Unlocking Finance and Trade: A Microscopic View[*]

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September 14, 2016

Abstract: We analyze highly disaggregated administrative data from two sources. The data from the Customs Department provide us with granular information on international trade at the transaction level while the data from the Bank of Thailand consist of account-level information on loans from financial institutions. We use the merged data to explore how changes in credit supply is related to export growth. First, we find that external finance matters for Thai export: credit growth to export firms leads to export growth. We also find that the elasticity of export to credit is heterogeneous across different types of firms, suggesting that there might be inefficiency in credit allocation across firms and sectors. Second, our point estimates imply that credit growth contributes to only small portion of total export growth while the rest is largely from the external demand factors. The insights from this study has important policy implications for Thailand: facilitating access to external finance could allow more Thai 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. However, boosting exports by injecting credits to export firms could be ineffective, especially if the growth of demand for Thai exports remains sluggish.

Keywords: Trade, export, finance, financial constraints, global production networks
JEL Classifications: F10, F14, G20, G28, G32

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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 when the world's 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 operation, which includes financing of fixed costs (e.g. R&D, marketing, and fixed capital investment) as well as financing of variable costs (e.g. purchases of inputs). This financing is often from external sources beyond their retained earnings and cash flows 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 comparing 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. This additional time required for international transactions usually stretch up to two to three months in the case of sea shipments (Djankov, Freund, and Pham 2006). As a result, firms engaged in international trade face longer cash conversion cycle and need to finance longer working capital, i.e., financing goods that have not yet been delivered and paid for. Finally, international trade entails additional risks that are generally not faced by domestic firms such as exchange rate fluctuation and breaches of contracts in different jurisdictions. These risks prompt firms to demand trade credit guarantee or insurance against the possibility of credit defaults. As a result, these firms turn to financial institutions for services that help facilitate smooth international transactions.

Given the indispensable role of finance in international trade, there have been a growing number of academic studies that look into this issue (Foley and Manova 2015). One strand of research

applies corporate finance literature to recent development on heterogeneous firms in international trade literature, focusing on the role of credit constraints on trade in which financially constrained firms were prevented from exporting despite their 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 their markets in foreign countries.

With the availability of new and more comprehensive databases, recent literature in empirical international trade has shown that finance is indeed one of the factors crucial for international trade. For example, Amiti and Weinstein (2011) identify a transmission mechanism through which shocks to banks that supply firms with trade finance affect firms' export behavior following the banking crisis in Japan. Since banks are the major supplier of trade finance, the supply of working-capital financing is highly dependent upon banks' health. The authors then match Japanese exporters with the institutions that provide them with finance and show that the health of financial institutions is an important determinant of firm-level exports. Additionally, financial shocks have a much larger impact on exports compared to domestic sales and the drop in exports originated from financial factors was as large as 20 percent of the drop in aggregate export. Bricongne et al. (2012), using a unique dataset of French firms, show that financing difficulties and shortage of liquidity are more prominent for export-oriented firms if they belong to sectors that are more dependent on external finance after the Global Financial Crisis. Using cross-country cross-industry US import data, Chor and Manova (2010) demonstrate that firms that are capable of exporting might be prevented from doing so due to high cost of external finance. They find that a more financially vulnerable sector experienced a sharper drop in monthly exports to the U.S. Furthermore, OECD (2009) shows that the availability and cost of trade finance had an impact on trade flows by constraining firm's ability to trade, especially during the crisis period. In the normal time, Auboin and Engemann (2012) show that bottleneck to trade credit and trade finance can hinder trade throughout the whole economic cycle, not just the turmoil one. On the other hand, Levchenko et al (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 the 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 (2012). They exploit disaggregated export data of Peruvian firms and outstanding credit of each firm with each bank, to estimate the elasticity of export to credit. They find the negative impact of bank shocks from the shortage of credit supply on the intensive margin (i.e., existing firms continuing export to the same product-destination market) but nothing on the extensive margin (i.e., probability of firms enters or exits a give product-destination export market). Their results suggest that shortages in credit supply affect variable cost of exporting rather than sunk entry costs. On the contrary, a study by Berman (2009) suggests that financing conditions affects trade mainly through the extensive margin, implying that a negative credit shock affects the entry margin; however, once the up-front investment is made, fluctuations in the supply of credit do not affect the intensive margin of exports. Feenstra et al. (2014) build a theoretical model of heterogeneous firms that explicitly accounts for "time to ship" of exporting firms that obtain working-capital loans from a bank. They find that longer time lag between production and sales receipt reduces exports on both the intensive and extensive margins.

The role of credits on export activities could be further divided into statics, i.e., patterns of specialization, versus dynamics, i.e., export outcomes after credit disruption. The causal link between financial market development and international trade is explored by Beck (2002) and Manova (2013). These studies examine cross-country differences in financial conditions, cross industry variations in the degree of external finance dependence, and predict steady-state patterns of international trade and comparative advantage. The findings suggest that sectors that are more financially vulnerable tend to be more susceptible to financial shocks in a country with a higher degree of credit market imperfections.

Another strand of literature studies how credit shocks differently affect firm level outcomes, in particular exports, through bank-lending channel. The demand for financing is trade-specific with respect to the mode of transportation (air versus sea). Because exports take longer in shipment, exporting firms face a tighter credit constraint compared to domestic trade. Furthermore, exporting firms shipping goods by sea would require higher working capital than air shipping due to longer transit time. Empirically, Amiti and Weinstein (2011) examine the effects of changes in bank health on firms in industries in which majority of goods are shipped by sea versus air. Their results

indicate that financial shocks play a much more important role in the drop in exports of goods shipped by sea. These results suggested that there exists important links between exporters and their financiers in which the role of banks works to amplify the impact of financial shocks and financial dependence on exports at the firm level.

Finally, there is also a strand of literature on how finance matter for trade in intermediate inputs versus final goods. For example, Yi (2004) documents the large and growing importance of trade in intermediates. Manova (2015) shows that trade in intermediate inputs for further processing and re-exporting expands faster than trade in final goods. Amiti and Davis (2011) develop a general equilibrium model that features firm heterogeneity, trade in final and intermediate products, and firm specific wages. Although there is no financial friction in their model, fixed cost of exporting and fixed cost of importing intermediates are still meaningful for our interpretation on intermediate versus final goods since fixed costs faced by a firm are a function of the mode of globalization, depending on the number of foreign markets. Foley and Manova (2015) argue that financial frictions restrict firm's entry into exporting, operational scale conditional on exporting, and firm's position in the global value chain (GVC). Finally, Manova and Yu (2013) show that credit constraints restrict Chinese firms to lower value added, less profitable stages of global supply chains. They also argue that the need of working capital by exporters rises with segments of production due to higher up-front costs (from least to greatest) as follows: (1) pure-assembly processing trade (PA), whereby processing firms receive foreign inputs at no cost for assembling and sell back to their trade partners, (2) processing with imports (PI), whereby processing firms source and pay for imported inputs, and (3) ordinary trade (OT), whereby firms conduct the whole segment of value chain (product design, input sourcing, input processing, final assembly and distribution). They find that financially healthier firms with more liquidity and less leverage have higher shares of OT/Total exports and PA/Total processing exports.

Our study contributes to these related strands of literature on the role of finance in international trade. In particular, we analyze highly disaggregated administrative data from two sources. The data from the Customs Department provide us with granular information on international trade at the transaction level while the data from the Bank of Thailand consist of account-level information on loans from financial institutions. We use the merged data to explore how changes to credit

supply affect exports at the firm level. The insights from this study have important policy implications for Thailand, the country where exports have been a major driving force of economic growth for several decades. On the one hand, our results suggest that the overall impact of credit growth is small in magnitude while other factors, especially foreign demand, play a much larger role in determining export growth. An important policy implication is that, in the absence of increasing foreign demand, injecting credit to firms in order to boost up their exports will have limited effectiveness. On the other hand, our findings imply that several export firms in Thailand remain under financial constraints. Relaxing financial frictions and facilitating access to external finance, especially short-term working-capital loans, could allow more Thai firms to become exporters, have access to more destinations, export a greater variety of products, as well as increase sales in each product-destination. We also find that the elasticity of export 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 elasticity. In other words, growth in credits supplied to these firms is associated with higher growth of exports. Finally, the elasticity also varies across sectors. These results suggest that there might be inefficiency in allocation of credits across exporters and sectors.

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. Our dataset is constructed from various 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 exporter, 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] Given the seasonality of international trade, we collapse our transactional data into annual flows at the product-destination-exporter

[1] For detailed description and stylized facts from the Customs Department data, see Apaitan, Disyatat, and Samphantharak (2016).

level. Second, loan data are from the Bank of Thailand and contain information on outstanding amount, type, purpose, lender, and borrower for each loans. The data include all loans with credit line above 20 million baht that were lent by any Thai commercial banks and foreign bank branches, as well as selected special financial institutions. We aggregate account-level observations into annual loan data at the borrower level. We then merge the annual export flows with the annual loan data by firm. Finally, we further supplement the data with firm's financial characteristics obtained from the Department of Business Development at the Ministry of Commerce. These characteristics include standard balance sheet and income statement items as well as industry in which each firm operates.

2.2 Descriptive Statistics

Table 1 presents descriptive statistics of firms in our sample. Small firms are defined as those with fixed assets below 40 million baht while large firms are those with fixed assets above 400 million baht. Table 2 shows descriptive statistics at the firm-product-destination level. Finally, we classify firms by their type of export products. We define a firm as an exporter of final goods if more than 50 percent of its total export value is from final goods. Likewise, an exporter of intermediate goods is defined as a firm that more than 50 percent of its exports are intermediate goods.

[Tables 1, 2, 3]

3. Empirical Strategy

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

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

where X_{pdit} is export of product p to destination d by firm i in period t; C_{it} is credit to firm i in period t; and η^{I} is the elasticity of export to credit. In addition to credit, H_{pdit} includes other factors rather credit that affect export 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. 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 α_{pdt} is the fixed effect for product *p* at destination *d* in period *t*, which captures the change in demand condition at the destination between periods *t-1* and *t* while γ_{pdi} is the fixed effect for product *p* at destination *d* from firm *i*, which captures the change in input costs and others 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 product 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:

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

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

where NP_{dit} represents the number of products exported to destination *d* by firm *i* in period *t* and ND_{pit} represents the number of destinations for product *p* exported by firm *i* in period *t*. The fixed effects capture the change in relevant conditions of the destination and product. Finally, we explore the likelihood of firm *i* being an export firm in period *t*, $Prob(X_{it} > 0)$, 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 probits.

4. Results

We first present our results from OLS estimation for export growth at the intensive and extensive margins. We then explore the heterogeneous effects across different types of export firms. Finally, we end this section with the estimates by industry.[2] We return to the endogeneity problem in the next section.

4.1 Overall Elasticity

4.1.1 Intensive Margin

Table 4 presents the estimation results of equation (1) using total credit and export volume at the intensive margin. Column 1 shows that there is a positive relationship between credit growth and export growth. We then explore further the contributions to intensive margin growth as export growth at the intensive margin could come from two channels: (1) an increase in the number of shipment per year, and (2) an increase in the amount of export per shipment. Columns 2 and 3 show that the effect of credit growth on export growth was from the growth in export volume per shipment and not from the increasing number of shipment.

[Table 4]

Since short-term and long-term loans could affect export differently, we estimate equation (1) using credits for short-term working-capital and for long-term fixed investment separately. The results of short-term working capital loans are presented in Table 4A and are largely similar to those in Table 4 discussed earlier. However, we find no significant relationship between long-term credit growth and export growth in Table 4B. This finding suggests that for export growth at the intensive margin, what matters was short-term rather than long-term credits, consistent with the

[2] The mega flood that took place in the second half of 2011 resulted in a large drop of exports in 2012 while credit growth went up at the same time, partly due to soft loans through assistance programs. Given this rare and unusual event, we separate the effect of loan growth on export growth in 2012 in all regressions in this study. The estimated elasticities for 2012 are negative and significant (not reported in the tables).

hypothesis that working-capital is needed for financing variable costs of exporting for incumbent firms already conducting export.

[Tables 4A and 4B]

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 equation (2) when we use overall credit growth as an explanatory variable. The results reveal that loan growth is associated with 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 intensive margin, we further look at the relationship of short-term versus long-term credit growth on export. Table 5A shows that short-term credit growth is positively correlated with export growth for all three extensive margins. More interestingly, as shown in Table 5B, we also find a positive relationship between long-term credit growth and the likelihood of exporting more products (Column 1) and accessing to more markets (Column 2). This finding is consistent to what established in the literature that export growth at the extensive margins is likely more difficult than the expansion at the intensive margin and may need longer-term finance for sunk fixed investment.

[Tables 5, 5A, and 5B]

4.2 Heterogeneous Elasticities by Firm Types

4.2.1 Intensive Margin

So far we have established that there is overall evidence that finance is associated with export and the elasticity of export 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 the extreme case, if export is not dependent on credit at all (i.e., export constraints are from other factors such as demand at destination rather than supply of credit), then the elasticity of export to credit should be zero. That is, increasing credit is not associated with growth in export. On the other hand, the more export depends on external finance, an increase in credit would lead to a higher increase in export, i.e., the higher the elasticity.[3] In this subsection, we explore possible heterogeneous elasticities in various dimensions.

Firm Size: In Table 6, we focus on the intensive margin. Columns 1 and 2 focus on firm size. The hypothesis is 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 Columns 1 and 2 are consistent with this hypothesis. In Column 1, the interaction term for small firms with credit growth is positive and significant, implying that export growth of these firms are more sensitive to credit growth. However, Column 2 shows that the interaction term for large firms is negative but not significant, implying no difference between the mid-size and the large-side firms. Overall, our findings support the argument of heterogeneous elasticities of export on credit across firms of different sizes.

[Table 6]

Shipping Methods: Column 3 analyzes the heterogeneous elasticity based on shipping methods. We first construct a dummy variable for each firm in each period. This variable takes the value of one if total sea shipments account for larger than 50 percent of the total value of the firm's export during that year, and takes the value of zero otherwise. Given that sea shipping takes much longer time than others (i.e. air and land), there is more need for firms to finance a longer period before goods arrive at the destinations. Our finding supports this hypothesis. The interaction term between sea shipment and credit growth is positive and statistically different from zero.

Rule of Law: We explore the heterogeneous institutional quality of the destination countries in Column (4), using the measure of country's rule of laws provided by the World Bank. Given that

[3] The rationale behind this statement is similar to Rajan and Zingales (1998) and Chor and Manova (2010).

international trade requires settlement of payments between two parties while it takes time for the goods to be delivered, there is risk in financing this trade. This risk is born by either financial institutions (in case of letter of credit) or trading partners (in case of direct settlement). 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. Providing credit to these firms would lead to faster growth of export. Again, this hypothesis is confirmed by our empirical result in Column 4. We find that the higher the quality, the less sensitive export growth to credit expansion.[4]

Recurring Relationship with Trading Partners: Trading partners could arrange the payment and settlement between themselves, allowing them to bypass credits from financial institutions. In such case, they are less dependent on external finance from banks and their export elasticity to credit from financial institutions would be smaller. This prediction is explored in Column 5 where we compute 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, the higher the number, the more interactions between the exporter and its trading partner(s) in the destination country. These repeated interactions likely create more trust between the trading partners, making them less dependent on bank credits. As predicted, our result shows that the more interactions, the less sensitive of export growth to growth of bank credit.

Firm's Location in Global Value Chains (GVC): 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 exports intermediate goods. A firm is considered as exporting final goods if more than 50 percent of its the total value of export are from final goods. Final versus intermediate goods are in turn classified based on the list from the United Nations Statistics Division (UNSD). Table 7 shows the estimated elasticities, comparing firms in group (i) and (ii). Column 1 compares elasticity of export to credit of final-goods exporting firms with that of intermediate-goods exporting firms.

[4] 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 credits than exports to developing countries.

Column 2 limits our sample to only firms that did not import final goods; Column 3 includes only export firms that imported intermediate goods; Column 4 consists of only firms that only used domestic inputs and did not import any intermediate inputs. The results are consistent across columns: Firms exporting final goods have higher export elasticity to credit than firms exporting intermediate goods. An interpretation is that credit growth of final-goods exporting firms results in higher export growth when compared to intermediate-goods exporting firms. One of the possible explanations is that finish-goods exporting firms involve in more complex and costly production process than intermediate-goods exporting firms, and thereby being more dependent on external finance.

[Table 7]

Note that the results on heterogeneous elasticities at the intensive margin when we use short-term loan growth are qualitatively similar to what we get when we use total loan growth. The results for long-term loan, however, are largely insignificant, which is consistent to the findings discussed earlier, and hence not reported here.

4.2.2 Extensive Margins

We also study the heterogeneous export elasticities to credit at the extensive margins. Table 8 shows that small firms experience larger sensitivity of credit growth on the likelihood of having more products or entering more destinations (Columns 1 and 5). Firms dominated by sea shipments also have higher elasticity of export destination to credit (Column 7). We find similar results when using short-term loan growth only, but find no significant heterogeneous elasticities when we look at long-term loan. Table 9 reports the estimated elasticities when we classify firms into finished-goods exporters versus intermediate-goods exporters. The results show that finished-goods exporting firms have higher sensitivities of both the number of products and the number of destinations to credit, in comparison with intermediate-goods exporting firms. 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 8]

4.3 Heterogeneous Elasticity by Industry

Finally, one may be interested in exploring overall export elasticities across different industries. We estimate export elasticities to credit, for the intensive margin, by industry. We also estimate the elasticities for the periods before and after 2012 separately so that the results shed light on the trend for each industry (detailed results not reported here). The results for the post-2012 period are also illustrated in Figure 1. The figure shows that export elasticities vary across industries. Other non-metallic mineral product (mainly cement, pipe and valve, and ceramic sink), electrical equipment (such as refrigerator, freezer, and air conditioner), and beverages have high export elasticities to credit. In contrast, computer and textile industries have negative elasticities; in other words, these industries recently experienced a decline in exports while their loan growth continued to grow. The figure also implies that using the current amount of loan (as shown on the vertical axis) as a guiding criteria for credit allocation could result in misallocation of resources: the ability that each industry transforms credit expansion into export growth is not related to the amount of credit that the industry currently receives.[5]

4. Endogeneity and Instrumental Variable

In the absence of market imperfection, credit observed in the data would reflect the equilibrium level of credit, i.e. it equals to both demand for credit and supply of credit. Like demand for any factors of production, demand for credit is derived demand and therefore depends on export. In other words, 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.

[5] Note that this argument is based on the assumption that only export growth (i.e., the 1st moment) is the sole criteria for loan allocation. It is abstract from the risk of export (i.e., the 2nd moment). Also, we are abstract from domestic sales—loan growth could result in the expansion of domestic market.

The endogeneity arising from credit being determined by export implies that OLS estimates would be biased. To explore this endogeneity problem, we adopt instrumental variable (IV) estimation to estimate equations (1) to (4) above.

Our strategy is based on the assumption that in the world with credit market imperfection, demand for credit could exceed supply of credit. In such environment, an expansion of credit would result in export growth and the elasticity of export 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 in the total revenue 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) revenue varies across financial institution and is likely orthogonal to export growth of exporting firms. The higher the weighted average of lagged fee shares, the more likely that the firm's credit will grow. Table 10 presents the results from the first-stage regression. The table shows that lagged weighted fee revenue indeed was positively correlated with credit growth.

[Table 10]

Tables 11 and 12 present the estimated export elasticities to credit from IV. The tables shows that the elasticities from IV are much higher than what we get from OLS estimation earlier. In effect, the results imply that endogeneity problem exist and it biases our OLS estimates towards zero. Our point estimates of elasticity are qualitatively similar to what Paravisini et al (2015) estimated from the Peruvian data. In particular, the OLS estimates for intensive margin growth of export are 0.012 in our Thai data and 0.025 in the Peruvian case. The IV estimates are 0.154 for Thailand and 0.195 for Peru, respectively.[6]

[6] 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

[Tables 11 and 12]

5. Discussion

To sum up, our study uses merged granular administrative datasets to study the role of finance in international trade. We find that external finance matters for Thai export: credit growth to export firms leads to export growth. One policy implication from our finding is that facilitating access to external finance could allow more Thai 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 export 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 elasticity. The elasticity also varies across sectors. Heterogeneity in export elasticities to credit suggest that there might be inefficiency in credit allocation across firms and sectors.

Despite confirming that finance matters for export, our point estimates of export elasticity to credit is small. At the high end, the estimate from 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-envelope calculation reveals that credit growth merely account for 2.25% of total export growth. For comparison, credit growth accounts for only 8% for Peruvian export growth. Though larger than the Thai case, the magnitude remains very small in comparison to total export growth. If we consider the Thai exports in 2009, the year during the Global Financial Crisis as what studied in the Peruvian study, export growth was -11.0% while credit growth was -14%, which implies that credit decline during that year accounted for 19.6% of the total drop in export, still less than a fifth of the total export decline. This finding has an important policy implication that increasing credit

with more exposure to capital reversal (i.e., higher foreign debt) were likely to drop more than those from financial institutions with smaller exposure.

supply to exporting firms is likely not an effective way to boost export growth. This conclusion is intuitive. Given that export is an equilibrium outcome that is determined by both supply and demand, injecting supply of credit to exporting firms will lead to an increase in exports only when demand for exports increases as well. If demand growth is sluggish, the impact of credit growth on export could be minimal. Our study quantitatively shows that this is the case for Thailand: demand factors that are captured by the fixed effects in the regressions seem to be the major contributor of the overall export growth.

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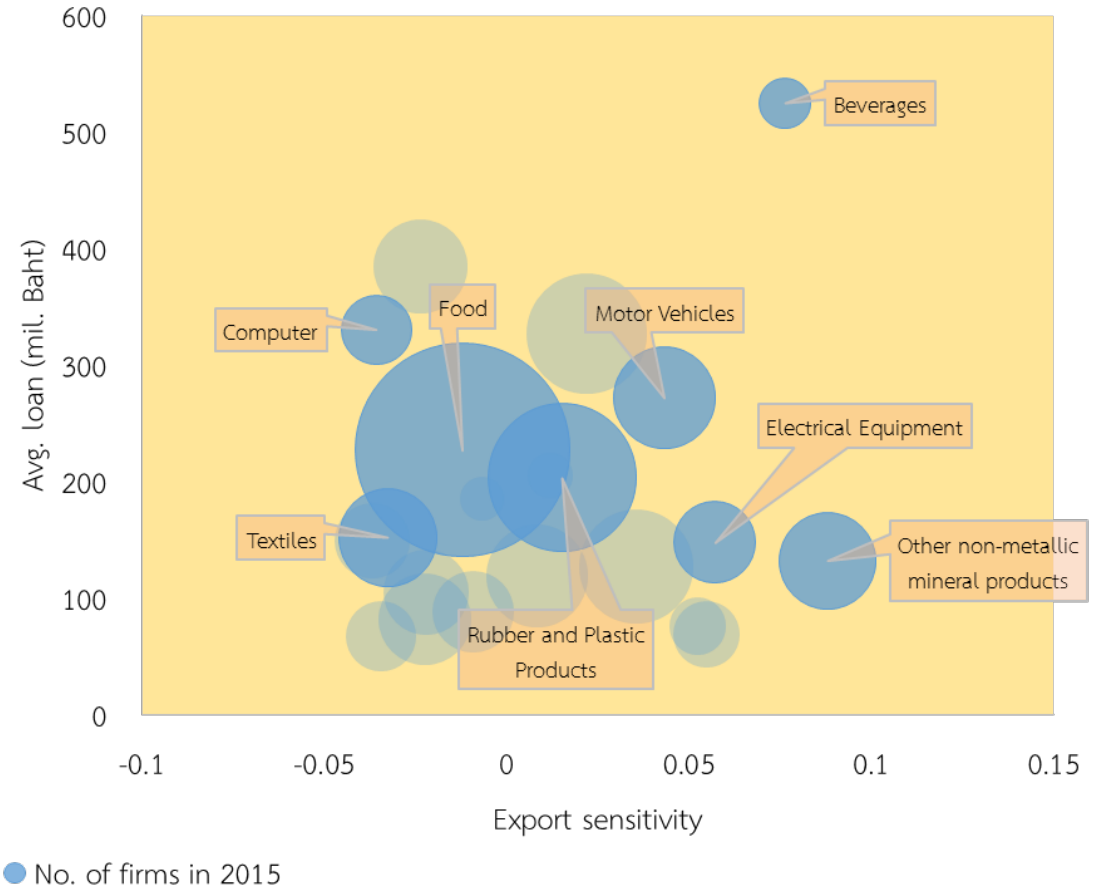
Figure 1 Export Elasticity to Credit versus Average Loan per Firm, by Industry



Remarks: The horizontal axis is export elasticity to credit for the post-2012 period, estimated separately by industry. The vertical axis is average loan per firm in each industry. The size of the circle represents the number of firms in each industry in 2015. Dark circles represents industries with statistically significant elasticity at 10%.

Table 1 Descriptive Statistics: Firm

	All Firms (n=279,913)		Exporters (n=90,019)		Small (n=81,253)		Medium (n=186,912)		Large (n=11,748)	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Exports value per year (million THB)	-	-	605.9	4,214.6	153.0	1,598.5	411.1	3,095.1	2,670.5	9,482.6
Credit (million THB)	133.0	750.4	276.3	1,220.9	56.3	223.2	110.9	638.2	1,014.6	2,401.4
Credit - working capital (million THB)	82.0	428.8	177.9	673.6	41.4	186.2	68.5	360.8	578.1	1,345.5
Credit - investment (million THB)	10.8	187.6	24.3	310.1	2.3	37.1	8.1	162.9	113.0	628.9
Fee share	0.18	0.06	0.18	0.07	0.17	0.06	0.19	0.06	0.15	0.07
Fixed assets (million THB)	230.5	2,216.7	419.5	3,112.0	11.9	11.6	127.2	87.6	2,143.5	7,343.9

Table 2 Descriptive Statistics: Firm-Product-Destination

	All n=2,155,105		Sea n=1,343,149		Air n=567,930	
	mean	sd	mean	sd	mean	sd
Exports value per year (million THB)	25.3	309.2	28.6	271.0	14.9	357.6
Number of shipments per year	17.3	102.4	16.4	71.5	13.2	133.9
Value per shipment (million THB)	1.0	10.4	1.4	12.5	0.3	5.9
Age of relationship (trading year)	4.1	3.4	4.4	3.5	3.1	2.9

Table 3 Number of firm-year by industry

	Export intermediate goods	Export final goods	Total
Manufacturing	108,076	22,615	130,691
Trading	138,887	10,335	149,222
Total	246,963	32,950	279,913

Table 4: Overview of intensive margin, OLS estimation

Dependent Variable	(1) Change in ln(export)	(2) Change in number of shipment	(3) Change in ln(average value per shipment)
Change in ln(total credit)	0.0120***	0.0328	0.00571***
	(0.00172)	(0.0511)	(0.00133)
Observations	745,001	745,001	745,001
R-squared	0.314	0.252	0.302
prod-dest-year FE	yes	yes	yes
prod-dest-firm FE	yes	yes	yes

Table 4A: Overview of intensive margin, OLS estimation

Dependent Variable	(1) Change in ln(export)	(2) Change in number of shipment	(3) Change in ln(average value per shipment)
Change in ln(working-capital credit)	0.0120***	0.00320	0.00518***
	(0.00173)	(0.0494)	(0.00135)
Observations	673,724	673,724	673,724
R-squared	0.323	0.260	0.311
prod-dest-year FE	yes	yes	yes
prod-dest-firm FE	yes	yes	yes

Table 4B: Overview of intensive margin, OLS estimation

Dependent Variable	(1) Change in ln(export)	(2) Change in number of shipment	(3) Change in ln(average value per shipment)
Change in ln(investment credit)	-0.0127	-0.325	-0.0148
	(0.0143)	(0.403)	(0.0112)
Observations	55,108	55,108	55,108
R-squared	0.487	0.511	0.458
prod-dest-year FE	yes	yes	yes
prod-dest-firm FE	yes	yes	yes

Standard errors in parentheses

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

Table 5: Overview of extensive margin

Dependent variable	(1) Change in number of products	(2) Change in number of destinations	(3) Pr(export > 0)
Change in ln(total credit)	0.0239***	0.0172***	0.00145***
	(0.00352)	(0.00395)	(0.000347)
Observations	444,538	284,623	199,721
R-squared	0.089	0.141	0.940
dest-year FE	yes		
dest-firm FE	yes		
prod-year FE		yes	
prod-firm FE		yes	
year FE			yes
firm FE			Yes

Table 5A: Overview of extensive margin, OLS estimation

Dependent variable	(1) Change in number of products	(2) Change in number of destinations	(3) Pr(export > 0)
Change in ln(working-capital credit)	0.0237***	0.0190***	0.000994***
	(0.00334)	(0.00398)	(0.000317)
Observations	409,857	260,147	168,403
R-squared	0.092	0.148	0.944
dest-year FE	yes		
dest-firm FE	yes		
prod-year FE		yes	
prod-firm FE		yes	
year FE			yes
firm FE			yes

Table 5B: Overview of extensive margin, OLS estimation

Dependent variable	(1) Change in number of products	(2) Change in number of destinations	(3) Pr(export > 0)
Change in ln(investment credit)	0.0693***	0.0342*	-0.000320
	(0.0184)	(0.0178)	(0.00134)
Observations	54,978	32,450	23,038
R-squared	0.169	0.324	0.957
dest-year FE	yes		
dest-firm FE	yes		
prod-year FE		yes	
prod-firm FE		yes	
year FE			yes
firm FE			yes

Table 6: Firm Heterogeneity (Intensive Margin)

	(1)	(2)	(3)	(4)	(5)
Dependent variable			Change in ln(export)		
Change in ln(total credit)	0.0178***	0.0212***	-0.00244	0.0128***	0.0359***
	(0.00215)	(0.00356)	(0.00287)	(0.00169)	(0.00376)
Small (yes=1)	-0.0622***				
	(0.0206)				
Small x Change in ln(total credit)	0.0442***				
	(0.00867)				
Large (yes=1)		-0.0459**			
		(0.0185)			
Large x Change in ln(total credit)		-0.00170			
		(0.00414)			
Sea (yes=1)			-0.104***		
			(0.0201)		
Sea x Change in ln(total credit)			0.0139***		
			(0.00332)		
Rule of law				-0.0346***	
				(0.00228)	
Rule of law x Change in ln(total credit)				-0.00526***	
				(0.00122)	
Number of trading years					-0.312***
					(0.00641)
Number of trading years x Change in ln(total credit)					-0.00349***
					(0.000477)
Observations	559,902	559,902	615,865	862,426	745,001
R-squared	0.332	0.332	0.341	0.088	0.317
prod-dest-year FE	yes	yes	yes		yes
prod-dest-firm FE	yes	yes	yes		yes
prod-year FE				yes	
prod-firm FE				yes	

Table 6A: Firm Heterogeneity (Intensive Margin)

	(1)	(2)	(3)	(4)	(5)
Dependent variable			Change in ln(export)		
Change in ln(working-capital credit)	0.0171***	0.0178***	0.0132	0.00962***	0.0378***
	(0.00212)	(0.00327)	(0.0196)	(0.00164)	(0.00378)
Small (yes=1)	-0.0637***				
	(0.0221)				
Small x Change in ln(total credit)	0.0393***				
	(0.00827)				
Large (yes=1)		-0.0626***			
		(0.0195)			
Large x Change in ln(total credit)		0.00265			
		(0.00399)			
Sea (yes=1)			0.0102		
			(0.120)		
Sea x Change in ln(total credit)			-0.0152		
			(0.0283)		
Rule of law				-0.0337***	
				(0.00235)	
Rule of law x Change in ln(total credit)				-0.00270**	
				(0.00118)	
Number of trading years					-0.315***
					(0.00695)
Number of trading years x Change in ln(total credit)					-0.00382***
					(0.000492)
Observations	509,446	509,446	44,222	794,673	673,724
R-squared	0.342	0.342	0.505	0.091	0.326
prod-dest-year FE	yes	yes	yes		yes
prod-dest-firm FE	yes	yes	yes		yes
prod-year FE				yes	
prod-firm FE				yes	

Table 7: Firm Type (Intensive Margin)

	(1)	(2)	(3)	(4)
Dependent variable		Change in ln(export)		
Change in ln(total credit)	0.00806***	0.00772***	0.00710***	0.0279
	(0.00211)	(0.00222)	(0.00228)	(0.0336)
Export final goods (yes=1)	0.00578	0.0221	0.0124	0.175
	(0.0183)	(0.0217)	(0.0229)	(0.123)
Export final goods x Change in ln(total credit)	0.0105***	0.0132***	0.0132***	0.0310
	(0.00330)	(0.00373)	(0.00386)	(0.0395)
Observations	745,001	597,514	552,945	19,537
R-squared	0.314	0.335	0.336	0.540
prod-dest-year FE	yes	yes	yes	yes
prod-dest-firm FE	yes	yes	yes	yes

Table 7A: Firm Type (Intensive Margin)

	(1)	(2)	(3)	(4)
Dependent variable		Change in ln(export)		
Change in ln(working-capital credit)	0.00736***	0.00705***	0.00659***	0.0227
	(0.00218)	(0.00230)	(0.00236)	(0.0294)
Export final goods (yes=1)	0.00450	0.0161	0.00339	0.204
	(0.0199)	(0.0234)	(0.0247)	(0.127)
Export final goods x Change in ln(total credit)	0.0115***	0.0121***	0.0120***	-0.0114
	(0.00327)	(0.00372)	(0.00388)	(0.0361)
Observations	673,724	540,111	498,651	17,929
R-squared	0.323	0.344	0.345	0.544
prod-dest-year FE	yes	yes	yes	yes
prod-dest-firm FE	yes	yes	yes	yes

Table 8: Firm Heterogeneity (Extensive Margin)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	Change in number of products				Change in number of destinations		
Change in ln(total credit)	0.0211***	0.0278***	0.0361***	0.0206***	0.0290***	0.0372***	0.0116
	(0.00426)	(0.00576)	(0.00755)	(0.00371)	(0.00500)	(0.00772)	(0.00768)
Small (yes=1)	-0.0117				-0.0497		
	(0.0334)				(0.0403)		
Small x Change in ln(total credit)	0.0514***				0.0434***		
	(0.0129)				(0.0155)		
Large (yes=1)		0.0505				0.137***	
		(0.0312)				(0.0435)	
Large x Change in ln(total credit)		-0.00365				-0.00735	
		(0.00748)				(0.00919)	
Sea (yes=1)			0.0912**				0.0459
			(0.0403)				(0.0472)
Sea x Change in ln(total credit)			-0.0177**				0.0162*
			(0.00825)				(0.00941)
Rule of law				-0.0203***			
				(0.00438)			
Rule of law x Change in ln(total credit)				0.000982			
				(0.00287)			
Observations	343,253	343,253	388,562	427,685	213,544	213,544	214,291
R-squared	0.111	0.111	0.100	0.030	0.163	0.163	0.165
prod-dest-year FE	yes	yes	yes				
prod-dest-firm FE	yes	yes	yes				
prod-year FE					yes	yes	yes
prod-firm FE					yes	yes	yes
year FE				yes			
firm FE				yes			

Table 8A: Firm Heterogeneity (Extensive Margin)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	Change in number of products				Change in number of destinations		
Change in ln(working-capital credit)	0.0171***	0.0229***	0.0321***	0.0185***	0.0247***	0.0338***	0.00634
	(0.00393)	(0.00541)	(0.00759)	(0.00350)	(0.00492)	(0.00719)	(0.00799)
Small (yes=1)	0.00776				-0.0296		
	(0.0351)				(0.0428)		
Small x Change in ln(total credit)	0.0568***				0.0386***		
	(0.0125)				(0.0148)		
Large (yes=1)		0.0332				0.100**	
		(0.0327)				(0.0460)	
Large x Change in ln(total credit)		-0.00165				-0.00966	
		(0.00703)				(0.00885)	
Sea (yes=1)			0.0711*				0.0257
			(0.0426)				(0.0502)
Sea x Change in ln(total credit)			-0.0118				0.0211**
			(0.00815)				(0.00956)
Rule of law				-0.0194***			
				(0.00454)			
Rule of law x Change in ln(total credit)				0.00135			
				(0.00272)			
Observations	316,175	316,175	358,326	395,664	195,206	195,206	194,779
R-squared	0.115	0.115	0.102	0.031	0.170	0.170	0.174
prod-dest-year FE	yes	yes	yes				
prod-dest-firm FE	yes	yes	yes				
prod-year FE					yes	yes	yes
prod-firm FE					yes	yes	yes
year FE				yes			
firm FE				yes			

Table 8B: Firm Heterogeneity (Extensive Margin)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	Change in number of products				Change in number of destinations		
Change in ln(investment credit)	0.0499**	0.0325	0.0681*	0.0502***	0.0141	-0.0384	0.0479*
	(0.0247)	(0.0351)	(0.0363)	(0.0194)	(0.0295)	(0.0360)	(0.0279)
Small (yes=1)	-0.149				0.0957		
	(0.184)				(0.194)		
Small x Change in ln(total credit)	0.00139				-0.319**		
	(0.0991)				(0.124)		
Large (yes=1)		0.314***				0.430***	
		(0.101)				(0.139)	
Large x Change in ln(total credit)		0.0308				0.100*	
		(0.0450)				(0.0547)	
Sea (yes=1)			0.00610				0.0888
			(0.147)				(0.184)
Sea x Change in ln(total credit)			-0.0254				-0.000411
			(0.0421)				(0.0479)
Rule of law				-0.0227*			
				(0.0122)			
Rule of law x Change in ln(total credit)				-0.00242			
				(0.0138)			
Observations	39,796	39,796	48,064	54,953	22,342	22,342	23,574
R-squared	0.192	0.192	0.179	0.034	0.340	0.341	0.355
prod-dest-year FE	yes	yes	yes				
prod-dest-firm FE	yes	yes	yes				
prod-year FE					yes	yes	yes
prod-firm FE					yes	yes	yes
year FE				yes			
firm FE				yes			

Table 9: Firm Type (Extensive Margin)

	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Dependent Variable	Change in Number of Products				Change in Number of Destinations			
Change in ln(total credit)	0.0185***	0.0186***	0.0181***	0.105***	0.00392	0.00130	-0.000750	0.0965
	(0.00435)	(0.00452)	(0.00464)	(0.0408)	(0.00473)	(0.00496)	(0.00508)	(0.0629)
Export final goods (yes=1)	-0.0615*	-0.0248	-0.0504	0.615***	0.0407	0.0970**	0.0658	0.826***
	(0.0326)	(0.0368)	(0.0387)	(0.132)	(0.0344)	(0.0404)	(0.0428)	(0.164)
Export final goods x Change in ln(total credit)	0.0141**	0.0209***	0.0208***	-0.0188	0.0399***	0.0469***	0.0460***	0.130*
	(0.00661)	(0.00729)	(0.00753)	(0.0489)	(0.00787)	(0.00905)	(0.00936)	(0.0714)
Observations	444,538	369,922	341,446	22,920	284,623	232,642	210,429	16,576
R-squared	0.089	0.100	0.099	0.298	0.141	0.162	0.163	0.361
dest-year FE	yes	yes	yes	yes				
dest-firm FE	yes	yes	yes	yes				
prod-year FE					yes	yes	yes	yes
prod-firm FE					yes	yes	yes	yes

Table 9A: Firm Type (Extensive Margin)

	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Dependent Variable	Change in Number of Products				Change in Number of Destinations			
Change in ln(working-capital credit)	0.0198***	0.0200***	0.0190***	0.0685*	0.00682	0.00481	0.00211	0.0852
	(0.00421)	(0.00436)	(0.00447)	(0.0406)	(0.00478)	(0.00499)	(0.00511)	(0.0578)
Export final goods (yes=1)	-0.0718**	0.000367	-0.0269	0.689***	0.0287	0.101**	0.0664	0.852***
	(0.0344)	(0.0390)	(0.0411)	(0.139)	(0.0368)	(0.0430)	(0.0456)	(0.171)
Export final goods x Change in ln(total credit)	0.00967	0.0142**	0.0153**	-0.0101	0.0361***	0.0394***	0.0417***	0.0610
	(0.00626)	(0.00687)	(0.00708)	(0.0489)	(0.00784)	(0.00899)	(0.00934)	(0.0677)
Observations	409,857	340,607	314,028	21,350	260,147	212,674	192,161	15,118
R-squared	0.092	0.103	0.102	0.291	0.148	0.170	0.172	0.375
dest-year FE	yes	yes	yes	yes				
dest-firm FE	yes	yes	yes	yes				
prod-year FE					yes	yes	yes	yes
prod-firm FE					yes	yes	yes	yes

Table 9B: Firm Type (Extensive Margin)

	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Dependent Variable	Change in Number of Products				Change in Number of Destinations			
Change in ln(investment credit)	0.0838***	0.0898***	0.0900***	-0.0979	0.0463**	0.0509**	0.0519**	-0.444
	(0.0224)	(0.0223)	(0.0226)	(0.393)	(0.0194)	(0.0199)	(0.0204)	(0.292)
Export final goods (yes=1)	-0.0142	0.0301	0.0303	-0.0971	0.0618	0.0904	0.0814	-0.234
	(0.119)	(0.124)	(0.126)	(1.444)	(0.124)	(0.139)	(0.143)	(2.055)
Export final goods x Change in ln(investment credit)	-0.0412	-0.0823**	-0.0902**	0.474	-0.0741*	-0.106**	-0.104*	0.212
	(0.0364)	(0.0390)	(0.0397)	(0.468)	(0.0442)	(0.0537)	(0.0567)	(0.424)
Observations	54,978	47,568	45,216	1,431	32,450	26,562	24,311	661
R-squared	0.169	0.159	0.157	0.491	0.324	0.348	0.349	0.659
dest-year FE	yes	yes	yes	yes				
dest-firm FE	yes	yes	yes	yes				
prod-year FE					yes	yes	yes	yes
prod-firm FE					yes	yes	yes	yes

Table 10: First-Stage Regression for Instrumental Variable Estimation

	(1)
Dependent Variable	Change in ln(total credit)
Weighted Average of Lagged Fee Revenue Share	1.270***
	(0.170)
Observations	59,528
R-squared	0.131
year FE	yes
firm FE	yes

Table 11: Overview of intensive margin, IV estimation

	(1)	(2)	(3)
Dependent Variable	Change in ln(export)	Change in number of shipment	Change in ln(average value per shipment)
Change in ln(total credit)	0.154***	1.005	0.0981***
	(0.0234)	(0.690)	(0.0182)
Observations	696,502	696,502	696,502
R-squared	0.304	0.257	0.296
prod-dest-year FE	yes	yes	yes
prod-dest-firm FE	yes	yes	yes

Table 12: Overview of extensive margin, IV estimation

	(1)	(2)
Dependent variable	Change in number of products	Change in number of destinations
Change in ln(total credit)	0.305***	-0.0651
	(0.0785)	(0.0942)
Constant		
Observations	413,021	266,299
R-squared	0.074	0.144
dest-year FE	yes	
dest-firm FE	yes	
prod-year FE		yes
prod-firm FE		yes