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A survey of empirical studies using firm level data**

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Abstract

Business managers are well aware of the fact that credit constraints can hamper or even prevent exporting. Economists only recently started to incorporate these arguments in theoretical models of heterogeneous firms and to test the implications of these models econometrically with firm-level data. Starting with the pioneering study by Greenaway, Guariglia and Kneller (*Journal of International Economics*, 2007) a growing number of empirical papers looked at the links between financial constraints and export activities using data at the level of the firm. This paper presents a tabular survey of 32 empirical studies that cover 14 different countries plus five multi-country studies. The big picture can be summarized as follows: Financial constraints are important for the export decisions of firms – exporting firms are less financially constrained than non-exporting firms. Studies that look at the direction of this link usually report that less constraint firms self-select into exporting, but that exporting does not improve financial health of firms. The paper argues that the results at hand should not be considered as stylized facts that can guide policy makers in an evidence-based way and suggests a strategy to further improve our knowledge in this area.

JEL classification: F14

Keywords: Credit constraints, exports, empirical studies, literature survey

1. Motivation

Business managers are well aware of the fact that credit constraints can hamper or even prevent exporting. The reason is that exporting involves extra costs to enter foreign markets (e.g., for the acquisition of information about a target market, for the adaptation of products to foreign legal rules or local tastes, for instruction manuals in a foreign language and for setting up a distribution network) that often have to be paid up front and that to a large extent are sunk costs. Firms need sufficient liquidity to pay for these costs, and constraints in the credit market may be binding. Furthermore, it tends to take considerably more time to complete an export order and to collect payment after shipping compared to a domestic order, and this increases exporters' working capital requirement. The higher risk of export activities (including exchange rate fluctuations and the risk that contracts cannot be as easily enforced in a foreign country) adds to these liquidity requirements. Therefore, whether a firm is financially constrained or not can be considered as one of the characteristics of a firm that are relevant for the decision to export.

While this is common knowledge for practitioners, economists only recently started to incorporate these arguments in theoretical models of heterogeneous firms and to test the implications of these models econometrically with firm-level data. Chaney (2013), Muuls (2008) and Manova (2013) introduce credit constraints into the seminal model of heterogeneous firms and trade by Melitz (2003) to discuss the role of these frictions for the export decision.¹ In the Chaney (2013) model firms must pay extra costs in order to access foreign markets, and if they face liquidity constraints to finance these costs, only those firms that have sufficient liquidity are able to export.

¹ A detailed discussion of the theoretical models is far beyond the scope of this empirical paper; for a synopsis see Egger and Kesina (2010) and Minetti and Zhu (2011).

The Muuls (2008) model has the same implication – firms are more likely to be exporters if they are less credit-constrained. In the Manova (2013) model firms that are more affected by credit constraints participate less likely in export markets, and if they do, they export less.

The basic idea that financial constraints matter for the export decision of a firm and the implications of the recent formal theoretical models are taken to firm level data in a number of micro-econometric studies for developed and developing countries. This paper surveys these studies and puts the results into perspective.

2. A survey of empirical studies on financial constraints and exports at the firm level

Starting with the pioneering study by Greenaway, Guariglia and Kneller (2007) a growing number of empirical papers looked at the links between financial constraints and export activities using data at the level of the firm². Table 1 is a tabular survey of 32 empirical studies that cover 14 different countries plus five multi-country studies.³

² Firm refers here to either the local production unit (establishment) or the legal unit (enterprise).

³ The tabular survey does not include studies with aggregate data by Manova (2013), Jaud et al. (2009), Chor and Manova (2012), Alvarez and Lopez (2013) and Felbermayr and Yalcin (2013). Furthermore, the following studies that use firm-level data to investigate related but different topics are excluded: Campa and Shaver (2002) use a sample of Spanish manufacturing firms to show that exporters' cash flows and capital investments are more stable than non-exporters' and find that liquidity constraints are less binding for exporters than for non-exporters. Bridges and Guariglia (2008) use U.K. firm level data to look at the effects of financial variables on firms' failure probabilities, differentiating firms into globally engaged (exporting or foreign owned) and purely domestic. They find that lower collateral and higher leverage result in higher failure probabilities for purely domestic than for globally engaged firms. They interpret this as evidence that global engagement shields firms from financial constraints. Buch et al. (2009) use German firm level data to analyze the impact of financial constraints on the decision to engage in foreign direct investment and on foreign affiliate sales. Damijan, Kostevc and Polanec (2010) investigate the causal relationship between the extent of external debt financing and the intensive margin of exports for firms of different size in Slovenia. They

As of today, we have evidence for countries that differ widely in the level of economic development. While the studies use different measures of financial constraints and apply different econometric methods to investigate the links between these constraints and export activities, the big picture⁴ can be summarized as follows: Financial constraints are important for the export decisions of firms – exporting firms are less financially constrained than non-exporting firms. Studies that look at the

find evidence that taking on any additional finance help firms to expand exports. Guariglia and Mateut (2010) use a panel of UK firms to investigate the role of financial constraints for inventory investments. They find, inter alia, that firms that do not export and are not foreign owned exhibit higher sensitivity of inventory investments to financial constraints. Bas and Berthou (2011) study how financial constraints affect the decision of firms to import foreign technology embedded in capital goods. They use firm panel data from India and confirm the important role of financial factors. Badinger and Url (2013) use data for 178 Austrian exporting firms for the year 2008 to investigate the impact of export guarantees and find that the use of these guarantees have a large positive effect on firm-specific export performance. Eck et al. (2012) investigate the role of trade credits (that are extended bilaterally between firms and exist in the form of supplier credits and cash in advance) and find that these credits have a positive impact on German firms' exporting and importing activities. Felbermayr et al. (2012) study the firm-level performance effects of export credit guarantees underwritten by the Federal Republic of Germany in 2000 to 2010; they report sizable positive causal effects of guarantees on sales growth and employment growth. Görg and Spaliara (2012) investigate the probability of firm survival conditional on, inter alia, financial constraints and various forms of engagement in exports (none, starter, stopper, switcher, continuous exporters) with data for the UK and France. They find that export starters and exiters experience much stronger adverse effects of financial constraints for their survival prospects. Nakhoda (2012) uses firm-level panel data from 27 countries across Central and Eastern Europe and Central Asia collected in the World Bank's Business Environment and Enterprise Performance Surveys (BEEPS). He finds that financial leverage does not inhibit firms which export only from becoming a two-way trader (exporter and importer), but it does inhibit firms which import only or operate only within the national market to become a two-way trader.

⁴ There are a few notable exceptions, see Stibale (2011) for France, Arndt et al. (2012) for Germany, Lancheros and Demirel (2012) for India and Akarim (2013) for Turkey; note that other studies using data for France, Germany and India report results that are in line with the big picture of a negative link between credit constraints and export activities.

direction of this link usually⁵ report that less constraint firms self-select into exporting, but that exporting does not improve financial health of firms.

[Table 1 near here]

3. Discussion

A bird's eye view on the literature on credit constraints and exports that emerged since the pioneering study by Greenaway, Guariglia and Kneller (2007) suggests that financial constraints are important for the export decisions of firms – exporting firms are less financially constrained than non-exporting firms – and that less constrained firms self-select into exporting, but that exporting does not improve financial health of firms. Can these findings be considered as a basis to discuss the need for policy measures that aim to improve access to credits for firms that intend to start or to expand export activities at the extensive or intensive margins? From my reading of the literature, the answer should be “no”. To guide policy makers in an evidence-based way stylized facts are needed that are valid over time and space (or at least for a selected country). Empirical evidence from the studies surveyed in this paper does not pass this test for four reasons:

- First, given that financial constraints are not directly observable for an applied econometrician who works with data for a sample of firms, empirical research has to rely on indirect measures. From Table 1 it is obvious that the way credit constraints are measured does differ widely across the studies listed. Therefore, results from these studies are not comparable. Furthermore, there is evidence that

⁵ An exception is the study by Greenaway, Guariglia and Kneller (2007) for the UK that reports an opposite result.

not all measures for financial constraints used can be considered as valid measures. Farre-Mensa and Ljungqvist (2013) recently evaluated how well five popular measures from the finance literature (that are based on balance-sheet data and that have been used in some of the studies listed in Table 1, too) identify firms that are financially constrained. They report that none of these five measures identifies firms that behave as if they were constrained.

An alternative way to measure credit constraints that has been used in studies for Belgium (Muuls 2008 and 2012), Germany (Wagner 2014) and Italy (Secchi, Tamagni and Tomasi 2011; Tamagni 2013) is the use of a credit rating score supplied by a credit rating agency. Compared to other widely used measures that are based on balance sheets information or subjective assessments collected in surveys, this score mirrors the credit market experts' view on the creditworthiness of a firm, and it is heavily relied upon by banks and firms in their day-to-day decisions. Usually a score is based on a number of firm characteristics, including liquidity, turnover, capital structure, information on payment behavior, legal form, industry, firm age, productivity and firm size. Muuls (2008) argues that although the score is clearly endogenous to the firm's performance and characteristics, it is not directly affected by its exporting behavior, given that exports are not used in constructing the index. Important advantages are that the score is determined independently by a private firm, is firm-specific, varies over time on an annual basis and allows for a measure of the degree of credit constraints rather than classifying firms as constrained or not. Given that evidence on the link between exports and credit constraints that is based on credit scores is hitherto limited to three (highly developed) countries empirical results at hand should not be considered as stylized facts.

- Second, results are not comparable across studies due to differences in the empirical models used. Any comparison that goes beyond a qualitative comparison of results for different countries or time periods and that looks at the size of the effects can only be based on results from identically specified empirical models that use the same type of data.
- Third, results are limited due to the availability of sound measures of credit constraints for smaller firms (that form the bulk of firms that do not yet export and that might be hit hardest by credit constraints).
- Fourth, the number of export status switchers in the samples used often tends to be small and the time span the data are available for usually is not long enough to investigate the direction of causality between exporting and credit constraints in a convincing way or to apply panel econometric methods to control for unobserved time-invariant firm characteristics.

Therefore, the results at hand should not be considered as stylized facts that can guide policy makers in an evidence-based way. One way to proceed⁶ would be to analyze in one study different data sets from different periods of time and/or different countries, and to perform what is called a *within-study replication* (Hamermesh 2007, p. 730). This approach of within-study replication is especially attractive. If work is done by a single researcher (or a single research team) the chances that all the details of the empirical study are identical (or at least very similar) across the data sets tends to be quite high. In most cases, however, firm level data are strictly confidential, and as a rule these data can only be used on computers located inside the statistical agencies that are in charge of collecting the data. The data cannot cross borders, and often they cannot be accessed by citizens

⁶ For a comprehensive discussion of this topic see Wagner (2011)

of a foreign country (who are not liable to jurisdiction in case of violation of privacy in the country where the data are located). Within-study replication using firm level data from various countries, therefore, usually cannot be performed by one author (or a team of authors) from one country.

A way out is to form a team of researchers who are located in different countries, each of whom does have access to firm level data from her or his country, to agree on a unified empirical approach, and to perform a within-study replication where strictly comparable results for each country are produced by the author(s) from that country. Some years ago, teams of researchers from some 15 countries joined to form the *International Study Group on Exports and Productivity* and to apply the approach of within-study replication using confidential firm level longitudinal data from various countries. The study looks at cross-country differences in exporter productivity premia estimated by using comparable data and a unified empirical approach (ISGEP 2008). This approach might act as a template for future research in the links between financial constraints and exports that might help to generate the stylized facts needed to inform both scientific research and policy makers in an evidence-based way.⁷

⁷ Researchers interested in forming a network to proceed in the suggested direction should contact me.

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Table 1: Empirical studies on exports and financial constraints with firm-level data

Country Authors (Year)	Data	Measures of financial constraints	Methods	Important findings
Argentina				
Espanol (2007)	Data for sample of manufacturing firms, 1992, 1996, 1998, 2001	Dummy indicating whether firm was inhibited to innovate because of financial restrictions (1998-2001); proportion of innovation financed by banking system (1992-1996)	Probit	Access to financial markets and not facing financial restrictions to innovate have positive impact on export decision
Castagnino, D’Amato and Sangiácomo (2012)	38,207 firms, 2001 - 2006	Firms debt with domestic banks and with foreign creditors (assume firms without access to bank financing are rationed)	Descriptive statistics, probit	Having more access to bank credit facilitates firms’ entry into export markets. Access to foreign financing seems to matter for success in foreign markets
Belgium				
Muuls (2008)	Trade and balance sheet data for manufacturing firms 1999 - 2005	Yearly measure of credit-worthiness of firms from a credit insurer (Coface International)	Descriptive statistics; linear probability model with / without fixed firm effects, fixed-effects OLS	Firms more likely to be exporters if they have higher productivity levels and lower credit constraints. Credit constraints important for extensive but not for intensive margin of trade in terms of destinations
Muuls (2012)	Manufacturing firms, 1999 – 2007	Credit score measure (as in Muuls 2008)	Descriptive statistics; linear probability model with / without fixed firm effects , fixed-effects OLS	Firms with lower credit constraints more likely to exports and import, export and Import more, and more products to and from more countries

China

Du and Girma (2007)	Data for domestic private firms from manufacturing, 1999 - 2002	Bank loans normalized by total assets	IV-Tobit	Access to bank loans is associated with greater export market orientation
Li and Yu (2009)	Firm-level data from manufacturing, 2000 - 2007	Firm's interest expenditures used as proxy for firm's capacity to borrow	OLS, fixed-effects, Poisson pseudo-ML fixed-effects, IV fixed-effects	Firms with fewer credit constraints export more
Egger and Kesina (2010)	Census data for firms, 2001 – 2005 (average values over years used)	Long-run dept-to-capital ratio, financial-costs-to-liquid-funds ratio, liquid-asset-to-capital ratio, ratio of surplus of profits over long run debts to total assets	Logit, fractional logit	Credit constraint firms are less likely to export and have lower shares of exports in total sales
Manova, Wei and Zhang (2011)	Customs data for all internationally active firms, 2005	Financial vulnerability measured at sector level (average over the 1980-1999 period for median U.S. firm in each sector)	Firm fixed-effects for firms active in more than one sector	Limited credit availability hinders firms' trade flows (export sales, export product scope, number of export destinations)
Czech Republik				
Manole and Spatareanu (2010)	Sample of 365 manufacturing firms, 1994-2003	Cash flow, liquidity ratio, leverage ratio	Fixed-effects OLS, system GMM IV	Exporters less financially constrained; less constrained firms self-select into exporting, but exporting does not alleviate firms' financial constraints

Egypt

Kiendrebeogo and Minea (2012)

Unbalanced panel of 2,387 manufacturing firms from World Bank's Enterprise Surveys database, 2003 – 2008

Self-assessment indicators of financial constraints; composite indicator of financial health, based on ratio of net income to total assets and share of new investment financed by equity; credit related variables in a robustness check

Pobit (pooled, random effects, dynamic random effects) for export participation; OLS fixed effects, Amemiya-MaCurdy, system GMM for export/sales ratio; Gamma RE and Normal RE for hazard rate of export start

Financial constraints reduce export participation, and have a negative impact on export intensity and the hazard rate of entry into exporting

France

Bellone, Musso, Nesta, Schiavo (2010)

Balance sheet data and DIANE database for manufacturing Firms, 1993 - 2005

Liquidity ratio, leverage ratio, index based on seven variables (size, profitability, liquidity, cash flow generating ability, solvency, trade credit over total assets, repaying ability)

OLS, random effects probit, dynamic GMM, discrete time duration model, Heckman Two-step model

Export starters have a significant ex ante financial advantage compared to non-exporters. No significant improvement in financial health of firms that started to export

Askenazy, Caldera, Gaulier and Irac (2011)

Customs data; profit and loss data; balance sheet data. Firms from manufacturing, 1995 - 2007

Liquidity ratio; inverse trade credit ratio; equity to asset ratio; dummy indicating whether firm has defaulted to its trade creditors

Negative binomial models

Credit constraints have negative influence on number of newly served destinations. Higher probability of export exit associated with credit constraints

Stiebale (2011)

Sample of firms from manufacturing from AMADEUS, 1998 – 2005

Liquidity ratio, long term debt / total assets, short term debt / current assets, cash flow / capital, earnings before interest and tax payments / interest payment

Dynamic probit, GMM, dynamic random effects Tobit

No evidence that financial constraints matter for export decision

Bellone, Bernini, Guillou and Schiavo (2013)	Customs and balance sheet data, 1997 – 2007	Firms' leverage (total debt over total assets), coverage ratio (pre-tax profits over interest rates payments), Musso and Schiavo score	Pooled OLS and FE (IV)	Financially healthier exporters sell expensive varieties on foreign markets
Germany				
Buch, Kesternich, Lipponer and Schnitzer (2010)	Enterprise level data from Dafne and MiDi, 2002 – 2006	Cash flow, debt ratio	Probit, OLS (no fixed effects models)	Positive impact of cash flow on probability to export and export volume; debt ratio insignificant.
Arndt, Buch and Mattes (2012)	Establishment level data; cross-section for 2004/2005	Self-reported financial constraints (from interview)	Two-step Heckman selection model	Self-reported financial constraints have no impact on firms' internationalization decisions
Wagner (2014)	Enterprise level data, 2007 – 2009	Credit-rating score by leading credit rating agency	Probit and fractional logit models	Positive but weak link between credit-rating score and exports. Weak evidence that credit-constrained firms are less likely to start to export. No evidence of difference in scores between firms that stopped to export and continuous exporters.
India				
Ito and Terada-Hagiwara (2011)	Sample of 6,000 manufacturing firms, 1996 – 2008	Cash flow / total assets, debt-to-asset ratio, ratio of retained profits to total assets	Random effects probit, OLS	Firms with higher amount of net cash flow and smaller debt-to-asset ratios are more likely to become exporters

Nagaraj (2011)	Balance sheet and financial statement data, manufacturing firms, 1989-2008	Liquidity = (Current Assets - Current Liabilities) / Total Assets; Leverage = Short term debt / Current Assets	Probit, IV-GMM, system GMM	New exporters have better financial health than non-exporters; financial health cause, not effect of exports. Share of exports in total sales not dependent on financial health.
Lancheros and Demirel (2012)	Indian service firms, 1999 – 2007	Stock of long-term debt over total assets; flow of short-term borrowing over total assets	IV Probit and Tobit; system GMM	No evidence that access to any particular source of finance influences the decision to export or the amount exported
Italy Forlani (2010)	Small and medium enterprises, 1998 - 2000, 2001-2003 (two cross sections)	Firms clustered into different groups according to their relative level of leverage	Probit, OLS	Probability of export start affected by cash stock for constrained firms. Exporters that increase number of destinations show higher liquidity. No evidence that export start improves firm's financial health
Minetti and Zhu (2011)	Sample of 4,680 manufacturing firms, 2001	Binary indicator based on answer to survey question about denied credits	Descriptive statistics, probit, bivariate probit, IV probit, OLS, 2SLS	Probability of exporting and foreign sales lower for credit rationed firms
Secchi, Tamagni and Tomasi (2011)	Customs information on exports plus register data for manufacturing firms, 2000 – 2003	Official credit rating issued by an independent institution (used after transformation into a dummy variable for constrained / unconstrained firms)	Descriptive statistics; 2-stage Heckman-type procedure for panel data models	Limited access to external capital narrows scale of foreign sales, exporters' product scope and number of trade partners

Caggese and Cunat (2013)	Sample of small and medium manufacturing firms, 1995 – 2003	Binary indicator based on answers to survey questions about credits; various instruments measuring regional financial development and based on relationship lending literature	IV regressions	Constraint firms are less likely to export when financing constraints are instrumented. Financial constraints do not affect percentage of sales exported. Financing constraints affect negatively number of export destination regions.
Ciani and Bartoli (2013)	7,436 small and medium sized firms, 2002-2010	Binary indicator based on answer to survey questions about denied credits; credit rating score	Probit, OLS, ordered probit, IV	Credit constraint firms are less likely to increase output quality for export market. Credit constraints important for extensive and intensive margins.
Tamagni (2013)	Population of limited firms in manufacturing, 2000 – 2003	Credit rating score, perceived as an official rating	Heckman type 2-stage approach for panel data with selection	Limited access to external capital narrows scale of foreign sales, exporters' product scope and number of trade partners
Portugal Silva (2011)	Panel of manufacturing firms, 1996 - 2003	Approximation of credit constraints by financial score built on eight variables based on balance sheet information	Propensity score matching with difference in differences	New exporters show significant improvements in their financial situation
Sweden Halldin (2012)	Panel of manufacturing Firms, 1997 – 2006	Degree of collateralizable assets	Probit (pooled cross-section, random effects panel probit)	Tangible assets are an important determinant of export entry
Thailand Cole, Elliott and Virakul (2010)	Manufacturing firms, 2001 – 2004	Liquidity ratio, leverage ratio	Pooled probit	Financial health has a significant influence on a firm's export decision

Turkey

Akarim (2013)	Firms traded at ISE Stock Exchange, 2000- 2011	Financial variables (total short term debt over total debts or total assets; leverage ratio, etc.)	Panel logit model	No significant relationship between liquidity and leverage ratios and the export probability of firms.
UK				
Greenaway, Guariglia and Kneller (2007)	Panel of 9,292 manufacturing firms, 1993 – 2003	Liquidity ratio (current assets less current liabilities over total assets); leverage ratio (ratio of short-term debt to current assets); Quiscore (likelihood of company failure over next 12 months; not used in econometric estimates)	Descriptive statistics; pooled probit, random-effects probit, fixed-effects, GMM, dynamic random effects probit, dynamic GMM	Positive link between firms' financial health and export status. No evidence that firms enjoying good ex-ante financial health are more likely to start exporting. Participation in exporting improves firms' ex-post financial health
Görg and Spaliara (2013)	Manufacturing firms, FAMA date base, 2000 – 2009	Liquidity (current assets less current liabilities over total assets); leverage (short-term debt to assets ratio)	Complementary log-log model	Deterioration in the financial position of firms increased the hazard of export exit
Multi-country studies				
9 developing and emerging countries Berman and Héricourt (2010)	World Bank Enterprise Survey Data, some 5,000 firms, between 1998 and 2004	Ratio of total debt over total assets; ratio of cash flow over total assets	Probit, OLS, 2SLS (Note: No investigation for single countries)	Access to finance important for export entry, but not for continue to export or for size of exports. Productivity only important for export start of firm has sufficient access to external finance

28 East European and Central Asian countries Wang (2010)	World Bank Enterprise Survey Data, 3,392 firms, between 2002 and 2009	Financially constrained firms applied for loans but got rejected, or did not apply for loans because of too high costs	Descriptive statistics, pooled Probit, random effects probit, fixed effects LPM, RE LPM, Heckman Selection model (Note: No investigation for single countries)	Probability of exporting higher among firms with no financial constraints; non-constraint firms tend to export more
18 developing countries Fauceglia (2011)	World Bank Enterprise Survey Data, 9,072 firms between 2002 and 2005	Liquidity ratio (current over total assets)	Probit, OLS, 2SLS, Heckman selection model (Note: No investigation for single countries)	Positive effect of firms' liquidity on export propensity larger for firms in financially less developed countries. Credit constraints do not constitute determinants for export revenues for existing exporters
27 transition economies (East Europe and Central Asia) Bernini (2012)	BEEPS data (waves II, III, IV), 25,086 firms (6,890 interviewed in more than one year)	Self-reported degree of financial constraints - size of obstacle in access to finance	Ordered probit, OLS, FE (Note: No investigation for single countries)	Findings suggest that export activities improve ex-post firms' access to credit by signaling their resilience to domestic and foreign competition
6 Latin American Countries Hasan (2013)	World Bank Enterprise Survey data, 1,501 firms, 2006 and 2008	Answer to survey question about availability of outside line of credit from private commercial bank or financial institution	Probit, OLS, IV (Note: No investigation for single countries)	Credit availability significant for the decision to export, but not significant in determining the volume of exports

Note: The studies are listed in alphabetical order of the countries covered and in chronological order of the publication year in a country. Studies that cover more than one country are listed at the end of the table

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