

# The Implications of Financial Frictions with International Trade Barriers\*

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## Abstract

We document that finance-dependent industries benefit from financial development, but only if trade barriers are low. To explain this finding, we develop a model of international trade featuring cross-country financial friction heterogeneity. In our model, although product markets are competitive, production in finance-dependent sectors is supported by an endogenous profit margin in equilibrium. The resulting economic profit in turn prevents firms from strategic defaults, which justifies external financing and investment to begin with. We directly test the key mechanism of our model regarding profit margins using cross-country firm-level data from ORBIS. We explore aggregate-level implications of our model. We show that a country gains more (relative to the frictionless benchmark) when trading with financially less-developed economies, since profits from producing finance-dependent goods shift from financially less- to more-developed countries. Furthermore, a small open economy may not benefit from financial development due to a fall in economic profits from exporting.

**JEL Codes:** G1, O16, E22, F1

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# 1 Introduction

It is widely known that financial development benefits finance-dependent industries (Rajan and Zingales, 1998; Manova, 2013). We, however, empirically document that this is the case if and only if trade barriers are low. To rationalize this finding and explore welfare implications, we develop a model of international trade featuring cross-country financial friction heterogeneity. The novel mechanism in our model that helps explaining our empirical facts is that firms in finance-dependent sectors earn an endogenous profit margin in financially underdeveloped economies, which we support using cross-country firm-level data from ORBIS. We show that the link we establish between financial frictions, trade barriers, and profits crucially influences industry- and aggregate-level implications of financial development and trade openness.

The key mechanism in our model that explains our empirical findings is that financial frictions generate endogenous economic profits in finance-dependent sectors, which prevent strategic default on loans and support production in these sectors. Our model shows that, by raising profit margins, financial *underdevelopment increases* value added of finance-dependent sectors when trade barriers are large. When trade barriers are low, however, financial underdevelopment hurts finance-dependent sectors due to a comparative disadvantage of these industries. We therefore show that there is a complementarity effect between trade openness and financial development on value added and profits of finance-dependent industries. Producers in finance-dependent industries do not benefit from financial development in a closed economy, and they do not benefit from trade openness in a financially less-developed economy either. At the aggregate level, since producing finance-dependent goods entails economic profits, our model along with firm-level evidence from ORBIS suggests that the presence of financial frictions increases (decreases) the gains from trade openness for financially more- (less-) developed countries, due to profit shifting from less- to more-developed countries. Moreover, a complete elimination of financial frictions may not be welfare improving for a small open economy.

By employing a triple-difference strategy, we first document that the sensitivity of finance-dependent industries (in terms of value added) to financial development depends crucially on trade barriers. To this end, we examine the value added of 27 manufacturing industries for a panel of around 100 countries from 1988-2003, along the dimensions of country-level financial development, industry-level financial dependence, and industry-country level tariff barriers. We document that more (relative to less) finance-dependent industries generate higher value added in financially more-developed economies, but only when trade barriers are low. More interestingly, we show that financial development indeed *hurts* finance-dependent sectors

when trade barriers are large. Our empirical estimates are economically significant: When tariffs are low (i.e., below the sample median), an industry in the 75th percentile of finance dependence relative to the one in the 25th percentile generates 62% more value added in a country at the 75th percentile of financial development compared to a country at the 25th percentile. Surprisingly, this difference in scale is indeed negative at -13.7% when tariffs are large, i.e., above the sample median.

Furthermore, we show that more (relative to less) finance-dependent industries generate more value added when tariff barriers are lower, but only in financially more-developed economies. Indeed finance-dependent industries' value added is insensitive to tariff barriers in financially underdeveloped economies. In sum, we conclude that there is a complementarity between trade openness and financial development on value added of finance-dependent industries. In a dynamic setting we further confirm this complementary effect by showing that the value added *growth* of finance-dependent industries is more sensitive to financial development for countries that experienced trade liberalizations than countries that did not.

To explain our empirical findings, we develop a stylized model of international trade that delivers tractable and closed-form results. To isolate from competing mechanisms we assume all markets except the financial market are frictionless. There are two sectors in our model economy, one is external-finance dependent, and the other is non-finance dependent. Capital is the sole factor of production and we have time-to-build friction. In the finance-dependent sector, a continuum of varieties are produced, each with a distinct productivity. We assume national product differentiation, i.e., varieties produced in a country are distinct from those in other countries. The production function features non-convexity: firms must operate above a minimum scale, which needs to be externally financed. External financing is subject to financial frictions.

We model financial market frictions in a forward-looking setup. A borrower may take away a fraction of firm revenue and strategically default on a loan. The fraction that could be taken away represents financial contract enforceability and determines the financing friction severity. A borrowing firm can credibly commit not to default if the firm is going to earn a high profit. Hence, firms' debt limits endogenously depend on firms' profits—determined by equilibrium forces—not just their internal resources at the time of financing the investment cost (as in a backward-looking setup with collateral constraints). Due to the forward-looking nature of our financial frictions, firms in the finance-dependent sector earn an endogenous economic profit in equilibrium, although product markets are competitive. This economic profit prevents strategic default on loans and is needed to support lending, investment, and production in the finance-dependent sector. In equilibrium, these economic profits increase with the financial friction severity.

To analyze the implications of international trade, we present a comparative advantage model of international trade in which the origin of comparative advantage is financial friction severity (Kletzer and Bardhan, 1987; Baldwin, 1989; Beck, 2002; Matsuyama, 2005; Ju and Wei, 2011; Becker, Chen and Greenberg, 2013) rather than production technology (à la Dornbusch, Fischer and Samuelson, 1977; Eaton and Kortum, 2002) or factor endowments (à la Heckscher-Ohlin-Samuelson model);<sup>1</sup> In our model, countries differ in their financial friction severity, and financially more-developed countries have a comparative advantage in producing finance-dependent goods. We empirically confirm this source of comparative advantage using Comtrade bilateral trade data and proxies for country-level financial development and industry-level finance dependence that are consistent with our model.<sup>2</sup> Through the lens of our model, when trade barriers are low, financial development benefits finance-dependent sectors, since production and profits shift to financially more-developed economies with a comparative advantage in these sectors. When trade barriers are large, however, financial development decreases profits and value added of finance-dependent sectors; This is because as explained above, firms in finance-dependent sectors earn higher profit margins when financial frictions are more severe.

The novel mechanism in our model that underlies the industry- and aggregate-level results is that production of finance-dependent varieties in the presence of financial frictions is supported by profits from production, which makes in-advance external financing and investment possible. Our model then implies that firms in finance-dependent sectors earn higher profit margins in financially less-developed economies. We empirically test this mechanism by employing a difference-in-difference identification strategy using ORBIS firm-level data for 11 European countries. Our estimate is economically significant: Profit margins are between 5%-20% (depending on proxies of financial development and finance dependence) larger in the 75th percentile of finance-dependence distribution relative to the 25th percentile, in the financially least- compared to the most-developed country in our sample.

The link between financial frictions and profits documented in this paper has important aggregate-level implications for the gains from international trade and the gains from financial development. In our model, trade openness influences welfare through two potentially competing forces—namely, price channel and profit-shifting channel. On the one hand, by reducing consumers' price index trade openness benefits consumers and raises welfare—the price channel. This channel is stronger when a country's trade partners are financially less frictional, since those trade partners would be able to produce finance-dependent varieties

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<sup>1</sup>Costinot (2009) provides a general theory of comparative advantage based on institutional quality, and Nunn and Trefler (2014) review the theoretical and empirical insights in this literature.

<sup>2</sup>This pattern of specialization is well documented in a large body of literature; See e.g. Manova (2013) among others.

at a lower profit margin and therefore cheaper prices. On the other hand, economic profits earned by producers of finance-dependent goods flow out of (into) an open economy that has a comparative disadvantage (advantage) in finance-dependent sectors, which in turn reduces (raises) welfare in that country—the profit-shifting channel.<sup>3</sup> The overall impact of the price and profit-shifting channels depends on the relative financial friction severity of trade partners. We use our theory along with firm-level empirical findings from ORBIS to show that the profit-shifting channel in our model is indeed a relevant force, and that the presence of financial frictions tends to increase (decrease) the gains from trade for countries that are financially more- (less-) developed than their trade partners.

Finally, even though financial friction is the only friction in our model, our theory shows that an open economy may lose from its own financial development (i.e., reducing its financial frictions). In a closed economy, however, welfare rises monotonically with financial development. To elaborate, financial development reduces economic rents in the finance-dependent sector, which reduces misallocation and raises welfare in a closed economy. Note that it is indeed consumers, not producers of finance-dependent goods, who enjoy the welfare gains from financial development in a closed economy. In an open economy, the benefits from the fall in economic profits induced by financial development are shared between Home and Foreign consumers. The reduction in economic profits embodied in the exported goods tends to reduce Home welfare while raising Foreign welfare. We therefore analytically show that there is an optimal level of financial frictions for an open economy, and a complete elimination of financial frictions in the Home economy indeed hurts welfare due to a reduction in exports' profits. We use our point estimates from the firm-level empirical findings from ORBIS together with our analytical result and show that while in the financially less-developed countries reducing financing frictions is welfare improving, financially more-developed countries may not benefit as much from a reduction in financial frictions on the margin.

This paper contributes to several strands of literature. First, this paper contributes to a large and growing body of the literature that studies international trade in the presence of financial frictions (see [Kohn, Leibovici and Szkup \(2022\)](#) for a review). A branch of this literature explores the role of financial frictions as a source of comparative (dis)advantage and its effects on trade flows ([Beck, 2002, 2003](#); [Wynne, 2005](#); [Svaleryd and Vlachos, 2005](#); [Hur, Raj and Riyanto, 2006](#); [Manova, 2013](#); [Tetenyi, 2019](#); [Kohn, Leibovici and Szkup, 2020a](#); [Leibovici, 2021](#)) as well as on capital flows ([Matsuyama, 2005](#); [Antras and Caballero, 2009](#)).

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<sup>3</sup>Note that the phrase “profit shifting” is used in two different stands of literature with two different meanings. In International Macro/Finance literature, profit shifting is typically defined as the practice of business owners transferring money to “tax heavens” to avoid paying taxes. In International Trade literature, however, profit shifting refers to the case where, due to comparative advantage, profits from producing some goods or services shift from producers in one country to those in another country (e.g., [Bagwell and Staiger, 2012](#); [Ossa, 2014](#)). In this paper, profit shifting refers to the latter.

Moreover, the effects of financial frictions and access to credit on firm-level export activities have been documented in this literature (Greenaway, Guariglia and Kneller, 2007; Muûls, 2008; Minetti and Zhu, 2011; Amiti and Weinstein, 2011; Becker, Chen and Greenberg, 2012; Paravisini et al., 2015; Manova, Wei and Zhang, 2015; Kohn, Leibovici and Szkup, 2016; Chaney, 2016).

While this literature focuses on the role of financial frictions in international trade, we explore the interplay between international trade and financial frictions from quite a different angle: We empirically and theoretically study the role of international trade barriers in the implications of financing frictions. In particular, we show that financial development indeed does not benefit finance-dependent industries if trade barriers are large. The novel mechanism that rationalizes our findings and lends support to our model is that firms in finance-dependent industries earn higher profit margins in financially less-developed economies. By empirically documenting this channel, we show that financial frictions can activate profit shifting across countries since trade openness shifts the profits entailed in finance-dependent sectors from financially less- to more-developed countries. In this regard, we contribute to the strategic trade policy and profit shifting literature (Spencer and Brander, 1983; Brander and Spencer, 1985; Brander, 1986; Krugman, 1987; Bagwell and Staiger, 2012; Ossa, 2014; Firooz and Heins, 2021).

The fact that financial frictions generate endogenous economic profits and activate the profit-shifting channel introduces a new mechanism through which financial frictions can influence the gains from international trade. We use our theoretical results along with our firm-level empirical findings to understand the role of this specific mechanism in changing the gains from trade under financing frictions. We contribute to this literature (Caggese and Cuñat, 2013; Kohn, Leibovici and Szkup, 2020b; Brooks and Dovis, 2020; Leibovici, 2021) by showing that the presence of financial frictions tends to increase (decrease) the gains from trade openness for financially more- (less-) developed economies, due to the profit-shifting channel. We therefore establish that the effects of financial frictions on a country's gains from trade depend not only on the financial friction severity of the home country, but also on financial friction severity of its trade partners.

Our paper also contributes to a large body of the literature in economics and finance examining the effects of financial frictions on economic development and growth (Aghion, Howitt and Mayer-Foulkes, 2005; Buera, Kaboski and Shin, 2011; Itskhoki and Moll, 2019), missallocation of input resources (Banerjee and Duflo, 2005; Hsieh and Klenow, 2009; Banerjee and Moll, 2010; Midrigan and Xu, 2014; Cole, Greenwood and Sanchez, 2016; Bai, Lu and Tian, 2018), and economic development and inequality (Greenwood and Jovanovic, 1990; Banerjee and Newman, 1993; Aghion and Bolton, 1997; Matsuyama, 2000; Townsend and

Ueda, 2006). To the best of our knowledge, the aforementioned literature in macro-finance ignores the role of trade barriers in analyzing the aggregate and distributional implications of financing frictions.

We show that the impact of financial frictions on the performance (value added and profits) of finance-dependent industries depends crucially on trade barriers. In particular, we document that financial development benefits finance-dependent sectors, *but only* when trade barriers are low. In a closed economy, while consumers burden the welfare cost of financing frictions, producers in finance-dependent sectors *benefit* from severe financing frictions since they can earn an endogenous economic profit. In the presence of frictions producers operate at a minimum scale supported by an endogenous positive profit margin in equilibrium. We show that while trade openness benefits consumers, it hurts finance-dependent producers in financially less-developed countries due to profit shifting out of these economies. We show that an open economy may *benefit* from the country's own financing frictions.

The key mechanism in our paper is that a positive profit margin emerges in the presence of financing frictions. This mechanism is driven by the forward-looking nature of the financing friction in our model. This force is absent in models with backward-looking collateral constraints. We model financing frictions in a setup with strategic default in which the amount of external funds that a producer can raise as well as the ultimate investment scale is endogenous and depends on the resultant cash flows. Paulson, Townsend and Karaivanov (2006) show that a forward-looking friction based on moral hazard (as opposed to a backward-looking friction based on collateral constraint) is the key driver of business startups in Thailand. Brooks and DAVIS (2020) show that the pattern of exports as well as exporters' growth upon Colombia's trade liberalization is explained by an endogenous debt limit implied by forward-looking financing frictions. Bai, Lu and Tian (2018) explain capital misallocation across Chinese firms via endogenous borrowing constraints in a forward-looking setup. We directly test the implications of the forward-looking financing constraints for profit margins in our model, using cross-country firm-level data from ORBIS.

The rest of the paper is organized as follows. Section 2 documents the industry-level empirical facts for value added. Section 3 develops a stylized model to rationalize these facts. Using cross-country firm-level data, Section 4 directly tests the key mechanism of the model that helps explaining the facts documented in Section 2. Section 5 illustrates how the key channel introduced in this paper influences the welfare consequences of trade under financial frictions and the welfare consequence of financing frictions against trade openness. Section 6 concludes.



## 2 Financial Underdevelopment with Trade Barriers: Evidence from Industry-Level Data

This section documents a set of novel empirical facts; We show that finance-dependent industries benefit (in terms of value added) from financial development, but only when trade barriers are low. We show that financial development indeed hurts finance-dependent industries when trade barriers are large. Moreover, we document that finance-dependent industries benefit from lower trade barriers, but only in financially developed economies.

We use various data sources to document our empirical facts. Here we briefly introduce data sources and explain how we construct our variables; more details on constructing data and summary statistics are provided in appendix A. As a proxy for financial development, we follow the literature and use country-level annual data on private credit by banks and other financial institutions (% GDP). We obtain these data from World Bank, Global Financial Development Database (Beck, Demirgüç-Kunt and Levine, 2000). We also employ two alternative proxies for financial development in our robustness checks: financial system deposits over GDP, and banks' overhead costs over total assets.

As in Manova (2013) we construct two measures to compare financial vulnerability across industries. First, we measure the external-finance dependence as the fraction of capital expenditures of an average firm in a specific industry that is not covered by internal cash revenue of the firm (Rajan and Zingales, 1998). Firms in more finance-dependent industries rely relatively more on external sources of funds to finance investment costs and are supposedly more affected by country-level financial development. As an alternative proxy, we compare industries based on their asset intangibility (Braun, 2005). The idea is that industries with a higher share of intangible assets are more vulnerable to financing frictions since they cannot use intangible assets as collateral when borrowing. Hence, financial development is especially crucial for industries with higher asset intangibility. We use U.S. Compustat firms in 1980s (and in 1970s as a robustness check) to construct industry-level measures of external-finance dependence and asset intangibility, for 27 three-digit ISIC (revision 2) manufacturing sectors. Both proxies of financial vulnerability are widely used in the literature. As in this literature, we treat both proxies as inherent characteristics of industries that are the same across countries. Here we report regression results using the Rajan-Zingales external-finance dependence measure, but as we show in the appendix our main results are robust to using asset intangibility as the alternative proxy for financial vulnerability.

In our empirical setup, we use trade tariffs as a proxy for trade barriers at the industry-country level. We use data on industry-country level bilateral tariffs and trade volumes from WITS (World Integrated Trade Solution) from 1988-2003. Trade tariffs are constructed as



the trade-weighted average tariffs that a country imposes on its imports and trade partners impose on the country’s exports in a given industry.

We obtain data on sales, value added (VA), and wage bill of three-digit ISIC manufacturing industries for a panel of 126 countries in four decades from 1963 to 2003 from United Nations Statistical Division, Industrial Statistics. To abstract from labor, we subtract wage bill from value added in data so that the resulting “VA” variable includes profits and capital rent only. This choice makes the VA variable consistent with the notion of value added in our theoretical model with no labor. Labor and material costs are presumably less exposed to time-to-build friction and financing constraints. Empirical results are, however, robust with or without subtracting the wage bill. Results also are robust to using sales instead of value added as an alternative measure of industry-level performance.

## 2.1 Financial Development and Value Added of Finance-Dependent Sectors

We first ask whether finance-dependent industries generate more value added in financially developed economies. Next, we show that the whole sample estimation masks significant heterogeneity between industries/countries with low versus high trade barriers.

We start with the following difference-in-difference regression:

$$\log[\text{VA}]_{ict} = \lambda_t + \theta_i + \delta_c + \alpha [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_{c,t-5} + \epsilon_{ict} . \quad (1)$$

The left-hand-side variable is the log of value added minus wage bills.<sup>4</sup> On the right-hand side, “Fin Dep” represents Rajan-Zingales external-finance dependence of an industry, and “Fin Dev” is the financial development of a country. The terms  $\lambda_t$ ,  $\theta_i$ , and  $\delta_c$  are year, industry, and country fixed effects, respectively. Results are robust to using industry×time  $\theta_{it}$  and country×time  $\delta_{ct}$  fixed effects.  $\epsilon_{ict}$  is the error term. We cluster standard errors at the industry-country level, given that data for an industry in a country across time are not independently drawn observations.

The coefficient of interest is  $\alpha$ , which is expected to be positive: finance-dependent industries benefit from financial development. In this regressions we exploit within-country differences in value added across industries with different external financing needs, and see how this difference varies across countries and time with different levels of financial develop-

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<sup>4</sup>We drop observations with negative value added (minus wage bill) in the data, as we include log of value added in regressions; Results hold when we instead use the alternative formula  $\log(1 + \max\{\text{value added}, 0\})$  or when we do Tobit regression for  $\log(\text{value added})$ , left-censored at 0.

ment. By doing so, this regression isolates from the classic endogeneity and reverse causality problems in the regression of value added on financial development at the country level. We use 5-year lag of financial development to further mitigate the reverse causality concerns.<sup>5</sup>

The first column in table 1 reports the regression results. Finance-dependent industries overall generate more value added in financially developed economies. The last row in this table interprets the results; an industry in the 75th percentile of external-finance dependence relative to the one in the 25th percentile generates 39.7% more value added in a country at the 75th relative to the one at the 25th percentile of financial development.

The specification above masks a substantial heterogeneity in the sensitivity of finance-dependent industries' value added to financial development in countries with high versus low trade barriers. Columns 3 and 4 in table 1 show the results of the same regression (1) for the subsample of countries with low versus high manufacturing tariffs.<sup>6</sup> We divide the sample into high- versus low-tariff countries based on the trade-weighted average tariffs that a country imposes on its imports and trade partners impose on the country's exports, across all manufacturing industries. The median tariff across countries in our sample, which is 7.2%, is used to divide countries into low- and high-tariff subsamples. The average manufacturing tariff is 4.3% for the low-tariff subsample and 11.4% for the high-tariff subsample.

Our results in columns 3 and 4 establish that the sensitivity of finance-dependent industries' performance to financial development depends crucially on trade barriers. In particular, our results indicate that country-level financial development benefits finance-dependent industries (in terms of value added), but only in countries with low trade barriers. More interestingly, our results show that in countries with high trade barriers, financial development *hurts* finance-dependent industries. The last row indicates that the results are economically significant; in low-tariff countries, an industry in the 75th percentile of finance dependence relative to the one in the 25th percentile generates 62% more value added in a country at the 75th percentile of financial development compared to a country at the 25th percentile. Surprisingly, this difference in scale is -13.7% when tariffs are large. The results presented in table 1 are qualitatively similar when using industry-level asset intangibility as an alternative proxy for financial vulnerability; see the appendix table D.1.

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<sup>5</sup>Indeed results do not significantly change when we use contemporaneous financial development, since the endogeneity problem is already mitigated by our cross-industry comparison within a country in the diff-in-diff specification.

<sup>6</sup>Note that tariffs for our sample of countries are available only after 1988.

Table 1: Financial development, trade barriers, and value added of finance-dependent industries.

log(Value added)	1963 to 2003				1988 to 2003			
	All	All	low Tariff	high Tariff	All	low Fin.Dev.	high Fin.Dev.	All
external-finance dependence × financial development	0.5215*** (0.0637)	0.5474*** (0.0927)	0.6746*** (0.1115)	-0.2065* (0.1187)				0.7568*** (0.1543)
external-finance dependence × tariff					-0.4656*** (0.0839)	-0.0319 (0.0967)	-0.8325*** (0.1304)	0.2314 (0.2119)
external-finance dependence × financial development × tariff								-0.2648*** (0.0913)
FE – Industry, Country, Year	✓	✓	✓	✓	✓	✓	✓	✓
Observation	44447	6645	3315	3330	6645	3329	3316	6645
Clusters (country×industry)	2703	1675	1050	1021	1675	847	997	1675
Differential scale (%)	39.7	47.9	62.0	-13.7	-30.4, per 10pp tariff	-2.5, per 10pp tariff	-47.7, per 10pp tariff	71.8, at tariff=0 0, at tariff=17.8%

Notes: An observation is an industry in a country in a year. The left-hand-side variable is the log of value added minus wage bills, which includes profits plus capital rent, at the three-digit (ISIC rev.2) level. External-finance dependence is defined as the fraction of capital expenditures not financed with cash revenues for the U.S. publicly traded firms in 1980s, in a given industry. Financial development is proxied by the log of total credit to private sector at the country level normalized by GDP (standardized by sample minimum and STD). Industry-country level trade barriers are proxied by trade-weighted average tariffs that a country imposes on its imports and trade partners impose on the country's exports at the broader two-digit industry level. Tariffs are scaled by their full-sample standard deviation, which is 6.2 percents. See appendix A for more details on constructing variables. The first column regression has the interaction of finance dependence and financial development on the right-hand side and covers data for five decades 1963 to 2003. The second to fourth columns replicate the same regression from 1988 to 2003 for which tariff data are available. The sample median of the whole manufacturing average tariff at the country level is used as the cutoff to divide the sample into high- and low-tariff countries. The fifth to seventh columns have the interaction of finance dependence and tariffs on the right-hand side. The sample median of credit over GDP is used as the cutoff to divide countries into less- and more-developed economies. The last column shows regression results for the full triple-diff specification. The differential scale in columns 1-4 as well as in the last column shows how much an industry at the 75th percentile of external-finance dependence in the regression sample would generate more value added relative to the one at the 25th percentile, in a country at the 75th percentile of financial development compared to the one at the 25th percentile. The last column reports this estimate at two levels of tariffs. The differential scale in columns 5-7 shows how much an industry at the 75th percentile of external-finance dependence would generate more value added relative to the one at the 25th percentile, per 10 percentage points increase in tariffs. Standard errors are clustered at the industry×country level, and are reported in parentheses.

\*\*\* $p < 0.01$  \*\* $p < 0.05$  \* $p < 0.1$

The facts that financial development is crucial for finance-dependent industries only when trade barriers are low, and indeed hurts finance-dependent industries when trade barriers are large are puzzling; as it is widely discussed in the literature, financing frictions result in a misallocation of capital and adversely affect finance-dependent sectors (e.g., [Banerjee and Duflo, 2005](#)). Our model in Section 3 rationalizes these facts, which we briefly explain here. Financially more-developed economies have a comparative advantage in finance-dependent industries. When trade barriers are low, financial development is crucial for finance-dependent industries to be able to gain market share in the global economy. More interestingly, we introduce a new force to explain the results for countries with large trade barriers: In equilibrium, there exists an endogenous positive profit margin which raises debt limits and supports production in the finance-dependent sector, and this profit margin rises with financial friction severity. This mechanism implies that when trade barriers are large, finance-dependent industries benefit from financial *under*development since they earn higher profit margins, without losing market shares to their foreign competitors.

## 2.2 Trade Barriers and Value Added of Finance-Dependent Sectors

To further support the complementarity effect between trade barriers and financial development on the performance of finance-dependent industries, we document that finance-dependent industries benefit from lower trade barriers, but only in financially developed countries. To this end, we run the following diff-in-diff regression, measuring the sensitivity of finance-dependent industries’ value added to tariff barriers, separately for financially less- and more-developed countries:

$$\log[\text{VA}]_{ict} = \lambda_t + \theta_i + \delta_c + \beta [\text{Fin Dep}]_i * [\text{Tariff}]_{ict} + \epsilon_{ict} , \quad (2)$$

where “Tariff” proxies for trade barriers at the industry  $i$  in county  $c$  at time  $t$ , and measures trade-weighted average tariffs that a country imposes on its imports and trade partners impose on the country’s exports. As in specification (1), we include year, industry, and country fixed effects. Results are robust to including industry $\times$ year and country $\times$ year fixed effects. By exploiting variations in cross-industry tariffs within a country, this specification addresses endogeneity issues that stem from the negative correlation between trade barriers and country-level economic development (which directly affect industries’ output and value added). Standard errors are clustered at the industry-country level.

Results are shown in table 1, the sixth and seventh columns, for financially less- and more-developed countries—with credit over GDP below and above the sample median, respectively.

For the sake of comparison, the full sample results are presented in the fifth column. The differential scale for the full sample estimate in column 5 indicates that an industry in the 75th percentile of finance dependence would generate 30.4% more value added per 10 percentage points reduction in tariffs relative to the industry at the 25th percentile. However, as columns 6 and 7 show, this relationship solely comes from countries with higher financial development. Indeed, for financially more-developed countries (column 7) the differential scale is 47.7% per 10 percentage points reduction in tariffs, which is substantially larger than the full sample estimate. For the subsample of financially less-developed economies (column 6) the sensitivity to tariff is nearly zero, and statistically insignificant, which indicates that trade barriers are irrelevant for finance-dependent industries in financially less-developed economies.

**Discussion.** Throughout this section, we use tariffs instead of other measures of trade openness (e.g., trade volume over domestic absorption), since other measures are arguably more endogenous than tariffs. Tariffs are likely endogenous as well and there are various reasons to argue that there might be a reverse causality from value added to tariffs. For instance, industries with higher value added in the subsample of financially less-developed economies may lobby for high tariffs (which would induce a positive link from value added to tariffs), or governments may impose large tariffs for struggling, low value added industries in the subsample of financially more-developed countries (which would induce a negative link from value added to tariffs). To address these reverse causality concerns, while our value added data is at the *three*-digit industry level, throughout this section we use average tariffs at the broader *two*-digit level, since broader industry-level tariffs are less likely to be lobbied by narrower industries, or to be targeted by governments to help narrower industries. Results throughout this section are also robust to using the average country-level tariffs for the whole manufacturing sector, and to using three-digit manufacturing tariffs. Moreover, although the number of observations would considerably drop, results are robust to using 5-year lags for tariffs as the right-hand-side variable to further address reverse causality concerns.

### **2.3 Financial Underdevelopment, Trade Barriers, and Value Added of Finance-Dependent Sectors**

Thus far, we have established two facts: Financial development benefits finance-dependent industries if and only if trade barriers are low, and finance-dependent industries benefit from lower trade barriers only in financially developed countries. To prove that the interaction

between financial development and trade barriers has a significant impact on the value added of finance-dependent industries, we run the following full triple-difference regression:

$$\begin{aligned} \log[\text{VA}]_{ict} = & \lambda_t + \theta_i + \delta_c + \alpha [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_{c,t-5} + \\ & \beta [\text{Fin Dep}]_i * [\text{Tariff}]_{ict} + \gamma [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_{c,t-5} * [\text{Tariff}]_{ict} + \epsilon_{ict} . \end{aligned} \quad (3)$$

As in the previous regressions, we include year, industry, and country fixed effects, and results are robust to including industry×year and country×year fixed effects. Standard errors are clustered at the industry-country level. The coefficient of interest is  $\gamma$ , which measures to what extent the sensitivity of finance-dependent industries’ value added to financial development varies with tariff barriers, and to what extent the sensitivity of finance-dependent industries’ value added to tariff barriers varies with financial development.

The last column in table 1 present the results. The triple-difference coefficient  $\gamma$  is negative and highly significant, confirming subsample estimation results: Finance-dependent industries benefit from low trade barriers, only in financially developed countries; and finance-dependent industries generate more value added in financially developed economies, but only when tariffs are low enough. The differential scale in the last row shows the economic significance of the result: In the limit of zero tariffs, an industry in the 75th percentile of external-finance dependence relative to the one in the 25th percentile would generate 71.8% more value added in a country at the 75th percentile of financial development compared to a country at the 25th percentile. This difference in scale would be *zero* at tariffs = 17.8%. Note that tariffs are on average 8.6% in our data with a standard deviation of 6.2%. Therefore, within the range of data covered in our sample we estimate that the value added of finance-dependent industries is insensitive to (and even falls with) financial development when tariffs are large enough. Furthermore, the coefficient of “finance dependence×tariff” in the triple-diff specification is *positive* (but statistically insignificant) which suggests that at the extreme of financial underdevelopment in our sample, larger tariffs do *not* hurt finance-dependent industries (relative to less-finance dependent industries).

As the appendix table D.1 reports, our results are qualitatively the same and quantitatively similar when using industry-level asset intangibility as an alternative proxy for financial vulnerability. In particular, in the limit of zero tariffs, an industry in the 75th percentile of asset intangibility relative to the one in the 25th percentile would generate 51.8% more value added in a country at the 75th percentile of financial development compared to a country at the 25th percentile, whereas this difference in scale would be *zero* at tariffs = 11.7%.

**Discussion.** The variable “tariff” in our regressions has been defined as the trade-weighted average of tariffs that country  $i$  imposes on its imports (import tariffs, hereon) as well as tariffs that country  $i$ ’s trade partners impose on country  $i$ ’s exports (export tariffs, hereon). Moreover, in constructing this “tariff” variable we have included *all* trade partners of a country, regardless of their financial development. There are, however, reasons to believe that import versus export tariffs have different effects in specification (3). Also, tariffs against financially less- or more-developed countries might have different implications for the sensitivity of finance-dependent industries to the country financial development. Indeed, as our theoretical model in Section 3 formalizes, the *relative* financial development of trade partners crucially influences the effect of trade barriers on the sensitivity of finance-dependent industries to financial development.

We now therefore include both the average import and export tariffs in specification (3), each separately defined against trade partners of a country that are financially less- and more-developed than that country. The appendix table D.2 reports the results. In this table, “export tariff with higher development,” for instance, measures the weighted-average tariffs on country  $i$ ’s exports, imposed by trade partners that are financially more developed than country  $i$ . The last column of table D.2 indicates that two sets of tariffs are crucial for the sensitivity of finance-dependent industries to financial development: import tariffs against financially more-developed economies (than home country), and export tariffs with financially less-developed countries (than home country). Export tariffs with financially more-developed economies, and import tariffs against financially less-developed partners are irrelevant for the impact of financial development on the performance of finance-dependent industries. Through the lens of our model in Section 3, export tariffs against less-developed countries are crucial since these tariffs reduce the comparative advantage of the home country in finance-dependent industries, and therefore reduce the importance of financial development for these industries. Moreover, import tariffs against more-developed countries reduce the importance of financial development for finance-dependent industries in the home economy, since in such a protected environment these industries earn high profit margins, especially in financially less-developed countries.

## 2.4 The Cases of Trade Liberalization

Thus far, we have established a complementary effect between trade barriers and financial development on the (relative) performance of finance-dependent industries by exploiting cross-country variations in financial development, cross-industry variations in finance dependence, and cross-industry and -country variations in tariffs as a measure of trade barriers. To further support that the sensitivity of finance-dependent industries to financial development



depends on trade barriers, we now focus on within-country variations in tariffs over time: We examine the extent to which value added growth of finance-dependent industries depends on financial development in countries that experienced a trade liberalization—a significant reduction in tariffs over our sample period. To this end, we choose countries that reduced their manufacturing tariffs by at least 3.3 percentage points (i.e., the 80th percentile of tariff reduction in our data) in a 5-year period during 1988-2003. This criterion gives us a small subsample of 11 countries for which manufacturing tariffs reduced by 7 percentage points on average in the aforementioned period.<sup>7</sup> For the rest of the sample the average change in tariffs is near zero. We run the following regression as proposed by [Rajan and Zingales \(1998\)](#), separately for the “trade-liberalization” subsample and “the rest” of countries, and then compare them to the full sample results:

$$[\text{VA Growth}]_{ict,t+5} = \lambda_t + \theta_i + \delta_c + \alpha[\text{VA Share}]_{ict} + \beta [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_{c,t} + \epsilon_{ict} . \quad (4)$$

The left-hand-side variable is the annualized growth of value added minus wage bills in the following 5 years (difference in *logs* divided by 5). We control for  $[\text{VA Share}]_{ict}$ , i.e., share of industry  $i$ 's value added in total value added in country  $c$  at time  $t$ , to allow for the possibility that industries with larger shares may grow slower. We cluster standard errors at the industry by country level. The coefficient of interest is  $\beta$ , i.e., the extent to which finance-dependent industries grow faster in financially developed economies. By comparing various industries within a country, the above diff-in-diff specification addresses concerns about the endogeneity of financial development at the country level. To further mitigate endogeneity and reverse causality issues, we use financial development at the beginning of the 5-year growth period. Results are also robust to including financial development at year  $t - 5$ .

Table 2 reports the regression results. Column 1 reports the results when we include all countries in the regression. Columns 2 and 3 show our subsample estimates. For the countries that experienced trade liberalization (column 3) the value added growth of finance-dependent industries is significantly more sensitive to the level of financial development, than it is for the other countries with no change in manufacturing tariffs on average (column 2). The last row interprets the results: Among the countries that experienced a trade liberalization, the value added of an industry at the 75th percentile of external-finance dependence grows 9.7% more in a country at the 75th percentile of financial development compared to the one at the 25th percentile. This difference in growth is only 3.7% for the rest of countries with no trade liberalization. The last column in this table includes an indicator dummy for

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<sup>7</sup>Here is the list of countries: Australia, Brazil, China, Costa Rica, Ecuador, India, Indonesia, Japan, Tunisia, Turkey, and Uruguay.

trade-liberalization countries, and confirms that the difference in the sensitivity between the two sets of countries is indeed statistically significant.<sup>8</sup>

**Summary.** In this section we documented that financial development increases (decreases) value added of finance-dependent industries when tariff barriers are low (large). Furthermore, lower tariff barriers benefit finance-dependent industries (in terms of value added), only in financially developed economies. Moreover, we showed that import tariffs against financially more-developed countries as well as export tariffs with financially less-developed countries (than home country) reduces the sensitivity of finance-dependent sectors to financial development. We further documented that the growth of finance-dependent industries is significantly more sensitive to financial development in countries that experienced a trade liberalization than countries that did not. We conclude that there is a complementary effect between trade barriers and financial development on the value added of finance-dependent industries, which particularly depends on the relative financial development of trade partners.

To rationalize these facts and explain the complementarity between trade barriers and financial development on finance-dependent industries, in the next section we develop a model of international trade with cross-country heterogeneity in financial frictions. In the model, financially more-developed economies have a comparative advantage in finance-dependent industries. When trade barriers are low, financial development is crucial for finance-dependent industries to be able to gain market share in the global economy. Moreover, higher trade barriers hurt finance-dependent sectors only in financially developed economies, due to reducing their comparative advantage in global markets. In addition to the comparative advantage force, which is standard in the literature, our theory introduces a new force that rationalizes why financial development *hurts* finance-dependent sectors when trade barriers are large: Finance-dependent industries earn higher profit margins in financially less-developed economies. This mechanism implies that when trade barriers are large, finance-dependent industries benefit from financial *under*development since they can earn higher profit margins, without losing market shares to their foreign competitors. To support our theory, we directly test this mechanism using ORBIS firm-level data in Section 4.

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<sup>8</sup>Note that our full-sample estimates cannot be directly compared with the results in [Rajan and Zingales \(1998\)](#)—henceforth RZ, since as suggested by our model we use the *log* of Credit/GDP, rather than the *level* as in RZ, as a proxy for financial development. In a specification with the *level* of Credit/GDP, we indeed get a significant coefficient estimate of .142—similar to the point estimate of .118 in RZ, although we use a different time period (due to the availability of tariff data for our trade-liberalization subsample). We note that our differential scale in column 1 is substantially larger than that in RZ, because the cross-country variation in Credit/GDP is much larger in our sample than in RZ. Finally, note that our new results here regarding the economically significant difference between “trade-liberalization” and “the rest” subsamples is robust to using the *level* of Credit/GDP.

Table 2: Trade liberalization and the growth of finance-dependent industries in countries with different financial development.

Value added growth	All countries	The rest	Trade Liberalization	All countries
external-finance dependence × financial development	0.0752*** (0.0222)	0.0474* (0.0251)	0.1250*** (0.0367)	0.0474* (0.0254)
external-finance dependence × financial development × $\mathbf{1}\{\text{trade liberalization}\}$				0.0776** (0.0367)
Initial share of total manufacturing FE – Industry, Country, Year	✓ ✓	✓ ✓	✓ ✓	
Observation	1490	1190	300	1490
Clusters (country×industry)	571	509	182	571
Differential in growth rate (%)	5.9	3.7	9.7	

Notes: An observation is an industry in a country in a year during 1988 to 2003. The left-hand-side variable is the annualized growth of value added minus wage bills (which resembles the value added in our model with no labor) in the following 5 years (difference in *logs* divided by 5). External-finance dependence is defined as the fraction of capital expenditures not financed with cash revenues for the U.S. publicly traded firms in 1980s. Log(financial development) is proxied by the log of total credit to private sector at the country level divided by GDP (standardized by sample minimum and STD) at the beginning of the period. The first column shows regression results for the full sample, while the second (third) column reports the results for subsamples of countries that have not (have) experienced a significant reduction in tariffs over the sample period. The last column shows the full sample triple-diff results by including an indicator dummy for trade-liberalization countries, interacted with the coefficient of interest. We divide countries based on the change in country-level trade-weighted average tariffs that a country imposes on its imports and trade partners impose on the country’s exports in the whole manufacturing sector: whether a country experiences a tariff reduction of at least 3.3% (the 80th percentile of tariff reduction in our data) in the following five years. This criterion gives us a subset of countries, “Trade Liberalization” sample, for which the average reduction in tariffs is around 7% in the sample period, and “the rest” for which tariffs on average almost do not change over time. Standard errors are clustered at the industry×country level, and are reported in parentheses. See appendix A for more details on constructing variables. The last row interprets the results and shows how much an industry at the 75th percentile of external-finance dependence grows faster relative to the one at the 25th percentile, in a country at the 75th percentile of financial development compared to the one at the 25th percentile.

\*\*\* $p < 0.01$  \*\* $p < 0.05$  \* $p < 0.1$

### 3 The Model

To rationalize the empirical facts documented in Section 2, this section develops a stylized model of international trade with cross-country heterogeneity in financial frictions. We first describe and analyze a closed economy and then introduce international trade.

#### 3.1 The Environment

There are two sectors in the economy, a non-finance-dependent sector ( $n$ ) and a finance-dependent sector ( $f$ ). Sector  $n$  produces a homogeneous final good, and sector  $f$  produces a continuum of varieties indexed by  $A$  with the cumulative distribution function  $F : [\underline{A}, \bar{A}] \rightarrow [0, 1]$ . In both sectors, capital  $k$  is the sole factor of production. In our model capital fully depreciates. There is a unit mass of agents each endowed with  $e > 0$  units of capital. We assume the technology of producing all goods (in both sectors) is common to all individuals in the economy and product markets are competitive.

The non-finance-dependent good, which is the model numeraire, is produced using the following Constant Returns to Scale (CRS) technology:

$$y_n(k) = A_n k, \tag{5}$$

where  $A_n$  is the productivity in sector  $n$ . The technology of producing variety  $A$  in the finance-dependent sector is:

$$y_f(k; A) = \begin{cases} 0 & k < I \\ Ak & k \geq I \end{cases} \tag{6}$$

where  $I$  is the minimum scale of operation for all varieties in this sector, and  $A$  is the productivity of producing this variety.<sup>9</sup> There is time-to-build friction in this sector. We assume  $e < I$ ; therefore, to operate in this sector producers need to rely on external-financing, i.e., to borrow capital from consumers. We assume there are two sub-periods in our model. In the first sub-period individuals lend capital to producers in sector  $f$ . In the second sub-period production takes place and return on loans are paid to lenders. Everyone enjoys utility from consuming goods at the end of sub-period 2.

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<sup>9</sup>The model easily extends to the one with multiple finance-dependent sectors with different  $I$ . To show the main idea in the simplest setup, however, we here present a model with only one finance-dependent sector.

The representative consumer has a Cobb-Douglas utility function over the two final goods:

$$U = C_n^\theta C_f^{1-\theta}, \quad (7)$$

where  $C_n$  is the consumption of good  $n$ , and  $C_f$  is the composite finance-dependent good, which is a CES aggregate over consumption of sector  $f$  varieties:

$$C_f = \left[ \int_A C(A)^{\frac{\sigma-1}{\sigma}} dF(A) \right]^{\frac{\sigma}{\sigma-1}}, \quad (8)$$

with  $\sigma > 1$  being the elasticity of substitution between varieties.

### 3.2 Financing Friction

The financial market is imperfect. We model financing frictions in the form of strategic default: A borrowing firm may default on the loan and run away with the fraction  $1 - \eta$  of the firm revenue. In the event of a default, lenders would receive nothing. The parameter  $\eta \in [0, 1]$  measures the severity of financial friction, where higher  $\eta$  represents less severe financial friction.  $\eta = 1$  represents a frictionless economy with a perfect credit market.  $\eta$  represents the financial development of the country.

The borrowing/lending contracts in equilibrium feature no default, since there is no uncertainty in our model and lenders would receive zero payoff upon a borrower's default. To produce a finance-dependent variety at scale  $k \geq I$ , an individual needs to borrow  $k - e$  units of capital in the financial market. Hence, the following no-default condition holds in equilibrium for producing variety  $A$  at scale  $k(A)$ :

$$(1 - \eta) p(A) A k(A) \leq p(A) A k(A) - R (k(A) - e), \quad (9)$$

where  $p(A)$  is the equilibrium price of variety  $A$  in sector  $f$ , and  $R$  is the equilibrium gross return rate on loans. The no-default condition states that the individual's payoff from defaulting on the loan (the LHS) needs to be less than what she would earn if she repays the loan (the RHS).

Define  $\gamma(A)$  as the profit margin, i.e., sales over total costs, of variety  $A$  produced in sector  $f$ :

$$\gamma(A) := \frac{p(A) A k(A)}{R k(A)} = \frac{p(A) A}{R}. \quad (10)$$

The price  $p(A)$  is an equilibrium object, so is the profit margin  $\gamma(A)$ . Given  $\gamma(A)$ , we can

re-write the no-default condition (9) as

$$(1 - \eta\gamma(A))k(A) \leq e . \tag{11}$$

If  $\eta\gamma(A) \geq 1$ , then inequality (11) would always hold, no matter what the size of operation  $k(A)$  is. In this case, there would be no limit on borrowing. This is the case because a high enough profit margin eliminates the incentives to default (even if the payoff to default is positive  $\eta > 0$ ), and therefore borrowers may raise funds with no financing constraint. In a frictionless economy (i.e.,  $\eta = 1$ ),  $\eta\gamma(A) \geq 1$  always holds.<sup>10</sup>

If  $\eta\gamma(A) < 1$ , the no-default condition (11) would imply that the scale of operation for variety  $A$  cannot exceed the threshold  $k_c(A)$ :

$$\eta\gamma(A) < 1 \Rightarrow k(A) \leq k_c(A) := \frac{e}{1 - \eta\gamma(A)} . \tag{12}$$

The scale threshold  $k_c(A)$  depends on three variables. First, the higher the endowment  $e$ , the higher the amount of capital that can be borrowed. Second, the scale threshold is increasing in  $\eta$ . As  $\eta$  rises, the payoff to default falls, and therefore more capital can be raised via external financing. Finally, the most consequential determinant of the borrowing limit and  $k_c(A)$  in our setup is the profit margin  $\gamma(A)$ . As the profit margin  $\gamma(A)$  rises, production of the finance-dependent variety  $A$  becomes more profitable, and the loss from default goes up, which lowers the incentive for defaulting on the loan. Note that the borrowing constraint in our setup is endogenous and represents a *forward-looking* financing friction (Albuquerque and Hopenhayn, 2004; Brooks and DAVIS, 2020); that is a borrower takes into account the end-of-period revenue of the firm in her decision to whether to default on a loan or not. As a result, the borrower may credibly commit not to default if the firm's end-of-period profit—determined by the equilibrium profit margin  $\gamma(A)$ , is high, and therefore may raise more funds from outside investors in advance. This is indeed why the profit margin  $\gamma(A)$  enters the borrowing limit and the amount of capital that can be externally financed rises with the profit margin.<sup>11</sup>

**Discussion.** In our model, although product markets are competitive, the profit margin  $p(A)A/R$  may be greater than one, which means that the marginal revenue of production is greater than the marginal cost; but the firm may not expand because of the financing

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<sup>10</sup>Note that  $\gamma(A) \geq 1$ , because otherwise producing variety  $A$  would deliver a negative profit and therefore this variety would not be produced.

<sup>11</sup>Note that while our model is static, we do have forward-looking financing constraint in our setup, since our model features two subperiods, with fundraising and investment in the first subperiod, and production and loan repayment at the end of the second subperiod.

constraint. If one takes the shadow price of financing constraint into account when calculating the marginal cost, then the marginal revenue and the marginal cost of production would be equal. In reality, constrained firms may pay a higher interest rate to intermediaries who finance firms on behalf of investors in order to mitigate the financing constraint. This additional interest payment reflects what the shadow price of constraint is in our model. In any case, what matters in deriving our model implications is that there exists a wedge between firms' marginal revenue and the opportunity cost of capital ( $R$ ) for investors. In reality, it would be either the case as in our model in which firm owners pay the return rate  $R$  and enjoy a positive profit, or that there would be no profits for firm owners but a return greater than the frictionless benchmark  $R$  is paid to rent capital from intermediaries. We cannot distinguish between these two cases and both scenarios have the same empirical predictions for the value added minus wage bill (i.e., profits plus capital rent) as well as welfare implications discussed in this paper.

### 3.3 Equilibrium Profit Margin

In equilibrium, consumers and firms optimize, and markets for good  $n$ , sector  $f$  varieties, and capital clear. Given the Cobb-Douglas utility function (7), both sectors produce in equilibrium. Hence, the gross return rate  $R$  in equilibrium is equal to the productivity of sector  $n$ :

$$R = A_n . \quad (13)$$

This is the case because the production in sector  $n$  features constant returns to scale and is common to all individuals, so it generates zero profits in equilibrium.

To derive the equilibrium profit margin of variety  $A$  in sector  $f$ ,  $\gamma(A)$ , we first characterize supply function of variety  $A$ . As appendix B shows, this supply function can be written as

$$Y(A; \gamma(A)) = \begin{cases} 0 & \gamma(A) < \gamma_c \\ 0 \leq \cdot \leq \frac{Ae}{1-\eta\gamma_c} & \gamma(A) = \gamma_c \\ \frac{Ae}{1-\eta\gamma(A)} & \gamma_c < \gamma(A) < \eta^{-1} \\ +\infty & \gamma(A) \geq \eta^{-1} \end{cases} \quad (14)$$

where the profit margin threshold  $\gamma_c$  is defined as

$$\gamma_c := \max\{1, (1 - e/I)\eta^{-1}\} , \quad (15)$$

Note that for the production of variety  $A$  to be feasible, it is required that the scale limit



implied by the financing constraint  $k_c(A)$  is greater than  $I$ , which implies that the profit margin  $\gamma(A)$  must be (weakly) greater than  $(1 - e/I)\eta^{-1}$ . This means that in an environment with low internal resources  $e$  relative to the minimum operation size  $I$ , or an economy with severe financing frictions (i.e., low  $\eta$ ), production of a finance-dependent variety is supported by a high profit margin  $\gamma(A)$  (and therefore, a high price  $p(A)$ ).

Given the supply function (14), appendix B shows that all varieties in sector  $f$  share the same profit margin in equilibrium:

$$\forall A : \quad \gamma(A) = \gamma_c = \max\{1, (1 - e/I)\eta^{-1}\} . \quad (16)$$

The intuition behind this result is that since the production technology of each variety is common to all individuals, each variety is produced at the lowest feasible profit margin (and price), and producers operate at the minimum scale  $I$  in equilibrium.<sup>12</sup> Total quantity of a variety  $A$  in equilibrium is determined by the extensive margin—number of firms, and is solved in equilibrium via the demand curve.

As equation (16) show, profit margin for a variety in the finance-dependent sector  $f$ ,  $\gamma_c$ , rises as either the financing friction gets more severe ( $\eta$  falls) or external-finance dependence rises (i.e., higher  $1 - e/I$ ). To elaborate, as finance dependence rises (i.e.,  $e/I$  falls), a higher profit margin is needed to raise enough external funds to support sector  $f$  production, as long as  $\eta$  is not high; if  $\eta$  is “high enough,” financial constraint would not bind, which in turn eliminates the profit margin. This pattern is the key mechanism in our model that will help explaining the empirical facts documented in Section 2. We summarize this implication below.

**Model’s Implication 1** (Profit margin in finance-dependent sectors). Firms in finance-dependent industries earn higher profit margins in financially less-developed economies.

We directly test this prediction of the model in Section 4 using ORBIS firm-level data for 11 European countries. Note that this pattern of profit margin against finance dependence and financial development does not reflect variations in productivity. To elaborate, even if finance-dependent industries are less productive in financially less-developed economies and therefore have higher relative prices, their output would also be less in such countries, so the profit margin—defined as sales over cost (see equation 10)—would be determined solely by the extent of industry-level finance dependence ( $e/I$ ) as well as country-level financial development ( $\eta$ ), irrespective of productivity.

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<sup>12</sup>In case financial constraint is not binding, i.e.,  $\gamma_c = 1$ , firms’ size would be indeterminate.

**Discussion.** Since the presence of profit margin explained above is at the core of our model, it is worth comparing our result for the profit margin to a more standard setup with collateral constraints and backward-looking financing frictions. Suppose we instead assumed that individuals can borrow up to a proportion  $\eta$  of their initial endowment  $e$ , i.e.,  $k - e < \eta e$ . Then if  $\eta$  is small such that  $\eta < I/e - 1$ , no firm in the finance-dependent sector would be able to operate at the minimum scale  $I$ , *irrespective of the equilibrium price of the good*. On the other hand, if  $\eta$  is large enough such that  $\eta > I/e - 1$ , all individuals may borrow enough to operate at least at the minimum scale  $I$ , again irrespective of the equilibrium price of the good, and therefore the profit margin would be reduced all the way down to zero by equilibrium forces (since the production technology is common). Producers in the finance-dependent sector would not enjoy economic profits in any case, which is in contrast with the firm-level facts we provide in Section 4 (that firms in finance-dependent sectors earn higher profit margins in financially underdeveloped economies) and with our established industry-level facts in Section 2 (that finance-dependent industries benefit from financial *underdevelopment* when trade barriers are large).

### 3.4 Closed Economy

**Consumption.** Maximizing individuals' utility function (7) yields the following First Order Conditions:

$$C_n = \theta Y , \quad (17)$$

$$C_f = (1 - \theta)Y/P_f , \quad (18)$$

where  $Y = P_f C_f + C_n$  is the aggregate income of the economy, and  $P_f$  is the aggregate price index of the composite finance-dependent good:

$$P_f^{1-\sigma} = \int_A p(A)^{1-\sigma} dF(A) . \quad (19)$$

Using the definition of profit margin  $\gamma(A)$  in equation (10) along with equations (13) and (16) we obtain

$$P_f = \gamma_c A_n / A_f , \quad (20)$$

where  $A_f$  is defined as the aggregate productivity of sector  $f$ :

$$A_f := \left[ \int_A A^{\sigma-1} dF(A) \right]^{1/(\sigma-1)} . \quad (21)$$

**Production and capital.** Markets for the non-finance-dependent good and finance-dependent varieties clear in equilibrium. The demand for capital in sector  $n$  is derived as

$$K_n = Y_n/A_n = \theta Y/A_n , \quad (22)$$

where  $Y_n$  is the production in sector  $n$ , and we substitute the market clearing condition  $Y_n = C_n$  from (17). The demand for capital in sector  $f$  is the sum of capital employed in producing all finance-dependent varieties:

$$K_f = \frac{(1 - \theta)Y}{\gamma_c A_n} , \quad (23)$$

where we use the definition of the equilibrium profit margin and the market clearing for each variety. See derivations in appendix B.

**Income.** In equilibrium, the demand for capital equals the supply of capital:

$$K_n + K_f = e . \quad (24)$$

Total supply of capital equals  $e$ , since there is a unit mass of individuals in the economy, each endowed with  $e$  units of capital. Substituting for  $K_n$  and  $K_f$  from equations (22)-(23) in (24) yields the aggregate income of the economy:

$$Y = \frac{\gamma_c A_n e}{\theta \gamma_c + 1 - \theta} . \quad (25)$$

**Borrowing.** Since sector  $f$  producers operate at the scale  $I$  (as discussed above), the fraction  $(1 - e/I)$  of total capital employed in sector  $f$  is externally financed, and total borrowing (or lending) in equilibrium is  $B = (1 - e/I)K_f$ . Using (23) joint with (25), we can derive total borrowing in equilibrium as

$$B = \left(1 - \frac{e}{I}\right) \frac{(1 - \theta)e}{\theta \gamma_c + 1 - \theta} . \quad (26)$$

Total borrowing rises with both  $\eta$  and external-finance dependence  $1 - e/I$ . As  $\eta$  rises, the finance-dependent sector can raise more external funds, and therefore  $K_f$  rises and  $K_n$  falls. Total credit over GDP is  $B/Y = \frac{1-\theta}{A_n} \eta$ . This is indeed why we use the log of total credit over GDP as our main proxy for  $\eta$  in our empirical specifications.

**Profit and value added.** Since capital fully depreciates in our model, net value added (i.e., economic profit plus net capital rent) in sector  $n$  and  $f$ , respectively, are

$$V_n = Y_n - K_n = \frac{\theta\gamma_c(A_n - 1)e}{\theta\gamma_c + 1 - \theta}, \quad (27)$$

$$V_f = P_f Y_f - K_f = \frac{(1 - \theta)(\gamma_c A_n - 1)e}{\theta\gamma_c + 1 - \theta}, \quad (28)$$

where  $Y_f$  is sector  $f$  production, and  $Y_f = C_f$  in equilibrium. As financial friction severity falls (i.e.,  $\eta$  rises), total borrowing rises and capital moves out of sector  $n$  to sector  $f$ , which in turn reduces the scale of production as well as the value added of sector  $n$ .<sup>13</sup> This shift in resources increases the scale of operation in sector  $f$ , but reduces economic profits and value added of this sector, since the profit margin  $\gamma_c$  in sector  $f$  falls as financial frictions fall.<sup>14</sup> This is the case because in a financially underdeveloped economy production in the finance-dependent sector is supported by a high profit margin  $\gamma_c$  (to eliminate the incentive to default on loans), which in turn generates high economic profits. Overall, while resources move to the finance-dependent sector, equations (27) and (28) show that  $V_f/V_n$  falls with  $\eta$  in a closed economy.<sup>15</sup> In other words, financial development *hurts* profits and value added of the finance-dependent sector (relative to sector  $n$ ). This implication of the model replicates the empirical fact in Section 2 regarding the effects of financial development on finance-dependent sectors when trade barriers are large. We summarize this result below.

**Model's Implication 2** (Value added, closed economy). Value added in sector  $f$  relative to sector  $n$ ,  $V_f/V_n$ , is decreasing in  $\eta$  in a closed economy; that is financial development hurts the finance-dependent sector (relative to sector  $n$ ) in a closed economy.

*Proof.* Divide equation (28) by (27), and the result immediately follows.

It is important to note that while the finance-dependent producers benefit from financial *underdevelopment* in a closed economy, consumers of such an economy burden the welfare cost of financing frictions by paying a higher price for finance-dependent goods. In other words, financial frictions make the finance-dependent producers better off at the expense of consumers, and a closed economy overall suffers from the financing friction as we discuss below.

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<sup>13</sup>Note that the net value added in sector  $n$  is just the net capital rent, which is linear in the size of production.

<sup>14</sup>When financial friction is low enough such that  $(1 - e/I)\eta^{-1} \leq 1$ , financial constraint does not bind and therefore the distortionary wedge between price and marginal cost in sector  $f$  disappears, and further reduction in financial frictions affects neither borrowing nor production.

<sup>15</sup>In our model the elasticity of substitution between sector  $n$  and  $f$  is equal to one, i.e., the utility function is Cobb-Douglas. Our results are nonetheless robust to assuming a CES utility function provided that the elasticity of substitution between sector  $f$  and  $n$  is small enough.

**Welfare.** The representative consumer's welfare in our model is  $U = \frac{Y}{P_f^{1-\theta}}$ , which can be simplified to

$$U = \Gamma e A_f^{1-\theta} A_n^\theta, \quad (29)$$

where

$$\Gamma := \frac{\gamma_c^\theta}{\theta \gamma_c + 1 - \theta}. \quad (30)$$

$\Gamma$  is less than one and decreasing in the equilibrium profit margin  $\gamma_c$ . Therefore, welfare is increasing in  $\eta$ , and is decreasing in the external-finance dependence  $1 - e/I$ . The utility share  $\theta$  controls the sensitivity of welfare to  $\eta$  and  $1 - e/I$ . As financing friction gets less severe, sector  $f$  profit margin  $\gamma_c$  falls and its production rises, which in turn raises welfare. Notice that if the profit margin hits the lower bound of one, further increase in  $\eta$  does not impact welfare. Since financial friction is the only friction in the model economy, no financial friction (i.e.,  $\gamma_c = 1$ ) would be optimal in the closed economy, i.e., yielding the highest welfare. Section 5 will, however, show that this is not necessarily the case in an open economy.

### 3.5 International Trade

The world consists of  $M$  countries. Countries are heterogeneous in terms of their financial friction severity, i.e., each country has a distinct  $\eta \in \{\eta_i\}_{i=1}^M$ . Other than heterogeneity in financing frictions, countries are homogeneous. This means that individuals in all countries share the same endowment  $e$ , and have access to the same production technologies (5)-(6) with the same productivity distribution  $F(\cdot)$ .

Preferences in country  $i$  are represented by

$$U^i = C_n^i{}^\theta C_f^i{}^{1-\theta}, \quad (31)$$

where  $C_n^i$  and  $C_f^i$  are country  $i$ 's consumption of non-finance dependent and finance-dependent goods, respectively. We assume national product differentiation, i.e., varieties produced in a country are distinct from those in other countries, and that the composite finance-dependent good  $C_f^i$  is a CES aggregate over all varieties produced across the world:

$$C_f^i = \left[ \sum_j \int_A C^{j \rightarrow i}(A)^{\frac{\sigma-1}{\sigma}} dF(A) \right]^{\frac{\sigma}{\sigma-1}}, \quad (32)$$

where  $C^{j \rightarrow i}(A)$  is country  $i$ 's demand for variety  $A$  produced in country  $j$ .

We assume all economies are open to international trade, and international trade is frictionless. As a result, countries share the same prices for all goods.<sup>16</sup> Moreover, we assume that capital is freely mobile between countries, and therefore capital lenders across the world would receive the same rate of return  $R = A_n$  in equilibrium.<sup>17</sup> In the free trade equilibrium, consumers and firms optimize, global markets for good  $n$ , sector  $f$  varieties, and capital clear, and each country satisfies a balance of payments. We solve for the free trade equilibrium below.

**Consumption, import, and export.** We start by specifying country  $j$ 's demand for variety  $A$  produced in country  $i$ ,  $C^{i \rightarrow j}(A)$ , using the preferences in (31):

$$C^{i \rightarrow j}(A) = (p^i(A)/P_f)^{-\sigma} (1 - \theta) Y^j / P_f, \quad (33)$$

where  $Y^j$  is the aggregate income in country  $j$  and  $P_f$  is the price index for the composite good  $f$ , both to be defined below.

In the same fashion as we derived in Section 3.3, we can show that the producer of variety  $A$  sourced from country  $i$  earns the profit margin  $\gamma_c^i := \max\{1, (1 - e/I)\eta_i^{-1}\}$ . The Model Implication 1 therefore holds in open economies as well: Finance-dependent producers earn higher profit margins in financially less-developed economies.

The price of variety  $A$  (across the world) is obtained by  $p^i(A) = \gamma_c^i R/A$ , which we use to solve for  $P_f$ , the world CES price index for the composite good  $f$ :

$$P_f = \gamma_w A_n / A_f, \quad (34)$$

where  $A_f$  is defined in equation (21), and  $\gamma_w$  is the *world profit margin* defined as

$$\gamma_w := \left[ \sum_i (\gamma_c^i)^{1-\sigma} \right]^{1/(1-\sigma)}. \quad (35)$$

The world demand for variety  $A$  produced in country  $i$ ,  $Y^i(A)$ , can be written as

$$Y^i(A) = \sum_j C^{i \rightarrow j}(A) = (\gamma_c^i R / A P_f)^{-\sigma} \cdot (1 - \theta) Y / P_f, \quad (36)$$

where  $Y$  stands for the world income, i.e.,  $Y = \sum_{i=1}^M Y^i$ . Total exports of the finance-

<sup>16</sup>Recall that the homogeneous non-finance dependent good  $n$  is the model numeraire.

<sup>17</sup>To satisfy market clearing conditions for all goods, we need to have  $R = A_n$ ; This is because if  $R > A_n$  ( $R < A_n$ ), the non-finance-dependent good (finance-dependent goods) would not be produced.

dependent sector from country  $i$  to  $j$  is:

$$X^{i \rightarrow j} = \int_A p^i(A) C^{i \rightarrow j}(A) dF(A) = \left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma} (1-\theta) Y^j, \quad (37)$$

which is increasing in  $\eta_i$ . This expression shows that an economy with less severe financing frictions has a comparative advantage in the finance-dependent sector  $f$ , as shown below.

**Model's Implication 3** (Comparative advantage in the finance-dependent sector). Total exports of finance-dependent varieties from country  $i$  relative to country  $j$  to an arbitrary destination  $k$  is weakly decreasing (increasing) in the financing friction severity of country  $i$  (country  $j$ ).

*Proof.* Use equation (37) to write  $\log(X^{i \rightarrow k}/X^{j \rightarrow k}) = (1-\sigma) \log(\gamma_c^i/\gamma_c^j) = (\sigma-1)[\log(\eta_i) - \log(\eta_j)]$ . The last equality holds assuming that financial constraints are binding in both countries (i.e.,  $\eta_i$  and  $\eta_j$  being sufficiently small:  $\eta_i < 1 - e/I$  and  $\eta_j < 1 - e/I$ ). If either  $\eta_i$  or  $\eta_j$  is large enough such that  $\eta_i > 1 - e/I$  or  $\eta_j > 1 - e/I$ , then  $\log(X^{i \rightarrow k}/X^{j \rightarrow k})$  would not change with  $\eta_i$  or  $\eta_j$ , respectively, which confirms the pattern being *weakly* increasing (decreasing).  $\square$

This pattern of specialization is a well-documented fact in the literature (see, e.g., Beck, 2002, 2003; Svaleryd and Vlachos, 2005; Hur, Raj and Riyanto, 2006; Becker, Chen and Greenberg, 2012; Manova, 2013). To verify this pattern in our data, we follow Costinot (2009) and show that financially developed economies have a revealed comparative advantage in finance-dependent sectors. To this end, we use Comtrade trade data for more than 160 countries in 27 three-digit ISIC manufacturing sectors and proxies for country-level financial development and industry-level finance dependence that are consistent with our model. See appendix C for more details.

The interpretation of this pattern of specialization is twofold (just as in the cited literature): One may argue that the reason behind the comparative disadvantage of finance-dependent industries in financially less-developed economies is (partly) that such industries are simply less productive in less-developed countries, not just that financial frictions on their own directly affect production, export, and competitiveness of finance-dependent industries (having controlled for productivity). In contrast, the empirical prediction that we establish in the Model's Implication 1 which we test in Section 4 can identify the specific impact of financial frictions on comparative advantage through endogenously distorted prices and the resulting profit margins (having controlled for productivity).



**Capital market and global income.** We can now derive the global demand for capital in sector  $f$ :

$$K_f = \sum_i K_f^i = \sum_i \int_A \frac{Y^i(A)}{A} dF(A) = \frac{(1-\theta)Y}{\gamma_w A_n} \sum_i (\gamma_c^i / \gamma_w)^{-\sigma}, \quad (38)$$

where  $K_f^i$  is the capital demand by sector  $f$  in country  $i$ . Global demand for capital by sector  $n$  is

$$K_n = \sum_i K_n^i = \theta Y / A_n, \quad (39)$$

where  $K_n^i$  is the capital demand by sector  $n$  in country  $i$ . Since there are  $M$  countries each with the stock of capital  $e$ , the world market clearing condition for capital satisfies

$$K_f + K_n = Me. \quad (40)$$

Using capital market equations (38)-(40), we solve for the world income:

$$Y = \frac{\hat{\gamma}_c A_n M e}{\theta \hat{\gamma}_c + (1-\theta)}, \quad (41)$$

where

$$\hat{\gamma}_c := \frac{\gamma_w}{\sum_i (\gamma_c^i / \gamma_w)^{-\sigma}} = \frac{\sum_i (\gamma_c^i)^{1-\sigma}}{\sum_i (\gamma_c^i)^{-\sigma}}. \quad (42)$$

**Balance of payments and country income.** Since capital is freely mobile between countries and receives the same return rate  $R = A_n$  across the world, there are no reasons for countries to import the non-finance-dependent good, because each country can meet its demand for this good by importing capital from other countries. Therefore, we assume each country produces the non-finance-dependent good to satisfy its domestic demand.<sup>18</sup> We also assume the balance of payments in equilibrium holds for each country  $i$ , i.e., net imports of finance-dependent varieties equals the value of exported capital:

$$\underbrace{(1-\theta)Y^i}_{\text{country } i\text{'s total imports}} - \underbrace{\left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma}(1-\theta)Y}_{\text{country } i\text{'s total exports}} = A_n \underbrace{\left[ e - \frac{(1-\theta)Y}{\gamma_w A_n} \left(\frac{\gamma_c^i}{\gamma_w}\right)^{-\sigma} - \frac{\theta Y^i}{A_n} \right]}_{\text{country } i\text{'s capital export}}, \quad (43)$$

<sup>18</sup>Note that this assumption is without loss of generality, since producing good  $n$  and exporting capital are isomorphic.

where both imports and exports on the LHS include domestic sales.<sup>19</sup> The second and third terms on the RHS represent the capital demand by country  $i$ 's finance-dependent sector (serving the global market) and non-finance-dependent sector (serving the domestic market), respectively.

To solve for each country's income, insert the world income (41) into the balance of payment equation (43) and simplify:

$$Y^i = A_n e \left[ 1 + (1 - \theta) \left( \frac{\gamma_c^i}{\gamma_w} \right)^{1-\sigma} \left( 1 - \frac{1}{\gamma_c^i} \right) \frac{\hat{\gamma}_c M}{\theta \hat{\gamma}_c + 1 - \theta} \right], \quad (44)$$

which, along with equations (34) and (35) can be used to compute welfare of each country  $i$ ,  $W^i = Y^i / P_f^{1-\theta}$ . Section 5 will explore welfare implications of trade openness and those of financial development.

**Profit and value added.** Net value added of each sector in country  $i$  equals

$$V_n^i = \theta Y^i \left( 1 - \frac{1}{A_n} \right), \quad (45)$$

$$V_f^i = \left( \frac{\gamma_c^i}{\gamma_w} \right)^{1-\sigma} (1 - \theta) Y \left[ 1 - \frac{1}{A_n \gamma_c^i} \right]. \quad (46)$$

The value added of sector  $n$  is a linear function of income  $Y^i$ , since each country produces good  $n$  for its own consumers. Financial frictions influence the value added of sector  $f$  through two forces. On the one hand, as  $\eta_i$  rises country  $i$  gains a comparative advantage in sector  $f$  and gets a larger sales share in the global market for finance-dependent varieties. This force is captured by the term  $(\frac{\gamma_c^i}{\gamma_w})^{1-\sigma} (1 - \theta) Y$  in the expression above. On the other hand, as  $\eta_i$  rises the profit margin of country  $i$ 's finance-dependent sector  $\gamma_c^i$  falls, which reduces the value added of this sector. This force is captured by the second term,  $1 - \frac{1}{A_n \gamma_c^i}$ , in the expression above. Appendix B shows that the first force dominates and  $V_f^i$  rises with  $\eta_i$ , provided that the elasticity of substitution  $\sigma$  is large enough, i.e.,  $\frac{\sigma}{\sigma-1} \leq A_n$ .

Comparing sectoral value added in autarky (equations (27)-(28)) to those under free trade (equations (45)-(46)) confirms that the model can rationalize the empirical facts presented in section 2 regarding the complementarity effect between financial development and trade barriers on finance-dependent sectors. In particular, the model implies that financial development increases the value added of finance-dependent industries (relative to the non-finance dependent sector), only in an open economy (i.e., when trade barriers are low).

<sup>19</sup>Country  $i$ 's total imports and exports are  $\sum_j \int_A p^j(A) C^{j \rightarrow i}(A) dF(A)$  and  $\sum_j \int_A p^i(A) C^{i \rightarrow j}(A) dF(A)$ , respectively, both including domestic sales.

In addition, the model predicts that reducing trade barriers increases the value added of finance-dependent industries (relative to the non-finance dependent sector), only in financially developed economies. These results are summarized below.

**Model's Implication 4** (Value added, open economy). Provided that  $\sigma$  is large enough such that  $\frac{\sigma}{\sigma-1} \leq A_n$ , (i)  $V_f^i/V_n^i$  is increasing in  $\eta_i$  in a small open economy  $i$ ; (ii) There exists a cutoff  $\eta^* < 1 - e/I$  such that opening up to trade increases  $V_f^i/V_n^i$  if and only if  $\eta_i > \eta^*$ ; that is the finance-dependent sector benefits from lower trade barriers if and only if the economy is financially developed; (iii) The gap between  $V_f^i/V_n^i$  under free trade (i.e., low trade barriers) and that under autarky (i.e., large trade barriers) rises with  $\eta_i$ ; that is the finance-dependent sector benefits *more* from lower trade barriers if and only if the economy is financially *more*-developed.

*Proof.* See appendix B.

The results (i), (ii), and (iii) above rationalize the empirical facts presented in Section 2.1, Section 2.2, and Section 2.3, respectively. The intuition behind these results is as follows. If a financially less-developed economy  $i$  opens up to trade, the value added in the finance-dependent sector would shrink (relative to sector  $n$ ); this is because such an economy has a comparative disadvantage in finance-dependent sectors, while these finance-dependent sectors could earn an endogenously high economic profit (and therefore generate high value added) under autarky, due to financing frictions. A reduction in financial frictions in this open economy (i.e., increasing  $\eta_i$ ) would reduce economic profits in this sector, but helps the finance-dependent industry gain a comparative advantage in the global market and a higher market share, and therefore generate more value added (relative to sector  $n$ ). In contrast, financial frictions reduction in a closed economy would reduce the profit margin and therefore the value added of the finance-dependent sector relative to the non-finance dependent sector (as discussed in model's implication 2). Therefore, there is a complementarity effect between financial development and trade openness on the value added of finance-dependent industries; specifically, a reduction in financial frictions would increase the gap between  $V_f^i/V_n^i$  under low trade barriers and that under high trade barriers, which is in line with the triple-difference empirical fact documented in Section 2.3.

## 4 Finance Dependence, Financial Development, and Profit Margin: Evidence from Firm-Level Data

Finance-dependent industries earn higher profit margins in financially less-developed economies; as explained above, this is the novel mechanism in our model that rationalizes why financial

development hurts value added of finance-dependent sectors when trade barriers are large, as documented in Section 2. In this section, we directly test this mechanism using cross-country firm-level data. To this end, we run the following difference-in-difference regression:

$$\log[\text{Profit Margin}]_{ic} = \theta_i + \delta_c + \beta [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_c + \epsilon_{ic} , \quad (47)$$

where  $\theta_i$  and  $\delta_c$  are industry and country fixed effects, respectively, and  $\epsilon_{ic}$  is the error term. “Fin Dep” and “Fin Dev” are our proxies for finance dependence and financial development, respectively. To run this regression, we use ORBIS data set which provides firm-level balance-sheet information on both large and small firms in several countries (Gopinath et al., 2017). We use data from 2000-2009 for 11 European countries, for which ORBIS has good data coverage. Table A.2 reports our sample countries. Industries are three-digit Standard Industrial Classification (SIC) codes in manufacturing.

Since variations in the right-hand-side variables are at the industry-country level, we aggregate the left-hand-side variable to the industry-country level as well. To this end, for each industry-country pair we take the cross-firm-year median of value added minus wage bill, divided by fixed assets. See details in appendix A. Consistent with the definition of profit margin in our model, our constructed profit margin measures economic profits plus capital rent, scaled by the size of capital.<sup>20</sup> Here we do not include other variable costs (i.e., labor and material) in the denominator, since we assume wage bill and material costs are not subject to financial frictions and are optimized out in the firm’s cost minimization problem. The results are nonetheless robust to defining the profit margin as revenue over total variable costs, i.e., wage bill plus material costs plus rental cost of capital.<sup>21</sup> This robustness measure also helps addressing the potential concern that finance-dependent industries may be more capital intensive in financially more-developed economies, which puts a downward pressure on our benchmark profit margin measure (i.e., value added minus wage bills divided by fixed assets) in such industries.

We use country-level financial development in 2000 (i.e., beginning of our sample), using three different proxies (reported in table A.2): private credit by banks and other financial institutions (% GDP), financial system deposits (% GDP), and banks’ overhead costs (% total

<sup>20</sup>While the denominator of profit margin in our model is  $Rk$ , we drop  $R$  in our profit margin measure here. Note that this would not matter since our diff-in-diff specification is comparing different sectors within a country, and sectors face the same economy-wide rate  $R$ .

<sup>21</sup>We measure the rental cost of capital as the 10-year government bond yields in each country plus a 10% depreciation rate, times fixed assets. Note that consistent with our theoretical model, our profit margin measure does *not* intend to measure price over *implied* marginal cost, i.e., taking into account the shadow price of financial constraint in measuring marginal cost. Indeed, price over marginal cost plus shadow price of financial constraint is equal to one in our model, and does not vary with finance dependence or financial development.

assets).<sup>22</sup> As discussed in Section 2, we use two proxies for industry-level financial vulnerability: Rajan-Zingales external-finance dependence and asset intangibility, both measured using U.S. publicly traded firms in the Compustat data set. See appendix A for more details.

Table 3 summarizes the regression results, where panel A and B report the results using external-finance dependence and asset intangibility, respectively, as proxies for industry-level financial vulnerability. Estimates indicate that firms in more finance-dependent industries earn higher profit margins in financially less-developed economies. This result confirms the key channel in our model summarized in the model's implication 1. The differential scale in table 3 interprets the diff-in-diff coefficients and shows that the results are economically significant: profit margins are between 5%-20% (depending on proxies for financial development and financial vulnerability) larger in the 75th percentile of financial vulnerability relative to 25th percentile, in the financially least- compared to the most-developed country in our sample of 11 European countries.

Although tables 1 and 3 employ two completely different data sources, the magnitudes of results in these two tables line up reasonably well. To elaborate, as the fourth column in table 1 reports for *high-tariff* countries, the value added of an industry at the 75th percentile of finance dependence relative to the one at the 25th percentile is 13.7% *smaller* in a country at the 75th percentile of financial development compared to the one at the 25th percentile. Through the lens of our model and as verified in table 3, this empirical fact is explained by that while financial development increases the size of finance-dependent sectors, it would reduce profit margins in these sectors. Therefore, one expects that the variations in profit margins (in terms of the differential scale) to be (at least) in the order of 13.7%, which is indeed close to what we find in table 3.<sup>23</sup>

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<sup>22</sup>Note that higher banks' overhead costs are interpreted as lower financial development.

<sup>23</sup>This conclusion is based on the fact that the dispersion in our financial development proxy (Credit/GDP) in table 3 and in table 1 are quite similar. In particular, the highest-lowest gap in Credit over GDP in our ORBIS sample in table 3 is 0.6, and the 75th-25th percentile gap in the same measure among countries in table 1 is 0.55.

Table 3: Finance dependence, financial development, and profit margin

log(Profit margin) {Panel A}			
external-finance dependence × log(total private credit/GDP %)	-0.221*** (0.056)		
external-finance dependence × log(financial system deposits/GDP %)		-0.166*** (0.045)	
external-finance dependence × log(banks overhead costs/total assets %)			0.022 (0.026)
Differential scale (%)	8.41	5.21	insignificant
log(Profit margin) {Panel B}			
asset intangibility × log(total private credit/GDP %)	-1.405*** (0.284)		
asset intangibility × log(financial system deposits/GDP %)		-1.092*** (0.239)	
asset intangibility × log(banks overhead costs/total assets %)			0.540*** (0.129)
Differential scale (%)	19.85	12.72	9.43
Industry FE	✓	✓	✓
Country FE	✓	✓	✓
# Firms	3,254,394	3,071,230	3,254,394
# Observations (industry × country)	1073	968	1073

Notes: An observation is an industry in a country. For each industry-country pair, the left-hand-side variable measures the cross-firm-year median of value added minus wage bill divided by fixed assets, using ORBIS data for 11 European countries listed in appendix table A.2. External-finance dependence for a given industry is calculated as the fraction of capital expenditures not financed with cash revenues, and asset intangibility is intangible assets over total assets, both measured using the U.S. publicly traded firms in that industry in Compustat. The differential scale measures to what extent the profit margin is larger in the 75th percentile of financial vulnerability distribution relative to 25th percentile in the financially least- compared to the most-developed country in our sample. Standard errors are reported in parentheses. See appendix A for more details on constructing variables.

\*\*\* $p < 0.01$  \*\* $p < 0.05$  \* $p < 0.1$ .

## 5 Financial Frictions and Trade Openness: Welfare Implications

The novel mechanism in our model that finance-dependent sectors earn higher profit margins in financially less-developed economies has important implications for the gains from trade as well as the gains from financial development. While our paper abstracts from several relevant forces in a standard quantitative model, in this section we explore how *this specific mechanism* influences the welfare consequences of trade and financial development.

Trade openness influences country  $i$ 's welfare through the price index  $P_f$  and country income  $Y^i$ . We can express the gains from trade openness as

$$GT_i = \underbrace{\frac{Y_{\text{trade}}^i}{Y_{\text{autarky}}^i}}_{\text{profit-shifting channel}} \underbrace{\left( \frac{P_{f,\text{autarky}}}{P_{f,\text{trade}}} \right)^{1-\theta}}_{\text{price channel}} = \frac{Y_{\text{trade}}^i}{Y_{\text{autarky}}^i} \left( \frac{\gamma_c^i}{\gamma_w} \right)^{1-\theta}, \quad (48)$$

where  $Y_{\text{trade}}^i$  and  $P_{f,\text{trade}}$  are the income and sector  $f$  price index under free trade given in equations (44) and (34), respectively, and  $Y_{\text{autarky}}^i$  and  $P_{f,\text{autarky}}$  are those under autarky in equations (25) and (20), respectively.

The price index always falls with trade openness since  $\gamma_w < \gamma_c^i$ . We call this force the *price channel*. This channel always generates gains from trade openness, since consumers get access to more (and potentially cheaper) varieties, i.e., love of varieties. In a world without financial frictions where we have  $\gamma_c^i = 1$  for all countries (the frictionless world, hereon), the price channel would be the same for all countries and equals  $M^{\frac{1-\theta}{\sigma-1}}$ . In the presence of frictions, the price channel is stronger for financially less-developed economies with higher  $\gamma_c^i$  relative to trade partners, since import prices are lower than varieties produced at home. The following proposition summarizes this result.

**Proposition 1.** *In the presence of financial frictions trade openness reduces the price index in country  $i$  by more than in the frictionless world if and only if  $\gamma_c^i > M^{1/(\sigma-1)}\gamma_w$ , or equivalently*

$$M(\gamma_c^i)^{1-\sigma} < \sum_j (\gamma_c^j)^{1-\sigma} \quad (49)$$

*Proof.* Use the price index equations (20) and (34), and the result immediately follows.

Besides the price channel, changes in income affect the gains from trade. A country's income equals capital rent  $A_n e$ , which is invariant to trade openness, plus economic profits generated in sector  $f$ . In a frictionless economy with  $\gamma_c^i = 1$ , income is unaffected by trade openness since economic profits are zero. For a frictional economy with  $\gamma_c^i > 1$ , however,



income entails a positive economic profit generated in sector  $f$ . Trade openness shifts these profits to countries with a comparative advantage in producing finance-dependent varieties. We call this force the *profit-shifting channel*. This channel generates gains (losses) from trade openness for a country if profits flow into (out of) the country. The following proposition formalizes the profit-shifting channel.

**Proposition 2.** *Provided that  $\gamma_c^i > 1$ , trade openness reduces country  $i$ 's income (and profits) if and only if*

$$M \left[ \theta (\gamma_c^i)^{1-\sigma} + (1-\theta) (\gamma_c^i)^{-\sigma} \right] < \theta \sum_j (\gamma_c^j)^{1-\sigma} + (1-\theta) \sum_j (\gamma_c^j)^{-\sigma} . \quad (50)$$

*Proof.* See appendix B.

**Corollary.** In a two-country model with Home and Foreign and  $\gamma_c^H > 1$ , trade openness reduces Home income (and profits) if and only if Home faces more severe financial frictions than Foreign, i.e.,  $\gamma_c^H > \gamma_c^F$  or equivalently  $\eta_H < \eta_F$ .

The intuition behind this proposition is as follows. Country  $i$  with a high  $\gamma_c^i$  (i.e., low  $\eta_i$ ) relative to its trade partners has a comparative disadvantage in sector  $f$ . Therefore, such a country loses profits after opening up to trade since economic profits from producing finance-dependent varieties shift away from this country.<sup>24</sup>

We note that although our context is different, the notion of profit shifting in our model is similar to that in the strategic trade policy and profit shifting literature (Spencer and Brander, 1983; Brander and Spencer, 1985; Brander, 1986; Krugman, 1987; Bagwell and Staiger, 2012; Ossa, 2014; Firooz and Heins, 2021). Unlike this literature that features imperfect competition in product markets, we assume perfectly competitive product markets in this paper, but firms may still earn positive profits due to financial frictions.

We put the price channel and the profit-shifting channel from propositions 1 and 2 together to analyze the implications of financial frictions on the gains from trade. First, note that in the frictionless world, the gains from trade are only through the price channel and equal

$$GT_i^{\text{frictionless}} = M^{\frac{1-\theta}{\sigma-1}} , \quad (51)$$

which is the same for all countries. Financial frictions can either raise or reduce the gains from trade openness. The following proposition formalizes our results. To keep tractability, we approximate equations up to the first order of variations in financing friction severity

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<sup>24</sup>In the case that all countries share the same profit margin  $\gamma_c$ , country  $i$ 's income and profits would not change by trade openness since all countries would be symmetric.

across countries.

**Proposition 3.** *For any average profit margin in the world  $\bar{\gamma} = \frac{\sum_j \gamma_c^j}{M} > 1$ , there exists a cutoff*

$$\sigma^* = \frac{\bar{\gamma}}{\bar{\gamma} - 1} + \frac{\theta \bar{\gamma}}{1 - \theta + \theta \bar{\gamma}} \quad (52)$$

*such that (i) provided that  $\sigma > \sigma^*$ , the gains from trade for country  $i$  in the presence of financial frictions are smaller than those in the frictionless world if and only if  $\gamma_c^i > \bar{\gamma}$ ; (ii) Provided that  $\sigma < \sigma^*$ , the gains from trade for country  $i$  in the presence of financial frictions are larger than those in the frictionless world if and only if  $\gamma_c^i > \bar{\gamma}$ ; (iii) In the case  $\sigma = \sigma^*$ , the gains from trade for all countries in the presence of financial frictions are the same as those in the frictionless world.*

*Proof.* See appendix B.

This proposition shows that the presence of financial frictions can either increase or decrease the gains from trade openness, depending on the relative financial friction severity of trade partners. The intuition behind this result is as follows. Consider a country with more severe financial frictions than the world average (i.e.,  $\gamma_c^i > \bar{\gamma}$ ). On the one hand, the presence of financial frictions increases the gains from trade for such a country through the price channel, since this economy gets access to cheaper varieties after trade openness (see proposition 1). On the other hand, perhaps less obviously, the presence of financial frictions reduces the gains from trade for such a country through the profit-shifting channel, because the profits generated in the finance-dependent industry shift to trade partners due to a comparative disadvantage (see proposition 2). When the elasticity of substitution  $\sigma$  is large enough, the loss from the profit-shifting channel would be more pronounced since finance-dependent varieties across the world are more substitutable; In this case therefore the profit-shifting channel dominates the price channel and determines the direction of changes in the gains from trade.

The profit-shifting channel induced by financial frictions is a new mechanism that we introduce in this paper. As explained above, the importance of this channel depends on the magnitude of  $\sigma$  compared to  $\sigma^*$ . Here we employ our empirical evidence in Section 4 to find a reasonable range for  $\sigma^*$ . We show that the values of  $\sigma$  estimated in the international trade literature falls in our range of estimated  $\sigma^*$ , and therefore the profit-shifting channel is indeed a relevant force for the gains from trade. To elaborate, our empirical results in table 3 show that profit margins in the 75th percentile of financial dependence relative to the 25th percentile are between 8%-20% larger in the least- compared to the most-financially developed country (proxied by Credit/GDP that is consistent with our model) in our sample of 11 European countries in ORBIS. Interpreting the industry at the 25th percentile of

finance dependence as the “non-finance dependent” sector in our model (with a profit margin implied by financing frictions equal to one) and assuming that the financially most-developed country in our sample is frictionless with  $\gamma_c^i = 1$ , we conclude that financial frictions create an average profit margin for European economies in our ORBIS sample ranging from 1.08 – 1.2. This range provides a lower bound for the world average profit margin  $\bar{\gamma}$  (induced by financial frictions), since an average European country in our ORBIS sample is financially less-frictional than the world average.  $\bar{\gamma}$  therefore lies above 1.08 – 1.2, which implies that  $\sigma^*$  falls below the range from 6 – 14.<sup>25</sup> Moreover, the trade elasticity estimates in the literature range from 4-8 (Simonovska and Waugh, 2014; Eaton and Kortum, 2002) and therefore  $\sigma$  falls between 5-9 in our model.<sup>26</sup> We therefore conclude that  $\sigma$  arguably falls in the same range as  $\sigma^*$  and so the profit-shifting channel induced by financial frictions is a relevant force (as compared to the price channel) that influences the gains from trade.

By introducing the profit-shifting channel induced by financial frictions, we contribute to the literature examining the welfare implications of trade in the presence of financing constraints (Leibovici, 2021; Kohn, Leibovici and Szkup, 2020b; Caggese and Cuñat, 2013; Brooks and DAVIS, 2020). In contrast to this literature, we showed that the effects of financial frictions on a country’s gains from trade depend not only on the financial friction severity of the home country, but also on financial friction severity of its trade partners. In particular, we showed that through the profit-shifting channel the presence of financial frictions *increases* the gains from trade for financially more-developed economies, while the opposite is true for financially less-developed countries.<sup>27</sup> The mechanism that cross-country heterogeneity in financial frictions activates profit shifting is absent in the literature.<sup>28</sup>

The mechanism introduced in this paper that due to financial frictions firms in finance-dependent sectors earn an endogenous economic profit also has important implications for

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<sup>25</sup>Note that  $\sigma^*$  is increasing in  $\theta$ , and ranges from  $\frac{\bar{\gamma}}{\bar{\gamma}-1}$  (for  $\theta = 0$ ) to  $\frac{\bar{\gamma}}{\bar{\gamma}-1} + 1$  (for  $\theta = 1$ ).

<sup>26</sup>Note that the trade elasticity in our model equals  $\sigma - 1$ .

<sup>27</sup>Our analysis abstracts from the potential effects of trade openness on financial development. Given the empirical facts documented in the literature, relaxing this assumption would make our profit-shifting channel even stronger. To elaborate, in a cross-country analysis, Do and Levchenko (2007) document that trade openness tends to *worsen* (improve) financial development in countries with a comparative disadvantage (advantage) in producing finance-dependent goods. The findings in Braun and Raddatz (2008) are also in line with this result. Based on these empirical findings, we conclude that taking into account the potential impacts of international trade on financial development would make the profit-shifting channel even stronger, i.e., the presence of financial frictions increases (decreases) the gains from trade for financially more- (less-) developed economies. This is because financially more-developed economies (i.e.,  $\gamma_c^i < \bar{\gamma}$ ) would become even more developed after trade openness and therefore gain even more from profit shifting, while the opposite is true for financially less-developed economies.

<sup>28</sup>Note that while employing a forward-looking financing friction, the profit-shifting channel does not exist in Brooks and DAVIS (2020). This is because they assume that the trade partner of the country of their study has frictionless financial markets and therefore by construction the trade partner earns no economic profits from producing finance-dependent goods.

the welfare consequences of financial development with/without international trade, which is summarized below.

**Proposition 4.** *While a closed economy  $i$  always gains from reducing its financial frictions (i.e., an increase in  $\eta_i$ ), a small open economy  $i$  gains from reducing its financial frictions if and only if  $\frac{\sigma}{\sigma-1} \leq \gamma_c^i$ . Hence, there exists an optimal level of financial development  $\eta_i^* = \frac{\sigma-1}{\sigma}(1 - e/I) < 1$  (i.e., below the frictionless value of one) that maximizes welfare of the small open economy  $i$ .*

*Proof.* See appendix B.

Proposition 4 shows that even though financial friction is the only source of friction in an open economy, an open economy may lose from reducing its financial frictions. This is the case for the range  $\gamma_c^i < \frac{\sigma}{\sigma-1}$ , or equivalently  $\eta_i > \frac{\sigma-1}{\sigma}(1 - e/I)$ . The intuition behind this result is as follows. Financial development (i.e., a reduction in financial frictions) influences the welfare of a small open economy by changing its income.<sup>29</sup> There are two forces that affect income. On the one hand, a country benefits from its financial development through shifting profits from its trade partners to its domestic producers. This is because financial development reduces the price of finance-dependent varieties that this country produces, which in turn leads to this country gaining a comparative advantage in the finance-dependent sector that entails economic profits. The larger the elasticity of substitution  $\sigma$ , the stronger is this force. On the other hand, however, financial development reduces the profit margin of finance-dependent varieties that a country exports to other countries (i.e., by reducing  $\gamma_c^i$ ), which tends to reduce this country's economic profits, income, and welfare. If the elasticity of substitution is low enough (such that  $\gamma_c^i \leq \sigma/(\sigma - 1)$ ), or equivalently financial friction is not severe, the second force dominates and therefore the economy would lose from its own financial development.

We employ our empirical findings to shed light on the welfare implications of financial development in a small open economy. As described in proposition 4, whether reducing financing frictions benefits a small open economy or not depends on the magnitude of  $\gamma_c^i$  relative to  $\frac{\sigma}{\sigma-1}$ . As noted above, the trade elasticity estimates in the literature range from 4 – 8, which implies that  $\frac{\sigma}{\sigma-1}$  ranges from 1.12 – 1.25 in our model. Moreover, as we interpreted our empirical findings in table 3 above, we find an estimate of implied profit margins for European countries in ORBIS in the range of  $\gamma_c^i \sim 1.08 - 1.2$ . This range of profit margin estimates  $\gamma_c^i$  therefore falls in the interval of calibrated  $\frac{\sigma}{\sigma-1}$  from the literature. Therefore, one expects that in the set of ORBIS countries both cases of  $\gamma_c^i \gtrsim \frac{\sigma}{\sigma-1}$  and  $\gamma_c^i \lesssim \frac{\sigma}{\sigma-1}$  apply; this suggests that while financially less-developed European countries are

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<sup>29</sup>Note that the world price index  $P_f$  is not affected, due to the *small* open economy assumption.

better off from their financial development, financially more-developed European countries might not benefit as much from their financial development on the margin.<sup>30</sup>

## 6 Conclusion

This paper studies the micro and macro implications of financing frictions in the presence of international trade barriers. We empirically document that finance-dependent industries benefit from financial development if and only if trade barriers are low. To rationalize this finding and analyze the interaction between financial frictions and trade openness, we develop a model of international trade featuring cross-country financial friction heterogeneity. In the model, although product markets are competitive, investment and production in finance-dependent sectors are supported by endogenous economic profits in equilibrium which would prevent firms from strategic default on loans. We support this key mechanism of our model using cross-country firm-level data from ORBIS. In a closed economy, while financing frictions hurt aggregate welfare, these frictions indeed benefit finance-dependent producers. Trade openness reduces the price of finance-dependent goods, which benefits consumers; however, economic profits of producing such varieties flow out of a financially-less developed economy due to a comparative disadvantage, which is welfare reducing. We show that the welfare gains from financial development depend on trade openness, and that the gains from trade openness depends on the relative financing friction severity of trade partners. In particular, our analytical results along with firm-level evidence from ORBIS shows that (i) while financially less-developed countries in our sample are better off from their financial development, financially more-developed countries may not benefit from their financial development on the margin; and (ii) the presence of financial frictions tends to increase (decrease) the gains from trade for financially more- (less-) developed economies, due to the profit-shifting channel.

## References

**Aghion, Philippe, and Patrick Bolton.** 1997. “A Theory of Trickle-Down Growth and Development.” *Review of Economic Studies*, 64(2): 151–172.

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<sup>30</sup>We note that financial development benefits a country through various forces that we abstract from in our model. Here we highlight a new mechanism for the welfare implications of financial development that differentially impacts open versus closed economies.

- Aghion, Philippe, Peter Howitt, and David Mayer-Foulkes.** 2005. "The Effect of Financial Development on Convergence: Theory and Evidence." *The Quarterly Journal of Economics*, 120(1): 173–222.
- Albuquerque, Rui, and Hugo A Hopenhayn.** 2004. "Optimal lending contracts and firm dynamics." *The Review of Economic Studies*, 71(2): 285–315.
- Amiti, Mary, and David E Weinstein.** 2011. "Exports and financial shocks." *The Quarterly Journal of Economics*, 126(4): 1841–1877.
- Antras, Pol, and Ricardo J Caballero.** 2009. "Trade and capital flows: A financial frictions perspective." *Journal of Political Economy*, 117(4): 701–744.
- Bagwell, Kyle, and Robert W Staiger.** 2012. "Profit shifting and trade agreements in imperfectly competitive markets." *International Economic Review*, 53(4): 1067–1104.
- Bai, Yan, Dan Lu, and Xu Tian.** 2018. "Do Financial Frictions Explain Chinese Firms' Saving and Misallocation?" National Bureau of Economic Research.
- Baldwin, Richard.** 1989. "Exporting the capital markets: Comparative advantage and capital market imperfections. In: Audretsch, D., Sleuwaegen, L., Yamawaki, H.(Eds.), *The Convergence of International and Domestic Markets.*"
- Banerjee, Abhijit V., and Andrew F. Newman.** 1993. "Occupational Choice and the Process of Development." *Journal of Political Economy*, 101(2): 274–298.
- Banerjee, Abhijit V., and Benjamin Moll.** 2010. "Why Does Misallocation Persist?" *American Economic Journal: Macroeconomics*, 2(1): 189–206.
- Banerjee, Abhijit V., and Esther Duflo.** 2005. "Chapter 7 Growth Theory through the Lens of Development Economics." In . Vol. 1 of *Handbook of Economic Growth*, , ed. Philippe Aghion and Steven N. Durlauf, 473–552. Elsevier.
- Becker, Bo, Jinzhu Chen, and David Greenberg.** 2012. "Financial Development, Fixed Costs, and International Trade." *The Review of Corporate Finance Studies*, 2(1): 1–28.
- Becker, Bo, Jinzhu Chen, and David Greenberg.** 2013. "Financial development, fixed costs, and international trade." *The Review of Corporate Finance Studies*, 2(1): 1–28.
- Beck, Thorsten.** 2002. "Financial development and international trade: Is there a link?" *Journal of international Economics*, 57(1): 107–131.
- Beck, Thorsten.** 2003. "Financial Dependence and International Trade." *Review of International Economics*, 11(2): 296–316.

- Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine.** 2000. “A new database on the structure and development of the financial sector.” *The World Bank Economic Review*, 14(3): 597–605.
- Brander, James A.** 1986. “Rationales for strategic trade and industrial policy.” *Strategic trade policy and the new international economics*, 23.
- Brander, James A, and Barbara J Spencer.** 1985. “Export subsidies and international market share rivalry.” *Journal of international Economics*, 18(1-2): 83–100.
- Braun, Matias.** 2005. “Financial contractability and asset hardness.” *Available at SSRN 2522890*.
- Braun, Matias, and Claudio Raddatz.** 2008. “The politics of financial development: evidence from trade liberalization.” *The Journal of Finance*, 63(3): 1469–1508.
- Brooks, Wyatt, and Alessandro Dovis.** 2020. “Credit market frictions and trade liberalizations.” *Journal of Monetary Economics*, 111: 32–47.
- Buera, Francisco J., Joseph P. Kaboski, and Yongseok Shin.** 2011. “Finance and Development: A Tale of Two Sectors.” *American Economic Review*, 101(5): 1964–2002.
- Caggese, Andrea, and Vicente Cuñat.** 2013. “Financing constraints, firm dynamics, export decisions, and aggregate productivity.” *Review of Economic Dynamics*, 16(1): 177–193.
- Chaney, Thomas.** 2016. “Liquidity constrained exporters.” *Journal of Economic Dynamics and Control*, 72: 141–154.
- Cole, Harold L., Jeremy Greenwood, and Juan M. Sanchez.** 2016. “Why Doesn’t Technology Flow From Rich to Poor Countries?” *Econometrica*, 84(4): 1477–1521.
- Costinot, Arnaud.** 2009. “On the origins of comparative advantage.” *Journal of International Economics*, 77(2): 255–264.
- Do, Quy-Toan, and Andrei A Levchenko.** 2007. “Comparative advantage, demand for external finance, and financial development.” *Journal of Financial Economics*, 86(3): 796–834.
- Dornbusch, Rudiger, Stanley Fischer, and Paul Anthony Samuelson.** 1977. “Comparative advantage, trade, and payments in a Ricardian model with a continuum of goods.” *The American Economic Review*, 67(5): 823–839.

- Eaton, Jonathan, and Samuel Kortum.** 2002. “Technology, geography, and trade.” *Econometrica*, 70(5): 1741–1779.
- Firooz, Hamid, and Gunnar Heins.** 2021. “Profit Shifting, Import and Export Markups, and the Gains from Trade.” Available at SSRN: <https://ssrn.com/abstract=3740634>.
- Gopinath, Gita, Şebnem Kalemli-Özcan, Loukas Karabarbounis, and Carolina Villegas-Sanchez.** 2017. “Capital allocation and productivity in South Europe.” *The Quarterly Journal of Economics*, 132(4): 1915–1967.
- Greenaway, David, Alessandra Guariglia, and Richard Kneller.** 2007. “Financial factors and exporting decisions.” *Journal of international economics*, 73(2): 377–395.
- Greenwood, Jeremy, and Boyan Jovanovic.** 1990. “Financial Development, Growth, and the Distribution of Income.” *Journal of Political Economy*, 98(5, Part 1): 1076–1107.
- Hsieh, Chang-Tai, and Peter J. Klenow.** 2009. “Misallocation and Manufacturing TFP in China and India\*.” *The Quarterly Journal of Economics*, 124(4): 1403–1448.
- Hur, Jung, Manoj Raj, and Yohanes E Riyanto.** 2006. “Finance and trade: A cross-country empirical analysis on the impact of financial development and asset tangibility on international trade.” *World Development*, 34(10): 1728–1741.
- Itskhoki, Oleg, and Benjamin Moll.** 2019. “Optimal development policies with financial frictions.” *Econometrica*, 87(1): 139–173.
- Ju, Jiandong, and Shang-Jin Wei.** 2011. “When is quality of financial system a source of comparative advantage?” *Journal of International Economics*, 84(2): 178–187.
- Kletzer, Kenneth, and Pranab Bardhan.** 1987. “Credit markets and patterns of international trade.” *Journal of Development Economics*, 27(1-2): 57–70.
- Kohn, David, Fernando Leibovici, and Michal Szkup.** 2016. “Financial frictions and new exporter dynamics.” *International economic review*, 57(2): 453–486.
- Kohn, David, Fernando Leibovici, and Michal Szkup.** 2020a. “Financial frictions and export dynamics in large devaluations.” *Journal of International Economics*, 122: 103257.
- Kohn, David, Fernando Leibovici, and Michal Szkup.** 2020b. *No Credit, No Gain: Trade Liberalization Dynamics, Production Inputs, and Financial Development*. Pontificia Universidad Católica de Chile.
- Kohn, David, Fernando Leibovici, and Michal Szkup.** 2022. “Financial Frictions and International Trade: A Review.” *Oxford Research Encyclopedia of Economics and Finance*.



- Krugman, Paul R.** 1987. “Is free trade passé?” *Journal of economic Perspectives*, 1(2): 131–144.
- Leibovici, Fernando.** 2021. “Financial development and international trade.” *Journal of Political Economy*, 129(12): 3405–3446.
- Manova, Kalina.** 2013. “Credit constraints, heterogeneous firms, and international trade.” *Review of Economic Studies*, 80(2): 711–744.
- Manova, Kalina, Shang-Jin Wei, and Zhiwei Zhang.** 2015. “Firm exports and multinational activity under credit constraints.” *Review of Economics and Statistics*, 97(3): 574–588.
- Matsuyama, Kiminori.** 2000. “Endogenous Inequality.” *The Review of Economic Studies*, 67(4): 743–759.
- Matsuyama, Kiminori.** 2005. “Credit market imperfections and patterns of international trade and capital flows.” *Journal of the European Economic Association*, 3(2-3): 714–723.
- Midrigan, Virgiliu, and Daniel Yi Xu.** 2014. “Finance and Misallocation: Evidence from Plant-Level Data.” *American Economic Review*, 104(2): 422–58.
- Minetti, Raoul, and Susan Chun Zhu.** 2011. “Credit constraints and firm export: Microeconomic evidence from Italy.” *Journal of International Economics*, 83(2): 109–125.
- Muûls, Mirabelle.** 2008. “Exporters and credit constraints. A firm-level approach.” NBB Working Paper.
- Nunn, Nathan, and Daniel Treffer.** 2014. “Domestic institutions as a source of comparative advantage.” *Handbook of international economics*, 4: 263–315.
- Ossa, Ralph.** 2014. “Trade wars and trade talks with data.” *American Economic Review*, 104(12): 4104–46.
- Paravisini, Daniel, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon.** 2015. “Dissecting the effect of credit supply on trade: Evidence from matched credit-export data.” *The Review of Economic Studies*, 82(1): 333–359.
- Paulson, Anna L, Robert M Townsend, and Alexander Karaivanov.** 2006. “Distinguishing limited liability from moral hazard in a model of entrepreneurship.” *Journal of political Economy*, 114(1): 100–144.
- Rajan, Raghuram G., and Luigi Zingales.** 1998. “Financial Dependence and Growth.” *The American Economic Review*, 88(3): 559–586.

- Simonovska, Ina, and Michael E Waugh.** 2014. “The elasticity of trade: Estimates and evidence.” *Journal of international Economics*, 92(1): 34–50.
- Spencer, Barbara J, and James A Brander.** 1983. “International R & D rivalry and industrial strategy.” *The Review of Economic Studies*, 50(4): 707–722.
- Svaleryd, Helena, and Jonas Vlachos.** 2005. “Financial markets, the pattern of industrial specialization and comparative advantage: Evidence from OECD countries.” *European Economic Review*, 49(1): 113–144.
- Tetenyi, Laszlo.** 2019. “Trade, misallocation, and capital market integration.” IWH-CompNet Discussion Papers.
- Townsend, Robert M., and Kenichi Ueda.** 2006. “Financial Deepening, Inequality, and Growth: A Model-Based Quantitative Evaluation<sup>1</sup>.” *The Review of Economic Studies*, 73(1): 251–293.
- Wynne, José.** 2005. “Wealth as a determinant of comparative advantage.” *American Economic Review*, 95(1): 226–254.

# Appendices

## A Empirical Facts: Constructing Variables

**Financial development.** We obtain data from World Bank, Global Financial Development Database (Beck, Demirgüç-Kunt and Levine, 2000), to proxy for financial development at the country level in each year. We use time series data of private credit by deposit money banks and other financial institutions to the private sector normalized by GDP as a proxy for financial development across countries. We winsorize the data at 1% level from bottom and top in our level specifications and data with a credit over GDP below 5% in our log specification to reduce noise in our right-hand-side variable. Summary statistics are provided in table A.1. Histograms for two time intervals are shown in figure A.1. For each country-year pair, we also use banks' total overhead costs over total assets, and total deposits over GDP from the same source, as alternative proxies for financial development.<sup>1</sup>

**Finance dependence.** As introduced in Rajan and Zingales (1998) we use the U.S. Compustat database and collect data on capital expenditures, cash flows, net property, plant and equipment, and total assets for the U.S. publicly traded manufacturing firms in 1980s. In our benchmark proxy, we measure external-finance dependence as  $[ext\ dep] = \frac{capx - cash}{capx}$  for each firm, where  $capx$  is the sum of capital expenditures of the firm in all years, and  $cash$  is the sum of cash flows. This ratio represents the fraction of investment costs that is not financed via internal cash revenues. Hence, it is a relative measure of dependence on external financing at the firm level. We then map each firm to a specific 3-digit ISIC code. We winsorize the variable  $ext\ dep$  at the firm level from bottom and top at the 10% level. External-finance dependence at the industry level is then calculated by taking median of  $ext\ dep$  across firms within an industry.

Table A.3 reports the external-finance dependence measure for each industry in our data. Tobacco, Footwear, and Leather are the least finance-dependent industries, while other chemicals (which includes drugs and medicines), Machinery, and Professional goods are the most finance-dependent industries.

As in Braun (2005) and Manova (2013), we construct the fraction of intangible assets at the industry level as an alternative proxy for financial vulnerability. We follow the same procedure as in constructing external-finance dependence: We take the cross-firm median within an industry of one minus the ratio of mean net property, plant and equipment over

<sup>1</sup>Note that higher banks' overhead costs are interpreted as lower financial development.

mean total assets in Compustat firms in 1980s. Net property, plant and equipment are considered as tangible assets that can be used as collateral for a loan more easily. Industries with higher levels of asset intangibility are considered to be financially more vulnerable. Table A.3 reports asset intangibility measure for each industry in our data.

**Exports and Imports.** We use Comtrade imports data for 181 exporters and 169 importers in 27 three-digit ISIC manufacturing industries (reported in table A.3). These data constitute all available exporter-importer-industry combinations. Since imports data are usually of higher quality, for the exports of origin  $o$  to destination  $d$  in a given sector, we use imports of country  $d$  from country  $o$  in that sector. The results are robust to using exports data instead. In our baseline, we use the data in 2005, and the results are robust to using data in 1995 or 2005. Table A.1 reports summary statistics.

**Profit margin.** We compute industry-country level profit margin using ORBIS firm-level data from 2000-2009 for 11 European countries reported in table A.2. We define industries as 3-digit SIC codes in manufacturing. We first construct profit margin for each firm-year as value added minus wage bill, divided by total fixed assets. We then take the sales-weighted median of this measure across all firm-year observations within each industry-country pair. We winsorize all variables at the firm level from bottom and top at the 10% level. We report the summary statistics in table A.1.

**Tariffs.** We use industry-country level import tariffs and trade volumes from 1988 to 2003 for a panel of 81 countries from WITS (World Integrated Trade Solution). We construct two measures for average tariffs. For the two-digit ISIC rev. 2 industry  $i$  in country  $c$  at year  $t$ , we first take an average of the *import* tariffs  $\tau_{cp}^{it}$  that importer  $c$  charges on trading partners  $p$ ; the average is weighted by the *import* volumes  $T_{cp}^{it}$ ; using the introduced notations, this measure is  $\sum_p T_{cp}^{it} \tau_{cp}^{it} / \sum_p T_{cp}^{it}$ . The second measure constructs the average tariffs that partners of a the country  $c$  impose on their imports from country  $c$  in industry  $i$  at year  $t$ . Using the notations, this measure is  $\sum_p T_{pc}^{it} \tau_{pc}^{it} / \sum_p T_{pc}^{it}$ . The first measure computes the average tariffs on the products of foreign producers in the domestic market, while the second measure calculates the average tariffs that domestic producers face in order to sell their products abroad. We use the trade-weighted average of these two measures in our benchmark regressions, and we do robustness checks using either one. Moreover, to use in our robustness checks, we do the same calculations to derive the average tariffs at the three-digit ISIC rev. 2 level, and also at the one-digit ISIC rev. 2 level—the whole manufacturing sector. We winsorize the data at the 1% level from above. The minimum tariff is zero in the

data. Table A.1 reports summary statistics.

Naturally, there is a positive correlation between financial development and trade openness: Richer economies are more open to international trade and are financially more developed. However, we still observe plausible variations in financial development, within each group of “low”- versus “high”-tariff economies, where we use median tariffs to divide countries. These variations help us precisely estimate the regression coefficient in our triple-difference specification. See histograms in the second panel of figure A.1.

**Value added.** We obtain industry-level data for value added from United Nations Statistical Division, Industrial Statistics. Annual data on value added, wage bill, output, employment, and number of establishments are reported for a panel of 126 countries from 1963 to 2003 at the manufacturing sector, which comprises 27 three-digit ISIC revision 2 industries. For a given sector-country pair, we take the value added minus total wage bill, which resembles the value added data in our model with no labor. We use exchange rates as well as the U.S. GDP deflator to convert nominal to real value added. To be used as the left-hand-side variable in our regressions, we take the log of the constructed value added after dropping negative values. We trim the data at 2.5% level from bottom and top. For the value added growth regressions, we calculate the average annualized five-year value added growth by measuring the five-year forward difference in the log of value added, divided by five. Summary statistics are reported in table A.1. In robustness checks, we instead use value added (not subtracting wage bills) as well as sales.

Table A.1: Summary statistics

Variable	Mean	Median	Std	p10	p90	Observations
log (Value added)	9.18	8.55	4.81	3.21	15.95	44447
log (Value added), 1988 to 2003	9.81	9.92	4.85	3.37	16.05	6645
Value added growth, 1988 to 2003	-0.087	-0.024	0.640	-0.964	0.602	1490
log (Exports)	4.80	4.82	3.96	-0.47	9.97	236288
log (Profit margin)	-1.08	-1.09	0.70	-1.69	-0.40	1216
Tariff (%)	8.32	6.91	6.12	2.34	16.10	3434
Tariff, country level, 5 year change (%)	-1.77	-1.21	3.45	-5.29	1.90	105
Credit (% of GDP)	36.4	26.1	28.4	9.4	76.6	2519
Credit (% of GDP), 1988 to 2003	45.4	37.4	33.4	10.6	90.6	1104
External finance dependence	0.070	-0.001	0.458	-0.530	0.732	27
Asset intangibility	0.691	0.697	0.102	0.519	0.836	27

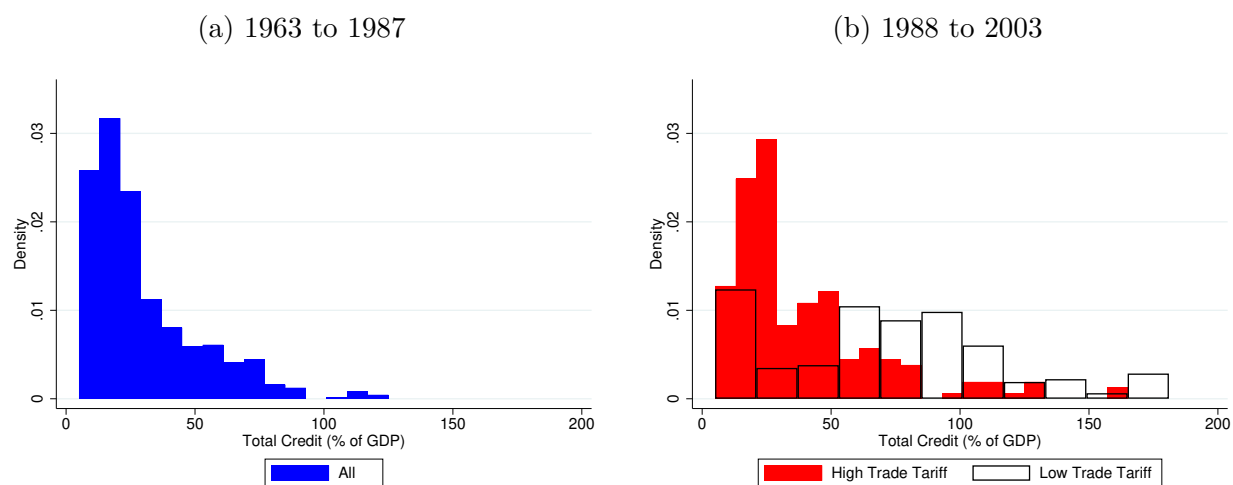
Notes: Columns respectively show the average, median, standard deviation, 10th percentile, and 90th percentile of the data, and the number of observations in the calculation of summary statistics. The first three rows show value added minus wage bills reported in the data, which resembles the value added in our model with no labor. We use exchange rates and the U.S. GDP deflator to convert nominal to real value added. The value added growth is derived from the forward difference in the log of value added in the following five years, divided by five. Summary statistics are provided for the pool of data at the country by year by three-digit ISIC rev. 2 industry level, separately from 1963 to 2003 and from 1988 to 2003, since our regressions span different time intervals. Tariffs are at the country by year by 2-digit ISIC rev. 2 industry level from 1988 to 2003, by calculating the average tariffs across trade partners weighted by trade volume. As for tariff changes at the country level, we first calculate trade-weighted average tariffs for the entire manufacturing sector of a country. We then take simple forward difference in five years. The statistics for total credit as a percentage of GDP at the country by year level are reported for the pool of countries separately from 1963 to 2003 and from 1988 to 2003, as in our regression specifications. External-finance dependence and asset intangibility are computed using the U.S. publicly traded firms in Compustat in 1980s, for 27 three-digit ISIC rev. 2 manufacturing industries (see notes on table A.3 for more details).

Table A.2: Countries in our ORBIS data set and proxies for financial development

Country	# Firm-Year	Total Credit /GDP (%)	Financial System Deposits /GDP (%)	Banks' Overhead Costs /Total Assets (%)
Austria	9,334	98.35	79.89	1.65
Belgium	59,747	77.34	82.74	1.32
Finland	104,057	51.38	46.18	1.27
France	842,641	81.29	61.76	1.31
Germany	98,959	116.33	90.92	1.62
Italy	985,826	70.33	49.02	2.04
Netherlands	9,128	125.34	87.62	0.67
Norway	88,007	70.41	43.25	1.98
Portugal	232,594	112.30	85.70	1.16
Spain	867,105	90.13	74.10	0.76
Sweden	196,365	64.28	—	1.56

Notes: This table reports the list of 11 European countries in the ORBIS firm-level data. The second column reports the number of firm-year observations for each country in our sample from 2000-2009. The last three columns report three proxies for financial development that we use in our regressions, all in year 2000.

Figure A.1: Histogram of our proxy for financial development across countries



Notes: We plot the histogram of financial development for two periods 1963-1987 and 1988-2003 to demonstrate the changes across decades. We use country-level trade-weighted average tariffs in the manufacturing sector, which is available from 1988 to 2003, to plot separate histograms of financial development for “low”- versus “high”-tariff economies, being those with average tariffs below and above the median, respectively. Financial development is proxied by the variable “private credit by deposit money banks and other financial institutions normalized by GDP,” from the World Bank Global Financial Development Database.

Table A.3: Capital expenditures, external-finance dependence, and asset intangibility of industries in the manufacturing sector

Rank	ISIC code	Industrial sectors	Capital expenditures	External dependence	Asset intangibility
1	314	Tobacco	0.163	-0.983	0.735
2	324	Footwear	0.213	-0.691	0.836
3	323	Leather	0.256	-0.530	0.858
4	313	Beverages	0.197	-0.271	0.697
5	361	Pottery	0.224	-0.246	0.691
6	311-2	Food products	0.204	-0.212	0.624
7	354	Petroleum and coal products	0.209	-0.195	0.661
8	353	Petroleum refineries	0.170	-0.178	0.508
9	369	Nonmetal products	0.144	-0.120	0.508
10	342	Printing and publishing	0.243	-0.117	0.706
11	381	Metal products	0.202	-0.085	0.715
12	351	Industrial chemicals	0.187	-0.075	0.574
13	371	Iron and steel	0.145	-0.005	0.581
14	341	Paper and products	0.193	-0.001	0.519
15	332	Furniture	0.207	0.040	0.711
16	355-6	Rubber and Plastic products	0.220	0.073	0.663
17	384	Transportation equipment	0.231	0.165	0.724
18	321	Textile	0.209	0.205	0.672
19	372	Nonferrous metal	0.207	0.233	0.655
20	322	Apparel	0.203	0.242	0.847
21	331	Wood products	0.185	0.307	0.680
22	362	Glass	0.187	0.497	0.567
23	390	Other industries	0.244	0.645	0.807
24	383	Electric Machinery	0.301	0.662	0.763
25	352	Other chemicals	0.264	0.732	0.768
26	382	Machinery	0.286	0.756	0.788
27	385	Professional goods	0.322	1.043	0.804

Notes: Data are constructed as in [Rajan and Zingales \(1998\)](#) and [Braun \(2005\)](#). The data source is the annual U.S. Compustat for publicly traded firms from 1980-1989. To calculate capital expenditures in the second column, we first calculate capital expenditures (capx) normalized by net property, plant, and equipment (ppent) for a firm in each year. We then take the cross-year mean of capx normalized by ppent for each firm, and then take the cross-firm median within each ISIC code. External-finance dependence is measured as follows. For each firm, we first take the sum over all years of capital expenditures (capx) minus cash flows (which is cash flows from operations (oancf) plus decreases in inventories (invt), decreases in receivables (rect), and increases in payables (ap)), divided by the sum of capx. We then take the cross-firm median within each industry. As for asset intangibility, we first calculate the fraction of intangible assets as one minus the mean of net property, plant, and equipment (ppent) scaled by the mean total assets (at) for each firm. We then take the cross-firm median within each industry. Before aggregating across years, we normalize all variables with the U.S. GDP deflator.



## B Proofs

### B.1 Supply function of finance-dependent varieties

Here we show that the supply of finance-dependent variety  $A$  can be written as the following piecewise function:

$$Y(A; \gamma(A)) = \begin{cases} 0 & \gamma(A) < \gamma_c \\ 0 \leq \cdot \leq \frac{Ae}{1-\eta\gamma_c} & \gamma(A) = \gamma_c \\ \frac{Ae}{1-\eta\gamma(A)} & \gamma_c < \gamma(A) < \eta^{-1} \\ +\infty & \gamma(A) \geq \eta^{-1} \end{cases} \quad (53)$$

Recall that the borrowing constraint for a firm implies

$$\eta\gamma(A) < 1 \Rightarrow k(A) \leq k_c(A) := \frac{e}{1-\eta\gamma(A)}, \quad (54)$$

and there would be no limit on borrowing if  $\gamma(A) \geq \eta^{-1}$ . If profit margin  $\gamma(A)$  falls below the threshold  $\gamma_c$ , the finance-dependent variety  $A$  is not produced. This is because if  $\gamma(A) < 1$ , producing this variety delivers a negative profit, and no one would produce it. On the other hand, if  $\gamma(A) < (1 - e/I)\eta^{-1}$ , the size limit  $k_c(A)$  would be less than the minimum scale  $I$  (look at (54)) and therefore producing this variety is not feasible.

If  $\gamma(A) = \gamma_c$ , equation (54) implies that the size threshold is  $k_c(A) = e/(1 - \eta\gamma_c) \geq I$ . Moreover, since  $\gamma(A) = \gamma_c \geq 1$ , producing the finance-dependent variety  $A$  is profitable. Therefore, all individuals are willing to supply variety  $A$  up to the point where the financial constraint binds, i.e.,  $k(A) = k_c(A)$ . As a result, the supply of this variety may be anything in  $[0, Ae/(1 - \eta\gamma_c)]$ .

Now consider the third case:  $\gamma_c < \gamma(A) < \eta^{-1}$ . Since by definition  $\gamma_c \geq 1$ , the profit margin  $\gamma(A)$  is strictly greater than one in this case. Hence, producing variety  $A$  delivers a positive profit, and variety  $A$  would be produced at its maximum capacity subject to the financial constraint. Therefore,  $Ak_c(A)$  amount of variety  $A$  will be produced in the aggregate.

As the last case, if  $\gamma(A) \geq \eta^{-1}$ , the supply of variety  $A$  would be infinity. This is because the financing constraint is not binding in this case, and therefore there would be no limit on borrowing and the scale of production. Moreover,  $\eta\gamma(A) \geq 1$  implies that  $\gamma(A) > 1$ , as long as  $\eta < 1$ . Therefore, producing variety  $A$  delivers a positive profit. Hence, the supply would

be infinity if  $\gamma(A) \geq \eta^{-1}$ .<sup>2</sup>

## B.2 Equilibrium profit margin and firm size

We show that all varieties in sector  $f$  share the same profit margin in equilibrium:

$$\forall A : \quad \gamma(A) = \gamma_c = \max\{1, (1 - e/I)\eta^{-1}\} . \quad (55)$$

We can see from the supply function (53) that the equilibrium profit margin of variety  $A$  needs to fall in the range  $\gamma_c \leq \gamma(A) < \eta^{-1}$ :  $\gamma(A) \geq \eta^{-1}$  would raise the scale of production and demand for capital to infinity, and  $\gamma(A) < \gamma_c$  results in zero supply of variety  $A$ , both of which cannot be an equilibrium outcome given the demand structure.

We also show that  $\gamma(A) > \gamma_c$  cannot be an equilibrium outcome. Because  $\gamma_c \geq 1$ ,  $\gamma(A) > \gamma_c$  results in  $\gamma(A) > 1$ , i.e., a positive economic profit. Moreover, because  $\gamma_c \geq (1 - e/I)\eta^{-1}$ ,  $\gamma(A) > \gamma_c$  would imply  $\gamma(A) > (1 - e/I)\eta^{-1}$  which permits a scale of operation satisfied by the no-default condition (54) that is strictly greater than the minimum scale  $I$ , i.e.,  $k_c(A) > I$ . In this case, a profit margin that is slightly below  $\gamma(A)$  would still permit an operation scale that meets the financing constraint and is still greater than  $I$ . Potential entrants would then be able to produce variety  $A$  at a lower profit margin and serve the entire market demand. The entrants meet both the financing and technological constraints and earn a positive profit. This is a contradiction for  $\gamma(A)$  being an equilibrium profit margin.

Now that we proved  $\gamma(A) = \gamma_c$ , we determine the firm size in equilibrium. Provided that  $\gamma_c > 1$ , the borrowing constraint (54) requires  $k(A) \leq k_c(A) = I$ , whereas the technological constraint requires  $k(A) \geq I$ . Therefore,  $k(A) = I$  for all varieties  $A$  as long as  $\gamma_c > 1$ . Note that  $\gamma_c = 1$  implies  $(1 - e/I)\eta^{-1} \leq 1$ , which in turn yields  $k_c(A) = \frac{e}{1-\eta} \geq I$ . In this case, firms' size would be indeterminate.

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<sup>2</sup>Note that if  $\gamma(A) = \eta = 1$ , supply would be anything from zero to infinity, which will be captured by the second case since  $\gamma_c = 1$  as well.

### B.3 Sector $f$ capital

Total demand for capital in sector  $f$  equals:

$$K_f = \int_A K(A) dF(A) = \int_A \frac{Y(A)}{A} dF(A) = \int_A \frac{C(A)}{A} dF(A) = \int_A \left(\frac{p(A)}{P_f}\right)^{-\sigma} \frac{C_f}{A} dF(A) = A_f^{\sigma-1} P_f^\sigma (\gamma_c A_n)^{-\sigma} C_f = C_f/A_f = \frac{(1-\theta)Y}{\gamma_c A_n}, \quad (56)$$

where  $Y(A)$  and  $K(A)$  are the equilibrium supply and capital of variety  $A$ , respectively. Here, we used the market clearing condition  $Y(A) = C(A)$ , and substituted for the demand for variety  $A$  derived from the CES aggregator (8):

$$C(A) = C_f (p(A)/P_f)^{-\sigma}. \quad (57)$$

We also substituted for the price of variety  $A$  from the equilibrium profit margin

$$\gamma(A) = p(A)A/R = \gamma_c \Rightarrow p(A) = \gamma_c R/A, \quad (58)$$

combined with  $R = A_n$  as well as the sector  $f$  aggregate price index

$$P_f = \gamma_c A_n/A_f, \quad (59)$$

and the aggregate productivity

$$A_f = \left[ \int_A A^{\sigma-1} dF(A) \right]^{1/(\sigma-1)} \quad (60)$$

from equations (20) and (21). Finally, we used equation (18) to substitute for the aggregate demand for the composite good  $f$  as  $C_f = (1-\theta)Y/P_f$ .

### B.4 Proof of model's implication 4

*Part (i).* In an open economy,

$$\begin{aligned} V_n^i &= \theta Y^i (1 - 1/A_n) \\ V_f^i &= \left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma} (1-\theta) Y \left[1 - \frac{1}{A_n \gamma_c^i}\right] \end{aligned} \quad (61)$$

Therefore,

$$V_f^i/V_n^i = \left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma} \left(\frac{1-\theta}{\theta}\right) \left(\frac{Y}{Y^i}\right) \frac{A_n \gamma_c^i - 1}{\gamma_c^i (A_n - 1)}. \quad (62)$$

Moreover,

$$Y^i = A_n e + (1-\theta) \left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma} \left(1 - \frac{1}{\gamma_c^i}\right) \underbrace{\frac{A_n e \hat{\gamma}_c M}{\theta \hat{\gamma}_c + 1 - \theta}}_{=Y}. \quad (63)$$

So we can simplify

$$\left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma} \left(\frac{Y}{Y^i}\right) = \frac{1}{(1-\theta) \left(1 - \frac{1}{\gamma_c^i}\right) + \frac{A_n e}{Y} \left(\frac{\gamma_w}{\gamma_c^i}\right)^{1-\sigma}}. \quad (64)$$

Substituting equation (64) in equation (62) delivers:

$$V_f^i/V_n^i = \frac{A_n \gamma_c^i - 1}{\theta (A_n - 1) (\gamma_c^i - 1 + \alpha (\gamma_c^i)^\sigma)}, \quad (65)$$

where

$$\alpha := \frac{A_n e \gamma_w^{1-\sigma}}{Y (1-\theta)} \quad (66)$$

is a positive constant. We can show that<sup>3</sup>

$$\frac{\partial (V_f^i/V_n^i)}{\partial \gamma_c^i} \propto 1 - A_n + \alpha (\gamma_c^i)^{\sigma-1} \underbrace{[\sigma + A_n \gamma_c^i (1-\sigma)]}_{\text{negative?}}. \quad (67)$$

A sufficient condition for the right-hand side to be negative is that the term in the bracket be negative. Given that  $\gamma_c^i \geq 1$ , this sufficient condition holds if  $\sigma + A_n (1-\sigma) \leq 0$ , which is equivalent to

$$1 < \frac{\sigma}{\sigma-1} \leq A_n. \quad (68)$$

If equation (68) holds, then  $V_f^i/V_n^i$  is decreasing in  $\gamma_c^i$  in the entire range of  $\gamma_c^i$ , which means that  $V_f^i/V_n^i$  is always increasing in  $\eta_i$ . Moreover, taking the derivative of  $V_f^i$  with respect to  $\gamma_c^i$  shows that  $V_f^i$  is decreasing in  $\gamma_c^i$ , provided that  $\frac{\sigma}{\sigma-1} \leq A_n$ .

*Part (ii).* We show that there exists an  $\eta^* < 1 - e/I$  such that  $V_f^i/V_n^i$  in an open economy is larger than that in autarky if and only if  $\eta_i > \eta^*$ . We show this result in three steps.

Step 1. While in an open economy  $i$ ,  $V_f^i/V_n^i$  is decreasing in  $\gamma_c^i$  (i.e., increasing in  $\eta_i$ ) as

<sup>3</sup>In taking the partial derivative of  $V_f^i/V_n^i$  w.r.t.  $\gamma_c^i$ , we abstract from the dependence of  $\alpha$  on  $\gamma_c^i$ , whereas  $\gamma_c^i$  indeed affects global income  $Y$  and price index  $\gamma_w$ . We can show that this simplification does not alter the final conclusion for a case that number of countries  $M$  is large enough.

shown in part (i) above,  $V_f^i/V_n^i$  is increasing in  $\gamma_c^i$  in the closed economy case. To see this, use equations (27) and (28) to write

$$(V_f^i/V_n^i)^{\text{closed}} = \frac{(1-\theta)(\gamma_c^i A_n - 1)}{\theta \gamma_c^i (A_n - 1)}, \quad (69)$$

which is increasing in  $\gamma_c^i$ .

Step 2. At  $\gamma_c^i = 1$ ,  $V_f^i/V_n^i$  is larger in an open economy than it is under autarky. To show this, note that under autarky and  $\gamma_c^i = 1$ , we have  $(V_f^i/V_n^i)^{\text{closed}} = (1-\theta)/\theta$ . Use equation (65) to show that in an open economy  $i$  and when  $\gamma_c^i = 1$ :

$$\left. \frac{V_f^i}{V_n^i} \right|_{\gamma_c^i=1} = \frac{1-\theta}{\theta} \frac{Y}{A_n e \gamma_w^{1-\sigma}} = \frac{1-\theta}{\theta} \frac{M}{\theta \sum_j (\gamma_c^j)^{1-\sigma} + (1-\theta) \sum_j (\gamma_c^j)^{-\sigma}} \geq \frac{1-\theta}{\theta}, \quad (70)$$

where we used equation (41) for the global income  $Y$ , and equation (35) for  $\gamma_w$ . The last inequality comes from the fact that  $\sum_j (\gamma_c^j)^{1-\sigma} \leq M$  and  $\sum_j (\gamma_c^j)^{-\sigma} \leq M$ , since  $\gamma_c^j \geq 1$  for all  $j$ . Note that the last *inequality* would be an *equality* if and only if  $\gamma_c^j = 1$  for all  $j$ , i.e., financial markets in all countries are frictionless.

Step 3. We show that in the limit of  $\gamma_c^i \rightarrow \infty$ ,  $V_f^i/V_n^i$  is smaller in an open economy than it is under autarky. To see this, note that under autarky and in the limit of financial underdevelopment (i.e.,  $\gamma_c^i \rightarrow \infty$ ), the ratio of the value added of two sectors is positive:

$$(V_f^i/V_n^i)^{\text{closed}} = \frac{(1-\theta)(\gamma_c^i A_n - 1)}{\theta \gamma_c^i (A_n - 1)} \xrightarrow{\gamma_c^i \rightarrow \infty} \frac{(1-\theta)A_n}{\theta(A_n - 1)}, \quad (71)$$

whereas from equation (65) we can see that, as long as  $\sigma > 1$ , in the limit  $\gamma_c^i \rightarrow \infty$ ,  $V_f^i/V_n^i$  in an open economy converges to zero.

These three steps together show that  $V_f^i/V_n^i$  in an open economy and that under autarky cross at some  $\gamma^* > 1$ , i.e., at some  $\eta^* < 1 - e/I$ . Moreover,  $V_f^i/V_n^i$  in an open economy is larger than that under autarky if and only if  $\gamma_c^i < \gamma^*$ , i.e.,  $\eta > \eta^*$ .

*Part (iii).* As we showed in part (ii),  $V_f^i/V_n^i$  is increasing (decreasing) in  $\eta_i$  in an open (a closed) economy. Therefore, the gap between  $V_f^i/V_n^i$  under free trade and that under autarky rises with  $\eta_i$ .

## B.5 Proof of proposition 2

Provided that  $\gamma_c^i > 1$ , producing finance-dependent varieties in country  $i$  entails economic profits. A country's income equals capital rent  $A_n e$ , which is invariant to trade openness,

plus economic profits generated in sector  $f$ . To explore profit shifting, we therefore compare a country's income in autarky to that under free trade. Country  $i$ 's income in autarky is given by equation (25) which can be written as

$$Y_{\text{autarky}}^i = A_n e \left[ 1 + \frac{(1-\theta)(\gamma_c^i - 1)}{\theta\gamma_c^i + 1 - \theta} \right], \quad (72)$$

and income under free trade is given by equation (44):

$$Y_{\text{trade}}^i = A_n e \left[ 1 + (1-\theta) \left( \frac{\gamma_c^i}{\gamma_w} \right)^{1-\sigma} \left( 1 - \frac{1}{\gamma_c^i} \right) \frac{\hat{\gamma}_c M}{\theta\hat{\gamma}_c + 1 - \theta} \right]. \quad (73)$$

In the case  $\gamma_c^i = 1$ ,  $Y_{\text{trade}}^i = Y_{\text{autarky}}^i = A_n e$ . Provided that  $\gamma_c^i \neq 1$ , we can write

$$Y_{\text{trade}}^i < Y_{\text{autarky}}^i \iff \left( \frac{\gamma_c^i}{\gamma_w} \right)^{1-\sigma} \frac{M\hat{\gamma}_c}{\theta\hat{\gamma}_c + 1 - \theta} < \frac{\gamma_c^i}{\theta\gamma_c^i + 1 - \theta}, \quad (74)$$

and substituting for  $\gamma_w$  and  $\hat{\gamma}_c$  from equations (35) and (42) delivers

$$Y_{\text{trade}}^i < Y_{\text{autarky}}^i \iff \frac{(\gamma_c^i)^{-\sigma}}{\sum_j (\gamma_c^j)^{-\sigma}} \frac{M}{\theta \frac{\sum_j (\gamma_c^j)^{1-\sigma}}{\sum_j (\gamma_c^j)^{-\sigma}} + 1 - \theta} < \frac{1}{\theta\gamma_c^i + 1 - \theta}, \quad (75)$$

which can be simplified to

$$Y_{\text{trade}}^i < Y_{\text{autarky}}^i \iff M \left[ \theta(\gamma_c^i)^{1-\sigma} + (1-\theta)(\gamma_c^i)^{-\sigma} \right] < \theta \sum_j (\gamma_c^j)^{1-\sigma} + (1-\theta) \sum_j (\gamma_c^j)^{-\sigma}. \quad (76)$$

## B.6 Proof of proposition 3

As mentioned in the text, to keep tractability, we approximate equations up to the first order of variations in financing friction severity across countries. We derive the first-order Taylor expansions of equations around the world average profit margin  $\bar{\gamma} := \frac{\sum_j \gamma_c^j}{M} > 1$ . Define  $\gamma_c^i := \bar{\gamma} + \Delta\gamma_c^i$ , where  $\sum_j \Delta\gamma_c^j = 0$  by definition. We first derive first-order approximations of  $\gamma_w$  and  $\hat{\gamma}_c$ .

$$(\gamma_c^i)^{1-\sigma} = (\bar{\gamma} + \Delta\gamma_c^i)^{1-\sigma} \approx \bar{\gamma}^{1-\sigma} \left( 1 + (1-\sigma) \frac{\Delta\gamma_c^i}{\bar{\gamma}} \right). \quad (77)$$

Therefore

$$\sum_i (\gamma_c^i)^{1-\sigma} \approx \bar{\gamma}^{1-\sigma} \left( M + (1-\sigma) \frac{\sum_i \Delta\gamma_c^i}{\bar{\gamma}} \right) = M\bar{\gamma}^{1-\sigma}. \quad (78)$$

Using the definition of  $\gamma_w$ , we derive

$$\gamma_w \approx M^{1/(1-\sigma)} \bar{\gamma}. \quad (79)$$

As for  $\hat{\gamma}_c$ :

$$\hat{\gamma}_c = \frac{\sum_i (\gamma_c^i)^{1-\sigma}}{\sum_i (\gamma_c^i)^{-\sigma}} \approx \frac{\bar{\gamma}^{1-\sigma} \sum_i (1 + (1-\sigma) \frac{\Delta \gamma_c^i}{\bar{\gamma}})}{\bar{\gamma}^{-\sigma} \sum_i (1 - \sigma \frac{\Delta \gamma_c^i}{\bar{\gamma}})} = \bar{\gamma}. \quad (80)$$

We write the gains from trade equation (48) as

$$\log(GT_i) = \underbrace{\log\left(\frac{Y_{\text{trade}}^i}{Y_{\text{autarky}}^i}\right)}_{\text{profit-shifting channel}} + \underbrace{(1-\theta) \log\left(\frac{\gamma_c^i}{\gamma_w}\right)}_{\text{price channel}}. \quad (81)$$

We can write the price channel as

$$(1-\theta) \log\left(\frac{\gamma_c^i}{\gamma_w}\right) = (1-\theta) \log\left(1 + \frac{\Delta \gamma_c^i}{\bar{\gamma}}\right) - (1-\theta) \log M^{1/(1-\sigma)} \approx (1-\theta) \frac{\Delta \gamma_c^i}{\bar{\gamma}} + \frac{1-\theta}{\sigma-1} \log M. \quad (82)$$

The first term in the price channel is due to the presence of financial frictions, while the second term equals the price channel in the frictionless case. The price channel is stronger in the presence of frictions relative to the frictionless world for countries with  $\Delta \gamma_c^i > 0$ , i.e., countries with more severe frictions than the world average.

We now derive the first-order approximations of income equations under autarky and free trade. We start with the income equation (25) under autarky:

$$\begin{aligned} Y_{\text{autarky}}^i &= \frac{A_n e \gamma_c^i}{\theta \gamma_c^i + 1 - \theta} = \frac{A_n e (\bar{\gamma} + \Delta \gamma_c^i)}{1 - \theta + \theta \bar{\gamma} + \theta \Delta \gamma_c^i} = \frac{A_n e \bar{\gamma}}{1 - \theta + \theta \bar{\gamma}} \frac{1 + \frac{\Delta \gamma_c^i}{\bar{\gamma}}}{1 + \frac{\theta \Delta \gamma_c^i}{1 - \theta + \theta \bar{\gamma}}} \\ &\approx \frac{A_n e \bar{\gamma}}{1 - \theta + \theta \bar{\gamma}} \left(1 + \frac{\Delta \gamma_c^i}{\bar{\gamma}} - \frac{\theta \Delta \gamma_c^i}{1 - \theta + \theta \bar{\gamma}}\right) = \frac{A_n e \bar{\gamma}}{1 - \theta + \theta \bar{\gamma}} \left[1 + \frac{\Delta \gamma_c^i}{\bar{\gamma}} \left(\frac{1 - \theta}{1 - \theta + \theta \bar{\gamma}}\right)\right]. \quad (83) \end{aligned}$$

We use equations (73), (79), and (80) to derive the first-order approximation for income

under free trade:

$$\begin{aligned}
Y_{\text{trade}}^i &= A_n e \left[ 1 + (1-\theta) \left( \frac{\gamma_c^i}{\gamma_w} \right)^{1-\sigma} \left( 1 - \frac{1}{\gamma_c^i} \right) \frac{\hat{\gamma}_c M}{\theta \hat{\gamma}_c + 1 - \theta} \right] \approx A_n e \left[ 1 + (1-\theta) \left( \frac{\gamma_c^i}{\bar{\gamma}} \right)^{1-\sigma} \left( 1 - \frac{1}{\gamma_c^i} \right) \frac{\bar{\gamma}}{\theta \bar{\gamma} + 1 - \theta} \right] \\
&\approx A_n e \left[ 1 + (1-\theta) \left( 1 + (1-\sigma) \frac{\Delta \gamma_c^i}{\bar{\gamma}} \right) \left( 1 - \frac{1}{\bar{\gamma}} \left( 1 - \frac{\Delta \gamma_c^i}{\bar{\gamma}} \right) \right) \frac{\bar{\gamma}}{\theta \bar{\gamma} + 1 - \theta} \right] \\
&\approx \frac{A_n e \bar{\gamma}}{\theta \bar{\gamma} + 1 - \theta} \left[ 1 + (1-\theta) \frac{\Delta \gamma_c^i}{\bar{\gamma}} \left( 1 - \sigma \left( 1 - \frac{1}{\bar{\gamma}} \right) \right) \right], \quad (84)
\end{aligned}$$

where the last approximation above assumes  $(\Delta \gamma_c^i)^2 \approx 0$ . Now we use equations (83) and (84) to write the profit-shifting channel as

$$\log \left( \frac{Y_{\text{trade}}^i}{Y_{\text{autarky}}^i} \right) \approx (1-\theta) \frac{\Delta \gamma_c^i}{\bar{\gamma}} \left[ 1 - \sigma \left( 1 - \frac{1}{\bar{\gamma}} \right) \right] - \frac{\Delta \gamma_c^i}{\bar{\gamma}} \left[ \frac{1-\theta}{1-\theta+\theta \bar{\gamma}} \right] = -(1-\theta) \frac{\Delta \gamma_c^i}{\bar{\gamma}} (\bar{\gamma}-1) \left[ \frac{\sigma}{\bar{\gamma}} - \frac{\theta}{1-\theta+\theta \bar{\gamma}} \right]. \quad (85)$$

Note that  $\frac{\sigma}{\bar{\gamma}} - \frac{\theta}{1-\theta+\theta \bar{\gamma}} > 0$  provided that  $\sigma > 1$ . As expected, for any average profit margin  $\bar{\gamma} > 1$ , country  $i$ 's income falls by trade if and only if  $\Delta \gamma_c^i > 0$ , i.e., country  $i$  is more frictional than the world average.

Using equations (82) and (85) into the gains from trade in equation (81), and subtracting the frictionless gains from trade in equation (51) delivers

$$\log(GT_i) - \log(GT_i^{\text{frictionless}}) = (1-\theta) \frac{\Delta \gamma_c^i}{\bar{\gamma}} \left[ 1 - (\bar{\gamma}-1) \left( \frac{\sigma}{\bar{\gamma}} - \frac{\theta}{1-\theta+\theta \bar{\gamma}} \right) \right]. \quad (86)$$

Defining  $\sigma^* = \frac{\bar{\gamma}}{\bar{\gamma}-1} + \frac{\theta \bar{\gamma}}{1-\theta+\theta \bar{\gamma}}$  as in the text, the equation above proves proposition 3. This equation e.g. shows that provided that  $\sigma > \sigma^*$ , the gains from trade for country  $i$  in the presence of financial frictions are smaller than those in the frictionless world if and only if  $\Delta \gamma_c^i > 0$  (i.e.,  $\gamma_c^i > \bar{\gamma}$ ).

## B.7 Proof of proposition 4

In a closed economy, welfare falls with financial frictions. To elaborate, taking the derivative of the welfare in closed economy in equation (29) with respect to  $\gamma_c$  delivers

$$\frac{\partial U}{\partial \gamma_c} = A_n^\theta A_f^{1-\theta} e \frac{\theta(1-\theta)(1-\gamma_c)\gamma_c^{\theta-1}}{(\theta\gamma_c+1-\theta)^2} \leq 0, \quad (87)$$

since  $\gamma_c \geq 1$ .

For a small open economy, the world price index for sector  $f$  does not change by  $\gamma_c^i$ .



Therefore, to explore changes in the welfare of a small open economy  $i$  with respect to financial friction severity, we take the derivative of the income equation (73) with respect to  $\gamma_c^i$ :

$$\frac{\partial Y_{\text{trade}}^i}{\partial \gamma_c^i} \propto (1 - \sigma)\gamma_i^\sigma + \sigma\gamma_i^{\sigma-1}, \quad (88)$$

which is positive if and only if  $\gamma_c^i \leq \sigma/(\sigma - 1)$ ; that is welfare rises with a reduction in financial friction severity if and only if  $\gamma_c^i \geq \sigma/(\sigma - 1)$ . Note that the world equilibrium objects  $\hat{\gamma}_c$  and  $\gamma_w$  do not change with  $\gamma_c^i$  since country  $i$  is small.

## C Financial Development and Comparative Advantage in Finance-Dependent Industries

In line with the literature (Beck, 2002, 2003; Svaleryd and Vlachos, 2005; Hur, Raj and Riyanto, 2006; Becker, Chen and Greenberg, 2012; Manova, 2013), here we document that financially developed economies have a comparative advantage in finance-dependent industries. We follow Costinot (2009) to measure revealed comparative advantage by running the following regression:<sup>4</sup>

$$\ln(x_{od}^i) = \alpha_{od} + \beta_d^i + \delta_o[\text{Fin Dep}]^i + \varepsilon_{od}^i, \quad (89)$$

where  $x_{od}^i$  is the exports from the origin country  $o$  to the destination country  $d$  in industry  $i$ .  $\alpha_{od}$  and  $\beta_d^i$  capture origin-destination and destination-industry fixed effects, respectively.  $[\text{Fin Dep}]^i$  is the Rajan-Zingales external-finance dependence for industry  $i$ : the fraction of firms' investment cost not financed via cash flows. The origin fixed effects  $\delta_o$  determine the pattern of cross-country comparative advantage in finance-dependent industries. To see why, take the diff-in-diff of the above regression to write

$$E[\ln(x_{o_1d}^{i_1}/x_{o_1d}^{i_2}) - \ln(x_{o_2d}^{i_1}/x_{o_2d}^{i_2})] = (\delta_{o_1} - \delta_{o_2}) * ([\text{Fin Dep}]^{i_1} - [\text{Fin Dep}]^{i_2}). \quad (90)$$

This representation shows that countries with higher  $\delta_o$  export relatively more in finance-dependent industries.

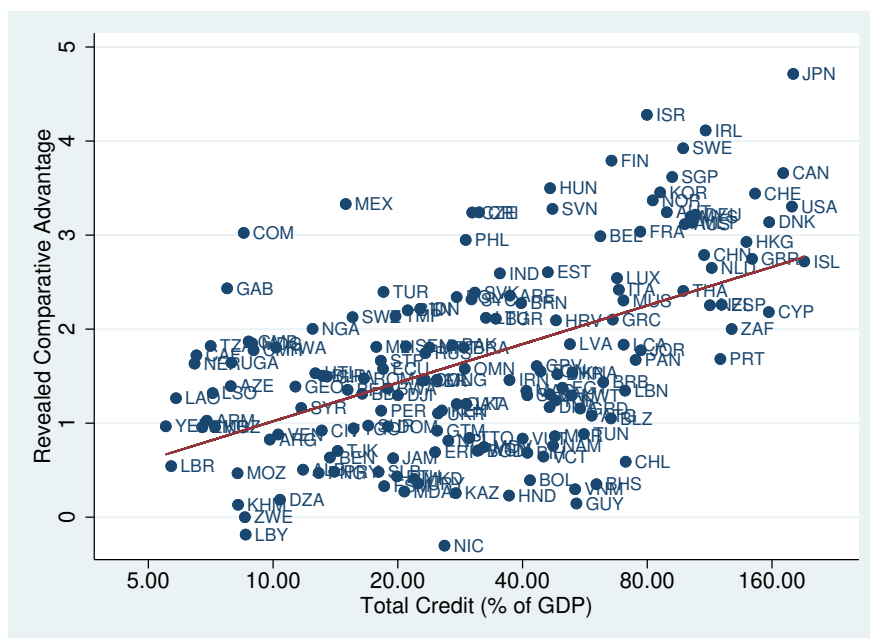
To run this regression, we use Comtrade import flows for 181 exporters and 169 importers in 27 three-digit ISIC manufacturing industries in 2005 (see details in appendix A).<sup>5,6</sup> Figure C.1 plots the estimated revealed comparative advantage  $\delta_o$  against our main proxy for financial development, i.e., private credit (% of GDP). We confirm that financially more-developed countries have a comparative advantage in finance-dependent industries. This result is robust to using our other proxies for finance dependence and financial development introduced above.

<sup>4</sup>The context in Costinot (2009) is different; he estimates revealed comparative advantage in producing “complex” goods.

<sup>5</sup>Table A.3 lists the industries.

<sup>6</sup>Using data in 1995 or 2015 delivers the same pattern.

Figure C.1: Revealed comparative advantage in finance-dependent industries against financial development



Notes: The vertical axis measures revealed comparative advantage in finance-dependent industries using regression (89). The horizontal axis is our proxy for financial development which measures total credit to private sector normalized by GDP, in the log scale. The slope of the linear fit is statistically significant, with the t-statistic being 7.78.

## D Additional Tables

Table D.1: Value added of financially vulnerable industries with respect to trade barriers and financial development

log(Value added)	1963 to 2003				1988 to 2003			
	All	All	low Tariff	high Tariff	All	low Fin.Dev.	high Fin.Dev.	All
asset intangibility × financial development	0.0751 (0.2902)	0.6508 (0.4318)	1.1174** (0.5345)	0.3666 (0.5865)	-0.5153 (0.3466)	0.0433 (0.4073)	-0.8754 (0.7408)	1.9662*** (0.7035)
asset intangibility × tariff								1.8321** (0.9334)
asset intangibility × financial development × tariff								-1.0481** (0.4458)
FE – Industry, Country, Year	✓	✓	✓	✓	✓	✓	✓	✓
Observation	44447	6645	3315	3330	6645	3329	3316	6645
Clusters (country×industry)	2703	1675	1050	1021	1675	847	997	1675
Differential scale (%)	1.4	14.8	26.8	8.1	-11.2, per 10pp tariff	1.0, per 10pp tariff	-18.3, per 10pp tariff	51.8, at tariff=0 0, at tariff=11.7%

Notes: An observation is an industry in a country in a year. The left-hand-side variable is the log of value added minus wage bills, which includes profits plus capital rent, at the three-digit (ISIC rev.2) level. Asset intangibility proxies for industry-level financial vulnerability, and is defined as one minus the ratio of net property, plant, and equipment over total assets for the U.S. publicly traded firms in 1980s, in a given industry. The country-level financial development is proxied by the log of total credit to private sector normalized by GDP (standardized by the sample minimum and STD). Industry-country level trade barriers are proxied by trade-weighted average of trade tariffs across trade partners at the broader two-digit industry level. Tariffs are scaled by their full-sample standard deviation, which is 6.2 percents. See appendix A for more details on constructing variables. The first column regression has the interaction of finance dependence and financial development on the right-hand side and covers data for five decades from 1963 to 2003. The second to fourth columns replicate the same regression from 1988 to 2003 for which tariff data are available. The sample median of country-level average tariffs for the whole manufacturing is used as the cutoff to divide the sample into high- versus low-tariff countries. The fifth to seventh regressions have the interaction of finance dependence and tariffs on the right-hand side. The sample median of credit over GDP is used as the cutoff to divide the sample into financially less- versus more-developed economies. The last column shows regression results for the full triple-difference specification. The differential scale in columns 1-4 as well as in the last column measures how much an industry at the 75th percentile of asset intangibility in the regression sample generates more value added relative to the one at the 25th percentile, in a country at the 75th percentile of financial development compared to the one at the 25th percentile. The last column reports this estimate at two levels of tariffs. The differential scale in the fifth to seventh columns shows how much an industry at the 75th percentile of asset intangibility generates more value added relative to the one at the 25th percentile, per 10 percentage points reduction in tariffs. Standard errors are clustered at the industry×country level, and are reported in parentheses.

\*\*\* $p < 0.01$  \*\* $p < 0.05$  \* $p < 0.1$

Table D.2: Value added of finance-dependent industries in countries with different financial development, and import/export tariffs with financially more-/less-developed countries.

log(Value added)	(1)	(2)	(3)	(4)	(5)	(6)
ExtDep × FinDev	0.7568*** (0.1543)	0.9006*** (0.1288)	0.8281*** (0.1492)	0.8039*** (0.1341)	1.0029*** (0.1618)	1.3486*** (0.2106)
ExtDep × average tariff	0.2314 (0.2119)					
ExtDep × import tariff w/ higher dev.		0.5304*** (0.1555)				0.4324 (0.2821)
ExtDep × export tariff w/ higher dev.			0.2542* (0.1423)			0.1257 (0.1517)
ExtDep × import tariff w/ lower dev.				0.5995*** (0.2047)		0.2550 (0.3141)
ExtDep × export tariff w/ lower dev.					1.1615*** (0.3898)	0.6354* (0.3749)
ExtDep × FinDev × average tariff	-0.2648*** (0.0913)					
ExtDep × FinDev × import tariff w/ higher dev.		-0.3415*** (0.0671)				-0.2847*** (0.0963)
ExtDep × FinDev × export tariff w/ higher dev.			-0.2138*** (0.0684)			-0.1167 (0.0736)
ExtDep × FinDev × import tariff w/ lower dev.				-0.3594*** (0.1002)		-0.1083 (0.1275)
ExtDep × FinDev × export tariff w/ lower dev.					-0.7493*** (0.1823)	-0.4562*** (0.1743)
FE – Industry, Country, Year	✓	✓	✓	✓	✓	✓
Observations	6645	6500	6484	6645	6455	6339
Clusters (country × industry)	1675	1653	1657	1675	1637	1635

Notes: An observation is a three-digit (ISIC rev.2) industry in a country in a year. Average tariffs are defined as the trade-weighted average of tariffs that country  $i$  imposes on its imports (import tariffs) as well as tariffs that country  $i$ 's trade partners impose on country  $i$ 's exports (export tariffs). "Export tariff w/ higher dev," for instance, measures trade-weighted average tariffs on a country's exports, imposed by trade partners that are financially more-developed than this country. Other variables are defined in table 1. Standard errors are clustered at the industry × country level, and are reported in parentheses. \*\*\* $p < 0.01$  \*\* $p < 0.05$  \* $p < 0.1$