Exploring Heterogeneity in Financial Development-Trade Relationship

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Abstract

Various studies have explored the relationship between financial development (FD from here on) and trade using aggregate trade data and mean analysis, and as such, may have missed important dynamics. We explore potential heterogeneity in this relationship in several ways. We utilize dis-aggregated product level trade data to decompose exports into the extensive and intensive margins. We explore this relationship at different levels of FD, across different product categories, and whether it is contingent upon a country's economic size. Finally, we utilize total aggregate international trade relative to domestic sales to identify this relationship, even in the presence of multilateral trade resistance controls. In all cases, we find that this relationship is driven exclusively by the extensive margin suggesting that FD reduces fixed cost to exports. We also find an increasing returns to the FD-trade relationship and that low-income countries have more to gain from this relationship. Interestingly, the positive impact of FD is homogeneous across product categories. These findings present a unique opportunity for low-income countries to boost its exports, and even for high-tech intensive goods.

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1 Introduction

The importance of financial institutions on international trade patterns has been well established. Theoretical models that explain this relationship (for example Kletzer and Bardhan (1987)) show that even with identical technology and endowments, trade costs will differ between countries when funding is needed for business investments. Consequently, disparities in domestic financial institutions are known to create comparative advantage for countries with well-developed financial systems. While seminal studies such as Beck (2002) utilized time-varying country level data to explore this relationship, it has since developed to include industry-level data-sets, in addition to using more sophisticated versions of the gravity model of international trade. Countries with well-developed financial sectors are found to have higher exports in manufactured goods (Amiti and Weinstein, 2011; Beck, 2002, 2003; Minetti and Zhu, 2011), and that they tend to specialize in industries that require more external financing (Beck, 2003; Svaleryd and Vlachos, 2005), while credit constraints have been found to lower exports (Manova, 2008; Minetti and Zhu, 2011; Wagner, 2014). A sound financial system boosts exports by reducing firms' financial constraints, which in-turn mitigates the impact of fixed costs and entry costs to new markets. It is also known to help establish and maintain distribution networks abroad, make market-specific investments, and compensate for time lags in payments.

While these studies utilize some form of aggregate trade flows, we utilize dis-aggregated product-level trade data to identify the channel that contributes to the positive association between trade and financial development (FD from here on). We examine whether increases in FD correlates to countries trading a wider variety of goods or new trading relationships (extensive margin); or an increase in existing trade relationships or trade volume (intensive margin). These adjustments along trade margins can have important consequences for trade flows. The extensive margin is positively associated with reducing volatility in the economy as well as increasing productivity (Agosin, 2007; Feenstra and Kee, 2008; Lederman and Maloney, 2003), while the intensive margin is found to be important for export growth and has been responsible for a significant portion of export growth over time (Besedeš and Prusa, 2011; Helpman et al., 2008). We find that the positive impact of FD on exports is driven exclusively by the extensive margin. Our results provide support to the hypothesis (for example Chaney (2008)) that financial constraint is generally associated with fixed cost to exporting.

We also explore additional heterogeneity in the FD-trade relationship. First, we consider the possibility of a non-linear FD-trade relationship, which is generally masked under a mean analysis. We utilize a quartile analysis to allow for this relationship to vary across different levels of FD. Indeed, we find an increasing returns to this relationship, which tends to be more pronounced for the extensive margin. Second, we examine the possibility that this relationship is contingent upon on a country's level of economic development. Low-income countries are known to face higher trade costs (Anderson and Yotov, 2010; Hoekman and Nicita, 2011; Waugh, 2010), and consequently higher market-entry costs (Baier et al. (2017)); have firms with lower productivity (Bloom et al. (2010)); and rely more on a narrow range of exports. If FD reduces fixed costs to exports, as our primary result suggest, this could prove to be an important policy tool for these low-income countries to boost exports, especially along the extensive margin. We find FD to be more important for countries at the lower end of the income distribution, and even more so for the extensive margin. Third, we examine whether FD is equally relevant across different product categories that ranges from labor-intensive and resource-based manufactures to manufactures with high skill and technology intensity. FD seems to positively affect the extensive margin across product categories in a non-discriminant fashion. This is an important finding, especially for low-income countries, who are known to export narrow range of goods that are dominated by primary products.

Finally, we recognize the limitation of estimating the impact of a time-varying policy variable like FD on international trade in the absence of country-specific time-varying fixed effects that generally serves as a proxy for multilateral trade resistance (MTR) controls. As Anderson and van Wincoop (2003) argue, failure to control for such MTRs in gravity estimations leads to biased estimates of the coefficients. To our knowledge, none of the past studies have utilized MTR controls while examining the FD-trade relationship. Following Heid et al. (2017) and Beverelli et al. (2018) we find a solution to estimating trade regressions with the aforementioned time-varying fixed effects by utilizing a data-set that includes both intra-national and international trade flows. Our result from this estimation is consistent with our primary result.

2 Background

2.1 Financial Development & Trade

One of the earlier theoretical models explaining the link between financial institutions and international trade patterns was Kletzer and Bardhan (1987). The model shows that, even with identical technology and endowments, costs will differ between countries when funding is needed for business investments. Chor and Manova (2012) explain why external finance is particularly crucial for exporting firms and the channels through which FD boosts exports. There are trade costs associated with entering foreign markets including transportation, unavoidable barriers like upfront sunk costs, costs of exploring newer markets, establishing and maintaining new distribution networks, and customizing products to fit preferences and regulations of foreign governments and trading partners. Moreover, there are time lags between when a shipment is made, the shipment is received, and the payment is made, during which exporting firms still need to tend to working capital needs. A sound financial system and adequate supply of liquidity facilitates these procedures and boosts exports.

The trade literature presents theoretical models to explain the impact of financial constraints on trade patterns, and how absence of these constraints would facilitate exports. Chaney (2016) proposed a model of international trade and argued that if there are fixed entry costs associated with entering a foreign market, only those firms with adequate liquidity are going to export - financial underdevelopment hampers exports from other firms with liquidity constraints. Broll and Wahl (2011) present a standard hedging model of an exporting firm with liquidity constraints, and find only firms that have the necessary financial resources can fully benefit from the gains from trade. Using export flows and equity market liberalization data, Manova (2008) investigates the importance of credit constraints in determining international trade flows. By exploiting shocks to the availability of external finance, their results show that there was a disproportionate increase in exports in sectors that used external finance more extensively following equity market liberalizations, implying that sectors were financially constrained prior to liberalization.

A few studies have examined the incidence of liquidity constraints on a specific country's firm-level margins of exports (Minetti and Zhu, 2011; Wagner, 2015). Liquidity constraints arising from credit rationing appears to impact both the firm-level intensive and extensive margins of trade by lowering the probability of firm‘s export and reducing firm-level exports. The negative impact of credit rationing on foreign sales appears to be more pronounced than that of domestic sales, and stronger for high-tech industries and those that use external finance more intensively. An even wider range of papers discuss the trade-finance link empirically. Beck (2002) explores a theoretical model and describes that countries with more developed financial sectors have a comparative advantage in manufacturing industries and evidently have higher shares of manufactured exports and trade balance in GDP and total merchandise exports. Using industry-level data on firms' dependence on external finance, Beck (2003) show that countries with greater dependence on external sources of finance have higher trade shares and higher trade balances within industries that use external finance more intensively. Svaleryd and Vlachos (2005) also find that countries with well developed financial sectors tend to specialize in industries that require more external financing. This reaffirms the importance of external finance in influencing exports.

Using industry-level data, Hur et al. (2006) find that increase in FD leads to increased export shares and trade balance in industries with more intangible assets while poorly-developed financial sectors have a comparative advantage in sectors with more tangible ones. Using the gravity equation for international trade as a starting point, Becker et al. (2012) find that finance is more important for country pairs when fixed costs are high. Industry-level data analysis further confirms their prediction and that finance has a larger positive effect on exports for industries with differentiated goods, and those that use more advertising and R&D. A couple of papers have focused on the importance of financial systems of both the exporter and the importer for increasing exports. Ma and Xie (2019) incorporate financial development conditions for both exporting and destination country in each country-pair to investigate if financial conditions of both affect international trade between them. They find that financial development of the destination country increases the variety of goods being exported (extensive margin) and also increases the volume of goods being exported (intensive margin).

2.2 Trade Margins & Financial Development

Although previous research have established a positive correlation between FD and exports, it has left some interesting questions unanswered. Theoretical models of trade in recent times have focused on differences in firm-level productivity and size and its' impact on trade structure (Bernard and Jensen, 1999, 2004; Clerides et al., 1998; Eaton et al., 2004). Incorporating such firm-level heterogeneity has led to decomposition of trade along its' margins. First is the firm-level extensive margin or the number of exporters selling in the destination market and second, the firm-level intensive margin or the change in average exports by firms that already export (Chaney, 2008; Dutt et al., 2013; Helpman et al., 2008; Melitz, 2003). These models predict on a theoretical level that only a subset of firms will export at a given level of trade costs as these firms vary by productivity (Chaney, 2008; Melitz, 2003). These trade costs can be fixed (such as communication cost, information cost and bureaucratic paperwork costs) or variable costs such as a reduction in tariff. Consequently, exports becomes profitable to only some (more) productive firms and this profitability can vary by destination.

A study by Dutt et al. (2013) show that changes to these trade margins can occur due to different factors. A reduction in fixed cost is known to reduce the productivity threshold that a firm must exceed before their entry into the export market, which can lead to an influx of firms into the market, thus increasing the extensive margin. The intensive margin on the other hand decreases because increases in firm entry without change in prices reduces market shares for incumbent firms. Dutt et al. (2013) argue that these new firms or entrants are relatively less productive (otherwise they would have already been exporting) and that they sell less than incumbent firms, which reduces average productivity and average sales in the market. These adjustments points towards a decrease in the intensive margin. A reduction in variable costs, which would also reduce the threshold productivity level, would increase the extensive margin. With the intensive margin however, there are two opposing effects. First, revenue for incumbent firms along with exports and average exports per firm increases. Second, since firms with lower productivity and consequently lower sales as compared to the incumbent firms also enter the market, this decreases the average exports per firm or the intensive margin. Dutt et al. (2013) mention that when productivity (and hence revenue) follow a Pareto distribution, the average does not change as these two effects cancel each other out.[1]

Recent studies have shown that the choice of exporters' productivity distribution can have important consequences as it can lead to changes in both margins. Dutt et al. (2013) and more recently Fernandes et al. (2018) have criticized the pareto distribution assumption in the Melitz (2003) model as being unrealistic. A distribution that is not Pareto normal can lead to adjustment in trade flows along the intensive margin. In that regards, Fernandes et al. (2018) adopt a log-normal distribution and find the adjustment along the intensive

[1] Lawless (2010) finds that the intensive margin is unaffected by a change in variable costs under this assumption. The Melitz (2003) model, which is based on the assumption of a pareto-distribution for firm productivity, suggests that all of the adjustments in trade flows occurs at the extensive margin.

margin to be much more important than previously realized. Similarly, Dutt et al. (2013) show that deviating from the pareto-distribution assumption, a reduction in variable cost can lead to an increase in the intensive margin.[2] Our current attempt to understand the role of FD on trade flows along these trade margins would represent an improvement in our understanding of how it influences trade flows.

3 Methodology

3.1 Traditional Log-linear Gravity Model

Although studies have examined the impact of FD on trade using the gravity model, they have not been typically employed in the literature with dis-aggregated trade data. A study somewhat similar to ours is by Ma & Xie (2019). They develop a theoretical model and test whether FD of the destination country also matters for exports and the margins of exports, in addition to the origin country. They utilize the log-linear gravity model with a sample of 116 origin and destination countries spanning years between 2005 and 2014. Unlike their analysis, we account for the multilateral resistance term within the gravity model and use a larger sample size of countries and a much longer time span. A longer time span becomes pertinent in order to understand the relationship better for a variable like FD that exhibits little variation in short periods of time. Figure 1 presents the average of log of domestic credit, our proxy for financial development, for every 5 years in our sample. The data indicates slow but substantial amount of variation in the FD variable over a long period of time. Additionally, figures 2 & 3 presents FD over time for two randomly picked country from the sample, China and Ghana. Not only does FD exhibit substantial variation over time, but does so across countries as well. Furthermore, we explore the heterogeneity in the export-FD relationship across several channels.

The traditional log-linear gravity model of trade augmented with the FD variable, and estimated by the Ordinary Least Squares (OLS) method is provided as follows:

[2] Dutt et al. (2013) consider two scenarios. In the first case, they place an upper bound on firm productivity or a lower bound on marginal costs, and in the second case they assume that lower-productivity firms can have not only higher variable costs but also higher fixed costs. Both of these scenarios limit the market entry for firms, and the intensive margin increases with decreasing variable cost.

$$\ln T_{ijt} = \alpha_0 + \alpha_1 DC_{it} + \beta Z_{ijt} + \sum \alpha_2 EXP_i + \sum \alpha_3 IMP_j + \sum \alpha_4 YR_t + \epsilon_{ijt} \quad (1)$$

where, T_{ijt} represents real bilateral exports from country i (exporter) to country j (importer) in a given year t. Domestic credit (DC_{it}) for exporter i is used as a proxy for the country's level of financial development. Domestic credit refers to financial resources provided to the private sector by financial corporations[3] through loans, purchases of non-equity securities, trade credits, and other accounts receivables. It may also include claims to public enterprises. Domestic credit is the most widely used variable used to measure the overall development of the financial system (Beck, 2002, 2003; Do and Levchenko, 2007; Gorodnichenko and Schnitzer, 2013; Svaleryd and Vlachos, 2005). Z_{ijt} is a vector of control variables commonly utilized in gravity trade models that serves as proxies for bilateral trade costs. These include the natural log of distance between countries i and j, GDP per capita of i and j, population of each country in a country-pair and the natural log of the product of the land area of the countries in a country-pair. It also includes bilateral pair dummies such as country pairs using the same currency, having a regional trade agreement, sharing a common language, sharing a common land border or having a colonial relationship. EXP_i & IMP_j are sets of time-invariant exporter and importer fixed effects that considers any country-specific characteristics. YR_t are year-specific fixed effects that considers any time-specific common trends or effects (e.g. business cycles, oil price shocks) and the robust standard errors are clustered by country pairs.

To explore the possibility that total exports can mask the heterogeneous impact of FD on trade, we utilize the four-digit Standard International Trade Classification (SITC) Revision 2 product level trade data to construct the extensive and the intensive margins of exports. Total exports T_{ijt} is therefore decomposed into the extensive and intensive margins of exports as follows:

$$\ln T_{ijt} = \ln N_{ijt} + \ln \frac{T_{ijt}}{N_{ijt}} \quad (2)$$

where the product-level extensive margin or export diversification is defined as the log of the number of products that a country i exports to j, N, at a given time t; and the

[3]These may include monetary authorities and deposit money banks, as well as other financial corporations like finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies.

product-level intensive margin or trade intensity is defined as the log of the average volume of exports per product from country i to j over time t, calculated by dividing the total volume of exports (T) by the total number of products exported (N).

One important advantage of these dis-aggregated data at the product level is that it can mimic firm level adjustments. When firms produce differentiated products, as Dutt et al. (2013) point out, these firm-level trade margins translate into product-level trade margins. Consequently, one can view the product-level trade margin as a proxy for the firm-level trade margin. Several studies (Bernard et al., 2007; Dutt et al., 2013; Flam and Nordström, 2006; Nitsch and Pisu, 2008) have utilized this methodology to explore trade margin adjustments, and is commonly known as the count method.

3.2 Poisson Specification

Despite it's prevalent use, the log-linear gravity model of trade is known to provide biased and inconsistent estimates in the presence of heteroskedastic residuals (Flowerdew and Aitkin, 1982; Santos Silva and Tenreyro, 2006). Under heteroskedastic errors, which is prevalent with trade data, Santos Silva and Tenreyro (2006) argue that the log-linear transformation leads to errors that will generally be correlated with the control variables resulting in biased estimates of the true elasticities. One solution to this predicament, as they propose, is the Poisson pseudo-maximum likelihood (PPML) estimation. The PPML method, given its' multiplicative form, does not force higher-order moments into the residuals. Therefore, PPML provides consistency for estimates and also allows for heteroskedasticity in the residuals (Liu, 2009; Santos Silva and Tenreyro, 2006). The dependent variable, real exports, is now expressed in levels. Under the PPML, we have the following specification:

$$T_{ijt} = exp(\alpha_0 + \alpha_1 DC_{it} + \beta Z_{ijt} + \sum \alpha_2 EXP_i + \sum \alpha_3 IMP_j + \sum \alpha_4 YR_t) + \epsilon_{ijt} \tag{3}$$

To ensure that our results with the PPML specification are robust across different set of fixed effects, we also examine this relationship with a comprehensive set of country-pair fixed effects that accounts for any time invariant characteristics common to a country pair. Our results remain robust under these sets of fixed effects; however we omit them for space considerations.[4] PPML is a non-linear specification, therefore the decomposition of total

[4]These results are available from the authors upon request.

exports, T into the export margins has the following specification:

$$T_{ijt} = N_{ijt} * \frac{T_{ijt}}{N_{ijt}} \tag{4}$$

3.3 Data

We utilize an unbalanced panel with 199 exporter and 220 importer countries for the time period 1962-2015. Our main variable of interest, Domestic Credit, is retrieved from the World Development Indicators database of the World Bank Databank. We utilize the "Center for Prospective Studies and International Information (CEPII)" to retrieve data for common gravity control variables such as distance, common border, language, and colonial ties.[5] We provide the list of the gravity control variables and the corresponding definitions in Appendix Table A.1. The dis-aggregated product level trade data under the SITC-Revision 2 classification at the 4-digit product level is obtained from Feenstra et al. (2005). The SITC classification comprises of approximately 790 product categories. There are product level trade data at finer levels of dis-aggregation (6-digit), however this data set starts from 1995, which would limit the variation in FD over time.

4 Empirical Results

4.1 Financial Development and Trade Margins

The importance of FD for international trade has been well documented. Firms face various fixed costs to enter the export market such as transportation costs, upfront sunk costs, cost of exploring new markets and maintaining new distribution networks. Therefore it is no surprise that access to credit and lack of financial constraints can alleviate these concerns for firms. Consequently, it is reasonable to expect FD to positively impact the extensive margin via reduction of such fixed costs. As financial constraints restrict exporting firms from entering foreign markets, we can expect the number of exporting firms to increase following improvements in the financial system of the exporting country.

The result in Table 1 (Column 1, OLS specification) confirms this assertion. A unit increase in the level of FD is correlated with an increase in total aggregate exports of approximately

[5]Available at `http://www.cepii.fr/CEPII/en/welcome.asp`.

24%.[6] This finding is consistent with past studies that find a positive relationship between FD and exports. However studies, with the exception of Ma and Xie (2019), that utilize the log-linear specification is known to be subjected to biases and inconsistent estimates under heteroskedastic residuals.[7]

Results from the PPML specification (Table 1, Column 4) suggest this biased effect for total trade, which is now no longer statistically significant. As we focus on the trade margins, it is evident that the positive impact of FD on trade is driven exclusively by the extensive margin, which is robust across specifications (Table 1, Columns 2 & 5). However, a much smaller magnitude under the PPML specification is suggestive, again, of the biased estimates under the OLS specification. Our finding supports the argument that access to credit & decrease in financial constraints indeed reduce fixed costs to export for firms. Under the PPML specification (Column 5), a 10% increase in domestic credit increases the extensive margin by around 0.6%. The coefficients on the intensive margin is not robust across specifications. Following Table 1, the rest of the analyses in this paper have been conducted using PPML estimation, in line with the recent trade literature.

4.2 Non-linear FD-trade Relationship

There is a potential for the impact of FD on trade to be contingent upon a given country's level of FD, a possibility which past studies have largely ignored. Beck (2002) suggests that FD shifts the incentives of the producers towards goods with increasing returns to scale; the inter-sectoral specialization, and therefore structure of the trade flows is determined by the relative level of financial inter-mediation. All else equal, economies with a better developed financial system are expected to be net exporters of goods with increasing returns to scale. In order to uncover this potential non-linearity, we separate the FD variable into four quartiles (50, 75 & 90, using the 25^{th} quartile as the base case) according to the distribution of the FD variable.[8] The argument for increasing returns to FD entails that the impact on trade

[6]The formula used in the calculation of the marginal effect, which are reported in this section, is: $e^{(0.215)} - 1 = 24\%$. The baseline gravity variables are reported in the results. Other control variables, when significant, have signs consistent with the previous literature.

[7]The extensive margin under the count method, by definition, is a count variable, which according to Cameron and Trivedi (2001) are intrinsically heteroskedastic with variance increasing with the mean. We also confirm that data for total exports and the intensive margin are heteroskedastic using the Wald test for group-wise heteroskedasticity for the residuals in the fixed-effect regression model.

[8]For example, the 50^{th} percentile includes all countries and years at a level of financial development below that percentile and above the 25^{th} percentile.

could be especially pronounced at higher levels of FD. This heterogeneous impact might be masked when we simply focus on the average impact of FD on exports.

Indeed, our results from Table 2 (Columns 1-3) indicates the presence of non-linearity on the impact of FD on total exports and export margins. The level of FD at the 75^{th} percentile (Column 1) is correlated with around 23% higher total exports compared to the base case of the 25^{th} percentile, while the level of FD at the 90^{th} percentile is associated with around 38% more increase in total exports compared to the base case. This non-linearity is even more pronounced along the extensive margin. The level of FD at the 75^{th} percentile (Column 2) is correlated with around 62% more increase in the extensive margin compared to the base case of the 25^{th} percentile, while the 90^{th} percentile (Column 2) experiences around 70% more increase in the extensive margin. As for the intensive margin, the effect of FD at different levels appears to be fairly linear. While we can not pinpoint the reason behind this heterogeneity, our results does indicate that more financially developed countries enjoy higher total trade and the extensive margin.

4.3 Financial Development and Country's Level of Development

For a given level of FD, do exports behave differently in countries based on their level of income or economic development? Past studies have found substantial variation in trade cost elasticity across country pairs (Bas et al., 2017; Novy, 2013), and that low-income countries often face higher trade costs than high-income countries (Anderson and Yotov, 2010; Hoekman and Nicita, 2011; Waugh, 2010). These higher trade costs could be due to lower levels of infrastructure, institutions and human capital, resulting in lower firm productivity (Tybout (2000)); higher market-entry costs, partly due to poorer international networks (Baier et al. (2017)) or low productivity due to bad management practices and financial constraints (Bloom et al. (2010)). Consequently, developing countries tend to rely more on a narrow range of exports that are usually some sort of primary product such as oil or agricultural goods. If FD indeed reduces the fixed costs to exporting, as our results suggest, it is reasonable to expect a larger effect of a given level of FD on exports, and especially the extensive margin, for developing countries relative to high-income ones. This pronounced effect of FD for developing countries can be attributed to their higher trade costs or having firms with lower productivity level.

We extend the FD-trade literature by examining whether a country's economic size plays a role in its response to an increase in FD. We propose that trade cost elasticity with respect to increase in FD is heterogeneous and is contingent upon a country's economic size. In order to examine this heterogeneity, we divide the log of exporters' GDP per capita (a proxy for the level of economic development or income) into four quartiles (25, 50, 75 and 90^{th}) according to the distribution of the variable. The variable of interest is the interaction term of the FD variable (DC) and GDPPC_{ikt}, where k is either 25^{th}, 50^{th} or 75^{th} quartile.[9] We label this interaction term as DC*GDPPC_{ikt}, where DC*GDPPC−50 captures the difference between the effect of FD at the 50^{th} and 90^{th} quartile (the baseline category).

We present our results in Table 3 (Columns 1-3). For total exports (Column-1), our results show that FD affects exports much more in case for low income countries (as measured by GDP per capita) compared to high-income countries. Countries at the lowest end of the income distribution (25^{th} percentile) experience 30% more increase in exports compared to countries at the 90^{th} percentile (baseline category) and an overall increase of 11%.[10] Countries at the 75^{th} percentile however, experience only a 12% more increase in exports compared to countries at the 90^{th} percentile and an overall decrease of around 4%. Therefore, our results provide evidence of a heterogeneous response to a change in FD on exports for countries based on their economic size.

This heterogeneity is even more distinct when we examine the extensive margin (Column-2). Countries at 25^{th} percentile of the income distribution experience 30% more increase in exports compared to those at the 90^{th} percentile, and an overall increase of around 22%. Along the intensive margin (Column-3), the difference across the income distribution is statistically insignificant. These findings suggest that FD is significantly more important for lower-income countries for their exports, and its product range.

4.4 Financial Development and Product Categories

In this section, we explore whether the FD-trade relationship is also contingent upon product categories. This potential source of heterogeneity has often been ignored in the literature. While existing studies (Beck, 2002, 2003; Minetti and Zhu, 2011) have established that countries with well developed financial sectors have a comparative advantage in manufacturing industries or industries that require more external financing, none have looked at the im-

[9] We therefore have the 90^{th} quartile as the base case.

[10] We calculate the overall effect of the interaction term by adding the coefficients of the baseline effect and the interaction term. For example, to calculate the impact of FD for countries at the 25^{th} percentile, we add −0.159 (the baseline effect) to 0.263 (the interaction term) to get the overall effect of 0.104, which equates to around 11%.

pact of an increase in FD across product categories and along its trade margins. While some industries are more reliant on external sources of finance, others are not. Therefore, it is reasonable to assume that the impact of FD on exports can differ across product categories. We thus examine whether the increase in FD is equally important for labor-intensive and resource-based manufactures as well as for manufactures with high skill and technology intensity. We follow the United Nations Conference on Trade and Development (2002) categorization of total tradable products into 5 categories: primary commodities, labor-intensive and resource-based manufactures, manufactures with low skill and technology intensity, manufactures with medium skill and technology intensity, and manufactures with high skill and technology intensity. This categorization is based on the SITC Revision 2 classification at the 3-digit level.

We present our results for total exports across product categories in Table 4. There is a weak but positive association between FD and manufactures with low skill and technology intensity, which appears to support past findings of a positive association between financial development and exports of manufactured goods. This positive association is largely absent across other product categories. This difference in findings, as compared to previous studies, can be attributed to our choice of specification (PPML method), suggesting biased coefficients under heteroskedasticity. As mentioned earlier, the positive association between FD and exports can be masked by aggregation. This is indeed the case as we turn our attention to the extensive margin (Table-5). This positive association is driven entirely by the extensive margin, which is consistent and interestingly equal across all product categories. This non-discriminant positive impact of FD can be an important policy tool, especially for developing economies who traditionally export labor intensive and low-technology intensive products. Based on our results, we propose that FD not only increases the varieties of goods exported, but also does so across product categories. Table 6 presents results for the intensive margin. The relationship is generally negative with the exception of high skill and low skill technology intensive manufacture goods. Our results suggest that these skilled intensive products stand to gain the most from an increase in FD.

5 Intra-national and International Trade flows- Robustness Check

The new version of the gravity model of international trade, as developed by Anderson and van Wincoop (2003), argues that trade between any two countries or trading partners i and j does not only depend on the "bilateral" trade resistance or the trade barriers between them, but also on the "multilateral" trade resistances (MTR) that they face from the rest of the world (or all of their trading partners). Consequently, bilateral trade between i and j will not only be determined by how close they are to each other but also by how remote or isolated they are from their other trading partners. Failure to account for such unobservable MTRs leads to biased coefficient estimates. To our knowledge, no studies have utilized MTR controls in the context of FD and trade. In a panel data setting, the literature suggests that the best way to account for MTR controls is by including country-specific time-varying fixed effects. This however comes with an important caveat: including these fixed effects in panel regressions does not allow for identification of certain policy variables that are also country-specific and time-varying, such as our FD variable, and would get completely absorbed by these fixed effects or lead to coefficient estimates associated with high standard errors.[11]

Some recent studies such as Heid et al. (2017) and Beverelli et al. (2018) have provided a solution to this challenge. They propose the gravity regressions be estimated with data that includes "intra-national" trade flows (non-exported domestic production), in addition to international trade flows. The inclusion of these intra-national data allows for identification of time-varying country-specific variables like FD because while the trade relevant variable only applies to international trade flows, the fixed effects are defined for both international as well as intra-national observations.[12] [13] However, it must be noted that data-sets with

[11]Head and Mayer (2014) conclude that these estimates may eventually be meaningless.

[12]Please refer to Heid et al. (2017) and Beverelli et al. (2018) for a detailed illustration of the identification strategy associated with country specific variables with MTR controls contingent upon the inclusion of intra-national trade flows for both cross-section and panel data context. Some additional known advantages that Beverelli et al. (2018) point out of including intra-national trade data in gravity equation are as follows: consistent with the gravity theory, theoretically consistent identification of the effects of bilateral policies, and ability to capture the effects of globalization on international trade.

[13]Some studies (Anderson and Marcouiller, 2002; Álvarez et al., 2018) have constructed bilateral variables of interest as a combination of the importer and on the exporter side. Although this approach can allow estimation with exporter & importer fixed effects, as Beverelli et al. (2018) argue, it does not allow for direct identification of the impact of such variables on international trade and poses a challenge with the interpretation of such estimates on trade.

consistently estimated international and intra-national trade flows are not common. Our primary data-set for this paper does not include intra-national trade flows.[14] While international trade flows are represented by total exports, intra-national trade flows are measured as the difference between total production and total exports. Since both variables are reported on a gross basis, we can ensure consistency between international and intra-national trade flows over time.[15] We utilize a panel data-set consisting of aggregate manufacturing sector data of 69 countries over the period 1986-2006. In this case, intra-national trade flows are calculated as the difference between total manufacturing production and total manufacturing exports. This data-set is available from Yotov et al. (2016), which was constructed and provided to them by Thomas Zylkin. In our analysis, the dummy variable "International" equals one for international trade flows and zero otherwise. The variable "Log(Domestic Credit)$_{it}$_International" is an interaction between the FD variable and the International dummy variable, which captures the impact of FD on international trade. As the interaction term is equal to zero for intra-national trade, the inclusion of these two variables allow for the identification of the impact of FD on international trade relative to internal trade even with MTR controls, which applies to both international and intra-national trade flows.[16] We also include a series of time-varying border dummies, which according to Beverelli et al. (2018) are designed to capture any globalization effects. Omission of such dummy variables is known to lead to biased estimates because they might capture globalization effects, such as technology and innovation.[17]

Beverelli et al. (2018) also mention that the inclusion of country-pair fixed effects holistically controls for all observable and unobservable bilateral trade barriers. Furthermore, Baier and Bergstrand (2007) demonstrate how including intra-national data also mitigates possible endogeneity concerns with respect to the bilateral policy covariates in gravity equa-

[14] Availability of reliable data on intra-national trade flows led Beverelli et al. (2018) to the use of data on total manufacturing observations.

[15] Heid et al. (2017) mention that while it is tempting to obtain aggregate domestic production as the difference between GDP and total exports, they do not recommend this approach due to the inconsistency between the measure of GDP as value added and the measure of total exports as gross value.

[16] Please refer to Beverelli et al. (2018) for a detailed discussion for the inclusion of these variables and identification strategies.

[17] Due to perfect collinearity with the rest of the fixed effects, it is not possible to estimate these international border dummies for all the years in the sample. International border dummy for a given year is dropped from the specification. Hence, the estimated coefficients of the other border/international dummy variables, according to Yotov et al. (2016) can be interpreted relative to the corresponding estimate for the base case (dropped year).

tions.[18] It is important to acknowledge, as Beverelli et al. (2018) point out, that such fixed effects can absorb the impact of variables like FD on trade resulting in relatively smaller magnitude of the coefficients and lower statistical significance. This is due to the fact that the identification of the effect of FD is from the time variation of the variable. Such variation, given the short sample period and the slow-moving nature of the variable, is not very large.[19]

Table 7 presents results for the aggregate manufacturing sector data of 69 countries over the period 1986-2006. Columns (1) and (3) present results under the OLS specification, and columns (2) and (4) for the PPML specification. To identify the impact of financial development on international trade, we look at the interaction term between Domestic Credit and the "International" dummy variable. Using traditional gravity variables in regressions (1) and (2), we obtain positive and statistically significant estimates for Domestic Credit, which suggests that financial development is important for influencing bilateral trade. In terms of economic magnitude, estimates from (2) indicate that a 1% increase in domestic credit increases bilateral trade by 1.24% relative to internal trade or domestic production. The estimates for domestic credit are no longer statistically significant when controlling for bilateral pair-fixed effects in regression (4). In spite of this, we are rather encouraged about the positive association between FD and exports, even with such rather demanding panel setting with such an abundant structure of fixed effects.

6 Conclusion

While past literature on FD and trade was focused on aggregated trade flows estimated by the OLS, an important innovation of our paper is to examine this relationship along the trade margins. We utilize dis-aggregated product level data and an augmented gravity model of trade with the PPML specification to account for the presence of heteroskedasticity, which is known to produce biased estimates under the OLS specification. We find that, on

[18] According to Beverelli et al. (2018), this method should deliver proper estimates without the need to use instrumental variables, should there be any endogeneity concerns.

[19] Essentially, on average, the time variation in the FD variable over the period of investigation is not enough for identification purposes.Beverelli et al. (2018) find a large and significant impact of institution on international trade relative to intra-national trade flows without the inclusion of country-pair fixed effects. However, once they account for country-pair fixed effects, the magnitude and significance with the OLS specification decrease greatly. Additionally, with the PPML specification and country-pair fixed effects, the average impact of institutions is not significant.

average, the positive impact of FD on trade is driven exclusively by the extensive margin, suggesting that FD tends to reduce fixed cost to exporting. Increase in the extensive margin is known to reduce volatility in the economy and increase firm productivity. A second innovation of our paper is that we explore the potential heterogeneity between the FD-trade relationship across several channels. Consequently, we find an increasing return to the FD-trade relationship which is more pronounced along the extensive margin. We also find that countries at the lower end of the income distribution experience a higher positive impact on exports, which is (again) more pronounced for the extensive margin. Our results have important policy implications for low-income countries that are subjected to higher trade costs than their high-income counterparts. We further find that the positive impact of FD on exports across product categories is driven exclusive by the extensive margin, and more importantly, the positive impact is even across such categories. This result is especially relevant for low-income countries that primarily export narrow range of labor intensive and low-technology intensive goods. Finally, unlike past studies, we account for MTR controls by utilizing gravity regressions with intra-national trade flows. Failure to account for such controls are also known to produce biased estimates. Our result suggests an even stronger FD-trade relationship under this rigorous specification.

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Table 1: Financial Development and Trade Margins

	OLS			PPML		
	Total Trade	Extensive Margin	Intensive Margin	Total Trade	Extensive Margin	Intensive Margin
Dependent Variable$_{ijt}$	(1)	(2)	(3)	(4)	(5)	(6)
Log(Domestic Credit)$_{it}$	0.215*** (0.015)	0.168*** (0.007)	0.047*** (0.012)	-0.046 (0.032)	0.057*** (0.006)	-0.362*** (0.050)
Log distance	-1.397*** (0.018)	-0.809*** (0.011)	-0.588*** (0.012)	-0.680*** (0.032)	-0.505*** (0.014)	-0.106** (0.045)
Log real GDP per capita (exporter)	0.872*** (0.021)	0.298*** (0.011)	0.574*** (0.017)	0.778*** (0.042)	0.208*** (0.009)	0.948*** (0.064)
Log real GDP per capita (importer)	0.688*** (0.019)	0.323*** (0.011)	0.366*** (0.015)	0.688*** (0.044)	0.190*** (0.010)	0.184 (0.117)
Adjusted R^2	0.701	0.762	0.522	0.860	0.719	0.279
Number of observations	573,650	573,650	573,650	573,650	573,650	573,650

Notes: Dependent variables are in logs under the OLS specification (columns 1-3) and are in levels under the PPML specification (columns 4-6). All estimates are obtained with year, exporter and importer fixed effects. Additional gravity control variables are included but not reported in the table. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10. The R^2 value for the PPML estimation is a pseudo-R^2, hence not directly comparable to the R^2 produced by OLS estimation. Interpret with caution.

Table 2: Non-linear FD-trade Relationship

Dependent Variable$_{ijt}$	Total Trade (1)	Extensive Margin (2)	Intensive Margin (3)
Log(Domestic Credit)$_{it}$	-0.146***	-0.145***	-0.322***
	(0.051)	(0.008)	(0.079)
DC-50	0.124***	0.302***	-0.121
	(0.046)	(0.012)	(0.128)
DC-75	0.208***	0.485***	-0.0975
	(0.072)	(0.016)	(0.200)
DC-90	0.321***	0.530***	0.058
	(0.103)	(0.021)	(0.191)
Log distance	-0.672***	-0.508***	-0.103**
	(0.032)	(0.014)	(0.044)
Log real GDP per capita (exporter)	0.737***	0.114***	0.899***
	(0.040)	(0.009)	(0.064)
Log real GDP per capita (importer)	0.626***	0.164***	0.132
	(0.043)	(0.010)	(0.112)
test DC50 = DC75	0.024	0.000	0.814
test DC50 = DC90	0.006	0.000	0.073
test DC75 = DC90	0.022	0.000	0.029
Adjusted R^2	0.858	0.71	0.279
Number of Observations	573650	573650	573650

Notes: All of the dependent variables are in levels under the PPML specification. All estimates are obtained with year, exporter and importer fixed effects. Additional gravity control variables are included but not reported in the table. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10. The R^2 value for the PPML estimation is a pseudo-R^2, hence not directly comparable to the R^2 produced by OLS estimation. Interpret with caution.

Table 3: Financial Development & Country's Level of Development

Dependent Variable$_{ijt}$	Total Trade (1)	Extensive Margin (2)	Intensive Margin (3)
Log(Domestic Credit)$_{it}$*	-0.159***	-0.148***	-0.345***
	(0.044)	(0.009)	(0.057)
DC*GDPPC-25	0.263***	0.344***	0.120*
	(0.071)	(0.014)	(0.068)
DC*GDPPC-50	0.306***	0.359***	-0.026
	(0.050)	(0.011)	(0.076)
DC*GDPPC-75	0.113***	0.225***	-0.067
	(0.043)	(0.010)	(0.065)
GDPPC-25	-1.075***	-1.504***	0.053
	(0.295)	(0.058)	(0.311)
GDPPC-50	-1.207***	-1.444***	0.281
	(0.213)	(0.052)	(0.351)
GDPPC-75	-0.478***	-0.850***	0.175
	(0.181)	(0.046)	(0.275)
Log Distance	-0.680***	-0.506***	-0.105**
	(0.032)	(0.014)	(0.045)
Log real GDP per capita (exporter)	0.752***	0.121***	1.042***
	(0.039)	(0.009)	(0.074)
Log real GDP per capita (importer)	0.686***	0.189***	0.193*
	(0.043)	(0.010)	(0.110)
test DC*GDPPC-25 = DC*GDPPC-50	0.490	0.216	0.009
test DC*GDPPC-25 = DC*GDPPC-75	0.019	0.000	0.005
test DC*GDPPC-50 = DC*GDPPC-75	0.000	0.000	0.574
Adjusted R^2	0.863	0.724	0.285
Number of Observations	573650	573650	573650

Notes: All of the dependent variables are in levels under the PPML specification. All estimates are obtained with year, exporter and importer fixed effects. Additional gravity control variables are included but not reported in the table. Robust standard errors are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$. The R^2 value for the PPML estimation is a pseudo-R^2, hence not directly comparable to the R^2 produced by OLS estimation. Interpret with caution.

Table 4: Financial Development & Product Categories - Total Exports

	Labor Intensive Goods	Low-technology -intensive Manufacture goods	Medium-technology -intensive Manufacture goods	High-technology -intensive Manufacture goods	Non-fuel Primary Commodities
Log(Domestic Credit)$_{it}$	0.011 (0.051)	0.077* (0.046)	-0.109*** (0.037)	0.0923 (0.071)	0.0283 (0.035)
Log Distance	-0.836*** (0.047)	-0.933*** (0.033)	-0.744*** (0.047)	-0.677*** (0.038)	-0.853*** (0.034)
Log real GDP per capita (exporter)	0.570*** (0.103)	0.735*** (0.056)	0.972*** (0.064)	0.905*** (0.049)	0.362*** (0.047)
Log real GDP per capita (importer)	0.663*** (0.072)	0.552*** (0.050)	0.813*** (0.055)	0.757*** (0.086)	0.730*** (0.063)
Adjusted R^2	0.775	0.822	0.891	0.816	0.805
Number of Observations	573,650	573,650	573,650	573,650	573,650

Notes: Dependent variables are in levels under the PPML specification. All estimates are obtained with year, exporter and importer fixed effects. Additional gravity control variables are included but not reported in the table. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10. The R^2 value for the PPML estimation is a pseudo-R^2, hence not directly comparable to the R^2 produced by OLS estimation. Interpret with caution.

Table 5: Financial Development & Product Categories - Extensive Margin

	Labor Intensive Goods	Low-technology -intensive Manufacture goods	Medium-technology -intensive Manufacture goods	High-technology -intensive Manufacture goods	Non-fuel Primary Commodities
Log(Domestic Credit)$_{it}$	0.066*** (0.007)	0.048*** (0.008)	0.0429*** (0.006)	0.066*** (0.007)	0.052*** (0.007)
Log Distance	-0.500*** (0.014)	-0.548*** (0.015)	-0.458*** (0.014)	-0.481*** (0.015)	-0.611*** (0.015)
Log real GDP per capita (exporter)	0.116*** (0.010)	0.204*** (0.011)	0.261*** (0.010)	0.243*** (0.010)	0.174*** (0.011)
Log real GDP per capita (importer)	0.250*** (0.011)	0.178*** (0.012)	0.178*** (0.009)	0.167*** (0.010)	0.185*** (0.012)
Adjusted R^2	0.687	0.674	0.716	0.716	0.676
Number of Observations	573,650	573,650	573,650	573,650	573,650

Notes: Dependent variables are in levels under the PPML specification. All estimates are obtained with year, exporter and importer fixed effects. Additional gravity control variables are included but not reported in the table. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10. The R^2 value for the PPML estimation is a pseudo-R^2, hence not directly comparable to the R^2 produced by OLS estimation. Interpret with caution.

Table 6: Financial Development & Product Categories - Intensive Margin

	Labor Intensive Goods	Low-technology -intensive Manufacture goods	Medium-technology -intensive Manufacture goods	High-technology -intensive Manufacture goods	Non-fuel Primary Commodities
Log(Domestic Credit)$_{it}$	0.001 (0.073)	0.087** (0.039)	-0.158*** (0.050)	0.153*** (0.054)	-0.053** (0.025)
Log Distance	-0.527*** (0.038)	-0.543*** (0.034)	-0.664*** (0.037)	-0.499*** (0.032)	-0.283*** (0.026)
Log real GDP per capita (exporter)	0.495*** (0.086)	0.608*** (0.055)	0.947*** (0.061)	0.889*** (0.046)	0.252*** (0.031)
Log real GDP per capita (importer)	0.451*** (0.060)	0.368*** (0.058)	0.715*** (0.058)	0.550*** (0.076)	0.355*** (0.042)
Adjusted R^2	0.408	0.598	0.85	0.728	0.357
Number of Observations	417,488	329,875	389,362	406,380	469,468

Notes: Dependent variables are in levels under the PPML specification. All estimates are obtained with year, exporter and importer fixed effects. Additional gravity control variables are included but not reported in the table. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10. The R^2 value for the PPML estimation is a pseudo-R^2, hence not directly comparable to the R^2 produced by OLS estimation. Interpret with caution.

Table 7: International & Intra-national Trade - MTR Controls

	(1)	(2)	(3)	(4)
International	-12.19***	-9.344***		
	(0.847)	(0.506)		
Log(Domestic Credit)$_{it}$*International	2.134***	1.238***	-0.002	-0.010
	(0.210)	(0.099)	(0.100)	(0.062)
Log Distance	-1.152***	-0.427***		
	(0.042)	(0.049)		
Adjusted R^2	0.843	xx	0.934	xx
Number of Observations	75,325	83,145	75,307	82,870
Intra-national trade flows	Yes	Yes	Yes	Yes
Exporter-year & Importer-year fixed effects	Yes	Yes	Yes	Yes
Country-pair fixed effects			Yes	Yes

Notes: Dependent variables are in logs under the OLS specification and are in levels under the PPML specification. Data-set is obtained from Yotov et al. (2016) consisting of aggregate manufacturing sector for 69 countries. International dummies for each year are included but not reported. Additional gravity control variables are included but not reported in the table. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10. The R^2 value for the PPML estimation is a pseudo-R^2, hence not directly comparable to the R^2 produced by OLS estimation. Interpret with caution.

Appendix Table A.1 : Data Appendix

Product level trade data are collected from Feenstra et al. (2005). Data for control variables are retrieved from the "Center for Prospective Studies and International Information (CEPII)" (`http://www.cepii.fr/CEPII/fr/bddmodele/presentation.asp?id=6`).

Domestic Creditit: Domestic credit to the private sector as a percentage of GDP for exporter i at time t.

Total Exports: Real value of exports (free on board, FOB) from exporter i to importer j, measured in millions of US dollars.

Extensive Margin: Number of products exported from i to j.

Intensive Margin: Volume of exports (in millions of US dollars) per product from i to j.

Distance: Log of the distance between country i and country j.

Population: Thousands of people (measured in logs for empirical analysis).

Real GDP per capita: Log of annual real GDP per capita.

Strict Currency Union: Equal to 1 if each country in a bilateral trading relationship share a common currency at time t.

Common Language: Equal to 1 if each country in a bilateral trading relationship share a common language.

Regional Trade Agreement: Equal to 1 if each country in a bilateral trading relationship have a RTA at time t.

Common Border: Equal to 1 if each country in a bilateral trading relationship share a border.

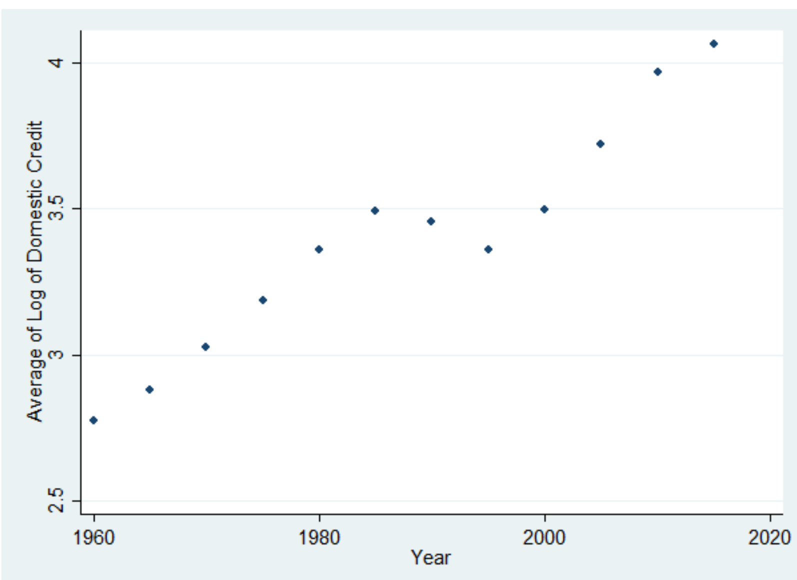
Log Product of Land Area: Log of the product of the land area of countries i and j.

Colony: Equal to 1 if each country in a bilateral trading relationship were ever in a colonial relationship.

Appendix Table A.2 : Summary Statistics

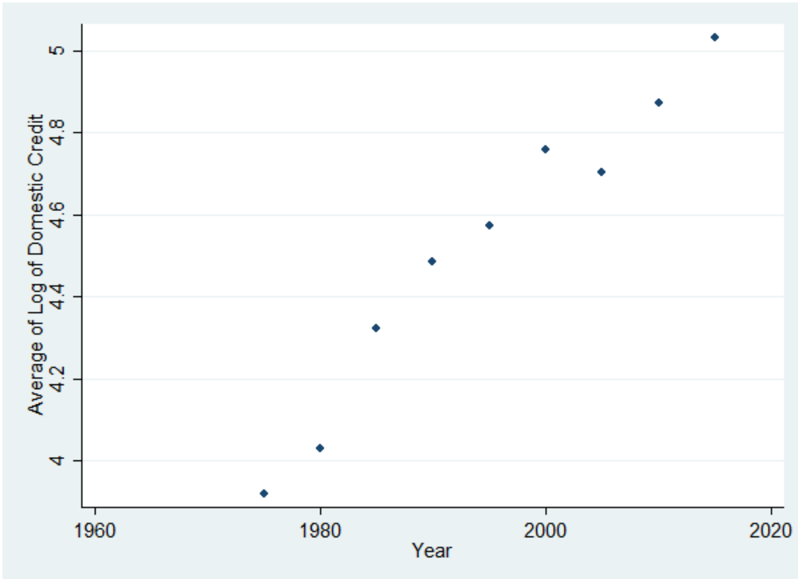
Variable	Obs	Mean	Std. Dev.	Min	Max
Total (real) exports	775,799	1853484	1.83e+07	.0042191	1.68e+09
Intensive margin	775,799	12990.09	238671.4	.0042191	1.11e+08
Extensive margin	775,799	90.13049	149.3513	1	775
Log of domestic credit	610,238	3.514	0.964	-1.681	5.733
Log of distance	775,799	8.670	0.802	4.107	9.892
Log of real GDP per capita (exporter)	754,176	19.32603	2.247349	11.10722	25.05529
Log of real GDP per capita (importer)	730,176	19.11381	2.280961	11.10722	25.05529
Common Currency	775,799	0.015	0.122	0	1
Common Language	775,799	0.164	0.370	0	1
Regional trade agreement	775,799	0.093	0.290	0	1
Common border	775,799	0.023	0.149	0	1
Log product of land area	775,799	23.546	3.584	5.165	32.769
Common colony	775,799	0.081	0.272	0	1
Current colony	775,799	0.003	0.052	0	1
Ever in a colonial relationship	775,799	0.024	0.154	0	1

Figure 1: Financial Development Over Time



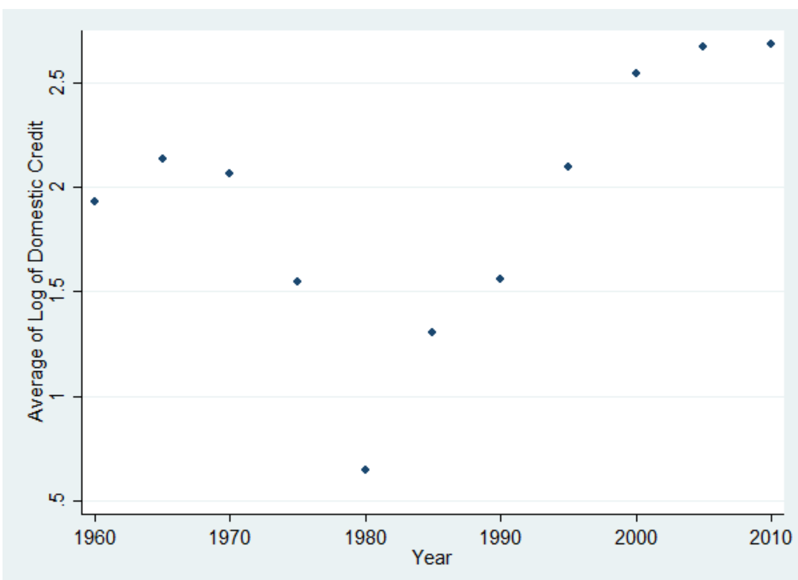
Note: Average of log of domestic credit (our proxy for financial development) for every 5 years in the sample.

Figure 2: Financial Development Over Time- China



Note: Average of log of domestic credit for every 5 years in the sample for China.

Figure 3: Financial Development Over Time- Ghana



Note: Average of log of domestic credit for every 5 years in the sample for Ghana.