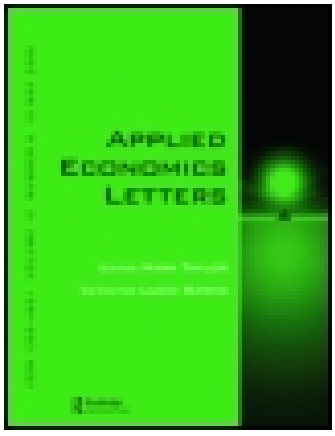

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Trade credit, international trade costs and exports: cross-country firm-level evidence

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Trade credit, international trade costs and exports: cross-country firm-level evidence

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This article finds that firms' trade credit, the financing provided by upstream input suppliers along the supply chain, plays an important role in determining firms' exportation. In a panel data set of manufacturing firms in 25 Eastern European and Central Asian countries between 2001 and 2007, we employ international trade cost shocks to identify the causal impacts of trade credit on firms' exportation. We find that when trade costs decline, firms with less trade credit increase their exports disproportionately more because of the alleviation of their financing burdens. Results are robust after controlling for bank and other financing channels, country financial development, and the endogeneity of trade credit. Our findings contribute to the empirical identification of financial frictions on firms' exports and to the role of trade credit on firms' performance.

Keywords: trade credit; export; trade liberalization; financial frictions

JEL Classification: F12; F14; F15; F36; G30

I. Introduction

Opening to international markets can help host countries improve productivity and speed up economic growth. These facts stimulate the increasing need to understand export-accelerating channels. A number of studies find that firms' financing conditions have impacts on their exportation (Manova, 2008; Berman and Héricourt, 2010). This article investigates the impacts of a specific financing channel, trade credit, which is the financing provided by upstream input suppliers along the supply chain.

We assume that firms are heterogeneous in productivity and face export costs and that firms face financial frictions. Therefore, firms export if their productivity is above the zero-export-profit threshold. The productivity threshold is higher for firms with less trade credit because these firms have more financing difficulties. We propose that decreases in export costs will have disproportionate impacts on firms with less trade credit, because these firms' financing burdens are alleviated asymmetrically more.

We employ a panel data set of manufacturing firms in 25 Eastern European and Central Asian countries from 2001 to 2007 in the World Bank Enterprise

Surveys, combined with industry-level international trade cost data from the United Nation Comtrade database. Enterprise Surveys data set has two advantages. First, it has trade credit measures at the firm level. Second, countries in the data are similar in economic background but have experienced various export cost changes, which allows us to observe firms' differentiated export behaviour.

Several findings stand out. First, we focus on firms' probability of exportation and find that the impacts of decreased trade costs are disproportionately high for firms with less trade credit, because trade liberalizations reduce their burdens in financing export costs systematically more. Second, we find similar impacts on trade volume for exporters. We employ the Heckman model to correct for the possible bias caused by firms' self-selection of export. Finally, our results are robust after incorporating firms' financing from banks and other channels and the country's financial development, and after controlling for the possible endogeneity of trade credit.

This article first contributes to the empirical identification of the impacts of financial frictions on firms' exports. As pointed out by Manova (2008), regressing firms' financial conditions on their exportation may only indicate the correlation, not the casuality. Manova (2008) uses the exogenous equity market liberalization to control for the endogeneity of firms' financing conditions. Employing the exogenous changes in export costs, this article finds that firms with less trade credit increase their exports disproportionately more after trade liberalization, which identifies the causal impacts of financial frictions on exportation. Second, this article contributes to the literature of trade credit. A series of finance articles have examined the reasons for the provision of trade credit by upstream suppliers (Fisman and Love, 2003; Cunat, 2007; Klapper *et al.*, 2012). This article examines the role of trade credit in financing firms' exportation.

The remainder of the article is organized as follows. Section II describes the data and constructs the empirical framework. Section III displays benchmark results and robustness checks. Section IV concludes.

II. Data and Empirical Framework

Data

The data set consists of two parts. The first part includes 1620 firm-year observations in 11 manufacturing industries in 25 Eastern European and Central Asian countries from 2001 to 2007, collected by the World Bank Enterprise Surveys.[1] The World Bank has surveyed each firm two (three) times every three years in every country and the data set is a balanced panel. On average, exporters are more productive, larger and older, have higher shares of foreign ownership, and have more trade credit.

The second part constructs industry-level export costs. Following Bernard *et al.* (2006), we proxy the *ad valorem* export costs as the sum of tariffs and transportation costs at the industry level, which is the most disaggregated level given the data limitation. Tariffs are extracted from the World Bank Consolidated Tariff Schedules database. Transportation costs are measured as the ratio of the cost-insurance-freight over free-on-board values for bilateral trade pairs from the United Nation Comtrade database. For every country-industry-year triplet, we average its export costs across different destinations. The average trade costs for all countries have decreased from 19.1% in 2001 to 14.2% in 2004 and to 12.0% in 2007.

Hypotheses and the empirical framework

We propose hypotheses based on two trends of literature: (i) only the productive firms export. Melitz (2003) assumes that firms are heterogeneous in productivity and pay fixed and variable costs to export. In the equilibrium, firms export if their productivity is above a zero-export-profit threshold. (ii) In an imperfect financial market, firms that are able to finance their export costs can export, as in Manova (2008). Fisman and Love (2003) point out that trade credit may ease firms' financing difficulties. Following the two trends in the literature, we postulate that declines in export costs will increase export profits, reduce the productivity threshold for exporting and therefore increase firms' exports. These effects are more pronounced for firms with lower

[1] Twenty-five countries are Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Slovak, Slovenia, Tajikistan, Turkey, Ukraine and Uzbekistan. Eleven manufacturing industries include food, textiles, garments, chemicals, plastics and rubber, nonmetallic mineral products, basic metals, fabricated metal products, machinery and equipment, electronics, and other manufacturing industries.

trade credit, because their financing burdens are alleviated more. We propose Hypotheses 1 and 2, which predict firms' export probability and volume, respectively.

Hypothesis 1: Declines in international trade costs increase firms' export probability; these effects are more pronounced for firms with lower trade credit.

Hypothesis 2: Declines in international trade costs increase export volume for existing exporters; these effects are more pronounced for firms with lower trade credit.

In order to test Hypothesis 1, we estimate:

$$p_{ijct} = 1[\alpha_p + \beta_p tcost_{jct} + \gamma_p tcredit_{ijct} + \delta_p tcost_{jct} \times tcredit_{ijct} + \lambda_p Z_{ijct} + d_j + d_c + d_t + v_{ijct} > 0], \quad (1)$$

where p_{ijct} is a dummy which equals 1 if firm i in industry j in country c in year t exports, 0 otherwise. $tcost_{jct}$ is the export cost. $tcredit_{ijct}$ is the trade credit measured by a share of intermediate goods financed by delayed payments from suppliers. The control vector Z_{ijct} includes employment, firm age, labour productivity relative to industry mean,[2] and a foreign ownership dummy which equals 1 if a firm has at least 10% of foreign ownership and 0 otherwise, as in Javorcik (2004). d_j, d_c and d_t are industry, country and year dummies respectively, and v_{ijct} is the error term. Following Berman and Héricourt (2010), we estimate (1) by the random-effects panel logit model, because the insufficient time spanning of firms (2 or 3 observations per firm) does not allow us to include firms' fixed effects.

The coefficients we focus on are β_p, γ_p and δ_p. We expect that $\beta_p < 0$ because lower export costs result in more exporting firms, $\gamma_p > 0$ because trade credit may help to finance export costs and $\delta_p > 0$ because the impacts of trade costs are disproportional large for firms with less trade credit.

Following Melitz *et al.* (2008), we test Hypothesis 2 by estimating a Heckman model in (1979), which corrects for firms' self-selection bias. Specifically, the export volume v_{ijct} is observed only when firms export: $p_{ijct} = 1$. If the error term for trade volume, μ_{ijct}, is correlated with v_{ijct} in Equation (1): $E(\mu|v) = av$, firms' self-selection of exportation will affect the estimation of export volume. Then, the Heckman model is:

$$E[ln(v_{ijct})|p_{ijct} = 1] = \alpha_v + \beta_v tcost_{jct} + \gamma_v tcredit_{ijct} + \delta_v tcost_{jct} \times tcredit_{ijct} + \lambda_v Z_{ijct} + d_j + d_c + d_t + a\Xi_{ijct}, \quad (2)$$

where Ξ_{ijct} is the inverse Mills ratio that summarizes the self-selection effect.[3] We estimate the Heckman model in two stages. In the first stage, we re-estimate Equation (1) with two additional variables that affect fixed cost of export and therefore the export probability only. One is whether firms have a quality certificate, another is whether firms use emails and websites, and both affect fixed export costs from information barriers. The second stage estimates Equation (2). SEs are clustered at the firm level. We are interested in coefficients β_v, γ_v and δ_v, and expect $\beta_v < 0$, $\gamma_v > 0$ and $\delta_v > 0$ as in Equation (1).

III. Results

Benchmark results

In Table 1, columns 1 and 2 display the estimation of Equation (1). Results confirm that firms with less trade credit engage disproportionably more into exportation because trade liberalizations alleviate their financing difficulties more. Table 2, columns 1 and 2 display the results for firms' export volume in estimating Equation (2). Take column 2 for instance, facing one percentage point decrease in trade costs, a firm with no trade credit will increase export by 1.57% more than a firm with the trade credit ratio of 50%.

Robustness check 1: financing from banks and other channels and financial development

Besides trade credit, firms may also acquire financing from banks and other channels. We add three variables to control for alternative financing channels – the first is a dummy of whether firms consider

[2] Results are robust if using total factor productivity but the number of observations is reduced by 60% because of missing capital.

[3] Assume v in Equation (1) follows a distribution $\Phi(v)$, $E(\mu|v, p = 1) = aE(v|v > -\beta x) = a\phi(\beta x)/\Phi(\beta x) = a\Xi$.

Table 1. The impacts of international trade costs and trade credit on export probability

		Dependent variable: export probability					
		Benchmark		Other finance		Endogeneity	
	Signs	(1)	(2)	(3)	(4)	(5)	(6)
Trade Cost	–		−9.462***		−8.346***		−2.213***
			(2.463)		(2.287)		(0.552)
Trade Credit	+	1.853***	1.348***	2.348***	1.778***	0.798***	
		(0.345)	(0.403)	(0.434)	(0.488)	(0.191)	
T. Cost*T. Credit	+		9.092*		4.387**		4.605***
			(4.805)		(2.198)		(1.253)
Fin. Development				2.915**	2.386		
				(1.466)	(1.496)		
Fin. Dev.*T. Credit				−4.451***	−4.212***		
				(1.475)	(1.493)		
Fin. Obstacle				−0.226	−0.189		
				(0.214)	(0.220)		
Bank Loan/Sales				3.341**	3.121**		
				(1.470)	(1.469)		
Fin. from Buyers				0.135	0.173		
				(0.288)	(0.292)		
Productivity		0.366***	0.393***	0.385***	0.393***	0.030	0.033
		(0.093)	(0.095)	(0.097)	(0.097)	(0.022)	(0.021)
Ln(Employment)		0.831***	0.767***	0.798***	0.821***	0.101***	0.104***
		(0.097)	(0.099)	(0.101)	(0.104)	(0.015)	(0.015)
Age		0.012*	0.015**	0.019***	0.019***	0.001	0.001
		(0.007)	(0.007)	(0.007)	(0.007)	(0.001)	(0.001)
FDI Firm		0.936***	1.024***	1.141***	1.298***	0.128***	0.134***
		(0.319)	(0.336)	(0.350)	(0.368)	(0.047)	(0.048)
Pseudo R^2		0.121	0.135	0.139	0.148		
Chi-squared		129.25	130.3	128.31	124.39		
Cragg-Donald *F*						26.504	25.896
Sargan Stat.						0.023	0.044
Observations		1612	1570	1528	1497	927	906

Notes: The instruments in (5) and (6) are firms' sale 3 years before and their liquidity.
Industry, country and year dummies are included.
***, ** and * denote significances at 1%, 5% and 10%, respectively.

access to finance as a moderate to major obstacle, following Eck *et al.* (2012), the second is firms' loans from banks divided by total sales and the third is a dummy of whether firms have financing from their buyers through cash in advance.[4] Similarly, a country's financial development may also impact firms' export. We measure financial development as the ratio of private credit over GDP from Beck *et al.* (2010) and add its interaction with trade credit in regressions. Columns 3 and 4 in Tables 1 and 2, respectively, confirm that the benchmark results still hold after controlling for firms' bank financing and the aggregate financial development.

[4] Due to data limitation, the dummy of financing from buyers is for firms' general sales.

Table 2. The impacts of international trade costs and trade credit on export volume

		Dependent variable: export volume					
		Benchmark		Other finance		Endogeneity	
	Signs	(1)	(2)	(3)	(4)	(5)	(6)
Trade Cost	–		−5.149***		−5.105**		−20.118***
			(0.383)		(0.387)		(5.030)
Trade Credit	+	1.497***	0.515**	2.348***	0.924*	23.941***	
		(0.278)	(0.220)	(0.434)	(0.571)	(4.150)	
T. Cost*T. Credit	+		3.659**		3.365*		56.106***
			(1.819)		(1.923)		(16.072)
Fin. Development				2.915**	4.358***		
				(1.466)	(1.516)		
Fin. Dev.*T. Credit				−4.451***	−0.419		
				(1.475)	(2.294)		
Fin. Obstacle				−0.226	−0.511***		
				(0.214)	(0.187)		
Bank Loan/Sales				3.341**	2.445***		
				(1.470)	(0.777)		
Fin. from Buyers				−0.104	0.016		
				(0.207)	(0.221)		
Productivity		0.860***	0.836***	0.385***	0.943***	1.739***	1.686***
		(0.092)	(0.073)	(0.097)	(0.094)	(0.517)	(0.395)
Ln(Employment)		0.711***	0.700***	0.798***	0.775***	2.110***	2.589***
		(0.105)	(0.088)	(0.101)	(0.133)	(0.342)	(0.261)
Age		−0.004	−0.008	0.019***	−0.006	0.009	0.022
		(0.007)	(0.007)	(0.007)	(0.006)	(0.024)	(0.018)
FDI Firm		−0.289	−0.297	1.141***	−0.154	2.412**	2.267***
		(0.271)	(0.312)	(0.350)	(0.305)	(1.087)	(0.851)
Inverse Mills ratio		−1.208**	−0.947***	−1.794***	−0.442		
		(0.511)	(0.489)	(0.332)	(0.873)		
R^2		0.399	0.419	0.420	0.447	0.413	0.385
Cragg-Donald F						27.686	46.676
Sargan Stat.						0.336	2.047
Observations		959	660	766	660	707	660

Notes: In (1) to (4) Heckman models, the first-stage exclusive variables are dummies of whether firms have quality certificate and online communication tools.
The instruments in (5) and (6) are firms' sale 3 years before and their liquidity.
Industry, country and year dummies are included. SEs are clustered at the firm level.
***, ** and * denote significances at 1%, 5% and 10%, respectively.

Robustness check 2: the endogeneity of trade credit

Firms' trade credit may not be fully determined by input suppliers but may also be affected by their relationship with input suppliers and their financial conditions, as in Klapper *et al.* (2012). We employ the instrument variable method to correct for the possible endogeneity. Specifically, we choose two instruments that are correlated with firms' trade credit but not with their export decisions. The first instrument is firms' sales prior to three years, which is not correlated with firms' current shocks that may

affect exportation, but correlated firms' need for trade credit as in Cunat (2007). The second instrument is firms' share of internal funds in financing investment, which measures their liquidity. Cunat (2007) finds that firms with lower liquidity obtain more trade credit. Columns 5 and 6 in Tables 1 and 2 show that benchmark results are qualitatively the same after controlling for the endogeneity of trade credit. The Cragg-Donald *F* statistics pass the weak instrument test, and the Sargan statistics indicate that the excluded instruments are uncorrelated with the error term.

IV. Conclusion

This article finds that declines in trade costs induce exports disproportionately more for firms with less trade credit, which implies that trade credit is an important determinant of firms' exports through the financing channel. Our results are robust after incorporating firms' financing from banks and other channels and the country's financial development, and after correcting for the possible endogeneity of trade credit. Even though we focus on the decrease in export costs, our results also imply that firms with more trade credit can perform better with higher trade costs, because they have more financing channels to cushion sudden cost shocks. Our results suggest that policy-makers may focus on policies that can provide firms broader and cheaper channels of financing in order to foster export growth.

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References

Beck, T., Demirguc-Kunt, A. and Levine, R. (2010) Financial institutions and markets across countries and over time: the updated financial development and structure database, *The World Bank Economic Review*, **24**, 77–92. doi:10.1093/wber/lhp016

Berman, N. and Héricourt, J. (2010) Financial factors and the margins of trade: evidence from cross-country firm-level data, *Journal of Development Economics*, **93**, 206–17. doi:10.1016/j.jdeveco.2009.11.006

Bernard, A. B., Jensen, J. B. and Schott, P. K. (2006) Trade costs, firms and productivity, *Journal of Monetary Economics*, **53**, 917–37. doi:10.1016/j.jmoneco.2006.05.001

Cunat, V. (2007) Trade credit: suppliers as debt collectors and insurance providers, *Review of Financial Studies*, **20**, 491–527. doi:10.1093/rfs/hhl015

Eck, K., Engemann, M. and Schnitzer, M. (2012) How trade credits foster international trade, Centre for Economic Policy Research Discussion Papers 8942.

Fisman, R. and Love, I. (2003) Trade credit, financial intermediary development, and industry growth, *The Journal of Finance*, **58**, 353–74. doi:10.1111/1540-6261.00527

Heckman, J. (1979) Sample selection bias as a specification error, *Econometrica*, **47**, 153–61. doi:10.2307/1912352

Javorcik, B. S. (2004) Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages, *American Economic Review*, **94**, 605–27. doi:10.1257/0002828041464605

Klapper, L., Laeven, L. and Rajan, R. (2012) Trade credit contracts, *Review of Financial Studies*, **25**, 838–67. doi:10.1093/rfs/hhr122

Manova, K. (2008) Credit constraints, equity market liberalizations and international trade, *Journal of International Economics*, **76**, 33–47. doi:10.1016/j.jinteco.2008.03.008

Melitz, M. (2003) The impact of trade on intra-industry reallocations and aggregate industry productivity, *Econometrica*, **71**, 1695–725. doi:10.1111/1468-0262.00467

Melitz, M., Helpman, E. and Rubinstein, Y. (2008) Estimating trade flows: trading partners and trading volumes, *Quarterly Journal of Economics*, **123**, 441–87. doi:10.1162/qjec.2008.123.2.441