. The estimated effect of supply shocks is positive and significant at a 3.8 percent significance level. The positive coefficient indicates that destination countries that experience larger declines in the supply of trade finance exhibit lower export growth rates. In column (2), country fixed effects are added, which affects neither the magnitude nor the significance of the coefficient. This confirms the finding that trade finance supply shocks are not correlated with time-invariant country characteristics as discussed in the previous section. In column (3), several control variables are added to the regression: the growth of U.S. imports from country i in period t, GDP growth and population growth of country i, the change in the USD exchange rate of the local currency, and growth in non-U.S. imports of country i. Again, the estimate of the coefficient of interest γ is practically unchanged.

Columns (4) to (6) show the results for negative and positive shocks separately. Two sets of country-level shocks are computed using either positive or negative bank-level shocks when aggregating shocks up to the country level, respectively. The results indicate that negative and positive shocks have asymmetric effects. Only the point estimate of the negative shock is statistically significant at a 10 percent level. In addition, it is larger than the coefficient of the positive shock.[27] This is in line with what one might expect and confirms findings in Amiti and Weinstein (2011). Because a reduction in the supply of LCs typically requires cutting them for existing customers whereas additional supply is more fungible, negative shocks should have a stronger effect.

Columns (7) and (8) report the results for the crisis and the non-crisis period, respectively. The crisis period goes from the third quarter of 2007 to the second quarter of 2009. The non-crisis period includes all other dates. Even when excluding the crisis period, the effect of supply shocks on export growth is significant at a 10 percent level in column (8) of table 10. This is evidence that the identification of the effect does not rely on the crisis period and that idiosyncratic bank shocks affect exports at all times.

A simple quantification shows that the estimated effect on export growth is large. Based

[27] The estimates are not significantly different from each other, however.

on the coefficient of 0.0572 displayed in column (1) of table 9, a country supply shock of one standard deviation increases export growth by 2 percentage points. This corresponds to about 7 percent of one standard deviation of export growth in the sample. As a reference, figure 7 shows the distribution of export growth rates. We discuss the magnitude of the effect in more detail in section 6.

To explore which banks are responsible for the effect on exports, we compute supply shocks for the five biggest trade finance suppliers and the remaining banks separately and rerun the baseline regression. Table 10 shows the results. Only the coefficient on the shock attributed to the top five banks is significant, now at a 2 percent significance level. Moreover, the R^2 is barely affected when shocks of smaller banks are included (see column (3)). This suggests that, in particular, the top players in the business affect export growth.

5.2 Heterogeneous effects across export destinations

In this section, we test whether the effect of supply shocks on exports is heterogeneous across destinations. To start with, we include an interaction term between the shock and country risk in the baseline regression, employing a measure of country risk from the Economist Intelligence Unit. This measure is available from 2000 onward and is a composite index of sovereign, exchange rate and banking risk in a country. Column (1) of table 11 shows the results. The interaction term is positive and significant at a 5 percent significance level. This indicates that exports to destinations with higher risk are more affected by LC supply shocks. Column (2) tests for a non-linear relationship between the magnitude of the effect and risk by including an additional interaction between the shock and risk squared. The coefficients of both interactions are significant at a 10 percent significance level. Figure 8 plots the effect of supply shocks based on these estimates. The graph shows that the relationship between the size of the effect and risk is u-shaped. The effect is particularly strong for high-risk countries: the shock coefficient exceeds the value of 0.1 for countries with risk levels above 60, which corresponds to the risk rating of Nicaragua in 2012, for example. Hence, the effect is twice as large for high-risk countries than what the coefficient in column (1) of table 9 suggests. Heterogeneity in the effect across countries is quantitatively important.

The effect of supply shocks on export growth also varies considerably across export destinations of different sizes. The regression that underlies column (3) of table 11 includes an interaction term between the shock and the one-quarter lagged number of banks that have positive trade finance claims in a given market. The negative and significant coefficient on the interaction term indicates that the shock has a smaller effect on export growth in countries in which a larger number of U.S. banks are active. In column (4), the size of the export market is measured by the log of the average U.S. exports to a destination country from 1997 to 2012. As before, this variable is interacted with the shock. As expected, the coefficient of the interaction term is negative, confirming that shocks have larger effects on export growth in smaller markets. The point estimates range from roughly 0.03 for the biggest export market to slightly above 0.2 for the smallest market. The same qualitative results hold when market size is proxied by the log of nominal GDP instead.

To further explore the role of market size, we split the sample in two. The regression in column (5) of table 11 includes only countries with below mean values of log average U.S. exports. Column (6) includes all countries for which log average U.S. exports are above the sample mean. The effect of trade finance supply shocks on export growth is significant only for smaller markets. Moreover, the point estimate is much larger, taking a value of 0.127. Hence, the coefficient more than doubles as large destination markets are excluded. At the same time, the coefficient on the shock is insignificant and essentially zero when only large countries are included. These results clearly indicate that exports to small countries with high levels of risk are particularly affected if banks contract their supply of LCs.

This is easy to rationalize. Only a few U.S. banks issue and confirm LCs in small and high-risk destinations. If one of the banks active in those markets reduces its supply, it is especially difficult for trading partners to find an alternative. Moreover, selling to small and high-risk destinations without LCs might not be profitable for the exporter: trade insurance is more likely to be unavailable or very costly, and the firm's implicit cost of conducting the transaction without a guarantee may be high. Effects may also be increasing in risk because LCs are used more intensively in high-risk countries in general.[28]

5.3 Stronger effects in LC-intensive industries

Not all industries use LCs to the same extent found by Del Prete and Federico (2012), for example. While we do not observe trade finance claims by industry in the FFIEC 009 data, we have information on LC use by industry from Turkish customs data in which importers have to report payment methods.[29] Table 12 shows, by industry, the average share of U.S. exports to Turkey that are settled based on LCs. This instrument is used most in Metals and Mineral Products and is used least in exports of Chemicals, Stone and Glass. To test whether the effect of trade finance shocks is related to the LC intensity of an industry, we run the following regression, using the LC intensity of U.S. exports to Turkey as a measure of the LC intensity of an industry overall:

$$\Delta X_{ikt} = \gamma_1 \text{ shock}_{it} + \gamma_2 \text{ shock}_{it} \times \text{LC intensity}_{kt} + \delta_t + \delta_i + \delta_k + \eta_{it}, \tag{5}$$

where ΔX_{ikt} represents the growth of U.S. exports in industry k to country i in quarter t. The coefficient γ_2 indicates whether the effect of trade finance supply shocks varies with the LC intensity of an industry. Quarterly industry-level trade data are from the Census Bureau, available from 2002 onward. As before, offshore centers are dropped and observations in the first and the 99th percentile of the export growth rate distribution are excluded from the sample.

Column (1) of table 13 presents the results. Standard errors are clustered at the country-industry level. While the shock coefficient is positive and significant, the interaction term between the LC intensity of an industry and the shock is insignificant. This changes, however,

[28] An alternative explanation is that banks may not cut trade finance symmetrically across export destinations. We do not find any evidence, however, that this is indeed the case. When we estimate equation 4 including interaction terms between country variables and the estimated bank shocks, the coefficients on the interaction terms are always insignificant.

[29] These data were first used in Demir et al. (2013). Banu Demir kindly provided the data.

as we take heterogeneity in the effect of shocks across countries with different sizes into account. From the discussion in the previous section, we know that a country-level supply shock of the same size has a larger effect on smaller export markets. Column (2) of table 13 reports the results when destinations with large aggregate exports are excluded.[30] Then, γ_2 is highly significant and positive, which implies that the effect of trade finance supply shocks on industry-level exports is larger the more intensively LCs are used in an industry. When the regression is run on a sample that includes only larger export markets (see column (3)), the interaction term is insignificant.

In column (4), we include in the regression a triple interaction between the shock, LC intensity and the average exports to a country together with all corresponding double interaction terms. This essentially allows the effect of the shock to vary with an industry's LC intensity and the size of a country. The triple interaction, as well as the interaction between LC intensity and the shock, is now significant at a 4 percent significance level, confirming the results obtained from splitting the sample. Figure 9 illustrates the estimated relationship between the effect of a shock and LC intensity evaluated at the mean log of average country-level exports. The higher the share of exports in an industry that relies on LCs, the larger the effect. These results provide strong support that finance affects exports through the risk channel.

5.4 Identification and Robustness

In this section, we present several robustness checks. First, we address the concern that the constructed country-level shocks might not be entirely purged of demand effects. To that end, we provide different pieces of evidence that banks do not specialize in certain industries. Second, we show that the results are robust to lagging banks' market shares by an alternative number of periods when constructing the country-level supply shocks. Combined with our previous observation that the estimated bank-level shocks are serially uncorrelated, this practically eliminates any concern that there could be an endogeneity problem due to sorting of banks into markets.

The skeptical reader may be concerned that, despite our methodology, the estimated supply shocks could be endogenous to demand effects. There is one case under which bank shocks could pick up demand effects. If banks were fully specialized in one particular industry and there was a shock to demand or production in this industry, then the estimated bank shock could reflect industry effects. Under full specialization, dropping country i information from the sample would not be sufficient to eliminate demand effects because shocks to the trade finance claims of bank b in other countries would be driven by the same industry effects.

To see this, consider the following example. Assume that there are two banks. Bank A specializes in confirming LCs for machinery, and bank B provides guarantees for exports of textiles. Suppose there is a shock to the supply of or the global demand for machinery so that exports in that industry increase. Then bank A faces a higher demand for trade finance and its trade finance claims increase. Because bank A sees an increase in the demand for

[30] We split the sample according to the mean of the log of average exports to country i.

LCs but not bank B, the estimation strategy could fail to filter out the demand effect. The increase in the demand for trade finance could then show up as a positive shock to bank A's supply of trade finance. When exports of machinery increase to all destination countries, bank shocks identified without the inclusion of bank A's trade finance claims in country i would still be correlated with exports to country i.

We address this issue in several different ways. First, it is difficult to imagine how specialization could generate the result that supply shocks affect mostly exports to small and risky destinations. Second, we have shown that the estimated bank shocks are correlated with relevant bank-level variables such as loan growth and banks' credit default swap spreads. Third, it is very unlikely that banks specialize in industries or that exports of single firms could drive changes in the trade finance claims of single banks and aggregate export growth rates at the same time. There are essentially five banks that provide trade finance, while there are many more firms and industries. So the mere fact that the provision of guarantees is concentrated in a few large banks makes specialization improbable. Also, the largest firms are less likely to rely on LCs. As Antràs and Foley (2011) show for one large U.S. exporter, large firms do not use LCs very much. Larger firms have longer lasting relationships and are better able to cope with risks, since they are big and can diversify within the firm. Moreover, a substantial amount of their trade is intra-firm so that there is less need for bank guarantees. Finally, banks diversify risks and, hence, should seek to spread trade financing over different industries and firms.

While we do not observe which bank clients obtain trade financing, we can test for specialization directly. Specialization would imply that a bank's share in the total trade finance claims of country i is correlated with the country-level export share of the industry in which the bank specializes. To check for evidence of specialization, we regress a particular bank's trade finance shares that vary across countries and over time on the export shares of different industries, which also vary across countries and over time. We split industries into fourteen groups according to the classification used previously. The regression equation reads as follows:

$$\phi_{it}^{b} = \sum_{k=1}^{K-1} \delta_k \text{ industry share}_{it}^{k} + \epsilon_t + \epsilon_i + \psi_{ikt}, \tag{6}$$

where $\phi_{it}^{b} = \frac{tf_{ibt}}{\sum_{b}^{B} tf_{ibt}}$ and $industry\ share_{it}^{k} = \frac{X_{ikt}}{\sum_{k}^{K} X_{ikt}}$. X_{ikt} stands for the exports in industry k to country i at time t. This regression is estimated for each of the top five banks because we have shown that these firms are mainly responsible for the identified effect of supply shocks. Table 14 shows that the trade finance shares of these banks do not co-vary with the export shares of any particular industry. We also regressed the log of the trade finance claims of a particular bank on the log of exports in different industries. Each bank's trade finance claims are correlated with exports in more than one industry. At the same time, exports of the same industry explain the variation in the trade finance claims of multiple banks. There is no indication that banks specialize and serve only a single industry or large firm.[31]

[31] We also check that results are not driven by a single one of the top five banks, always excluding the bank-level shocks of the respective bank when computing the country-level shocks.

As an additional robustness check, we exclude a larger set of countries when estimating equation 1. To further account for the possibility that demand effects could drive results, we drop not only information on country i but also on the entire region in which country i is located to obtain the bank-level shocks α_{ibt} that are used to compute the aggregate supply shock of country i. We split countries into eight regions: East Asia and Pacific, Europe and Central Asia, High-income OECD members, High-income non-OECD members, Latin America and the Caribbean, the Middle East and North Africa, South Asia, and Sub-Saharan Africa. The results are essentially unchanged, as table 15 shows. The standard errors of the coefficients increase slightly but the results are qualitatively the same.

Finally, we consider whether our results still hold if we do not estimate equation 1 but use a bank's average country-level growth in trade finance claims or the growth of a bank's total trade finance claims in place of the bank-level shocks. If specialization drove the results, then the observed growth in bank b's trade finance claims would correspond to industry-level export growth. Similarly, the share of bank b in a country's trade finance claims would reflect the share of exports of the industry in which the firm specializes in total exports that go to that country. Consequently, if there were specialization, the placebo country-level shocks that we construct based on the observed trade finance growth rates would be correlated with export growth. Table 16 shows the results of this exercise. In columns (1) and (2), country-level shocks are calculated using the average growth rate of bank b's trade finance claims in quarter t. In columns (3) and (4), banks' trade finance claims are summed over all countries before computing the trade finance growth of bank b in quarter t. In none of the columns is the effect of these alternative shock variables significant. This does not change when we take heterogeneity in the effect into account by adding an interaction term between log average exports to a destination country and the shock variable. This is strong evidence against the hypothesis that the shocks in our baseline regression incorporate demand effects to generate the presented findings. Instead, it shows that we need to filter out demand effects to uncover any relationship between trade finance and export growth.

The previous discussion addresses concerns that the idiosyncratic bank shocks we obtain could be endogenous to export growth. Any remaining endogeneity between country-level shocks and export growth rates must thus come through banks' market shares. The identification assumption would be violated if banks with positive shocks in period t were to provide more trade finance in period $t-2$ to markets with positive deviations from trend export growth in period t.

In columns (1) and (2) of table 17, banks' market shares are lagged by one or three quarters, respectively, when computing the country shocks Δtf_{ct}, in contrast to the two-quarter lags used in the baseline specification. The effect of supply shocks on export growth remains significant at a 5 percent level throughout. Given these results, our identification strategy could be violated only if banks that anticipate growing in period t sort, in period $t-1$, $t-2$ and $t-3$, into markets with higher deviations from trend export growth in period t. We have shown in section 4.3 that the estimated bank-level shocks are serially uncorrelated. That is, past bank supply shocks have no predictive power for supply shocks today. The fact that all three lags work is therefore inconsistent with systematic sorting of banks period by period.

6 Quantifying the Effect of Supply Shocks

To explore, in greater detail, the magnitude of the effect of supply shocks on exports, we conduct the following experiment. We assume that a major trade finance provider experiences a negative supply shock that corresponds to the 10th percentile of the bank shock distribution (a value of -0.53). Using this bank's market share in each destination country in the fourth quarter of 2011 and export values in the first and second quarters of 2012, the predicted aggregate effect on export growth is calculated as follows:

$$\Delta X_t = \frac{\sum_{c=1}^{N} \left(\gamma(-0.53)\phi_{cbt-2}X_{ct-1}\right)}{X_{t-1}}. \tag{7}$$

We set γ equal to 0.0572, which corresponds to the estimated coefficient in column (2) of table 9. The calculations predict that such a trade finance supply shock would reduce aggregate U.S. export growth by around 0.9 percentage point. This shows that a reduction in the supply of trade finance by one large bank in the U.S. would have a significant effect on exports.

It does matter which bank is subject to the shock. In a next step, we choose two large trade finance suppliers and calculate the effect on export growth in selected regions of the world when each of them is hit by the shock described above. The upper panel of table 18 shows the results. Whereas exports in South Asia would fall by 0.9 percentage point if bank A were hit by the shock (see column (1)), the same relative reduction in trade finance by bank B would reduce exports in this region by 0.3 percentage point (see column (3)). An even stronger asymmetry arises for Sub-Saharan Africa. If bank B reduced its supply of LCs, exports to this region would decline by more than 2 percentage points. U.S. exports to East Asia and the Pacific would be affected more evenly. This example illustrates that banks, through their global operations, affect export patterns. The same bank shock affects countries differentially, depending on how important the bank is for the provision of LCs in each export market.

Smaller export markets are more affected than larger markets when there is a reduction in the supply of trade finance according to the results presented in section 5.2. To account for this, we recalculate the effect of supply shocks based on the estimated relationship in column (4) of table 11. As can be seen from columns (2) and (4) of table 18, the effect on export growth is slightly lower in most regions when heterogeneity across countries is taken into account. However, the effect of a reduction in trade finance by bank B is predicted to be larger for exports to Europe and Central Asia as well as to Sub-Saharan Africa under the alternative formula.

So far, the different experiments consider what happens when only one of the banks reduces its supply of trade finance. Next, we analyze the effect on exports if all banks were hit by a moderate shock that corresponds to the 25th percentile of the bank-level shock distribution (a value of $\alpha_{bt} = -0.16$) and roughly to a third of the shock considered before. Using the estimated loan growth coefficient in column (4) of table 9, aggregate U.S. exports would fall by around 0.9 percentage point.

In the lower panel of table 18 countries are grouped according the their EIU risk levels. Column (1) shows how effects would be distributed across groups of countries when we assume a uniform effect of supply shocks. Column (2) takes into account the finding that exports to countries with higher levels of risk would be more affected. Based on the estimated coefficients in column (1) of table 11, exports to the group of countries with a moderate risk level, among them China, would decline by around 0.65 percentage point. In contrast, exports to the group of countries with elevated risk (Vietnam, for example, is in this group) would drop by 1.5 percentage points. These quantifications suggest that reductions in the supply of trade finance can reduce export growth to a substantial degree, especially in high-risk countries.

As a final exercise, we compare the effect of an LC supply shock to the effect of an exchange rate shock. According to the estimated coefficient in column (3) of table 11, a 10-percent appreciation of the USD against the local currency of the importing country reduces U.S. exports by 1.87 percentage points. Hence, the effect of a negative LC supply shock of one standard deviation generates the same reduction in trade as an appreciation of the USD by 10.7 percent. This shows that LC supply shocks have an economically significant effect on export growth compared to another major factor.

7 Evidence on the Role of Trade Finance in the Great Trade Collapse

There is an ongoing debate concerning the extent to which trade finance contributed to the Great Trade Collapse in 2008/2009. While our estimation strategy does not allow us to identify aggregate supply shocks, the evidence presented in this paper suggests that trade finance played a magnifying role. First, we find that shocks to the supply of LCs have a causal effect on exports at all times. Second, effects can be large. Single banks are large enough to affect aggregate outcomes so that shocks to individual banks can significantly harm exports. Third, the idiosyncratic bank shocks we obtain are correlated with bank-level variables, in particular with loan growth and banks' credit default swap spreads. Balance sheets deteriorated and CDS spreads widened during the crisis.[32] Together, these findings strongly suggest that trade finance, through the risk channel, was a contributor to the trade collapse in 2008/2009.

Several works do not find a role for trade-specific financial instruments in the 2008/2009 crisis (e.g., Del Prete and Federico (2012) and Rhee and Song (2013)) or they find that shocks to the supply of loans do not have differential effects across export destinations (see Paravisini et al. (2011)). As documented in this paper, the effect of LC supply shocks is heterogeneous across countries. Studies that do not take this heterogeneity into account may have a hard time finding any effect. At the same time, the risk channel has to be distinguished from the working capital channel. A reduction in the supply of credit, which is fungible, has a different effect than a reduction in the supply of LCs, which are tied to specific

[32] Moreover, in addition to the effects on exports through the LC channel, there may have been additional effects through a reduction in the supply of working capital loans.

export transactions. Moreover, firms will be differentially affected by the risk channel since they rely to varying degrees on LCs, depending on the duration of their trade relationships, their size, and the industry they belong to.

A number of researchers argue that demand effects explain most of the Great Trade Collapse (e.g., Eaton et al. (2011), Bems et al. (2010)). As we have shown, the risk channel is most relevant for industries in which LCs are used intensively and for risky and small destinations. Hence, demand effects may explain most of the drop in exports and imports in large, developed countries. However, the results in this paper suggest that trade finance can explain a sizable drop in trade in industries that rely heavily on LCs and in countries that are risky and small. Therefore, through the LC channel, the crisis may have spilled over to exports and imports to and from countries that were not directly affected by the financial crisis.

8 Conclusions

Exploiting data on the trade finance claims of U.S. banks that vary across countries and over time, this paper sheds new light on the effects of financial shocks on trade. While existing studies emphasize the working capital channel, this work highlights the risk channel. We show that shocks to the supply of LCs, a trade-specific risk-reducing financial instrument, have statistically and economically significant effects on exports. Unlike previous papers, our paper finds that the effect of trade finance supply shocks is heterogeneous across destinations and industries. Exports to countries that are riskier and smaller and exports in industries that rely more on bank guarantees are more affected. At the same time, the same bank-level shock has an asymmetric effect on trade across destination countries because banks specialize in providing LCs to certain markets. These findings imply that banks have an impact on trade patterns and transmit shocks across borders.

As the quantifications show, the effect of supply shocks on aggregate U.S. exports can be large. Because the trade finance business is highly concentrated in a few big banks, a large negative shock to a single bank can reduce exports by up to 1 percentage point. This, together with the fact that reductions in the supply of LCs are associated with a contraction in bank lending and a rise in banks' credit default swap spreads, suggests that trade finance has a role in explaining the Great Trade Collapse, in particular with regard to trade with small and risky countries.

References

Ahn, JaeBin, "A Theory of Domestic and International Trade Finance," 2010. Columbia University, mimeo.

_ , "Estimating the Direct Impact of Bank Liquidity Shocks on the Real Economy: Evidence from Letter-of-Credit Import Transactions in Colombia," 2013. mimeo.

_ **, Mary Amiti, and David Weinstein**, "Trade Finance and the Great Trade Collapse," *American Economic Review*, 2011, *101* (3), 298–302.

Amiti, Mary and David E. Weinstein, "Exports and Financial Shocks," *The Quarterly Journal of Economics*, 2011, *126* (4), 1841–1877.

_ **and** _ , "How Much do Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Loan Data," Working Paper 18890, National Bureau of Economic Research March 2013.

Antràs, Pol and C. Fritz Foley, "Poultry in Motion: A Study of International Trade Finance Practices," NBER Working Papers 17091, National Bureau of Economic Research, Inc May 2011.

Ashcraft, Adam B., "Are Banks Really Special? New Evidence from the FDIC-Induced Failure of Healthy Banks," *The American Economic Review*, 2005, *95* (5), 1712–1730.

Asmundson, Irena, Thomas William Dorsey, Armine Khachatryan, Ioana Niculcea, and Mika Saito, "Trade and trade finance in the 2008-09 financial crisis," IMF Working Papers 11/16 2011.

Beck, Thorsten, "Financial Dependence and International Trade," *Review of International Economics*, May 2003, *11* (2), 296–316.

Bems, Rudolfs, Robert Christopher Johnson, and Kei-Mu Yi, "Demand Spillovers and the Collapse of Trade in the Global Recession," *IMF Economic Review*, 2010, *58* (2), 295–326.

Bruno, Valentina and Hyun Song Shin, "Capital flows, cross-border banking and global liquidity," NBER Working Papers 19038, National Bureau of Economic Research 2013.

Cetorelli, Nicola and Linda S. Goldberg, "Banking Globalization and Monetary Transmission," *The Journal of Finance*, 2012, *67* (5), 1811–1843.

Chodorow-Reich, Gabriel, "The Employment Effects of Credit Market Disruptions: Firm-level Evidence from the 2008-09 Financial Crisis," *The Quarterly Journal of Economics*, 2014, *129* (1), 1–59.

Cornett, Marcia Millon, Jamie John McNutt, Philip E. Strahan, and Hassan Tehranian, "Liquidity risk management and credit supply in the financial crisis," *Journal of Financial Economics*, August 2011, *101* (2), 297–312.

Del Prete, Silvia and Stefano Federico, "Trade and finance: is there more than just trade finance? Evidence from matched bank-firm data," 2012. Bank of Italy, mimeo.

Demir, Banu, Tomasz Michalski, and Evren Ors, "Risk-Based Capital Requirements for Banks and International Trade: Evidence from Basel 2 Implementation in Turkey," August 2013. Bilkent University, mimeo.

Eaton, Jonathan, Samuel Kortum, Brent Neiman, and John Romalis, "Trade and the Global Recession," NBER Working Papers 16666, National Bureau of Economic Research, Inc January 2011.

Gabaix, Xavier, "The Granular Origins of Aggregate Fluctuations," *Econometrica*, 05 2011, *79* (3), 733–772.

Greenstone, Michael and Alexandre Mas, "Do Credit Market Shocks affect the Real Economy? Quasi-Experimental Evidence from the Great Recession and Normal Economic Times," 2012. mimeo.

Hale, Galina, Christopher Candelaria, Julian Caballero, and Sergey Borisov, "Bank Linkages and International Trade," Technical Report, Federal Reserve Bank of San Francisco 2013.

Hoefele, Andreas, Tim Schmidt-Eisenlohr, and Zhihong Yu, "Payment Choice in International Trade: Theory and Evidence from Cross-country Firm Level Data," CESifo Working Paper Series 4350, CESifo Group Munich 2013.

ICC, "Global Risks - Trade Finance Report 2013," Technical Report, International Chamber of Commerce April 2013.

IFC, "Global Trade Finance Program Brochure," Technical Report, International Finance Corporation January 2012.

Jimenez, Gabriel, Steven Ongena, Jose-Luis Peydro, and Jesus Saurina, "Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications," *American Economic Review*, August 2012, *102* (5), 2301–26.

Kalemli-Ozcan, Sebnem, Elias Papaioannou, and Fabrizio Perri, "Global Banks and Crisis Transmission," CEPR Discussion Papers 9044, C.E.P.R. Discussion Papers 2012.

Khwaja, Asim Ijaz and Atif Rehman Mian, "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market," *American Economic Review*, 2008, *98* (4), 1413–42.

Levchenko, Andrei A., Logan T. Lewis, and Linda L. Tesar, "The Collapse of International Trade during the 2008-09 Crisis: In Search of the Smoking Gun," *IMF Economic Review*, December 2010, *58* (2), 214–253.

Manova, Kalina, "Credit constraints, heterogeneous firms, and international trade," *The Review of Economic Studies*, 2013, *80* (2), 711–744.

Mian, Atif and Amir Sufi, "Household Leverage and the Recession of 2007–09," *IMF Economic Review*, 2010, *58* (1), 74–117.

Niepmann, Friederike and Tim Schmidt-Eisenlohr, "Banks in International Trade Finance: Evidence from the U.S.," Staff Reports 633, Federal Reserve Bank of New York 2013.

Ongena, Steven, José-Luis Peydró, Neeltje Van Horen, and De Nederlandsche Bank, "Shocks abroad, pain at home?," 2013. mimeo.

Paravisini, Daniel, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon, "Dissecting the Effect of Credit Supply on Trade: Evidence from Matched Credit-Export Data," Working Paper 16975, National Bureau of Economic Research April 2011.

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

Rhee, Changyong and E. Young Song, "Trade Finance and Trade Collapse during the Global Financial Crisis: Evidence from the Republic of Korea," Februart 2013. Mimeo.

Rosengren, Eric S. and Joe Peek, "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States," *American Economic Review*, March 2000, *90* (1), 30–45.

Santos, Joao A. C., "Bank Corporate Loan Pricing Following the Subprime Crisis," *Review of Financial Studies*, 2011, *24* (6), 1916–1943.

Schmidt-Eisenlohr, Tim, "Towards a theory of trade finance," *Journal of International Economics*, 2013, *91* (1), 96 – 112.

Sharpe, Steven A., "Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships," *The Journal of Finance*, 1990, *45* (4), 1069–1087.

van der Veer, Koen, "The Private Credit Insurance Effect on Trade," *Journal of Risk and Insurance*, forthcoming.

Williamson, Stephen D., "Costly monitoring, loan contracts, and equilibrium credit rationing," *Quarterly Journal of Economics*, 1987, *102* (1), 135–145.

Data Appendix

Data sources

- Quarterly trade data by country: IMF Direction of Trade Statistics.
- Quarterly industry-level trade data: Census Bureau.
- Balance sheet data is from the FFIEC031 or the Y9c reports. Where available, FFIEC031 information was aggregated up for each Bank Holding Company to match the FFIEC009 reporting level.
- Quarterly GDP was obtained from national statistical agencies via Haver Analytics' Data Link Express (DLX) Software.
- Annual population: World Development Indicators.
- EIU country risk: Quarterly index that combines banking, sovereign and currency risk, provided by the Economist Intelligence Unit, downloaded from Thomson Reuters Datastream.
- Exchange rates: International Financial Statistics, IMF.
- Letter of credit intensities by industry from Turkish customs data was provided by Banu Demir, Bilkent University.
- Quarterly credit default swap spreads on senior unsecured debt with maturity 6 months in USD: Markit.com. Matching between ticker names and IDRSSDs was done manually. Quarterly data was obtained by averaging the monthly data.

List of countries

- Countries designated as offshore financial centers: Netherlands Antilles, Antigua and Barbados, Azerbaijan, Bahrain, Bahamas, Belize, Bermuda, Barbados, Cayman Islands, Cyprus, Dominica, Grenada, Hong Kong, Ireland, Jordan, Lebanon, Macao, Monaco, Maldives, Malta, Mauritius, Seychelles, Vanuatu, Samoa.

Figure 1: How a letter of credit works

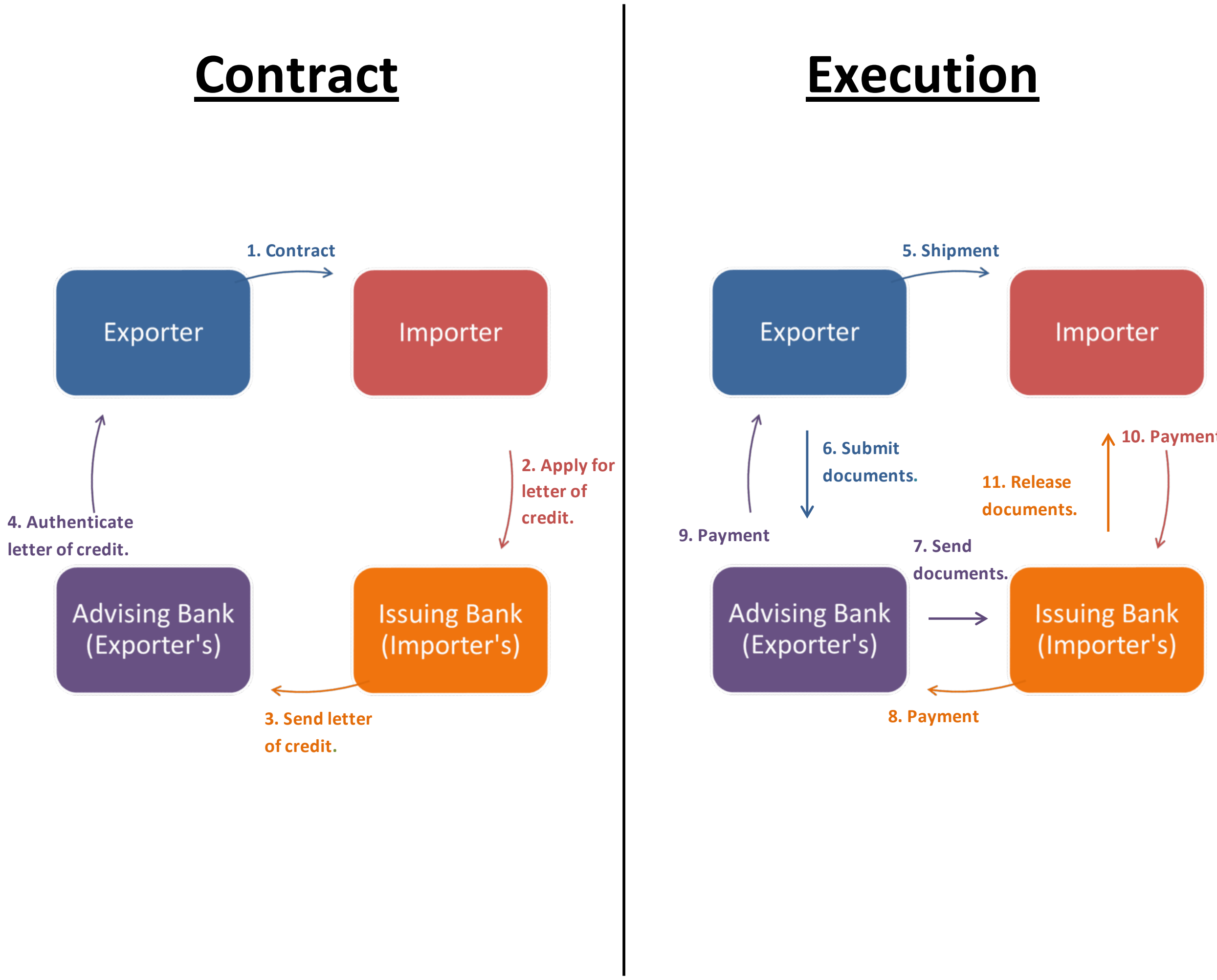
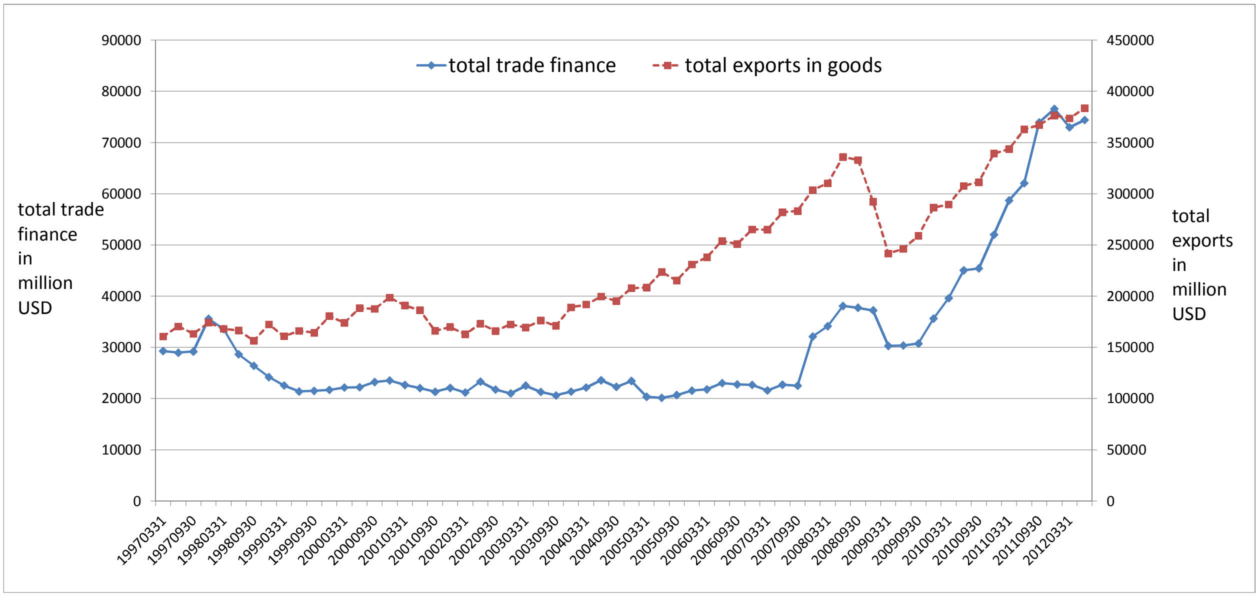


Figure 2: Evolution of aggregate trade finance claims and exports

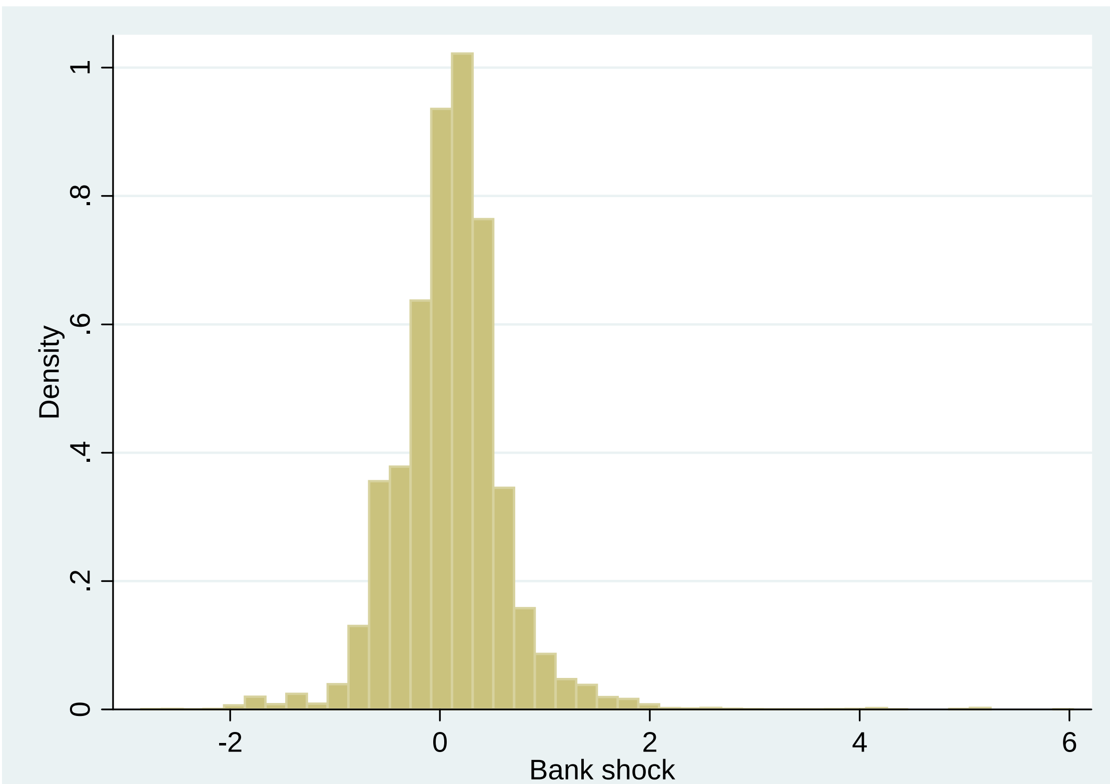


Note: The solid line in the graph shows the aggregate trade finance claims of all reporting U.S. banks over time. The years 1997-2000 exclude data from one large bank that changed its trade finance business fundamentally in the reporting period. The dashed line displays the evolution of aggregate U.S. exports in goods over time.

Figure 3: Heterogeneity in the use of trade finance

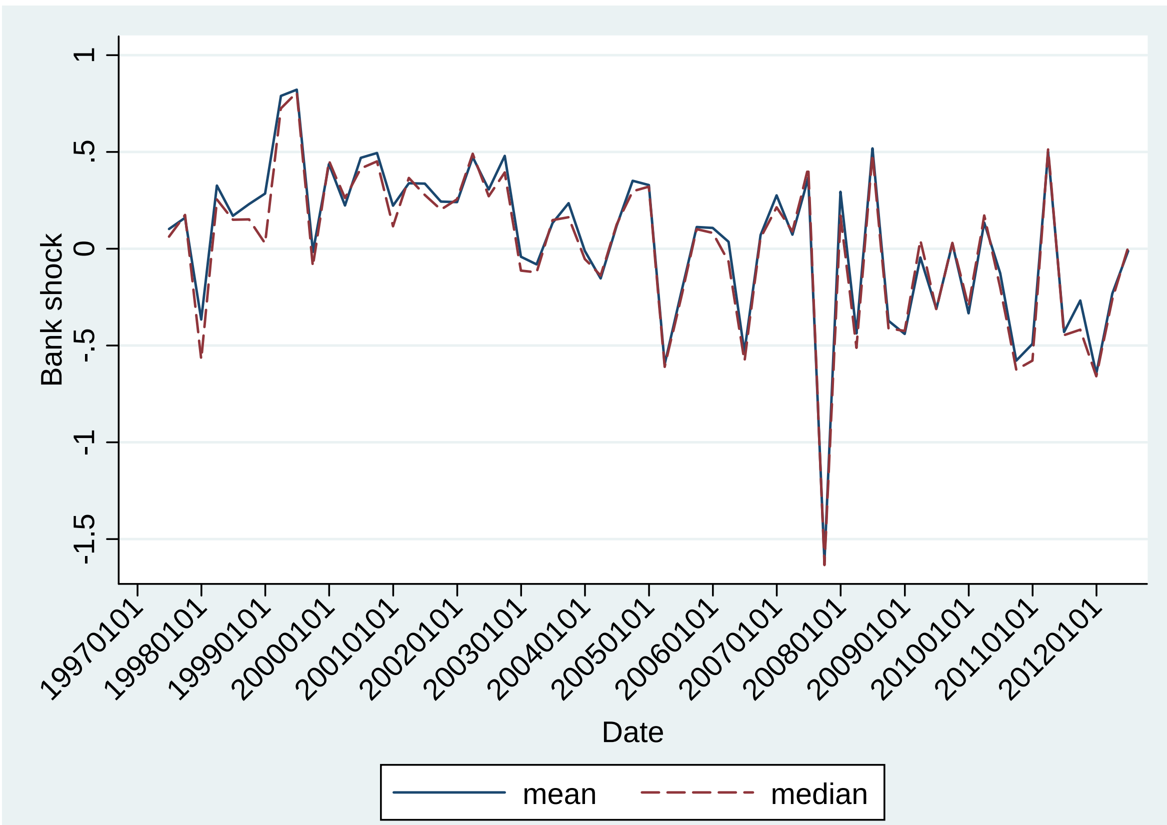
Note: The graph displays the average trade finance intensities of the top 35 countries from 2006 to 2012. A country's trade finance intensity is defined as the ratio of aggregate trade finance claims to total U.S. exports in goods in a quarter. Offshore financial centers are excluded.

Figure 4: Distribution of bank supply shocks



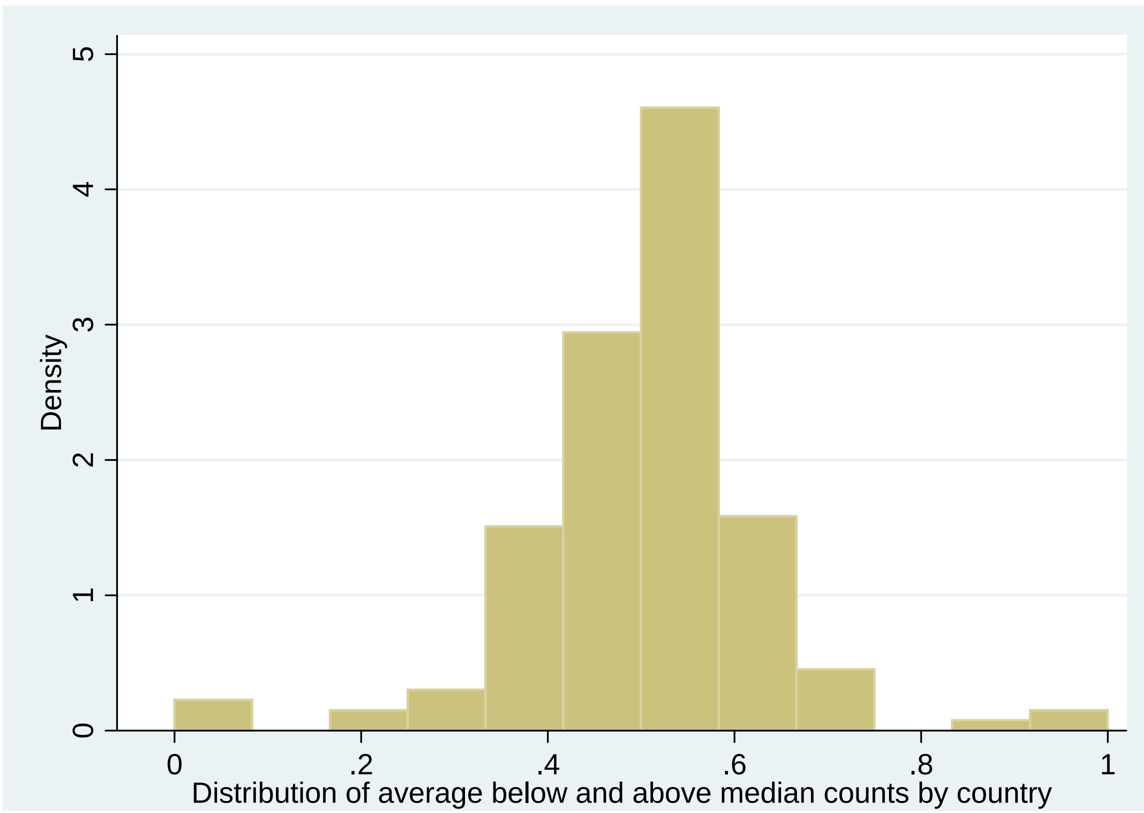
Note: The graph shows the histogram of the estimated bank-level shocks.

Figure 5: Mean and median bank supply shock over time



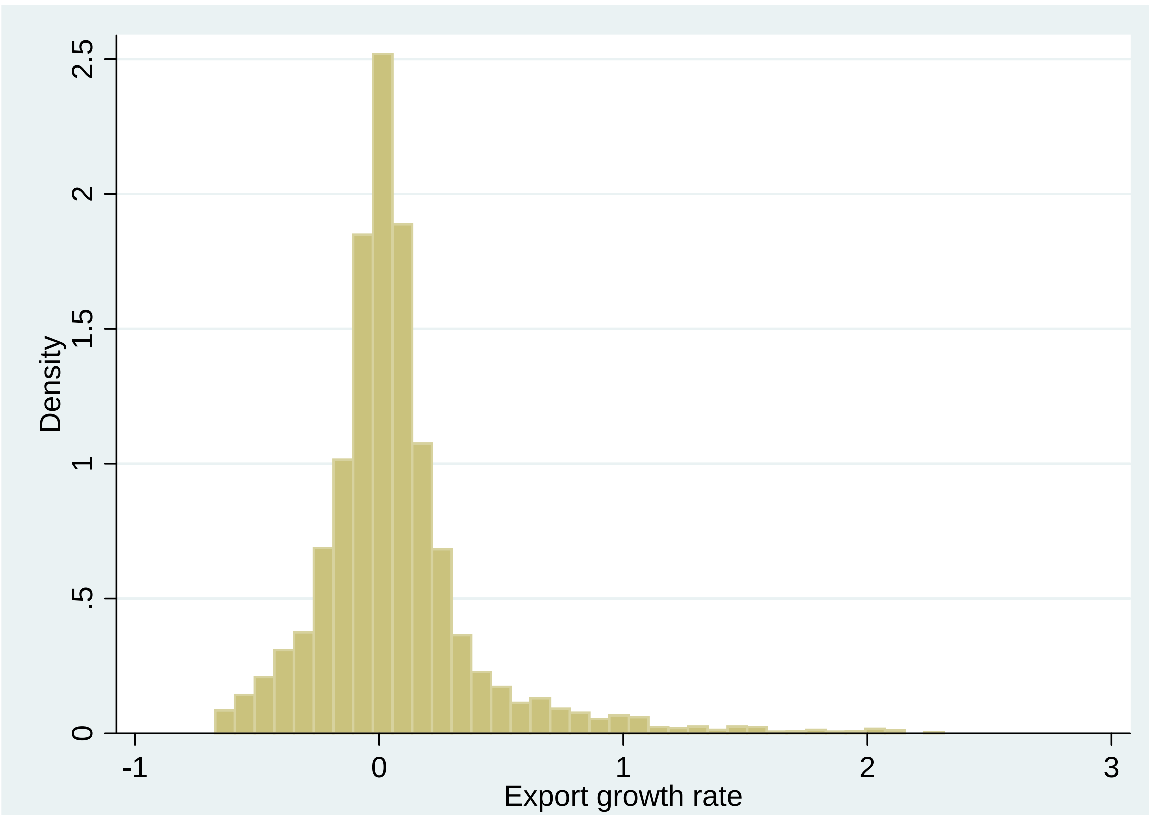
Note: The dotted line in the graph shows the median bank-level supply shock over time. The solid line displays the mean supply shock.

Figure 6: Evidence for random distribution of shocks across countries



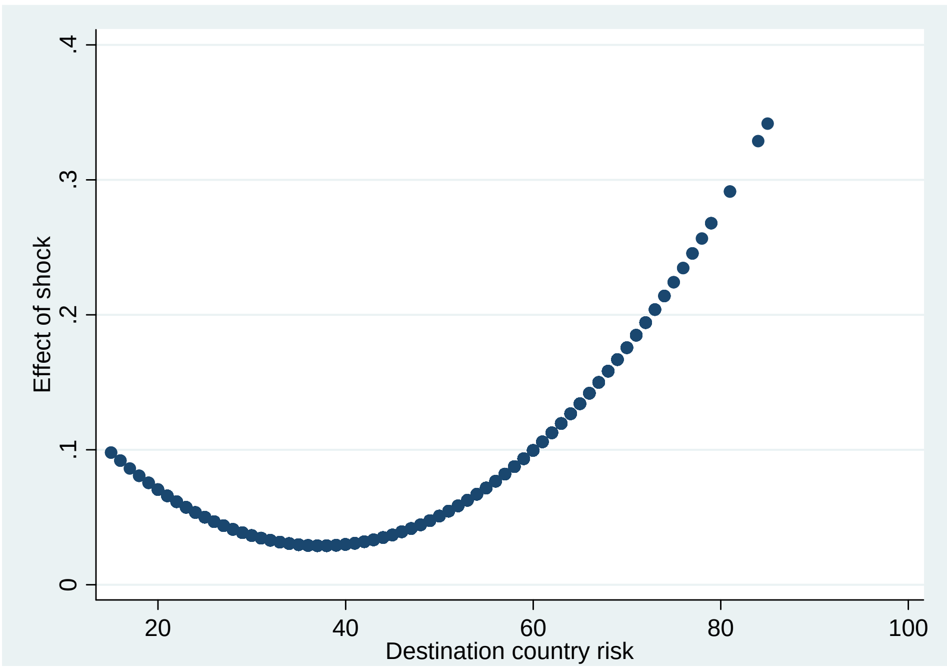
Note: The histogram shows the distribution of country means of a dummy variable that takes value 1 if country i is hit by an above median shock in period t and zero otherwise. If shocks are randomly distributed across countries, then the means should be distributed symmetrically around 0.5.

Figure 7: Distribution of export growth rates



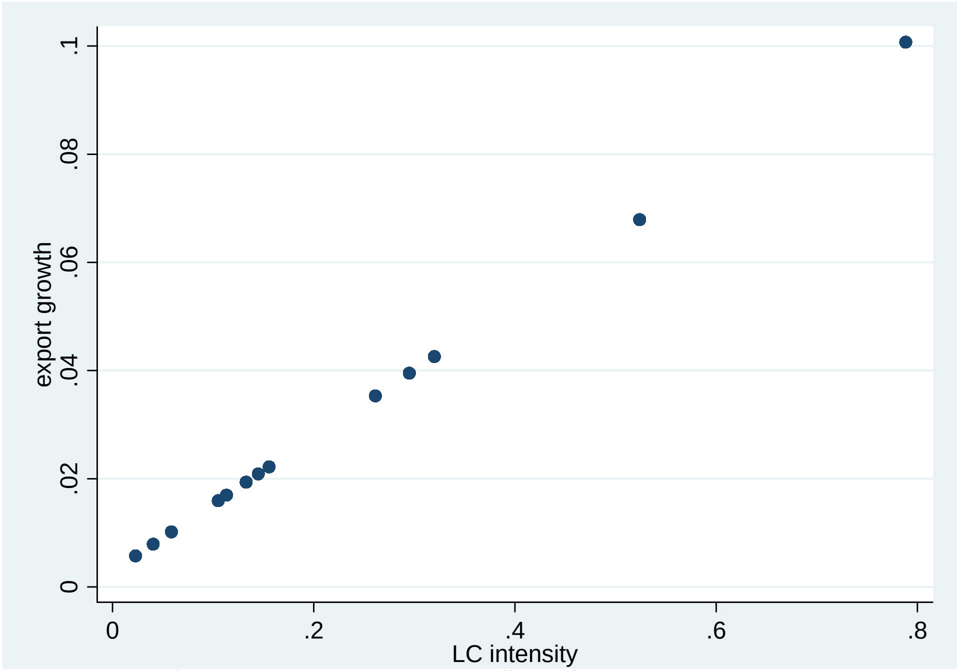
Note: The graph shows the distribution of the quarterly growth rate of U.S. exports by destination country over the sample period from the first quarter in 1997 until the second quarter in 2012.

Figure 8: Heterogeneous effects of shocks across export destinations



Note: The figure shows the estimated effect of a country-level supply shock on U.S. export growth as a function of country risk. Country risk is measured by the EIU country risk index, which is a composite index of banking, sovereign and exchange rate risk.

Figure 9: Heterogeneous effects of shocks across industries



Note: The figure shows the estimated effect of a country-level supply shock on U.S. export growth as a function of an industry's letter-of-credit intensity. LC intensity is measured as the average share of U.S. export to Turkey that are settled based on letters of credit.

Table 1: Different forms of bank trade finance and underlying trade transactions captured in the data

	U.S. exports	U.S. imports	Third party trade
Pre-export financing (parent)	-	✓	X
Pre-import financing (affiliate)	X	-	X
LC issuance (affiliate)	✓	-	X
LC confirmation (parent)	✓	-	X

Note: ✓ indicates that a type of trade transaction is captured in the data. X indicates that a type of trade transaction could be included in the data in principle but is not so in a quantitatively meaningful way.

Table 2: Summary statistics of banks' market shares and the number of trade finance suppliers by country

	date	N	mean	std.	min	max
ϕ_{ibt}	2000 q1	758	0.151	0.250	0.0003	1
	2006 q1	453	0.256	0.314	0.0003	1
	2012 q1	484	0.277	0.324	0.0001	1
n_{it}	2000 q1	115	6.591	6.569	1	34
	2006 q1	116	3.905	2.871	1	14
	2012 q1	134	3.612	2.810	1	13

Note: This table reports summary statistics based on data from the Country Exposure Report (FFIEC 009). ϕ_{ibt} is the share of the trade finance claims of bank b in the total trade finance claims of country i at time t. n_{it} is the number of banks with positive trade finance claims in country i at time t.

Table 3: Persistence in banks' market shares

	(1)	(2)	(3)
ϕ_{ibt-1}	0.913***		0.704***
	(0.00331)		(0.0132)
ϕ_{ibt-2}		0.880***	0.236***
		(0.00399)	(0.0132)
Observations	32,896	29,538	28,196
R-squared	0.836	0.773	0.854

Note: This table analyzes the persistence of the market shares of banks within countries. The dependent variable is the share of the trade finance claims of bank b in the trade finance claims of all banks in country i at time t. All regressions include a constant. Robust standard errors are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 4: Persistence in the number of banks active in a market

	(1)	(2)	(3)
n_{it-1}	0.956***		0.690***
	(0.00440)		(0.0173)
n_{it-2}		0.925***	0.265***
		(0.00547)	(0.0173)
Observations	6,914	6,697	6,587
R-squared	0.947	0.924	0.950

Note: This table analyzes the persistence of the number of banks active in a trade finance market. The dependent variable is the number of banks with positive trade finance claims in country i at time t. All regressions include a constant. Robust standard errors are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 5: Summary statistics of bank- and country-level supply shocks

variable	N	mean	sd	min	max
bank shock α_{ibt}	35,919	0.097	0.522	-2.847	6.038
country-level shock$_{it}$	7,347	0.022	0.375	-1.848	1.702

Note: This table reports summary statistics on the estimated bank and country-level supply shocks. Banks shocks α_{ibt} are estimated excluding information on country i.

Table 6: Correlation of estimated bank shocks with bank-level variables

	(1)	(2)	(3)	(4)	(5)	(6)
deposit growth$_{bt}$	0.366			0.0527	-0.0743	
	(0.294)			(0.190)	(0.249)	
loan growth$_{bt}$		0.472		0.438*	0.608	
		(0.290)		(0.230)	(0.464)	
charge-offs growth$_{bt}$			-6.38e-05***		-6.24e-05***	
			(1.42e-05)		(1.53e-05)	
CDS spread$_{bt}$						-0.0357**
						(0.0159)
Time FE	yes	yes	yes	yes	yes	no
Bank FE	no	no	no	no	no	yes
Observations	1,801	1,801	1,135	1,801	1,135	268
R-squared	0.435	0.439	0.430	0.439	0.440	0.094

Note: This table analyzes the relationship between our estimated bank shocks and bank-level variables. The dependent variable is the mean bank shock $\bar{\alpha}_{bt}$, which corresponds to the value of α_{ibt} averaged over all countries. Charge-offs growth is the growth rate in real estate charge-offs. CDS spread is the bank-specific current default swap spread of bank b at time t. All regressions include a constant. Standard errors are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 7: Predicting observed trade finance growth rates using bank-level shocks

	(1)	(2)	(3)
α_{ibt}	0.350***	0.859***	0.982***
	(0.121)	(0.226)	(0.283)
Country FE	no	yes	no
Time FE	no	yes	no
Time×County FE	no	no	yes
Observations	31,566	31,566	31,566
R-squared	0.000	0.009	0.297

Note: This table analyzes the relationship between the constructed country-level trade finance supply shocks and the observed trade finance claims growth rates of country i at time t. All regressions include a constant. Standard errors are clustered at the bank-time level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 8: Testing whether bank-level supply shocks are serially correlated

	(1)	(2)	(3)
$\bar{\alpha}_{bt-1}$	-0.0204	-0.0246	-0.0206
	(0.0342)	(0.0352)	(0.0403)
$\bar{\alpha}_{bt-2}$		0.0261	0.0274
		(0.0258)	(0.0298)
$\bar{\alpha}_{bt-3}$			0.0441
			(0.0316)
$\bar{\alpha}_{bt-4}$			-0.0355
			(0.0296)
Observations	1,704	1,575	1,369
R-squared	0.458	0.461	0.453

Note: This table tests for serial correlation in the average bank level supply shocks $\bar{\alpha}_{bt}$. The dependent variable is the mean bank shock $\bar{\alpha}_{bt}$, which corresponds to the value of α_{ibt} averaged over all countries. All regressions include a constant and time-fixed effects. Robust standard errors are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 9: Baseline results

				pos. shock	neg. shock	neg. & pos. shock	crisis	no crisis
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
shock_{it}	0.0571**	0.0572**	0.0635**				0.0683	0.0566*
	(0.0267)	(0.0275)	(0.0294)				(0.0574)	(0.0306)
pos shock $_{it}$				0.0456		0.0390		
				(0.0364)		(0.0367)		
neg shock $_{it}$					0.0901*	0.0853*		
					(0.0486)	(0.0489)		
growth in exports to U.S._{it}			0.000483					
			(0.00105)					
pop growth_{it}			-2.333***					
			(0.657)					
GDP growth_{it}			-0.0698					
			(0.0762)					
USD xrate growth_{it}			-0.187**					
			(0.0806)					
growth in non-U.S. imports_{it}			0.337***					
			(0.0508)					
Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes	yes	yes
Observations	5,824	5,824	5,284	5,824	5,824	5,824	768	5,056
R-squared	0.047	0.079	0.094	0.078	0.079	0.079	0.176	0.076

Note: This table reports our baseline results on the causal impact of trade finance supply shocks on U.S. export growth. The dependent variable is the growth rate of U.S. exports to country i at time t. $shock_{it}$ is the constructed country-level trade finance supply shock. Positive and negative shocks are constructed using only positive and negative bank-level shocks, respectively. Column (3) controls for the growth rate in exports to the U.S., population growth, GDP growth, exchange rate growth and growth in imports from third countries. All regressions include a constant. Standard errors are clustered at the country level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 10: Shocks of the top five banks versus shocks of smaller banks

	(1)	(2)	(3)
shock big_{it}	0.0691**		0.0755**
	(0.0302)		(0.0324)
shock $small_{it}$		-0.00748	0.0234
		(0.0307)	(0.0329)
Observations	5,824	5,824	5,824
R-squared	0.079	0.078	0.079

Note: This table analyses the effect of trade finance supply shocks on U.S. export growth for large and small banks separately. The dependent variable is the growth rate of U.S. exports to country i at time t. Column (1) includes country-level trade finance supply shocks constructed only from shocks to the five largest trade finance suppliers. Column (2) includes shocks constructed only from shocks to all but the five largest trade finance suppliers. All regressions include a constant, time- and country-fixed effects. Standard errors are clustered at the country level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 11: Heterogeneous effects on export growth across countries

					small countries	large countries
	(1)	(2)	(3)	(4)	(5)	(6)
shock_{it}	-0.0396	0.222*	0.0829**	0.372**	0.127***	-0.00386
	(0.0562)	(0.131)	(0.0333)	(0.149)	(0.0473)	(0.0184)
$\text{risk}_{it} \times \text{shock}_{it}$	0.00214**	-0.0103*				
	(0.00103)	(0.00619)				
risk_{it}	-0.000804	-0.00293				
	(0.00119)	(0.00528)				
$\text{risk}^2_{it} \times \text{shock}_{it}$		0.000138*				
		(7.08e-05)				
risk^2_{it}		2.26e-05				
		(5.47e-05)				
# $\text{banks}_{it-1} \times \text{shock}_{it}$			-0.00457**			
			(0.00204)			
# banks_{it-1}			-0.000150			
			(0.00111)			
$\log(\text{mean exp}_i) \times \text{shock}_{it}$				-0.0133**		
				(0.00585)		
Observations	3,523	3,523	5,824	5,824	2,679	3,145
R-squared	0.093	0.094	0.080	0.080	0.067	0.152

Note: This table tests for a heterogeneous causal effect of trade finance supply shocks on U.S. export growth across countries. The dependent variable is the growth rate of U.S. exports to country i at time t. $shock_{it}$ is the constructed country-level trade finance supply shock. $risk_{it}$ is the Economist Intelligence Unit country risk measure. # $banks_{it-1}$ is the number of banks active in country i at time $t-1$. $mean\ exp_i$ is the mean of U.S. exports to country i over the sample period. Column (5) only includes observations for countries with below mean values of U.S. exports. Column (6) only includes observations for countries with above mean values of U.S. exports. All regressions include a constant, time- and country-fixed effects. Standard errors are clustered at the country level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 12: LC intensity by industry

Industry	LC intensity
Stone & Glass	0.023
Chemicals & Allied Industries	0.04
Transportation	0.06
Raw Hides, Skins, Leather, & Furs	0.105
Miscellaneous	0.113
Machinery & Electrical	0.133
Wood & Wood Products	0.145
Footwear & Headgear	0.152
Plastics & Rubbers	0.261
Food	0.294
Textiles	0.322
Mineral Products	0.528
Metals	0.787

Note: The table shows the average letter of credit intensity of U.S. exports to Turkey for different industries over the years 2002 to 2011 based on information from Turkish customs data.

Table 13: Testing whether the effect of shocks depends on the LC intensity of an industry

	(1)	small cntry (2)	large cntry (3)	(4)	(5)	(6)
shock_{it}	0.0730**	0.0900	0.0532*	0.00367	0.0400	
	(0.0294)	(0.0567)	(0.0281)	(0.222)	(0.224)	
$\text{shock}_{it} \times \text{LC intensity}_k$	0.0701	0.243**	-0.0143	1.488**	1.366*	1.431**
	(0.0490)	(0.120)	(0.0442)	(0.723)	(0.728)	(0.676)
$\text{shock}_{it} \times \text{LC intensity}_k \times \log(\text{mean exp}_i)$				-0.0593**	-0.0573**	-0.0570**
				(0.0289)	(0.0291)	(0.0270)
$\text{shock}_{it} \times \log(\text{mean exp}_i)$				0.00287	0.00208	
				(0.00880)	(0.00886)	
$\text{LC intensity}_k \times \log(\text{mean exp}_i)$				0.00531	0.00582	0.00584
				(0.00896)	(0.00890)	(0.00934)
Time FE	yes	yes	yes	yes	no	no
Industry FE	yes	yes	yes	yes	yes	no
Country FE	yes	yes	yes	yes	no	no
Country× Time FE	no	no	no	yes	no	yes
Industry×Time FE	no	no	no	no	yes	yes
Observations	52,361	18,261	34,100	52,361	52,361	52,361
R-squared	0.039	0.024	0.040	0.039	0.053	0.130

Note: This table tests for a heterogeneous causal effect of trade finance supply shocks on U.S. export growth across industries. The dependent variable is the growth rate of U.S. exports to country i at time t. $shock_{it}$ is the constructed country-level trade finance supply shock. $LCintensity_k$ is the share of all U.S. exports to Turkey in industry k done with LCs in total U.S. exports to Turkey in industry k in the period 2002 to 2011. $mean\ exp_i$ is the mean of U.S. exports to country i over the sample period. All regressions include a constant. Standard errors are clustered at the country-industry level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 14: Robustness I: Correlation between banks' market shares and industry shares

	Bank A	Bank B	Bank C	Bank D	Bank E
	(1)	(2)	(3)	(4)	(5)
exp $share_{it}^{I1}$	-1.002	-0.957	-1.404	0.219	-0.497
	(0.681)	(1.182)	(0.914)	(0.731)	(1.250)
exp $share_{it}^{I2}$	0.0322	-1.675	-1.168	-0.0223	-0.360
	(0.853)	(1.231)	(1.049)	(0.763)	(1.332)
exp $share_{it}^{I3}$	-2.596	-9.071	-3.414	1.645	-0.214
	(3.413)	(6.348)	(3.436)	(1.152)	(9.665)
exp $share_{it}^{I4}$	-0.563	-1.759	-1.244	0.413	-0.440
	(0.673)	(1.169)	(0.922)	(0.714)	(1.284)
exp $share_{it}^{I5}$	-1.621**	-0.931	-1.114	0.0624	-0.572
	(0.640)	(1.213)	(1.063)	(0.776)	(1.340)
exp $share_{it}^{I6}$	-0.893	-1.284	-0.891	0.415	-0.173
	(0.626)	(1.135)	(0.866)	(0.708)	(1.259)
exp $share_{it}^{I7}$	-0.343	-1.763	-1.402	0.512	-0.0272
	(0.794)	(1.204)	(0.998)	(0.778)	(1.324)
exp $share_{it}^{I8}$	-0.770	-1.253	-1.017	0.234	-0.390
	(0.625)	(1.134)	(0.901)	(0.709)	(1.264)
exp $share_{it}^{I9}$	-1.392	-1.310	-1.246	0.177	-1.338
	(0.925)	(1.210)	(1.083)	(0.670)	(1.458)
exp $share_{it}^{I10}$	-0.990	-2.292	-0.558	1.482	1.887
	(1.322)	(2.312)	(1.974)	(2.511)	(1.818)
exp $share_{it}^{I11}$	-1.185*	-1.094	-1.109	0.554	-0.445
	(0.662)	(1.145)	(0.919)	(0.840)	(1.287)
exp $share_{it}^{I12}$	-0.967	-1.048	-1.271	-0.321	-0.901
	(0.618)	(1.169)	(0.886)	(0.822)	(1.317)
exp $share_{it}^{I13}$	-0.887	-1.349	-1.146	0.244	-0.413
	(0.650)	(1.136)	(0.921)	(0.695)	(1.263)
Observations	2,540	1,938	1,440	4,595	1,475
R-squared	0.664	0.551	0.672	0.716	0.751

Note: This table reports a robustness check that tests for the specialization of banks in industries. The regressions are run separately for each of the top 5 trade finance suppliers, denoted Bank A to Bank E. The dependent variable is the share of a bank in the total trade finance business of country i at time t. The independent variables are the shares of exports in industry I2-I13 in total U.S. exports to country i at time t. Positive and significant coefficients would indicate specialization of banks into industries. All regressions include a constant. Standard errors are clustered at the country level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 15: Robustness II: Excluding regions

	(1)	(2)	(3)	(4)	(5)
shock_{it}	0.0456			-0.0494	0.170
	(0.0280)			(0.0559)	(0.127)
pos shock_{it}		0.0276			
		(0.0379)			
neg shock_{it}		0.0723			
		(0.0492)			
shock big_{it}			0.0661**		
			(0.0334)		
shock small_{it}			0.0119		
			(0.0319)		
$\text{shock}_{it} \times \text{risk}_{it}$				0.00175*	-0.00870
				(0.00101)	(0.00594)
risk_{it}				-0.000793	-0.00298
				(0.00119)	(0.00530)
$\text{shock}_{it} \times \text{risk}^2_{it}$					0.000116*
					(6.78e-05)
risk^2_{it}					2.31e-05
					(5.50e-05)
Observations	5,823	5,823	5,823	3,522	3,522
R-squared	0.080	0.080	0.080	0.094	0.094

Note: This table reports a robustness check where the bank-level trade finance supply shocks are estimated without information from any country in the region of the country of interest i. The dependent variable is the growth rate of U.S. exports to country i at time t. $shock_{it}$ is the constructed country-level trade finance supply shock. Positive and negative shocks are constructed using only positive and negative bank-level shocks, respectively. Shock big are country-level trade finance supply shocks constructed only from shocks to the five largest trade finance suppliers. Shock small are shocks constructed only from shock to all but the five largest trade finance suppliers. Risk is the Economist Intelligence Unit country risk measure. All regressions include a constant. Standard errors are clustered at the country level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 16: Robustness III: Placebo tests

	average tf growth		growth in total tf	
	(1)	(2)	(3)	(4)
shock_{it}	0.0131	0.0602	0.0219	0.235
	(0.00951)	(0.0978)	(0.0209)	(0.207)
$\text{shock}_{it} \times$ log(mean exp_i)		-0.00197		-0.00830
		(0.00384)		(0.00748)
Observations	5,824	5,824	5,824	5,824
R-squared	0.078	0.079	0.078	0.079

Note: This table reports a robustness check where a placebo shock variable is constructed using data on trade finance claims directly. The dependent variable is the growth rate of U.S. exports to country i at time t. $shock_{it}$ is the constructed placebo country-level trade finance supply shock. In columns (1) and (2), the average trade finance growth rate of a bank is used instead of the estimated bank supply shocks to construct the country-level shock. In columns (3) and (4), the growth rate of the total trade finance of a bank is used to construct the country-level shock. $mean\ exp_i$ is the mean of U.S. exports to country i over the sample period. All regressions include a constant. Standard errors are clustered at the country level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 17: Robustness IV: Lagging banks' market shares by an alternative number of quarters

	1q-lag	3q-lag
	(1)	(2)
shock_{it}	0.0509**	0.0598**
	(0.0249)	(0.0275)
Observations	5,824	5,824
R-squared	0.079	0.079

Note: This table reports a robustness check where the shock variable is constructed using different lags of the bank market shares. The dependent variable is the growth rate of U.S. exports to country i at time t. $shock_{it}$ is the constructed country-level trade finance supply shock. In column (1), it is constructed using one quarter lagged bank market shares. In column (2), three quarters lagged bank market shares are used. All regressions include a constant, time- and country-fixed effects. Standard errors are clustered at the country level and are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level.

Table 18: Quantifications

	Shock to Bank A		Shock to Bank B	
	uniform	hetero.	uniform	hetero.
Region	(1)	(2)	(3)	(4)
East Asia and Pacific	-0.279%	-0.059%	-0.376%	-0.323%
Europe and Central Asia	-0.316%	-0.216%	-0.457%	-0.51%
South Asia	-0.883%	-0.452%	-0.328%	-0.293%
Sub-Saharan Africa	-0.283%	-0.202%	-2.15%	-2.32%

	Shock to all banks	
	uniform	hetero.
Risk group	(1)	(2)
Low risk group (e.g. Chile)	-0.91%	-0.233%
Moderate risk group (e.g. China)	-0.867%	-0.649%
Elevated risk group (e.g. Vietnam)	-1.28%	-1.52%
High risk group (e.g. Jamaica)	-0.723%	-1.27%%

Note: The upper panel of the table shows the effect on export growth in different world regions if a large bank in the U.S. were to reduce its supply of trade finance by a value of -0.53, which corresponds to the 10th percentile of the bank-level shock distribution. The lower panel shows the effect on export growth for groups of countries with different risk levels if all U.S. banks were subject to a moderate shock of -0.15. The low risk group includes countries with an EIU risk index below 30. Countries in the group with moderate risk have indices between 30 and 45. The elevated risk group includes countries with an index between 45 and 60. The high risk group collects all countries with a risk measure above 60. All columns with the title "uniform" assume a uniform effect of supply shocks based on the estimated coefficient in column (2) of table 9. The heterogeneous effects calculated for different regions take into account that the effect on exports depends on the value of U.S. exports that go to a country and are based on the coefficients displayed in column (4) of table 11. The heterogeneous effects calculated for different risk groups take into account that exports to countries with different risk levels are affected differentially and are based on the coefficients displayed in column (1) of table 11.