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The Effect of Financial Development, Tariff, and RTA on Exports: A Structural Gravity Analysis

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Abstract This paper examines the effect of financial development (FD), tariffs, and RTA on bilateral exports in a structural gravity framework. Applying high-dimensional fixed effects in OLS and PPML estimation technique in a panel framework covering 169 countries over 2001-2017, this paper finds that FD of both exporters and importers are an important determinant for boosting exports. The EIA has the most trade creation effect than any other form of RTA. Importers' FD has a larger effect on bilateral exports for developed to developed and developed and developing country trade than that of the exporters. The trade between developing to developing countries is positively affected by both exporters' and importers' FD; and negatively to a larger extent by tariff measures. However, in the case of developing and developed country estimation, FD of the exporter country is significantly affecting bilateral trade. Tariffs significantly distort trade, largely between developing and developed countries.

Keywords: financial development, exports, tariffs, regional trade agreement, gravity model

JEL Classifications: F10, F14, F15, F36, G20

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I. Introduction

The traditional literature on trade considers factors endowment, economies of scale, and technologies are causing comparative advantage that determines trade flows among countries (Beck, 2003). Institutions have now been argued to play a major role in forming comparative advantage, as they influence accumulation factors and technological advancement. Among many forms of institutions, those associated with financial development are also causing comparative advantage (Nunn & Trefler, 2014). The supply-leading hypothesis, augmented theoretically by

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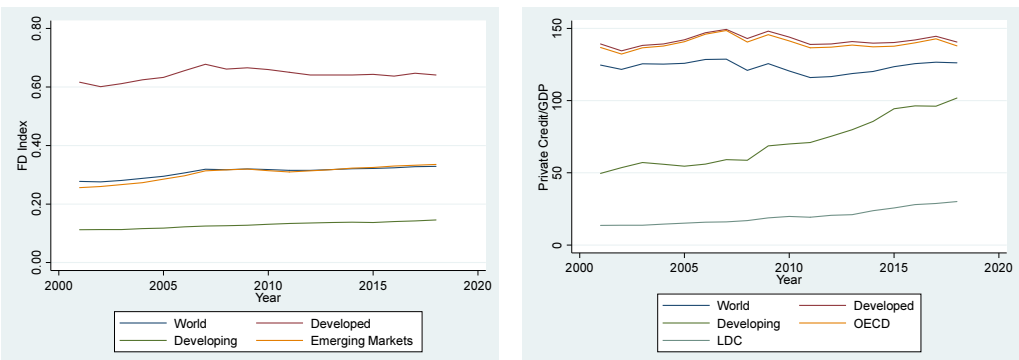
Kletzer and Bardhan (1987), Baldwin and Krugman (1989), and Ju and Wei (2005) advocates that financial issues have an exogenous impact on foreign trade. According to Acemoglu et al. (2001), "the development of the financial sector can be regarded as an endowment for comparative advantage". In contrast, the demand-following hypothesis states that financial constraints affect a firm's participation in international trade. Based on the theoretical background, empirical studies also documented that cross-border trade (Beck, 2002; Beck, 2003; Amiti & Weinstein, 2011; Manova, 2013) has been affected by financial sector development.

The role of international trade in the development of globalizing the world economy has been augmented over the last few decades. According to Madison (2001), "a significant share of the world's GDP is now exported and imported across national borders". Based on the United Nations Statistics Division data, the world's share of exports to GDP and imports to GDP has increased from 23.08% to 29.21% and 23.11% to 28.51% respectively from 2001 to 2018. At the same time, the world observed substantial development in the financial sector (Figure 1). However, there is a substantial difference in financial development among countries. Based on the IMF's report of the financial development index (left panel of Figure 1), the average value for the period of 2001-2018 for the world was 0.31; however, for the developed, developing, and emerging markets the average index was 0.64, 0.13 and 0.30 respectively. Meanwhile, the average of the private sector credit to GDP, a usual measure of financial development, over the same period at the world level was 123.41% with substantial differences between developed (141.76%) and developing (71.35%) countries. Henceforth, there is a question of how important is the interaction or relationship of financial development and trade to define the broad features of the world economy today and how this relationship differs across different categories of countries.

Figure 1. Financial development overtime



(Source) Author's calculation based on IMF and WB (WDI) data.

Trade is also a key to the end of poverty. Countries that are open internationally tend to develop more quickly and give their people better opportunities. On the contrary, many governments also enact trade policies in such a way that it helps to protect domestic industry by encouraging imports. There are three approaches to regulating international trade. First, a unilateral measure in which a country can impose it unilaterally. Second, the undertaking of bilateral agreements in which policy measures is taken by agreement with trading partners. The third is the undertaking of multilateral agreements where policies are enacted by coordination with participating countries. Among the different approaches to trade policy measures tariffs (mainly protectionism) and regional trade agreements, and RTAs (liberalization policy) are the two most applicable measures of trade policy. Although the tariff rate has been reduced over time because of the deepening of the multilateral trading system, the recent trend showed that trade could be impacted due to tensions and heightened tariff rates or trade policy uncertainty. Both theoretical (e.g. Handley, 2014; Handley & Limão, 2022) and empirical (e.g. Caldara et al., 2019; Novy & Taylor, 2020; Borojo et al., 2023) literature established that trade policy uncertainty (TPU) adversely affect trade flows. There is, however, evidenced that trade agreements or permanent normal trade relations (PNTR) help to reduce TPU and boost exports (Pierce & Schott, 2016; Handley & Limão, 2022). Meanwhile, there is an explosion of regional trade agreements (RTAs) in recent years (Larch et al., 2019) among the countries to ease TPU and expand trade potential. It is also, therefore, imperative to study how tariffs and RTAs are reshaping trade trends in a broader view.

The absence of reliable data is one of the main limitations of the empirical analysis. Although there exist several studies of the effect on financial development on trade (e.g. Beck, 2002; Beck, 2003; Manova, 2013; Ma & Xie, 2019), however, earlier studies rely on the private sector credit to GDP as a proxy for the measurement of the development of the financial sector. Beck et al. (2000) pointed out that "the indicators of financial development should reflect the size, activity, and efficiency of both financial institutions and markets". Due to the deficiency of a dependable measure of financial development in a longitudinal context, the literature in this field is relatively few. Against this backdrop, Svirydzenka (2016) has developed financial development in the purview of the IMF. This database has led us to an opportunity to examine the impact of financial development on trade, especially on exports in a worldwide context.

While investigating the determinants of bilateral trade researchers mostly relied on the "gravity equation" as the method usually presents an excellent fit of the data. It is theoretically established that the destination countries' financial development is equally important as that of the origin country to characterize the trend of global trade (Ma & Xie, 2019). The gravity model is very useful to incorporate the financial development of both exporting countries and importing countries by its formulation. Additionally, Baier and Bergstrand (2007) proved the usefulness of the gravity equations in the empirical analysis of international agreements (FTAs).

The trade cost in international trade not only includes physical costs (e.g. transportation costs) but also includes policy-related costs incurred due to tariff barriers and non-tariff barriers. In this context, Hayakawa (2013) stressed the importance of studying tariff rates in analyzing trade trends. Before Hayakawa (2013), the bilateral tariff rates have not been studied with a worldwide sample in a gravity model. Moreover, studies like Redding and Venables (2004), Disdier and Head (2008) concluded that the empirical findings might be affected due to omitted variable bias arising from the exclusion of tariff rates. The application of the structural or theory consistent gravity model (Anderson & Wincoop, 2003) in recent times allows and motivates us to study such policy variables (financial development, tariff, and RTAs) impact on bilateral trade. Nevertheless, Manova (2013), and Ma and Xie (2019) argued theoretically that "financial development in destination countries increases the firms' exports from the origin as well as the productivity cut-off for exporting is lower if the destination countries are more financially developed". Because the level of financial development is heterogeneous across countries around the world, these arguments also motivate me to study the effect of financial development on exports by dividing our sample into different (developed and developing) country groups.

By utilizing a panel data of 169 countries for 2001-2017 and best practice econometric techniques including OLS and PPML estimates with high dimensional fixed effects, this paper, in general, finds that the financial development of both exporters and importers significantly and positively affects bilateral exports. Tariff significantly distorts bilateral trade. In decomposing RTA in different modes, we find that economic integration agreement (EIA) has the most trade creation effect than any other form of RTA. In the case of developed-to-developed country trade; the importer country's financial development has a larger effect on bilateral exports of the exporters' country and the effect of tariff and RTA is neutral. The bilateral trade from a developed to a developing country is more likely to be affected by the financial development of the importer's (developing) country. For developing to developing country estimation, the result shows that both exporters and importers countries' financial development is important for bilateral exports, and tariff has a larger negative effect on bilateral exports. However, for developing and developed country estimation, the financial development of the developing country is significantly affecting bilateral exports, while the financial development of the importer's country (developed) is unimportant. Tariff significantly distorts trade between developing and developed countries and RTA does not affect trade.

This paper, therefore, has important contributions to the body of trade literature. First, the study investigates the impact of financial development on bilateral exports by utilizing a comprehensive novel set of financial development measurements developed by the IMF. Second, the study extends the gravity literature in utilizing bilateral tariff data (both AHS and MFN) in a worldwide context which is very limited in existing literature due to data unavailability. Third, this paper examines the impact of trade policy variables on trade by classifying our

sample into different country groups considering the heterogeneity of financial development.

The remainder of the paper is organized as follows: In section 2 we give a brief review of relevant theoretical and empirical literature. Section 3 presents empirical methodology and data. In section 4 we discuss step-by-step empirical procedures and results, and we do a robustness check in section 5. Finally, we conclude in section 6.

II. Literature Review

The literature on finance-led trade is vast. The focus of this review is to assess critically how the literature has evolved both theoretically and empirically.

A. Theory

Besides the conventional factors, financial development has also been considered a possible basis for the comparative advantage of a country in recent times. Theoretical papers that advocate this notion is Kletzer and Bardhan (1987), Baldwin (1989), Rajan and Zingales (1998), Xu (2001), Beck (2002), Manova (2013), Chan and Manova (2015), and Ma and Xie (2019).

By augmenting the Heckscher-Ohlin model for trade with a financial sector and assuming identical factor endowments across borders, Kletzer and Bardhan (1987) show that a matured financial sector leads to a comparative advantage in such industrial sector that depends more on external funding. Unlike in standard trade theory, the comparative advantage of a country also explicitly depends on institutions, particularly those in the financial sector. According to their model, the opportunity cost of credit to firms is an important factor determining trade and financial sector development reduces this search cost. The country with a comparatively higher cost of credit will enjoy a comparative advantage in the manufacture of the intermediate goods; and will export the intermediate goods and import the final goods.

Baldwin's (1989) works are based on the financial market's risk diversification function. Considering a two-country, two-sector, and one-factor (2x2x1) model, "Baldwin (1989) shows that economies with higher financial development have higher possibilities of risk diversification due to the demand shocks". Risky products are produced facing low levels of risk premiums and thereby lesser marginal costs. Therefore, countries with mature financial markets and higher potential to diversify will concentrate on producing and exporting risky goods.

The relevant literature on the link between financial development and economic growth also advocates the importance of the relationship between the nature of the trade balance and the development of the financial sector. Rajan and Zingales (1998) extend their analysis to a larger set of industries and note that "countries with a higher level of financial development should

enjoy a comparative advantage in those industrial sectors that require more external finance and therefore, higher export shares and higher trade balances in these industries".

Xu (2001) incorporates the selection of entrepreneurs and financial market imperfections into the two-country, two-factor, and two-goods (2x2x2) model of international trade. That is, their model adds two more dimensions to the H-O model: (1) entrepreneurial selection and factor prices endogenously determine the productivity of the capital-intensive sector, and (2) financial market imperfections affect factor intensities. According to Xu (2001), "comparative advantage has three sources: (1) differences in factor abundance, (2) differences in the productivity of the capital-intensive sector caused by entrepreneurial selection, and (3) differences in financial market imperfections".

Beck (2002) extends the work of Kletzer and Bardhan (1987) by permitting both sectors to use external funding, where one sector is more dependent on credit because of an increasing return to scale. Even though there are numerous links through which financial development affects international trade, his approach focuses mainly on the financial sector's ability to channel funds to the domestic private sector, which helps mitigate liquidity problems. Eventually, Beck (2002) argues that "countries with a better developed financial system and a higher level of external finance should have a comparative advantage in sectors that exhibit high economies of scale" Empirically, their analysis shows that countries with a well-developed financial system have a larger export share and trade balance in manufactured goods.

Manova (2013) introduces a model with firm heterogeneity and with a variation of financial development by countries following the basic production mechanism and market structure of Melitz (2003) into a static and partial equilibrium framework. Theoretically, she examines "how financial market imperfections distort international trade by decomposing their effect into three channels: (1) the selection of heterogeneous firms into domestic production, (2) the selection of domestic manufacturers into exporting, and (3) the level of firm exports". The theory indicates that financially advanced countries enjoy a competitive advantage in financially weak industries.

Chan and Manova (2015) extend the work of Manova (2013) by concentrating explicitly on the prophecies for the pecking order of the destinations of exports. Theoretically and empirically, they demonstrate that the number and identity of exporting destinations are affected by imperfections in the financial system.

Extending the theoretical foundation of Manova (2013), Ma and Xie (2019) develop a trade model by taking into account the financial development of both the origin country and the importing country. They empirically show that the financial development of importers is equally important as that of the exporters for shaping international trade. According to them, the financial development of the importing country reduces entry barriers and increases the volume of exports for overseas companies.

B. Empirics

How comparative advantage is engendered by financial development was first empirically examined by Beck (2002) who augmented the notion of the Kletzer and Bardhan (1987) model. Beck (2002) examined the relationship between the share of manufacturing exports to gross exports and a measure of financial development, where the latter is proxied by the private sector credit of banks and financial institutions to GDP. Using a panel dataset for 65 countries for 1966-1995 and controlling for cross-sectional fixed effects (FEs) and reverse causality, his results demonstrate that comparatively financially developed countries enjoy a comparative advantage in the manufacturing sector. However, his methodology did not consider possible endogeneity issues of financial development.

Beck (2003) extends his earlier empirical research to the industry level utilizing the methodological approach of Rajan and Zingales (1998) and assesses how financial development brings on comparative advantage in industries that depend heavily on external finance. In particular, he evaluates empirically the relationship between financial development interaction and dependence on external funding with exports and balance of trade. He uses the ratio of exports or balance of trade to GDP as the dependent variable and 'private credit to GDP' and 'stock market capitalization to GDP' as a measure of financial sector development and stock market development respectively. Utilizing a large sample containing 56 countries and 36 industries averaged for 1980-1989, Beck (2003) demonstrates that "countries with a well-developed financial system have higher shares of exports and trade balances in industries that use more outside finance". Even though the model incorporates the endogeneity issue, however, his method unsatisfactorily deals with it (Nunn & Trefler, 2014). Manova (2008) addresses the question of endogeneity effectively by exploring what happens to exports in the country as it undergoes a phase of financial liberalization. "Developing a credit-constrained heterogeneous firms' model, countries differ by the levels of financial development and sectors vary by the extent of financial vulnerability, Manova (2008) shows that financially developed countries are more likely to be a bilateral net exporter".

Becker et al.(2013) argue that for entering into the export market firms incur high unobservable fixed costs. These fixed costs are higher in countries with comparatively lower levels of financial development and in industries that require large sale proceeds and R&D expenses or produce differentiated products. They, thus, hypothesize a relationship between financial development and the domestic firms' ability of exports. Their study uses accounting standards or private sector credit to GDP to measure financial development. Employing a gravity equation for bilateral trade flows with exporter's and importer's FEs they find that when fixed costs are high, exports are more vulnerable to financial development. Their analytics at the industry level show that financial development is linked with more exports to industries with higher fixed

costs and importers with high costs. According to Becker et al.(2013), financial development also affect trade dynamics. Their analysis also finds a positive estimate of the importer's financial development on exports; however, the significance level is weak. It implies that having a lower level of fixed costs for exporting is potentially instigating the comparative advantage.

There is also empirical literature on the relationship between finance and trade both at the firm level and at the country level or sector level. The two most recent studies, Amiti and Weinstein (2011) and Muuls (2015) focus on firm-level data. Amiti and Weinstein (2011) is the first study to match exporter firms and bank data to demonstrate a relationship between the strength of trade finance-providing banks and the growth of exports in a firm compared to its domestic sales. Their paper uses banks' and exporters' data from Japan from 1986 to 2010. To study empirically the way the export growth of a firm has shifted with the health of banks providing commercial finances, their work uses a within-industry-year variation. Their empirical results suggest that the health of banks (measured by market-to-book value) is a significant determinant of firm-level exports at the time of crisis. Muuls (2015) examines the interaction between credit restrictions and trading performance by breaking down trade into extensive margin and intensive margins. He uses a novel dataset for manufacturing firms of Belgium covering 1999 and 2007 which includes information on firm-level transactions on trade, balance sheets, and credit scores. He collected this data from a credit insurance company. Muuls (2015) finds that "firms that are less credit constraint, more productive have a greater possibility of being exporters and/or importers, and them also likely to export and import more". The two studies agree that export trends rely on financial development.

There are also other interesting studies that are concerned with firm-level comparative advantage within a sector and entry barriers into foreign markets. Examples of empirical studies that utilize sectoral-level data include Hur et al. (2006), Manova (2013), and Chan and Manova (2015). Utilizing the data for 42 countries and 27 industries, Hur et al.(2006) find that higher financially developed economies have higher shares of export and trade balances in industries that have more intangible assets. Their findings evidenced that the domestic financial market development lifts international trade of manufacturing goods. The influential contribution of Melitz (2003) has lifted the attention of scholars in studying international trade with heterogeneous firms' models. Manova (2013) develops a heterogeneous firm model in which countries vary in terms of financial development levels and sectors vary in terms of tangible asset levels. Using a panel of aggregate trade data for 107 countries and 27 sectors for 1985-1995 and private sector credit to GDP as financial development measurement, she finds that financially advanced economies export more in sectors that are financially weak because of both extensive margins (cover more markets or export more product varieties to each destination), and the intensive margin (export more of existing products). Using panel data on bilateral trade for 78 countries and 27 industries over 1985-1995, Chan and Manova (2015) demonstrate that financially more

developed states have more trading partners and are moving the order further, especially in sectors that depend deeply on the financial structure.

On the other hand, financial underdevelopment and regulatory challenges influence the fixed costs of creating a company and hence the extensive trade margin. "According to La Porta et al. (2008), financially underdeveloped countries typically have high regulatory barriers to entry which have a major impact on the extensive trade margin (Helpman et al.,2008)".

Several recent studies have added new dimensions to the international trade and finance literature. Caballero et al.(2018) reveal a new channel, international bank linkages, through which international trade is associated with overseas finance. They define bank linkages for each pair of countries by the number of bank pairs that are linked through cross-border syndicated lending. Using a gravity model of trade for 66 countries over 1990-2013 with exporter-year, importer-year, and exporter-importer FEs, the findings of Caballero et al.(2018) suggest that "new bank linkages in a given country-pair have trade creation effect between these countries in the following year and trade diversions effect from competing countries for similar imports".

Memanova and Mylonidis (2020) analyze the role of bank market power on total exports. Besides, their model includes the financial freedom variable index to capture the country's financial development and liberalization and the trade freedom index which capture both tariff and non-tariff barriers. Using panel data for 125 countries covering the period of 1997-2010, and controlling for both observed and unobserved country heterogeneity, they found that bank market power positively affects exports. Their baseline regression shows that financial freedom and trade freedom has a mixed and positive impact, although insignificant, on trade.

Further, few studies look at the short-run and long-run relationship between financial development and international trade at a country level. Shaheen et. al. (2011) examines this case for Pakistan. Utilizing the ratio of M2 to GDP as a measure of financial development and applying the Autoregressive-distributed lag (ARDL) approach for cointegration, they find a long-run positive and unidirectional relationship. Applying the same ARDL approach Bilas et al.(2017), however, find negative long-run and positive short-run relationships between financial developments and international trade in Croatia.

Finally, Ma and Xie (2019) add important aspects to this strand of literature. Based on their theoretical propositions, their empirical analysis uses a balanced panel consisting of 116 countries across 36 sectors over 2005-2014 and a variant of the gravity model. Ma and Xie (2019) show that, "conditional upon the exporter's financial development, firms especially those in financially more vulnerable sectors, export higher volumes of goods and more types of varieties to partners in countries of a higher level of financial development".

A central element of the gravity model is analyzing the effect of trade policies (e.g. tariffs, RTAs) on trade. Researchers find that RTAs have a positive effect on trade between the partners of the agreements. For instance, by using a gravity model of static and dynamic framework

Martinez-Zarzoso et al.(2009) examine the impact of preferential trade agreements (PTAs) on trade between members and non-members of the group. They find that RTAs had larger positive effects on trade in developed countries under the EU and NAFTA compared to developing countries. Kurihara (2011) also draws the same conclusion that RTAs promote trade more in OECD countries than the non-OECD countries. The same conclusion has been drawn by Gylfason et.al, (2015) for free trade agreements of Eastern Partnership States (Ukraine, Georgia, and Moldova) with the EU and Russia; and by Ngepah and C.Udeagha (2018) for RTAs in the African region. On the other hand, researchers tend to omit tariffs from the gravity equation due to the unavailability of worldwide bilateral tariff data. Nevertheless, few studies explore the effect of the bilateral tariff on trade for a limited sample of countries mostly covering advanced countries (e.g. Debaere & Mostashari, 2010; Caliendo & Parro, 2014). However, the most important work in this line has been done by Hayakawa (2013). He studied the seriousness of omitting bilateral tariff rates using worldwide data. Hayakawa (2013) concluded that although omitting the bilateral tariff rate from the gravity equation is not a serious issue, however, the RTA is not to be treated as a statistical substitute for tariff rates[1].

III. Empirical Methodology and Data

A. The theoretical framework of finance and trade

The empirical analysis largely follows the theoretical framework of Ma and Xie (2019) which is an extension of Manova (2013). For intuition, we reproduce the Ma and Xie(2019) model with the help of Manova (2013).

Basic Setup: According to Ma and Xie (2019), "Manova (2013) incorporates credit constraints and firm heterogeneity into a static and partial equilibrium model of Meliz (2003)".

Consumption Expenditure: Firms in each of countries *j* and sector *s* produce differentiated goods. Consumers have a preference for a "love of variety". The consumers of country *i* face sector-specific CES consumption indices defined by-

$$C_{is} = [\int_{\omega\varepsilon}\Omega_{is}q_{is}(\omega)^{\alpha}d\omega]^{1/\alpha} \quad (1)$$

1) Earlier studies assumed that RTA dummies in gravity studies explain most of the variation in bilateral tariff rates. However, Hayakawa (2013) showed that the inclusion of an RTA dummy failed to offset the effects of RTA with worldwide tariff data.

where Ω_{is} represents the set of available products and $\varepsilon = 1/(1-\alpha) > 1$ is the elasticity of substitution. The share of each sector in total expenditure Y_i is defined by $\theta_s \epsilon (0,1)$ and $\Sigma_s \theta s = 1$. Let's, define the price indices by $P_{is} = [\int_{\omega \varepsilon \Omega_{is}} P_{is}(\omega)^{1-\alpha} d\omega]^{1/(1-\alpha)}$, then the country i's demand for a variety with price $p_{is}(\omega)$ is-

$$q_{is}(\omega) = \{ p_{is}(\omega)^{-\varepsilon} \theta_s Y_i) / (P_{is}^{1-\varepsilon}). \quad (2)$$

Firm Production: "Firms in country *j* pay a sunk entry cost $c_{js}f_{ej}$ before drawing a productivity level 1/a from a cumulative distribution function *G(z)* with support [*zL,zH*], *zH* >*zL*>0. Since *cjs* captures differences in aggregate productivity, factor prices, and factor intensities across countries and sectors, *G(z)*does not depend on *j* and *s*(Ma &Xie, 2019)".

To reflect the effect of credit constraints on exports beyond domestic output, Manova (2013) assume that "firms finance their domestic activities with cash flows from operations, and there are no fixed costs to servicing the home market". Hence all firms that enter the industry produce domestically.

Financial Frictions: While exporting firms in country *j* pay a fixed cost $c_{js}f_{ij}$ in each period, where $f_{ij}>0$ for all $i \neq j$ and $f_{jj}=0$. Exporting firms often incur iceberg trading costs so that $\tau_{ij}>1$ units of a good need to be transported to 1 unit to reach at the destination. Manova (2013) assumes that firms face liquidity constraints in financing foreign sales. That is, a fraction $\delta_s \epsilon (0,1)$ of the fixed trade cost$[\delta_s c_{js} f_{ij}]$ is borne up-front which is to be covered by external finance. Moreover, a fraction $t_s \epsilon (0,1)$ of the sunk cost goes towards tangible assets as collateral."

In addition, Manova (2013) assumes that the degree of financial contractibility varies between countries. The probability of enforcement of financial contract $\lambda_j \epsilon (0,1)$ and with the probability of $(1-\lambda_j)$ firms being default the creditor seized the collateral $t_s c_{js} f_{ej}$. With this setup, Ma and Xie (2019) explicitly modeled financial development in both origin and destination countries. "A firm in sector s of country j maximizes profit by choosing the price and quantity p_{ijs} and q_{ijs} respectively for the product that it exports and sell in the country i (Ma & Xie, 2019)":

$$\max \; p_{ijs}(z)q_{ijs}(z) - (1-\delta_s)q_{ijs}(z)\tau_{ij}c_{js}z - (1-\delta_s)c_{js}f_{ij} - [\lambda_j\lambda_i E(z) + (1-\lambda_j\lambda_i)c_{js}f_{ej}] \quad (3)$$
$$\text{p.q.F}$$

subject to,

$$q_{ijs}(z) = \frac{p_{ijs}(z)^{-\alpha}\theta_s Y_i}{P_{is}^{1-\alpha}} \tag{4}$$

$$R_{ijs}(z) = p_{ijs}(z)q_{ijs}(z) - (1-\delta_s)\, q_{ijs}(z)\tau_{ij}c_{js}z - (1-\delta_s)c_{js}f_{ij} \geq F(z) \tag{5}$$

$$E_{ijs}(z) = -\delta_s q_{ijs}(z)\tau_{ij}c_{js}z - \delta_s c_{js}f_{ij} + [\lambda_j\lambda_i F(z) + (1-\lambda_j\lambda_i)c_{jjs}f_{ej}] = 0$$

The profit function reveals that firms pay a fraction δ_s of its variable cost $q_{ijs}(z)\tau_{ij}c_{js}z$ and fixed cost $c_{js}f_{ij}$ through external finance. 1/z reflects firms' productivity. The external finance is finance by an outside investor, and firms pay the investor F(z) from their revenue if the contract is enforced with probability $\lambda_j\lambda_i$ and pay $c_{js}f_{ej}$if default with probability $(1-\lambda_j\lambda_i)$. λ_j and λ_i represent the probability of the enforcement of contracts in country *j* and *i* respectively. Higher the λ_j and λ_i, higher the extent of financial development in country *j* and *i* respectively.

If the liquidity constraint (5) is not binding, firms become an exporter. In the case of trade finance, financial institutions of importing countries are engaged by means of issuing " Letter of Credit" or " Cash in Advance"(Schmidt-Eisenlohr, 2013). By solving the problem, Ma and Xie (2019) showed theoretically that "the financial development of the destination country is equally important as that of the origin country for determining bilateral trade patterns".

B. Empirical specifications

The general model takes the form of as-

$$\text{InTRADE}_{ijt} = \alpha_0 + \beta_1 \text{FINDEV}_{it} + \beta_2 \text{FINDEV}_{jt} + \delta_1 \text{InGV}'_{it} + \delta_2 \text{InGV}'_{jt} + \gamma \text{GC}'_{ij} + \epsilon_{ijt} \tag{6}$$

where, TRADE_{ijt} is either exports or imports from country i to j, α_{it},and α_{jt} are directional fixed effects, FINDEV_{it} and FINDEV_{jt} are financial development of exporters (importers) and importers (exporters) respectively. GV′ is a vector of time-variant gravity variables, GC′ is a vector of time-invariant gravity constants between trading partners, and ϵ_{ijt} is the error term.

The main issue here is to choose gravity variables including policy-related ones. Head and Mayer (2014) conducted a meta-analysis of 159 papers published in the top five influential journals of international economics on gravity analysis and provided results for the most frequently used variables, which are reproduced below in Table 1:

Table 1. *Estimates of Gravity Variables Typically Used*

Estimates	Structural Gravity		
	Mean	Std. dev.	Number
Origin GDP	0.74	0.45	31
Destination GDP	0.58	0.41	29
Distance	-1.1	0.41	328
Contiguity	0.66	0.65	266
Common Language	0.39	0.29	205
Colonial Link	0.75	0.49	60
RTA/FTA	0.36	0.42	108
EU	0.16	0.5	26
NAFTA	0.76	0.64	17
Common Currency	0.86	0.39	37
Home	1.9	1.68	71

(Source) Head and Mayer (2014).

The main interest is to ascertain the relationship between financial development and international trade. Tariffs and RTA are also other explanatory variables of our interest. Incorporating time-variant and time-invariant gravity variables and considering exports as our main dependent variable, the baseline gravity model will take the following form-

$$\begin{aligned} \ln EX_{ijt} = {} & \alpha_0+\beta_1 FINDEV_{it}+\beta_2 FINDEV_{jt}+ \beta_3 \ln TARIFF_{ijt}+ \delta_1 \ln GDPPP_{it} + \delta_2 \ln GDPPP_{jt} \\ & + \delta_3 RTA_{ijt} + \gamma_1 \ln Dist_{ij} + \gamma_2 CONT_{ij}+ \gamma_3 LANGUAGE_{ij} + \gamma_4 COLONIAL_{ij} \\ & + \gamma_5 LANDLOCK_{ij} + \varepsilon_{ijt} \end{aligned} \quad (7)$$

where,

EX_{ijt} = Exports of country i to country j at time t;
$FINDEV_{it}$ = Financial Development of country i (exporter) at time t;
$FINDEV_{jt}$ = Financial Development of country j (importer) at time t;
$TARIFF_{ijt}$ = Applied Tariff of country j (importer) at time t on imports from i;
$GDPPP_{it}$ = Gross Domestic Product on PPP basis of country i at time t;
$GDPPP_{jt}$ = Gross Domestic Product on PPP basis of country j at time t;
RTA_{ijt} = Regional or Free Trade Agreement between country i and j at time t;
$DIST_{ij}$ = Distance between country i's and j's capital;
$CONT_{ij}$ = A dummy for Contiguity between country i and j;
$LANGUAGE_{ij}$ = A dummy for a common language for country i and j;

$COLONIAL_{ij}$ = A dummy for both *i* and *j* if they have common colonial history;
$LANDLOCK_{ij}$ = A dummy representing that countries *i* and *j* are landlocked.

The study uses panel data. Recently, it has been argued that in gravity estimations the multilateral resistance terms (MRTs) should be controlled by exporter-time and importer-time fixed effects (FEs) in dynamic panel data settings (Olivero & Yotov,2012; Feenstra,2016). According to Yotov et al.(2016), "the inclusion of the exporter-time and importer-time FEs will, however, absorb the size variables (e.g. GDP, Population) from the structural gravity model as well as all other observable and unobservable country-specific characteristics which vary across these dimensions like national policies, institutions, and exchange rates". Accordingly, equation (7) becomes-

$$\begin{aligned} InEX_{ijt} = {} & \alpha_{it}+\alpha_{jt}+\beta_1 FINDEV_{it}+\beta_2 FINDEV_{jt}+ \beta_3 InTARIFF_{ijt} + \delta_1 RTA_{ijt} + \gamma_1 InDist_{ij} \\ & + \gamma_2 CONT_{ij} + \gamma_3 LANGUAGE_{ij} + \gamma_4 COLONIAL_{ij} + \gamma_5 LANDLOCK_{ij} + \varepsilon_{ijt} \end{aligned} \quad (8)$$

The presence of endogeneity and reverse causality result in biased estimates of an empirical study of international trade. Trade policy variables are endogenous, especially to currency unions and RTAs. The use of standard instruments is a method of dealing with endogeneity. However, due to a lack of plausible instruments, researchers are now suggesting incorporating country-pair FEs (Head & Mayer, 2014; Yotov et al.2016). An important feature of country-pair FEs is that they will control all time-invariant gravity variables. Therefore, the structural gravity equation of interest then becomes-

$$InEX_{ijt} = \alpha_{it}+\alpha_{jt}+\alpha_{ij}+\beta_1 FINDEV_{it}+\beta_3 FINDEV_{jt}+ \beta_4 InTARIFF_{ijt} + \delta_1 RTA_{ijt} + \varepsilon_{ijt} \quad (9)$$

Consistent estimation of the gravity equation with the structural gravity model is a vital issue. To estimate the model, the pseudo-poisson maximum likelihood (PPML) is proposed by Santos Silva and Tenreyro (2006), and it is preferable due to numerous reasons. PPML accounts for the heteroscedasticity and existence of zero trade flows. Recent studies show that PPML estimates are consistent with the high dimensional fixed effects model (Larch et al.,2019). Kabir et al. (2017) recently conducted a study on the survey on gravity estimations, and finally emphasizes the use of PPML for getting consistent gravity estimation. According to Santos Silva and Tenreyro (2006), the dependent variable will be in levels, not in logs and it does not matter whether the error term enters the model in either additive or multiplicative form. Specifically, we estimate the following equation-

$$EX_{ijt} = \exp\left[\begin{array}{c} \alpha_{it}+\alpha_{jt}+\alpha_{ij}+\beta_1 FINDEV_{it}+\beta_2 FINDEV_{jt} \\ + \beta_4 InTARIFF_{ijt} + \delta_1 RTA_{ijt} + \end{array}\right] + \varepsilon_{ijt} \quad \ldots. \quad (10)$$

Intuitively, we estimate all equations (18)-(21) using the PPML method represented by equation (21).

In the robustness check, we first measure bilateral exports from country i to country j, using reported exports by country i from country j; and second, we use a separate set of matched tariff and trade data collected from TRAINS through the 'advance query options' of WITS software. We then check the sensitivity of our estimates by adding country level institutional ability to enforce contracts (e.g. rule of law) as an explanatory variable. We also perform robustness check by using alternative measure of financial development (using domestic private credit to GDP).

C. Data

The study employs a panel data framework that covers 169 countries for 2001-2017 which constitutes 482,664 observation rows. Initially, the sample size was 183 countries since the financial development index database of the International Monetary Fund (IMF) has coverage of more than 180 countries with annual frequency from 1980 onwards. As some countries do not have data for some of the variables under this study as well as lack data for the early years, we have to limit the sample finally to 169 countries (Appendix Table A1). The following Table 2 describes the construction of variables and their sources.

Table 2. *Construction of Variables and Sources*

Variables	Description/ Construction	Sources
Exports (EX)	Exports are measured in two ways. First, the reported imports (on a CIF basis) of the importing countries are treated as exports of the exporting countries. Second, the reported exports (on an FOB basis) of the exporting countries.	The direction of Trade Statistics (DOTS), IMF
		UNCTAD TRAINS database by WITS
Financial Development (FD) for exporter and importer	Svirydzenka (2016) developed a financial development index for the IMF. FD is defined as a relative ranking of the countries on their financial institutions and financial markets' depth, access, and efficiency. FD index is a composite measure of the Financial Institution Index (FI) and Financial Market Index (FM).	Financial Development Index database, IMF
	Domestic Credit to Private Sector to GDP[DCR] (used in robustness check as an alternative measure of FD)	WDI
GDPPPP for exporter and importer	GDP measured in current international dollars on PPP basis.	International Comparison Program (ICP), 2017, WB.
Tariff (TARIFF) of the importer	The tariff is defined by (1+ Tariff Rate). AHS weighted average effectively applied tariff rate is used.	WITS, WB
	MFN weighted average effectively applied tariff rate is also used (robustness test).	UNCTAD TRAINS database by WITS
Regional Trade Agreements (RTA)	RTA is comprised of Free Trade Agreements (FTA), Customs Union (CU), Economic Integration Union (EIA), and Partial Scope (PS).	Mario Larch's RTA database(Egger and Larch ,2008)

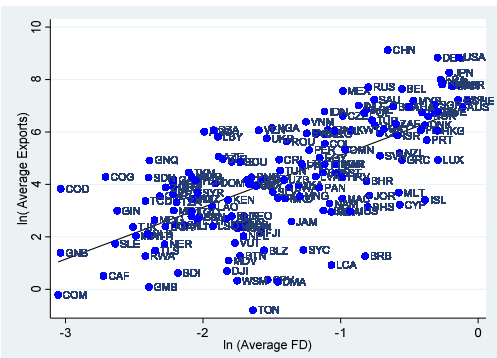
Table 2. *Continued*

Variables	Description/ Construction	Sources
Rule of Law (ROL)	The rule of law estimates of the Worldwide Governance Indicators (WGI) is used as a measure of judicial quality or contract enforcement ability. Higher positive values indicate strong contract enforcement ability.	The WGI 2023 update, WB.
Distance (DIST)	Population weighted bilateral distance between exporter and importer in kilometer.	CEPII's Geodist database.
Contiguity (CONT)	A dummy for contiguity between exporter and importer.	
Common Language (LANGUAGE)	A dummy representing the common language between exporter and importer.	
Colony (COLONIAL)	A dummy for exporter and importer ever in a colonial relationship.	
Landlocked (LANDLOCK)	A dummy for exporter and importer if they are landlocked.	

D. Stylized facts: Summary statistics

The summary statistics of the variable used in this study are presented in Appendix Table A2. The main interest variables are exports and financial development (FD) and their average value is 0.321. To measure bilateral exports from country *i* to country *j*, we use imports reported by country *j* (importer) from country *i* (exporter) from the IMF's DOTS database. We assume that importers' reports are more accurate than the exporter's reports following Feenstra et al. (2005) because our analysis also uses tariff as an explanatory variable which is reported by the importer. Nevertheless, we also use the exporters' report of exports in the robustness analysis. The average value of exports by importers' report is USD 635.733 million and exporters' report is USD 693.529 million with a fairly large standard deviation.

Figure 2. *Stylized facts-financial development and exports: All countries*

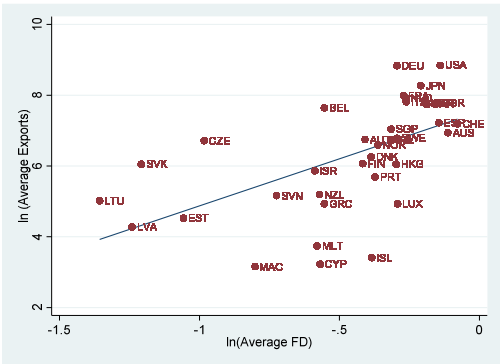


Panel-1: Exportes' FD and Exports

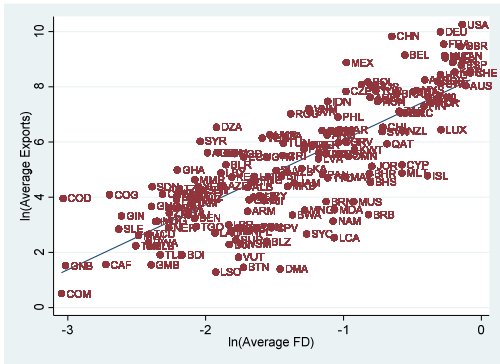
Panel-2: Importers' FD and Exports

(Source) Author's calculation based on dataset.

Figure 3. Stylized facts-financial development and exports: Developed countries



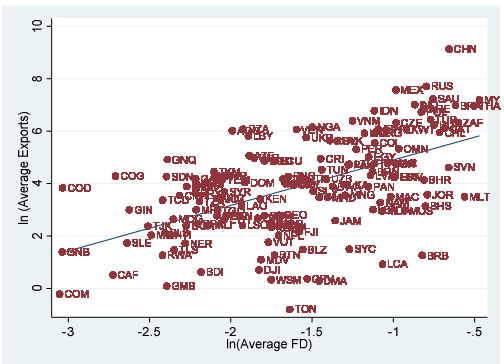
Panel-1: Exporters' FD and Exports



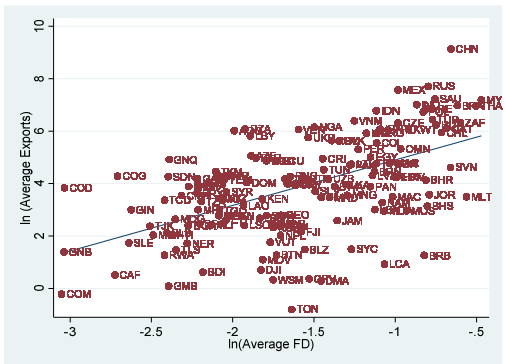
Panel-2: Importers' FD and Exports

(Source) Author's calculation based on dataset.

Figure 4. Stylized facts-financial development and exports: Developing countries



Panel-1: Exporters' FD and Exports



Panel-2: Importers' FD and Exports

(Source) Author's calculation based on dataset.

The stylized facts of financial development and export data are presented in Figure 2, Figure 3, and Figure 4. Figure 2 shows the relationship between financial development and exports for the full sample, and both exporters' and importers' financial development is positively associated with the exports of the exporter country. Figure 3 and Figure 4 show the same relationship for developed and developing countries' exports respectively. Panel-2 of Figure 3 depicts that developed countries' exports are largely associated with importers' financial development. Conversely, Figure 4 reveals that both exporters' and importers' financial development are likely to equally affect exports of the developing countries.

Our bilateral export data is a balanced panel consisting of 169 countries from 2001-2017 in annual frequency. Out of 482,664 samples of observations around 28% and 34% have zero

trade flows in export data of importers' reports and exporter's reports respectively, which are not trivial. Traditionally, there are three alternative approaches to handling zero trade flows: (i) dropping observations with zero trade flows; (ii) adding an arbitrarily small constant (say 1) to trade value before taking logarithms, and (iii) estimating the model in levels. Dropping observations is not a good option for gravity analysis of trade as zero trade is reported in the data are zero or it may be reflected due to systematic rounding errors with small trade flows. According to Helpman et al.(2008), zero trade flows are considered as missing values or missing observations and are replaced with zero trade flows. Additionally, truncating the data by deleting all zero trade flows may lead to leaving out low levels of trade from the model "which leads to biased results when zero trade flows are not randomly distributed (Eichengreen & Irwin, 1998)". Likewise, adding a small positive constant may not be adequate as the choice of the number is arbitrary and lacks both theoretical and empirical justifications (Linders & de Groot, 2006) as well as may affect research results (Flowerdew & Aitkin, 1982) based on the unit of recording trade flows. Retaining zero trade flows, however, requires an appropriate estimation technique. OLS estimation is incorrect and biased. The most widely used and appropriate method is the PPML estimator proposed by Santos Silva and Tenreyro (2006).

IV. Empirical Analysis and Results

Table 3 reports the baseline OLS estimation results under the cross-sectional framework of several gravity equations. We first estimate the intuitive or traditional gravity model with the inclusion of different measures of financial development as an explanatory variable [Column 1]. In columns 2-3, we augmented the model by including trade policy variables e.g. tariff and regional trade agreements (RTAs). All estimated coefficients have the desired signs and significance level. The baseline results show that the financial development of the exporting country (origin) has a larger effect, almost double, on trade than the financial development of the importing (destination) country. Geographical distance negatively affects bilateral exports and the extent of its coefficient falls within the estimated values of earlier studies (ranges from -1.411 to -1.262 in my case).

In column 2, we add tariff as an explanatory variable. It seems from the result that, even though tariff rates are important determinants of bilateral trade, however, their omission has little bias in other gravity variables as well as the empirical fit of the model. We then introduce the RTA dummy in column3 to check whether the RTA dummy makes the tariff coefficient insignificant. If the inclusion renders the tariff coefficient insignificant, then it does not matter if the tariff is omitted from the model because the RTA dummy assumes its role. However, the result shows that the RTA dummy can reduce the magnitude of the coefficient tariff, but

cannot make it insignificant. These results reveal that RTA is trade-creative and both RTA and Tariff are important policy variables for our model.

Table 3. *Effect of Financial Development on Exports-OLS Estimation*

VAR.	(1)	(2)	(3)
	Intuitive	Augmented	
	Dependent Variable: ln_Exports		
ln_fdexp	1.299*** (0.0236)	1.306*** (0.0236)	1.281*** (0.0236)
ln_fdimp	0.617*** (0.0237)	0.589*** (0.0237)	0.564*** (0.0238)
ln_gdppppexp	1.037*** (0.00868)	1.033*** (0.00870)	1.026*** (0.00870)
ln_gdppppimp	0.939*** (0.00864)	0.937*** (0.00866)	0.929*** (0.00866)
ln_distw	-1.377*** (0.0212)	-1.367*** (0.0211)	-1.267*** (0.0221)
contig	1.162*** (0.121)	1.175*** (0.120)	1.076*** (0.117)
language	1.180*** (0.0466)	1.190*** (0.0464)	1.145*** (0.0457)
colony	0.955*** (0.109)	0.951*** (0.109)	0.985*** (0.108)
landlocked	-0.721*** (0.0940)	-0.728*** (0.0935)	-0.694*** (0.0918)
ln_tariff		-1.027*** (0.114)	-0.996*** (0.111)
rtadum			0.499*** (0.0384)
Constant	-7.881*** (0.279)	-7.848*** (0.278)	-8.712*** (0.279)
Observations	347,990	347,822	347,822
R-squared	0.650	0.651	0.653
F-value	7262.73***	6612.29***	6350.80***

Note. In regression the dependent variable is natural log of volume of exports. Standard errors are reported in parentheses. *** , **, and * represent 1%, 5%, and 10% level of significance respectively.

A. Treatment of multilateral resistance terms (MRTs) and endogeneity in structural gravity

This traditional gravity estimation is biased and is not theoretical as it neglects the control for theoretically motivated MRTs (Feenstra, 2004; Baier & Bergstrand, 2007). MRT refers to exporters' and importers' price indices concerning all trading partners. Anderson and Wincoop (2003) model adopts two sets of MRT: (i) an outward MRT that reveals the fact that exports from origin to the destination depend on trade costs across all export markets; and (ii) an

inward MRT which captures the dependence of imports from origin to the importers on trade cost across all possible suppliers. In particular, these outward and inward MRTS involving trade costs across all bilateral routes obviously can affect bilateral trade flows. As the intuitive model does not include these MRTs, there is an indication of omitted variable bias.

The estimation of a theoretically constructed gravity model with MRTs is a challenge as they are not directly observable (Yotov et al., 2016). Head and Mayer (2104) also emphasized that MRTs are a pivotal element in a structural gravity model. According to Feenstra (2016), the introduction of directional fixed effects (exporter and importer FEs) in a cross-sectional framework could be the easiest solution to capture MRT. However, Head and Mayer (2014) postulate that "time-invariant directional fixed effects do not capture MRTs effectively and advocate to use of exporter-time and importer-time fixed effects". In a panel data setting, Baier and Bergstrand(2007) claim that "MRTs are time-varying as the factors that affect international prices change over time and, therefore, advocate for adding time-variant MRT to the gravity model". Additionally, Olivero and Yotov (2012), and Feenstra (2016) argued that in gravity estimations MRTs should be controlled by exporter-time and importer-time fixed effects (FEs) in dynamic panel data settings. The downside of this treatment is that the inclusion of the exporter-time and importer-time FEs will also capture the size variables (e.g. GDP, Population) from the structural gravity model along with all other observable and unobservable country-specific characteristics(Yotov et al., 2016). Failing to estimate some explanatory variable with directional-time fixed effects is referred to as a "gold medal mistake" (Baldwin & Taglioni, 2006).

The main explanatory variable of our interest is financial development which is also time-variant. Capturing MRTs with control variables (exporter-time and importer-time FEs dummy) presents collinearity issues with financial development and therefore eliminates the estimation. We employ multiple solutions to this problem. First, we employ exporter, importer, and time FEs to capture the effect of financial development on trade in line with the United Nations and WTO (2012). They suggest using time-invariant fixed effects to control MRTs by arguing that the introduction of exporter-time and importer-time FEs may not be feasible as they are generally collinear with policy variables. Second, we employ the exporter-time and importer-time FEs to capture MRTs, however, introduce an interaction term between financial development and distance aiming to disentangle the effect of financial development (Rodriguez-Crespo & Martinez-Zarzoso,2019)[2]. The interaction term does not present collinearity issues with MRT control variables (directional-time FEs) and therefore does not eliminate the estimation. Third, congruent with Gylfason et al.(2015). Florensa et al. (2015), Martinez-Zarzoso and Marquez-Ramos (2019), and Rodriguez-Crespo and Martinez-Zarzoso(2019), we could still estimate the effect of

2) Like a measure of elasticity, the interaction between financial development and distance assesses the effect of financial development on trade that varies by distance. Intuitively, we are interested in examining how the negative effect of distance on exports is diminished with financial development.

time-varying variable financial development by adding exporter-time and importer-time dummies that vary every four years and able to capture MRTs. The reason behind this choice is that financial development varies by country and year to capture its effects on exports, and we are interested to examine its variation in the short-run, but controlling for additional persistent factors[3].

Another concern in studying international trade empirically is endogeneity which yields biased estimates. According to Baier and Bergstrand (2007), "there are three major causes for endogeneity: measurement errors, reverse causality and omitted variable bias". Trade policy variables are endogenous, especially to currency unions, tariffs, and RTAs (Trefler, 1993). For instance, trade policies are often determined by the level of a country's integration into the international market. More advanced and liberal economies tend to introduce more and more liberal trade policies which ultimately create a reverse causality between trade policies and trade flows.

Based on existing economic knowledge we also understand that financial development is endogenous, and it will be affected by trade-causing the presence of reverse causality (Do & Levchenko, 2004). According to Newbery and Stiglitz (1984), "trade can increase uncertainty and income volatility in an economy". Therefore, after the opening of trade, the financial system is expected to grow.

The OLS estimations are severely biased due to endogeneity while trade policy variables are included in the model. The use of standard instruments is a method of dealing with endogeneity. However, finding standard instruments is a challenge. To address the endogeneity issue, we first take lags of the possibly endogenous variables followed by Vemuri and Siddiqi (2009), Alvarez et al. (2018), and Rodriguez-Crespo and Martinez-Zarzoso (2019). Lagging the potentially endogenous variables make them predetermined and leads them to be unaffected by any shocks in the present period. Additionally, due to a lack of plausible instruments, researchers are now suggesting including country-pair FEs (Head & Mayer, 2014; Yotov et al., 2016) in analyzing bilateral trade in the gravity framework. The country-pair FEs takes into account all time-invariant gravity variables. Therefore, the general form of the estimated model becomes-

$$\begin{aligned} \ln EX_{ijt} = {} & \alpha_i+\alpha_j+ \alpha_t +\beta_1 \ln FINDEV_{i,t-1}+\beta_2 \ln FINDEV_{j,t-1} + \beta_3 InTARIFF_{ij,t-1} + \delta_1 InGDPPP_{it} \\ & + \delta_2 InGDPPP_{jt} +\delta_3 RTA_{ij,t-1}+ \gamma_1 InDist_{ij} + \gamma_2 CONT_{ij} +\gamma_3 LANGUAGE_{ij} \\ & + \gamma_4 COLONIAL_{ij} + \gamma_5 LANDLOCK_{ij} +\varepsilon_{ijt} \end{aligned} \quad (11)$$

and,

3) For example, tastes, cultural factors, and business cycles do not change in the short run. Moreover, third-country characteristics that are unobservable (like political relations of the exporting and importing countries with the third country) may also lead to a change in the export policies or import policies; however, the change usually does not immediately or in the short run. Exporter-time and importer-time dummies that vary every four years control for such unobservable characteristics and other factors that do not change over a short period; and allow for observing the effect of policy variables that varies by country and year.

$$\begin{aligned} InEX_{ijt} = {} & \alpha_{it}+\alpha_{jt}+\beta_1 lnFINDEV_{i,t-1}* lnDist_{ij}+\beta_2 lnFINDEV_{j,t-1}* lnDist_{ij} + \beta_3 InTARIFF_{ij,t-1} \\ & + \delta_1 RTA_{ij,t-1} + \gamma_1 InDist_{ij} + \gamma_2 CONT_{ij} + \gamma_3 LANGUAGE_{ij} + \gamma_4 COLONIAL_{ij} \\ & + \gamma_5 LANDLOCK_{ij} + \varepsilon_{ijt} \end{aligned} \quad (12)$$

$$\begin{aligned} InEX_{ijt} = {} & \alpha_{iy}+\alpha_{jy}+\beta_1 lnFINDEV_{i,t-1}+\beta_2 lnFINDEV_{j,t-1} + \beta_3 InTARIFF_{ij,t-1} + \delta_1 InGDPPP_{it} \\ & + \delta_2 InGDPPP_{jt} + \delta_3 RTA_{ij,t-1} + \gamma_1 InDist_{ij} + \gamma_2 CONT_{ij} + \gamma_3 LANGUAGE_{ij} \\ & + \gamma_4 COLONIAL_{ij} + \gamma_5 LANDLOCK_{ij} + \varepsilon_{ijt} \end{aligned} \quad (13)$$

where, the prefix y in the fixed effect notation represents exporter-time and importer-time dummy variables that vary every four years. Time invariant gravity variables are eliminated from the estimations when pair FEs (α_{ij}) is included in equation 12 and 13.

B. Estimations and discussions: OLS FE and PPML FE

Table 4 presents OLS and PPML estimations with high dimensional FEs. Column 1 represents the OLS estimate with time-invariant MRT (exporter, importer, and time FEs) in which we can extract the individual effect of financial development on exports. The sign of all three forms of financial development indicators for importers is positive and significant meaning that the destination country's financial development significantly affects bilateral trade. The sign of the FD index for exporters is positive but not significant. However, it becomes positive and significant when financial development is measured by the financial market index (FM)[4]. Overall, we can assert that exporters' country's financial development is also an important factor for bilateral trade patterns.

To capture MRTs consistent with the theory of structural gravity model of trade, we include exporter-time and importer-time FEs (column 3) and also pair fixed effects (column 5) in the estimations. In these cases, we are not able to evaluate the direct effect of financial development on exports as directional-time FEs capture all time-variant variables. To ascertain the effect of financial development on bilateral exports we, therefore, interact the financial development variables with the distance which also allows us to assess how the financial development varies with the distance. The sign of the interaction terms with all three forms of financial development is significant and positive showing a positive effect of financial development on bilateral exports which is consistent with the literature[5]. The findings also affirm the fundamental gravity principle and the sign of policy variables, tariffs, and RTAs, which are also significant and in line with the literature.

4) The regression results with FM index can be provided on request.

5) Assuming the level of financial development is zero, the marginal effect of the log of the distance is $\gamma 1$ in equations 12. Taking into account financial development in the model, the marginal effect of the log of distance is defined by ($\gamma_1+\beta_1 lnFINDEV_{it}+\beta_2 lnFINDEV_{jt}$). Therefore, financial development can substantially offset the negative effect of distance on trade.

Table 4. *Estimation of the Effect of Financial Development, Tariff, and RTA on Trade: Structural Gravity Estimations (OLS with FE, and PPML with FE)*

VAR.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Time-Invariant MRT		Time variant MRT in structural gravity		Time variant MRT with pair FEs in structural gravity		Time variant MRT (directional time dummy in every 4 years)	
	OLS	PPML	OLS	PPML	OLS	PPML	OLS	PPML
	Dependent Variable							
	lnExports	Exports	lnExports	Exports	lnExports	Exports	lnExports	Eports.
$ln\_fdexp_{(t-1)}$	0.0295	0.0892					0.0784*	0.370***
	(0.0412)	(0.0607)					(0.0405)	(0.0590)
$ln\_fdexp_{(t-1)}$*ln_dist			0.194***	0.151***	0.150**	0.198***		
			(0.0265)	(0.0390)	(0.0702)	(0.0559)		
$ln\_fdimp_{(t-1)}$	0.135***	0.270***					0.176***	0.534***
	(0.0437)	(0.0669)					(0.0432)	(0.0582)
$ln\_fdimp_{(t-1)}$*ln_dist			0.339***	0.215***	0.119**	0.195***		
			(0.0374)	(0.0382)	(0.0525)	(0.0591)		
ln_gdppppexp	0.669***	0.861***					0.519***	0.487***
	(0.0454)	(0.0706)					(0.0332)	(0.0388)
ln_gdppppimp	0.952***	1.012***					0.786***	0.534***
	(0.0402)	(0.0579)					(0.0310)	(0.0407)
ln_dist	-1.641***	-0.788***	-0.996***	-0.603***	-0.436**		-1.646***	-0.787***
	(0.0253)	(0.0419)	(0.0551)	(0.0497)	(0.182)		(0.0253)	(0.0418)
$ln\_tariff_{(t-1)}$	-1.318***	-0.380**	-1.351***	-0.298*	-0.605***	-0.649***	-1.317***	-0.427**
	(0.117)	(0.159)	(0.168)	(0.155)	(0.176)	(0.163)	(0.117)	(0.175)
$rta_{(t-1)}$	0.412***	0.265***	0.454***	0.289***	0.00889	0.0358	0.398***	0.266***
	(0.0352)	(0.0702)	(0.0369)	(0.0684)	(0.0423)	(0.0243)	(0.0351)	(0.0692)
contig	0.557***	0.377***	0.386***	0.370***			0.558***	0.380***
	(0.118)	(0.0800)	(0.113)	(0.0804)			(0.118)	(0.0796)
language	0.830***	0.102	0.810***	0.0813			0.830***	0.102
	(0.0436)	(0.0777)	(0.0449)	(0.0788)			(0.0436)	(0.0773)
colony	0.959***	0.170	0.915***	0.163			0.959***	0.171
	(0.116)	(0.126)	(0.112)	(0.111)			(0.116)	(0.125)

Table 4. *Continued*

VAR.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Time-Invariant MRT		Time variant MRT in structural gravity		Time variant MRT with pair FEs in structural gravity		Time variant MRT (directional time dummy in every 4 years)	
	OLS	PPML	OLS	PPML	OLS	PPML	OLS	PPML
	Dependent Variable							
	lnExports	Exports	lnExports	Exports	lnExports	Exports	lnExports	Eports.
landlocked	0.572***	0.328*	0.457***	0.205			0.572***	0.327
	(0.0988)	(0.199)	(0.104)	(0.187)			(0.0989)	(0.199)
Constant	-3.493***	-11.26***	15.33***	15.48***	8.046***	11.00***	0.348	1.246**
	(0.790)	(1.541)	(0.223)	(0.350)	(1.260)	(0.517)	(0.396)	(0.539)
Exporters FE	YES	YES	NO	NO	NO	NO	NO	NO
Importers FE	YES	YES	NO	NO	NO	NO	NO	NO
Time FE	YES	YES	NO	NO	NO	NO	NO	NO
Exporter-Time FE	NO	NO	YES	YES	YES	YES	YES	YES
Importer-Time FE	NO	NO	YES	YES	YES	YES	YES	YES
Pair FE	NO	NO	NO	NO	YES	YES	NO	NO
Observations	315,018	315,018	80,163	80,163	77,906	77,906	315,018	315,018
R^2/(Pseudo)R^2	0.739	0.929	0.752	0.933	0.924	0.993	0.739	0.926

Note. In OLS regression (column 1,3,5,& 7) the dependent variable is natural log of volume exports and in PPML estimation (column 2,4,6, & 8) the dependable variable is the volume of exports. Robust standard errors are in parentheses. ***, **, and * represent 1%, 5%, and 10% level of significance respectively. (Pseudo)R^2 is reported for PPML estimation. In column -3 to column-6 we multiply financial development measure by distance (following Rodriguez-Crespo & Martinez-Zarzoso, 2019) to remove the risk of removal due to collinearity issues when explorer-time, importer-time and pair FEs is used. This interaction term also allow us to disentangle how the financial development (FD) diminishes the negative effect of distance on exports.

In column 7, we estimate the model with time-variant MRT but varying the exporter and importer fixed effects by every four years to retain the individual effect of financial development in the estimation. The sign of coefficients of financial development variables is significantly positive showing that financial development is a significant determining factor of bilateral trade flows or exports.

The estimation of the gravity equation with an emphasis on consistency with the structural gravity model is a key question. The OLS with FEs estimates does not account for heteroscedasticity and the existence of zero trade flows. Zero trade flows are very common in bilateral trades and these are not trivial. To get a consistent estimate of the model, we then apply the PPML as proposed by Santos Silva and Tenreyro (2006). PPML is preferable for many reasons. PPML accounts for the heteroscedasticity and existence of zero trade flows. Recent studies show that PPML estimates are consistent with the high dimensional fixed effects model (Larch et al.,2019). According to Santos Silva and Tenreyro (2006), the dependent variable will be in levels, not in logs and it does not matter whether the error term enters the model in either additive or multiplicative form. The PPML estimation is also shown in Table 4. The results are very similar to OLS with FEs estimations in terms of significance.

Column 2 represents the PPML estimate with time-invariant MRT (exporter, importer, and time FEs) in which we can extract the individual effect of financial development on exports. The sign of all three forms of financial development indicators for importers is again positive and significant; however, those coefficients for the exporters are positive but insignificant. It reveals that the destination country's financial development is important for bilateral trade. It could be apparent since world exports are mostly dominated by the developed countries where financial sectors are already developed. While exporting to their counterparts exporters emphasize the financial sector of the importing countries.

To capture MRTs consistent with the theory of structural gravity model for trade, we again include exporter-time and importer-time FEs (column 4) and also pair FEs (column 6) in the PPML estimations. To ascertain the effect of financial development on bilateral exports we interact the financial development variables with distance. The sign of the interaction term with financial development (FD) is significant and positive showing a positive effect of financial development on bilateral exports consistent with the literature. The results also affirm the fundamental notion of gravity and mostly the sign of policy variables, tariffs, and RTAs, which are also significant and in line with the literature. The magnitude of the coefficients is within the range of earlier as reported by Head and Mayer (2014).

In column 8, we estimate the model (by PPML estimator) with time-variant MRT but varying the exporter and importer fixed effects by every four years to retain the individual effect of financial development in the estimation. The sign of coefficients of financial development variables for both exporters and importers are significantly positive revealing that financial

development is a significant determining factor of bilateral trade flows.

1. Do forms of RTA matter?

A regional trade agreement (RTA) refers to a treaty signed between two or more trading partners that define the rules of trade. RTA aims to encourage the free movement of goods and services across the border of its members. RTAs are at the core of the policy debate that is shaping trade and economic relations. RTA varies with the level of commitment among the member countries. There are four distinct types of RTAs: Customs Union (CU), Free Trade Agreement (FTA), Partial Scope Agreement (PSA), and Economic Integration Agreement (EIA). Three other forms of trade agreements that are formed with the combination of this four categories-CUEIA, FTAEIA, and PSEIA.

Paragraph 8(a) of Article XXIV of GATT 1994 defines" custom union as a single customs territory of two or more customs territories in which duties and other restrictive regulations of commerce are eliminated for trade between the parties of CU (Regional Trade Agreements - Goods (GATT) Provisions - WTO, n.d.)". Each of the CU members applies the same duties and regulations to trade with non-CU members. Paragraph 8(b) of Article XXIV of GATT 1994 defines "FTA as a group of two or more customs territories in which the duties and other restrictive regulations of commerce are eliminated on substantially all the trade between the constituent territories in products originating in such territories (Regional Trade Agreements - Goods (GATT) Provisions - WTO, n.d.)". The difference between CU and FTA is that under FTA members countries can still apply domestic regulations when trading with non-members. A partial scope agreement refers to those agreements which cover only certain products. A PS is not defined in the WTO agreement. An EIA is defined in Article V of GATS (Legal Texts - Marrakesh Agreement - WTO, n.d.). This agreement renders members to eliminate discriminatory measures between or among the parties of the agreement.

We collect RTA data from Mario Larch's database, which includes 516 agreements defined in seven categories: CU(16), FTA(287), PSA(31), EIA(3), CUEIA(5), FTAEIA(163), and PSAEIA(1). RTA captures all those combinations of agreements.

We now decompose our RTA dummy into a dummy reflecting all those seven types RTAs except PSA, and PSAEIA and estimate the model controlling for MRTs with exporter-time, importer-time, and exporter-importer pair FEs in the PPML estimator (Table 5). Among the five forms of RTAs, EIA and CUEIA have the largest trade creation effects as their coefficients are significantly positive in all forms of the measurement of financial development. The coefficient of tariff remains significantly negative and their magnitude does not change much with different measures of financial development and RTA. In all of the specifications and forms of RTA, the effect of financial development of both exporters and importers shows their importance and positive effect on bilateral trade.

Table 5. *Decomposing Different Forms of RTAs-Gravity Estimations Using PPML Estimator*

VAR.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Time Variant MRT (Directional time dummy in every 4 years)					Time Variant MRT with pair FEs				
	CU	FTA	EIA	CUEIA	FTAEIA	CU	FTA	EIA	CUEIA	FTAEIA
	Dependent Variable: Exports									
$ln\_fdexp_{(t-1)}$	0.383***	0.383***	0.355***	0.358***	0.376***					
	(0.0586)	(0.0584)	(0.0580)	(0.0582)	(0.0583)					
$ln\_fdimp_{(t-1)}$	0.535***	0.537***	0.499***	0.502***	0.538***					
	(0.0603)	(0.0602)	(0.0596)	(0.0599)	(0.0598)					
ln_gdppppexp	0.504***	0.503***	0.502***	0.502***	0.496***					
	(0.0395)	(0.0395)	(0.0385)	(0.0386)	(0.0382)					
ln_gdppppimp	0.556***	0.553***	0.547***	0.547***	0.543***					
	(0.0400)	(0.0399)	(0.0395)	(0.0394)	(0.0419)					
ln_dist	-0.853***	-0.845***	-0.774***	-0.788***	-0.851***					
	(0.0347)	(0.0355)	(0.0393)	(0.0389)	(0.0343)					
$ln\_tariff_{(t-1)}$	-0.527**	-0.531**	-0.492***	-0.483***	-0.501**	-0.683***	-0.688***	-0.687***	-0.689***	-0.685***
	(0.207)	(0.210)	(0.177)	(0.174)	(0.199)	(0.162)	(0.162)	(0.162)	(0.162)	(0.164)
$rta_{(t-1)}$	0.240	0.166*	0.539***	0.468***	0.116**	0.131	0.0276	0.492***	0.285***	-0.00151
	(0.192)	(0.0913)	(0.0912)	(0.0886)	(0.0565)	(0.0947)	(0.0259)	(0.0993)	(0.0674)	(0.0197)
contig	0.417***	0.419***	0.422***	0.412***	0.404***					
	(0.0806)	(0.0807)	(0.0811)	(0.0803)	(0.0795)					
language	0.123	0.126*	0.164**	0.161**	0.122*					
	(0.0759)	(0.0747)	(0.0735)	(0.0733)	(0.0738)					
colony	0.0810	0.0781	0.165	0.152	0.0985					
	(0.139)	(0.137)	(0.135)	(0.136)	(0.138)					
landlocked	0.318*	0.313	0.343*	0.341*	0.322					
	(0.194)	(0.195)	(0.190)	(0.190)	(0.197)					
$ln\_fdexp_{(t-1)}$*ln_dist						0.198***	0.200***	0.203***	0.209***	0.201***
						(0.0561)	(0.0562)	(0.0559)	(0.0563)	(0.0561)
$ln\_fdimp_{(t-1)}$*ln_dist						0.196***	0.197***	0.206***	0.208***	0.198***
						(0.0598)	(0.0599)	(0.0604)	(0.0610)	(0.0600)

Table 5. *Continued*

VAR.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Time Variant MRT (Directional time dummy in every 4 years)					Time Variant MRT with pair FEs				
	CU	FTA	EIA	CUEIA	FTAEIA	CU	FTA	EIA	CUEIA	FTAEIA
Constant	1.354**	1.332**	0.703	0.836	1.629***	11.02***	11.01***	10.88***	11.26***	11.26***
	(0.548)	(0.548)	(0.568)	(0.566)	(0.548)	(0.519)	(0.520)	(0.520)	(0.314)	(0.313)
Exporter-Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer-Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pair FE	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Observations	315,018	315,018	315,018	315,018	315,018	77,906	77,906	77,906	77,906	77,906
(pseudo) R^2	0.925	0.926	0.927	0.927	0.926	0.993	0.993	0.993	0.993	0.993

Note. In regression the dependent variable is the volume of exports. Robust standard errors are reported in the parentheses. ***, **, and * represent 1%, 5%, and 10% level of significance respectively. In column -6 to column-10 we multiply financial development measure by distance (following Rodriguez-Crespo & Martinez-Zarzoso, 2019) to remove the risk of removal due to collinearity issues when explorer-time, importer-time and pair FEs is used. This interaction term also allow us to disentangle how the financial development (FD) diminishes the negative effect of distance on exports.

2. Effect of financial development on exports by country classification

We then estimate the effect of financial development (FD) on bilateral exports using the PPML estimator segmenting the data by country groups as per the classification of UN and IMF. In Table 6, we report the estimations for developed to developed countries' trade in column 1-2, and column 3-4 report the estimation for developed to developing countries' trade. Column 5-6 and column 7-8 report the estimation for developing to developing and developing to developed countries respectively.

Column 1, column 3, and column 7 report the PPML estimation with exporter-time, importer-time, and exporter-importer pair FEs to have consistent estimation controlling for MRTs, endogeneity, and heteroscedasticity. In column 2, column 4, and column 8, we estimate the structural gravity model with exporter-time and importer-time dummies with time varies by every 4 years (2001, 2005, 2009, 2013, and 2017).

For developed to developed country estimation, the result shows that the importer (destination) country's financial development has a larger effect on bilateral exports of the exporters country than the exporters country's financial development. The effect of tariff and RTA on bilateral trade is neutral as their sign are not significant when the full set of control is implemented (column 1).

In the case of developed to developing country estimation, the results reveal that the financial development of the exporters' country is not significant. It could be apparent since developed countries are already financially developed. The results also confirm that bilateral trade between developed and developing countries is more likely to be affected by the financial development of the importer (developing) country. Tariff negatively affects the trade flows, in line with expectations.

However, in the case of developing to developing country estimation, we get mixed results. In the case of the full set of controls (column 5), the result shows that both exporters' and importers' country's financial development is important for bilateral exports. The tariff has a larger effect on bilateral exports between developing and developing countries compare to developed-developed and developed-developing country trade. However, RTA seems to have no effect as the sign is not significant.

Lastly, in the case of developing and developed country estimation, we find that the financial development of the importers country (developed) is unimportant for augmenting bilateral exports between developing and developed countries. The financial development of the exporter (developing) country is significantly affecting bilateral exports (column 7) between developing and developed countries. Tariffs significantly distort trade between developing and developed countries, even if the effect is larger. RTA does not affect trade, even though the sign is positive but it is insignificant. The result gives us the scope for further study of why tariff is more protective for exports from developing to developed countries, while the developed counties allow some favorable treatments to developing countries, especially to LDCs.

Table 6. *Effect of FD, Tariff, and RTA on Exports in different Country Groups: PPML Estimations with Time Variant MRT*

VAR.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Developed to Developed		Developed to Developing		Developing to Developing		Developing to Developed	
	MRT with pair FEs	MRT with directional time dummy in every 4 years	MRT with pair FEs	MRT with directional time dummy in every 4 years	MRT with pair FEs	MRT with directional time dummy in every 4 years	MRT with pair FEs	MRT with directional time dummy in every 4 years
	Dependent Variable: Exports							
$ln\_fdexp_{(t-1)}$		0.399***		0.322		0.200**		0.0552
		(0.154)		(0.213)		(0.0876)		(0.0810)
$ln\_fdimp_{(t-1)}$		0.728***		0.336***		0.0872		0.0114
		(0.0881)		(0.0722)		(0.0617)		(0.235)
ln_gdppppexp		0.215***		0.136		0.812***		0.767***
		(0.0807)		(0.169)		(0.0664)		(0.0844)
ln_gdppppimp		0.564***		0.814***		0.591***		0.00735
		(0.0848)		(0.122)		(0.0593)		(0.121)
ln_distw		-0.788***		-0.932***		-1.081***		-0.614***
		(0.0629)		(0.0491)		(0.0714)		(0.0889)
$ln\_tariff_{(t-1)}$	0.157	0.148	-0.501*	-0.543	-0.870***	-3.767***	-0.878**	-5.943***
	(0.183)	(0.108)	(0.304)	(0.388)	(0.291)	(0.636)	(0.356)	(2.130)
$rta_{(t-1)}$	0.0125	0.339***	-0.0128	0.258***	0.0142	-0.0908	0.0371	0.198
	(0.0492)	(0.124)	(0.0429)	(0.0771)	(0.0675)	(0.124)	(0.0408)	(0.125)
contig		0.419***		0.0652		-0.0528		0.960***
		(0.0916)		(0.123)		(0.138)		(0.186)
language		0.185		0.0983		0.0842		0.157
		(0.122)		(0.114)		(0.118)		(0.127)
colony		-0.177		0.498***		1.273***		0.329**
		(0.145)		(0.102)		(0.210)		(0.137)
landlocked		0.396		-0.103		0.429		0.499*
		(0.246)		(0.282)		(0.294)		(0.272)
$ln\_fdexp_{(t-1)}$*ln_dist	0.145**		0.133		0.300***		0.386***	
	(0.0693)		(0.144)		(0.0792)		(0.0833)	

Table 6. *Continued*

VAR.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Developed to Developed		Developed to Developing		Developing to Developing		Developing to Developed	
	MRT with pair FEs	MRT with directional time dummy in every 4 years	MRT with pair FEs	MRT with directional time dummy in every 4 years	MRT with pair FEs	MRT with directional time dummy in every 4 years	MRT with pair FEs	MRT with directional time dummy in every 4 years
$ln\_fdimp_{(t-1)}$*ln_dist	0.170**		0.403***		0.188***		-0.0418	
	(0.0662)		(0.0738)		(0.0687)		(0.0464)	
Constant	10.80***	4.715***	12.39***	3.436***	12.06***	-2.363**	12.57***	3.557**
	(0.211)	(0.840)	(0.473)	(1.233)	(0.694)	(1.141)	(0.583)	(1.428)
Exporter-Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Importer-Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Pair FE	YES	NO	YES	NO	YES	NO	YES	NO
Observations	4,286	16,516	16,389	65,291	40,658	170,059	15,736	63,152
(Pseudo)R^2	0.995	0.937	0.993	0.947	0.985	0.867	0.994	0.923

Note. In regression the dependent variable is the volume of exports. Robust standard errors are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% level of significance respectively. In column -1, 3, 5, and 7, we multiply financial development measure by distance (following Rodriguez-Crespo & Martinez-Zarzoso, 2019) to remove the risk of removal due to collinearity issues when explorer-time, importer-time and pair FEs is used. This interaction term also allow us to disentangle how the financial development (FD) diminishes the negative effect of distance on exports.

V. Robustness Check

We first perform the robustness analysis by using an alternate measure of exports and by using different measures of tariff and trade combinations. In the main estimations, we follow Feenstra et al. (2005) and the dependent variable exports are measured by the importers' report of imports which are on cost, insurance, and freight (cif) basis. In particular, researchers are usually using exports of the origin country by exporter's report of exports which is on a free-on-board (fob) basis. These two data differ significantly and importer's reports are treated as more accurate (Feenstra et al., 2005) since imports are reported immediately after it enters the destination country. Nevertheless, to check the robustness of my analysis we extract export data of exporters from DOTS of IMF and estimate the structural gravity model using the PPML estimator (Table 7).

Column 1 of Table 7 reports PPML estimation with exporters-time and importers-time fixed effects, but by taking a directional time dummy for every four years. Column 2, however, reports PPML estimates with all-time variant FEs including exporter-importer pair FEs. The results still reveal that financial development is a significant determinant of bilateral trade. All the gravity variables and policy variables have expected sign and significance levels (except landlocked) and establish the robustness of my analysis.

Another important challenge in gravity analysis of trade with policy variable tariffs is to get reliable bilateral tariff data. As noted by Hayakawa (2013) absence of bilateral tariff data is a clear reason to exclude tariff rates in gravity analysis which renders omitted variable bias. Hayakawa (2013) is the first study that uses bilateral tariff rates in a worldwide sample. Countries use different kinds of tariffs and levy diverse duties on trading partners based on bilateral relationships, bilateral or multilateral agreements, and WTO rules like the most-favored-nation (MFN) tariff, a generalized system of preferences (GSP), and FTA preferences. In our main estimation, we use AHS weighted average applied tariff rates from WITS.

In this case, we use MFN weighted average applied tariff rates. The tariff data was extracted from Trade Analysis and Information System (TRAINS) by the United Nations Conference on Trade and Development (UNCTAD) through the World Integrated Trade Solution (WITS) software. WITS is the most comprehensive software developed by the World Bank, UNCTAD's International Trade Center (ITC), United Nations Statistical Division (UNSD), and the WTO. We utilize advanced query options of WITS and extract raw data through tariff and trade analysis sub-options which give us to collect matching tariff and import data of importers. Again we treat importers' import data as exports of the exporters. The PPML estimates with this combination of MFN tariff and trade data are also reported in Table 7.

Table 7. *Effect of FD, Tariff, and RTA on Exports: PPML Estimation with Exports Measured by Exporter's Report and Using TRAINS Data*

VAR.	(1)	(2)	(3)	(4)
	Exports measured by exporter's report		Estimation using TRAINS data	
	Time variant MRT (directional time dummy in every 4 years)	Time variant MRT with pair FE	Time variant MRT (directional time dummy in every 4 years)	Time variant MRT with pair FE
	Dependent Variable: Exportsfob		Dependent Variable: Exports	
$ln\_fdexp_{(t-1)}$	0.391*** (0.0569)		0.170*** (0.0647)	
$ln\_fdimp_{(t-1)}$	0.528*** (0.0596)		0.503*** (0.0696)	
ln_gdppppexp	0.644*** (0.0373)		0.641*** (0.0419)	
ln_gdppppimp	0.383*** (0.0406)		0.366*** (0.0433)	
ln_distw	-0.805*** (0.0420)		-0.722*** (0.0467)	
$ln\_tariff_{(t-1)}$	-0.375** (0.155)	-0.305* (0.168)	-2.150*** (0.701)	-0.637 (0.573)
$rta_{(t-1)}$	0.355*** (0.0666)	0.0855*** (0.0331)	0.178*** (0.0681)	0.0679*** (0.0256)
contig	0.460*** (0.0840)		0.505*** (0.114)	
language	0.0971 (0.0802)		0.0845 (0.0788)	
colony	0.183 (0.118)		0.0968 (0.153)	
landlocked	0.348* (0.204)		0.467*** (0.155)	
$ln\_fdexp_{(t-1)}$*ln_dist		0.217*** (0.0529)		0.252*** (0.0665)
$ln\_fdimp_{(t-1)}$*ln_dist		0.154*** (0.0503)		0.377*** (0.0585)
Constant	1.247** (0.550)	11.11*** (0.291)	1.085* (0.634)	12.24*** (0.362)
Exporter-Time FE	YES	YES	YES	YES
Importer-Time FE	YES	YES	YES	YES
Pair FE	NO	YES	NO	YES
Observations	290,052	71,203	228,645	54,491
(Pseudo)R^2	0.924	0.993	0.897	0.985

Note. In regression the dependent variable in column 1 & 2 is the volume of exports in f.o.b basis and in column 3 & 4 is the volume of exports. Robust standard errors are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% level of significance respectively. In column -2 and Column-4 we multiply financial development measure by distance (following Rodriguez-Crespo & Martinez-Zarzoso, 2019) to remove the risk of removal due to collinearity issues when explorer-time, importer-time and pair FEs is used. This interaction term also allow us to disentangle how the financial development (FD) diminishes the negative effect of distance on exports.

Column 3 of Table 7 reports PPML estimation with exporters-time and importers-time fixed effects, but by taking a directional time dummy for every four years. Column4, however, reports PPML estimates with all-time variant FEs including exporter-importer pair FEs. The results still reveal that financial development (FD) is a significant determinant of bilateral trade. All the gravity variables and policy variables have expected sign and significance levels (except language and contiguity) in directional-time FEs estimation (Column 3) and establish the robustness of my analysis. When the exporter-importer pair FEs is imposed, the tariff becomes insignificant although the sign is negative.

Studies documented that a country's contract enforcement capability is an important determinant of comparative advantage for shaping trade patterns. It is evidenced from literature that that country level judicial quality or contract enforcement capability has an effect on the patterns of trade (Nunn, 2007; Cui et al.,2021) and even in financing terms of international trade (Antras & Foley,2015). Country level ability to enforcement of contracts has also been used in several studies in a gravity level framework which found that a country's volume of trade is positively affected by its contract enforcement ability (Anderson & Marcouiller, 2002; Berkowitz et al., 2006; Ranjan & Lee, 2007). The general perception is that country-level rule of law or judicial quality has a positive impact on bilateral trade. To check this notion and sensitivity of our estimations we extend our model by including World Bank's Rule of Law (ROL) estimates from Worldwide Governance Indicators (WGI) 2023 update as an explanatory variable. According to Kaufman and Krayy (2023), "Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". The value of the indicator ranges from -2.5(weak governance) to 2.5 (strong governance) as it covers high number of countries starting from 1996. World Bank published WGI bi-annually since 1996 to 2000 and annually from 2002. We, therefore, considered the values of 2000 for 2001 assuming that trade contracts were made based on the available information.

There is a possibility of endogeneity between judicial quality or rule of law and international trade (Nunn & Trefler, 2014; Cui et al., 2021). We also tackle this issue by taking lags (Rodriguez-Crespo & Martinez-Zarzoso, 2019) of ROL of both exporters and importers, and finally by including country pair FEs (Yotov et al., 2016) in a gravity framework. The PPML estimates of exporters-time, importers-time, and pair FEs (specification 12) as well as MRT with directional time dummy with every four years (specification 13) is reported in Table 8 (column 1, 2, 5, and 6). The inclusion of ROL does not alter our original estimations and confirms that our specification does not suffer from any omitted variable bias. The estimated results with the treatment of endogeneity (column 2 and 6) revealed that the rule of law in both exporting and importing countries has positive and significant impact on volume of exports of the exporting country.

Table 8. *Effect of FD, Tariff, RTA, and ROL on Exports: PPML Estimations with Time Variant MRT*

VAR.	(1)	(2)	(3)	(4)	(5)	(6)
	Adding rule of law (ROL) as an explanatory variable		Using Alternative measure of FD (DCR)		Adding ROL in the model while FD is measured by DCR	
	with directional time dummy in every 4 years	with pair FEs	with directional time dummy in every 4 years	with pair FEs	with directional time dummy in every 4 years	with pair FEs
	Dependent Variable: Exports (Ex)					
$ln\_fdexp_{(t-1)}$	0.357*** (0.0594)					
$ln\_fdimp_{(t-1)}$	0.533*** (0.0585)					
$ln\_DCRexp_{(t-1)}$			0.0593** (0.0255)		0.0606** (0.0256)	
$ln\_DCRimp_{(t-1)}$			0.156*** (0.0224)		0.156*** (0.0224)	
ln_gdppppexp	0.496*** (0.0391)		0.535*** (0.0362)		0.541*** (0.0364)	
ln_gdppppimp	0.532*** (0.0409)		0.572*** (0.0420)		0.573*** (0.0423)	
ln_distw	-0.787*** (0.0418)		-0.787*** (0.0417)		-0.787*** (0.0417)	
$ln\_tariff_{(t-1)}$	-0.427** (0.175)	-0.579*** (0.125)	-0.449** (0.183)	-0.554*** (0.127)	-0.448** (0.183)	-0.555*** (0.127)
$rta_{(t-1)}$	0.267*** (0.0692)	0.0430* (0.0220)	0.270*** (0.0690)	0.0431* (0.0243)	0.270*** (0.0690)	0.0426* (0.0242)
$ln\_ROLexp_{(t-1)}$	-0.0147*** (0.00380)				-0.0193*** (0.00362)	
$ln\_ROLimp_{(t-1)}$	-0.000558 (0.00317)				-0.00720** (0.00294)	
contig	0.380*** (0.0796)		0.379*** (0.0797)		0.379*** (0.0797)	
language	0.102 (0.0773)		0.102 (0.0774)		0.102 (0.0774)	

Table 8. *Continued*

VAR.	(1)	(2)	(3)	(4)	(5)	(6)
	Adding rule of law (ROL) as an explanatory variable		Using Alternative measure of FD (DCR)		Adding ROL in the model while FD is measured by DCR	
	with directional time dummy in every 4 years	with pair FEs	with directional time dummy in every 4 years	with pair FEs	with directional time dummy in every 4 years	with pair FEs
colony	0.171 (0.125)		0.172 (0.125)		0.173 (0.125)	
landlocked	0.327 (0.199)		0.326 (0.199)		0.326 (0.199)	
$ln\_fdexp_{(t-1)}$*ln_dist		0.207*** (0.0505)				
$ln\_fdimp_{(t-1)}$*ln_dist		0.137*** (0.0523)				
$ln\_DCRexp_{(t-1)}$*ln_dist				0.0322* (0.0187)		0.0302 (0.0185)
$ln\_DCRimp_{(t-1)}$*ln_dist				0.0958*** (0.0163)		0.0939*** (0.0162)
$ln\_ROLexp_{(t-1)}$*ln_dist		0.0111*** (0.00392)				0.0101*** (0.00379)
$ln\_ROLimp_{(t-1)}$*ln_dist		0.00789** (0.00358)				0.00638* (0.00362)
Constant	1.139** (0.550)	10.96*** (0.271)	-0.424 (0.556)	9.698*** (0.0264)	-0.528 (0.562)	9.654*** (0.0281)
Exporter-Time FE	YES	YES	YES	YES	YES	YES
Importer-Time FE	YES	YES	YES	YES	YES	YES
Pair FE	NO	YES	NO	YES	NO	YES
Observations	315,018	314,021	315,030	314,032	315,030	314,032
(Pseudo)R^2	0.926	0.993	0.926	0.993	0.926	0.993

Note. Robust standard errors in parentheses. ***, **, and * represent 1%, 5%, and 10% level of significance respectively. The dependent variable in the gravity model takes the logarithmic form. 58% of our rule of law (ROL) observations have negative. However, negative values have no logs. We follow Blonigen and Davis, 2004 for logarithmic transformation of ROL using $ROL^*_{i,t}$= (+/-)ln|$ROL_{i,t}$|. In column -2 and column-6 we multiply ROL by distance (following Rodriguez-Crespo & Martinez-Zarzoso, 2019) to remove the risk of elimination due to collinearity issues when explorer-time, importer-time and pair FEs is used. This interaction term also allow us to disentangle how the ROL diminish the negative effect of distance on exports.

Furthermore, we perform robustness our analysis by using alternative measure of financial development. As discussed earlier, studies usually proxies of financial development by private sector domestic credit to GDP, stock market capitalization to GDP, bank assets, and liquid liabilities etc. Replacing the IMF's measure of financial development by private sector domestic credit to GDP (DCR), we re-estimate the model and reported in Table 8 (column 3-6). The estimated results statistically remain the same with the estimation with our original financial development measure. However, the magnitude of the coefficient of financial development is smaller when alternative measure of financial development is used. Overall, the model is robust even with alternative measure of financial development (DCR).

VI. Conclusions

This paper examined the effect of financial development, tariff, and RTA on exports with the gravity framework utilizing panel data of 169 countries covering the period from 2001 to 2017. Employing OLS with high dimensional fixed effects and finally, PPML estimates to get consistent and efficient estimates, this paper, in general, finds that financial development (irrespective of its measurement) of both exporters (origin country) and importers (destination country) significantly and positively affects bilateral trade. The results also hold with different measurements of exports and with a different combination of tariff and trade data. The tariff has negative effects on exports. In decomposing RTA in different modes, this paper finds that EIA has the most trade creation effect than any other form of RTA. Our results are also robust with the addition of more independent variable (e.g. rule of law) and with alternative measure of financial development (private sector domestic credit to GDP).

In analyzing the effect of financial development on bilateral trade (exports) by different country classifications, this paper finds very interesting results that may have policy implications. For developed to developed country trade, the importer (destination) country's financial development has a larger effect on bilateral exports of the exporter (origin) country. The effect of tariffs and RTA on bilateral trade is neutral. In the case of developed to developing country trade, the results reveal that the financial development of the exporters' country (developed) is not an important issue. However, bilateral exports between developed and developing countries are more likely to be affected by the financial development of the importers (developing) countries. For developing to developing country estimation, the result shows that both exporters' and importers' country's financial development is important for bilateral trade when financial development is measured by FD and FI. The tariff has a larger effect on bilateral exports between developing and developing countries and RTA seems to have no effect. In the case of developing and developed country estimation, the financial development of the developing country is

significantly affecting bilateral exports, but the financial development of the importers country (developed) is unimportant. Tariff significantly distorts trade between developing and developed countries and RTA does not affect trade.

The study establishes that the financial development of both exporting and importing countries is a significant determining factor of bilateral exports. This implies that increased credit availability to the private sector, better institutional framework, and increased access to credit will improve the level of bilateral exports. In this context, countries (mostly developing) need to take proactive financial and monetary policies that make more efficient and transparent banking operations, prohibit money laundering, decrease willful default culture, and voluntary money heist from the banking system to enhance the development of the financial sectors. Also, care should be taken while formulating rules and regulations for RTAs, mostly between developed to developing and developing to developing.

Although this study employs worldwide data in a gravity context, the research also opens an avenue to employ these financial development indicators in regional and/or individual country contexts. The study finds that tariff has larger distortive effects on exports from developing to developed countries. The result gives us the scope for further study of why tariff is more protective for exports from developing to developed countries, while the developed counties allow some favorable treatments to developing countries, especially to LDCs. The study can also be extended by linking financial development to GVC export data in a gravity context. GVC trade renders the actual value addition in a country's economy due to trade and it is pertinent to study how financial development affects a country's GVC position.

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Appendix

Table A1. *List of the Sample Countries*

Albania	Macao SAR, China	Honduras	Mongolia	South Africa
Algeria	China	Hungary	Morocco	Spain
Angola	Colombia	Iceland	Mozambique	Sri Lanka
Argentina	Comoros	India	Myanmar	St. Lucia
Armenia	Congo	Indonesia	Namibia	Sudan
Australia	Congo Dem. Rep.	Iran	Nepal	Suriname
Austria	Costa Rica	Ireland	Netherlands	Sweden
Azerbaijan	Cote d'Ivoire	Israel	New Zealand	Switzerland
Bahamas	Croatia	Italy	Nicaragua	Syria
Bahrain	Cyprus	Jamaica	Niger	Tajikistan
Bangladesh	Czech Republic	Japan	Nigeria	Tanzania
Barbados	Denmark	Jordan	North Macedonia	Thailand
Belarus	Djibouti	Kazakhstan	Norway	Timor Leste
Belgium	Dominica	Kenya	Oman	Togo
Belize	Dominican Republic	Korea	Pakistan	Tonga
Benin	Ecuador	Kuwait	Panama	Trinidad and Tobago
Bhutan	Egypt	Kyrgyz Republic	Papua New Guinea	Tunisia
Bolivia	El Salvador	Lao PDR	Paraguay	Turkey
Bosnia	Equatorial Guinea	Latvia	Peru	Turkmenistan
Botswana	Estonia	Lebanon	Philippines	Uganda
Brazil	Ethiopia	Lesotho	Poland	Ukraine
Brunei- Darussalam	Fiji	Liberia	Portugal	United Arab Emirates
Bulgaria	Finland	Libya	Qatar	United Kingdom
Burkina Faso	France	Lithuania	Romania	United States
Burundi	Gabon	Luxembourg	Russian Federation	Uruguay
Cabo Verde	Gambia	Madagascar	Rwanda	Uzbekistan
Cambodia	Georgia	Malawi	Samoa	Vanuatu
Cameroon	Germany	Malaysia	Saudi Arabia	Venezuela
Canada	Ghana	Maldives	Senegal	Vietnam
Central African Republic	Greece	Mali	Seychelles	Yemen
	Guatemala	Malta	Sierra Leone	Zambia
Chad	Guinea	Mauritania	Singapore	
Chile	Guinea-Bissau	Mauritius	Slovak Republic	
Hong Kong SAR, China	Guyana	Mexico	Slovenia	
	Haiti	Moldova	Solomon Islands	

Table A2. *Descriptive Statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
exports	347999	635.733	5923.684	0	505597.09
exportsfob	317737	693.529	6272.64	0	433744.88
fdexp	482664	0.321	0.229	0	1
fdimp	482664	0.321	0.229	0	1
fiexp	482664	0.419	0.22	0	1
fiimp	482664	0.419	0.22	0	1
fmexp	482664	0.217	0.26	0	1
fmimp	482664	0.217	0.26	0	1
trfrind	482664	71.275	13.901	0	95
gdppppexp	482664	495059.97	1649869.3	380.257	19600000
gdppppimp	482664	495059.97	1649869.3	380.257	19600000
distw	482664	7758.067	4448.931	60.771	19658.131
contig	482664	0.019	0.135	0	1
language	482664	0.141	0.349	0	1
colony	482664	0.012	0.109	0	1
landlock	482664	0.391	0.559	0	2
rta	482664	0.188	0.391	0	1
cu	482664	0.024	0.152	0	1
fta	482664	0.055	0.228	0	1
eia	482664	0.025	0.157	0	1
tariff	383005	0.084	0.432	0	55.27
dcrexp	482664	0.510	0.453	0.002	3.089
dcrimp	482664	0.510	0.453	0.002	3.089
rolexp	482664	-0.052	0.977	-2.267	2.124
rolimp	482664	-0.052	0.977	-2.267	2.124