

Services trade and credit frictions: evidence with matched bank – firm data ¹

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Abstract

The effects of credit supply shocks on the exports of services are not clear a priori. On the one hand, services need lower initial investment in physical capital than manufacturing. On the other hand, competitiveness for exporting services requires investments in intangible capital and in product customization that may be subject to credit frictions. Using Italian matched bank-firm data and focusing on the Sovereign Debt Crisis, we find an elasticity of services exports to credit supply, between 0.3 and 0.4. The effects of credit shocks are especially relevant for firms exporting complex services to countries with weaker institutions and for services that are not the main product of the firms. Overall, our results suggest that credit supply plays a relevant role for exporting services during crises.

Keywords: Trade in services, credit frictions, bank-firm data.

JEL Classification: F10, F14, F36, G21, L80

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1. Introduction

Due to the technology improvements, services trade has grown considerably in the recent decades.² In this context, competitiveness is a key factor for firms exporting services, but it requires dedicated investments in intangible capital and product customization, that may be subject to credit frictions, especially during a financial shock.

After the Great Recession a large body of empirical literature has established that financial frictions have important effects on several firm outcomes, such as investments, employment and exports of goods (e.g., Amiti and Weinstein, 2018; Chodorow-Reich, 2014; Foley and Manova, 2015). However, we still have a limited understanding of the influence of financial factors on firms' abilities to export services.

A clear prediction of the role of credit frictions for services exports is not obvious a priori. On one hand, services typically require lower investment in physical initial capital than manufacturing; hence, it is reasonable to expect lower credit needs for starting up a business, or the export activity.

On the other hand, exporting services requires high up-front sunk cost that must be borne to enter into the export market. In particular, an investment to acquire knowledge of the characteristics of the destination country, such as the legal framework, clients network, etc. are often necessary (Eickelpasch and Vogel, 2011; Silva and Carreira, 2016; Lejpras, 2009). The prevailing intangible nature of these assets does not allow to be used as collateral in case of default (Haskel and Westlake, 2017), thus enhancing the risk of credit constraints (Almeida and Campello, 2007). The greater reliance of firms on the traditional system of bank lending in many countries does not help overcome the tyranny of collateral that is inherent in financing intangible investments (Dell'Ariccia *et al.*, 2018).

Variable costs may also affect the international competitiveness of services. Even though shipments are typically rapid in the case of service exports (the delivery is immediate³), production lags due to product customization can justify external financing. In the case of some complex services such as software production could plausibly be longer than that of many manufactured goods. Moreover, several services tend to be less standardized to fit the specific needs of customers, so that dedicated costs in product customization are required (Vogel, 2011; Hoekman and Mattoo, 2008; Wong *et al.*, 2006).

² The share of services in world trade has increased from 15% at the beginning of the 80's to 20% in 2010 (Jensen, 2016).

³ Services are non-storable, that is, the delivery is likely to be immediate (especially if they are traded over the internet); this implies the absence of shipment delays (as in the case of goods) that justify exporters' working capital needs during the transfer: for a discussion on shipment delays in services trade see Ariu (2016a).

Overall, credit constraints may occur if a relevant part of the costs of providing services is financed externally due to the existence of high entry costs, the tyranny of collateral in financing intangible assets, production lags and product customization. It turns out that this is a likely situation, as various papers show by calculating the external financial dependence for manufacturing and services.⁴

It follows that the role of credit frictions on the exports of services is a likely result and has to be tested empirically. To this aim, we use a high-quality dataset obtained by merging matched bank-firm relationships data, supervisory data on banks' balance sheets, and survey data on services exports of Italian companies (mainly business and personal services⁵). We focus on a specific event — the Sovereign Debt Crisis between 2011 and 2012 —to disentangle credit supply from demand factors.⁶ Our identification strategy exploits the fact that during the crisis, banks reliant on retail funding were less exposed to the shock and thus were able to continue to expand credit supply, while the more exposed banks reduced credit supply (see section 4 for further details).

The empirical exercise consists of cross section IV regressions of the growth rate of export services in 2012 on the change in the credit granted in the same period. The growth rate of credit is instrumented with the “retail” components of domestic bank funding (the ratio of deposits and bank bonds held by domestic households over bank assets) lagged one year. The validity of our instrument is tested by using matched bank-firm credit data, to show that this credit change was higher for firms financed more intensively by banks with a greater relevance of retail funding (see Section 5).

We find that credit supply had a significant impact on services exports of Italian firms during the period considered. A bank credit change of 1% induced a rise in exports flows between 0.28% and 0.41%. This result holds true even after the inclusion of various firm controls and several robustness checks.

Our contribution not only provides the first evidence of the importance of credit frictions for exporting services, but it also extends to other dimensions. To unpack the adjustment mechanisms, we focus on two features closely related to services. First, we show that the significant role of credit

⁴ In the Appendix (table A.1) we report as an example the measure computed by Catão *et al.* (2009) on manufacturing and services US firms, which clearly shows that external financial dependence is higher in various some services sectors than in other manufacturing ones. For example, “sale, maintenance and repair of motor vehicles and motorcycles, sector code 50,” has a higher level of external financial dependence than “manufacture of other transport equipment, code 35”: 1.12 Vs 0.69, respectively. Other works in this vein have similar findings (Duygan-Bump *et al.*, 2015; De Serres *et al.*, 2006; Balta and Nikolov, 2013).

⁵ In detail, these are: computer and information services; other business services; personal, cultural and recreational services; communication services.

⁶ The crisis derived from increased uncertainty over sovereign risk and subsequently it affected banks with a different intensity. Since during that period financial tensions derived from the sovereign debt market (and not by the imports of Italian services from the rest of the world), we consider this crisis as an exogenous event with respect to the services traded by Italian firms.

supply arises when services are exported to countries with weaker institutional background, where contractual risks are greater.⁷ This result is consistent with the “complementarity of inputs” assumption. This is a typical feature of services provision such that the production process ends in the country where it is consumed (Lennon *et al.*, 2009). Moreover, credit supply shocks affect exports of services that require more complex tasks in production and these effects are only significant when exporting to countries with weaker institutional backgrounds.

Secondly, we find that credit constraints affect the exports of services when these are exported as secondary products by a multi-product firm, typically a manufacturer; the case is known as *servitization* (Breinlich *et al.* 2014; Crozet and Millet, 2017). While there are various reasons for manufacturers to provide services, credit needs may arise if marginal costs increase as one moves away from the product of core competence (Eckel and Neary, 2010; Eckel *et al.*, 2015).

The paper is structured as follows. In section 2, we briefly review the literature related to trade services and to trade and finance. The datasets and the sample definition are described in section 3. In section 4, we shortly discuss the sovereign crisis, and the empirical methodology is outlined in section 5. The main results are presented in section 6 the robustness checks are in section 7. Section 8 concludes the paper. An appendix gives a short description of the survey, discusses sample restrictions and reports some additional statistics. Other robustness checks are in the Online Appendix.

2. Related literature

The literature on international trade in services has grown remarkably in the last decade. Several papers have analyzed firm-level data on exporters and importers of services: Breinlich and Criscuolo (2011) in the UK, Kelle *et al.* (2013) in Germany, Ariu (2016a and 2016b) in Belgium, Federico and Tosti in Italy (2016) among others. Most of these works highlight the relevant heterogeneity among firms exporting services and, consistently with the consensus in the international trade in goods literature, that exporting firms are more productive and bigger in size.

Despite the growing interest for firms’ exports of services, the literature on trade services and finance is still very scant, and to the best of our knowledge, only few papers have considered this topic so far. Biewen *et al.* (2012) show that the level of financial development of the exporting countries did not have a significant effect on services imports by German multinational firms during the years 2002–2008. Borchert and Mattoo (2012) provide anecdotal evidence of Indian firms to

⁷ For example, this is the case when the importer’s decision to buy foreign services critically depends on local financing intermediaries (Niepmann and Schmidt-Eisenlohr, 2017).

show that the crisis resilience of services trade (relative to the collapse of trade in goods) in 2008–2009 was due to the lower dependence on external financing of services with respect to the production of goods. Using balance sheet data, Ariu (2016a) shows that services exports of Belgian firms have been quite resilient to the financial crisis and that services exports were not affected by external finance dependence, nor by long term financial debt. Our results on the effect of credit for export services depart from Ariu (2016a), most likely because we study a different country and the sovereign crisis which did not affect world trade in services, aside from 2008-2009..

Differently from these contributions, our work explores the role of external financing on service trade using very detailed data on the financial exposure of firms, i.e., the outstanding credit by banks to Italian firms exporting services. We match these data with information from the banks' balance sheets. In this way, we can exploit the heterogeneity not only across firms, but also across banks i to detect different behaviors of lenders in response to their idiosyncratic shocks.

This work is also related to the recent literature on international trade in goods and finance. In this field, many papers have used sector-level measures of the “external finance dependence” first introduced by Rajan and Zingales (1998) (see, for example, Chor and Manova, 2012; Iacovone and Zavacka, 2009). Other works have applied this approach using firm level data (see for example: Behrens *et al.*, 2013; Alborno *et al.*, 2012; Feenstra *et al.*, 2014). Among the latter group, our paper is related to Muûls (2015) who shows that manufacturing imports and exports are affected by firm credit scores, where this last variable is a proxy of credit constraints. Similarly to Muûls (2015), we consider the role of firm credit ratings, where the score is assigned by an independent body using the balance sheet data of the firm; however, unlike Muûls' , we rely on a more direct measure of credit supply shocks: the overall outstanding credit given by banks. Our work is also related to the papers on multi-product companies. Among others, Manova and Yu (2017) show how Chinese multi-product firms allocate exports across destinations depending on the quality of their products. Since our dataset of services exporters is composed of many manufacturers, we provide evidence that credit frictions significantly affect firms' decisions of exporting services, independently of whether they also export goods.

Finally, our empirical methodology follows mainly the trade and finance literature using bank firm data, which has greatly expanded since the first work in the aftermath of the financial crisis (Ahn *et al.*, 2011). We also took from the wide literature on multiple lending and bank-firm relationships during the sovereign debt crisis (Bolton *et al.*, 2016). In this vein, our methodology is closer to that of Paravisini *et al.* (2015), who estimate the effect of the credit crunch on goods exports of Peruvian firms using a specific event shock. Our estimates also use a “within firm”

estimation methodology, following Khwaja and Mian (2008); this last approach has been also exploited by Del Prete and Federico (2014) , among others, to estimate the impact of trade finance on the overall (goods and services) exports of Italian firms. Our work is also related to Buono and Formai (2018), who analyzed the link between credit supply changes following M&A operations involving Italian banks and goods exports for the correction of omitted variable bias through an ancillary regression method.

3. Data

The paper uses four main sources of data. The first is the TTN (Non-financial Quarterly Transactions, *Transazioni Trimestrali Non finanziarie* in Italian) section of the Direct Reporting database (DR) of the Bank of Italy. This is a survey on services trade – excluding travel and tourism – which collects data on services exports per firm, quarter, year, type of service and country of destination and it is carried out every quarter on a representative sample of Italian firms. A short description of the survey is provided in the Appendix (section A.1).

The services analyzed in the TTN survey are business services (that is, services provided to firms) and personal services (see Table A.2 for the list of services included in the analysis).⁸ Since services trade transactions are reported quarterly, we collapse data to one-year period to avoid estimation bias due to seasonality and serial correlation of exports.

The second source we use is the Italian Credit Register (CR) of the Bank of Italy, which collects data on all borrowers with exposure above 30,000 euros towards a single intermediary.⁹ Since Italian firms – differently from US companies – are strongly reliant on bank credit (Langfield and Pagano, 2016), by focusing on the shocks to the banking system we can capture most of their external financing. In our main regressions we consider the overall exposure including three types of outstanding debt: loans backed by account receivables, term loans and revolving credit lines. Guarantees granted to firms are included in a robustness check.

Our third source is the Supervisory Reports (SR) reported by banks to the Bank of Italy on a quarterly basis. SR contain balance-sheet data for all banks operating in Italy, including banks that are not listed on the stock market. From these data we select various bank variables (yearly averages) to instrument credit supply, as it will be explained in detail below. It is worth noting that

⁸ We exclude taxes and government, financial, insurance and construction services and royalties and licenses fees.

⁹ The threshold is computed on the overall outstanding exposure (including debt and guarantees) of a firm with respect to a given intermediary operating in Italy (banks, other financial intermediaries providing credit, special purpose vehicles).

we use consolidated bank data, to exclude interbank transactions made by banks belonging to the same group.

The fourth data source is the Company Accounts Data Service (CADS – *Centrale dei Bilanci*), managed by an independent agency, Cerved Group. CADS include detailed balance-sheet data for a large sample of non-financial incorporated firms in Italy. For our analysis we consider, an overall measure of the ex-ante risk of firms' default (*Cred_Score*), among other measures. This variable is computed annually by Cerved Group on every incorporated firm of the database using balance sheet information (Altman *et al.*, 1994).

We apply various restrictions to our data (see Appendix A.2 for details), after which we are left with a dataset of about 9,000 observations at bank-firm-year level (about 3,500 at firm-service-country-year level). Since our identification strategy (see section 5) relies on the heterogeneous reaction of banks' lending decisions in response to financial shocks, as in Khwaja and Mian (2008) and Jiménez *et al.* (2010), we restrict the sample to firms that obtain loans from at least two banks. Multiple banking is quite common in Italy; for example, each firm borrows from four banks on average (see Buono and Formai (2018)) and multiple banking is common even among small firms and during the last years of crisis (Gobbi and Sette, 2015).

All variable definitions are described in Table A.3 in the Appendix. Table A.4 reports the summary statistics of the main variables used in the empirical analysis.

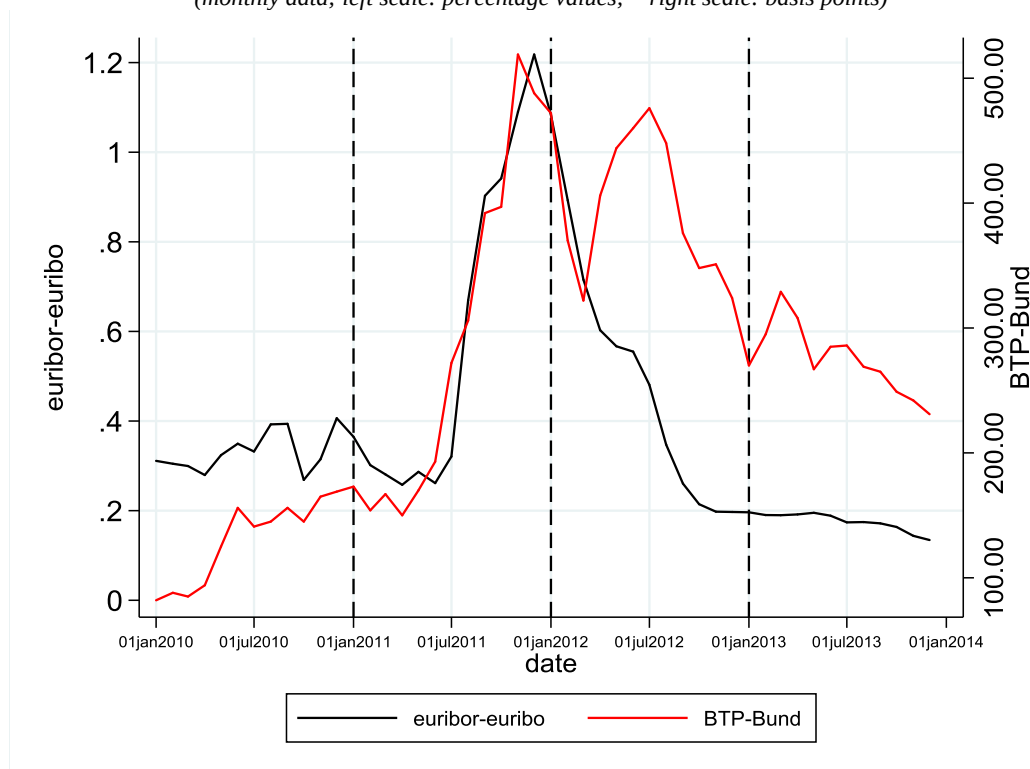
4. The sovereign debt crisis: timing and instrumental variable

In this section we explain the timing of the exogenous shock and our choice of the instrumental variable, highlighting the events of the Sovereign Debt Crisis that are salient for our analysis.

In the summer of 2011, after the announcement of the involvement of private-sector investors in the restructuring of the Greek public debt, the attention of the media and financial markets spread from Greek and Portuguese to Italian and Spanish government bonds. These countries fell into a negative feedback loop between sovereign difficulties and bank funding.

For the Italian case, the spread between the Italian 10 year T-bills and the corresponding German bills soared in the second half of 2011, reaching values above 500 basis points in November. Because of the rising tensions in the sovereign debt markets, the cost of wholesale funding increased sharply, as shown by the rise of the spread between the price of unsecured interbank deposits in Europe ("Euribor") relative to secured deposits ("Eurepo"): see Fig. 1.

Figure 1. T-Bills spread and Euribor Eurepo spread.⁽¹⁾
(monthly data; left scale: percentage values;⁽²⁾ right scale: basis points)



Source: Bank of Italy and ECB. (1): The BTP-Bund spread is the difference between the yield on the Italian T-bills with 10 years of maturity and the yield on the corresponding German T-bills (right axis). The Euribor-Eurepo spread is the difference between unsecured (“Euribor”) and secured (“Eurepo”) 3 months interbank rates (left axis).

In the last quarter of the year, when the tensions on the Italian sovereign debt and the cost of interbank funding reached their peak, Italian banks also experienced a relevant decline in wholesale funding (see Fig. 2).¹⁰

As regards the choice of the instrumental variable, we start from the acknowledgment that, differently from other countries, such as Ireland and Spain, where the main fragility factors were in the domestic banks, in Italy the instability originated from the sovereign debt and only after it affected domestic banks, not vice-versa (Angelini *et al.*, 2014); for this reason, we can consider as exogenous to our empirical exercise an instrumental variable related to banking liabilities.

Among the different possibilities, we decided to use the retail funding components (deposits and bank bonds held by resident households) as appropriate instrument of credit supply. In fact, retail components have been stable sources of funding for banks operating in Italy during the period considered and marked a difference in lending practices after the intervention of the European Central Bank (ECB).

¹⁰ In the Online Appendix a chart with banks funding is reported over a longer time span: see Fig. A1.

The malfunctioning of the wholesale funds markets over several European area countries induced the ECB to implement non-conventional monetary policy measures. In summer 2011 the ECB provided extraordinary short term liquidity by refinancing operations with a maturity of approximately six months at a fixed rate with “full allotment”. Starting December 2011, it enacted the three years Long Term Refinancing Operations (LTRO’s), aimed at increasing banks liquidity.¹¹

Figure 2. Italian banks’ funding
(quarterly changes in billions of euros)



Source: Bank of Italy Supervisory Reports.

Note that *all* banks benefited from LTROs, as the LTRO's attractive pricing prompted banks to borrow at the ECB regardless of their exposure to the dry-up.¹² The ability to access retail funding marked a difference for lending practices across Italian banks: aggregate growth in lending remained positive only for those most relying on the retail funding channel, whilst it was reduced for other banks (see Fig. 3), as documented also by Albertazzi *et al.*, (2014) and Del Giovane *et al.* (2013). In other terms, the lending supply by banks with a greater access to retail funding was better insulated from the significant fluctuations in funding market conditions.

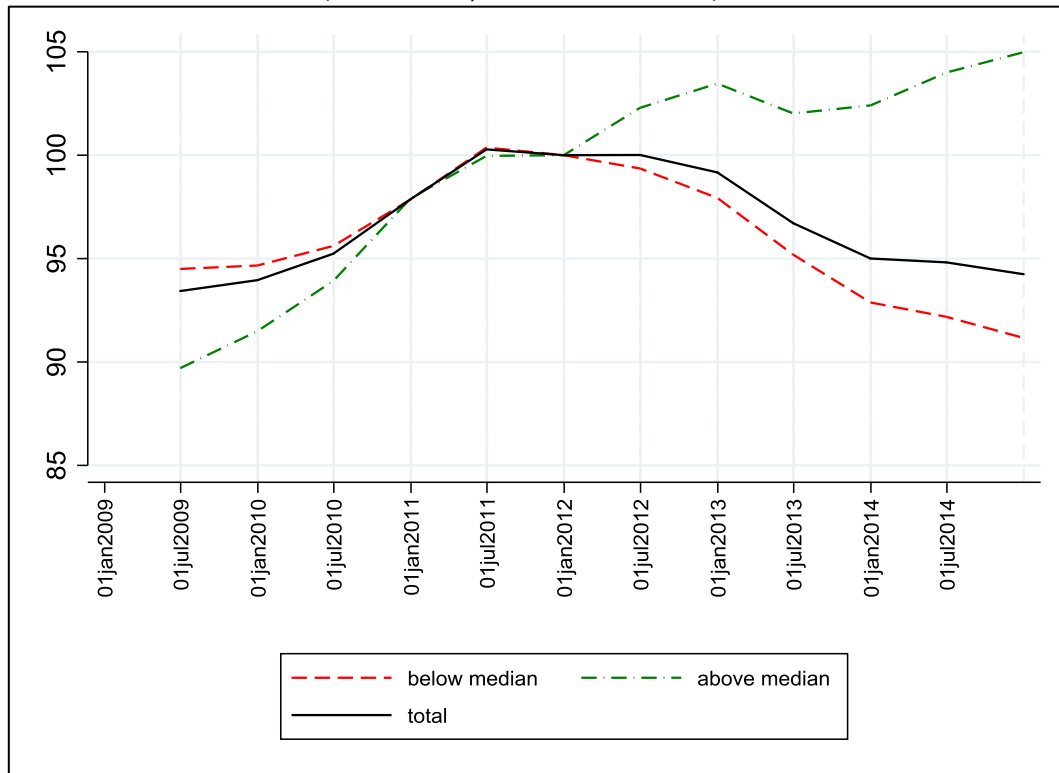
After the wholesale funding drop and the ECB intervention in the last quarter of 2011, the pattern of lending volumes of banks above the median (of retail funding) departed from the other banks (below the median) in the first quarter of 2012 (see Fig. 3). Note that unconventional short

¹¹ Between December 2011 and February 2012 the Eurosystem conducted two three-year longer-term refinancing operations (LTROs) and widened the range of assets eligible as collateral (ECB, 2012 and 2013).

¹² Carpinelli and Crosignani (2017) document that bank-level LTRO borrowing and bank exposure to the wholesale market were uncorrelated.

term financing by the ECB in the third quarter of 2011 did not change lending by banks in the two groups. It was only with longer term unconventional measures (LTRO's) that the two lending patterns started to diverge. For this reason, we set the timing of the shock at the end of 2011 (31 December 2011). We also consider robustness checks in the case in which banks' lending policies might have changed one year before or one year later (see the Online Appendix).

Figure 3. Total loans by banks with respect to retail funding ⁽¹⁾
(total amount of loans; 31-12-2011=100) ⁽²⁾



Source: Bank of Italy. (1) The figure illustrates bank lending from banks with different levels of retail funding: a bank is classified as below (above) the median if the ratio of average retail funding in 2011 was lower (higher) than the median value of the year. The vertical dotted lines mark the start of each semester. (2) Total amount of loans by banks belonging to the dataset. Loans include bad loans, repos, and loans not reported in banks' balance sheets because they have been securitized.

5. Empirical methodology

To assess whether the change of bank credit granted¹³ to services exporting firms affects the growth of services exported, we need to disentangle supply from (firm-specific) demand determinants of credit growth on one hand, and isolating the role of credit from that of alternative drivers of exports on the other. To this end, identification necessitates detailed information on both bank–firm relationships and banks' and firms' balance sheets (as well as services exports country of destination to isolate importing countries' demand shocks). Our identification strategy, which follows strictly the methodology of Paravisini *et al.* (2015), moves along two separate steps.

¹³ Rather than the amount of credit actually *used* by firms, we consider the credit *granted* to them which is commonly acknowledged as a better proxy of credit supply. See for instance Jiménez *et al.* (2012).

Drawing on a matched firm-bank dataset from Italy, we first show, using a *within-firm* estimation procedure, that banks that were less reliant on retail borrowing before the crisis subsequently tightened credit conditions (as measured by credit quantities) more than other banks did. We then assess the reduced-form effect of firm exposure to the credit shock on services exports by running an IV estimation.

1. *within-firm estimation.* We first show the validity of the selected instrument using matched bank-firm data. Recall that our identification assumption is that banks with a lower fraction of retail funding in year $t-1$ (2011) have reduced the supply of credit in the following year t (2012) relatively more than other banks. Following Khwaja and Mian (2008), we test the identification assumption using the *within-firm* estimation procedure, which compares the change in the amount of lending by banks with different dependence on retail funding to the same firm, before and after the sovereign debt shock.¹⁴ In practice, this means estimating the following equation:

$$\Delta \log(CR_{i,b,2012}) = \delta_0 \text{retail_funding}_{b,2011} + \delta_i + u_{i,b,2012} \quad (1)$$

The dependent variable is the change in the log of the total amount of outstanding debt of firm i with bank b ($\log(CR_{i,b,2012})$) in 2012. Our explanatory variable (*retail_funding*) is the log of the ratio of bank b deposits and bonds (held by domestic residents) over bank assets lagged one year (in 2011). We also include firm fixed effects (δ_i) to control for unobserved changes at firm level.¹⁵

Note that equation (1) states our identification assumption. That is, credit supply of banks with a greater access to retail funding was better insulated – during the Sovereign crisis – from the significant fluctuations in market conditions, and also from the changes in monetary policy¹⁶. As we already mentioned in section 4, banks with a large and stable pool of retail deposit funding were less vulnerable to changes in market rates (since most of their funding is non-market based; Berlin and Mester, 1999). Along this line of thought, the bank lending channel literature (Gambacorta and Marques-Ibanez, 2011; Albertazzi *et al.* 2016) has recently highlighted the role of bank funding composition in influencing lending supply during periods of financial stress.

Indeed, in 2011, with sovereign yields rapidly rising, wholesale funding (both domestic and foreign) decreased sharply. As already mentioned above, these funding shocks were transmitted to

¹⁴ Accordingly, we use observations of firms with credit relationships only from multiple banks. This procedure has been used by a large literature on within-firm estimations with bank firm data. To mention a few of them, see Jiménez *et al.* (2010) and Jiménez *et al.* (2012).

¹⁵ We cluster the standard errors at the bank level in order to allow for correlations in error terms across observations related to the same bank.

¹⁶ In fact, banks that are less dependent on wholesale financing tend to adjust their lending supply more slowly, as they are relatively less sensitive to changes in market rates, thereby leading to a relatively slower speed of the pass-through of monetary policy (Kok and Werner, 2006).

the supply of credit, even though only to some extent because the drain in funds was partially offset by central bank refinancing (see Fig. 3).¹⁷ For example, using banks responses to the euro-area Bank Lending Survey in Italy, Del Giovane *et al.* (2013) show that at the peak of the sovereign debt crisis (the last quarter of 2011) the supply of credit has been mostly dependent from the banks' funding difficulties. Differently, banks with the higher share of retail funding have provided more credit than the banks relying relatively more on other sources.¹⁸ We exploit the heterogeneity across banks with respect to this variable in order to identify credit supply. Indeed, the coefficient of variation (the standard deviation divided by the mean) of the ratio of retail funding over assets was 40.6% in 2011, reaching almost the levels of the Financial Crisis of 2009 (46.3%).

In order to ensure the validity of our instrument, is to address the orthogonality condition of the instrument across firms. In other terms, one may be worried that the funding shock affected banks' credit supply only for a particular subset of firms in the sample, so that our instrument might only identify the local average treatment effect (LATE). If the instrument is random regarding the potential outcomes, there should not be relevant differences in the firms' characteristics (at their mean values) across the subgroups of firms defined by quartile values of the instrument. Table 1

Table 1. Firms' characteristics by quartile of the instrumental variable ⁽¹⁾

	quartiles			
	1 st	2 nd	3 rd	4 th
Services Exports ⁽²⁾	1,061,101 (0.592)	1,206,260 (0.3182)	1,855,673 (0.4991)	1,485,999
Employees ⁽²⁾	1,015.8 (0.781)	939.4 (0.169)	2,304.9 (0.3072)	1,377.9
Profitability ⁽³⁾	29.5 (0.367)	22.9 (0.5309)	40.8 (0.3777)	17.2
Cred_Score ⁽²⁾	4.7 (0.421)	4.1 (0.4472)	4.1 (0.022)	4.6
Distressed ⁽²⁾	0.51 (0.074)	0.67 (0.6319)	0.63 (0.6922)	0.64
Capital Intensity ⁽³⁾	226.3 (0.129)	144.5 (0.378)	161.4 (0.9849)	186.0
Intangibles ⁽³⁾	0.22 (0.716)	0.24 (0.2882)	0.26 (0.7896)	0.29
Trade Credit ⁽²⁾	109,595 (0.395)	147,389 (0.7759)	125,784 (0.9214)	147,963
Ext. Fin ⁽³⁾	1.9 (0.187)	1.9 (0.3166)	1.9 (0.7975)	1.9
For_Debt ⁽³⁾	175.9 (0.315)	146.2 (0.1578)	113.3 (0.9443)	99.5

Source: CADS, CR, SR. (1): Average values by quartile of the instrumental variable. (2): unit values; (3): ratio. P-values of the difference tests are reported in parentheses below each value. For example, 0.592 is the p-value of the equality of means test between the mean value in the 1st quartile and the mean value in the 2nd quartile of the Services Exports variable. See Table A.3 for variables definition.

¹⁷ Carpinelli and Crosignani (2017) compute that wholesale funding went down by 5 percentage points, to 28% of overall funding, in just 6 months, from June to December 2011. At the end of 2011 funding from the Eurosystem represented 9% of total funds.

¹⁸ In a theoretical paper, Agur (2013) shows that wholesale funding raises the impact of capital requirements on credit rationing compared to retail funding. Ratnovski and Huang (2009) find that the high reliance on depository funding (vs. wholesale funding) was a source of resilience of Canadian banks during the financial crisis. Dagher and Kazimov (2015) show that during the financial crisis banks that were more reliant on wholesale funding curtailed their credit significantly more than retail-funded banks.

shows that there are not systematic differences among the different quartiles that are statistically significant according to the relevant t-tests, thus corroborating the validity of our instrument.

2. *firm level estimation*. After estimating equation (1), in the second step we implement IV estimation. In practice, we aggregate the data at firm level and estimate the relationship between credit supply and exports using the following reduced form equation:

$$\Delta \log(X_{i,s,c,2012}) = \beta \Delta \log(CR_{i,2012}) + \gamma_s + \gamma_c + \varepsilon_{i,s,c,2012} \quad (2)$$

where $\Delta \log(X_{i,s,c})$ is the one year change (between 2011 and 2012) of the log of services exports by firm i of service s to destination country c .

Equation (2) is composed of two parts. The first part is given by the one year change of *total credit* granted $\Delta \log(CR_i)$ by all banks' lending to firm i in the same period. Credit growth is instrumented to capture the dynamics of credit supply. Note that in estimating equation (2) with IV's, our instrumental variable (*retail_funding*) is now at firm level. This means that we have aggregated the variable, summing the amount of credit across banks. As it is standard in this kind of exercises (see for example Cingano *et al.*, 2016), the instrumental variable at firm level is a weighted measure sum of retail funding, where the weight is given by the following:

$$\omega_i = \frac{CR_{i,b,2011}}{\sum_{i=1}^n CR_{i,b,2011}} \quad (3)$$

Equation (3) shows that ω_i is the fraction of lending by bank b in 2011 ($CR_{i,b,2011}$) over the sum of credit granted by all banks (n) to the firm i in the same year. Note that in order to reduce endogeneity we lag the weight of one year.

In the second part of equation (2) we include a set of service and country (γ_s and γ_c) dummies that account for any features of service s (technology differences that affect tradability, regulatory standards, etc.) or for local shocks in the importing country c (such as demand shocks, regulatory barriers, etc.). In this way, following Paravisini *et al.* (2015), we also address the issue of the potential bias on our estimated coefficients that may rise because of non-random matching between banks and firms when using bank-firm data: that is, when some banks might be specialized in lending to firms exporting a specific type of services s or to a particular country c .

Finally, note that the focus of the paper is on the intensive margin of services exports. The analysis of the extensive margin (i.e. the number of firms starting to export or exiting from the foreign market) is not feasible because a relevant share of the firms in the export services dataset are sampled (for the methodology see Appendix A.1). Nevertheless, two facts reveal that focusing on the intensive margin is a proper approach to our analysis. Indeed, various studies — also on

countries similar to Italy — show that services exports are very concentrated in few medium size and large firms,¹⁹ which are typically better able to bear the fixed costs of exporting and therefore to maintain the export status even during a time of crises. Secondly, as long as we limit our attention to credit supply shocks taking place in a limited period, it is plausible that in face of sudden shocks, firms will reduce the level of exports, rather than exiting the exports markets altogether. For example, Paravisini *et al.* (2015) find that credit shocks affected the intensive margin of goods exports by Peruvian firms—during the financial crisis, but they find no significant effect on the extensive margin.

6. Results

6.1 Preliminary analysis of data

In this part we document the heterogeneity of banks over the retail funding variable before the sovereign debt shock. Table 2 shows descriptive statistics for the 72 bank groups in our sample. Banks with a value of the retail funding ratio (over assets) below the median are usually bigger in size (in terms of assets) and more capitalized (in terms of “Tier 1 ratio” and “Total capital ratio”). The two groups of banks are quite similar as regards their business model: lending is the main activity of the banks analyzed (credits are about 70% of total assets); the relative importance of the investments in Government bonds is, by and large, the same for both; the burden of “non-performing loans”

Table 2. Banks’ characteristics by median of the instrumental variable ⁽¹⁾

Variable	Mean			Standard deviation	
	below	above	diff. (p-value)	below	above
Log(Assets)	20.8	19.7	0.0000	2.0	1.3
Credit/Assets	69.1	70.1	0.5183	23.5	15.0
Gov_bonds/Assets	17.3	16.4	0.4227	16.1	10.3
Tier_1_ratio	21.3	16.3	0.0000	15.6	9.0
Total_capital_ratio	23.6	17.5	0.0000	18.1	9.5
Non_perf_loans/credits	11.2	12.0	0.1843	8.9	7.5

(1): all data refer to year 2011. Source: Bank of Italy (Supervisory Reports).

6.2 Within-firm estimation

In this subsection we show the validity of our proposed instrument of credit supply through a *within-firm* estimation of matched bank-firm credit data as in equation (1). Following Khwaja and Mian (2008), this means estimating the growth rate of total credit growth on our proposed

¹⁹ Federico and Tosti (2016) show that exports and imports of services in Italy are highly concentrated in few firms. For similar results in other countries see for example Gaulier *et al.* (2011) on French firms and Breinlich and Criscuolo (2011) for firms in the UK.

instrumental variable (*retail_funding*) and firm fixed effects. The results (column 1 of Table 3) show that the estimated coefficient of the IV variable is, as expected, positive and significant.

Moreover, since the banking literature suggests the relevance of other determinants of credit supply, we test the effects of these variables as regressors additional to *retail_funding*. We first explore the role of an additional instrumental variable (*Gov_bonds*) on credit change, which is given by the ratio between bank holdings of Italian Government securities and bank assets. This has been used by Bottero *et al.* (2015) to show that credit supply tightening was more intense for Italian banks that were more exposed to government sovereign securities during the Sovereign debt crisis.

Table 3. Within – firm estimates of Credit Growth

	(1)	(2)	(3)	(4)	(5)	(6)
Retail_fund.	0.0969* (0.0513)	0.582*** (0.158)	0.186*** (0.0582)	0.0969* (0.0513)	0.0944* (0.0513)	0.517*** (0.160)
Gov_bonds		-0.636*** (0.199)				-0.459** (0.210)
Low_Cap			-0.371*** (0.115)			-0.293** (0.119)
Foreign_Bank				2.125* (1.141)		2.001* (1.120)
Mainbank					-0.158*** (0.0499)	-0.152*** (0.0500)
Observations	9096	8930	9096	9096	9096	8930
R ²	0.785	0.793	0.786	0.785	0.786	0.793

The estimates show OLS regressions. The dependent variable is the growth rate of credit (ΔCredit). Retail_funding is the log of the ratio between retail funding sources (domestic retail deposits and banks bonds held by households) over total bank asset assets. Gov_bonds is the log of the ratio between the bank holdings of government securities and risk weighted assets. Low_Cap is a dummy=1 if the bank Total Capital Ratio is below 10 and 0 otherwise. Foreign_Bank is dummy=1 if the bank is foreign. Mainbank is a dummy=1 for the main lender of a firm. All variables definitions are in Table A2 in the Appendix. All regressors are lagged 1 year (2011). All estimates include firm fixed effects. Standard errors (in parentheses) are robust and clustered at bank level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We find that credit growth is lower for firms financed by banks having higher exposure towards sovereign securities (column 2). We also test the validity of another plausible instrumental variable: *Low_Cap* is a dummy variable equal to 1 for banks that were low capitalized, that is with a Total Capital Ratio (TCR) lower than 10%.²⁰ We find a significant effect with the expected negative sign, that is credit supply growth is lower for firms financed by banks with a Total Capital Ratio lower than 10% (column 3). A recent contribution by Bofondi *et al.* (2017) suggests that foreign banks benefited from lower exposure to the adverse effects of the Italian sovereign debt crisis: in column 4 we find that the estimated parameter of foreign banks dummy (*Foreign_Bank*) is positive as expected. Finally, we also repeat the previous exercise using *Mainbank* (a dummy equal to 1 when the bank is the main bank lending to firm i and 0 otherwise), as in Del Prete and Federico (2014): the effect is negative suggesting that in that period on average main banks reduced credit supply to their borrowers (column 5). Note that in all the specifications analyzed so far the parameter of *retail_funding* remains positive and significant as in column 1. Finally, results are confirmed even

²⁰ Following Albertazzi and Marchetti (2010), we choose the dummy specification (instead of a continuous variable) to capture possible non-linearity; in fact, capital requirements might affect credit supply especially when the bank ratio is closer to the threshold. Then, we set the threshold at a higher value than the official Basel II regulatory threshold (8%), because this is the value that was actually perceived by the market as the relevant benchmark.

when we repeat the previous tests by including simultaneously all the determinants of bank lending (column 6).

6.3 Firm level estimation (baseline)

In this subsection we move to estimate the aggregate effect of credit supply at firm level as in Jiménez *et al.* (2010). This means that we regress the effects of a shock in credit supply on firms' services exports using a weighted measure of retail funding as instrumental variable as described in section 5 by equation (2). In column 1 of Table 4 (Panel A) we report the results of an OLS regression of services exports growth on credit changes without any firm-level control. The estimated effect – which still includes credit demand factors – is positive (0.21%) and significant at 1% confidence level. When the change of credit is instrumented, as in column 2, the effect is also significant at 1% and positive (0.41%). It follows that the IV estimate of the export elasticity to credit is about 2 times larger than the OLS estimate. This bias highlights the relative importance of demand (in addition to supply determinants) of credit in shaping this result and it is consistent with the idea that firms with higher export growth have more internal funds at their disposal and, consequently, they demand less bank credit (on this point see also Buono and Formai, 2018).

To control for potentially confounding firms' characteristics, we add some firm-specific regressors suggested by the wide literature on international trade and firm heterogeneity.²¹ A first set of controls consists of the log of employment (*Employees*) to take firm size into account and the log of firm's EBIT over assets to capture total profitability (*Profitability*). When we add both these variables (column 3), the instrumented measure of credit supply has still a significant impact on the dependent variable.

Another relevant control is *Cred_score*, an inverse measure of the credit worthiness of a firm. This is a categorical variable that measures the probability of default.²² The effect of *Cred_score* is found to be not statistically different from zero (column 4) Most probably, this is due to the fact that it capture credit supply as well as demand effects, since the *Cred_score* is known both to the borrower and to the lender. On top of that, its inclusion does not change the statistical significance and, to a lesser extent, the magnitude of the instrumented credit supply change ($\Delta Credit$), thus confirming the role of bank funding on their lending practices and ultimately on services exports.

²¹ All controls are lagged one period.

²² The *Cred_score* variable takes integer values from 1 to 9, with higher values representing higher probability of default of the firm.

Table 4. Firm level (baseline) estimates

Panel A											
	OLS 2 nd stage	2SLS Second stage estimates									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ΔCredit	0.208*** (0.0340)	0.414*** (0.125)	0.461*** (0.127)	0.378*** (0.100)	0.409*** (0.119)	0.327*** (0.107)	0.406*** (0.120)	0.286*** (0.105)	0.413*** (0.122)	0.358*** (0.139)	0.286** (0.126)
Employees			0.166*** (0.0319)								0.203*** (0.0444)
Profitability			0.0734*** (0.0222)								0.126*** (0.0322)
Cred_Score				-0.0695 (0.0609)							0.00114 (0.0728)
Distressed					0.116 (0.0944)						0.469*** (0.152)
Capital int.						0.0102 (0.0223)					0.0825** (0.0420)
Intangibles							-0.376*** (0.129)				-0.0653 (0.179)
Trade Cred.								0.379* (0.224)			1.009*** (0.336)
Ext. Fin									-4.744 (6.047)		2.932 (7.259)
For_Debt										0.0264 (0.0331)	-0.0327 (0.0257)
Service FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.0386										

Panel B: First stage estimates											
		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Retail_fund		1.263*** (0.155)	1.215*** (0.155)	1.561*** (0.174)	1.319*** (0.167)	1.449*** (0.166)	1.310*** (0.147)	1.834*** (0.183)	1.283*** (0.155)	1.552*** (0.170)	1.822*** (0.147)
R ²		0.157	0.164	0.217	0.241	0.180	0.248	0.203	0.174	0.307	0.546
F test		65.98	61.37	80.71	62.29	76.26	79.74	100.22	68.23	83.57	153.46
(p-value)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	3554	3531	3437	3440	3440	3213	3437	2617	3439	2477	2283

The estimates show OLS (column 1) and 2SLS regressions (columns 2 to 11). The dependent variable is the growth rate of services exports. ΔCredit is the log difference of credit. The IV variable (Retail_funding) is the log of the ratio between retail funding sources (deposits and banks bonds held by domestic households) over total bank assets. All controls and IV's are lagged 1 year (2011). Variables definitions are in Table A.3 in the Appendix. Standard errors (in parentheses) are clustered at service and country level: * p < 0.1, ** p < 0.05, *** p < 0.01.

In the successive columns we control for firm financial characteristics that can also challenge our candidate variable to explain services exports.²³ With any of these controls, the sign (positive, as expected) and the statistical significance of the coefficient of credit supply does not change substantially, whilst its magnitude mildly varies, in a range between 0.41 and 0.29: this latest value is obtained once we include *Trade_Cred* (that is, the credit granted by suppliers) in column 8. We expect this variable to influence the estimated parameter of interest because trade credit can act as a substitute of bank credit. This is both in column 8 and in the horse race (column 11), where estimated coefficient of interest drops to 0.29. Thus, our analysis highlight that the effect of credit on services exports is lower in magnitude than that on goods exports found by other papers using Italian data: Minetti and Zhu (2011) find that credit rationing reduced foreign sales of medium and big size manufactures by 0.38% in the year 2000. Using a dataset comprising

²³ A dummy for highly leveraged firms (*Distressed*) in column 5. *Capital intensity* (given by the log of the ratio between fixed assets and employees) in column 6; the ratio of intangibles over the sum of tangible and intangible assets (*Intangibles*) in column 7; a general measure of firm external financial dependence (*Ext. Fin*) in column 9. Finally, to capture substitutes of bank financing we add a measure of trade credit over total firm debt (*Trade_cred*) in column 8 and a measure of the firm's reliance on external financial resources from foreign sources relatively to its overall debt (*For_Debt*) in column 10. See table A.3 for variables definition.

manufacturing and services companies for a long period (1997-2011), Buono and Formai (2018) obtain an elasticity of goods exports to credit supply shocks of 0.56%.

To give a sense of the economic magnitudes, we calculate the change in export growth in response to a one standard deviation increase in the instrumented variable (as from column 11): increasing the growth of credit supply by one standard deviation would increase the exports growth by around 12% of a standard deviation.

The first-stage estimates in Panel B show a significantly strong relation between our instrument and the change of credit. The F tests of excluded instruments are well above the value of 10, the threshold recommended by Staiger and Stock (1997).

6.4 Other results

In this section we report results additional to the baseline and that enrich our analysis. They regard the role of geography variables, the characteristics of the services exported and the main activity of the firm.

Geography – We analyze the role of country of destination characteristics and how these interact with ΔCredit . In this way we check whether the credit frictions are relevant for exporting services to some groups of countries. In Table 5 we first interact ΔCredit with dummies for the level of GDP, GDP per capita and a financial development indicator (higher or lower than the sample median) and we find that the effect of credit growth is significant only for exports to less developed countries or with a lower level of financial development (columns 1 to 3). Similar results emerge when the ΔCredit is interacted with the Rule of Law.²⁴

Overall, these results reveals that credit supply is especially relevant for exporting services to countries with weaker institutional framework. This finding highlights a typical feature of services provision, the “complementarity of inputs” (Lennon *et al.*, 2009), which means that the production process ends in the country where it is consumed, so that particular features affecting the importer (adequate institutions, infrastructure, financial means, etc..) may play a role.

²⁴ In unreported estimates we repeat this exercise using the other measures of the World Governance Indicators (Regulatory Quality, Control of corruption, Government effectiveness and Voice and accountability). We also repeat all the estimates splitting between Advanced and Emerging countries (using the IMF classification) and OECD and non-OECD. In all these exercises we obtain similar results.

Table 5. Estimates on services exports with Δ credit interacted with country characteristics

	(1)	(2)	(3)	(4)
	GDP	GDP per capita	Financial Development	Rule of Law
Δ Credit x high GDP countries	0.192 (0.158)			
Δ Credit x low GDP countries	0.350** (0.153)			
Δ Credit x high GDP pc. countries		0.193 (0.160)		
Δ Credit x low GDP pc. countries		0.393*** (0.149)		
Δ Credit x high FinDev countries			0.260 (0.164)	
Δ Credit x low FinDev countries			0.315** (0.137)	
Δ Credit x high Rule of Law				0.167 (0.160)
Δ Credit x low Rule of Law				0.435*** (0.139)
Weak identification Cragg-Donald Wald F Test	53.27	50.59	50.66	51.77
10% maximal IV size	7.03	7.03	7.03	7.03
Observations	2283	2283	2283	2283

The estimates show GMM-IV regressions (only second stage). The dependent variable is the growth rate of services exports. Δ Credit is the log difference of credit. The IV (Retail_funding) is the log of the ratio between retail funding sources (deposits and banks bonds held by domestic households) over total bank assets. In the first stage this variable is interacted with any of the interacting variables that appear in the table. FinDev is the level of financial development measured as the ratio between private credit by commercial banks and other private institutions over GDP. GDP, GDP per capita and Findev are from the IMF (IFS). Rule of Law is from the World Governance Indicators. All estimates include firm controls (Employees, Profitability, Cred_score, Distressed, Capital int., Intangibles, Trade Cred., Ext. Fin and For_Debt), services FE's and country FE's, not reported. All controls and IV's are lagged 1 year (2011). Variables definitions are in Table A.3 in the Appendix. Standard errors (in parentheses) are clustered at service and country level: * p < 0.1, ** p < 0.05, *** p < 0.01.

Services – We look also at two characteristics of services that, as mentioned in the introduction, may explain the presence of credit frictions: production customization and intangibility.

Customization of services on specific clients' needs may require executing very complex tasks for each service provision. This implies that credit could spur exports of services that are the output of a more complex production process. To test this hypothesis, we use a measure of production complexity developed by Naghavi *et al.* (2015) for almost all sectors of the US economy. They build this measure using data on the task “complexity of problem solving” from the US occupation database (O*NET). Note that using US data allows to consider this measure more exogenous with respect to our data. We convert these indexes into our services categories and divide services into high vs low complex tasks intensity.²⁵ By interacting credit growth with high vs low services complexity dummies we provide a first evidence that credit growth affected exports only of more complex services (Table 5bis, column 1). Moreover, starting from this finding, we investigate further the channels that drive credit frictions. Recall that in Table 5 we have found that the effects are significant when exporting services to countries that are poorer or have weaker institutions. Indeed, services with higher customization have little (or null) market value outside the buyer-seller relationship; this makes the counterparty contractual risk greater especially in countries where the institutional setting of the importer is weak. Accordingly, by interacting further this

²⁵

The procedure to build these variables are described in the Appendix (section A.3).

interacted measure of ΔCredit with binary measures of countries that have high or low GDP per capita or Rule of Law (columns 2 and 3), we find interestingly that credit supply shocks significantly affected exports of complex services to countries with lower GDP per capita and lower institutional background.

Table 5bis. Estimates on services exported with ΔCredit interacted with tangibility, product complexity and country group measures

GMM Second stage estimates						
	(1)	(2)	(3)	(4)	(5)	(6)
	Complexity	Complexity x Hi/Low RGDPpc	Complexity x Hi/Low Rule of Law	Intangibility	Intangibility X Hi/Low RGDPpc	Intangibility X Hi/Low Rule of Law
ΔCredit x Hi-Complexity	0.328** (0.162)					
ΔCredit x Low-Complexity	0.159 (0.119)					
ΔCredit x Hi-Compl x Low RoL		0.482** (0.189)				
ΔCredit x other		0.184 (0.157)				
ΔCredit x Hi-Compl x Low RGDPpc			0.545*** (0.194)			
ΔCredit x other			0.164 (0.155)			
ΔCredit x Hi-Intangibility				0.451** (0.217)		
ΔCredit x Low-Intangibility				0.229* (0.132)		
ΔCredit x Hi-Int x Low_RGDPpc					0.630** (0.270)	
ΔCredit x other					0.258* (0.144)	
ΔCredit x Hi-Int x Low_RoL						0.629** (0.278)
ΔCredit x other						0.266* (0.145)
Weak identification	64.40	64.71	66.14	37.38	37.19	53.15
Cragg-Donald Wald F Test	7.03	7.03	7.03	7.03	7.03	7.03
10% maximal IV size	7.03	7.03	7.03	7.03	7.03	7.03
Observations	2283	2283	2283	2222	2222	2222

The estimates show GMM-IV regressions (only second stage). The dependent variable is the growth rate of services exports. ΔCredit is the log difference of credit. The IV (Retail_funding) is the log of the ratio between retail funding sources (deposits and banks bonds held by domestic households) over total bank assets. In the first stage this variable is interacted with any of the interacting variables that appear in the table, as explained in what follows. Hi-Int./ Compl. are the dummies for services that have intangibility or of product complexity above the respective median (see section Appendix A.3). Hi/Low-RGDPpc and Hi/Low -RoL are dummies for countries above/below the median of the GDP per capita and the Rule of Law from the World Governance Indicators. "Other" represents the complementary case to any interaction. All estimates include firm controls (Employees, Profitability, Cred_score, Distressed, Capital int., Intangibles, Trade Cred., Ext. Fin and For_Debt), services FE's and country FE's, not reported. All controls and IV's are lagged 1 year (2011). Variables definitions are in Table A.3 in the Appendix. Standard errors (in parentheses) are clustered at service and country level: * p < 0.1, ** p < 0.05, *** p < 0.01.

Secondly, we look at intangibility of services. In general, all services are predominantly intangible, so that borrowing constraints may be binding through limited collateral value of the assets. Nevertheless, to investigate this issue more deeply, we split services into high and low intangibility of their assets using firm level data of listed companies in the US (from ORBIS Bureau van Djck), where intangibility is the ratio of intangible fixed assets over total fixed assets. (see

section 3 in the Appendix). By interacting credit growth with the services intangibility dummies we show that credit supply shocks affect significantly both the exports that have relatively higher or lower rates of intangible assets in the production (column 4), with the magnitude of the high services parameter slightly greater (0.45). Also in this case we further interact credit supply growth with dummies of low real GDP per capita or low Rule of Law. The estimates (column 5 and 6) show that both the coefficients of credit shocks are significant.

Overall, from this group of estimates we derive two main conclusions. First, credit supply shocks affect the exports of services when these are directed to importing countries with a weaker institutional setting, but only for the services requiring higher complexity in production. Secondly, all services are subject to the tyranny of intangibles so that they are affected by credit frictions.

Intangible investment – We analyze further the role of intangibility, by looking at firm investment into this type of capital, which is likely to be an important input for producing and exporting services. Indeed, if a firm has prevalently invested in intangibles, when hit by a credit supply shock it might not be able to offer adequate collateral to keep on borrowing. In this case, exporting services might be affected since this activity requires relevant investment in intangibles. To see this point, in Table 5ter we report estimates where we interact the credit and the IV variable with dummies of firms that have had in the previous years (from 2007 to 2011)²⁶ an average investment rate (investment over capital) above or below the median. Three measures of capital investment are considered: tangible fixed assets, intangible fixed assets and both (=tangibles+intangibles). The results reveal that the effect of credit on services exports growth is significant only for firms that have invested relatively more in intangible capital. This means that even if investment in this form of capital is necessary for exporting of services, it might not provide sufficient collateralizable assets when the firm is hit by a credit supply shock, so that ultimately services exports may be affected.²⁷

²⁶ Since investment is lumpy we take the average values in the previous five years.

²⁷ Finally, it could be that credit is mainly used to finance investment, and that the credit supply shock affects investment primarily rather than services exports. In unreported estimates we do not find any effect on current investment, whether it is in tangible or in intangible assets.

Table_5ter. Baseline estimates using investment rate (2nd stage)

	(1)	(2)	(3)
	Tangibles	Intangibles	All
DCredit x High Tangible Inv.	-1.344 (2.061)		
DCredit x Low Tangible Inv.	0.176 (0.128)		
DCredit x High Intangible Inv.		0.333** (0.144)	
DCredit x Low Intangible Inv.		0.717 (4.261)	
DCredit x High Total Inv.			0.374*** (0.108)
DCredit x Low Total Inv.			6.969 (5.748)
<i>Observations</i>	2283	2283	2283

The estimates show GMM-IV regressions. The dependent variable is the growth rate of services exports. Δ Credit is the log difference of credit. The IV variable is the ratio between retail funding sources and total bank assets. Retail funding is given by the ratio of deposits and banks bonds held by domestic households and bank total assets. In the first stage this variable is interacted with any of the interacting variables that appear in the table, as explained in what follows. High Tangible/Intangible/total Inv. are the dummies for firms that in the period 2007 2011 have had an investment rate (defined respectively on tangible, intangible and total fixed assets) above the respective median (see section Appendix A.3). All estimates include firm controls (Employees, Profitability, Cred_score, Distressed, Capital int., Intangibles, Trade Cred., Ext. Fin and For_Debt), services FE's and country FE's, not reported. All controls and IV's are lagged 1 year (2011). Variables definitions are in Table A.3 in the Appendix. Standard errors (in parentheses) are clustered at service and country level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Multi-product firms – In this subsection we check whether our results may be driven by the presence of firms whose core activity is not in producing services (manufacturers, construction companies, etc...): they are more than 50% of the sample and have a low intensity of services exports (see Table A.5). These features are found also in other countries (see for example, Kelle and Kleinert (2010)). In addition to this, even among services firms there are firms which export services that are different from their main production code. Overall, in our sample about 89% of the firms are multi-product, in the sense that they export at least one service that is not their core activity.

Multi-product firms might use credit for various purposes, and it is likely that the use is concentrated on their core business, such as exporting goods or to differentiate quality of their exports across destinations (Manova and Yu, 2017). Therefore, the risk is to wrongly attribute the effect of credit supply frictions to services exports, rather than to the production and exporting of goods.

Then, we check whether the significant parameter estimates we find on services exports are not driven by the core activities of the firms. In other terms, manufacturing firms might require higher levels of physical assets for the provision of services, so that they might need higher levels of external finance to produce their main product (e.g.: car), rather than the ancillary activity (e.g.: post sale assistance). To this end, we first check whether there are any unobserved sector effects: in Table 6 we repeat the baseline regressions by adding sector fixed effects and the results are

substantially unchanged (column 1): the sign of the effect of credit supply growth on the change of exports of services is positive and different from zero.²⁸ Moreover, since half of the firms in the sample are manufacturers, we repeat the previous exercise by interacting Δcredit with a dummy for manufacturers. The estimates (column 2) show that the effect derives from non-manufacturing firms. Third, since in our dataset two thirds of the firms export also goods, we consider whether the effect of credit supply on services exports depends on whether firms are goods exporters. To this aim, we interact ΔCredit with a dummy equal to 1 if the firm reports goods exports and the complementary dummy for non-exporters of goods. The estimates (column 3) show that credit change still has positive and statistically significant effect, but only for non-exporters of goods, thus revealing that being a goods exporter did not imply a differential reaction on services exports.

Moreover, in column 4 we split firms by the level of services export intensity (given by the ratio of services exports and turnover); given the feature of multi-product firms, this ratio can be interpreted as the intensity of secondary production for most of the firms in the sample (see Table A.5 in the Appendix). The estimates show that the effect of credit is relevant only in firms where the secondary activity is more relevant. Since about 89.8% of firms are multi-product, as already mentioned above, we expect that the effect of credit derives mainly from these firms: column 5 confirms this point. Finally, we repeat the previous exercise by considering multi-product exports: that is, we label as multi product the exports of services that are not the core product of the firm. We find that the significant effect derives from the export of services that are both primary and secondary products (column 6).

In general these estimates show that credit constraints affected the exports of services when these are not the main product of the firm. This phenomenon, known as *servitization*, is diffused among manufacturers of advanced countries (see among others Crozet and Milet, 2017). Our results are coherent with the assumption made by works on multi-product firms that marginal costs increase as one moves away from the product of core competence (Eckel and Neary, 2010; Eckel *et al.*, 2015). Then, the greater marginal costs circumstances could justify credit frictions in these circumstances.

²⁸ Since exports of services are mainly concentrated among big or very profitable firms, for which credit constraints might be less binding, we have also tested whether the effect is stronger among bigger or more profitable enterprises of some particular sectors (Manufacturing, Services, etc...). Unreported estimates results do not show any particular effect and the coefficient of credit change is still significant and positive.

Table 6. Estimates with sector effects, services intensity, goods exports and multi-product

	(1)	(2)	(3)	(4)	(5)	(6)
	Sector FE	Manufacturing	Goods Exports	Services intensity	Multi- product firms	Multi-product exports
Δ Credit	0.318*** (0.121)					
Δ Credit x Manuf. sector		0.254 (1.317)				
Δ Credit x Other sectors		0.371*** (0.102)				
Δ Credit x Goods Exporter ⁽¹⁾			0.298 (3.808)			
Δ Credit x no Goods Export ⁽²⁾			0.378*** (0.107)			
Δ Credit x High Ser. Int. ⁽²⁾				0.418** (0.146)		
Δ Credit x Low Ser. Int. ⁽²⁾				-5.237 (5.586)		
Δ Credit x multi-product firm ⁽³⁾					0.339*** (0.128)	
Δ Credit x single-prod. firm ⁽³⁾					-5.926 (4.455)	
Δ Credit x multi-pr. exports ⁽³⁾						0.406*** (0.139)
Δ Credit x single-pr. exports ⁽³⁾						0.327** (0.128)
Sector FE ⁽⁴⁾	Yes	No	No	No	No	No
F-test	267.17					
(p-value)	(0.000)					
Weak identification Cragg-Donald		96.12	24.16	14.29	44.87	128.80
Wald F Test						
10% maximal IV size		7.03	7.03	7.03	7.03	7.03
Observations	2283	2283	2260	2283	2283	2283

The estimates show 2SLS and GMM-IV regressions (only second stage). The dependent variable is the growth rate of services exports. Δ Credit is the log difference of credit. The IV (*Retail_funding*) is the log of the ratio between retail funding sources (deposits and banks bonds held by domestic households) over total bank assets. In the first stage this variable is interacted with any of the interacting variables that appear in the table, as explained in what follows. (1): “Goods Exporter” is a dummy =1 if the firm exports goods. (2) “High/Low Services intensity” is a dummy for firms with a ratio of services exports over sales above (below) the sample median. (3): Single/multi-product exports are trade flows of the same/different service of the firm core activity. (4): Sectors are defined by NACE Rev. 2 classification. All interacting variables are defined in the year 2011. All estimates include firm controls (Employees, Profitability, Cred_score, Distressed, Capital int., Intangibles, Trade Cred., Ext. Fin and For_Debt), services FE’s and country FE’s, not reported. All controls and IV’s are lagged 1 year (2011). Variables definitions are in Table A.3 in the Appendix. Standard errors (in parentheses) are clustered at service and country level: * p < 0.1, ** p < 0.05, *** p < 0.01.

7. Robustness checks

In this section we comment robustness checks of the identification strategy, mainly dealing with the correction for non-random matching between banks and firms. Other robustness checks are briefly mentioned at the end of this section and the interested reader may find the details in the Online Appendix.

A relevant concern in the identification strategy adopted is the possibility of non-random matching between banks and firms. Recall that our correction consisted of adding fixed effects to isolate demand effects of particular services *or* of particular countries. Paravisini *et al.* (2015) consider the more binding case where banks might be specialized in lending to firms that export particular services *and* to particular destinations. In practice, this means using joint service-country fixed effects, rather than separate service and destination fixed effects. Column 1 of Table 7 shows

that the estimated coefficient is still significant, albeit its magnitude is slightly lower with respect to the baseline specification. A similar concern stems from the possibility that banks might be specialized in lending to firms located in an area where there are many producers or exporters of some given services. To deal with this second possibility of non-random matching we add joint service-geographic area dummies to the baseline specification. Results in columns 2 shows that the estimated coefficient is positive and significant and with a magnitude slightly greater to the analogous estimates in the baseline specification. Results are qualitatively unaffected even when we repeat the previous exercise adding both types of interacted dummies (see column 3).

A second issue regards the definition of the instrument. Defining retail funding over assets implies assuming that bank assets have been quite stable over the period. However, the available evidence shows that these have been affected in a relevant measure by the Sovereign crisis (for example, by the decrease of government bonds prices). Therefore, in column 4 the instrument is defined as share of domestic retail funding on *total* funding. This alternative definition also avoids any concern about potential endogeneity between bank total assets and credit granted. Even in this case the estimated coefficients of the elasticity of credit supply are statistically significant and positive, as expected.

Table 7. Estimates with interacted dummies (services&country, services&area) and with share of retail funding

Panel A: 2SLS Second stage estimates			
	Service & Country dummies	Service & Area dummies	Service & Country dummies and Service & Area dummies
	(1)	(2)	(3)
ΔCredit	0.230* (0.132)	0.301* (0.159)	0.353** (0.164)
Service FE	No	Yes	No
Country FE	No	Yes	No
Serv.&Coun. FE	Yes	No	Yes
Serv.&Area FE	No	Yes	Yes
			IV: Share of Retail Funding
			(4)
			0.219** (0.107)
			Yes
			Yes
			No
			No
Panel B: First stage estimates			
Retail_fund/Assets	1.668*** (0.145)	1.571*** (0.127)	1.575*** (0.140)
Retail_fund/Total Funding			2.054*** (0.142)
R ²	0.546	0.619	0.639
F test	133.11	152.31	126.82
(p-value)	(0.000)	(0.000)	(0.000)
Observations	2283	2283	2283

The estimates show 2SLS regressions. The dependent variable is the growth rate of services exports. ΔCredit is the log difference of credit. The IV variable in columns 1 to 3 is the ratio between retail funding sources and total bank assets; in column 4 it is the share of retail funding over total funding. Retail funding is given by deposits and banks bonds held by domestic households. Assets are bank total assets. Total Funding includes also bank funding from the interbank market and from foreign retail depositors. All estimates include firm controls (Employees, Profitability, Cred_score, Distressed, Capital int., Intangibles, Trade Cred., Ext. Fin and For_Debt), not reported. All controls and IV's are lagged 1 year (2011). Variables definitions are in Table A.3 in the Appendix. Standard errors (in parentheses) are clustered at service and country level: * p < 0.1, ** p < 0.05, *** p < 0.01.

Finally, here we shortly mention other robustness checks that corroborate our main analysis and that are reported with more detail in the Online Appendix. In detail, we make estimates: in

different periods; adding a firm dummy to capture credit demand; at firm level, including also goods exports; with additional instrumental variables; using a different definition of credit; using imports of services as dependent variable.

8. Conclusions

While the empirical literature on trade in services has grown considerably in the last decade highlighting the relevance of firms' heterogeneity and restrictive regulation, very few papers, if any, have analyzed in detail the role of financial frictions for exporting of services.

Despite services requiring less capital investment than goods, services may be highly dependent on external finance as well. In fact, they are intensively produced with intangible capital and on dedicated investments on product customization. These features make services likely to be subject to credit frictions.

We fill this gap in the literature by showing that credit supply shocks have a sizeable and significant effect on the exports of services. We use matched bank-firm data and firm level data on service transactions to examine the relationship between credit supply and service exports of Italian firms during the years when the sovereign debt crisis was most acute. We find a significant and positive effect of credit supply variation on the growth rate of exports in services of Italian firms. .

Overall, we make various contributions to the literature. First, we show empirically that credit frictions may play an important role for firms exporting services. Secondly, when focusing on multi product firms, we find that credit shocks affect the exports of secondary products (servitization) more than the core product of the firm. Thirdly, the effects of credit shocks are especially relevant for exporting services to countries where institutions are weaker, and, consequently, the counterparty contractual risk is greater. Lastly, we further show that credit frictions matter more for firms exporting complex services in countries with weaker institutions or lower GDP per capita.

These findings have relevant implications for the role of credit frictions in the international global value chains, where services traded internationally and multi-product firms have an increasing role.

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Appendix

A.1 *Short description of Direct Reporting*

The Direct Reporting (section TTN) is a survey on trading services held by the Bank of Italy. The sample of firms is composed by two groups: in the first group there are firms that have been signaled by financial intermediaries for having made cross border transactions; in the second group there are other firms that have not been signaled. The survey is built using a cut-off approach: there are two thresholds of firms' turnover which determine whether firms are surveyed or not. The lower threshold is 10 million of euros for both groups: firms with a turnover below this threshold are not included in the survey. The upper threshold varies every year in order to make the sample stable over time and it is different between the two groups. In 2012 the "high turnover" threshold was 100 million of euros for the first group and 250 million for the second group. In both groups, firm between the two thresholds are sampled with random extraction from the relevant subpopulation. All firms above the upper threshold are selected. Selected firms have a legal obligation to answer to the TTN questionnaire. For more detail, see Federico and Tosti (2016).

A.2 *Sample restrictions*

We apply some restrictions to our datasets, explained in detail as follows.

- 1st We limit our analysis to non-financial firms by dropping from the DR sample companies with NACE Rev. 2 code equal to 65, 66 and 67 (e.g: financial and insurance companies). With this restriction we lose about 1% of the observations.
- 2nd We winsorize the bottom and top 1% percentiles of the export values in order to avoid that our results are driven by outliers.²⁹
- 3rd We restrict the sample to firms that obtain loans from at least two banks. Single-bank firms amount to just 8.6% of the total observations.
- 4th Finally, we drop destination countries that are tax havens,³⁰ international organizations (such as IMF, etc.) or rare destinations (countries with an overall frequency lower than 10). Overall this causes a drop of 10% of the observations.

²⁹ Results showed in the paper hold when both trimming at 1% or not applying any restriction even if, instead of winsorizing (results are available on request).

³⁰ Tax havens are excluded from the analysis because the transactions with these countries might be more motivated by tax avoidance, than reflecting actual demand of services provision from these countries. Excluded countries are the ones listed in the Financial Secrecy Index (FSI) of the Tax Justice Network, with the exception of countries that are members of the EU, of the OECD and the BRICS countries.

After all these restrictions we are left with a database of about 9,000 observations, with 482 exporting services firms and 72 bank groups; on average each firm borrows from 6.2 banks, exports 2,6 services to 19.4 countries.

A3. *Indicators of services intangibility and of product complexity*

Production complexity – Naghavi *et al.* (2015) build measures of production complexity using the intensity of problem solving tasks in each occupation, where occupations are classified with the System of Occupations Classification (SOC). They use data on complex problem solving skills from the U.S. Department of Labor's Occupational Information Network (O*NET). From SOC they convert these measures into NACE Rev. 1.1 at two digit.

We convert their production complexity measures from NACE Rev. 1.1 to NAICS 2002 at two digit using the correspondence tables provided by the Census Bureau. Then, from NAICS 2002 we convert them to EBOPS 2002 using the correspondence table provided by E. Van der Marel. At this point for each service we take the simple average of the complexity index. Finally, we match these measures with services trade data.

Intangibility – Intangibility of assets has been computed on ORBIS Bureau van Djck data on US listed firms between 2008 and 2011. For each firm we compute intangibility as the sum of intangible fixed assets in the four years divided by the sum of total fixed assets in the same period. We take the average of the intangibility rate and the sum of total sales at sector level, using the NAICS 2002 classification at four digit. Then, we convert both intangibility and total sales from NAICS 2002 at 3 digit into the EBOPS 2002 services classification system, using the correspondence table provided by E. Van der Marel (<https://sites.google.com/site/erikvandermarel/links>). Finally, we take the weighted average of intangibility in each EBOPS 2002 service category using total sales.

Table A.1. Sectoral measure of External Financial Dependence (EFD)

Macro-sector	Isic Rev. 3	Description	EFD
Services	62	Air transport	1.27
Services	75	Public administration and defence; compulsory social security	1.26
Services	50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	1.12
Utilities	40	Electricity, gas, steam and hot water supply	1.07
Services	55	Hotels and restaurants	0.84
Manufacturing	35	Manufacture of other transport transport equipment	0.69
Services	60	Land transport; transport via pipelines	0.53
Manufacturing	20	Manufacture of wood and of products of wood and cork, except furniture;	0.51
Manufacturing	28	Manufacture of fabricated metal metal products, except machinery and equipment	0.51
Services	53	Wholesale trade, retail and commission trade, except of motor vehicles and motorcycles	0.46
Manufacturing	33	Manufacture of medical, precision precision and optical instruments, watches and clocks	0.40
Manufacturing	27	Manufacture of basic metals metals	0.33
Primary	14	Other mining and quarrying quarrying	0.25
Manufacturing	19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.25
Services	64	Post and telecommunications	0.16
Manufacturing	26	Manufacture of other non-metallic non-metallic mineral products	0.13
Services	85	Health and social work	0.13
Manufacturing	18	Manufacture of wearing apparel; apparel; dressing and dyeing of fur	0.09
Construction	45	Construction	0.08
Manufacturing	32	Manufacture of radio, television television and communication equipment and apparatus	0.07
Manufacturing	23	Manufacture of coke, refined refined petroleum products and nuclear fuel	0.05
Services	93	Other service activities	0.05
Manufacturing	15	Manufacture of food products products and beverages	-0.02
Manufacturing	21	Manufacture of paper and paper products	-0.04
Services	90	Sewage and refuse disposal, disposal, sanitation and similar activities	-0.10
Services	80	Education	-0.14
Manufacturing	24	Manufacture of chemicals and chemical products	-0.17
Manufacturing	29	Manufacture of machinery and equipment n.e.c.	-0.20
Manufacturing	31	Manufacture of electrical machinery machinery and apparatus n.e.c.	-0.23
Manufacturing	17	Manufacture of textiles	-0.43
Manufacturing	34	Manufacture of motor vehicles, vehicles, trailers and semi-trailers	-0.45
Primary	13	Mining of metal ores ores	-0.54
Manufacturing	36	Manufacture of furniture; manufacturing manufacturing n.e.c.	-0.59
Services	63	Supporting and auxiliary transport transport activities; activities of travel agencies	-0.62
Services	74	Other business activities	-0.67
Services	92	Recreational, cultural and sporting sporting activities	-0.86
Manufacturing	25	Manufacture of rubber and plastics products	-0.96
Services	72	Computer and related activities activities	-1.30
Services	70	Real estate activities	-1.55
Manufacturing	22	Publishing, printing and reproduction reproduction of recorded media	-1.68

Source: Catão et al. (2009).

Table A.2. Classification of service types

Service	(EBOPS ¹ 2002) code	Percentage of total ⁽²⁾
Communications services	245	
Postal Services	246	3.3%
Courier Services	246	0.1%
Telecommunication services	247	9.5%
Computer and information services	262	
Computer Services	263	9.0%
News agency services	889	0.0%
Other information provision services	890	0.6%
Other business services	268	
Other trade-related services	271	3.6%
Operational leasing services	272	1.9%
Legal Services	275	0.1%
Accounting, auditing, book-keeping and tax consulting services	276	2.6%
Business and management consultancy, public relations services	277	6.2%
Advertising, market research and public opinion polling	278	11.7%
Research and development services	279	2.5%
Architectural, engineering and other technical consultancy	280	10.4%
Waste treatment and depollution	282	0.0%
Agricultural services	283	0.0%
Mining and on-site processing services	283	0.4%
Other miscellaneous business, professional and technical services	284	26.7%
Services between affiliated enterprises, n.i.e.	285	10.5%
Personal, cultural and recreational services	287	
Education Services	895	0.9%
Health services	896	0.0%
Other	897	0.1%

(1): Extended Balance of Payments Services classification 2002. (2): percentages are computed on years 2011 and 2012.

Table A.3. Variables description

Variable name	Description	Source
Exports of services	Log of services exports	Direct Reporting
Credit	Log of credit granted to the firm	Credit Register
Retail funding ⁽¹⁾	Log of 1 + the ratio of retail domestic deposits and bonds held by the households over total bank assets ⁽²⁾	Supervisory Reports
Low_Capit. ⁽¹⁾	Dummy equal to 1 if bank's total capital ratio is above 10%	Supervisory Reports
Mainbank	Dummy equal to 1 if the bank is the main lender of a firm	Credit Register
Employees	Log of the number of employees	CADS ⁽³⁾
Profitability	Log of 1 + EBIT/Assets	CADS ⁽³⁾
Cred_score	Log of 1 + Credit Score variable ⁽⁴⁾	CADS ⁽³⁾
Distressed	Dummy equal to 1 if firm leverage is above the sample median	CADS ⁽³⁾
Capital intensity	Log of 1 + the ratio of the stock of capital over employees	CADS ⁽³⁾
Intangibles	Share of intangible assets over the sum of tangibles and intangibles	CADS ⁽³⁾
Trade Credit	Log of 1+ trade credit	CADS ⁽³⁾
Ext. Fin	Log of 1+ the ratio between the external financial resources and the capital expenditure	CADS ⁽³⁾
For_Debt	Log of 1+ the ratio between total firm external financial resources from foreign sources (banks, trade debt and intra-group finance) and total debt	Direct Reporting
Exports of goods	Log of goods exports	CADS ⁽³⁾
Investment rate	Log of 1+ the ratio between investment and total assets	CADS ⁽³⁾

(1): the variables are weighted with the share of banks' lending to the firms; (2) in the alternative definition the denominator is given by total funding by both domestic and foreign depositors (wholesale and retail) plus the total amount of bank bonds; (3): Company Accounts Data Service; (4): the original variables takes integer values from 1 to 9, where higher values mean a higher probability of default.

Table A4. Summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
ΔExports of services ⁽¹⁾	482.0	0.01	1.23	-8.64	4.90
ΔCredit ⁽¹⁾	482.0	0.0	0.2	-0.8	4.1
Employees ⁽¹⁾	441	1,589.3	7,827.9	5.0	146,178.0
Profitability (EBIT)	441	2,432,563.0	272,545.9	1,749,436.0	6,973,078.0
Cred_score ⁽¹⁾	441	4.3	1.95	1	9
Distressed ⁽¹⁾	441	0.61	0.49	0	1
Capital Intensity ⁽¹⁾	407	199.2	702.5	0.6	12,444.2
Intangibles ⁽¹⁾	441	0.27	0.30	0	1
Trade Credit ⁽¹⁾	441	146,185.5	422,541.0	54.0	5,201,734.0
Ext. Fin ⁽¹⁾	441	0.88	0.02	0.6	0.9
For_Debt ⁽¹⁾	193	142.7	199.0	0.0	1,131.1
ΔExports of goods ⁽¹⁾	441	0.03	0.85	-6.47	7.04
Investment rate ⁽¹⁾	271	0.0	0.1	0.0	0.7
Retail funding ⁽²⁾	1,652	0.51	0.39	0.00	6.88
Gov_Bonds ⁽²⁾	1,981	0.10	0.26	0.00	5.19
Low capitalization ⁽²⁾	2,028	0.06	0.23	0.00	1.00
Mainbank ⁽²⁾	2,028	0.18	0.38	0.00	1.00
Foreign banks ⁽²⁾	2,028	0.01	0.08	0.00	1.00

(1): Variables are defined at firm-year level. (2): variables are defined at bank-firm-year level.

Table A.5. Services intensity by sector in 2011

	Sector code (Nace Rev.2 2 digit)	Sector description	Services export Intensity ⁽¹⁾
Top 25%	35	Electricity, gas, steam and air conditioning supply	87.88%
	96	Other personal service activities	85.17%
	92	Gambling and betting activities	65.26%
	71	Architectural and engineering activities; technical testing and analysis	47.11%
	26	Manufacture of computer, electronic and optical products	44.92%
	49	Land transport and transport via pipelines	29.76%
	72	Scientific research and development	18.06%
	93	Sports activities and amusement and recreation activities	16.38%
	42	Civil engineering	15.26%
	61	Telecommunications	14.61%
	43	Specialised construction activities	14.46%
	77	Rental and leasing activities	14.44%
	74	Other professional, scientific and technical activities	13.07%
	22	Manufacture of rubber and plastic products	12.75%
	81	Services to buildings and landscape activities	12.63%
Bottom 75%	60	Programming and broadcasting activities	1.86%
	32	Other manufacturing	1.82%
	17	Manufacture of paper and paper products	1.26%
	16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1.24%
	41	Construction of buildings	1.09%
	78	Employment activities	0.69%
	19	Manufacture of coke and refined petroleum products	0.52%
	86	Human health activities	0.46%
	47	Retail trade, except of motor vehicles and motorcycles	0.38%
	1	Crop and animal production, hunting and related service activities	0.38%
	84	Public administration and defence; compulsory social security	0.32%
	33	Repair and installation of machinery and equipment	0.31%
	56	Food and beverage service activities	0.23%
	38	Waste collection, treatment and disposal activities; materials recovery	0.10%
	36	Water collection, treatment and supply	0.09%

(1): Services Intensity is defined as the ratio between services exports and turnover. Source: Direct Reporting.