Southeast Asian Journal of Economics 9(2), August 2021: 39-72
Received: 11 January 2021
Accepted: 16 May 2021

A Microscopic View to Unlocking Finance and Trade: Evidence from Thailand

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Abstract

We study how changes to credit supply affect exports at the firm level using highly disaggregated administrative data from Thailand. To do so, we merge transaction-level trade data from the Customs Department with account-level loan data from the Bank of Thailand between 2004 and 2015. We find that bank credit mattered for Thai exports during the Global Financial Crisis

period when there was an adverse shock to the credit supply from financial institutions, leading to a decline in exports for Thai firms. However, we do not find such relationship during non-crisis periods. Our results suggest that although credit facilitates firms to have access to more destinations, export a greater variety of products, and increase sales in each product destination, it is not sufficient. Boosting exports by injecting credit to export firms could be ineffective, especially if export demand remains sluggish and there are non-financial constraints that prevent market penetration and expansion.

Keywords: Trade, export, finance, financial constraints, global production networks

JEL Codes: F10, F14, G20, G28, G32

1. Introduction

The role of finance in international trade has gained particular attention from both academic and policymaking communities in the past decade, especially following the 2008-2009 Global Financial Crisis (GFC) when world exports plummeted. One of the most important questions for scholars and policymakers is how finance matters for trade. The goal of this paper is to shed light on this issue by using granular-level data on loans and trade from Thailand, a country where exports have played a crucial role in the economy.

The importance of finance in trade is undeniable. As Manova (2015) summarizes, trade could not take place without finance. Firms need to finance various stages of their operations, including financing fixed costs (e.g. research and development, marketing, and fixed capital investment), as well as financing variable costs (e.g. purchasing inputs). This financing is often from external sources beyond their retained earnings and cash flow from operation. In addition, export firms likely rely on even more external finance than their domestic counterparts for several reasons. First, their fixed costs also include costs of entering foreign markets, such as product customization, regulatory compliance, and distribution networks, thereby demanding greater credit lines compared to purely domestic operations (Melitz, 2003). Second, international trade firms also face additional variable costs, such as duties and freight insurance. Third, shipments take longer for international than domestic trade, which could stretch up to two to three months in the case of sea shipments (Djankov, Freund, & Pham, 2010). As a result, firms engaged in international trade face longer cash conversion cycles and need to finance longer working capital. Finally, international trade entails additional risks, such as exchange rate fluctuation, breaches of contracts in different jurisdictions, or unexpected events like the Suez Canal blockage in March 2021. These risks prompt firms to turn to financial institutions for services that help facilitate smooth international transactions.

In this paper, we take a microscopic view of the indispensable role of finance in international trade by analyzing disaggregated administrative data from two main sources. Data from the Customs Department provide us with granular information on international trade at the transaction level, while data from the Bank of Thailand consist of account-level information on loans from financial institutions. We use merged data from these two sources to explore how changes to credit supply affect exports at the firm level. Following Paravisini, et al. (2015), we control for non-credit determinants of export growth by estimating the elasticity of exports to credit with a full set of product-destination-time dummies. In other words, we essentially compare two almost identical firms exporting the same product to the same destination in the same period, with the only difference being their outstanding credit.

We find evidence that external finance matters for Thai exports: credit growth to export firms leads to export growth. On the intensive margin of exports (i.e., existing firms continuing to export to the same product-destination markets), the contribution to export growth comes from growth in export value per shipment and not from an increasing number of shipments. We further test for the relevance of short-term loans versus long-term loans that could differentially impact export activities. Our results suggest that export growth on the intensive margin is driven mainly by short-term loans, highlighting the importance of bank credit in financing variable costs associated with exports. We also analyze the relationship between loan growth and export growth at three different extensive margins. The results reveal that loan growth is associated with a higher likelihood that a firm will export more products, have access to more markets, and become an exporting firm. In this case, long-term credit growth also matters for export growth on the extensive margins, suggesting that long-term loans are crucial to firms for financing sunk entry costs.

With regards to trade-specific financing demand, we also find that the elasticity of exports to credit is heterogeneous across different types of firms, products, and destinations. We show that export growth for firms that are smaller, exporting more products via sea shipments, exporting to destinations

with low rule of law, exporting new product-market bundles, and exporting finished-goods are more sensitive to credit growth. In other words, financial constraints are likely more binding for these firms such that credit allocative efficiency could be enhanced by catering to exporters with different financial needs.

In order to address the potential endogeneity problem arising from credit being determined by exports, we supplement our main merged dataset with information on banks' balance sheets obtained from the Bank of Thailand and propose using a lagged fee share as an instrumental variable. For each firm, we compute the lagged share of fee revenues from the total revenues of each financial institution, weighted by a firm's debt composition across all banks that lend to the firm during the period. Given that fee revenues have been growing tremendously over the past decade, they provide supply of funds to financial institutions that could be lent to exporting firms. The share of fee (non-interest) revenue varies across financial institutions and is likely orthogonal to export growth of exporting firms. The estimated export elasticities to credit for intensive margin growth increase from 0.012 in the ordinary least squares (OLS) estimation to 0.154 in the instrumental variable (IV) estimation. This implies that the endogeneity problem biases our results toward zero.

Despite confirming that finance matters for exports, we further estimate the elasticity of exports to credit across three different time periods: pre-crisis, GFC, and post-crisis periods. The estimation results show that credit mattered for Thai exports the most during the GFC period. This was a period when there was an adverse shock to credit supply from financial institutions, which led to a decline in exports of Thai firms. However, we do not find such a relationship between bank credit and firms' exports during non-crisis periods, neither before nor after the GFC. Other factors, especially foreign demand, play a much larger role in determining export growth, as captured by the fixed effects in our regressions. The insights from this study point towards important policy implications for export-oriented economies: although credit facilitates firms to have access to more destinations, export a greater variety of products, as

well as increase sales in each product-destination, it is not sufficient. Boosting exports by injecting credit to export firms could be ineffective, especially if the demand for exports remains sluggish and there are non-financial constraints that prevent market penetration and expansion.

This paper is closely related to a growing number of academic studies that look into finance and trade (Foley & Manova, 2015). One strand of research applies the corporate finance literature to recent developments on heterogeneous firms in the international trade literature, focusing on the role of credit constraints on trade in which financially constrained firms are prevented from exporting despite potential profitability. These constraints not only affect "trade finance" (narrowly defined as finance needed for trade transactions), but also put limits on the financing of manufacturing export products and establishing markets in foreign countries.

With the availability of new and more comprehensive databases, Amiti and Weinstein (2011) identify a transmission mechanism through which shocks to banks that supply firms with trade finance affect firm export behavior following the banking crisis in Japan. The authors show that the health of financial institutions that provide finance to firms is an important determinant of firm-level exports. The drop in exports originating from financial factors was as large as 20 percent of the drop in aggregate exports. Bricongne et al. (2012), using a unique dataset composed of French firms, show that financing difficulties and shortages of liquidity are more prominent for export-oriented firms if they belong to sectors that are more dependent on external finance after the GFC. Using cross-country, cross-industry import data from the United States (U.S.), Chor and Manova (2012) demonstrate that firms capable of exporting might have been prevented from doing so due to high costs of external finance. They find that financially vulnerable sectors experienced sharper drops in monthly exports to the United States. Furthermore, Auboin and Engemann (2014) show that bottlenecks in trade credit and trade finance can hinder trade throughout the whole business cycle, not just the crisis period. Niepmann and Schmidt-Eisenlohr (2017), using data on U.S. bank trade finance

claims by country, investigate whether shocks to the supply of letters of credit affect firm exports. They find that a one-standard deviation negative shock to a country's letter-of-credit supply by U.S. banks reduced U.S. exports to that country by 1.5 percentage points. The effect more than doubles during the crisis period. On the other hand, Levchenko, Lewis, and Tesar (2010) employ external finance dependence measures similar to those in Rajan and Zingales (1998) and find little empirical evidence that finance was an important factor in the collapse of U.S. trade.

The extent to which finance may have played a differential role in the extensive and intensive margins of international trade is explored by Paravisini et al. (2015). They exploit disaggregated export data for Peruvian firms and outstanding credit of each firm with each bank to estimate the elasticity of exports to credit. They find that bank shocks leading to a shortage of credit supply have a negative impact on the intensive margin of exports, but not on the extensive margin. Defever et al. (2020) evaluate the impact of short-term and long-term export finance schemes on Pakistani firms' exports. They find evidence that subsidized loans increase the growth rate of export sales, but no significant impact on the extensive margin. We add to the literature by showing that short-term credit matters for export growth at the intensive margin, whereas long-term credit matters for export growth at the extensive margin.

The rest of the paper proceeds as follows: Section 2 describes data sources and provides descriptive statistics. Section 3 introduces the empirical strategy. Section 4 presents our results on the elasticity of exports to credit. Section 5 discusses the endogeneity problem in the estimation and introduces an instrumental variable approach. Finally, section 6 concludes.

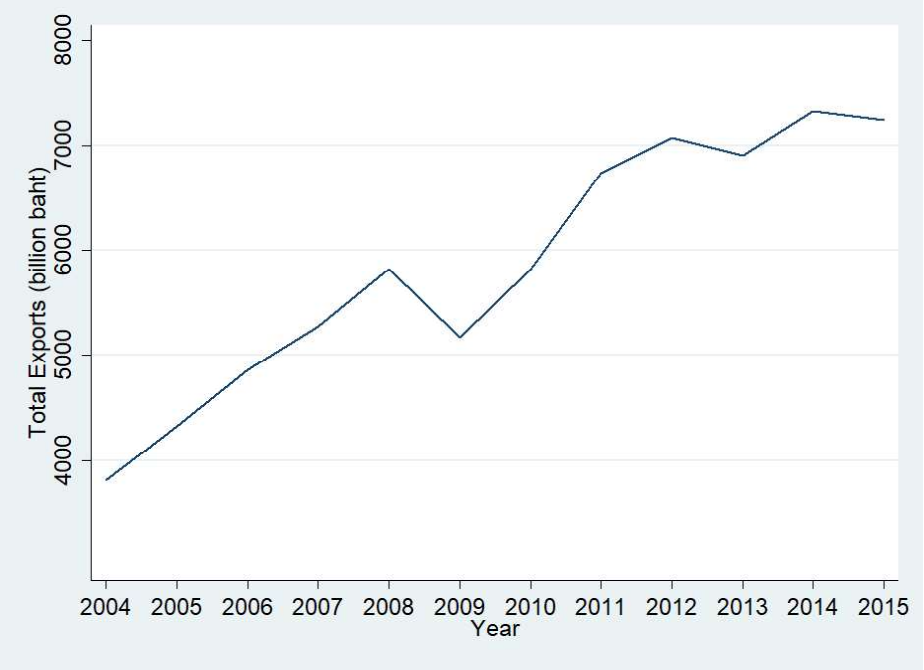
2. Data

2.1 Data Sources

The analysis in this paper is based on panel data of 279,913 unique registered firms in Thailand, of which, 90,019 are exporters. The dataset

is constructed from four different data sources. First, export data are from export entries collected by the Customs Department at the Ministry of Finance. The data provide us with information on the exporting firm, product, destination, trade volume, and method of shipment, among others, for each export transaction. The data contain the universe of all export activities in Thailand from January 2004 to December 2015.[1] Figure 1 shows that annual exports (Thai baht (THB) billions) have grown steadily since the start of the sample period, with a sharp drop after 2008 due to the GFC. Given the seasonality of international trade, we collapse our transactional data into annual flows at the product-destination-exporter level.

Figure 1. Annual exports between 2004-2015



Source: Export data from the Customs Department of Thailand.

[1] For a detailed description and stylized facts from the Customs Department data, see Apaitan, Disyatat, and Samphantharak (2019).

The second source of data comprises loan data from the Bank of Thailand's Loan Arrangement (LAR) database. The dataset includes all loans with a credit line above THB 20 million that were lent by Thai commercial banks and foreign bank branches in Thailand, as well as selected special financial institutions. The database contains information on the outstanding amount, type, purpose, lender, and borrower for each loan made. The loan data represents about 60% of total loans outstanding in Thailand. We aggregate account-level observations into annual loan data at the borrower level. We then merge annual export flows with annual loan data by firm. Our combined dataset covers around 73% of Thailand's total export value and 25% of credit in the LAR database. We further supplement our main dataset with firm-level financial characteristics obtained from the Ministry of Commerce's Department of Business Development Company Profile and Financial Statement (CPFS) database. These characteristics include standard balance sheet and income statement items. Finally, the fourth dataset containing financial statements of lending institutions from the Bank of Thailand is used to construct our proposed instrumental variable described in Section 5.

2.2 Descriptive Statistics

Table 1 provides descriptive statistics for the main variables of interest for all firms, exporters, and all firms classified by firm size according to Thailand's Ministry of Industry's firm size classifications. Small firms correspond to firms with assets up to THB 50 million; medium firms correspond to firms with assets of no less than THB 50 million and up to THB 200 million; and large firms correspond to firms with assets above THB 200 million. In addition to export value and credit, summary statistics on fixed assets and fee shares – our instrument for supply of credit – are also presented.

Table 1. Descriptive statistics at the firm-level, 2004-2015

(in THB millions)	All Firms (n=279,913)	Exporters (n=90,019)	Small (n=81,253)	Medium (n=186,912)	Large (n=11,748)
Exports value per year	-	605.87	152.95	411.14	2,670.53
	-	(4,214.60)	(1,598.55)	(3,095.10)	(9,482.61)
Credit - total	132.98	276.28	56.28	110.91	1,014.55
	(750.41)	(1,220.91)	(223.16)	(638.23)	(2,401.43)
Credit - working capital	82.00	177.92	41.39	68.47	578.14
	(428.84)	(673.64)	(186.15)	(360.82)	(1,345.48)
Credit - investment	10.80	24.27	2.34	8.06	113.02
	(187.57)	(310.06)	(37.11)	(162.91)	(628.85)
Fee share	0.18	0.18	0.17	0.19	0.15
	(0.06)	(0.07)	(0.06)	(0.06)	(0.07)
Fixed assets	230.47	419.46	11.88	127.21	2,143.55
	(2,216.71)	(3,112.00)	(11.59)	(87.61)	(7,343.85)

Notes: Table 1 reports means and standard deviations (in parentheses).

Source: Export data are from the Customs Department of Thailand. Credit data (total, short-term working capital, and long-term investment) are from the Bank of Thailand's Loan Arrangement (LAR) database. The two datasets are linked at the firm level. Fee share is calculated from the financial statements of financial institutions from the Bank of Thailand, weighted by firms' debt composition from LAR. Fixed assets are from the Department of Business Development's Company Profile and Financial Statement (CPFS) database.

In Table 2, we present descriptive statistics at the firm-product-destination level, the level in which we conduct our empirical analysis. We also show summary statistics for firms stratified by transport type (sea and air freight) to be analyzed in section 4.2. Since firms can increase exports of a given product to a given destination either by increasing the frequency of shipments or by increasing the size of each shipment, we provide summary statistics on the number of shipments per year and the value per shipment.

Table 2. Descriptive statistics at the firm-product-destination level

	All n=2,155,105	Sea n=1,343,149	Air n=567,930
Exports value per year	25.31	28.64	14.93
	(309.21)	(271.02)	(357.61)
Number of shipments per year	17.30	16.44	13.15
	(102.43)	(71.51)	(133.87)
Value per shipment	1.00	1.36	0.34
	(10.38)	(12.51)	(5.91)
Age of relationship (trading year)	4.07	4.41	3.14
	(3.37)	(3.48)	(2.86)

Notes: Table 2 reports means and standard deviations (in parentheses). Export value per year and value per shipment are in THB millions.

Source: Export data are from the Customs Department of Thailand.

3. Empirical Strategy

To study the effect of credit on exports, we begin with the following reduced-form export equation:

$$ln(X_{pdit}) = \eta^I \cdot ln(C_{it}) + F(H_{pdit}) + \varepsilon_{pdit}$$

where is export of product *p* to destination *d* by firm *i* in period *t*; is credit to firm *i* in period *t*; and is the elasticity of export to credit. In addition to credit, includes factors other than credit that affect exports, such as, but not limited to, demand for product *p* in destination *d* in period *t* and costs of producing product *p* for destination *d* by firm *i*. To eliminate the firm-product-destination time-invariant fixed effects, we further assume a linear relationship for the first-difference relationship, i.e., the intensive margin of export growth and credit growth:

$$ln(X_{pdit}) - ln(X_{pdit-1}) = \eta^I \cdot [ln(C_{it}) - ln(C_{it-1})] + \alpha_{pdt} + \gamma_{pdi} + \varepsilon'_{pdit} \quad (1)$$

where is the fixed effect for product *p* at destination *d* in period *t*, which captures the change in demand conditions at the destination between periods *t-1* and *t*, while is the fixed effect for product *p* at destination *d* from firm *i*, which captures the change in input costs and other unobserved heterogeneity that could affect export growth. Given that our regression includes these fixed effects, the estimated elasticity compares export growth of two almost identical firms exporting identical products to the same destination in the same period, where the only difference between these two firms is credit growth.

Similarly, for the relationship between credit and the extensive margins of export, we estimate the following reduced-form regressions:

$$(NP_{dit} - NP_{dit-1}) = \eta^{EP} \cdot [ln(C_{it}) - ln(C_{it-1})] + \alpha_{dt} + \gamma_{di} + \varepsilon'_{pdit} \quad (2)$$

$$\left(ND_{pit} - ND_{pit-1}\right) = \eta^{ED} \cdot [ln(C_{it}) - ln(C_{it-1})] + \alpha_{pt} + \gamma_{pi} + \varepsilon'_{pdit} \quad (3)$$

where represents the number of products exported to destination *d* by firm *i* in period *t*, and represents the number of destinations for product *p* exported by firm *i* in period *t*. The fixed effects capture changes in relevant conditions for the destinations and products in equations (2) and (3), respectively. Finally, we explore the likelihood of firm *i* being an export firm in period *t* by estimating the following regression:

$$Prob(X_{it} > 0) = \eta^{EF} \cdot [ln(C_{it}) - ln(C_{it-1})] + \alpha_t + \gamma_i + \varepsilon'_{it.} \quad (4)$$

Since we have fixed effects in our regression, we choose to estimate equation (4) using a linear probability model rather than a probit model.

4. Results

We first present our OLS results for export growth at the intensive and extensive margins, focusing on the differential effects of short-term and long-term loans. We then explore the heterogeneous effects across different types of export firms. Finally, we end this section with the estimated elasticities of exports to credit for crisis and non-crisis periods.

4.1 Overall Elasticities

4.1.1 Intensive Margin

Table 3 presents the estimation results of equation (1) using total credit taken by the firm and exports at the intensive margin. Column (1) shows that there is a positive relationship between credit growth and export growth. We then further explore the contributions to the intensive margin of growth from two channels: (i) an increase in the number of shipments per year; and (ii) an increase in the value of exports per shipment. Columns (2) and (3) show that the effect of credit growth on export growth was from the growth in export value per shipment and not from an increasing number of shipments.

Table 3. Overview of intensive margin elasticity to credit

	(1)	(2)	(3)
Dependent variables:	Change in ln(export)	Change in no. of shipments	Change in ln(avg. value per shipment)
Change in ln(total credit)	0.012***	0.033	0.006***
	(0.002)	(0.051)	(0.001)
Product-destination-year FE	yes	yes	yes
Product-destination-firm FE	yes	yes	yes
Observations	745,001	745,001	745,001
R-squared	0.314	0.252	0.302

Notes: ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.

Source: Authors' estimates.

Since short-term and long-term loans could affect exports differently, we estimate equation (1) using credit for short-term working capital and long-term fixed investment separately. This disaggregation in loan duration is made possible by utilizing detailed information on loan purpose from the LAR database. Table 4 reports the elasticity of the intensive margin of exports to

credit for different loan maturities. The results for short-term working capital credit in columns (1), (3), and (5) are largely similar to those results using total loans discussed earlier. However, we find no impact of long-term credit growth as shown in columns (2), (4), and (6). These findings suggest that for export growth at the intensive margin, what matters is short-term rather than long-term credit, which is consistent with the hypothesis that working capital is needed to finance variable costs of exporting for incumbent firms already involved in the export market.

Table 4. Intensive margin elasticity to credit, short-term vs. long-term loans

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	Change in ln(export)		Change in no. of shipments		Change in ln(avg. value per shipment)	
Change in ln (working capital credit)	0.012***		0.003		0.005***	
	(0.002)		(0.049)		(0.001)	
Change in ln (investment credit)		0.013		0.325		0.015
		(0.014)		(0.403)		(0.011)
Product-destination-year FE	yes	yes	yes	yes	yes	yes
Product-destination-firm FE	yes	yes	yes	yes	yes	yes
Observations	673,724	55,108	673,724	55,108	673,724	55,108
R-squared	0.323	0.487	0.26	0.511	0.311	0.458

Notes: ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.

Source: Authors' estimates.

4.1.2 Extensive Margins

Next, we analyze the relationship between loan growth and export growth at three different extensive margins: (i) exporting more products; (ii) having access to more markets; and (iii) becoming an exporting firm. Table 5 presents the regression results of equations (2) through (4) when we use overall

credit growth as an explanatory variable. The results reveal that loan growth is associated with a higher likelihood that a firm will export more products (Column (1)), have access to more markets (Column (2)), and become an exporting firm (Column (3)). Similar to the analysis on the intensive margin, we further investigate the effects of short-term versus long-term credit growth in Table 6. Columns (1), (3), and (5) show that short-term credit growth is positively correlated with export growth for all three extensive margins. Interestingly, we also find a positive relationship between long-term credit growth and the likelihood of exporting more products (Column (2)) and accessing more markets (Column (4)). These findings are consistent with what is established in the literature, namely that export growth at the extensive margin is likely more difficult than expansion at the intensive margin and may need longer term financing for sunk fixed investments.

Table 5. Overview of extensive margins elasticity to credit

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	Change in ln(export)		Change in no. of shipments		Change in ln(avg. value per shipment)	
Change in ln (working capital credit)	0.012***		0.003		0.005***	
	(0.002)		(0.049)		(0.001)	
Change in ln (investment credit)		0.013		0.325		0.015
		(0.014)		(0.403)		(0.011)
Product-destination-year FE	yes	yes	yes	yes	yes	yes
Product-destination-firm FE	yes	yes	yes	yes	yes	yes
Observations	673,724	55,108	673,724	55,108	673,724	55,108
R-squared	0.323	0.487	0.26	0.511	0.311	0.458

Notes: ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.

Source: Authors' estimates.

Table 6. Extensive margins elasticity to credit, short-term vs long-term loans

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Change in number of products		Change in number of destinations		Pr(export>0)	
Change in ln(working capital credit)	0.024***		0.019***		0.001***	
	(0.003)		(0.004)		(0.000)	
Change in ln (investment credit)		0.069***		0.034*		0.000
		(0.018)		(0.018)		(0.001)
Destination-year FE	yes	yes				
Destination-firm FE	yes	yes				
Product-year FE			yes	yes		
Product-firm FE			yes	yes		
Year FE					yes	yes
Firm FE					yes	yes
Observations	409,857	54,978	260,147	32,450	168,403	23,038
R-squared	0.092	0.169	0.148	0.324	0.944	0.957

Notes: ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.

Source: Authors' estimates.

4.2 Heterogeneous Elasticities by Firm Type

4.2.1 Intensive Margin

So far we have established that there is overall evidence that finance is associated with exports, and that the elasticity of exports to credit is positive. However, the relationship between credit growth and export growth could be different across various types of firms, products, or destinations. In this subsection, we explore possible heterogeneous elasticities across various dimensions.

Firm Size: In Table 7, we focus on the intensive margin of exports. We first hypothesize that smaller firms are more likely to be external finance

dependent as it is more difficult for them to generate internal funds to finance their export activities. The results shown in Column (1) are consistent with this hypothesis. The interaction term for small firms – proxied by a dummy variable equal to one for firms with fixed assets up to THB 50 million and interacted with credit growth – is positive and significant. The result implies that export growth for small firms is more sensitive to credit growth compared to mid-sized and large-sized firms.

Shipping Methods: In Column (2), we analyze heterogeneous elasticities based on shipping methods. We first construct a dummy variable to proxy for the most prominent method of shipping for each firm in each period. This variable takes the value of one if total sea shipments account for more than 50% of the total value of a firm's exports during that year, and takes the value of zero otherwise. Given that sea shipping takes much longer than air transport, there is a greater need among firms to finance a longer period before goods arrive at their destinations. Our findings support this hypothesis. The interaction term between sea shipment and credit growth is positive and statistically different from zero.

Rule of Law: In Column (3), we explore heterogeneity in institutional quality in the destination countries using a rule of law index provided by the Worldwide Governance Indicators (WGI) compiled by the World Bank.[2] The rule of law index ranges from 0 to 100, with higher values corresponding to better governance. Given that international trade requires the settlement of payments between two parties while it takes time for the goods to be delivered, there is risk involved with financing trade. When a trading partner is located in a country with low institutional quality, the default risk is higher, which in turn makes it harder for firms to acquire loans in the first place. Again, this hypothesis is confirmed by our empirical results reported in Column (3). We find that the higher the institutional quality of destination countries, the less

[2] The rule of law index captures perceptions of the extent to which agents have confidence in and abide by the rules of society, particularly the quality of contract enforcement, property rights, the police, and courts.

sensitive export growth is to credit expansion.[3]

Recurring Relationships with Trading Partners: Trading partners can arrange payments and settlements between themselves, allowing them to bypass credit from financial institutions. In such cases, they are less dependent on external financing from banks and their export elasticity to credit from financial institutions would be smaller. This prediction is explored in Column (4). The number of trading years is computed from the number of times that a particular firm exports a particular product to a given country during the period of our study. Our assumption is that a higher number of trading years is correlated with more interactions, which likely creates more trust and thereby makes firms less dependent on bank credit. As predicted, our results show that longer interactions between trading partners is associated with less sensitivity between bank credit and export growth.

Table 7. Firm Heterogeneity (Intensive Margin Elasticity to Credit)

	(1)	(2)	(3)	(4)
Dependent variable:	Change in ln(export)			
Change in ln(total credit)	0.018***	-0.002	0.013***	0.036***
	(0.002)	(0.003)	(0.002)	(0.004)
Small (yes=1)	-0.062***			
	(0.021)			
Small x Change in ln(total credit)	0.044***			
	(0.009)			
Sea (yes=1)		-0.104***		
		(0.020)		
Sea x Change in ln(total credit)		0.014***		
		(0.003)		
Rule of law			-0.035***	

[3] Given that the World Bank's measure of rule of law is highly correlated with the level of economic development of each country, we can broaden our interpretation that exports to more developed countries are less sensitive to credit than exports to developing countries.

			(0.002)	
Rule of law x Change in ln(total credit)			-0.005***	
			(0.001)	
Number of trading years				-0.312***
				(0.006)
Number of trading years x Change in ln(total credit)				-0.004***
				(0.001)
Product-destination-year FE	yes	yes		yes
Product-destination-firm FE	yes	yes		yes
Product-year FE			yes	
Product-firm FE			yes	
Observations	559,902	615,865	862,426	745,001
R-squared	0.332	0.341	0.088	0.317

Notes: OLS estimation of equation (1) with added explanatory variables and interaction terms with credit growth. In Column (1), the dummy for "small" is equal to one if a firm's fixed assets are less than THB 50 million. In Column (2), the "sea" dummy takes the value of one if total sea shipments account for more than 50% of the firm's total exports in a given year. In Column (3), "rule of law" of destination countries ranges from 0 to100, with higher values indicating better institutional quality. In Column (4), "number of trading years" is measured by the number of times firm *i* exports product *p* to a given destination *d* during the sample period. ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.
Source: Authors' estimates.

Firm's Location in Global Value Chains: Foley and Manova (2015) argue that financial frictions restrict not only a firm's entry into exporting and its operational scale conditional on exporting, but also a firm's position in the global value chain (GVC). We explore how finance matter for firms that trade intermediate inputs versus final goods. Although our data do not allow us to nail down the exact location of each firm in the GVC, we make an attempt to shed some light on this issue by classifying export firms into two broad categories: (i) firms that export final goods; and (ii) firms that export

intermediate goods. A firm is considered as exporting final goods if more than 50% of its total value of exports are from final goods. Final versus intermediate goods are in turn classified based on the Central Product Classification (CPC) from the United Nations Statistics Division (UNSD). Table 8 shows the estimated elasticities, comparing firms in group (i) and (ii). We further classify firms into different segments of the production chain due to higher up-front costs concerning input usage. In Column (1), the regression includes all firms. In Column (2), we exclude firms that import final goods. In Columns (3) and (4), we restrict our sample to firms that use imported intermediate inputs and firms that use only domestic inputs, respectively. The results are consistent across columns. Firms exporting final goods have a higher export elasticity to credit than firms exporting intermediate goods. One of the possible explanations is that firms exporting finished goods are involved in more complex and costly production processes than firms exporting intermediate goods, and thereby are more dependent on external finance.

Table 8. Firm's Position in Global Value Chain (Intensive Margin Elasticity to Credit)

	(1)	(2)	(3)	(4)
	All firms	Excludes importers of final goods	Firms using imported inputs	Firms using domestic inputs
Dependent variable:	Change in ln(export)			
Change in ln(total credit)	0.008***	0.008***	0.007***	0.028
	(0.002)	(0.002)	(0.002)	(0.034)
Export final goods (yes=1)	0.006	0.022	0.012	0.175
	(0.018)	(0.022)	(0.023)	(0.123)
Export final goods x change in ln(total credit)	0.011***	0.013***	0.013***	0.031
	(0.003)	(0.004)	(0.004)	(0.040)
Product-destination-year FE	yes	yes	yes	yes
Product-destination-firm FE	yes	yes	yes	yes

Observations	745,001	597,514	552,945	19,537
R-squared	0.314	0.335	0.336	0.54

Notes: OLS estimation of equation (1) with added export final goods dummy and its interaction term with credit growth. Export final goods dummy is defined as equal to one if more than 50 percent of a firm's total exports are in final goods. ***p<0.01, **p<0.05, *p<0.1. Robust standard errors in parentheses.

Source: Authors' estimates.

4.2.2 Extensive Margins

We also study export elasticities to credit at the extensive margins for heterogeneous firms. Table 9 shows that small firms are more sensitive to credit growth on the likelihood of having more products or entering more destinations (Columns (1) and (4)). Firms dominated by sea shipping also have a higher elasticity of export destination to credit (Column (5)). Table 10 reports the estimated elasticities when we classify firms into exporters of finished goods versus exporters of intermediate goods. The results show that firms exporting finished goods are more sensitive to both the number of products and the number of destinations to credit, in comparison with firms exporting intermediate goods. The findings suggest that financial constraints are likely more binding for firms exporting final goods. This is intuitive since these firms need to finance more costs related to customization, regulatory compliance, and foreign distribution network development.

Table 9. Firm Heterogeneity (Extensive Margin Elasticity to Credit)

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Change in number of products		Change in number of destinations		
Change in ln(total credit)	0.021***	0.036***	0.021***	0.029***	0.012
	(0.004)	(0.008)	(0.004)	(0.005)	(0.008)
Small (yes=1)	-0.012			-0.050	
	(0.033)			(0.040)	
Small x change in ln(total credit)	0.051***			0.043***	
	(0.013)			(0.016)	
Sea (yes=1)		0.091**			0.046
		(0.040)			(0.047)

Sea x change in ln(total credit)		-0.018**			0.016*
		(0.008)			(0.009)
Rule of law			-0.020***		
			(0.004)		
Rule of law x change in ln(total credit)			0.001		
			(0.003)		
Destination-year FE	yes	yes			
Destination-firm FE	yes	yes			
Year FE			yes		
Firm FE			yes		
Product-year FE				yes	yes
Product-firm FE				yes	yes
Observations	343,253	388,562	427,685	213,544	214,291
R-squared	0.111	0.100	0.030	0.163	0.165

Notes: OLS estimations of equation (2) (Columns (1)-(3)) and equation (3) (Columns (4) and (5)) with added explanatory variables and their interaction terms with credit growth. The dummy for "small" is equal to one if a firm's fixed assets are less than THB 50 million. The "sea" dummy takes the value of one if total sea shipments account for more than 50% of a firm's total exports in a given year. Rule of law of destination countries ranges from 0 to100, with higher values indicating higher institutional quality. ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.
Source: Authors' estimates.

Table 10. Firm's Position in Global Value Chain (Extensive Margin Elasticity to Credit)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All firms	Excludes importers of final goods	Firms using imported inputs	Firms using domestic inputs	All firms	Excludes importers of final goods	Firms using imported inputs	Firms using domestic inputs
Dependent variable	Change in number of products				Change in number of destinations			
Change in ln(total credit)	0.019***	0.019***	0.018***	0.105***	0.004	0.001	0.001	0.097
	(0.004)	(0.005)	(0.005)	(0.041)	(0.005)	(0.005)	(0.005)	(0.063)
Export final goods (yes=1)	-0.062*	-0.025	-0.050	0.615***	0.041	0.097**	0.066	0.826***
	(0.033)	(0.037)	(0.038)	(0.132)	(0.034)	(0.040)	(0.043)	(0.164)
Export final goods x change in ln(total credit)	0.014**	0.021***	0.021***	-0.019	0.040***	0.047***	0.046***	0.130*
	(0.007)	(0.007)	(0.008)	(0.049)	(0.008)	(0.009)	(0.009)	(0.071)
Destination-year FE	yes	yes	yes	yes				
Destination-firm FE	yes	yes	yes	yes				
Product-year FE					yes	yes	yes	yes
Product-firm FE					yes	yes	yes	yes
Observations	444,538	369,922	341,446	22,920	284,623	232,642	210,429	16,576
R-squared	0.089	0.1	0.099	0.298	0.141	0.162	0.163	0.361

Notes: OLS estimations of equation (2) (Columns (1)-(4)) and equation (3) (Columns (5)-(8)) with added export final goods dummy and its interaction term with credit growth. The "export final goods" dummy is defined as equal to one if more than 50% of a firm's total export are in final goods. ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.
Source: Authors' estimates. Final and intermediate goods classification from UNSD's Central Product Classification (CPC).

4.3 Timing Matters: Before, During, and After the 2008 Global Financial Crisis

4.3.1 Intensive Margin

In this section, we explore a very important question: when do changes in credit supply provide the strongest impact on export growth? We repeat the same empirical exercises as in sections 4.1 and 4.2, but divide our sample data into three different time periods: pre-crisis (before 2008), during crisis (2008-2010), and post-crisis (after 2010). We first re-estimate equation (1) using total credit on the intensive margin in Table 11. We find that a reduction in credit supply growth reduces export growth only during the GFC period (Column (2)). We find an insignificant impact of credit supply change on export growth for the pre-crisis (Column (1)) and small negative significant effect for the post-crisis (Column (3)). The results provide new insights into the important role of credit in export financing that is amplified during an economic downturn, when cost of financing is high and access to credit is difficult. The post-crisis result shows that credit is not sufficient in boosting exports when demand remains sluggish.

Table 11. Different time periods of intensive margin elasticity to credit

	(1)	(2)	(3)
	Pre-Crisis	During GFC	Post-Crisis
Dependent variable:		Change in ln (export)	
Change in ln(total credit)	-0.001	0.026***	-0.006**
	(0.004)	(0.005)	(0.003)
Product-destination-year FE	yes	yes	yes
Product-destination-firm FE	yes	yes	yes
Observations	239,611	217,238	391,334
R-squared	0.209	0.201	0.185

Notes: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors in parentheses.

Source: Authors' estimates.

We further test for the relationship between credit growth and export growth separately for short-term working capital and long-term investment loans during the 2008 financial crisis, when credit mattered for exports the most. The results are presented in Table 12. Similar to Table 6, we find that it is short-term credit that matters for export growth at the intensive margin by affecting exporters' working capital needs (Column (1)). Furthermore, during this critical time period, short-term credit impacted both the frequency of shipments of a given product to a given destination (Column (3)), as well as the value per shipment (Column (4)). This is different from our previous findings reported in Table 6 in which credit affects only the value of each shipment in the whole sample.

Table 12. Intensive margin elasticity to credit during GFC: Short-term versus long-term loans

	(1)	(2)	(3)	(4)
Dependent variables:	Change in ln(export)		Change in number of shipments	Change in ln(avg. value per shipment)
Change in ln(working capital credit)	0.025***		0.637***	0.012***
	(0.005)		(0.172)	(0.003)
Change in ln(investment credit)		-0.044		
		(0.051)		
Product-destination-year FE	yes	yes	yes	yes
Product-destination-firm FE	yes	yes	yes	yes
Observations	197,547	10,798	197,547	197,547
R-squared	0.208	0.394	0.172	0.195

Notes: OLS estimation of equation (1). ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.

Source: Authors' estimates.

4.3.2 Extensive Margin

As for the association between loan growth and the three extensive margins of exports, we re-estimate equations (2) through (4) for the three different time periods. The results are reported in Table 13. Again, we find that credit supply disruptions during the crisis period reduce the number of products exported and the number of export market destinations. The point estimates for exporting more products and accessing more markets during the crisis in Columns (2) and (5) (0.036 and 0.034) are higher compared to the point estimates obtained from the whole sample period in Columns (1) and (2) of Table 4 (0.024 and 0.017). Even though we do not find evidence that credit shocks during the crisis affect the probability of a firm becoming an exporter in Column (8), we find that credit growth helps a firm to enter an export market in the aftermath of the crisis (Column (9)).

Table 13. Extensive margin elasticities to credit before, during, and after the GFC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable	Change in number of products			Change in number of destinations			Pr(export>0)		
	Pre-Crisis	During GFC	Post-Crisis	Pre-Crisis	During GFC	Post-Crisis	Pre-Crisis	During GFC	Post-Crisis
Change in ln(total credit)	-0.001	0.036***	0.014**	0.003	0.034***	-0.014***	0.000	0.001	0.001***
	(0.007)	(0.010)	(0.006)	(0.007)	(0.007)	(0.005)	(0.000)	(0.000)	(0.000)
Destination-year FE	yes	yes	yes						
Destination-firm FE	yes	yes	yes						
Product-year FE				yes	yes	yes			
Product-firm FE				yes	yes	yes			
Year FE							yes	yes	yes
Firm FE							yes	yes	yes
Observations	145,110	121,318	203,606	87,757	79,822	148,777	55,492	44,447	91,382
R-squared	0.069	0.072	0.055	0.146	0.128	0.087	0.970	0.974	0.964

Notes: OLS estimation of equation (2) in columns 1-3 and equation (3) in columns 4-6. Linear probability model estimation of equation (4) in columns 7-9. Robust standard errors in parenthesis ***p<0.01, **p<0.05, *p<0.1.

Source: Authors' estimates.

We next investigate the relationship between different credit maturities and the extensive margins of exports during the GFC. Table 14 shows that during the crisis period, short-term credit supply affected both the number of products exported and the number of export market destinations (Columns (1) and (3)). Negative shocks to long-term credit also reduce the number of export market destinations (Column (4)).

Table 14. Extensive margin elasticities to short-term and long-term credit during the GFC

	(1)	(2)	(3)	(4)
Dependent variables:	Change in number of products		Change in number of destinations	
Change in ln(working capital credit)	0.032***		0.032***	
	(0.009)		(0.007)	
Change in ln(investment credit)		-0.189		0.094*
		(0.185)		(0.053)
Destination-year FE	yes	yes		
Destination-firm FE	yes	yes		
Prodcut-year FE			yes	yes
Product-firm FE			yes	yes
Observations	111,955	12,575	72,977	6,708
R-squared	0.072	0.088	0.131	0.267

Notes: OLS estimation of equation (2) in columns 1-2 and equation (3) in columns 3-4. ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.

Source: Authors' estimates.

5. Endogeneity and Instrumental Variable

As Paravisini et al. (2015) point out, loan growth is likely endogenous to export growth. Specifically, firms with export growth potential tend to receive more loans. The endogeneity arising from credit being determined by exports implies that OLS estimates would be biased. To explore this endoge-

neity problem, we adopt and instrumental variable (IV) approach to estimate equations (1) to (4). Our strategy is based on the assumption that in a world with credit market imperfections, demand for credit can exceed the supply of credit. In such an environment, an expansion of credit would result in export growth, and the elasticity of exports to credit implies the causality of the effects of credit growth on export growth.

Our instrument for loan growth for each firm *i* in period *t* is therefore a variable that is correlated with loan growth, but not directly with export growth. In this paper, we use a weighted average of the lagged share of fee revenues out of the total revenues of each financial institution, across all financial institutions that lend to firm *i* during that period. Given that fee revenues have been growing tremendously in the past decade, they provide supply of funds to financial institutions that could be lent to exporting firms. The share of fee (non-interest) revenues varies across financial institutions and is likely orthogonal to export growth of exporting firms. The higher the weighted average of the lagged fee share, the more likely that a firm's credit will grow.

As weak instruments can produce a biased IV estimator, we first test for the strength of our proposed instrument following Stock and Yogo (2005)'s weak identification test procedure. The results from the selected first-stage regression of intensive margin elasticity to credit are provided in the Appendix. Table A1 shows that the coefficient on the lagged weighted fee revenue share is positive and statistically significant. Because the Cragg-Donald F-statistic (116.17) is above the critical value for a 5% Wald test and a desired maximal distortion size of 10 percent (7.03), we reject the null hypothesis that the instrument is weak.

Table 15 presents the estimated export elasticities to credit from the IV estimation. The table shows that the elasticities from the IV regressions are much higher than what we get from the earlier OLS estimations. In effect, the results imply that an endogeneity problem exists and it biases our OLS estimates towards zero. Our point estimates of elasticity are qualitatively similar to what Paravisini et al. (2015) estimated from Peruvian data. In particular, the

OLS estimates for intensive margin growth of exports are 0.012 in our Thai data and 0.025 in the Peruvian case. The IV estimates are 0.154 and 0.195 for Thailand and Peru, respectively.[4]

Table 15. Intensive and extensive margin elasticities to credit, IV estimations

	(1)	(2)	(3)	(4)	(5)
	Intensive Margin			Extensive Margin	
Dependent variable	Change in ln(export)	Change in no. of shipment	Change in ln(average value per shipment)	Change in no. of products	Change in no. of destination
Change in ln (total credit)	0.154***	1.005	0.098***	0.305***	-0.065
	-0.023	-0.690	-0.018	-0.079	-0.094
Product-destination-year FE	yes	yes	yes		
Product-destination-firm FE	yes	yes	yes		
Destination-year FE				yes	
Destination-firm FE				yes	
Product-year FE					yes
Product-firm FE					yes
Observations	696,502	696,502	696,502	413,021	266,299
R-squared	0.304	0.257	0.296	0.074	0.144

Notes: IV estimations of equations (1) are reported in Columns (1) to (3), and equations (2) and (3) are reported in Columns (4) and (5) using lagged fee share as an instrument. ***p<0.01, **p<0.05, *p<0.1; robust standard errors in parentheses.
Source: Authors' estimates.

[4] Paravisini et al. (2015) use a weighted lagged share of foreign debt held by financial institutions as an instrument. With capital reversal during the Global Financial Crisis in 2008-09, loans to export firms from financial institutions with more exposure to capital reversal (i.e., higher foreign debt) were likely to drop more than those from financial institutions with smaller exposure.

6. Conclusion and Policy Implications

Our study uses merged granular administrative datasets to study the role of finance in international trade. We find that external finance matters for Thai exports: credit growth to export firms leads to export growth. One policy implication from our findings is that facilitating access to external finance could allow more firms to become exporters, have access to more destinations, export a greater variety of products, as well as increase sales in each product-destination. This is particularly the case for short-term loans that help firms finance their working capital. We also find that the elasticity of exports to credit is heterogeneous across different types of firms: smaller firms; firms exporting more products via sea shipments; firms exporting to destinations with low rule of law; firms exporting new product-market bundles; and finished-goods exporting firms tend to have higher elasticities. We also find that credit mattered for Thai exporting firms the most during the Global Financial Crisis.

Despite confirming that finance matters for exports, our point estimates of export elasticity to credit are small. At the high end, the estimate from the IV method yields an overall elasticity of 0.154 for the intensive margin growth. Given that the average growth of credit during the period in our sample was 0.46% per year and the average growth of export during the same period was 3.89%, a back-of-the-envelope calculation reveals that credit growth merely accounts for 2.25% of total export growth. For comparison, Paravisini et al. (2015) find that credit growth accounts for only 8% for Peruvian export growth. Although larger than the Thai case, the magnitude remains small in comparison to total export growth. If we consider Thai exports in 2009, a year during the Global Financial Crisis, export growth was -11.0% while credit growth was -14%, which implies that the decline in credit during that year accounted for 19.6% of the total drop in exports, or around one-fifth of the total export decline. This finding has an important policy implication: increasing credit supply to exporting firms is likely insufficient to boost export growth if product demand growth remains sluggish. Exports is an equilibrium outcome that is

determined by both supply and demand. This is confirmed by the fixed effects in our regressions which show that demand factors seem to play a major role in overall export growth.

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Appendix

Table A.1. First-stage regression of intensive margin elasticity to credit

Dependent variable:	Change in ln(total credit)
Weighted average of lagged fee revenue share	1.270***
	(0.170)
Observations	696,502
R-squared	0.304
Cragg-Donald F-statistic	116.17

Notes: Cragg-Donald F-statistic (116.17) is above the critical value for a 5 percent Wald test and a desired maximal distortion size of 10 percent (7.03), we reject the null hypothesis that the instrument is weak. ***p<0.01, **p<0.05, *p<0.1. Robust standard errors in parentheses.

Source: Authors' estimates.