**Mariana Spatareanu, Vlad Manole and Ali Kabiri**

# Exports and bank shocks: evidence from matched firm-bank data

## Article (Accepted version) (Refereed)

**Original citation:**
Spatareanu, Mariana and Manole, Vlad and Kabiri, Ali (2018) *Exports and bank shocks: evidence from matched firm-bank data*. Structural Change and Economic Dynamics. ISSN 0954-349X (In Press)
DOI: 10.1016/j.strueco.2018.06.004

# Exports and Bank Shocks: Evidence from Matched Firm-Bank Data

**Mariana Spatareanu**
Rutgers University
E-mail: marianas@andromeda.rutgers.edu

**Vlad Manole**
Rutgers University
E-mail: vlad.manole@rutgers.edu

**Ali Kabiri**
University of Buckingham
Email: ali.kabiri@buckingham.ac.uk

March 10, 2018

**Abstract:** A growing literature aims to understand the structural change and cyclical factors that contributed to the Great Trade Collapse. This paper adds to the conversation by investigating the impact of bank distress on firms' exports using matched firm-bank data for the UK. We use two novel measures of bank distress: the Basel III net stable funding ratio, as well as the market-based bank credit default swap spreads, which best capture bank default risk, especially during crises. Our detailed database provides the crucial firm-bank relationship information that allows us to directly test for the banking channel effect on the real economy, and to carefully account for various endogeneities and biases in estimation. We also test for the possible contagion of the Sovereign Debt Crisis from the GIIPS economies to the UK. We find that the severe bank distress generated by the recent crises immediately, negatively and significantly affects UK firms' exports, independent of demand shocks. However, not all firms were impacted equally: private firms and firms in industries more dependent on external finance were impacted the most, while publicly owned firms were less affected by their bank's distress.

*Key words:* exports, bank distress, crisis, UK

*JEL classification:* E44, E32, G21, F40.

## Introduction

The recent Global Financial Crisis was accompanied by a large decrease in international trade – in 2009 the 3.5% fall in world GDP was associated with an 11% decrease in exports in developed economies alone (Contessi and de Nicola, 2013) - known in the literature as the Great Trade Collapse. While the severe recession in the US and in most of the Western European economies may highlight the demand channel driving the fall in exports, the severity of the trade decrease relative to GDP points to the decrease in demand being just part of the puzzle. The importance of the financial sector for international trade, and severe distress in the banking sector during the crisis suggest that banks' problems may propagate to firms, and significantly hinder their export performance. How firms are affected as a result of financial crises, and the effects on the level and the nature of trade of restricted access to finance is a fertile area of investigation.

Previous studies suggest that access to external finance is more important for exporters than for firms that serve domestic markets. If exporters need greater access to external finance, they are more vulnerable to distress in the financial sector relative to firms producing for the domestic market. Melitz (2003) highlights the importance of sunk costs for firms that start exporting. Exporters also incur significant search costs to find the correct export markets and higher R&D and marketing costs needed to adjust their products to the specifications of foreign markets. Relative to domestic producers, exporters may also face higher transportation costs and longer shipping times, requiring higher-levels of working capital. In addition, selling in a different country also increases the risks faced by exporters, which leads to higher insurance costs or more liquidity/ cash demands to cover for unexpected events. Chaney (2016) extends the

theoretical model proposed by Melitz (2003) by introducing frictions in the financing of exporters, and finds that the deepening of financial markets allows firms to start exporting, increasing total exports.

A growing literature analyses the Great Trade Collapse identifying both structural changes and cyclical factors that contributed to the large fall in international trade. Our paper builds on and adds to the previous literature by highlighting the connection between the financial sector and international trade. Bems, Johnson and Yi (2013) provide a survey of the literature and conclude that the tradable durable goods sector was most affected during the period and that a significant effect of credit constraints, as well as demand side shocks, produced the collapse in trade. Others such as Constantinescu, Mattoo and Ruta (2015) suggest that structural factors are at work and that trade after the crisis is recovering slowly not only because of slow growth of Gross Domestic Product (GDP), but also because of a structural change in the trade-GDP relationship. They suggest that the explanation may lie in the slowing pace of international vertical specialization rather than increasing protectionism or the changing composition of trade and GDP. Lewis and De Schryder (2015) highlight that although the collapse and recovery in world trade appears, in aggregate to be a temporary shock rather than a structural change, the recovery of UK exports post crisis underperforms the prediction of their global model significantly. These analyses leave the door open for a potential structural break in the UK's ability to export as a result of the crisis. We focus on the UK whose exports fell markedly during the crisis and whose performance has been weak in the post crisis period. We demonstrate that this credit channel deterioration during the crisis had a material effect on exports and importantly in which types of firm the effects may be concentrated. The results should spur further research into a potential structural change caused by a credit channel that is still impaired or if the crisis has induced long

run damage to UK firms; the credit shock may have inhibited new exporter firm formation or damaged existing exporters productivity and innovation behavior.

The Global Financial Crisis and the Sovereign Debt Crisis both affected demand in the UK's main export market, the European Union, and in turn significantly affected UK exports. Simultaneously, the UK bank crisis, witnessing the first major bank run in 140 years (Northern Rock) and very high levels of governmental intervention to rescue the banking sector, led to de facto nationalization of some of the largest and oldest banks in British economy (Shin, 2009). This severe banking crisis and the attendant 'credit crunch' were accompanied by a significant decline in exports. Accurately measuring bank distress is therefore central to the analysis. To the best of our knowledge our paper is the first that uses the most timely, market based measures of bank distress - credit default swap (CDS) spreads, and the new Basel III net stable funding ratio (NSFR). NSFR is the latest indicator of bank structural liquidity, aimed at limiting the dependence on short-term wholesale funding, and incentivizing banks to use stable funding sources, the lack of which, was a major factor causing bank distress during the crisis. Bank CDS spreads capture the default risk of banks at a higher frequency, avoiding the delays associated with ratings agencies' evaluation of risk and most appropriately reflect conditions in the financial sector at an early stage, thus being best suited to capture bank distress (Otker-Robe and Podpiera, 2012). Similarly, Chiaramonte and Casu (2013) determine that during crises bank CDS spreads properly capture bank risk, while Avino, Conlon and Cotter (2016) show that changes in banks' CDS spreads represent a robust signal of bank failure, and "provide information about the

condition of banks which supplements that available from equity markets and contained in accounting metrics."[1]

Our paper is the first to study the relationship between banks' CDS spreads; NSFR and firms' export performance during the recent crisis,[2] and a transmission channel of contagion from GIIPS economies to the UK. In addition while most other studies use firm level financial variables or industry level variables that inadequately measure access to credit, our unique firm-bank level database has the advantage of providing the critical firm-bank relationship information that allows us to *directly* test for the banking channel effects on the real economy.

Distressed banks restricted financing to firms. Our data includes mostly domestic private firms, which are dependent on bank financing, and more likely to be affected by the 'credit crunch'. Earlier studies focused only on publicly traded, large and very large firms, which are less likely to rely on banks for their financing and frequently use alternative sources of external finance. This potential bias therefore can significantly underestimate the effects of a distressed bank-lending channel on the real economy.[3]

We also account for various firms and industry heterogeneities, as well as for firms' dependence on external capital, which influences the degree to which firms respond to disruptions in the supply of bank lending. We carefully correct for possible endogeneity in estimation and use novel instrumental variables to provide robustness for our results.

[1] Aizenman et al (2013) and De Bruyckere et al (2013) argue that CDS is a market based instrument that reflects immediately changes in credit risk. Similarly, Flannery et al. (2010) see CDS as a viable substitute for credit ratings with the supplementary advantage of a quick reaction to new information.

[2] Paravisini et al. (2015) is the only other paper that analyzes the effect of bank distress on the export performance of firms (for Peru) during the recent crisis, but they are not using market-based bank distress measures. Rather they rely on banks' exposure to foreign funds borrowing.

[3] Amiti and Weinstein (2011) use only *public* firms' data to study the sensitivity of Japanese exporters to financial shocks, during 1990-2010. As public firms are less dependent on bank's finance, their study underestimates the impact of financial shocks on all Japanese exporters (private and public).

We are able to build a unique comprehensive matched bank-firm dataset and show that worsening bank health has an immediate, negative and statistically significant effect on firms' exports. The results are economically significant, on average a 10% worsening of bank's health translate into a 1.6% decrease in firms' exports. The results are more pronounced in externally finance dependent sectors; firms in both manufacturing and services sectors are affected. Interestingly, we find that foreign and UK publicly owned firms, which have access to alternate sources of external finance are not affected by the banking sector distress. UK publicly owned firms' exports are however, significantly impacted by the increase in stock market volatility.

We are also able to test for a possible contagion of the Sovereign Debt Crisis in GIIPS economies to the UK Economy via the financial system. Firms whose banks have GIIPS owners, or are more exposed to sovereign debt originating from GIIPS countries cut their exports more. These results highlight the importance of the banking sector for the healthy functioning of modern economies.

The paper is structured as follows: the next section reviews the UK economy under crisis; then, we review the relevant literature; section 4 describes the data and the econometric strategy. Section 5 discusses the results. Section 6 deals with endogeneity in estimation, section 7 - firm heterogeneity, section 8 – the crises, section 9 provides robustness checks, followed by the conclusion.

## 1. The UK and the Global Financial Crisis

The decline in economic activity was severe in the UK during the crisis of 2008/2009, which we label the Global Financial Crisis. GDP fell (-) 0.5% and (-) 4.2% in 2008 and 2009, respectively and unemployment rose from 5.4% in 2008 to crest at 8% in 2012. Exports fell by 6.5%[4] in 2008-2009 (World Bank Development Indicators)[5]. Real effects occurred in tandem with severe distress in the UK banking system.

The associated banking crisis in the UK, which is described below began with the run on Northern Rock in late 2007, and this bank's subsequent nationalization in February 2008. This bank run was a rare phenomenon in the UK, the previous incident occurring in 1866 when an English bank had overstretched itself during the railway boom (Shin, 2009). These problems ensued following the fallout from the US subprime financial crisis, and the dry up in liquidity for mortgage backed security products, which Northern Rock's business model relied heavily on (see Milne and Wood, 2009 for a detailed overview). A Bank of England scheme, the 'Special Liquidity Scheme', supported by a Treasury guarantee was introduced in April 2008, lasting until January 2012, to increase the liquidity of UK banks under which banks swapped assets for more liquid Treasury Bills in return for a fee. In July 2008 the Government arranged the takeover of Alliance and Leicester, a large building society that had begun to experience difficulties resulting from write-downs related to US mortgage lending, by the Spanish banking giant Santander[6].

The collapse of Lehman Brothers in September 2008 and the ensuing systemic banking crisis across the world led to nationalization of significant parts of the UK banking system. Various assistance schemes were enacted. These schemes had as the main objectives to protect

[4] Constant GBP values
[5] http://data.worldbank.org/ accessed March 14, 2016.
[6] Completed on October 10, 2008.

depositors in banks suffering insolvency and also to ensure systemically important financial institutions, whose failure would threaten the overall financial system, to meet their obligations. The main UK Government actions were firstly the recapitalisation of Lloyds Banking Group (Lloyds), following Lloyds own rescue of HBOS in September 2008, which left the merged HBOS-Lloyds vulnerable, and secondly the rescue of The Royal Bank of Scotland (RBS). Through a series of transactions the UK Government eventually acquiring 83 per cent of RBS[7] and 41 per cent of Lloyds[8] (National Audit Office, 2010). Northern Rock and Bradford & Bingley were nationalised in 2008[9]. A 'Credit Guarantee Scheme', was introduced from October 2008-2012. Its purpose was to help restore investors' confidence in UK banks' wholesale funding through guarantees on selected unsecured debts.

In total £133 billion was provided in cash to the UK banks, while all guarantees, liquidity and asset protection provision totalled £1029 billion[10] (National Audit Office, 2010). These measures mitigated the full impact of the crisis but strong effects on the economy remained despite these actions.

## 2. **Literature Review**

The connection between the financial sector and international trade has recently received lots of attention, and spurred several theoretical and empirical papers. In one of the first papers to analyze the impact of credit market imperfections on international trade Kletzer and Bardhan (1987) build a theoretical model that shows the potentially deleterious effect of high finance

[7] But 68 per cent of the voting rights
[8] Of both ordinary shares and voting rights
[9] Santander bought the deposits, savings and the branch network of Bradford and Bingley.
[10] This is a total value of peak provisions when summed, not a temporal peak in the total value of the guarantees

costs on firms' abilities to develop products that can compete in international export markets. They find that higher interest rates on financing, due to poor reputation associated with sovereign debt, results in lack of specialization in industries with more complex products, ultimately affecting country's comparative advantage, and its exports in these industries. The authors find similar results when firms face credit rationing due to weaker financial institutions. Matsuyama (2005) proposes a theoretical model that shows that agency problems in the context of credit market imperfections affect the patterns of trade. Chan and Manova (2015) build a theoretical model that explains why exporting firms' selection of potentially profitable markets are a function of market size and trade costs. Credit constraints can reduce firms' ability to select profitable markets, but a developed financial sector may alleviate the level of distortion, thus increasing exports. The authors use aggregated, bilateral trade data to validate the theoretical model.

A problem associated with the financing of trade is the higher information asymmetry for a bank lending to an exporting firm. Feenstra et al. (2014) argue that the bank has incomplete information on the productivity of the firm and the use of loans for domestic or export sales. Based on these assumptions the authors build a theoretical model in which the bank will find it optimal to offer the firm a loan and interest schedule that leave the firm credit constrained but, at the same time, forces the firm to reveal its information to the bank. Export sales are differentiated from domestic sales due to longer time lag between production and sale, which result in tighter credit constrains for exporters. Using firm level data from China the authors find that credit constraints are more significant the larger the share of exports for a firm, the longer the transportation time for exports and the higher the variation of firms' productivities.

Some very recent papers have investigated the trade collapse that was associated with the 2008 crisis, by focusing on firms' liquidity constraints or credit rationing as a potential causal factor in the decline. Bricongne, J.-C et al. (2012) use French export data linked with exporting firm's characteristics to analyze the 2008–2009 trade collapse. The authors find that credit constraints affected the exports of firms in industries highly dependent on access to finance but, overall, the effect of credit constraints on exports was not very significant. A similar study by Behrens et al. (2013) use Belgian firm level data matched with exports and imports and finds a decrease in the intensive margins of trade due mainly to a reduction of demand. In contrast to these two papers' use of firms' balance sheet information to identify credit constrained firms, Minetti and Zhu (2011) use Italian firms' self-identification as being credit constrained from survey data. After controlling for endogeneity the authors find that credit rationing for a given firm reduces the probability of exporting by 39% and decreases the volume of exports by 38%. All the above papers use only indirect measures of firms' access to credit and the results are mixed.

The papers closest to our approach are Amity and Weinstein (2011), and Paravisini et al. (2015). To the best of our knowledge these are the only two empirical studies that use the crucial bank-firm relationship information to analyze the impact of financial crises on firms' exports. This information is vital, as liquidity constraints or other firm level financial variables are rough measures of firms' access to credit, and consequently impede more direct identification of the real credit relationship between firms and their banks. Amity and Weinstein (2011) use *publicly owned* firms data from Japan to analyze the extent to which their exports are sensitive to bank shocks. The authors argue that as firms engage in export activities, they have a greater default

risk and experience a longer time delay to finalize their sales, and as a result, they are more dependent on the financial sector than firms serving the domestic market. The authors use matched firm-bank data from Japan for the period 1990-2010 to confirm their hypothesis. Paravisini et al. (2015) research the impact of loan reduction on the export performance of Peruvian firms during the recent financial crisis. They observe that Peruvian banks, which use foreign funds as a substitute for domestic deposits to fund their lending activities, were severely affected by the 2008 financial crisis. Their method compares the export performance of firms using these externally dependent banks with the performance of firms borrowing from more stable, deposit financed banks. The authors use matched firm-bank data that is connected with disaggregated export data specifying the product and the destination of exports. They find that credit shocks affect the intensive margin of exports with no significant effect on the extensive margin (confirming the findings of Feenstra et al., 2014)[11].

Our paper adds to the above studies by analyzing the link between banks distress and firms' exports using data from one of the developed economies most affected by the recent crises. Its banking sector was severely distressed and significantly negatively impacted firms' exports, independently of the export destination countries' demand shocks. The economy was affected both by the Global Financial Crisis, and by the European Sovereign Debt Crisis. We use crucial information on matched firms and their relationship banks to *directly* investigate banks distress' impact on firms' exports from both sources. Our comprehensive data has the advantage of including both private and publicly owned firms. Previous studies (Amiti and Weinsten, 2011)

[11] A number of papers use the information on bank-firm connections to analyze the effect of financial shocks on other firm non–export variables. Balduzzi et al (2014), Cingano et al (2016) and Bofondi et al (2013) use Italian Central Credit Register to match Italian firms with banks and analyze the effect of crisis on firm's value added, employment, investment or credit. Chodorow-Reich (2014) uses syndicated loans to match U.S. firms with their creditors and finds that the Lehman default had a significant effect on employment for medium and small firms.

focused on publicly owned firms only, which are less dependent on banks' finance; therefore, their study could severely underestimate the impact of financial shocks on exporters. We also improve upon the previous literature by using two novel and informative measures of bank distress, the Basel III NSFR, and a market-based measure of bank distress, CDS spreads, which best capture bank default risk, especially during crises (Chiaramonte and Casu (2013), Otker-Robe and Podpiera (2012), Avino et. al (2016), Aizenman et al (2011) and De Bruyckere et al (2012)). We carefully account for various possible endogeneities and biases in estimation. We use novel instrumental variables to account for possible endogeneity in estimation to insure that our results are not biased. We also account for export demand, and for various firm and sectoral heterogeneities. We find that domestic private firms and firms in externally financially dependent industries are negatively affected by bank distress. Interestingly, foreign owned firms, and publicly owned domestic firms' exports are not statistically significantly impacted by their bank's distress. A more thorough analysis shows that publicly owned firms' exports are negatively affected by increased volatility in the stock market. Finally, we account for the Sovereign Debt Crisis to find that firms whose banks have GIIPS owners or are exposed to sovereign debt are more hurt, and decrease their exports more. Our results highlight the tremendous importance banking sector plays in modern economies, and its impact on firms' participation in global markets.

## 4. Data and Econometric Methodology

### *4.1. Data*

We use numerous data sources for this paper: firm level information for all UK firms is obtained from the FAME database from Bureau van Dijk; the Amadeus database[12] provides us with the crucial link between borrowing firms and their relationship banks, which is essential for our analysis; the Bankscope database[13] provides bank specific information, while Data Stream and SNL financial databases[14] contain bank Credit Default Swaps (CDS) variables, which we use as the main measures of bank distress.

The Amadeus database has detailed data on firms' relationship bank(s), which provides us with the key information about firms-banks linkages, allowing us to directly test for the impact of bank distress on firms' exports. While the Amadeus data provides the names of the banks firms have relationships with, there is no specific bank identifier. Therefore, we manually searched and matched the name of each bank listed by firms in the Amadeus database with the names of the banks in the Bankscope database, in order to also be able to retrieve the appropriate information for those banks. Most firms in our sample report only one bank. There are very few firms that report relationships with more than one bank; for those firms we take the average of the bank distress values of the reported banks. Another important characteristic of these firm-bank relationships in the context of UK is that they tend to be very stable over time, as firms seldom if at all switch banks.[15] This is important because one possible concern is that there are biases in estimation introduced by firms with higher export growth switching to better banks. We argue that this is very unlikely because of the remarkable stability of the firm-bank relationships observed in our data.

[12] Bureau Van Dijk
[13] Bureau van Dijk
[14] Each database covered slightly different banks and timeframes so we combined the information from the two datasets to cover the largest number of banks and years.
[15] Slovin, Sushka and Polonchek (1993) find it is harder and costlier for firms that depend primarily on bank lending to switch banks. Hubbard, Kuttner, and Palia (2002) emphasize the challenges that firms face when trying to obtain loans from other banks.

Our firm level data sample spans both manufacturing and services sectors. We focus on firm level as well as bank level yearly data for the UK, 2006-2015. We interpolate missing variables and winsorize the variables at 1% to discard the influence of outliers. After cleaning the data and constructing the relevant variables we are left with 9,939 domestic firms in manufacturing and services sectors (from which 443 were public firms and the rest were private firms). The firms report relationships with 214[16] domestic and foreign banks operating in the UK. Summary statistics for the main variables in the regression are presented in Table 1.

*4.2 Econometric Methodology*

Our baseline specification links firms' changes in exports to its determinants, including changes in their relationship bank's distress. We use the following econometric model:

$$\Delta lnExports_{ijt} = \alpha + \beta_1 \Delta BankDistress_{kt} + \pi_{jt} + \varepsilon_{ijkt} \qquad (1)$$

where, the dependent variable is the change in firm *i*'s exports in industry *j*, at time *t*. The regressions are estimated in first difference, which accounts for any firm and industry specific fixed effects[17]. All regressions are estimated on a sample of domestically owned firms. Errors are robust and clustered at bank level.

To account for other potentially important factors related to export growth, such as factor endowments and factor prices, exchange rates, etc. we include in all regressions 'industry*year dummies', which account for factors that are common to all exporters within an industry at a

[16] We counted both banks and subsidiary banks, as declared by firms. When a bank didn't have a CDS, we used the CDS of the parent bank as a proxy for the subsidiary bank's CDS (Coutts & Co., the seventh oldest bank in the world, was owned by RBS from the year 2000. As we didn't found a CDS for Coutts, we used the CDS of RBS as a proxy for the CDS of Coutts).

[17] Paravisini et al. (2015) also finds that variation of credit supply contemporaneously affects variation of exports

moment in time.[18] These 'industry*year' dummies account for any other macro specific, as well as industry and year specific demand and supply shocks that may have affected firms' exports.

The variable of interest, which could potentially significantly impact firms' exports, is bank distress. We use two novel measures of bank distress: the net stable funding ratio (NSFR), which is a new indicator of structural liquidity designed at limiting the dependence on short-term wholesale funding and incentivizing banks to use stable funding sources (BCBS, 2010). NSFR is a measure of structural bank liquidity proposed under the Basel III Accord, by the Basel Committee on Banking Supervision. This measure captures the stability of a bank's funding sources relative to the liquidity of its assets by linking components from both the asset and liability sides of the balance sheet.

NSFR is computed as a ratio between the weighted sum of liabilities and the weighted sum of long-term illiquid assets. Therefore:

$$NSFR = \sum_i w_i L_i \Big/ \sum_j u_j A_j$$

Where $L_i$ stands for liabilities and $A_j$ for assets and $w_i$ and $u_j$ are weights. We use Bankscope as a source of banks data, and the weights proposed by Vazquez and Federico (2015).

NSFR thus reflects bank soundness, and is used by regulators as a signal of potential build-up of vulnerabilities in the banking system. It aims to measure exposure to a potential bank liquidity shock and hence is reflective of this exposure during the crisis. The higher this measure is, the healthier the bank. We use the *opposite* of the NSFR variable in the regressions as a measure of bank distress, and if indeed bank distress curtails firms' exports we expect a negative and statistically significant coefficient for the opposite of the NSFR bank variable.

[18] We have 71 manufacturing and services sectors (3 digit NACE classification), during 2007-2015, resulting in 639 industry*time dummies.

Second, to assure the robustness of our results we also use another measures of bank distress – banks' CDS spreads, which measure the default risk of the reference entity, with a higher spread implying a greater risk. CDS were, created by the investment bank JP Morgan in 1994, became more widely used since 2003, and more so during the crisis. "CDS (…) consist of an agreement between two parties, the so-called protection buyer and protection seller. The protection seller undertakes, in exchange for a premium paid by the protection buyer, to pay out if a specific credit event occurs, typically the default of a third debtor, the so-called reference entity." (Chiaramonte and Casu, 2013). The advantage of CDS is that they are market based, and thus allow for timely information on the default risk of banks, and are not subject to the delay in ratings agencies evaluation of risk. Banks' CDS spreads are one of the indicators that can most appropriately reflect conditions in the financial sector at an early stage, and are thus best suited to capture bank distress.

We use monthly CDS spread data using the 5 year Tenor for Senior debt CDS[19]. Banks' CDS spread data comes in a monthly form, which we average over the year to match the yearly firm level data. The implicit assumption we make is that credit supply is a function of the level of bank distress, measured by the CDS spread. We expect that banks that experience distress curtail the supply of loans to firms. The recent crisis provided plenty of evidence as banks distress led to significant reduction of the flow of funds throughout the economy. In the estimation we use the change in bank CDS and investigate whether it affects changes in export volumes. We expect the coefficient of the change in the CDS variable to be negative and statistically significant if indeed bank distress limits the supply of loans to exporters and negatively affects the volume of exports.

[19] The 5 year Tenor for Senior debt CDS is the most traded CDS and, consequently, the most liquid. It is frequently used in papers using the CDS variable (Aizenman et al, 2013 and De Bruyckere et al 2013).

There are several econometric concerns when estimating such regressions, like endogeneity in estimation, selection bias, and omitted variables. It may be the case that bank distress was caused by firm's export performance, or a possible correlation between bank distress and firm's exports exists because both are caused by external factors that are omitted from the regression. We address each of these concerns in turn to make sure that they are not driving our results. They are discussed in the following sections.

## 5. Main Results

We start by presenting the results from the base line specification in Table 2. We regress the change in firm's exports[20] on change in firm's bank's NSFR measure[21] (column 1), respectively, on change in firm's bank's CDS (column 2). The coefficients of both measures of bank distress are negative and statistically significant, suggesting that the decline in bank health impacts firms' exports, and the effect is immediate. Firms are forced to adjust their exports when their bank faces distress, which highlights the importance of access to credit for exporting.[22] This is not unexpected, as British firms tend to rely relatively more on financing from banks than from other sources of external finance. The majority of domestic firms in our sample are privately owned, which rely primarily on their relationship bank for external finance. Firm-bank

[20] For robustness, we estimated the base specifications using percentage change instead of change of exports the results are similar.

[21] As presented in the previous section, for consistency in interpreting the results, the variable used in regressions represents the change in firm's bank's *opposite* value of the NSFR variable. Thus we expect the coefficients of both bank CDS and bank opposite NSFR to be negative and statistically significant if indeed bank distress decrease firms' exports.

[22] To insure that we capture not only the impact of bank distress on firms' exports, but also the timing of the effect we also regressed the contemporaneous change in exports on the first, respectively the second lag of change in bank distress. For the lags of change in bank distress we find no statistically significant effects on exports. In other words, worsening of banks' health, which hinders firms' access to external finance has an immediate and statistically significant negative impact on UK firms' exports.

relationships also tend to be quite stable over time, as firms rarely report changing banks. This was particularly the case during the recent crisis, when bank distress was widespread, with many banks experiencing troubles simultaneously, making it even harder and costlier for firms to switch banks. This would be especially hard for exporters, as potential new lenders would face a high level of information asymmetry, since they need to carefully examine the various reasons why the exporters were seeking to switch banks in highly uncertain times. Issues ranging from the health of firms' balance sheets to increased risks associated with selling in foreign markets mean such evaluations become more complex during a crisis, hence the information asymmetry grows and the probability that a firm can switch bank decreases. Even if firms could find new sources of finance, the time delay may be long enough to create disruptions in their exports. It is therefore not unexpected that bank distress immediately and significantly impacts firm's exports[23]. The results, importantly, are also economically meaningful; a 10% worsening of bank distress causes a 1.6% decrease in firms' exports (using Table 2, column 2).

During the sample period there were two major international shocks - the Global Financial Crisis that started in the US, and the Sovereign Debt Crisis that plagued several European countries. To the extent to which banks lending to UK firms have loan exposures to countries that have experienced the crises, and if the same countries are also major export destinations for UK firms, the crises could have simultaneously affected both banks and exports. If this were the case, our results would be biased.

We therefore include in the regressions, export destination countries' GDP growth in order to explicitly control for possible export demand shocks. Since we do not have export

[23] Paravisini et al. 2015 also found that shock on credit supply has a contemporaneous effect on exports.

market information at the firm level we use WITS[24] to obtain industry level exports to each destination country for the period 2000-2006. We use the pre-sample period to avoid endogeneity in estimation. We then calculate each destination country's yearly shares in total UK exports in a particular industry and year. These shares are then averaged to calculate a weighted average of GDP growth for each export destination market at the 3-digit industry level. These proxies are then introduced in the regressions to control for changes in export destination demand, possibly caused by the two crises. The results of the regressions, presented in column 3 and 4 in Table 2 suggest that the banks distress coefficients are still negative and statistically significant, reinforcing our previous findings that bank distress negatively affects firms' exports, even after explicitly accounting for the demand shock component. This is also another way of insuring that our results are not biased because of omitted variables in regressions.[25]

## 6. Endogeneity in Estimation

One of the most important concerns in this type of analysis is the potential endogeneity in estimation – it may very well be the case that firms' export performance affects the health of the bank that the firm has a relationship with (reverse causality), or that both bank performance and firm performance may be jointly determined by other variables omitted from the estimation (in this particular case an omitted export demand variable). To make sure that we control for these

[24] WITS stands for World Integrated Trade Solution, a World Bank created software that provides access to international merchandise trade, tariff and non-tariff measures (NTM) data - http://wits.worldbank.org/, accessed on 04/24/2016.

[25] The number of observations drops when explicitly accounting for export demand growth in the regressions, as in the WITS database export data for services sectors is unavailable.

potential problems, and that our results are not subject to these problems we implement several robustness checks.

Since exports may be persistent, and to make sure we do not have spurious correlation, we introduce a lagged export growth variable and then re-estimate the model both with OLS and the Arrelano-Bond method. These steps control for any past export behavior feeding into bank performance, and leading to a spurious correlation between change in bank distress and firm's exports. The Arrelano-Bond results[26], presented in columns 1-2, Table 3 support our previous findings, i.e. it is not the possible correlation between exports and bank distress that drives the results; rather, it is bank distress which causes a decline in firms' exports. The coefficient of the change in bank distress variable is negative and statistically significant in regressions on firms' exports.

Second, although our regressions are estimated in first differences, which control for firm specific characteristics, we aim to insure that we are accounting for all possible correlations between bank distress and firm performance, and that our bank distress variable is not picking up some further firm specific variables with which it may be correlated. We re-estimate the regressions by introducing firm size and firm productivity in the regressions (introduced in first differences since our regressions are in first difference). These variables have been found in the literature to affect firms' exports.[27] For firms' size we use the logarithm of total assets. Labor productivity is measured as total sales divided by the number of employees. The results (presented in Table 3) are basically unchanged, strengthening our finding that it is bank distress

[26] Alternate OLS results concur.
[27] These variables have been shown in the literature to impact firms' exports. Additionally, introducing profitability does not modify the results.

which impact firm's exports independent of any other factors possibly affecting firms' sales in foreign markets. We also introduced these variables in lagged first differences, and the results are unchanged, the coefficients of bank distress variables are still negative and statistically significant.

To further ensure potential reverse causality can be discounted - firm distress affecting bank distress, we also implement instrumental variables tests. One could worry that firms' distress might feed into and cause a distress in their relationships' banks. To make sure we account for this possibility we first estimate a regression of changes in bank distress on several instrumental variables. Subsequently, we use the fitted values from these regressions as measures of bank distress unaffected by firm's performance in a second stage regression aiming to explain the impact on firm's exports. The results of both stages are presented in Tables 4a and 4b and the details of this procedure are listed below.

First, we compute a novel and innovative instrument to account for possible endogeneity in estimation. We make use of the fact that essentially the Subprime crisis started when banks' ownership of toxic mortgage-backed securities became public knowledge. Arguably, these toxic assets worsened banks' health and, we hypothesize, these banks shocks affected the exports of borrowing firms. While it wasn't possible to find data on UK's banks' exposure to subprime assets, we follow the suggestion of Chodorow-Reich (2014) and we surmise banks' sensitivity to these assets using the correlation between banks' stock prices and the return on the ABX AAA 2006-H1 index. This index serves as a benchmark for the market for subprime securities that were issued initially with an AAA rating, on the second half of 2005. We compute the

correlations between this index and banks' stock prices for the period October 2007 – December 2007, and use these correlations as instruments for banks' distress. We use pre-sample data to avoid further endogeneity in the estimation. We use these correlations as instruments for banks' distress. We then estimate the two-step instrumental variables regressions using data from 2008 onwards, to avoid further endogeneity in estimation. As in our base regressions the dependent variable is the change in NSFR (respectively CDS). We regress the change in NSFR (CDS) on the NSFR (CDS) variable, and use the corresponding coefficient and the fitted values from the first stage regressions (Table 4a) to compute synthetic fitted values to be used in the second stage regressions for change in NSFR (change in CDS). The results from the first stage regressions (Table 4a), and the tests for the validity of the instruments show that these are valid instruments for bank distress. The coefficients from the second stage regressions (presented in Table 4b), using the synthetic fitted values from the first stage as instruments, are highly significant and negative confirming that our earlier results are robust to correcting for possible endogeneity in estimation.

Second, to insure there is no reverse causality arising from firm distress affecting bank distress we follow Amiti and Weinsten (2011) and use the fitted values from a regression of changes in bank distress on various firm performance variables, like firms' leverage ratio, liquidity ratio, and profit ratio, as instruments. We focus on these particular firm specific variables as they could theoretically affect firm's bank's health. We then use the fitted values from these regressions as measures of bank distress unaffected by firms' export performance.

All first stage regressions include 'industry*year' dummies to account for all factors common to all industries at the same time. The results of the first stage regressions (Table 4a) are very informative – interestingly, none of the coefficients of the firm performance variables (liquidity, leverage, and profit ratios) are statistically significant suggesting, as expected, that the distress of UK banks is not driven by the performance of the UK exporting firms. The results from the second stage regressions (presented in Table 4b), using these fitted values as instruments, barely change the previously found impact of bank distress on firm exports. The results confirm that our previous findings are robust to correcting for possible reverse causation in estimation. Bank distress negatively and statistically significantly impacts firm's exports independently of the firms' performance.

## 7. Firm Heterogeneity

Firms are heterogeneous, have different needs for external finance and varying degrees of bank dependence. We test whether firms with different characteristics are affected differently by bank distress. A priori we would expect that certain firm characteristics would affect firms' responses to changes in their bank's health. For example, we would expect that foreign owned firms, which are able to access alternative sources of finance through their parent companies, might be less affected by their local (UK) bank's distress. In addition, foreign owned subsidiaries of multinationals with diversified activities in multiple markets may face, a lower default risk. Therefore, foreign firms' dependence of their UK relationship bank may be lower than domestic

firms', so we would expect foreign firms' operating in the UK's exports to be less affected by UK banks' distress.

It has also been argued that public firms, which have access to other external sources of finance, like the stock market, depend less on bank funding, and may be able to weather better a worsening of their bank's health. Domestic privately owned firms, which depend much more on their bank for external finance, may be more affected than publicly owned firms by their bank's distress.

Another potential heterogeneity is that exporting firms in industries more dependent on external finance will be affected more by their bank distress than similar firms in industries less dependent on external finance.[28]

As in previous tests, we use both measures of bank distress to ensure greater robustness. To test for firms' public/private heterogeneity we re-estimate the regressions as before and now include an interaction between 'bank distress' and a Public firms dummy, which takes the value 1 if the firm is publicly traded, and 0 otherwise. Since public firms have alternate sources of finance they rely less on their bank for external funds, thus they may be less influenced by their banks' distress. Public firms however, may be more responsive to turmoil in the stock market. We therefore also introduce in the regression a variable that measures the implied volatility of the UK's FTSE 100 (VIX FT)[29]. Interestingly, the results show that exporting firms are definitely hurt by an increase in uncertainty, as the coefficient of the VIX variable is negative and highly significant. The results show that higher volatility in the stock market negatively

[28] We proxy these industry characteristics, using pre-crisis industry characteristics of U.S. firms, that are exogenous to our sample of firms (see Rajan and Zingales, 1998). We follow the methodology suggested by Rajan and Zingales (1998) to separate industries into more, or less externally finance dependent.

[29] The variable VIX FT is an annual average of the price of the volatility index VIX FTSE 100. This index measures the implied volatility of the UK's FTSE 100. The latter is a share index of the top 100 companies with the highest market capitalization listed on the London Stock Exchange.

affects public firms' exports. Public firms are not affected differently by their bank distress than private firms from this source. The results are presented in Table 5.

Industries more dependent on external finance are affected significantly more by bank distress than firms in less externally dependent industries (Table 6).

## 8. Accounting for the Sovereign Debt Crisis

In Europe a severe Sovereign Debt Crisis followed the Great Recession in 2011-12, with ripple effects throughout European economies. As a result, there is a growing interest in analyzing the relation between sovereign risk and banks. De Bruyckere et al. (2013) use CDS spreads and find that there is contagion between sovereign risk and bank risk. Acharya et al. (2014) and Alter and Schüler (2012) also found links amongst the two types of risk, with sovereign risk affecting the bank risk after Government bailouts. Bart et al (2012) show that although most of the GIIPS countries' sovereign debt was held by domestic banks, a significant part of GIIPS sovereign debt was also held by other European banks, from non-GIIPS countries, significantly increasing these banks' risk levels.

We test for a possible contagion of the Sovereign Debt Crisis from GIIPS economies to the UK. This allows us to expand the scope of the research to answer additional questions about how UK exports are vulnerable to financial distress in foreign countries system spilling over to the UK economy via the global financial system. Banks operating in the UK with GIIPS owners, or with larger GIIPS sovereign debt in their portfolios may have been more negatively affected than other banks, that were less exposed to GIIPS sovereign debt. An increase in the risk associated with the GIIPS sovereign debt owned by banks significantly decreases the value of

these assets, and, as a result, banks tighten lending more and charge higher interest in the crisis period than banks with lower sovereign risk exposures (Acharya et al., 2014). If this is the case, firms whose relationship banks have high GIIPS exposure may be more negatively affected, and experience sharper decline in their exports.

In an effort to capture the impact of the Sovereign Debt Crisis we investigate to what extent bank exposure to GIIPS sovereign debt impacted firms' response to bank distress. We make use of unique data from the EU-wide stress tests undertaken by the European Banking Authority. We obtain detailed information about banks' holdings of various countries' sovereign debt. A closer look at the geographical distribution of sovereign debt owned by banks reveals a strong home bias. GIIPS countries' banks hold on average more than 50% of their sovereign debt assets originating in GIIPS countries (for Italian banks the proportion is even higher, Italian banks holding more than 90% of sovereign debt assets in GIIPS sovereign debt). This is not the case for banks from other countries – French banks tend to have a higher GIIPS sovereign debt exposure than other non-GIIPS banks, on average 16% - 21% of their sovereign debt exposure is in GIIPS bonds. Out of the German banks, only Commerzbank has a 20% ratio, the other banks' ratios are in the single digits. As for the British banks, the exposure is relatively low - Lloyd 0%, HSBC 4%, RBS 7%, and Barclays 12.5%. As a result, we expect a stronger effect of the sovereign debt crisis on GIIPS banks, or on banks with GIIPS owners and, consequently, we expect more stringent financial constraints for firms that take loans from GIIPS owned banks.

We follow Acharya et al. (2014) and introduce in the regression a newly composed variable, which captures bank ownership. We use the Bankscope database to construct the dummy variable *GIIPS owned*, which takes value 1 if a bank is from GIIPS countries or it is controlled by an entity from a GIIPS country, and zero otherwise. We expect the coefficient

associated with this variable to be negative and statistically significant. Furthermore, we make use of the unique data from the European banks stress tests and calculate a *GIIPS intensity* variable, which captures the intensity of GIIPS sovereign debt holdings. For each bank from the stress test data that is relevant for the UK firms, we compute the ratio of GIIPS issued sovereign debt relative to the total sovereign debt from the EU. For the stress tests from the year 2011 and from 2014 (for which we have individual bank data available), we compute the median for this ratio for each year and identify the banks with a higher ratio than the median. The *GIIPS intensity* variable takes value of 1 for banks with the ratio higher than the respective median for both years (2011 and 2014) and 0 in the rest.

We next re-estimate the regressions and account successively for GIIPS ownership, and for GIIPS debt intensity. The results, presented in Table 7, show a negative, statistically significant effect of banks' GIIPS affiliation or GIIPS sovereign debt exposure on firms' exports, in addition to the negative impact of bank distress. The bank distress variable has negative coefficients, and these coefficients are statistically significant in regressions with the change in exports as the dependent variable. When we use the variable *GIIPS intensity* instead of *GIIPS owned* in regressions, the results are similar. The results show that the Sovereign Debt Crisis had real effects and impacted UK firms' export performance. Firms whose relationship banks have large GIIPS exposures have been more negatively affected, and experienced sharper declines in their exports. Such results therefore unravel an extra layer of the complexity of the fall in UK exports and illuminate an additional transmission channel.

## 9. Other Robustness Checks

It may be argued that a few outliers – banks that suffered the most during the crisis, or banks that serve a large number of the firms in the sample, may influence our results. We therefore identified the banks with the largest number of firms listing them as a source of funding. Barclays Bank leads, with close to 30% of the firms in our sample listing it as their relationship bank, followed by Royal Bank of Scotland (6.85% for RBS and 18.64% for NatWest, which is part of RBS), HSBC, with 17.56% and Lloyds with 14.18% of the firms. We re-estimate the regressions using the data from all the firms with the exception of firms in a relationship with Barclays Bank. We repeat the exercise after dropping sequentially each of the banks with large number of customer firms (we dropped RBS, HSBC and Lloyds one by one). We even drop combinations of the top two banks with most customer firms (Barclays Bank and RBS), and re-estimate the regressions. In all the cases the results are consistent with our previous findings. As a result of these tests it becomes less likely that our results are driven by a small number of large banks that serve a large number of firms and which suffered the most distress during the crisis.[30]

## 10. Conclusion

Our paper focuses on the UK economy and examines to what extent the distress in the banking sector affects firms' export volumes. The motivation for our research is to bridge a deficit in the existing literature on the effects of bank distress on its borrowing firms' performance. We build a unique firm-bank level database that has the advantage of providing detailed firm-bank relationship s that allows us to *directly* test for the banking channel effects on the real economy. We focus on the UK, a large developed economy that was affected directly

[30] The results are available upon request.

and extensively by the recent crises, and whose export performance has been weak in the post crisis period. The paper seeks to establish the scale and scope of credit frictions that reduced exports and in which firms the effects may be concentrated.

Our results show that worsening bank heath negatively and statistically significantly affects UK firms' exports. Interestingly, the effects of the bank distress are immediate. As bank ability to access finance decreased, so did the loans to their customer firms, which were then forced to cut exports. The results are economically significant, on average a 10% worsening of bank's health translate into a 1.6% decrease in firm's exports. The results hold for both manufacturing and services, and are robust to carefully correcting for possible endogeneity in estimation. Domestic private firms, which rely primarily on their banks for funds are immediately negatively affected by their relationship bank's distress. Remarkably, we find that foreign firms and public domestic firms that have access to alternate sources of finance are not affected by banking sector distress. In contrast, domestic publicly owned firms are negatively affected by stock market volatility.

The results highlight the importance of banking sector for modern economies and stress the tremendous impact bank distress can have on exports. The results may have significance in the debate regarding the resilience of the economy to economic or financial shocks in the face of firms' high dependency on banks rather than the use of public markets for funding. The paper should also enhance further research on whether a structural change indeed occurred in the UK post 2008. Persistently weak exports in the UK post crisis mean that knowing whether the credit

shock inhibited new exporter firm-formation, damaged existing exporters' productivity or, if credit starvation to firms persists are all important areas for future research.

## References


Aizenman, J., Hutchison, M., and Jinjarak, Y. 2013. What is the risk of European sovereign debt defaults? Fiscal space, CDS spreads and market pricing of risk. Journal of International Money and Finance, 34, 37-59.

Avino, D., T. Conlon, J. Cotter, 2016." Credit Default Swaps as Indicators of Bank Financial Distress", Working Paper, UCD Geary Institute for Public Policy Discussion Paper Series

Acharya, V., Drechsler, I., P. Schnabl, 2014. A pyrrhic victory? Bank bailouts and sovereign credit risk. The Journal of Finance, 69(6), 2689-2739.

Acharya V., T. Eisert, C. Eufinger, C. Hirsch, 2014. Whatever it Takes: The real effects of unconventional monetary policy. Working paper, London, Centre for Economic Policy Research.

Alter, A., Schüler, Y.S., 2012. Credit spread interdependencies of European states and banks during the financial crisis. Journal of Banking and Finance 36, 3444-3468.

Amiti, M., and Weinstein, D., 2011. Exports and financial shocks. Quarterly Journal of Economics, 126(4), 1841-1877.

Arellano, C., Conesa, J.C. and Kehoe, T.J., 2012. Chronic Sovereign Debt Crises in the Eurozone, 2010–2012. Economic Policy Paper 12-4, Federal Reserve Bank of Minneapolis, May 2012.

Balduzzi, P., Brancati, E., and F. Schiantarelli. 2013. Financial Markets, Banks' Cost of Funding, and Firms' Decisions: Lessons from Two Crises. IZA Discussion Paper No. 7872, December 2013.

Barth, J. R., Prabha, A. and Y. Greg, 2012. The eurozone financial crisis: role of interdependencies between bank and sovereign risk, Journal of Financial Economic Policy, Vol. 4 Iss: 1 pp. 76 – 97

Basel Committee on Banking Supervision (BCBS), 2010. Basel III: International framework for liquidity risk measurement, standards and monitoring. BIS Report, December. Available on: http://www.bis.org/publ/bcbs188.pdf (accessed on June 8, 2016).

Behrens, K., Corcos, G., and Mion, G. 2013. Trade crisis? What trade crisis?. Review of Economics and Statistics, 95(2):702-709

Bems, R., Johnson, R., and Yi, K. 2013 The Great Trade Collapse. Annual Review of Economics, 5:375-400.

Bofondi, M., L. Carpinelli, and E. Sette. 2013. Credit supply during a sovereign debt crisis. Banca D'Italia Working papers, Number 909 - April 2013.

Bricongne, J.-C., Fontagn, L., Gaulier, G., Taglioni, D., and Vicard, V. 2012. Firms and the global crisis: French exports in the turmoil. Journal of International Economics, 87(1), 134-146.

Chan, J. M.L, and Manova, K., 2015. Financial development and the choice of trade partners. Journal of Development Economics, 116:122-145.

Chaney, T., 2016. Liquidity constrained exporters. Journal of Economic Dynamics and Control, vol. 72: 141-154

Chiaramonte, L., and Casu, B., 2013. The determinants of bank CDS spreads: evidence from the financial crisis. The European Journal of Finance, 19(9), 861-887.

Chodorow-Reich, G. 2014. The Employment Effects of Credit Market Disruptions: Firm level Evidence from the 2008- 09 Financial Crisis. Quarterly Journal of Economics, 129:159.

Cingano, F., Manaresi, F. and Sette, E. 2016. Does Credit Crunch Investment Down? New Evidence on the Real Effects of the Bank-Lending Channel. The Review of Financial Studies, 29(10): 2737-2773.

Constantinescu, C., Mattoo, A. and Ruta, M. 2015 The Global Trade Slowdown: Cyclical or Structural? IMF Working Paper WP/15/6

Contessi, S. and De Nicola, F., 2012, What Do We Know about the Relationship between Access to Finance and International Trade? Research Division, Federal Reserve Bank of St. Louis Working Paper Series, Working Paper 2012-054B, October 2012, Revised March 2013.

De Bruyckere, V., Gerhardt, M., Schepens, G., & Vander Vennet, R. (2013). Bank/sovereign risk spillovers in the European debt crisis. Journal of Banking & Finance, 37(12), 4793-4809.

Feenstra, C. R., Li, Z., and Yu, M., 2014. Exports and credit constraints under incomplete information: Theory and evidence from China. The Review of Economics and Statistics, 96(4): 729–744.

Flannery, M. J., Houston, J. F., and Partnoy, F. 2010. Credit default swap spreads as viable substitutes for credit ratings. University of Pennsylvania Law Review, 2085-2123.

Hubbard, R. G., Kuttner, K. N., and Palia, D. N., 2002. Are There Bank Effects in Borrowers' Costs of Funds? Evidence from a Matched Sample of Borrowers and Banks. The Journal of Business, vol. 75(4), pages 559-81.

Kapan, T. and Minoiu, C., 2013. Balance Sheet Strength and Bank Lending During the Global Financial Crisis. IMF Working Paper No. 13/102.

Kletzer, K., and Bardhan, P., 1987. Credit markets and patterns of international trade. Journal of Development Economics, 27(1-2), 57-70.

Lewis, J and De Schryder, S., 2015 Bank of England Working Paper No.535

Matsuyama, K., 2005. Credit market imperfections and patterns of international trade and capital flows. Journal of the European Economic Association, 3(2-3), 714- 723.

Melitz, M., J., 2003. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. Econometrica, 71, 1695–1725.

Milne, A., and Wood, G., 2009. Shattered on the Rock? British financial stability from 1866 to 2007. Journal of Banking Regulation, 10(2), 89-127.

Minetti, R., and Zhu, S., 2011. Credit constraints and firm export: Microeconomic evidence from Italy. Journal of International Economics, 83(2), 109-125.

National Audit Office, 2010. HM Treasury - The Asset Protection Scheme, Report by the Comptroller and Auditor General, London, UK. HC 567 Session 2010–2011, 21 December 2010.

Paravisini, D., Rappoport, V., Schnabl, P., and Wolfenzon, D., 2015. Dissecting the effect of credit supply on trade: Evidence from matched credit-export data. Review of Economic Studies (2015) 82, 333–359.

Otker-Robe, I. and Podpiera, J., 2012. Explaining Credit Default Swaps Pricing for Large Banks. Journal of Financial Transformation, Capco Institute, vol. 34, pages 63-75.

Rajan, R. G., and Zingales, L., 1998. Financial dependence and growth. American Economic Review, 88(3), 559-586.

Shin, H. S., 2009. Reflections on Northern Rock: The Bank Run that Heralded the Global Financial Crisis. Journal of Economic Perspectives, Vol. 23, No. 1, pp 101–119.

Slovin, B., M., Sushka, M. E., and Polonchek, J.A., 1993. The Value of Bank Durability: Borrowers as Bank Stakeholders. The Journal of Finance, Vol. 48, No. 1 (Mar., 1993), pp. 247-266.

Stock, James, and Motohiro Yogo, 2005.‘‘Testing for Weak Instruments in Linear IV Regression,’’ in Donald Andrews and James Stock, eds., Identification and Inference for

Econometric Models: Essays in Honor of Thomas Rothenberg (Cambridge: Cambridge University Press, 2005), pp. 80–108.

Vazquez, F. and Federico, P., 2012. Bank funding structures and risk: Evidence from the global financial crisis, IMF Working Paper No. 12/29.

**Table 1 Summary statistics**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Change in ln(export) | 45,534 | 0.007 | 0.670 | -9.823 | 8.572 |
| Change in CDS | 45,534 | -0.002 | 0.073 | -0.767 | 1.035 |
| Change in NSFR | 44,668 | -0.001 | 0.076 | -0.527 | 0.618 |
| Age | 45,534 | 30.480 | 23.046 | 0.000 | 158.000 |
| Size | 45,534 | 9.958 | 1.465 | 3.178 | 14.581 |
| Labor productivity | 45,534 | 753.041 | 8245.012 | 0.332 | 879535.000 |
| Change in liquidity ratio | 38,580 | 0.010 | 0.355 | -20.535 | 28.889 |
| Change in leverage ratio | 41,377 | 0.075 | 21.594 | -2378.000 | 3001.314 |
| Change in profit ratio | 45,520 | -0.003 | 1.491 | -215.395 | 137.354 |
| Dependence on external finance | 41,862 | 0.544 | 0.498 | 0.000 | 1.000 |
| Market growth for export destinations | 21,031 | 1.592 | 1.781 | -4.833 | 5.843 |

Note: Table 1 provides summary statistics on firm characteristics and bank distress (proxied by NSFR or CDS). We present most of the variables as differences between variables at *t* and *t-1* as they are used in regressions. For firms' size we use the logarithm of total assets. Labor productivity is measured as total sales divided by the number of employees. Liquidity ratio is measured as the ratio between the difference between current assets and current liabilities and total assets. Leverage ratio is measured as the ratio between short term loans and current assets. Profit ratio is defined as the ration between the difference between revenue and operating expenses and total assets. For the variable "Dependence on external finance" we use as a proxy the industry characteristics of U.S. firms pre-crisis, which therefore, are exogenous to our sample of firms (see Rajan and Zingales, 1998). We follow the methodology suggested by Rajan and Zingales (1998) to separate industries into more, or less externally finance dependent.The variable "Market growth for export destinations" is computed at 3 digits industry level and using the pre-sample period (2000-2006) to avoid endogeneity in estimation.

Table 2. Baseline regressions

| Dependent variable | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) |
|---|---|---|---|---|
| VARIABLES | | | | |
| Δ NSFR | **-0.0447*** ** | | **-0.0588*** ** | |
| | **[-16.42]** | | **[-7.419]** | |
| Δ CDS | | **-0.144*** | | **-0.121*** |
| | | **[-2.438]** | | **[-2.226]** |
| Export Destination Market Growth | | | 0.0131*** | 0.0137*** |
| | | | [136.0] | [333.5] |
| Fixed effects (industry * year) | yes | yes | yes | yes |
| Observations | 52,720 | 48,479 | 40,446 | 38,562 |
| R-squared | 0.025 | 0.026 | 0.055 | 0.061 |

*** p<0.01, ** p<0.05, * p<0.1

Note: The regressions are estimated in first difference, which accounts for any firm and industry specific fixed effects. The coefficients of both measures of bank distress are negative and statistically significant, suggesting that the decline in bank health impacts firms' exports, and the effect is immediate. The results are economically meaningful, a 10% worsening of bank distress causes a 1.6% decrease in firms' exports (using Table 2, column 2).

**Table 3. Accounting for lagged exports, and firm specific variables**

| Dependent variable | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) |
|---|---|---|---|---|---|---|
| Δ NSFR | **-0.0588*** [-7.419]** | | **-0.0247*** [-4.665]** | | **-0.0432*** [-3.866]** | |
| Δ CDS | | **-0.121* [-2.226]** | | **-0.165* [-2.071]** | | **-0.166* [-2.070]** |
| Δ ln(export)_lag | -0.172*** [-248.4] | -0.186*** [-254.0] | | | | |
| Δ Size | | | 4.34e-07*** [31.23] | 3.83e-07*** [32.76] | | |
| Δ Productivity | | | 3.47e-06*** [131.4] | 3.36e-06*** [212.1] | | |
| Δ Size_lag | | | | | 2.25e-07*** [114.8] | 2.33e-07*** [122.6] |
| Δ Productivity_lag | | | | | -1.58e-06*** [-177.4] | -1.57e-06*** [-581.0] |
| Fixed effects (industry * year) | yes | yes | yes | yes | yes | yes |
| Observations | 40,446 | 38,562 | 52,632 | 48,270 | 45,844 | 43,518 |
| R-squared | 0.055 | 0.061 | 0.029 | 0.03 | 0.025 | 0.026 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Since exports may be persistent, and to make sure we do not have spurious correlation, we introduce a lagged export growth variable and re-estimate the model with the Arrelano-Bond method. The coefficients of the change in bank distress variables (NSFR and CDS) are negative and statistically significant in regressions on firms' exports. For robustness, we re-estimate the regressions by introducing in the regressions firm size and firm productivity (introduced in first differences since our regressions are in first difference). For firms' size we use the logarithm of total assets. Labor productivity is measured as total sales divided by the number of employees. The results (columns 3-4) are basically unchanged. We also introduced these variables in lagged first difference (columns 5-6), and the results are unchanged, the coefficients of bank distress variables are still negative and statistically significant.

**Table 4.a Correcting for endogeneity - Instrumental variables - First Stage Regressions**

| Dependent variable | Δ CDS | Δ NSFR | Δ CDS | Δ NSFR | Δ CDS | Δ NSFR | Δ CDS | Δ NSFR |
|---|---|---|---|---|---|---|---|---|
| Correlation Bank's stock price and Subprime Index | 0.0307* | 0.165 | | | | | | |
| | [2.365] | [1.288] | | | | | | |
| Change liquidity ratio | | | 0.0003 | -0.0003 | | | | |
| | | | [0.57] | [-0.32] | | | | |
| Change leverage ratio | | | | | -2E-07 | 4.89E-06 | | |
| | | | | | [-1.379] | [1.27] | | |
| Change Profit/ Total Assets | | | | | | | -4.16E-05 | 2.28E-05 |
| | | | | | | | [-0.79] | [1.795] |
| Fixed effects (industry * year) | yes | yes | yes | yes | yes | yes | yes | yes |
| Observations | 47,209 | 48,624 | 41,564 | 46,021 | 45,663 | 50,715 | 50,486 | 56,089 |
| R-squared | 0.939 | 0.961 | 0.592 | 0.238 | 0.576 | 0.236 | 0.58 | 0.235 |

Note: To control for endogeneity, we also implement instrumental variables procedures. We first estimate a regression of changes in bank distress on several instrumental variables. Subsequently, we use the fitted values from these regressions as measures of bank distress unaffected by firm's performance in a second stage regression aiming to explain the impact on firm's exports. The results of both stages are presented in Tables 4a and 4b. For the first instrument, we follow the suggestion of Chodorow-Reich (2014) and we surmise banks' sensitivity to the subprime assets using the correlation between banks' stock prices and the return on the ABX AAA 2006-H1 (an index of subprime securities). We compute the correlations between this index and banks' stock prices for the period October 2007 – December 2007, and use these correlations as instruments for banks' distress. We use pre-sample data to avoid further endogeneity in the estimation. We use these correlations as instruments for banks' distress. Second, to insure there is no reverse causality arising from firm distress affecting bank distress we follow Amiti and Weinsten (2011) and use the fitted values from a regression of changes in bank distress on various firm performance variables, like firms' leverage ratio, liquidity ratio, and profit ratio as instruments. We focus on these particular firm specific variables as they could theoretically affect firm's bank's health.

**Table 4.b Correcting for endogeneity - Instrumental variables - Second stage regressions**

| Dependent variable | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) |
|---|---|---|---|---|---|---|---|---|
| eCorrelation Bank's stock price and Subprime Index - NSFR | **-9.822*** ** | | | | | | | |
| | **[-8.138]** | | | | | | | |
| eCorrelation Bank's stock price and Subprime Index - CDS | | **-588.1*** ** | | | | | | |
| | | **[-43.66]** | | | | | | |
| eLiq - NSFR | | | 0.00689** | | | | | |
| | | | [2.503] | | | | | |
| eLiq - CDS | | | | **-0.149** ** | | | | |
| | | | | **[-3.211]** | | | | |
| eLev - NSFR | | | | | **-0.0210*** ** | | | |
| | | | | | **[-13.37]** | | | |
| eLev - CDS | | | | | | **-0.115** ** | | |
| | | | | | | **[-3.447]** | | |
| eEBIT - NSFR | | | | | | | **-0.0380*** ** | |
| | | | | | | | **[-21.35]** | |
| eEBIT - CDS | | | | | | | | **-0.0891** ** |
| | | | | | | | | **[-2.862]** |
| Fixed effects (industry * year) | yes | yes | yes | yes | yes | yes | yes | yes |
| Observations | 48,624 | 47,209 | 46,021 | 41,564 | 50,715 | 45,663 | 56,089 | 50,486 |
| R-squared | 0.023 | 0.023 | 0.034 | 0.033 | 0.027 | 0.027 | 0.026 | 0.025 |

*** p<0.01, ** p<0.05, * p<0.1

**Table 5 Firm heterogeneity - public versus private domestic firms**

| Dependent variables | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) |
|---|---|---|---|---|
| VARIABLES | | | | |
| Δ NSFR | **-0.0381*** ** | **-0.0378*** ** | | |
| | **[-31.89]** | **[-19.16]** | | |
| Δ CDS | | | **-0.146*** | **-0.152*** |
| | | | **[-2.395]** | **[-2.323]** |
| Δ NSFR x Public firm | -0.0015 | | | |
| | [-0.0799] | | | |
| Δ CDS x Public firm | | | -0.153 | |
| | | | [-1.147] | |
| Public firm | 0.0387*** | 0.0392*** | 0.0272*** | 0.0271*** |
| | [15.98] | [18.56] | [9.984] | [13.13] |
| Δ VIX x Public firm | | 0.00207** | | 0.000891 |
| | | [2.721] | | [1.129] |
| Δ VIX | | -0.0940*** | | -0.0170*** |
| | | [-84,710] | | [-37.65] |
| Fixed effects (industry * year) | yes | yes | yes | yes |
| Observations | 56169 | 56169 | 51467 | 51467 |
| R-squared | 0.026 | 0.026 | 0.027 | 0.027 |

*** p<0.01, ** p<0.05, * p<0.1

Note: To test for firms' heterogeneity we re-estimate the regressions and include an interaction between bank distress and Public firms dummy (which has value 1 if the firm is publicly traded, 0 otherwise) – columns 1 & 3. Public firms may rely less on their bank (less influenced by their banks' distress) but they may be more responsive to the stock market. We also introduce in the regression a variable that measures the implied volatility of the UK's FTSE 100 (VIX FT) – columns 2 & 4. The results show that exporting firms are hurt by an increase in uncertainty, public firms are not affected differently by their bank distress than private firms.

**Table 6. Industry Heterogeneity - industry dependence on external finance**

| Dependent variable | Domestic owned firms in industries **more** dependent on external finance | | Domestic owned firms in industries **less** dependent on external finance | |
|---|---|---|---|---|
| | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) |
| Δ NSFR | **-0.0816*** ** | | 0.0355 | |
| | **[-64.36]** | | [0.164] | |
| Δ CDS | | **-0.226** ** | | -0.0308 |
| | | **[-4.023]** | | [-0.410] |
| Fixed effects (industry * year) | yes | yes | yes | yes |
| Observations | 28553 | 25997 | 23066 | 21325 |
| R-squared | 0.033 | 0.034 | 0.026 | 0.016 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Firms in industries more dependent on external finance are affected significantly more by bank distress than firms in less externally dependent industries. We follow the methodology suggested by Rajan and Zingales (1998) to separate industries into more, or less externally finance dependent. As expected, exporters in industries more dependent on external finance are more hurt by their bank distress.

**Table 7. Accounting for the Sovereign Debt Crisis**

| Dependent variable | Δ ln(export) | Δ ln(export) | Δ ln(export) | Δ ln(export) |
|---|---|---|---|---|
| VARIABLES | | | | |
| Δ NSFR | **-0.0389*** [-24.97]** | **-0.0429*** [-27.57]** | | |
| Δ CDS | | | **-0.0879** [-2.853]** | **-0.0873** [-2.868]** |
| GIIPS owned | **-0.0123** [-3.029]** | | **-0.0124** [-2.584]** | |
| GIIPS intensive | | **-0.00772*** [-13.11]** | | **-0.00543*** [-7.948]** |
| Fixed effects (industry * year) | yes | yes | yes | yes |
| Observations | 56169 | 56,169 | 50,557 | 50,557 |
| R-squared | 0.026 | 0.026 | 0.025 | 0.025 |

*** p<0.01, ** p<0.05, * p<0.1

Note: We expect a stronger effect of the sovereign debt crisis on banks with GIIPS owners or for higher GIIPS sovereign debt intensity, leading to more stringent financial constraints for firms that take loans from these. We re-estimate the regressions and account successively for GIIPS ownership, and for GIIPS sovereign debt intensity. We found a negative, statistically significant effect of banks' GIIPS affiliation or GIIPS sovereign debt exposure on firms' exports, in addition to the negative impact of bank distress. The result show that the Sovereign Debt Crisis had real effects and impacted firms' performance. Firms whose relationship banks have large GIIPS exposures have been more negatively affected, and experienced sharper decline in their exports.

**From:** D'Maris Coffman (Structural Change and Economic Dynamics) [mailto:EviseSupport@elsevier.com]
**Sent:** 17 June 2018 19:52
**To:** Ali Kabiri <ali.kabiri@buckingham.ac.uk>
**Subject:** Your manuscript SCED_2017_232_R1 has been accepted

Ref: SCED_2017_232_R1
Title: Exports and Bank Distress: Evidence from Matched Firm-Bank Data
Journal: Structural Change and Economic Dynamics

Dear Dr. Kabiri,

I am pleased to inform you that your paper has been accepted for publication. I am sorry it took longer than expected, but one of the reviewers never replied to our requests to review your resubmission. As a consequence, I had to make other arrangements. Now that your manuscript has been accepted for publication it will proceed to copy-editing and production.

Thank you for submitting your work to Structural Change and Economic Dynamics. We hope you consider us again for future submissions.

Kind regards,

D'Maris Coffman
Managing Editor
Structural Change and Economic Dynamics

**Have questions or need assistance?**

For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISE® via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

---