Who Benefits from Financial Development? The Interaction of Finance and Trade*

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Abstract

We document that finance-dependent industries benefit from financial development, but if and only if trade barriers are low. To explain this finding, we develop an international trade model featuring cross-country financial friction heterogeneity. Although product markets are competitive, production in finance-dependent sectors is supported by endogenous profit margins to prevent firms from making strategic defaults. We test this mechanism using cross-country firm-level ORBIS data. We further show that, because of profit shifting, a country may gain more (relative to the frictionless case) when trading with less financially developed economies, and a small open economy may not benefit from financial development.

JEL Codes: G1, F1, O16, E22.

Keywords: Financial Frictions, Profits, International Trade, Finance Dependence, Financial Development.

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1 Introduction

It is hard to overstate the importance of financial development for the macroeconomy. A large body of literature in economics and finance emphasizes the key role of financial development in economic growth, resource allocation, and technology adoption (e.g., Rajan and Zingales, 1998; Alfaro et al., 2004; Banerjee and Duflo, 2005; Midrigan and Xu, 2014; Cole, Greenwood and Sanchez, 2016). While beneficial overall, financial development would not affect all agents in the economy equally (e.g., Greenwood and Jovanovic, 1990; Aghion and Bolton, 1997; Townsend and Ueda, 2006; Braun and Raddatz, 2008). In this paper, we show that the extent of international trade barriers is a key determinant of who benefits from financial development in the economy. In particular, we document that financial development benefits finance-dependent sectors, but if and only if trade barriers are low. Indeed, when trade barriers are large enough, financial development *hurts* finance-dependent sectors. Our findings have implications for understanding the development of a country's financial sector from a political economy perspective, especially in an era of powerful *de*globalization movements. Specifically, our evidence implies that finance-dependent sectors do not benefit from and therefore would not support financial development in an environment with restricted international trade, which might pose a threat against financial development. To rationalize our empirical findings and explore aggregate implications, we develop a stylized model of international trade featuring cross-country financial friction heterogeneity.

By employing a difference-in-difference strategy in subsamples of countries with different trade barriers, we first document that the sensitivity of finance-dependent industries (in terms of total *profits*) to financial development depends crucially on trade barriers. As a proxy for total payoffs to capital/firm owners, we use value added net of wage bill—which equals capital rents plus (variable) economic profits—and call it *profits* in what follows.[1] We examine the profits of 27 manufacturing industries for a panel of around 100 countries from 1988 to 2003, along the dimensions of country-level financial development, industry-level finance dependence, and industry-country level tariff barriers.

We document that more (relative to less) finance-dependent industries generate higher profits in more financially developed economies, but only when trade barriers are low. More interestingly, we show that financial development indeed *hurts* finance-dependent sectors' profits when trade barriers are large. Our empirical estimates are economically significant: when tariffs are low (i.e., below the sample median), an industry at the 75th percentile of finance dependence relative to the one at the 25th percentile generates 68.1% more profits 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 and equals -19.1% when tariffs are large (i.e., above the sample median).

[1] In accounting terms, this variable is called *gross* profits.

Furthermore, we show that more (relative to less) finance-dependent industries generate more profits when tariff barriers are lower, but only in financially developed economies (i.e., above the median). Indeed, finance-dependent industries' profits are not sensitive to tariff barriers in financially underdeveloped economies (i.e., below the median). To formally document the complementarity between trade openness and financial development on the profits of finance-dependent industries, we employ a triple-difference strategy and find economically and statistically significant results, which confirm our subsample estimations.

To show that our empirical findings are robust, we run a battery of robustness tests. In particular, we use various proxies for country-level financial development: credit to the private sector over GDP, financial system deposits over GDP, banks' overhead costs over assets, and net interest margin; alternative proxies for industry-level financial vulnerability: external-finance dependence, asset intangibility, and capital intensity; alternative proxies for trade barriers: tariffs at different aggregation levels, the opposite of trade openness (imports plus exports over GDP), and the opposite of "natural openness" implied by a gravity model. We further employ alternative notions of industry outcome as our left-hand-side variable: value added net of wage bill, value added, sales, and value added net of wage bill and capital depreciation. In all robustness checks, our results are qualitatively, and in most cases also quantitatively, similar. Importantly, we find that the sensitivity of finance-dependent industries to financial development falls with international trade barriers, and this estimated sensitivity is indeed negative at the right tail of trade barriers in our sample.

To explain our empirical findings, we develop a stylized model of international trade that delivers tractable and closed-form results. To isolate our mechanism from competing forces, we assume all markets except the financial market are frictionless. Our model features two sectors: 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—that is, 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 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). In equilibrium, firms in the finance-dependent sector earn an endogenous profit *margin* (i.e., profit per size), although product markets are perfectly competitive and we impose free entry. This profit margin prevents strategic default on loans and is needed to support lending, investment, and production in the finance-dependent sector. In equilibrium, this profit margin increases 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 the Heckscher-Ohlin-Samuelson model).[2] In our model, countries differ in their financial friction severity; therefore, more financially developed countries have a comparative advantage in producing finance-dependent goods.[3] Through the lens of our model, when trade barriers are low, financial development benefits finance-dependent sectors, since production and profits shift to more financially developed economies with a comparative advantage in these sectors. When trade barriers are large, however, financial development decreases the total profits of finance-dependent sectors. This is because, although these industries shrink in production size, firms in finance-dependent sectors earn higher profit *margins* when financial frictions are more severe, as explained above.

The key mechanism in our model that underlies our results is that production of finance-dependent varieties in the presence of financial frictions is supported by profits from production, which facilitates in-advance external financing and investment in a forward-looking setup. Our model then implies that firms in finance-dependent sectors earn higher profit margins in less financially 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 5%-20% (depending on proxies for financial development and finance dependence) larger at the 75th percentile of the finance-dependence distribution relative to the 25th percentile, in the least compared to the most financially developed country in our ORBIS 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, the 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 less financially frictional, since

[2] 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.

[3] This pattern of specialization is well documented in a large body of literature; see, for example, Manova (2013), among others. We also 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.

those trade partners are able to produce finance-dependent varieties at a lower profit margin and therefore cheaper prices. On the other hand, the 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.[4] 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 our empirical findings from ORBIS to show that the profit-shifting channel in our model is indeed a relevant force, through which the presence of financial frictions tends to increase (decrease) the gains from trade for countries that are more (less) financially 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 the profit margin in the finance-dependent sector, which reduces misallocation and raises welfare in a closed economy. Note that it is indeed the consumers, not the 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 profit margin induced by financial development are shared between Home and Foreign consumers. The reduction in profit margin 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 as a result of the reduction in export profits. We use the estimates from our empirical findings from ORBIS together with our analytical results and show that while reducing financing frictions is welfare improving in less financially developed countries, more financially developed countries in our ORBIS sample may not benefit as much from a reduction in financial frictions.

This paper contributes to several strands of literature. We contribute 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), misallocation 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,

[4]Note that the phrase "profit shifting" is used in two different stands of literature with two different meanings. In the international macro/finance literature, profit shifting is typically defined as the practice of business owners transferring money to so-called tax havens to avoid paying taxes. In the international trade literature, however, profit shifting refers to the case in which, as a result of comparative advantage, the 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 definition.

2000; Townsend and Ueda, 2006; Ebrahimian, 2020). To the best of our knowledge, the aforementioned literature in macro-finance does not emphasize the role of trade barriers in shaping the aggregate and distributional implications of financing frictions, while we show that these implications depend crucially on the extent of trade barriers.

We also contribute to the literature on the determinants of financial development at the country level. The legal system and cultural forces, private interests and politics, and demand for financing as a result of, for example, comparative advantage in finance-dependent sectors are discussed in the literature as determinants of financial development (see e.g., Beck, Demirgüc-Kunt and Levine, 2003; Rajan and Zingales, 2003; Do and Levchenko, 2007; Braun and Raddatz, 2008, among others). In particular, by studying the patterns of international trade and financial development across countries over time, Rajan and Zingales (2003) argue that international trade may affect financial development by changing the private interests of incumbents and demand for financial development. We contribute to this literature by providing direct evidence and a theoretical explanation for the fact that financial development benefits finance-dependent industries, but if and only if trade barriers are low. By identifying who benefits/loses from financial development, our results shed light on the potential supporters/opponents and therefore on the dynamics of financial development from a political economy perspective, especially in an era of deglobalization movements.

This paper also contributes to a large and growing body of 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, 2020*a*; Leibovici, 2021) as well as on capital flows (Matsuyama, 2005; Antras and Caballero, 2009). 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, 2013; 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 a distinctly 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 *hurts* profits in finance-dependent industries if trade barriers are large.

Lastly, we contribute to a literature that studies gains from trade under financing frictions (Caggese and Cuñat, 2013; Kohn, Leibovici and Szkup, 2020*b*; Brooks and Dovis, 2020; Leibovici, 2021). In our paper, financial frictions lead to endogenous profits in finance-dependent sectors. Trade openness shifts these profits to more financially developed countries. By introducing this profit-shifting channel, we establish that the effects of financial frictions on a country's gains from trade depend on the financial friction severity not only of the home country but also of its trade partners. In this regard, we also 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) by introducing that financial frictions activate profit shifting across less and more financially developed countries.

The rest of the paper is organized as follows. Section 2 documents our industry-level empirical facts. 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 to explain the empirical 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 consequences of financing frictions against trade openness. Section 6 concludes.

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

This section documents a set of empirical facts. First, Section 2.2 shows that finance-dependent industries benefit from financial development, but only when trade barriers are low. We find that financial development indeed hurts finance-dependent industries when trade barriers are large. Second, Section 2.3 documents that finance-dependent industries benefit from lower trade barriers, but only in financially developed economies. We show that finance-dependent industries are insensitive to trade barriers in financially underdeveloped economies. Putting these facts together, Section 2.4 lastly establishes a complementarity between financial development and trade openness: finance-dependent industries benefit more from financial development when trade barriers are lower, and they benefit more from trade openness in more financially developed economies. We run a battery of robustness tests to show the robustness of these empirical facts to alternative empirical specifications and proxies that we use.

2.1 Data

We use various data sources to document our empirical facts. Here we briefly introduce the data sources and explain how we construct our variables. More details on the data and variables that we use are provided in appendix A. Summary statistics for baseline variables are provided in the appendix table A.1.

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 the World Bank Global Financial Development Database (Beck, Demirgüc-Kunt and Levine, 2000). We also employ three alternative proxies for financial development in our robustness checks: financial system deposits over GDP, banks' net interest margin, and banks' overhead costs over total assets.

We construct three measures to compare financial vulnerability across industries. First, we measure external-finance dependence as the fraction of capital expenditures of an average firm in a specific industry that is not covered by the 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 therefore more affected by country-level financial development. Second, we compare industries based on their asset intangibility (Braun, 2005; Manova, 2013). 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; to raise funds for investment, they instead need to pledge future cash flows in a forward-looking sense, which requires sophisticated financial institutions. Third, we compare industries based on their capital intensity in production. One minus the share of material and labor in sales can be a proxy for capital intensity (both tangible and intangible capital such as entrepreneurial ability and managerial efficiency) in the production technology. Given the time-to-build nature of capital, capital-intensive industries presumably rely more on finance and are therefore more affected by financial development. We use the U.S. Compustat data to construct industry-level measures of external-finance dependence and asset intangibility and use the NBER-CES Manufacturing Industry Database to construct capital intensity in the production technology, all for 27 three-digit ISIC (revision 2) manufacturing sectors. As in the literature, we treat these proxies as inherent characteristics of industries that are the same across countries. Note that to construct our proxies, we use data from the 1980s—ahead of our main sample period—for the U.S. (presumably a financially developed economy) to address concerns about reverse causality from industry performance to our proxies for financial vulnerability. Here we present regression results using the Rajan-Zingales external-finance dependence measure, and the appendix shows that the results are robust to using asset intangibility and capital intensity as alternative proxies for financial vulnerability.

We employ three proxies for international trade barriers in our empirical setup. First, 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 to 2003.[5] Trade tariffs are constructed as the trade-weighted average tariffs that a country imposes on its imports and that trade partners impose on the country's exports in a given industry. As our second proxy, we use (the opposite of) trade openness, defined as observed international trade divided by GDP. As our last proxy, we construct (the opposite of) "natural openness," as in Frankel and Romer (1999), which measures trade openness (trade over GDP) predicted by a gravity model. We employ tariffs in the text and use the other two

[5]For many countries in our sample, tariffs are not available before 1988.

alternative proxies as robustness checks in the appendix.

We obtain data on value added, wage bill, sales, and capital formation for a panel of 126 countries from United Nations Statistical Division, Industrial Statistics for manufacturing industries at the three-digit ISIC rev. 2 level reported in four decades from 1963 to 2003. We abstract from labor in this paper and use value added minus wage bill—which equals capital rents plus (variable) economic profits—as the left-hand-side variable, to proxy for total payoffs to capital/firm owners. We call this variable *profits* in what follows. We note that, in accounting terms, this variable is called gross profits. In our robustness checks, we also employ alternative measures as our industry outcome variables: value added (without subtracting wage bill), sales, and value added net of wage bill and capital depreciation (which corresponds to profits net of capital depreciation) for part of the sample with non-missing data on capital formation. We back out capital depreciation using the perpetual inventory technique and assuming a constant depreciation rate. Further details are provided in appendix A.

2.2 The Impact of Financial Development

In this section, we estimate the sensitivity of finance-dependent industries to financial development and show that this sensitivity varies significantly across countries with low versus high trade barriers.

We first run the following difference-in-difference regression using the whole sample of countries in our data:

$$\log[\text{Profits}]_{ict} = \theta_{it} + \delta_{ct} + \alpha \ [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_{ct} + \epsilon_{ict} \ . \tag{1}$$

The left-hand-side variable is the log of profits (i.e., value added minus wage bill). 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 θ_{it} and δ_{ct} are industry-year and country-year fixed effects, respectively, and ϵ_{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 necessarily independent observations.

The coefficient of interest is α, which is expected to be positive: more finance-dependent industries generate more profits (relative to less finance-dependent industries) in more financially developed countries. This regression exploits within-country differences in profits across industries with different external financing needs and measures how these differences vary across countries with different levels of financial development in a given year. By doing so, this regression isolates from the classic endogeneity and reverse causality problems in the regression of a country-level outcome variable on financial development. To further address the reverse causality concerns, we use a 5- or 10-year lag of financial development in our robustness checks.

Table 1: The impact of financial development and trade barriers on finance-dependent industries.

log(Profits)	1968 to 2003	1988 to 2003						
	All	All	low Tariff	high Tariff	All	low Fin.Dev.	high Fin.Dev.	All
external-finance dependence × log(total credit/GDP)	0.5251***	0.5247***	0.7364***	-0.3003***				0.9001***
	(0.0560)	(0.0922)	(0.1336)	(0.1082)				(0.1616)
external-finance dependence × tariff					-0.4843***	-0.0490	-0.9121***	0.5236***
					(0.0764)	(0.0851)	(0.1323)	(0.1892)
external-finance dependence × log(total credit/GDP) × tariff								-0.3951***
								(0.0826)
FE – Industry & Country, by Year	✓	✓	✓	✓	✓	✓	✓	✓
Observations	55073	6985	3386	3483	6985	3440	3454	6985
Clusters (country×industry)	2951	1747	1091	1056	1747	1053	837	1747
Differential scale (%)	38.8	44.8	68.1	-19.1	-32.2, per 10pp tariff	insignificant	-51.9, per 10pp tariff	88.7, at tariff=0 0, at tariff=13.8%

Notes: An observation is an industry in a country in a year. The left-hand-side variable is the log of profits (i.e., value added minus wage bill) 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 the 1980s in a given industry. Financial development is proxied by the country-level log of total credit to private sector 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 that 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 6.3 percents. See appendix A for more details on constructing variables. The regression in Column 1 has the interaction of finance dependence and financial development on the right-hand side and covers data for four decades from 1963 to 2003. Columns 2-4 replicate the same regression, but from 1988 to 2003, the time period 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 low- and high-tariff countries in Column 3 and Column 4. Columns 5-7 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. Column 8 shows regression results for the full triple-difference specification. The differential scale in Columns 1-4 and in Column 8 shows how much an industry at the 75th percentile of external-finance dependence in the regression sample would generate more profits 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. Column 8 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 profits relative to the one at the 25th percentile, per a 10 percentage points increase in tariffs. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Column 1 of table 1 reports the results. Overall, finance-dependent industries generate more profits in more financially developed economies. The last row interprets the results: an industry at the 75th percentile of external-finance dependence relative to the one at the 25th percentile generates 38.8% more profits in a country at the 75th percentile of financial development relative to the one at the 25th percentile.

The specification above masks a substantial heterogeneity in the sensitivity of finance-dependent industries 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.[6] The median tariff across all countries in our sample (which is 7.4%) is used to divide countries into low- and high-tariff subsamples.[7] The average manufacturing tariff is 4.3% for the low-tariff subsample and 11.4% for the high-tariff subsample.[8]

Our results in Columns 3 and 4 establish the fact that the sensitivity of finance-dependent industries' profits 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 profits), but only in countries with low trade barriers. In countries with high trade barriers, however, financial development indeed *hurts* finance-dependent industries. The last row indicates that results on differential sensitivity are economically significant: in low-tariff countries, an industry at the 75th percentile of finance dependence relative to the one at the 25th percentile generates 68.1% more profits in a country at the 75th percentile of financial development compared to a country at the 25th percentile. Interestingly, this difference in scale is negative and equals -19.1% when tariffs are high, implying that finance-dependent industries *lose* in terms of profits when financial development improves under high tariffs.

2.3 The Role of Trade Barriers

In this section, we explore the complementarity between financial development and trade openness from a different angle. In particular, we assess the sensitivity of finance-dependent industries to trade barriers and how this sensitivity varies across the subsamples of less and more financially developed countries. We document that finance-dependent industries benefit from lower trade barriers, but only in financially developed countries.

[6] Note that tariffs for our sample of countries are available only after 1988. For comparison with full sample estimates, Column 2 reports the same specification as in Column 1, but for the period after 1988.

[7] We divide the sample based on the trade-weighted average tariffs that a country imposes on its imports and that trade partners impose on the country's exports, across all manufacturing industries in the country.

[8] Naturally, there is a negative correlation between financial development and trade barriers: richer economies are more open to international trade and are more financially developed. However, we still observe considerable variations in financial development within each group of low- and high-tariff economies; see histograms in figure A.1. These variations help us precisely estimate the regression coefficients in our subsample regressions here and those in our triple-difference specification below.

We run the following difference-in-difference regression to measure the sensitivity of finance-dependent industries' profits to tariffs, separately for less and more financially developed countries:

$$\log[\text{Profits}]_{ict} = \theta_{it} + \delta_{ct} + \beta\ [\text{Fin Dep}]_i * [\text{Tariff}]_{ict} + \epsilon_{ict}\ , \qquad (2)$$

where "Tariff" proxies for trade barriers at industry i in country c at time t and measures the trade-weighted average tariffs that a country imposes on its imports and that trade partners impose on the country's exports in that industry. As in specification (1), we include industry-year and country-year fixed effects, and standard errors are clustered at the industry-country level. By exploiting within-country variations in profits across industries with different levels of external-finance dependence, this specification addresses endogeneity issues that stem from the negative correlation between trade barriers and country-level economic development (which directly affect industries' value added and profits). To further address endogeneity and reverse causality concerns, we use tariffs at a broader *two*-digit industry level, whereas our left-hand-side variable is measured at the *three*-digit level. In our robustness checks in Section 2.5, we discuss this choice and also employ alternative proxies for trade barriers to address these endogeneity and reverse causality concerns.

Results are shown in table 1, Columns 5-7, for the full sample and for the subsamples of less and more financially developed countries—with credit over GDP below and above the sample median, respectively. The differential scale for the full sample estimate in Column 5 indicates that an industry at the 75th percentile of finance dependence would generate 32.2% more profits per a 10 percentage points *reduction* in tariffs relative to the industry at the 25th percentile. However, as Columns 6-7 show, this relationship comes solely from countries with higher financial development. Indeed, for more financially developed countries (Column 7), the differential scale is 51.9% per a 10 percentage points *reduction* in tariffs, which is substantially larger than the full sample estimate. For the subsample of less financially developed economies (Column 6), however, the sensitivity to tariffs is almost zero and statistically insignificant, which indicates that trade barriers are irrelevant for finance-dependent industries in less financially developed economies.

2.4 The Interaction of Financial Development and Trade Barriers

Thus far, we have established two facts. First, financial development benefits finance-dependent industries (in terms of profits) if and only if trade barriers are low. Second, lower trade barriers benefit finance-dependent industries, but only in financially developed countries. In this section, we formally document the complementarity between financial development and trade openness.

To this end, we run the full triple-difference regression:

$$\log[\text{Profits}]_{ict} = \theta_{it} + \delta_{ct} + \alpha\ [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_{ct} + \\ \beta\ [\text{Fin Dep}]_i * [\text{Tariff}]_{ict} + \gamma\ [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_{ct} * [\text{Tariff}]_{ict} + \epsilon_{ict}\ . \tag{3}$$

From what we documented in the previous sections, we expect to see (i) a positive α, implying that finance-dependent industries benefit from financial development when trade barriers are low; (ii) a zero (or positive) β, implying that finance-dependent industries do not benefit from lower trade barriers in less financially developed countries; and (iii) a negative γ, implying that finance-dependent industries benefit more from financial development when trade barriers are lower, or equivalently, finance-dependent industries benefit more from lower trade barriers in more financially developed countries. Moreover, the expression $\alpha + \gamma * [\text{Tariff}]_{ict}$ measures how the impact of financial development on the profits of finance-dependent industries varies with trade barriers, which we expect to be negative under high trade barriers: financial development hurts finance-dependent industries when trade barriers are large.

Column 8 of table 1 reports the results; the estimated coefficients have the expected signs and are highly significant, confirming our subsample estimation results in previous sections. The differential scale in the last row shows the economic significance of the results: according to the point estimate of α, 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 88.7% more profits in a country at the 75th percentile of financial development compared to the one at the 25th percentile. This difference in scale is estimated to be *zero* at tariffs equal to 13.8%, which falls within the range of tariffs covered in our sample.[9] The appendix figure E.1 reports the differential scale estimate at different tariff levels along with the histogram of tariffs in our sample. This figure shows that the impact of financial development on the profits of finance-dependent industries (i.e., $\alpha + \gamma * [\text{Tariff}]_{ict}$) is significantly negative at the right tail of tariff distribution in our sample.

Furthermore, we highlight that β is *positive* and significant, which suggests that at the extreme of financial underdevelopment in our sample, larger tariffs *benefit* finance-dependent industries (relative to less finance-dependent industries).

Finally, we note that our empirical results have implications for understanding the development of a country's financial sector from a political economy perspective. By identifying which sectors benefit/lose from financial development, our results shed light on the potential supporters/opponents and therefore on the dynamics of financial development, especially in an era of deglobalization movements. Specifically, our evidence implies that in an environment with restricted international trade, finance-dependent sectors do not benefit from and therefore would not demand financial development, which might pose a threat against financial development.

[9] Tariffs are on average 8.8% in our data, with the standard deviation of 6.3%.

2.5 Robustness of Results

In this section, we discuss endogeneity issues and threats to identification in our empirical results. Furthermore, we show that the empirical facts that we established above are robust to various modifications to the empirical specification and proxies that we employ.

Trade barriers. We discuss here how we address endogeneity concerns regarding our proxy for trade barriers, as well as the alternative proxies that we employ. Throughout this section, we used tariffs as a proxy for trade barriers. Tariffs are likely endogenous, and various reasons might suggest a reverse causality from profits to tariffs. For instance, larger industries with higher profits in the subsample of less financially developed economies may lobby for high tariffs (which would induce a positive link from profits to tariffs), or governments may impose larger tariffs for struggling low-profit industries (which would induce a *negative* link from profits to tariffs). To address these reverse causality concerns, while our left-hand-side outcome variable is at the *three*-digit industry level, in our benchmark regressions we used average tariffs at the broader *two*-digit level, since narrower industries are less likely to lobby for broader industry-level tariffs, and governments are less likely to target these tariffs to help narrower industries. For example, if financially vulnerable industries call for higher tariffs *relative* to other industries, using average tariffs at broader levels isolates the estimates from these endogenous differences in tariffs across finer industries and therefore addresses this reverse causality concern.

Furthermore, we show that our results are indeed robust and qualitatively similar to using average tariffs at the broadest (country) level for the whole manufacturing sector, or to using tariffs at the fine three-digit industry level; see the appendix table E.1, Columns 1-3. We note that the magnitude and economic importance of results are different when we use tariffs at different ISIC levels, with the largest effect being at the broadest level. We explain this result through the lens of our model in Section 3.

To further address reverse causality concerns, we also use five-year lags, rather than contemporaneous figures, for tariffs. Although the number of observations would drop considerably, we show that our results are indeed robust; see the appendix table E.1, Columns 4-6. The results show that the triple-difference coefficient of interest remains negative and significant in all specifications. See the interpretation of our results in the last two rows of the table.

Additionally, we use two alternative measures to proxy for trade barriers. First, we use the conventional measure of trade openness. In particular, we employ (the opposite of) manufacturing imports, and imports plus exports, scaled by country GDP. Columns 3-4 of the appendix table E.2 show the results using imports and imports plus exports, respectively. Second, since trade openness is an endogenous measure, we use a measure of "natural openness," as in, for example, Frankel and Romer (1999). To elaborate, we use a gravity model to predict countries' trade over GDP, using variables such as distance, common language, shared borders, population, and partners' GDP. We then use the opposite of natural openness as our proxy for trade barriers. Columns 5-6 of the appendix table E.2 report the results using imports and imports plus exports to construct natural openness, respectively. To facilitate a comparison with the specifications using tariffs, Columns 1-2 report the results using trade-weighted average tariffs at the two-digit level for imports and for average imports and exports (as in our baseline regression), respectively. Using all these alternative proxies shows that the baseline results are robust, and in particular, the triple-difference coefficient of interest is negative and highly significant.

Import versus export barriers. 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. However, we have reasons to believe that import versus export tariffs have different effects in specification (3). Also, tariffs against less or more financially developed countries might have different implications for the sensitivity of finance-dependent industries to the country's 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 average export tariffs in the specification (3), each separately defined against the trade partners of a country that are less and more financially developed than the given country. The appendix table E.3 reports the results. In this table, "export tariff with higher developed," for instance, measures the weighted-average tariffs on country i's exports, imposed by trade partners that are more financially developed than country i. We consider import and export tariffs against more and less financially developed countries in isolation in Columns 2-5. We note that all measures of tariffs are highly correlated, and therefore, Column 6 includes all measures of import and export tariffs against more and less financially developed countries. To facilitate the comparison, Column 1 repeats the benchmark results—that is, using average import and export tariffs against all countries. Results in table E.3 indicate that it is mostly tariffs against more financially developed countries that govern the sensitivity of finance-dependent industries to financial development. We interpret these results using the model presented in Section 3 through comparative advantage forces.

Alternative measures for industry-level financial vulnerability. We have used external-finance dependence as a proxy for financial vulnerability (Rajan and Zingales, 1998). As a robustness check, we also employ asset intangibility (Braun, 2005; Manova, 2013) and capital intensity (one minus share of labor and material costs in sales) as alternative proxies for financial vulnerability and finance dependence. Intuitively, it is harder for industries with more intangible assets to raise debt, since they might not pledge their intangible assets as collateral, unless they are interacting with sophisticated financial institutions. Moreover, industries with a higher capital intensity are more financially vulnerable because of the time-to-build nature of capital—that is, investment is made and paid for ahead of the time that the production revenue is realized.

As the appendix table E.4 reports, our results are qualitatively the same and quantitatively similar when using industry-level asset intangibility and capital intensity as alternative proxies for financial vulnerability. In particular, the tariff at which finance-dependent industries' profits are no longer sensitive to financial development is robust at around 15%. Specifically, in the limit of zero tariffs, an industry in the 75th percentile of *asset intangibility* relative to the one in the 25th percentile generates 67.2% more profits in a country at the 75th percentile of financial development compared to the one at the 25th percentile, whereas this difference in scale would be zero at tariffs equal to 15.1%. Moreover, in the limit of zero tariffs, an industry at the 75th percentile of *capital intensity* relative to the one at the 25th percentile earns 50.7% more profits in a country at the 75th percentile of financial development compared to the one at the 25th percentile, whereas this difference in scale would be zero at tariffs equal to 15.5%.

Alternative measures for country-level financial development. We used contemporaneous Credit over GDP as our proxy for financial development. As a robustness check, we use 5- and 10-year lags of Credit over GDP in our regressions to further address endogeneity and reverse causality concerns. Moreover, while we included Credit over GDP *in log terms* to represent financial friction severity (to have a tight connection to our theory), we show that the results are robust to using *the level* of Credit over GDP. Lastly, we use three alternative measures to proxy for financial development: financial system deposits over GDP, banks' net interest margin, and banks' overhead costs over total assets. The appendix table E.5 presents robustness results. The triple-difference coefficient is negative and highly significant in all specifications. Depending on the proxy for financial development, the difference in the profits of an industry at the 75th percentile of finance dependence relative to the one at the 25th percentile in a country at the 75th percentile of financial development relative to the one at the 25th percentile is estimated to be in the range of 50%-100% at the limit of zero tariffs. This differential scale would be zero for tariffs in the range of 10%-15%.

Measuring the industry outcome. As the left-hand-side variable in our baseline regressions, we used profits (i.e., value added minus wage bill) as a proxy for total payoffs to capital/firm owners. We use *the log of* profits on the left-hand side and therefore automatically drop observations with negative profits. As a robustness check, we employ a Tobit model in which we include observations with negative profits in the estimation. Results are reported in Column 2 of the appendix table E.6. Moreover, our empirical results are robust to using value added (without subtracting wage bill) as the industry outcome on the left-hand side, which is reported in Column 3. We further subtract capital depreciation from value added net of wage bill as a robustness check. To this end, we use data on capital formation to calculate capital stock using the perpetual inventory method, setting the depreciation rate to 5%. Table E.6, Column

4 shows that the results are robust, although we lose statistical power as a result of frequent missing data on the capital formation, which makes the sample size 75% smaller. The last column in this table shows that using sales as the industry outcome variable delivers qualitatively similar results, while the point estimate for the triple-difference coefficient of interest is smaller compared to the benchmark result for profits. To explore why the triple-difference coefficient is smaller, we run the subsample regressions for countries with high and low trade barriers, using sales as the left-hand-side variable; see table E.7. Interestingly, for high-tariff countries the sensitivity of finance-dependent industries' sales to financial development is weaker than the benchmark results using profits and is in particular not statistically significantly different from zero. We explain this fact using the model presented in Section 3.

Measurement errors in high-tariff or less financially developed countries. A potential concern is that measurement errors might be higher in high-tariff and/or less-developed countries, as presumably such countries have smaller manufacturing industries, and their annual data on value added and wage bill may reflect measurement/reporting errors. These potential measurement errors might affect our statistical power and estimation precision and might bias our estimates.

To address this potential concern, we use Monte Carlo simulations. In particular, we use the observed standard deviation of the outcome variable and the mean squared error of the subsample regressions (for less-developed and/or high-tariff countries) to gauge the size of potential noises to the left-hand-side variable. Our simulation results show that, given the large size of our subsamples, the presence of such potential noises to the left-hand-side variable in the high-tariff or less financially developed subsamples would have a negligible impact on the standard errors of our difference-in-difference subsample regressions. Our estimated coefficients do not significantly change either. This is the case regardless of whether the measurement error is specific to less-developed, high-tariff countries or applies to all high-tariff countries.

Sources of variations. Our results are robust to the sources of variations that we use in identification. In our main specifications, we include industry-year and country-year fixed effects, in order to rely on cross-industry-country variations at a given point in time in identifying the difference-in-difference and triple-difference coefficients. In fact, almost the entire variation in financial development comes from across countries, not within a country across time. Moreover, we fix the industry-level finance dependence for the entire period, which we construct using U.S. Compustat. Furthermore, most of the variations in tariffs are across countries, although they are, to a lesser extent, across time and industries as well. As a robustness check, we employ various combinations of fixed effects and show that our results are robust; see the appendix table E.8. Moreover, instead of relying on cross-industry-country variations, in what follows we exploit within-country changes in tariffs over time in exploring how the sensitivity of finance-dependent industries to financial development varies with trade barriers.

The cases of trade liberalization. To further support the complementarity between financial development and trade openness in a dynamic setting, we focus on within-country variations in tariffs over time. In particular, we examine the extent to which the *growth* of profits of finance-dependent industries depends on financial development for countries that experienced a trade liberalization—a significant reduction in tariffs over our sample period.[10]

We run the following regression in the spirit of Rajan and Zingales (1998), but separately for the "trade-liberalization" subsample and "the rest" of countries, and then compare them to the full sample results:

$$[\text{Profits Growth}]_{ict,t+5} = \lambda_t + \theta_i + \delta_c + \alpha[\text{Profits Share}]_{ict} + \beta\ [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_{ct} + \epsilon_{ict}\ . \tag{4}$$

The left-hand-side variable is the annualized growth of profits (value added minus wage bill) in the following five years (i.e., *log* differences divided by five). We control for $[\text{Profits Share}]_{ict}$ (i.e., the share of industry i's profits in total profits 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-country level. The coefficient of interest is β (i.e., the extent to which finance-dependent industries grow faster in financially developed economies).[11]

The appendix table E.9 reports the regression results. The profits growth of finance-dependent industries is significantly more responsive to the level of financial development in countries that experienced trade liberalization (Column 2) compared to the other countries with no change in manufacturing tariffs on average (Column 3). The last row interprets the results: among the countries that experienced a trade liberalization, the profits of an industry at the 75th percentile of external-finance dependence grow 10.2% more 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. This difference in growth is 4.3% for the rest of countries with no trade liberalization. We confirm that the difference in the sensitivity between the two sets of countries is statistically significant (Column 4).

[10]These are the countries that reduced their average manufacturing tariffs by at least 3.3 percentage points (the 80th percentile of tariff reduction in our data) in a five-year rolling period using data from 1988 to 2003. This criterion gives us a small subsample of 12 countries for which manufacturing tariffs reduce by around 7 percentage points on average in the aforementioned period. These countries are Argentina, Australia, Brazil, China, Costa Rica, Ecuador, India, Indonesia, Japan, Tunisia, Turkey, and Uruguay. For the rest of the sample, the average change in tariffs is nearly zero.

[11]We use 5-year growth, instead of 10-year growth as in Rajan and Zingales (1998), to have more observations and statistical power in our regressions; because of the availability of tariff data, our sample size would be much smaller if we were to adopt 10-year growth rates. For the same reason and to reduce noise in our regressions, we also calculate and include growth rates on a 5-year *rolling* window, instead of just including one observation per industry-country over the entire period. We therefore cluster standard errors at the industry-country level as observations are clearly not independently drawn. We find a coefficient estimate similar to Rajan and Zingales (1998) in our full-sample specification, despite these modifications and the fact that our data cover a different time period.

3 The Model

3.1 Overview

The previous section documented a complementarity between financial development and international trade. We showed that financial development benefits finance-dependent industries, but if and only if trade barriers are low. This fact is puzzling because, as widely discussed in the literature, financing frictions result in a misallocation of capital and adversely affect finance-dependent sectors in terms of their production scale (e.g., Banerjee and Duflo, 2005). Hence, one expects that, *regardless* of trade barriers, relaxing financial frictions (i.e., financial development) helps finance-dependent industries to scale up and generate more, not less, profits (compared to industries that are less finance dependent).

To rationalize our empirical facts, this section develops a stylized model of international trade with cross-country heterogeneity in financial frictions. In the model, more financially 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, in addition to the comparative advantage force which is standard in the literature, our model can rationalize why financial development *hurts* profits in finance-dependent sectors when trade barriers are large. In equilibrium, because of the presence of financing frictions, there emerges an endogenous profit *margin* (profits per size) which prevents strategic defaults and supports production. When trade barriers are large, finance-dependent industries benefit (in terms of total profits) from financial *under*development since they earn higher profit margins without losing market shares to foreign competitors. We directly test this mechanism on profit margins using ORBIS firm-level data in Section 4.

We present the model in this section by first analyzing a closed economy and then introducing international trade.

3.2 The Environment

There are two sectors in the economy: a traditional, non-finance-dependent sector (n) and a modern, 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 $F : [\underline{A}, \overline{A}] \to [0, 1]$. In both sectors, capital k is the sole factor of production, which 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 perfectly competitive. We therefore assume free entry in producing all goods in the economy.

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.[12] This minimum scale of operation implies that to produce a variety in the modern, finance-dependent sector, firms need to be larger than a certain size, which is arguably a reasonable assumption and is in line with a large body of literature (e.g., Midrigan and Xu, 2014).

There is time-to-build friction in the finance-dependent sector. We assume $e < I$; therefore, to operate in this sector, producers need to rely on external financing (i.e., they need to borrow capital from consumers). We assume there are two subperiods in our model. In the first subperiod, individuals lend capital to producers in sector f. In the second subperiod, production takes place and returns on loans are paid to lenders. Everyone enjoys utility from consuming goods at the end of subperiod 2.

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

$$U = C_n^{\theta} C_f^{1-\theta} \ , \tag{7}$$

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:

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

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

3.3 Financing Frictions

The financial market is imperfect. We model financing frictions in the form of strategic default: a borrowing firm may default on the loan and liquidate the firm, in which case it earns a fraction

[12] 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, here we present a model with only one finance-dependent sector.

$1-\eta$ of the firm revenue. Lenders receive nothing in the event of a default.[13] The parameter $\eta \in [0,1]$ measures the severity of financial frictions, where higher η represents less severe financial frictions, or a higher level of financial development. The case with $\eta = 1$ represents a frictionless economy with a perfect credit market.

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 $k(A)$:

$$(1-\eta)\ p(A)\ A\ k(A)\ \leq\ p(A)\ A\ k(A) - R\ (k(A)-e)\ , \tag{9}$$

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:[14]

$$\gamma(A) := \frac{p(A)Ak(A)}{Rk(A)} = \frac{p(A)A}{R}\ . \tag{10}$$

The price $p(A)$ is an equilibrium object, as is the profit margin $\gamma(A)$. Given $\gamma(A)$, we can rewrite the no-default condition (9) as

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

If $\eta\gamma(A) \geq 1$, the 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 either if η is large enough, in which case the payoff to default is low, or if the profit margin $\gamma(A)$ is large enough, since it would eliminate the incentives to default (even if the payoff to default is positive $\eta > 0$). In these cases, borrowers may raise funds with no financing constraint. Notice that in a frictionless economy (i.e., $\eta = 1$), $\eta\gamma(A) \geq 1$ always holds.[15]

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

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

[13] Strategic default is socially inefficient since the fraction η of the firm revenue is lost upon default.

[14] Note that in our model with no material and labor, sales are equal to profits—that is, capital rents plus economic profits.

[15] Note that $\gamma(A) \geq 1$ in equilibrium, because otherwise producing variety A would deliver a negative profit and therefore this variety would not be produced.

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 η. As η 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. 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, thereby increasing the debt limit and the scale of operation. Note that the borrowing constraint in our setup is endogenous and represents a *forward-looking* financing friction (Albuquerque and Hopenhayn, 2004; Brooks and Dovis, 2020); that is, a borrower takes into account the end-of-period revenue of the firm in her decision on whether or not to default on a loan.[16] As a robustness check, Section 3.8 employs an alternative model with collateral constraints to show that our theoretical results are robust to the form of financing frictions.

3.4 Firms in the Finance-Dependent Sector

A firm with productivity A in the finance-dependent sector solves the following profit maximization problem:

$$k^* = \arg\max_k \quad p(A)Ak - Rk$$
$$\text{s.t.} \quad k \geq I \ , \quad k \leq k_c(A) = \frac{e}{1 - \eta\gamma(A)}.$$

If $\gamma(A) < 1$, producing the variety A is not profitable, hence $k^* = 0$ (regardless of financing friction severity η). Otherwise, the firm optimally chooses $k^* = k_c(A)$ as long as the size limit $k_c(A)$ implied by financing frictions exceeds the minimum scale of operation I. As we show below, these two constraints—debt limit and minimum scale of operation—determine the profit margin $\gamma(A)$ in equilibrium.

3.5 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 sector n productivity: $R = A_n$.

[16]Note that while our model is static, we do have a 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.

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.[17]

To derive the equilibrium profit margin of variety A in sector f, $\gamma(A)$, we first characterize the supply function of variety A. As appendix B.1 shows, this supply function can be written as

$$Y(A;\gamma(A)) = \begin{cases} 0 & \gamma(A) < \gamma_c \\ 0 \leq . \leq \frac{Ae}{1-\eta\gamma_c} & \gamma(A) = \gamma_c \\ \frac{Ae}{1-\eta\gamma(A)} & \gamma_c < \gamma(A) < \eta^{-1} \\ +\infty & \gamma(A) \geq \eta^{-1} \end{cases} \tag{13}$$

where the profit margin threshold γ_c is defined as

$$\gamma_c := \max\{1, (1 - e/I)\eta^{-1}\} \ . \tag{14}$$

Note that for the production of variety A to be feasible, $k_c(A)$ needs to be 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 in sector f, or in an economy with severe financing frictions (i.e., low η), the production of a finance-dependent variety is supported by a high profit margin $\gamma(A)$ (and therefore, a high price $p(A)$). Moreover, $\gamma(A) \geq 1$ also needs to hold to have a non-negative profit from producing this variety. Given the supply function (13), appendix B.2 shows that all varieties in sector f share the same profit margin in equilibrium:

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

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). As a result, producers operate at the minimum scale I in equilibrium.[18] The total quantity of a variety A in equilibrium is therefore determined by the extensive margin—the measure of firms—and is solved in equilibrium via the demand curve. If, for example, η falls and therefore γ_c rises, the demand for a variety A falls, as does total output and capital employed by producers of this variety. As a result, the *measure* of firms falls, while each firm operates at the same scale $k = I$, which is invariant to the degree of financing friction severity. This implication of our model that financial frictions influence the extensive margin (measure of firms) only, not the intensive margin (size per firm), is largely in line with the literature. For example, Midrigan and Xu (2014) show that the effect of financial frictions on misallocation

[17]We abstract from the effects of financial frictions on R, which would emerge in a setup with diminishing marginal product of capital (e.g., Antras and Caballero, 2009).

[18]In case the financial constraint is not binding (i.e., $\gamma_c = 1$), firms' size would be indeterminate.

and productivity is mainly through the extensive margin. Moreover, Rajan and Zingales (1998) show that financial development affects economic growth mostly through the growth of the number of firms (extensive margin) rather than the growth of typical establishments (intensive margin). In line with this evidence, our model therefore abstracts from the dynamic effects of financial frictions on within-firm capital accumulation and focuses on the extensive margin in a static setup.

As equation (15) shows, the profit margin for a variety in the finance-dependent sector f, γ_c, rises as either the financing friction gets more severe (η 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 η is not large; if η is "large enough," the financial constraint would not bind, which in turn would eliminate the profit margin. This pattern is the key mechanism underlying our results and a testable implication of the model.

Model's Implication 1 (Profit margin in finance-dependent sectors)**.** Firms in finance-dependent industries earn higher profit margins in less financially 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 less financially developed economies and therefore have higher relative prices (oas in, for example, Buera, Kaboski and Shin, 2011), 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 (η), irrespective of productivity.

3.6 Closed Economy

Consumption. Maximizing individuals' utility function (7) yields the following first-order conditions:

$$C_n = \theta Y \ , \ C_f = (1 - \theta)Y/P_f \ , \tag{16}$$

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:

$$P_f^{1-\sigma} = \int_A p(A)^{1-\sigma} dF(A) \ . \tag{17}$$

Using that $R = A_n$ in equilibrium along with the equilibrium profit margin in equation (15), we obtain

$$P_f = \gamma_c A_n / A_f \ , \tag{18}$$

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

$$A_f := \left[\int_A A^{\sigma-1} dF(A) \right]^{1/(\sigma-1)} \ . \tag{19}$$

The price index P_f is increasing in γ_c—hence, it is weakly decreasing with η. Financial development reduces the price of finance-dependent varieties, which (everything else constant) benefits consumers.

Capital and income. In equilibrium, the demand for capital equals the supply of capital:

$$K_n + K_f = e \ , \tag{20}$$

where K_n is the demand for capital in sector n, and K_f is the demand for capital in sector f—the sum of capital employed in producing all finance-dependent varieties. The total supply of capital equals e, since there is a unit mass of individuals in the economy, each endowed with e units of capital.

From the market clearing for the non-finance-dependent good and finance-dependent varieties, and also the demand for capital in each sector, we find that

$$K_n = Y_n / A_n = \theta Y / A_n \ , \tag{21}$$

where Y_n is the production in sector n, and that

$$K_f = Y_f / A_f = \frac{(1-\theta) Y}{\gamma_c A_n} \ . \tag{22}$$

where Y_f is sector f production (see derivations in appendix B.3).

Substituting for K_n and K_f from equations (21)-(22) in (20) yields the aggregate income of the economy:

$$Y = \frac{\gamma_c A_n \ e}{\theta \gamma_c + 1 - \theta} \ . \tag{23}$$

The aggregate income in the economy is *increasing* in γ_c and is therefore (weakly) decreasing in η. This is because profits in the finance-dependent sector rise with γ_c.

From equations (21) to (23) we observe that in equilibrium, K_f is decreasing in γ_c and so is weakly increasing in η, whereas the opposite is true for K_n. As η rises, the finance-dependent sector can raise more external funds, and therefore K_f rises at the expense of K_n.[19] Relaxing financing frictions would reduce the misallocation of input resources and results in a flow of capital from the non-finance-dependent sector n to the finance-dependent sector f, which in turn raises production in sector f relative to sector n (as in, for example, Banerjee and Duflo, 2005; Midrigan and Xu, 2014). While sector f production relative to sector n rises with η, we show below that the relative profit in these two sectors moves in the opposite direction because of the endogenous changes in the profit margin γ_c.

Profits. Since capital fully depreciates in our model, the appropriate measure of total payoffs to capital/firm owners is sales net of depreciation (i.e., net capital rents plus economic profits).[20] Profits in sector n and f can therefore be written as

$$\Pi_n = Y_n - K_n = \frac{\theta\gamma_c(A_n - 1)e}{\theta\gamma_c + 1 - \theta} \ , \tag{24}$$

$$\Pi_f = P_f Y_f - K_f = \frac{(1-\theta)(\gamma_c A_n - 1)e}{\theta\gamma_c + 1 - \theta} \ . \tag{25}$$

As financial friction severity falls (i.e., η rises), capital moves out of sector n to sector f, which in turn reduces the scale of production as well as profits of sector n.[21] This shift in capital increases the scale of operation in sector f, but at the same time reduces the economic profits of this sector, since the profit margin γ_c in sector f falls as η rises. This is the case because in a financially underdeveloped economy, production in the finance-dependent sector is supported by a high profit margin γ_c (to eliminate the incentive to default on loans), which in turn generates high economic profits in sector f. Overall, while capital moves to the finance-dependent sector, equations (24) and (25) show that Π_f/Π_n falls with η in a closed economy.[22]

[19] Note that total borrowing (or lending) in equilibrium equals $B = (1 - e/I)K_f = (1 - \frac{e}{I})\frac{(1-\theta)e}{\theta\gamma_c+1-\theta}$, since the fraction $(1 - e/I)$ of total capital employed in sector f is externally financed. Total credit over GDP therefore equals $B/Y = \frac{1-\theta}{A_n}\eta$, which rationalizes why we used the log of total credit over GDP as our main proxy for financial development in our empirical specifications.

[20] Since our model abstracts from labor and material, this variable corresponds to the notion of profits (i.e., value added net of wage bill) in our empirical setup. Moreover, note that the depreciation rate in the data is much smaller than that in our static model, which makes it less crucial to subtract capital depreciation from profits in the empirical part. However, as we showed in robustness checks in Section 2, our empirical results when subtracting capital depreciation from profits are similar, although we lose statistical power because of frequent missing data on capital formation, which makes the sample size 75% smaller.

[21] Note that the Π_n equals net capital rents, which is linear in the size of production.

[22] In our model, the elasticity of substitution between sector n and f is equal to one (i.e., the utility function is Cobb-Douglas). This assumption implies that, in a closed economy, sales in sector f relative to n are unaffected by financial frictions, which is consistent with the empirical evidence in Section 2. Our main results regarding sectoral profits are nonetheless robust to assuming a CES utility function provided that the elasticity of substitution between sector f and n is not very large. In general, the lower the cross-sector elasticity of substitution, the stronger our results. This is because under a small substitution elasticity, consumers would not be able to switch easily to sector n when sector f prices go up. The fact that our empirical findings in Section 2 are strongest when using trade barriers at the country level (instead of the two- or three-digit industry level) is indeed consistent with this insight because imposing trade barriers at the country level implies that consumers would not switch easily to other (imported) products.

In other words, financial development *hurts* the profits of the finance-dependent sector (relative to the non-finance-dependent sector).[23] This implication of the model rationalizes 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 (Profits, closed economy)**.** Profits in sector f relative to sector n, Π_f/Π_n, are decreasing in η in a closed economy; that is, financial development hurts the finance-dependent sector (relative to the non-finance-dependent sector) in a closed economy.
Proof. Divide equation (25) by (24), and the result immediately follows.

Two points are worth mentioning here. First, in line with our empirical evidence, the model's implication above is about profits in sector f *relative* to those in sector n. While we abstract from the effects of financial development on the total capital stock in the economy, which would affect the level of profits in both sectors, this simplification would not change our result about the *relative* profits in these sectors. Second, while the finance-dependent producers benefit from financial *under*development in a closed economy, the representative consumer of such an economy bears 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 all consumers. A closed economy overall suffers from financing frictions in terms of welfare, as we explain below.

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

$$U = \Gamma e A_f^{1-\theta} A_n^{\theta} \ , \tag{26}$$

where

$$\Gamma := \frac{{\gamma_c}^{\theta}}{\theta\gamma_c + 1 - \theta} \ . \tag{27}$$

Here, Γ is decreasing in the equilibrium profit margin γ_c. Therefore, welfare is increasing in η and is decreasing in the external-finance dependence $1 - e/I$. The utility share θ controls the sensitivity of welfare to η and $1 - e/I$. As the financing friction gets less severe, the sector f profit margin γ_c falls and its production rises, which in turn increases welfare. Notice that if the profit margin hits the lower bound of one, a further increase in η does not have an impact on welfare. Since the 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., the one yielding the highest welfare). Section 5 will, however, show that this is not necessarily the case in an open economy.

[23] Our theoretical results imply that relaxing frictions reduces sector f profits in *absolute* terms as well.

3.7 International Trade

The world consists of M countries. As in Antras and Caballero (2009), 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

$$U^i = C_n^{i\ \theta} C_f^{i\ 1-\theta} \ , \tag{28}$$

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—that is, 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:

$$C_f^i = \left[\sum_j \int_A C^{j \to i}(A)^{\frac{\sigma-1}{\sigma}} dF(A) \right]^{\frac{\sigma}{\sigma-1}} \ , \tag{29}$$

where $C^{j \to i}(A)$ 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. Section 3.8 relaxes the frictionless trade assumption and introduces an iceberg trade cost into the model. Moreover, we assume that a country can borrow capital from other countries, subject to its own financing friction severity.[24] In the free trade equilibrium, consumers and firms optimize, 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, $C^{i \to j}(A)$, using the preferences in (28):

$$C^{i \to j}(A) = (p^i(A)/P_f)^{-\sigma}(1-\theta)Y^j/P_f \ , \tag{30}$$

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 3.5, we can show that the producer of variety

[24] We can alternatively assume that capital is immobile between countries, since trade in sector n and capital mobility are substitutes in our setup as a result of having a constant marginal product of capital (in contrast to, e.g., Antras and Caballero, 2009).

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 less financially 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:

$$P_f = \gamma_w A_n / A_f \ , \tag{31}$$

where A_f is defined in equation (19), and γ_w is the world profit margin defined as

$$\gamma_w := \left[\sum_i (\gamma_c^i)^{1-\sigma}\right]^{1/(1-\sigma)} . \tag{32}$$

Note that capital lenders across the world receive the same rate of return $R = A_n$ in equilibrium.[25]

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

$$Y^i(A) = \sum_j C^{i\to j}(A) = (\gamma_c^i R/AP_f)^{-\sigma} \cdot (1-\theta)Y/P_f \ , \tag{33}$$

where Y stands for the world income (i.e., $Y = \sum_{i=1}^M Y^i$). The total exports of the finance-dependent sector from country i to j are

$$X^{i\to j} = \int_A p^i(A) C^{i\to j}(A)\ dF(A) = (\frac{\gamma_c^i}{\gamma_w})^{1-\sigma}(1-\theta)Y^j \ , \tag{34}$$

which are increasing in η_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 are weakly decreasing (increasing) in the financing friction severity of country i (country j).

Proof. Use equation (34) to get $\log(X^{i\to k}/X^{j\to k}) = (1-\sigma)\log(\gamma_c^i/\gamma_c^j) = (\sigma-1)[\log(\eta_i) - \log(\eta_j)]$. The last equality holds assuming that financial constraints are binding in both countries (i.e., η_i and η_j being sufficiently small: $\eta_i < 1-e/I$ and $\eta_j < 1-e/I$). In case either η_i or η_j is large enough such that $\eta_i > 1-e/I$ or $\eta_j > 1-e/I$, then $\log(X^{i\to k}/X^{j\to k})$ would not change with η_i or η_j, respectively, which is why the pattern holds *weakly.* □

[25] 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.

The pattern of specialization specified above 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, 2013; Manova, 2013). Appendix D verifies this pattern of specialization by following Costinot (2009)'s methodology and showing 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 our empirical proxies for country-level financial development and industry-level finance dependence.

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

$$K_f = \sum_i K_f^i = \sum_i \int_A \frac{Y^i(A)}{A} \, dF(A) = \frac{(1-\theta)Y}{\gamma_w A_n} \sum_i (\gamma_c^i/\gamma_w)^{-\sigma} \ , \tag{35}$$

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

$$K_n = \sum_i K_n^i = \theta Y / A_n \ , \tag{36}$$

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 resource constraint for capital satisfies

$$K_f + K_n = Me \ . \tag{37}$$

Using equations (35)-(37), we solve for the world income:

$$Y = \frac{\hat{\gamma}_c A_n Me}{\theta \hat{\gamma}_c + (1-\theta)} \ , \tag{38}$$

where

$$\hat{\gamma}_c := \frac{\gamma_w}{\sum_i (\gamma_c^i/\gamma_w)^{-\sigma}} = \frac{\sum_i (\gamma_c^i)^{1-\sigma}}{\sum_i (\gamma_c^i)^{-\sigma}} \ . \tag{39}$$

Balance of payments and country income. Countries have no reason to import the non-finance-dependent good because each country can meet its demand for this good by borrowing capital from other countries. Therefore, we assume each country produces the non-finance-dependent good to satisfy its domestic demand.[26] We also assume that the balance of payments in equilibrium holds for each country i—that is, the net imports of finance-dependent varieties

[26] Note that since producing good n and exporting capital are isomorphic, this assumption does not affect the balance of payment equation. Moreover, if we alternatively assume that countries trade good n instead of capital, the main results below regarding the sectoral profits would be even stronger.

equal the value of exported capital:

$$\underbrace{(1-\theta)Y^i}_{\text{country } i\text{'s total imports}} - \underbrace{(\frac{\gamma_c^i}{\gamma_w})^{1-\sigma}(1-\theta)Y}_{\text{country } i\text{'s total exports}} = \underbrace{A_n\left[e - \frac{(1-\theta)Y}{\gamma_w A_n}(\frac{\gamma_c^i}{\gamma_w})^{-\sigma} - \frac{\theta Y^i}{A_n}\right]}_{\text{country } i\text{'s capital export}}, \tag{40}$$

where both imports and exports on the left-hand side include domestic sales.[27] The second and third terms on the right-hand side 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 (38) into the balance of payment equation (40) and simplify:

$$Y^i = A_n e\left[1 + (1-\theta)\left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma}(1 - \frac{1}{\gamma_c^i})\frac{\hat{\gamma}_c M}{\theta\hat{\gamma}_c + 1 - \theta}\right]. \tag{41}$$

Country i's welfare equals $Y^i/P_f^{1-\theta}$. Section 5 will explore the welfare implications of trade openness and those of financial development.

Profits. The profits of each sector in country i equal

$$\Pi_n^i = \theta Y^i(1 - \frac{1}{A_n}), \tag{42}$$

$$\Pi_f^i = (\frac{\gamma_c^i}{\gamma_w})^{1-\sigma}(1-\theta)Y[1 - \frac{1}{A_n\gamma_c^i}]. \tag{43}$$

The profits of sector n are a linear function of income Y^i, since each country produces good n for its own consumers. Financial frictions influence the profits of sector f through two forces. First, as η_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. Second, as η_i rises, the profit margin of country i's finance-dependent sector γ_c^i falls, which reduces the profits 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.4 shows that the first force dominates and Π_f^i rises with η_i, provided that the elasticity of substitution σ is large enough (i.e., $\frac{\sigma}{\sigma-1} \leq A_n$).

Comparing sectoral profits in autarky (equations (24)-(25)) to those under free trade (equations (42)-(43)) confirms that the model can rationalize the empirical facts presented in Section 2 regarding the complementarity between financial development and trade openness on finance-dependent sectors. The model results are summarized below.

[27] Country i's total imports and exports are $\sum_j \int_A p^j(A)C^{j\to i}(A)\ dF(A)$ and $\sum_j \int_A p^i(A)C^{i\to j}(A)\ dF(A)$, respectively, both including domestic sales.

Model's Implication 4 (Profits, open economy)**.** Provided that σ is large enough such that $\frac{\sigma}{\sigma-1} \leq A_n$, (i) Π^i_f/Π^i_n is increasing in η_i in a small open economy i; (ii) There exists a cutoff $\eta^* < 1 - e/I$ such that opening up to trade increases Π^i_f/Π^i_n 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 Π^i_f/Π^i_n under free trade (i.e., low trade barriers) and that under autarky (i.e., large trade barriers) rises with η_i; that is, the finance-dependent sector (relative to sector n) benefits *more* from lower trade barriers when the economy is *more* financially developed.
Proof. See appendix B.4.

The results (i), (ii), and (iii) above rationalize the empirical facts presented in Sections 2.2, 2.3, and 2.4, respectively. The intuition behind these results is as follows. If a financially underdeveloped economy i opens up to trade, the profits 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, whereas these finance-dependent sectors could earn endogenously high economic profits under autarky as a result of financing frictions. A reduction in financial frictions in this open economy (i.e., increasing η_i) would help the finance-dependent industry gain a comparative advantage in the global market and a higher market share, therefore generating more profits (relative to sector n).[28] In contrast, a reduction in financial frictions in a closed economy would reduce the profit margin, thereby reducing the total profits of the finance-dependent sector relative to the non-finance-dependent sector (as discussed in the model implication 2). Therefore, there is a complementarity effect between financial development and trade openness on the profits of finance-dependent industries; specifically, a reduction in financial frictions would increase the gap between Π^i_f/Π^i_n under low trade barriers and that under high trade barriers, which is in line with the triple-difference empirical fact documented in Section 2.4.[29]

3.8 Discussions and Extensions

Profit margins and the marginal cost of production. 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 scale up because of the financing constraint. However, if one takes the shadow price of the financing constraint into account when calculating the marginal cost, then the marginal

[28] A reduction in financial frictions would also reduce the profit *margin* in the finance-dependent sector, but, provided that $\sigma/\sigma - 1 > A_n$, this force is dominated by the comparative advantage channel. Moreover, consistent with the empirical evidence in Section 2, a reduction in financial frictions increases the sales of sector f relative to n.

[29] This result is stronger when a country opens up to trade to a *more* financially developed country, since the comparative advantage force would be stronger in that case. This insight is in line with the empirical evidence in Section 2 that trade barriers against *more* financially developed countries matter the most.

revenue and the *implied* marginal cost of production would be equal. In reality, to mitigate the financing constraint, constrained firms may pay an interest margin to intermediaries who finance firms on behalf of investors (e.g., via monitoring). This additional interest payment reflects the shadow price of the constraint in our model. Nevertheless, there exists a wedge between the marginal revenue (for the borrowing firm) and the opportunity cost of capital (for lenders), which shows up as part of our measured "profit" (i.e., capital rents plus economic profits) in the data.

Forward-looking financing frictions. In our model, we consider a forward-looking financing friction, in which the profit margin affects the borrowing limit. As a result, while product markets feature perfect competition and free entry, a positive profit margin emerges in equilibrium to support borrowing, investment, and production under financing frictions. Forward-looking financing frictions are employed and tested in various contexts in the literature. 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 Dovis (2020) show that the pattern of exports 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. In Section 4, we test the key mechanism of our model regarding profit margins using the firm-level data from ORBIS.

It is worth highlighting that a setup with backward-looking financing frictions, while maintaining our product market structure, would not be able to explain why financial development hurts finance-dependent industries when trade barriers are large, as we documented in Section 2. To elaborate, suppose we imposed collateral constraints in our setup, in which case individuals can borrow up to a proportion of their capital stock. The size limit would depend on initial endowment only, not on the profit prospects of the firm. In that case, regardless of the degree of financing friction severity, firms would earn zero profits in equilibrium as a result of free entry and perfectly competitive product markets.[30] This result is in contrast to our empirical fact mentioned above. However, as we discuss below, by relaxing the perfect competition and free entry assumptions, alternative forms of financing frictions such as collateral constraints can also generate the aforementioned empirical fact.

[30]Specifically, suppose individuals may borrow up to a fraction $\eta < 1$ of the stock of capital k that is used as the collateral. The debt limit and maximum scale are then derived as $k - e \leq \eta k \Rightarrow k \leq e/(1-\eta)$. If η is small such that $\eta < 1 - e/I$, 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. If η is large enough such that $\eta \geq 1 - e/I$, all individuals may borrow enough to operate at least at the minimum scale I in sector f, again irrespective of the equilibrium price of the good; therefore, the profit margin would fall to zero by equilibrium forces (since the production technology is common under perfect competition).

A model with monopolistic competition. While in our model with perfectly competitive product markets and free entry we need forward-looking financing frictions to generate a positive equilibrium profit margin, our key theoretical results still hold in a framework with collateral constraints, monopolistic competition, and restricted entry. Appendix C.1 presents this alternative model. In this framework, a more severe financing friction forces *all* firms to scale down—to effectively coordinate on a higher aggregate price—which increases each firm's profits. This mechanism holds as long as competition is limited—that is, the economy is closed to international trade and free entry is not imposed in the home country. In an open economy, however, a more severe financial friction would still result in firms scaling down, but the aggregate price does not rise since consumers switch to foreign producers. Therefore, profits in the finance-dependent industry would fall. We provide a formal discussion and mathematical proofs in appendix C.1.

Incorporating trade costs. For tractability reasons, in the model presented above we abstracted from any trade frictions in the trade equilibrium. Our main results in the paper are, however, robust to incorporating a *variable* trade friction. In particular, in appendix C.2 we assume that country i faces an iceberg trade cost τ^i to import from and export to other countries in the world; that is, to receive/deliver one unit of any goods, country i needs to purchase/export τ^i units of that good. As appendix C.2 shows, when the trade cost τ^i is large enough, the model behaves like the model in autarky, and therefore the results in the model implication 2 hold. Moreover, when trade costs are low enough, the model behaves like that under free trade presented above, therefore delivering the model's implications 4.

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

Firms in finance-dependent industries earn higher profit margins in less financially developed economies. As explained in Section 3, this is the key mechanism in our model that rationalizes why financial development hurts the profits 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 from ORBIS.

To this end, we run the following difference-in-difference regression:

$$\log[\text{Profit Margin}]_{ic} = \theta_i + \delta_c + \beta\ [\text{Fin Dep}]_i * \log[\text{Fin Dev}]_c + \epsilon_{ic}\ , \tag{44}$$

where θ_i and δ_c are industry and country fixed effects, respectively, and ϵ_{ic} is the error term. "Fin Dep" and "Fin Dev" are our proxies for industry-level financial vulnerability and country-level financial development, respectively. To run this regression, we use the 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 to 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. Given the variations in the right-hand-side variables, we construct profit margins at the industry-country level by taking the cross-firm-year median of value added minus wage bill, divided by fixed assets. 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.[31] Here we do not include other variable costs (i.e., labor and material) in the denominator, since wage bill and material costs are presumably less subject to financial frictions and are optimized out in the firm's cost minimization problem. Results are nonetheless robust to defining the profit margin as sales over total variable costs—that is, wage bill plus material costs plus the rental cost of capital.[32,33] Lastly, as in Section 2, we use external-finance dependence, asset intangibility, and capital intensity (all measured using U.S. data) as proxies for industry-level financial vulnerability, and private credit over GDP, financial system deposits over GDP, the opposite of banks' overhead costs over total assets, and the opposite of net interest margin as proxies for country-level financial development. See details in appendix A.

Table 2 summarizes the regression results, where panels A, B, and C report the results using external-finance dependence, asset intangibility, and capital intensity, respectively, as proxies for financial vulnerability. Our estimates indicate that firms in more financially vulnerable industries earn higher profit margins in less financially developed economies. This result confirms the key channel in our model summarized in the model implication 1. The differential scale measure interprets the difference-in-difference coefficients and shows that the results are economically significant: profit margins are between 5% and 20% (depending on proxies for financial development and financial vulnerability) larger in the 75th percentile of financial vulnerability relative to the 25th percentile, in the least financially developed country compared to the most financially developed one in our sample of 11 European countries.

[31] While the denominator of profit margin in our model is Rk, we drop R in our profit margin measure here. Note that this does not matter since our difference-in-difference specification is comparing different sectors within a country, and sectors face the same economy-wide rate R.

[32] We measure the rental cost of capital as the 10-year government bond yields in each country plus a 5% depreciation rate, times fixed assets. Note that consistent with our theoretical model, our profit margin measure does *not* intend to measure price over the *implied* marginal cost (i.e., taking into account the shadow price of the financial constraint). Indeed, price over implied marginal cost in our model is equal to one, regardless of the severity of frictions.

[33] This robustness measure also helps to address the potential concern that finance-dependent industries may be more capital intensive in more financially developed economies, which puts downward pressure on our benchmark profit margin measure in such industries.

Table 2: Profit margin, financial vulnerability, and financial development

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)	
external-finance dependence × -log(net interest margin)				0.003 (0.027)
Differential scale (%)	8.32	5.23	insignificant	insignificant
# Firms (# industry × country)	3,254,394 (1073)	3,071,230 (968)	3,254,394 (1073)	3,254,394 (1073)
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)	
asset intangibility × -log(net interest margin)				-0.611^{***} (0.137)
Differential scale (%)	19.63	12.71	9.40	8.64
# Firms (# industry × country)	3,254,394 (1073)	3,071,230 (968)	3,254,394 (1073)	3,254,394 (1073)
log(Profit margin) {Panel C}				
capital intensity × log(total private credit/GDP)	-0.691^{*} (0.366)			
capital intensity × log(financial system deposits/GDP)		-0.304 (0.312)		
capital intensity × -log(banks overhead costs/total assets)			-0.305^{*} (0.170)	
capital intensity × -log(net interest margin)				-1.150^{***} (0.175)
Differential scale (%)	7.12	insignificant	3.92	11.99
# Firms (# industry × country)	3,427,122 (1168)	3,230,790 (1050)	3,427,122 (1168)	3,427,122 (1168)
Industry & Country FE	✓	✓	✓	✓

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 firm-level data from 2000 to 2009 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. Capital intensity is one minus share of labor and material in sales for a given industry in the U.S., using the NBER-CES data set. We use four proxies for country-level financial development, private credit by banks and other financial institutions (% GDP), financial system deposits (% GDP), the opposite of banks' overhead costs (% total assets), and the opposite of net interest margin, all reported in 2000 (i.e., beginning of our sample). See appendix A for more details on constructing variables. The differential scale measures to what extent the profit margin is larger in the 75th percentile of the financial vulnerability distribution relative to the 25th percentile, in the least financially developed country compared to the most financially developed country in our sample. Standard errors are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$.

Interestingly, although tables 1 and 2 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 profits of an industry at the 75th percentile of finance dependence relative to the one at the 25th percentile are 19% *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 2, the explanation for this empirical fact is that while financial development increases the size of finance-dependent sectors, it would also reduce the profit margins in these sectors. Therefore, one expects the variations in profit margins (in terms of the differential scale) to be (at least) in the order of 19%, which is close to what we find in table 2.[34]

5 Financial Frictions and Trade Openness: Welfare Implications

The key mechanism in our model that finance-dependent sectors earn higher profit margins in less financially developed economies has important implications for the gains from trade as well as the gains from financial development. While our model abstracts from several relevant forces in a standard quantitative model, in this section we explore how variations in profit margins due to financing frictions influence the welfare consequences of trade and financial development. We use our point estimates in the previous section to shed light on the quantitative relevance of this particular mechanism for welfare analysis.

5.1 Gains from Trade

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

$$GT_i = \underbrace{\frac{Y^i_{\text{trade}}}{Y^i_{\text{autarky}}}}_{\text{profit-shifting channel}} \underbrace{\left(\frac{P_{f,\text{autarky}}}{P_{f,\text{trade}}}\right)^{1-\theta}}_{\text{price channel}} = \frac{Y^i_{\text{trade}}}{Y^i_{\text{autarky}}} \left(\frac{\gamma^i_c}{\gamma_w}\right)^{1-\theta}, \tag{45}$$

where Y^i_{trade} and $P_{f,\text{trade}}$ are the income and sector f price index under free trade given in equations (41) and (31), respectively, and Y^i_{autarky} and $P_{f,\text{autarky}}$ are those under autarky in equations (23) and (18), respectively.

[34] This conclusion is based on the fact that the dispersion in our financial development proxy (Credit/GDP) in table 2 and in table 1 are quite similar. In particular, the highest-lowest gap in Credit over GDP in our ORBIS sample in table 2 is 0.6, and the 75th-25th percentile gap in the same measure among countries in table 1 is 0.55.

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 would equal $M^{\frac{1-\theta}{\sigma-1}}$. In the presence of frictions, the price channel is stronger for less financially developed economies with higher γ_c^i relative to trade partners, since import prices are lower than the prices for 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 it does in the frictionless world if and only if $\gamma_c^i > M^{1/(\sigma-1)}\gamma_w$, or equivalently,*

$$M(\gamma_c^i)^{1-\sigma} < \sum_j (\gamma_c^j)^{1-\sigma} \tag{46}$$

Proof. Use the price index equations (18) and (31), 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*

$$M\left[\theta(\gamma_c^i)^{1-\sigma} + (1-\theta)(\gamma_c^i)^{-\sigma}\right] < \theta \sum_j (\gamma_c^j)^{1-\sigma} + (1-\theta)\sum_j (\gamma_c^j)^{-\sigma} \ . \tag{47}$$

Proof. See appendix B.5.

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—that is, $\gamma_c^H > \gamma_c^F$, or equivalently, $\eta_H < \eta_F$.

The intuition behind this proposition is as follows. Country i with a high γ_c^i (i.e., low η_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 the economic profits from producing finance-dependent varieties shift away from this country.[35]

[35] In the case that all countries share the same profit margin γ_c, country i's income and profits would not

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 and free entry in this paper, but firms may still earn positive profits as a result of 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

$$GT_i^{\text{frictionless}} = M^{\frac{1-\theta}{\sigma-1}} \ , \tag{48}$$

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 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*

$$\sigma^* = \frac{\bar{\gamma}}{\bar{\gamma}-1} + \frac{\theta\bar{\gamma}}{1-\theta+\theta\bar{\gamma}} \tag{49}$$

such that (i) provided that $\sigma > \sigma^*$, the gains from trade for country i in the presence of financial frictions are <u>smaller</u> 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 <u>larger</u> 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.6.

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, and 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 as a result of a comparative

change by trade openness since all countries would be symmetric.

disadvantage (see proposition 2). When the elasticity of substitution σ 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, the profit-shifting channel therefore 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 σ compared to σ^*. Here we employ our empirical evidence in Section 4 to find a reasonable range for σ^*. We show that the values for σ estimated in the international trade literature fall in our range of estimated σ^*, and therefore the profit-shifting channel is indeed a relevant force for the gains from trade. To elaborate, our empirical results in table 2 show that profit margins in the 75th percentile of financial dependence relative to the 25th percentile are 8%-20% larger in the least financially developed 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 most financially 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 to 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 less financially frictional than the world average. The profit margin $\bar{\gamma}$ therefore lies above $1.08 - 1.2$, which implies that σ^* falls below the range from 6 to 14.[36] Moreover, the trade elasticity estimates in the literature range from 4 to 8 (Simonovska and Waugh, 2014; Eaton and Kortum, 2002), and therefore σ ranges from 5 to 9 in our model.[37] We therefore conclude that σ arguably falls in the same range as σ^*, 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, 2020*b*; Caggese and Cuñat, 2013; Brooks and Dovis, 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 the 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 more financially developed economies, whereas the opposite is true for less financially developed countries.[38] The mechanism that cross-country heterogeneity in financial frictions

[36] Note that σ^* is increasing in θ and ranges from $\frac{\bar{\gamma}}{\bar{\gamma}-1}$ (for $\theta = 0$) to $\frac{\bar{\gamma}}{\bar{\gamma}-1} + 1$ (for $\theta = 1$).

[37] Note that the trade elasticity in our model equals $\sigma - 1$.

[38] 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

activates profit shifting is absent in the literature.[39]

5.2 Gains from Financial Development

The mechanism that firms in finance-dependent sectors earn endogenous profit margins because of financial frictions also has important implications for 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 η_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 the welfare of the small open economy i.*

Proof. See appendix B.7.

Proposition 4 shows that even though financial friction is the only source of friction in our 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.[40] Two forces 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 σ, 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 γ_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, the financial friction is not severe, the second force dominates, and therefore the economy would lose from its own financial development.

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. That is, the presence of financial frictions increases (decreases) the gains from trade for economies that are more (less) financially developed. This is because economies that are more financially developed (i.e., $\gamma_c^i < \bar{\gamma}$) would become even more developed after trade openness and therefore gain even more from profit shifting, whereas the opposite is true for economies that are less financially developed.

[39]Note that although they employ a forward-looking financing friction, the profit-shifting channel does not exist in Brooks and Dovis (2020). This is because they assume that the trade partner of the country in their study has frictionless financial markets, and therefore by construction the trade partner earns no economic profits from producing finance-dependent goods.

[40]Note that the world price index P_f is not affected as a result of the *small* open economy assumption.

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 or not reducing financing frictions benefits a small open economy depends on the magnitude of γ_c^i relative to $\frac{\sigma}{\sigma-1}$. As noted above, the trade elasticity estimates in the literature range from 4 to 8, which implies that $\frac{\sigma}{\sigma-1}$ ranges from 1.12 to 1.25 in our model. Moreover, as we interpreted our empirical findings in table 2 above, we find an estimate of financial-frictions-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 γ_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 less financially developed European countries are better off from their financial development, more financially developed European countries might not benefit as much from their financial development on the margin.[41]

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 (in terms of total profits) from financial development if and only if trade barriers are low. By identifying which sectors benefit/lose from financial development, our empirical findings have implications for understanding the development of a country's financial sector from a political economy perspective. Specifically, our evidence implies that finance-dependent sectors would not support financial development in an environment with restricted international trade, which might pose a threat against financial development in an era of powerful *de*globalization movements.

To rationalize our empirical evidence and to 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 an endogenous profit margin in equilibrium, which would prevent firms from making strategic defaults 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, the economic profits of producing such varieties flow out of an economy that is less financially developed because of a comparative disadvantage.

We show that the welfare gains from financial development depend on trade openness and

[41] We note that financial development benefits a country through various forces that we abstract from in our model. Here, we highlight a particular mechanism—profit shifting—for the welfare implications of financial development that differentially affects open versus closed economies.

that the gains from trade openness depend on the relative financing friction severity of trade partners. In particular, our analytical results, along with firm-level evidence from ORBIS, show that (i) while less financially developed countries in our sample are better off from their financial development, more financially developed countries may not benefit from their financial development on the margin; and (ii) through the profit-shifting channel, the presence of financial frictions tends to increase (decrease) the gains from trade for more (less) financially developed economies.

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Appendices

A Empirical Facts: Constructing Variables

Financial development. We obtain data from the World Bank Global Financial Development Database (Beck, Demirgüc-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 with a credit over GDP below 0.05 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 from the same source (the opposite of) banks' total overhead costs over total assets, (the opposite of) net interest margin, and total deposits in the financial system over GDP, as alternative proxies for financial development in robustness checks.[1]

Financial vulnerability. As our main proxy for industry-level financial vulnerability, we use external-finance dependence as introduced in Rajan and Zingales (1998). To construct this measure, we use the U.S. Compustat database and collect data on capital expenditures (*capx*) and cash flows ("*cash*" defined as cash flows from operations (*oancf*) plus decreases in inventories (*invt*), decreases in receivables (*rect*), and increases in payables (*ap*)) for the U.S. publicly traded manufacturing firms in the 1980s. We measure external-finance dependence as $[\text{ext dep}] = \frac{capx - cash}{capx}$ 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 winsorize the variable *ext dep* at the firm level from bottom and top at the 10% level. We then map each firm to a specific three-digit ISIC code. External-finance dependence at the industry level is then calculated by taking the 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 use data on net property, plant and equipment (*ppent*), and total assets (*at*) for the U.S. publicly traded firms in Compustat in the 1980s and take the within-industry, cross-firm median of one minus the ratio of mean net property, plant and equipment over mean total assets, $1 - \frac{ppent}{at}$. Net property,

[1] Note that when banks' overhead costs or net interest margin are higher, this is interpreted as lower financial development.

plant and equipment are considered as tangible assets that can presumably be more easily used as collateral for a loan. Industries with higher levels of asset intangibility are then considered to be more financially vulnerable. Table A.3 reports asset intangibility measure for each industry in our data.

Finally, we use a new measure for finance dependence: capital intensity in production technology. We use the annual NBER-CES Manufacturing Industry Database in the 1980s at the four-digit SIC level to construct this measure. We first calculate one minus production costs (material *matcost* plus labor *prodw*) divided by sales (total value of shipments *vship*). We then take the average across years and across all four-digit SIC industries that belong to a particular three-digit ISIC industry code. Intuitively, this measure captures the share of capital (both physical capital and human capital, which reflects, for example, managerial quality and entrepreneurial ability that contribute to TFP) in the production technology.[2] Industries with capital-intensive technologies rely more on finance, as a result of the time-to-build friction for capital. Table A.3 reports the measured capital intensity for each industry in our data. This proxy ranges from 0.2 to 0.5.

Imports, exports, and trade openness. For imports and exports, we use Comtrade data for 27 three-digit ISIC manufacturing industries (reported in table A.3). These data constitute all available exporter-importer-industry combinations and are available beginning in 1988 for the wide range of countries in our sample. As a proxy for country-level trade barriers, we employ the opposite of trade openness using two alternative measures: total imports of manufacturing divided by GDP and total imports plus exports of manufacturing divided by GDP. Table A.1 reports summary statistics.

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 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 τ_{cp}^{it} that importer c imposes on trading partners p, where the average is weighted by the *import* volumes T_{cp}^{it}. Using the introduced notations, this measure equals $\sum_p T_{cp}^{it}\tau_{cp}^{it}/\sum_p T_{cp}^{it}$. The second measure constructs the average tariffs that partners of the country c impose on their imports from country c in industry i at year t. Using our notations, this measure equals $\sum_p T_{pc}^{it}\tau_{pc}^{it}/\sum_p T_{pc}^{it}$. 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

[2] Assume that firms optimally set material and labor in an intra-period cost minimization problem, given the level of capital and TFP. Consider a Cobb-Douglas technology $y = e^{1-\alpha-\beta-\gamma}k^{\alpha}l^{\beta}m^{\gamma}$ for output y, with e being TFP (capturing human capital—for example, managerial ability), k being physical capital, l being labor, and m being material. The capital intensity measure—one minus the share of material and labor cost in sales—would be $1-\beta-\gamma$ (i.e., the sum of the share of e and k in the production function).

average of these two measures in our benchmark regressions, and we do robustness checks using import tariffs only. Moreover, to use in our robustness checks, we do the same calculations to derive the average tariffs at the *three*-digit ISIC level and also at the *one*-digit ISIC level—that is, 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.

Natural openness. We construct country-level "natural openness" (as in, e.g., Frankel and Romer, 1999) using a gravity model. To this end, we use CEPII version 2022 data on trade, population, GDP, and geography variables to construct gravity-implied openness for each country in our sample. In particular, we regress the log of bilateral manufacturing imports (and separately for exports) divided by GDP on the log of distance between the two countries, whether the two countries share a border, whether the two countries share the same language, the log of source and destination GDP, and the log of source and destination population to predict the log of imports (and separately for exports) divided by GDP. We then take the exponential of these predicted values, since they are in log terms, and then sum over all trading partners. We then construct the gravity-implied imports divided by GDP and gravity-implied imports plus exports divided by GDP as two alternative measures that capture natural openness.

Industry outcomes. We obtain industry-level data from United Nations Statistical Division, Industrial Statistics. This data set reports annual data on sales,[3] value added, wage bill, and capital formation for a panel of 126 countries in the manufacturing sector, which consists of 27 three-digit ISIC revision 2 industries, reported from 1963 to 2003. We use exchange rates as well as the U.S. GDP deflator to convert nominal values to real ones. We trim the data at 2.5% level from bottom and top. For a given sector-country pair at a given year, we calculate value added minus total wage bill and call it *profits*, which equals capital rents plus (variable) economic profits. To be used as the left-hand-side variable in our baseline industry-level regressions, we take the log profits after dropping negative values. For the growth regressions, we calculate the average annualized five-year growth by measuring the five-year-forward difference in the log of profits, divided by five. In robustness checks, we also use value added (without subtracting wage bill), sales, and value added net of wage bill and capital depreciation. To back out capital depreciation, we first construct data on capital stock using the reported data on capital formation, following the perpetual inventory method. We assume a capital depreciation rate of 0.05 and an initial steady state growth of 0.05 (i.e., the median data on growth rates). Having constructed an estimate for the capital stock per year for each industry, we then estimate capital depreciation by multiplying the estimated capital stock by the assumed depreciation rate. Data coverage on capital formation is poor, since the data are frequently missing. Summary statistics are reported in table A.1.

[3] What is reported in the data is the value of production.

Table A.1: Summary statistics

Variable	Mean	Median	Std	p10	p90	Observations
log (Profits)	9.00	8.38	4.79	3.04	15.79	55257
log (Profits), 1988 to 2003	9.79	9.94	4.80	3.37	15.96	7012
growth (Profits), 1988 to 2003	-0.077	-0.025	0.626	-0.938	0.602	1595
log (Imports)	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 (%)	8.79	7.48	6.30	2.49	16.61	7012
Tariff, country level, 5 year change (%)	-1.53	-1.20	3.35	-5.31	2.64	117
-log ((import+export)/GDP)	1.133	1.177	0.723	0.213	1.949	6988
-log (natural openness)	1.196	1.431	1.073	-0.210	2.379	6461
Credit (% of GDP)	36.1	25.1	30.4	7.9	78.1	3552
Credit (% of GDP), 1988 to 2003	44.8	32.0	37.5	7.6	98.3	1447
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
Capital intensity in production	0.356	0.352	0.070	0.267	0.447	27

Notes: Columns show the average, median, standard deviation, 10th percentile, 90th percentile, and the number of observations in calculating the summary statistics, respectively. The first three rows show value added minus wage bill reported in the data, referred to as profits in the paper. We use exchange rates and the U.S. GDP deflator to convert nominal to real values. The growth in profits is calculated using the forward difference in the log of value added minus wage bill 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. We use data on bilateral imports for three-digit ISIC industries from Comtrade. We compute the industry-country-level profit margin using ORBIS firm-level data from 2000 to 2009 for 11 European countries reported in table A.2, where we define industries as three-digit SIC codes in manufacturing. Tariffs are at the country by year by two-digit ISIC rev. 2 industry level from 1988 to 2003, by calculating the average tariffs across trade partners weighted by trade volumes. 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 the simple five-year-forward difference. As an alternative proxy for trade barriers, we use (the opposite of) trade openness—that is, the sum of total manufacturing imports and exports in a country divided by GDP. Natural openness measures gravity-implied manufacturing imports plus exports divided by GDP, where we use data from CEPII on gravity variables. 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 the 1980s, and capital intensity in the production technology is calculated from NBER-CES manufacturing data in the 1980s, all for 27 three-digit ISIC rev. 2 manufacturing industries (see notes in table A.3 for further details).

Profit margin. We compute the industry-country-level profit margin using ORBIS firm-level data from 2000 to 2009 for 11 European countries reported in table A.2. We define industries as three-digit SIC codes in manufacturing. We first construct the 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.

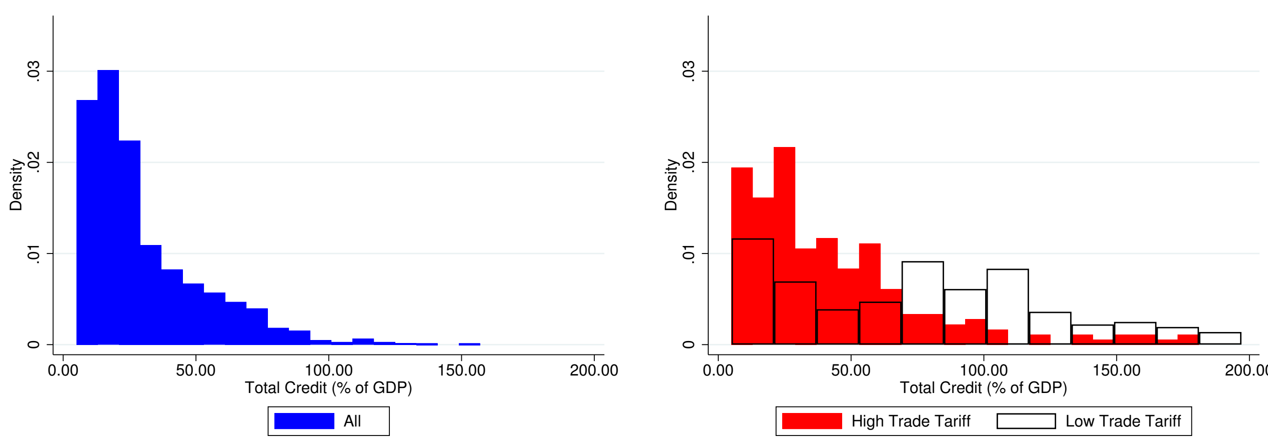
Table A.2: Countries in our ORBIS data set and proxies for financial development

Country	# Firm-Year	Total Credit /GDP (%)	Financial System Deposits /GDP (%)	Banks' Overhead Costs /Total Assets (%)	Net Interest Margin (%)
Austria	9,334	98.35	79.89	1.65	1.71
Belgium	59,747	77.34	82.74	1.32	1.36
Finland	104,057	51.38	46.18	1.27	1.84
France	842,641	81.29	61.76	1.31	0.93
Germany	98,959	116.33	90.92	1.62	1.17
Italy	985,826	70.33	49.02	2.04	2.06
Netherlands	9,128	125.34	87.62	0.67	1.20
Norway	88,007	70.41	43.25	1.98	2.19
Portugal	232,594	112.30	85.70	1.16	1.35
Spain	867,105	90.13	74.10	0.76	0.89
Sweden	196,365	64.28	–	1.56	1.32

Notes: This table reports the list of 11 European countries in the ORBIS firm-level data. Column 2 reports the number of firm-year observations for each country in our sample from 2000 to 2009. Columns 3-6 report four proxies for financial development that we use in our regressions, all in the year 2000.

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

(a) 1968 to 1987 (b) 1988 to 2003



Notes: We plot the histogram of our baseline proxy for 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 are available from 1988 to 2003, to plot separate histograms of financial development for "low"- versus "high"-tariff economies—that is, those with average tariffs below and above the median, respectively. The financial development proxy refers to 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: External-finance dependence, asset intangibility, and capital intensity for industries in the manufacturing sector

Rank	ISIC code	Industrial sectors	External dependence	Asset intangibility	Capital intensity
1	314	Tobacco	-0.983	0.735	0.424
2	324	Footwear	-0.691	0.836	0.350
3	323	Leather	-0.530	0.858	0.336
4	313	Beverages	-0.271	0.697	0.390
5	361	Pottery	-0.246	0.691	0.436
6	311-2	Food products	-0.212	0.624	0.320
7	354	Petroleum and coal products	-0.195	0.661	0.267
8	353	Petroleum refineries	-0.178	0.508	0.194
9	369	Nonmetal products	-0.120	0.508	0.384
10	342	Printing and publishing	-0.117	0.706	0.465
11	381	Metal products	-0.085	0.715	0.370
12	351	Industrial chemicals	-0.075	0.574	0.347
13	371	Iron and steel	-0.005	0.581	0.298
14	341	Paper and products	-0.001	0.519	0.313
15	332	Furniture	0.040	0.711	0.352
16	355-6	Rubber and Plastic products	0.073	0.663	0.354
17	384	Transportation equipment	0.165	0.724	0.334
18	321	Textile	0.205	0.672	0.272
19	372	Nonferrous metal	0.233	0.655	0.273
20	322	Apparel	0.242	0.847	0.330
21	331	Wood products	0.307	0.680	0.258
22	362	Glass	0.497	0.567	0.384
23	390	Other industries	0.645	0.807	0.398
24	383	Electric Machinery	0.662	0.763	0.408
25	352	Other chemicals	0.732	0.768	0.447
26	382	Machinery	0.756	0.788	0.404
27	385	Professional goods	1.043	0.804	0.504

Notes: The data source for external-finance dependence and asset intangibility is the annual U.S. Compustat database for publicly traded firms from 1980 to 1989. To build external-finance dependence, 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)) for each firm, and divide by the sum of capital expenditures (capx). We then take the cross-firm median within each industry (three-digit ISIC level). 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 (three-digit ISIC level). The data source for capital intensity in the production technology is the annual NBER-CES Manufacturing Industry Database at the four-digit 1987 SIC level, from 1980 to 1989. We first calculate sales (total value of shipments) minus production costs (total cost of materials plus production worker wages) divided by sales (total value of shipments). We then take the average of this ratio across years and across all four-digit SIC codes that belong to a three-digit ISIC code. Before taking the summation over years, we normalize all variables with the U.S. GDP deflator. In this table, we sort industries based on their external-finance dependence.

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:

$$Y(A;\gamma(A)) = \begin{cases} 0 & \gamma(A) < \gamma_c \\ 0 \leq . \leq \frac{Ae}{1-\eta\gamma_c} & \gamma(A) = \gamma_c \\ \frac{Ae}{1-\eta\gamma(A)} & \gamma_c < \gamma(A) < \eta^{-1} \\ +\infty & \gamma(A) \geq \eta^{-1} \end{cases} \tag{50}$$

Recall that the borrowing constraint for a firm implies

$$\eta\gamma(A) < 1 \;\Rightarrow\; k(A) \leq k_c(A) := \frac{e}{1-\eta\gamma(A)} \ , \tag{51}$$

and there would be no limit on borrowing if $\gamma(A) \geq \eta^{-1}$. If profit margin $\gamma(A)$ falls below the threshold γ_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 (51)), and therefore producing this variety is not feasible.

If $\gamma(A) = \gamma_c$, equation (51) 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 $\gamma(A) \geq \eta^{-1}$.[4]

[4]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.2 Equilibrium profit margin and firm size

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

$$\forall A: \quad \gamma(A) = \gamma_c = \max\{1, (1-e/I)\eta^{-1}\} \ . \tag{52}$$

We can see from the supply function (50) 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 (51) 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 (51) 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.

B.3 Sector f capital

Total demand for capital in sector f equals

$$K_f = \int_A K(A)\ dF(A) = \int_A \frac{Y(A)}{A}\ dF(A) = \int_A \frac{C(A)}{A}\ dF(A) = \\ \int_A (\frac{p(A)}{P_f})^{-\sigma} \frac{C_f}{A}\ dF(A) = A_f^{\sigma-1} P_f^{\sigma} (\gamma_c A_n)^{-\sigma} C_f = C_f / A_f = \frac{(1-\theta)Y}{\gamma_c A_n} \ , \tag{53}$$

where $Y(A)$ and $K(A)$ are the equilibrium output/supply and capital demand 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)

$$C(A) = C_f\ (p(A)/P_f)^{-\sigma} \ . \tag{54}$$

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

$$\gamma(A) = p(A)A/R = \gamma_c \quad \Rightarrow \quad p(A) = \gamma_c R/A \ , \tag{55}$$

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

$$P_f = \gamma_c A_n / A_f \ , \tag{56}$$

and the aggregate productivity

$$A_f = \left[\int_A A^{\sigma-1} dF(A) \right]^{1/(\sigma-1)} \tag{57}$$

from equations (18) and (19). Finally, we used equation (16) 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,

$$\begin{aligned} \Pi_n^i &= \theta Y^i (1 - 1/A_n) \\ \Pi_f^i &= (\frac{\gamma_c^i}{\gamma_w})^{1-\sigma} (1-\theta) Y [1 - \frac{1}{A_n \gamma_c^i}] \end{aligned} \tag{58}$$

Therefore,

$$\Pi_f^i / \Pi_n^i = (\frac{\gamma_c^i}{\gamma_w})^{1-\sigma} (\frac{1-\theta}{\theta}) (\frac{Y}{Y^i}) \frac{A_n \gamma_c^i - 1}{\gamma_c^i (A_n - 1)} \ . \tag{59}$$

Moreover,

$$Y^i = A_n e + (1-\theta) \left(\frac{\gamma_c^i}{\gamma_w} \right)^{1-\sigma} (1 - \frac{1}{\gamma_c^i}) \underbrace{\frac{A_n e \hat{\gamma}_c M}{\theta \hat{\gamma}_c + 1 - \theta}}_{=Y} \ . \tag{60}$$

So we can simplify

$$(\frac{\gamma_c^i}{\gamma_w})^{1-\sigma} (\frac{Y}{Y_i}) = \frac{1}{(1-\theta)(1 - \frac{1}{\gamma_c^i}) + \frac{A_n e}{Y} (\frac{\gamma_w}{\gamma_c^i})^{1-\sigma}} \ . \tag{61}$$

Substituting equation (61) in equation (59) delivers

$$\Pi_f^i / \Pi_n^i = \frac{A_n \gamma_c^i - 1}{\theta (A_n - 1)(\gamma_c^i - 1 + \alpha (\gamma_c^i)^\sigma)} \ , \tag{62}$$

where

$$\alpha := \frac{A_n e \gamma_w^{1-\sigma}}{Y(1-\theta)} \tag{63}$$

is a positive constant. We can show that[5]

$$\frac{\partial(\Pi_f^i/\Pi_n^i)}{\partial\gamma_c^i} \;\propto\; 1 - A_n + \alpha(\gamma_c^i)^{\sigma-1}\underbrace{\left[\sigma + A_n\gamma_c^i(1-\sigma)\right]}_{negative?} \;. \tag{64}$$

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

$$1 < \frac{\sigma}{\sigma - 1} \leq A_n \;. \tag{65}$$

If equation (65) holds, then Π_f^i/Π_n^i is decreasing in γ_c^i in the entire range of γ_c^i, which means that Π_f^i/Π_n^i is always increasing in η_i. Moreover, taking the derivative of Π_f^i with respect to γ_c^i shows that Π_f^i is decreasing in γ_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 Π_f^i/Π_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, Π_f^i/Π_n^i is decreasing in γ_c^i (i.e., increasing in η_i) as shown in part (i) above, Π_f^i/Π_n^i is increasing in γ_c^i in the closed economy case. To see this, use equations (24) and (25) to write

$$(\Pi_f^i/\Pi_n^i)^{\text{closed}} = \frac{(1-\theta)(\gamma_c^i A_n - 1)}{\theta\gamma_c^i(A_n - 1)} \;, \tag{66}$$

which is increasing in γ_c^i.

Step 2. At $\gamma_c^i = 1$, Π_f^i/Π_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 $(\Pi_f^i/\Pi_n^i)^{\text{closed}} = (1-\theta)/\theta$. Use equation (62) to show that in an open economy i and when $\gamma_c^i = 1$,

$$\left.\frac{\Pi_f^i}{\Pi_n^i}\right|_{\gamma_c^i=1} = \frac{1-\theta}{\theta}\frac{Y}{A_n e \gamma_w^{1-\sigma}} = \frac{1-\theta}{\theta}\frac{M}{\theta\sum_j(\gamma_c^j)^{1-\sigma} + (1-\theta)\sum_j(\gamma_c^j)^{-\sigma}} \geq \frac{1-\theta}{\theta} \;, \tag{67}$$

where we used equation (38) for the global income Y and equation (32) for γ_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 $\gamma_c^i \to \infty$, Π_f^i/Π_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

[5] In taking the partial derivative of Π_f^i/Π_n^i w.r.t. γ_c^i, we abstract from the dependence of α on γ_c^i, whereas γ_c^i indeed affects global income Y and price index γ_w. We can show that this simplification does not alter the final conclusion for a case that the number of countries M is large enough.

underdevelopment (i.e., $\gamma_c^i \to \infty$), the ratio of the profits of these two sectors is positive:

$$(\Pi_f^i/\Pi_n^i)^{\text{closed}} = \frac{(1-\theta)(\gamma_c^i A_n - 1)}{\theta \gamma_c^i (A_n - 1)} \xrightarrow{\gamma_c^i \to \infty} \frac{(1-\theta)A_n}{\theta(A_n - 1)} \ , \tag{68}$$

whereas from equation (62) we can see that, as long as $\sigma > 1$, in the limit $\gamma_c^i \to \infty$, Π_f^i/Π_n^i in an open economy converges to zero.

These three steps together show that Π_f^i/Π_n^i in an open economy and that under autarky cross at some $\gamma^* > 1$ (i.e., at some $\eta^* < 1 - e/I$). Moreover, Π_f^i/Π_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), Π_f^i/Π_n^i is increasing (decreasing) in η_i in an open (a closed) economy. Therefore, the gap between Π_f^i/Π_n^i under free trade and that under autarky rises with η_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 (23), which can be written as

$$Y_{\text{autarky}}^i = A_n e \left[1 + \frac{(1-\theta)(\gamma_c^i - 1)}{\theta \gamma_c^i + 1 - \theta}\right] , \tag{69}$$

and income under free trade is given by equation (41):

$$Y_{\text{trade}}^i = A_n e \left[1 + (1-\theta)\left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma} (1 - \frac{1}{\gamma_c^i}) \frac{\hat{\gamma}_c M}{\theta \hat{\gamma}_c + 1 - \theta}\right] . \tag{70}$$

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

$$Y_{\text{trade}}^i < Y_{\text{autarky}}^i \iff \left(\frac{\gamma_c^i}{\gamma_w}\right)^{1-\sigma} \frac{M\hat{\gamma}_c}{\theta\hat{\gamma}_c + 1 - \theta} < \frac{\gamma_c^i}{\theta \gamma_c^i + 1 - \theta} \ , \tag{71}$$

and substituting for γ_w and $\hat{\gamma}_c$ from equations (32) and (39) delivers

$$Y_{\text{trade}}^i < Y_{\text{autarky}}^i \iff \frac{(\gamma_c^i)^{-\sigma}}{\sum_j (\gamma_c^j)^{-\sigma}} \frac{M}{\theta \frac{\sum_j (\gamma_c^j)^{1-\sigma}}{\sum_j (\gamma_c^j)^{-\sigma}} + 1 - \theta} < \frac{1}{\theta \gamma_c^i + 1 - \theta} \ , \tag{72}$$

which can be simplified to

$$Y^i_{\text{trade}} < Y^i_{\text{autarky}} \iff M\left[\theta(\gamma^i_c)^{1-\sigma} + (1-\theta)(\gamma^i_c)^{-\sigma}\right] < \theta\sum_j(\gamma^j_c)^{1-\sigma} + (1-\theta)\sum_j(\gamma^j_c)^{-\sigma} \,. \quad (73)$$

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 $\bar{\gamma} := \frac{\sum_j \gamma^j_c}{M} > 1$. Define $\gamma^i_c := \bar{\gamma} + \Delta\gamma^i_c$, where $\sum_j \Delta\gamma^j_c = 0$ by definition. We first derive first-order approximations of γ_w and $\hat{\gamma}_c$.

$$(\gamma^i_c)^{1-\sigma} = (\bar{\gamma} + \Delta\gamma^i_c)^{1-\sigma} \approx \bar{\gamma}^{1-\sigma}(1 + (1-\sigma)\frac{\Delta\gamma^i_c}{\bar{\gamma}}). \quad (74)$$

Therefore,

$$\sum_i(\gamma^i_c)^{1-\sigma} \approx \bar{\gamma}^{1-\sigma}(M + (1-\sigma)\frac{\sum_i \Delta\gamma^i_c}{\bar{\gamma}}) = M\bar{\gamma}^{1-\sigma}. \quad (75)$$

Using the definition of γ_w, we derive

$$\gamma_w \approx M^{1/(1-\sigma)}\bar{\gamma}. \quad (76)$$

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

$$\hat{\gamma}_c = \frac{\sum_i(\gamma^i_c)^{1-\sigma}}{\sum_i(\gamma^i_c)^{-\sigma}} \approx \frac{\bar{\gamma}^{1-\sigma}\sum_i(1 + (1-\sigma)\frac{\Delta\gamma^i_c}{\bar{\gamma}})}{\bar{\gamma}^{-\sigma}\sum_i(1 - \sigma\frac{\Delta\gamma^i_c}{\bar{\gamma}})} = \bar{\gamma}. \quad (77)$$

We write the gains from trade in equation (45) as

$$\log(GT_i) = \underbrace{\log(\frac{Y^i_{\text{trade}}}{Y^i_{\text{autarky}}})}_{\text{profit-shifting channel}} + \underbrace{(1-\theta)\log\left(\frac{\gamma^i_c}{\gamma_w}\right)}_{\text{price channel}} \,. \quad (78)$$

We can write the price channel as

$$(1-\theta)\log\left(\frac{\gamma^i_c}{\gamma_w}\right) = (1-\theta)\log(1+\frac{\Delta\gamma^i_c}{\bar{\gamma}}) - (1-\theta)\log M^{1/(1-\sigma)} \approx (1-\theta)\frac{\Delta\gamma^i_c}{\bar{\gamma}} + \frac{1-\theta}{\sigma-1}\log M. \quad (79)$$

The first term in the price channel is a result of 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 $\Delta\gamma^i_c > 0$ (i.e., countries with frictions that are more severe 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 (23) under autarky:

$$Y^i_{autarky} = \frac{A_n e \gamma^i_c}{\theta\gamma^i_c + 1 - \theta} = \frac{A_n e(\bar{\gamma} + \Delta\gamma^i_c)}{1 - \theta + \theta\bar{\gamma} + \theta\Delta\gamma^i_c} = \frac{A_n e\bar{\gamma}}{1 - \theta + \theta\bar{\gamma}} \frac{1 + \frac{\Delta\gamma^i_c}{\bar{\gamma}}}{1 + \frac{\theta\Delta\gamma^i_c}{1-\theta+\theta\bar{\gamma}}}$$
$$\approx \frac{A_n e\bar{\gamma}}{1 - \theta + \theta\bar{\gamma}}(1 + \frac{\Delta\gamma^i_c}{\bar{\gamma}} - \frac{\theta\Delta\gamma^i_c}{1 - \theta + \theta\bar{\gamma}}) = \frac{A_n e\bar{\gamma}}{1 - \theta + \theta\bar{\gamma}}\left[1 + \frac{\Delta\gamma^i_c}{\bar{\gamma}}(\frac{1 - \theta}{1 - \theta + \theta\bar{\gamma}})\right]. \quad (80)$$

We use equations (70), (76), and (77) to derive the first-order approximation for income under free trade:

$$Y^i_{\text{trade}} = A_n e\left[1+(1-\theta)\left(\frac{\gamma^i_c}{\gamma_w}\right)^{1-\sigma}(1-\frac{1}{\gamma^i_c})\frac{\hat{\gamma}_c M}{\theta\hat{\gamma}_c + 1 - \theta}\right] \approx A_n e\left[1+(1-\theta)\left(\frac{\gamma^i_c}{\bar{\gamma}}\right)^{1-\sigma}(1-\frac{1}{\gamma^i_c})\frac{\bar{\gamma}}{\theta\bar{\gamma} + 1 - \theta}\right]$$
$$\approx A_n e\left[1 + (1-\theta)(1 + (1-\sigma)\frac{\Delta\gamma^i_c}{\bar{\gamma}})(1 - \frac{1}{\bar{\gamma}}(1 - \frac{\Delta\gamma^i_c}{\bar{\gamma}}))\frac{\bar{\gamma}}{\theta\bar{\gamma} + 1 - \theta}\right]$$
$$\approx \frac{A_n e\bar{\gamma}}{\theta\bar{\gamma} + 1 - \theta}\left[1 + (1-\theta)\frac{\Delta\gamma^i_c}{\bar{\gamma}}(1 - \sigma(1 - \frac{1}{\bar{\gamma}}))\right], \quad (81)$$

where the last approximation above assumes $(\Delta\gamma^i_c)^2 \approx 0$. Now we use equations (80) and (81) to write the profit-shifting channel as

$$\log(\frac{Y^i_{\text{trade}}}{Y^i_{\text{autarky}}}) \approx (1-\theta)\frac{\Delta\gamma^i_c}{\bar{\gamma}}\left[1-\sigma(1-\frac{1}{\bar{\gamma}})\right]-\frac{\Delta\gamma^i_c}{\bar{\gamma}}\left[\frac{1-\theta}{1-\theta+\theta\bar{\gamma}}\right] = -(1-\theta)\frac{\Delta\gamma^i_c}{\bar{\gamma}}(\bar{\gamma}-1)\left[\frac{\sigma}{\bar{\gamma}}-\frac{\theta}{1-\theta+\theta\bar{\gamma}}\right]. \quad (82)$$

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 $\Delta\gamma^i_c > 0$ (i.e., country i is more frictional than the world average).

Using equations (79) and (82) into the gains from trade in equation (78), and subtracting the frictionless gains from trade in equation (48) delivers

$$\log(GT_i) - \log(GT^{\text{frictionless}}_i) = (1-\theta)\frac{\Delta\gamma^i_c}{\bar{\gamma}}\left[1 - (\bar{\gamma} - 1)(\frac{\sigma}{\bar{\gamma}} - \frac{\theta}{1 - \theta + \theta\bar{\gamma}})\right]. \quad (83)$$

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 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 $\Delta\gamma^i_c > 0$ (i.e., $\gamma^i_c > \bar{\gamma}$), and vice versa for the case $\sigma < \sigma^*$, up to the first order of approximation of $\Delta\gamma^i_c$.

B.7 Proof of proposition 4

In a closed economy, welfare falls with financial frictions. To elaborate, taking the derivative of welfare in the closed economy in equation (26) with respect to γ_c delivers

$$\frac{\partial U}{\partial \gamma_c} = A_n^{\theta} A_f^{1-\theta} e \frac{\theta(1-\theta)(1-\gamma_c)\gamma_c^{\theta-1}}{(\theta\gamma_c + 1 - \theta)^2} \leq 0, \tag{84}$$

since $\gamma_c \geq 1$.

For a small open economy, the world price index for sector f does not change by γ_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 (70) with respect to γ_c^i:

$$\frac{\partial Y_{\text{trade}}^i}{\partial \gamma_c^i} \propto (1-\sigma)\gamma_i^{\sigma} + \sigma\gamma_i^{\sigma-1} \ , \tag{85}$$

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 γ_w do not change with γ_c^i since country i is small.

C Robustness and Extensions of the Model

C.1 A model with monopolistic competition and a collateral constraint

Consider a version of our model with monopolistic competition, a collateral constraint, and a fixed measure of firms (i.e., no free entry). We assume the same Cobb-Douglas preferences as in the model in the text and also assume the same CES aggregation over varieties A in the finance-dependent sector f, with the elasticity of substitution across varieties being σ. The firm A in the finance-dependent sector f operating at scale k produces Ak units of its particular variety, selling this product in a monopolistically competitive product market. This firm faces the demand curve $Y(A) = (p(A)/P_f)^{-\sigma} Y_f$, where $p(A)$ is the price charged by this producer, P_f is the aggregate price index of the finance-dependent sector, and Y_f is the aggregate demand for sector f. In line with models in the literature, we abstract from the minimum scale I by assuming that it is small and therefore not biding in equilibrium. In an unconstrained world, the firm chooses its capital k and price $p(A)$ to maximize its profit:

$$k^*(A) = \arg\max_k \quad p(A)Y(A) - Rk,$$

such that

$$Y(A) = Ak,$$

$$Y(A) = (p(A)/P_f)^{-\sigma} Y_f.$$

The optimal, unconstrained price and capital would be

$$p^*(A)A/R = \sigma/(\sigma - 1),$$

$$k^*(A) = 1/AY_f(\frac{R}{AP_f}\frac{\sigma}{\sigma-1})^{-\sigma}.$$

In a world with imperfect financial markets, firms face a constraint in raising funds to scale up their operation. In particular, we assume that the amount of loans that can be raised to finance investment is limited to a fraction η of their entire stock of capital k, which is posted as collateral: $l \leq \eta k$, where l is the amount of loan. Here, $\eta \in [0, 1]$ governs the severity of financing friction; in a perfect financial market, $\eta = 1$, which means that the entire stock of capital is valued as collateral. In a world with no financial markets, $\eta = 0$. Assuming that all producers have an endowment e, we have $k = l + e$, and therefore the collateral constraint can be written as $k \leq e/(1 - \eta)$. Define

$$k_c := e/(1 - \eta)$$

as the maximum possible scale, given that financial markets are imperfect ($\eta < 1$). In the rest of this section, we drop the notation η and simply refer to k_c as the proxy for financial development.

We assume that the financing constraint is binding for all firms—that is, $k_c \leq k^*(A)$ for all A. All firms will therefore operate at $k(A) = k_c$. Firm A produces

$$Y(A) = k_c A$$

and sells the product at the price

$$p(A) = (\frac{k_c A}{Y_f})^{-1/\sigma} P_f.$$

The aggregate price index of sector f in a closed economy solves

$$P_f^{1-\sigma} = \int p(A)^{1-\sigma} dF(A) = (k_c \hat{A}_f / Y_f)^{(\sigma-1)/\sigma} m P_f^{1-\sigma},$$

where

$$m := \int dF(A)$$

is the measure of firms, which is fixed since we do not allow entry, and

$$\hat{A}_f := [\int A^{(\sigma-1)/\sigma} dF(A) / \int dF(A)]^{\sigma/(\sigma-1)}$$

is the average productivity.

Given the Cobb-Douglas preferences across sectors n and f, the aggregate demand for sector f equals

$$Y_f = (1-\theta) Y / P_f,$$

where Y is the country's total income. We can then solve for P_f as

$$P_f = \frac{(1-\theta)Y}{k_c \hat{A}_f m^{\sigma/(\sigma-1)}}.$$

The price index of sector f, P_f, is decreasing in financial development k_c, holding everything else unchanged. If k_c rises, *all* firms scale up, which reduces the price index. This decrease in P_f, in turn, would hurt an individual firm. We show that the total profit of sector f would also decrease with k_c, even though each individual firm would get closer to its optimal scale of operation k^*. The output of sector f, Y_f, can also be solved as

$$Y_f = k_c \hat{A}_f m^{\sigma/(\sigma-1)}.$$

Note that Y_f is increasing in k_c: Financial development allows more capital allocation to sector f, and the output of sector f rises as a result.

Aggregate profits of sector f equal

$$\Pi_f = \int p(A)Y(A)dF(A) - K_f,$$

where we subtract K_f since the depreciation rate is one, as in the baseline model. Substituting for $p(A)$ and $Y(A)$ delivers

$$\Pi_f = \frac{(\hat{A}_f k_c)^{\frac{\sigma-1}{\sigma}}}{(Y_f)^{\frac{-1}{\sigma}}} m P_f - mk_c = (1-\theta)Y - mk_c,$$

where the second equality is obtained by substituting for P_f. We solve for the aggregate income Y from the market clearing condition for capital. Specifically,

$$K_n = e - K_f = e - mk_c \;\Rightarrow\; Y_n = A_n K_n = A_n(e - mk_c).$$

Given the Cobb-Douglas preferences, $Y_n = \theta Y$, and therefore,

$$Y = A_n(e - mk_c)/\theta.$$

By substituting for Y in the profits equation, Π_f simplifies to

$$\Pi_f = \frac{1-\theta}{\theta} A_n(e - mk_c) - mk_c.$$

Here, Π_f is clearly decreasing in k_c, the maximum scale of operation imposed by the financing constraint. This pattern is driven by a fall in P_f and not a rise in Y_f, as we discussed above.

On the other hand, the profits of sector n equal

$$\Pi_n = Y_n - K_n,$$

which, given the production function $Y_n = A_n K_n$ and capital market clearing $K_n = e - mk_c$, simplifies to

$$\Pi_n = (A_n - 1)(e - mk_c).$$

We can now derive the profits of sector f relative to sector n:

$$\frac{\Pi_f}{\Pi_n} = \frac{\frac{1-\theta}{\theta} A_n - \frac{mk_c}{e-mk_c}}{A_n - 1},$$

which is *decreasing* in k_c. Financial development (an increase in η and hence k_c), while increasing the output, results in a *decrease* in the profits of the finance-dependent sector f (relative to n), through a reduction in the price index of this sector P_f. This result is similar to the one we derived in the main text and is summarized below.

Proposition. *In a closed economy, the profits of sector f relative to sector n are decreasing in financial development.*

Note that in our comparative statics, we are assuming the measure of firms in the finance-dependent sector is exogenously fixed at m. By imposing free entry in this model, however, there would be no economic profits in sector f, regardless of financing friction severity.

We now turn to the case of an open economy with free trade. For a small open economy i, the price index P_f is given. Demand for country i's firm A is derived by

$$Y^i(A) = (p^i(A)/P_f)^{-\sigma} Y_f,$$

where P_f is the global price index and Y_f is the global demand for good f. Given Cobb-Douglas preferences, $Y_f = (1-\theta)Y/P_f$, where Y is the global income. We again assume that all firms in sector f of country i are financially constrained, and therefore the production of firm A is given by

$$Y^i(A) = Ak_c^i,$$

where $k_c^i := e/(1-\eta_i)$ and $\eta_i < 1$ governs the financial friction severity in country i. We can solve for $p^i(A)$ via market clearing for country i's product A:

$$p^i(A) = (\frac{AP_f k_c^i}{(1-\theta)Y})^{-1/\sigma} P_f.$$

The profits of sector f in country i can be written as

$$\Pi_f^i = \int p^i(A)Y^i(A)dF(A) - \int k^i(A)dF(A) = \frac{m^i(P_f \hat{A}_f k_c^i)^{\frac{\sigma-1}{\sigma}}}{[(1-\theta)Y]^{\frac{-1}{\sigma}}} - m^i k_c^i.$$

We solve for the global price index P_f to simplify this equation:

$$P_f^{1-\sigma} = \sum_i \int p^i(A)^{1-\sigma} dF(A) \;\Rightarrow\; P_f = \frac{(1-\theta)Y}{\hat{A}_f \hat{k}_c m^{\frac{\sigma}{\sigma-1}}},$$

where $\hat{k}_c := (\sum_i m^i (k_c^i)^{\frac{\sigma-1}{\sigma}} / \sum_i m^i)^{\frac{\sigma}{\sigma-1}}$ is the cross-country average of size limits imposed by financing frictions, and $m := \sum_i m^i$ is the sum of the mass of firms in sector f across the world.

We can now rewrite the profits in sector f of country i as

$$\Pi_f^i = \frac{(1-\theta)Y}{m}(\frac{k_c^i}{\hat{k}_c})^{\frac{\sigma-1}{\sigma}} m^i - m^i k_c^i.$$

In contrast to the closed economy, here Π_f^i is *increasing* in k_c^i as long as the global income Y is large enough and/or the size limit in country i, k_c^i, is small relative to the rest of the world. The key point is that a larger k_c^i allows firms in the home economy to scale up, which increases their total profits, since a larger k_c^i does not affect the global income and price index P_f for i being a small open economy.

The profits of sector n depend on the income of the country

$$\Pi_n^i = Y_n^i - K_n^i = Y_n^i(1 - 1/A_n) = \theta Y^i (1 - 1/A_n),$$

where we again assume that sector n in country i produces good n for its own consumers, and therefore $Y_n^i = \theta Y^i$ given the Cobb-Douglas preferences.

The income of country i is pinned down by the balance of payments:

$$\underbrace{(1-\theta)Y^i}_{\text{total consumption of good } f} - \underbrace{\int p^i(A) Y^i(A) dF(A)}_{\text{total export of good } f} = \underbrace{A_n[e - K_f^i - K_n^i]}_{\text{flow of capital across border times eqm return rate on capital}}.$$

By substituting for sectoral demand for capital, we get

$$Y^i = A_n e + \int p^i(A) Y^i(A) dF(A) - A_n m^i k_c^i.$$

We can now derive the relative profits of sectors as

$$\frac{\Pi_f^i}{\Pi_n^i} = \frac{\frac{(1-\theta)Y}{m}(\frac{k_c^i}{\hat{k}_c})^{\frac{\sigma-1}{\sigma}} m^i - m^i k_c^i}{\theta(1-1/A_n)(A_n e + \frac{(1-\theta)Y}{m}(\frac{k_c^i}{\hat{k}_c})^{\frac{\sigma-1}{\sigma}} m^i - A_n m^i k_c^i)}.$$

The profits of sector n (the denominator) are proportional to the income of the country, which in turn depends on k_c^i. The profits of sector f (the numerator) are also affected by k_c^i. We see that the numerator is more sensitive to k_c^i than the denominator, in log scale, because of the fixed term $A_n e$ in the denominator and also since $A_n > 1$. A sufficient condition for Π_f^i/Π_n^i being *increasing* in k_c^i is that the derivative of the denominator is positive (i.e., the income of the country is increasing in k_c^i). This is the case, for example, if θ is small enough or k_c^i is small (relative to the world average $\hat{k}_c$). We summarize this result below.

Proposition. *In a small open economy, the profits of sector f relative to sector n are increasing with financial development if (as a sufficient condition) the total income of the economy increases with financial development.*

C.2 The model with iceberg trade cost

Consider a world in which country i faces the iceberg trade cost τ^i on both imports and exports. We show that the main results provided in the text hold in this world as well. In particular, we show that Π_f^i/Π_n^i is increasing in γ_c^i when τ^i is large enough and decreasing in γ_c^i when τ^i is low enough.

Facing the iceberg trade cost τ^i, the price of variety A exported from country i to any country in the world would be $\gamma_c^i R\tau^i/A$. Similarly, the price of variety A that country i imports from country j would be $\gamma_c^j R\tau^i/A$. Notice that, as before, $R = A_n$ in equilibrium. The total exports of country i (not including domestic sales) therefore equal

$$\sum_{j\neq i}\int_A \left(\frac{\gamma_c^i R\tau^i/A}{P_f}\right)^{1-\sigma}(1-\theta)Y^j dF(A) = (\gamma_c^i\tau^i)^{1-\sigma}\Omega P_f^{\sigma-1}\sum_{j\neq i}Y^j, \tag{86}$$

where $\Omega \equiv (1-\theta)(A_n/A_f)^{1-\sigma}$, A_f is defined in equation (19), and P_f is the sector f CES price index that all countries in the world except country i face:

$$P_f = \frac{A_n}{A_f}\left[(\tau^i\gamma_c^i)^{1-\sigma} + \sum_{j\neq i}\gamma_c^{j\ 1-\sigma}\right]^{1/1-\sigma}. \tag{87}$$

The total imports of country i (not including domestic sales) can be written as

$$\sum_{j\neq i}\int_A \left(\frac{\gamma_c^j R\tau^i/A}{P_f^i}\right)^{1-\sigma}(1-\theta)Y^i dF(A) = \Omega\tau^{i\ 1-\sigma}P_f^{i\ \sigma-1}\gamma_{w\neq i}^{1-\sigma}Y^i, \tag{88}$$

where $\gamma_{w\neq i}^{1-\sigma} \equiv \sum_{j\neq i}\gamma_c^{j\ 1-\sigma}$ and P_f^i is the sector f CES price index in country i:

$$P_f^i = \frac{A_n}{A_f}\left[\gamma_c^{i\ 1-\sigma} + \tau^{i\ 1-\sigma}\sum_{j\neq i}\gamma_c^{j\ 1-\sigma}\right]^{1/1-\sigma}. \tag{89}$$

Total capital demand in sector f of country i can be written as:

$$K_f^i = \int_A \left(\frac{\gamma_c^i R/A}{P_f^i}\right)^{-\sigma} \frac{(1-\theta)Y^i}{AP_f^i} dF(A) + \sum_{j\neq i} \int_A \left(\frac{\gamma_c^i R\tau^i/A}{P_f}\right)^{-\sigma} \frac{(1-\theta)Y^j}{AP_f} \tau^i dF(A) \tag{90}$$

$$= \frac{\Omega}{A_n} \gamma_c^{i\ -\sigma} P_f^{i\ \sigma-1} Y^i + \frac{\Omega}{A_n} \gamma_c^{i\ -\sigma} \tau^{i\ 1-\sigma} P_f^{\sigma-1} \sum_{j\neq i} Y^j. \tag{91}$$

Balance of payments implies that total imports minus total exports equals capital exports. Capital exports equal $A_n(e - K_f^i - \theta Y^i/A_n)$ since we again assume that each country produces good n for its own consumption only. Balance of payments can therefore be written as

$$\Omega\tau^{i\ 1-\sigma} P_f^{i\ \sigma-1} \gamma_{w\neq i}^{1-\sigma} Y^i - (\gamma_c^i \tau^i)^{1-\sigma} \Omega P_f^{\sigma-1} \sum_{j\neq i} Y^j = A_n e - \theta Y^i - \Omega \gamma_c^{i\ -\sigma} P_f^{i\ \sigma-1} Y^i - \Omega \gamma_c^{i\ -\sigma} \tau^{i\ 1-\sigma} P_f^{\sigma-1} \sum_{j\neq i} Y^j, \tag{92}$$

which can be simplified to

$$Y^i \left[\Omega\tau^{i\ 1-\sigma} P_f^{i\ \sigma-1} \gamma_{w\neq i}^{1-\sigma} + \theta + \Omega\gamma_c^{i\ -\sigma} P_f^{i\ \sigma-1}\right] = A_n e + \Omega \gamma_c^{i\ -\sigma} \tau^{i\ 1-\sigma} P_f^{\sigma-1} (\gamma_c^i - 1) \sum_{j\neq i} Y^j. \tag{93}$$

Note that as $\tau^i \to \infty$, the economy goes into autarky, and therefore the balance of payment equation delivers the country income Y^i, as in equation (23).

We now explore how profits in sector f relative to those in sector n, Π_f^i/Π_n^i, vary by γ_c^i. Profits in sector f equal exports plus domestic sales minus capital (since capital fully depreciates):

$$\Pi_f^i = \gamma_c^{i\ -\sigma} \Omega P_f^{i\ \sigma-1} Y^i (\gamma_c^i - \frac{1}{A_n}) + \gamma_c^{i\ -\sigma} \Omega \tau^{i\ 1-\sigma} P_f^{\sigma-1} \sum_{j\neq i} Y^j (\gamma_c^i - \frac{1}{A_n}). \tag{94}$$

Profits in sector n equal

$$\Pi_n^i = \theta Y^i (1 - \frac{1}{A_n}). \tag{95}$$

Using these two equations, relative profits can be written as

$$\frac{\Pi_f^i}{\Pi_n^i} = \frac{\Omega}{\theta(A_n - 1)} \gamma_c^{i\ -\sigma} P_f^{i\ \sigma-1} (A_n \gamma_c^i - 1) + \frac{\Omega}{\theta(A_n - 1)} \gamma_c^{i\ -\sigma} \tau^{i\ 1-\sigma} P_f^{\sigma-1} (A_n \gamma_c^i - 1) \frac{\sum_{j\neq i} Y^j}{Y^i}, \tag{96}$$

where $\sum_{j\neq i} Y^j / Y^i$ can be replaced using the balance of payment equation (93). To elaborate, the first term corresponds to the relative profits from serving the domestic market, while the second term is associated with exports.

When trade cost τ^i is large enough, the second term would be negligible. In particular, as

$\tau^i \to \infty$, the second term goes to zero, and therefore Π^i_f/Π^i_n would converge to relative profits under autarky:

$$\left.\frac{\Pi^i_f}{\Pi^i_n}\right|_{\tau^i \to \infty} = \frac{\Omega}{\theta(A_n - 1)} \gamma^{i\ -\sigma}_c P^{i\ \sigma-1}_f (A_n \gamma^i_c - 1), \tag{97}$$

which, as shown above, is increasing in γ^i_c given the fact that under autarky $P^i_f = \gamma^i_c A_n / A_f$. Therefore, given the continuity of Π^i_f/Π^i_n, there exists a trade cost τ^i above which Π^i_f/Π^i_n is increasing in γ^i_c. In contrast, as $\tau^i \to 1$, relative profits Π^i_f/Π^i_n converge to that under free trade, which is decreasing in γ^i_c, as we showed above. Hence, again since Π^i_f/Π^i_n is continuous, there exists a trade cost below which Π^i_f/Π^i_n is decreasing in γ^i_c. We can therefore conclude that when trade costs are large (small) enough, profits in sector f relative to those in sector n rise (fall) with γ^i_c.

D 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, 2013; 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:[6]

$$\ln(x_{od}^{i}) = \alpha_{od} + \beta_{d}^{i} + \delta_{o}[\text{Fin Dep}]^{i} + \varepsilon_{od}^{i} \; , \tag{98}$$

where x_{od}^{i} is the exports from the origin country o to the destination country d in industry i, and α_{od} and β_{d}^{i} capture origin-destination and destination-industry fixed effects, respectively. Here, $[\text{Fin Dep}]^{i}$ 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 δ_o determine the pattern of cross-country comparative advantage in finance-dependent industries. To see why, take the difference-in-difference of the above regression to write

$$\mathrm{E}[\ln(x_{o_1 d}^{i_1}/x_{o_1 d}^{i_2}) - \ln(x_{o_2 d}^{i_1}/x_{o_2 d}^{i_2})] = (\delta_{o_1} - \delta_{o_2}) * ([\text{Fin Dep}]^{i_1} - [\text{Fin Dep}]^{i_2}) \; . \tag{99}$$

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

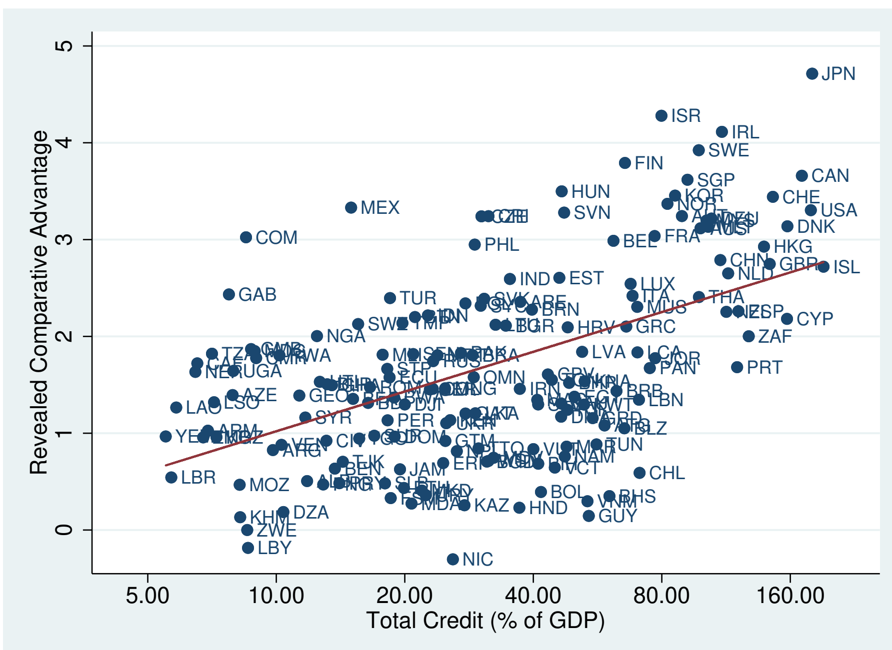
To run this regression, we use Comtrade import flows for 181 exporters and 169 importers in 27 three-digit ISIC manufacturing industries in 2005 (see details in appendix A).[7,8] Figure D.1 plots the estimated revealed comparative advantage δ_o against our main proxy for financial development (i.e., private credit (% of GDP)) in log scales. We confirm that more financially 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.

[6] The context in Costinot (2009) is different, as he estimates revealed comparative advantage in producing "complex" goods.

[7] Table A.3 lists the industries.

[8] Using data in 1995 or 2015 delivers the same pattern.

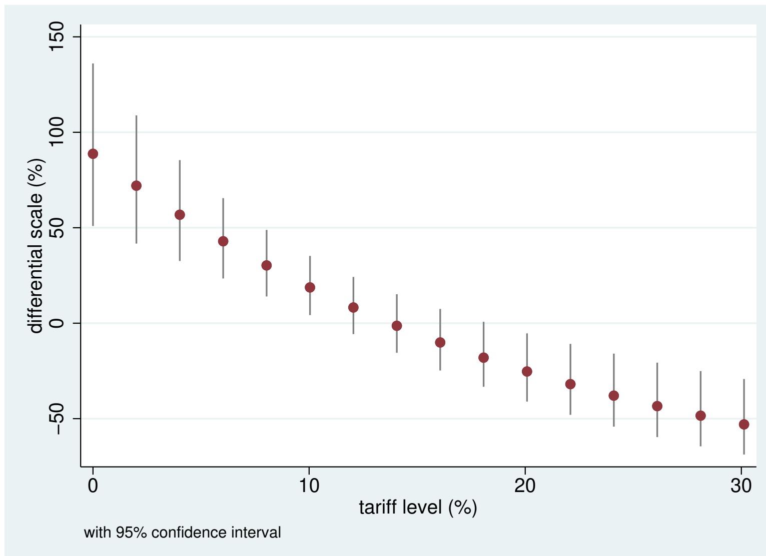
Figure D.1: Revealed comparative advantage in finance-dependent industries against financial development



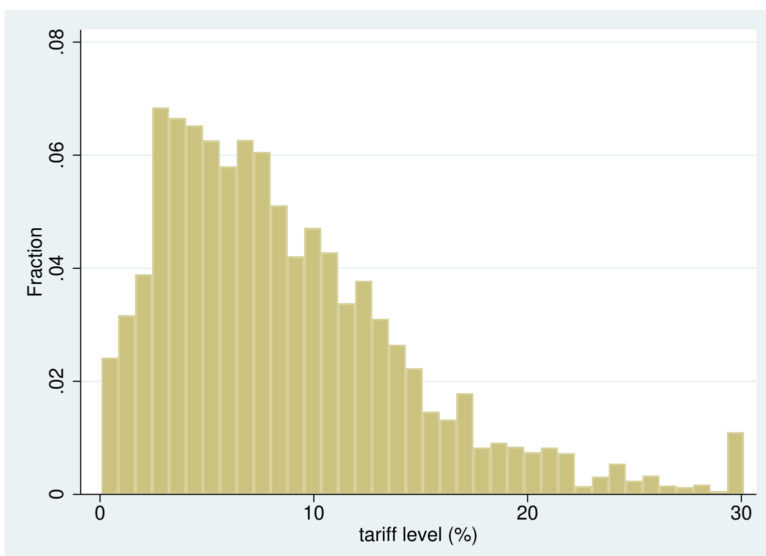
Notes: The vertical axis measures revealed comparative advantage in finance-dependent industries using regression (98). The horizontal axis is our proxy for financial development, which measures total credit to private sector normalized by GDP, in the log scale. The slope of the linear fit is statistically significant, with the t-statistic being 7.78.

E Additional Tables and Figures

Figure E.1: The estimates of the sensitivity of finance-dependent industries to financial development versus tariff level, and the histogram of tariffs in our regression sample



(a) The estimates of the sensitivity of finance-dependent industries to financial development at different tariff levels



(b) The histogram of tariffs in the benchmark regression sample

Notes: Panel (a) reports the percentage difference in profits for the industry at the 75th percentile of the finance dependence distribution relative to the one at the 25th percentile, in a country at the 75th percentile of financial development relative to the one at the 25th percentile, estimated at different tariff levels, as implied by our benchmark estimates in specification (3). Vertical lines show the 95% confidence interval. See further notes on variables and point estimates in table 1. Panel (b) depicts the histogram of tariff levels in our regression sample. In this representation, we limit tariffs at the 99th percentile from above, which is around 30%.

Table E.1: Robustness results with respect to the measure of tariffs

log(Profits)	(1)	(2)	(3)	(4)	(5)	(6)
external-finance dependence	1.1451***	0.9001***	0.7390***	1.1911***	1.0889***	1.0224***
× log(total credit/GDP)	(0.1793)	(0.1616)	(0.1366)	(0.2351)	(0.2268)	(0.1963)
external-finance dependence	1.0069***	0.5236***	0.2922**	0.7823**	0.5014**	0.5566***
× tariff	(0.2825)	(0.1892)	(0.1482)	(0.3096)	(0.2241)	(0.1921)
external-finance dependence	-0.6889***	-0.3951***	-0.2258***	-0.5239***	-0.3366***	-0.3114***
× log(total credit/GDP)	(0.1254)	(0.0826)	(0.0592)	(0.1425)	(0.0970)	(0.0840)
× tariff						
FE − Industry & Country, by Year	✓	✓	✓	✓	✓	✓
Observations	6985	6985	6985	2391	2391	2391
Clusters (country×industry)	1747	1747	1747	916	916	916
Diff. scale at tariff=0	124.4%	88.7%	68.5%	134.7%	118.1%	107.9%
... at tariff=20%	-55.1%	-25.0%	-0.6%	-32.2%	-1.8%	-0.6%

Notes: Variables are the same as defined in table 1, except that we use alternative measures for tariffs. In Columns 1-3, we use tariffs at one-, two-, and three-digit ISIC levels, respectively. In Columns 4-6, we use the five-year lag measure of tariffs used in Columns 1-3, respectively. All tariff measures are normalized by the standard deviation of tariffs at the two-digit level—that is, 6.3 percent, as in our benchmark specification. The last two rows interpret the results by reporting differential scales as defined in table 1, for two levels of tariffs: zero and 20%. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Table E.2: Robustness results with respect to the measure of trade barriers

log(Profits)	(1)	(2)	(3)	(4)	(5)	(6)
external-finance dependence	0.7726***	0.9001***	0.9278***	0.8054***	0.8300***	0.7539***
× log(total credit/GDP)	(0.1321)	(0.1616)	(0.2181)	(0.1613)	(0.1951)	(0.1836)
external-finance dependence	0.7692***	0.5236***	0.4162*	0.3637*	0.5624**	0.5747*
× trade barriers	(0.2036)	(0.1892)	(0.2144)	(0.2117)	(0.2650)	(0.3004)
external-finance dependence	-0.4669***	-0.3951***	-0.1717**	-0.1958**	-0.2249**	-0.2688***
× log(total credit/GDP)	(0.0933)	(0.0826)	(0.0810)	(0.0825)	(0.0895)	(0.1037)
× trade barriers						
FE − Industry & Country, by Year	✓	✓	✓	✓	✓	✓
Observations	6985	6985	6961	6961	6434	6434
Clusters (country×industry)	1747	1747	1726	1726	1653	1653
Diff. scale at trade barrier=10th percentile	71.1%	68.5%	66.0%	66.0%	66.0%	70.0%
... at trade barrier=90th percentile	-15.8%	-11.1%	24.7%	20.6%	15.0%	8.0%

Notes: Variables are the same as defined in table 1, except that we use alternative proxies for trade barriers. In Columns 1-2, we use tariffs at the two-digit ISIC level for imports and for average imports and exports, respectively. In Columns 3-4, we use (the opposite of) trade openness—that is, manufacturing imports divided by GDP and manufacturing imports plus exports divided by GDP, respectively. In Columns 5-6, we use (the opposite of) natural trade openness using gravity-implied imports divided by GDP and gravity-implied imports plus exports divided by GDP, respectively. All measures are normalized by the full sample standard deviation. The last two rows interpret the results by reporting differential scales as defined in table 1, at two levels of trade barriers: the 10th and the 90th percentiles. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Table E.3: The role of import and export barriers against countries that are more financially developed and less financially developed compared to a given country

log(Profits)	(1)	(2)	(3)	(4)	(5)	(6)
ExtDep × FinDev	0.9001***	0.8657***	0.7841***	0.6494***	0.7679***	1.0353***
	(0.1616)	(0.1361)	(0.1423)	(0.1346)	(0.1527)	(0.1831)
ExtDep× average tariff	0.5236***					
	(0.1892)					
ExtDep × import tariff w/ higher dev.		0.5050***				0.5729***
		(0.1169)				(0.1941)
ExtDep × export tariff w/ higher dev.			0.6023***			0.3473
			(0.2138)			(0.2244)
ExtDep × import tariff w/ lower dev.				0.2936**		-0.2706
				(0.1181)		(0.2020)
ExtDep × export tariff w/ lower dev.					0.1418	0.0926
					(0.1183)	(0.1217)
ExtDep × FinDev × average tariff	-0.3951***					
	(0.0826)					
ExtDep × FinDev × import tariff w/ higher dev.		-0.2953***				-0.2887***
		(0.0528)				(0.0918)
ExtDep × FinDev × export tariff w/ higher dev.			-0.3631***			-0.2229**
			(0.1080)			(0.1096)
ExtDep × FinDev × import tariff w/ lower dev.				-0.2171***		0.0687
				(0.0531)		(0.0966)
ExtDep × FinDev × export tariff w/ lower dev.					-0.1352**	-0.0941*
					(0.0529)	(0.0547)
FE − Industry & Country, by Year	✓	✓	✓	✓	✓	✓
Observations	6985	6847	6845	6958	6686	6534
Clusters (country×industry)	1747	1726	1724	1731	1676	1643

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 more financially developed relative to this country. Other variables are defined in table 1. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Table E.4: Robustness results with respect to the measure of financial vulnerability

log(Profits)	(1)	(2)	(3)
financial vulnerability	0.9001***	2.4511***	3.3661***
× log(total credit/GDP)	(0.1616)	(0.7223)	(1.1439)
financial vulnerability	0.5236***	1.7403**	2.5025*
× tariff	(0.1892)	(0.8301)	(1.4337)
financial vulnerability	-0.3951***	-0.9787**	-1.3159**
× log(total credit/GDP)	(0.0826)	(0.3829)	(0.6550)
× tariff			
FE − Industry & Country, by Year	✓	✓	✓
Observations	6985	6985	6985
Clusters (country×industry)	1747	1747	1747
Differential scale at zero tariff	88.7%	67.2%	50.7%
Tariff for zero diff. scale	13.8%	15.1%	15.5%

Notes: Variables are the same as defined in table 1, except for the proxy for industry-level financial vulnerability. In Column 1, we use external-finance dependence as in the benchmark specification. In Column 2, we use asset intangibility (one minus the ratio of net property, plant and equipment over total assets). In Column 3, we use capital intensity in the production technology (one minus the share of labor and material costs in sales). The last two rows interpret the results by reporting differential scales as defined in table 1 for each measure of financial vulnerability. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Table E.5: Robustness results with respect to the measure of financial development

log(Profits)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
external-finance dependence	0.9001***	0.8497***	0.8876***	0.8565***	0.7061***	0.6578***	0.9315***
× financial development	(0.1616)	(0.1545)	(0.1539)	(0.1480)	(0.1621)	(0.1688)	(0.1899)
external-finance dependence	0.5236***	0.3817**	0.4853**	-0.0077	0.3542	0.8533**	1.8706***
× tariff	(0.1892)	(0.1881)	(0.1997)	(0.0973)	(0.2444)	(0.4075)	(0.6085)
external-finance dependence	-0.3951***	-0.3463***	-0.3719***	-0.3371***	-0.2744***	-0.3582***	-0.4000***
× financial development	(0.0826)	(0.0857)	(0.0848)	(0.0792)	(0.0890)	(0.0915)	(0.0962)
× tariff							
FE − Industry & Country, by Year	✓	✓	✓	✓	✓	✓	✓
Observations	6985	6548	6205	6985	6868	5199	5245
Clusters (country×industry)	1747	1655	1574	1747	1698	1533	1579
Differential scale at zero tariff	88.7%	81.3%	103.9%	78.5%	47.4%	50.3%	62.0%
Tariff for zero diff. scale	13.8%	14.8%	14.4%	15.4%	15.5%	11.1%	14.1%

Notes: Variables are the same as defined in table 1, except for the measure of financial development. In Column 1, we use the log of credit over GDP (as in the benchmark). In Columns 2 and 3, we use the 5- and 10-year lag of the log of credit over GDP, respectively. In Column 4, we use *the level of* credit over GDP. In Column 5, we use the log of financial system deposits over GDP. In Column 6, we use (the opposite of) banks' net interest margins. In Column 7, we use (the opposite of) banks' overhead costs relative to total assets. All measures are normalized by the sample minimum and standard deviation. The last two rows interpret the results by reporting differential scales as defined in table 1 for each proxy of financial development. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Table E.6: Robustness results with respect to the outcome variable

	(1)	(2)	(3)	(4)	(5)
external-finance dependence	0.9001***	0.9199***	0.8483***	0.4406	0.7499***
× log(total credit/GDP)	(0.1616)	(0.1590)	(0.1418)	(0.2695)	(0.1384)
external-finance dependence	0.5236***	0.4933***	0.4103**	-0.5543	0.2476
× tariff	(0.1892)	(0.1868)	(0.1643)	(0.3641)	(0.1598)
external-finance dependence	-0.3951***	-0.3911***	-0.3238***	-0.1449	-0.2563***
× log(total credit/GDP)	(0.0826)	(0.0801)	(0.0677)	(0.1520)	(0.0686)
× tariff					
FE − Industry & Country, by Year	✓	✓	✓	✓	✓
Observations	6985	7282	8200	1674	8872
Clusters (country×industry)	1747	1787	1827	621	2011
Differential scale at zero tariff	88.7%	88.1%	83.1%	64.0%	69.1%
Tariff for zero diff. scale	13.8%	14.2%	15.8%	18.4%	17.7%

Notes: The right-hand-side variables are the same as defined in table 1. In Column 1, we run the OLS regression using the log of profits (value added minus wage bills) on the left-hand side, as in the benchmark. In Column 2, we run a Tobit model to accommodate observations with negative and zero profits, those censored from the left in the benchmark specification. In Column 3, we run the OLS regression using the log of value added (without subtracting wage bill) on the left-hand side. In Column 4, we run the OLS regression using the log of profits net of the estimated capital depreciation on the left-hand side. In Column 5, we run the OLS regression using the log of sales on the left-hand side. The last two rows interpret the results by reporting differential scales as defined in table 1 with respect to each outcome variable. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Table E.7: Subsample results for industry sales

log(Sales)	(All)	(low Tariff)	(high Tariff)	(All)
external-finance dependence × log(total credit/GDP)	0.6028*** (0.0884)	0.8308*** (0.1307)	-0.1314 (0.0935)	0.7499*** (0.1384)
external-finance dependence × tariff				0.2476 (0.1598)
external-finance dependence × log(total credit/GDP) × tariff				-0.2563*** (0.0686)
FE − Industry & Country, by Year	✓	✓	✓	✓
Observations	6791	3275	3401	8872
Clusters (country×industry)	1727	1076	1039	2011
Differential scale (%)	53.0	79.7	insignificant	69.1 17.7

Notes: The right-hand-side variables and subsample definitions are the same as defined in table 1. We use sales on the left-hand side. The last two rows interpret the results by reporting differential scales as defined in table 1 with respect to each outcome variable. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Table E.8: Robustness results with respect to the source of variations in the estimation

log(Profits)	(1)	(2)	(3)	(4)
external-finance dependence × log(total credit/GDP)	0.8096***	0.8864***	0.8047***	0.9001***
	(0.1612)	(0.1576)	(0.1674)	(0.1616)
external-finance dependence × tariff	0.3326*	0.4568**	0.3619*	0.5236***
	(0.1918)	(0.1874)	(0.2007)	(0.1892)
external-finance dependence × log(total credit/GDP) × tariff	-0.2926***	-0.3650***	-0.3000***	-0.3951***
	(0.0825)	(0.0818)	(0.0868)	(0.0826)
FE − Year	✓			
FE − Country	✓		✓	
FE − Industry	✓	✓		
FE − Year ⊗ Country		✓		✓
FE − Year ⊗ Industry			✓	✓
Observations	7012	6994	7003	6985
Clusters (country×industry)	1749	1747	1749	1747
Differential scale at zero tariff	77.1%	86.9%	76.5%	88.7%
Tariff for zero diff. scale	16.7%	14.7%	16.2%	13.8%

Notes: Variables are the same as defined in table 1. The only difference relative to the benchmark specification is the set of fixed effects included. The last two rows interpret the results by reporting differential scales for each specification, as defined in table 1. Standard errors are clustered at the industry-country level and are reported in parentheses. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$

Table E.9: Trade liberalization and the growth of finance-dependent industries in countries with different financial development.

growth(Profits)	All countries	The rest	Trade Liberalization	All countries
external-finance dependence	0.0725***	0.0504**	0.1197***	0.0504**
$\times$ log(total credit/GDP)	(0.0209)	(0.0224)	(0.0417)	(0.0226)
external-finance dependence				0.0693*
$\times$ log(total credit/GDP)				(0.0397)
$\times$ $\mathbf{1}\{$trade liberalization$\}$				
Initial share of total manufacturing	✓	✓	✓	✓
FE − Industry, Country, Year	✓	✓	✓	✓
Observations	1594	1274	319	1594
Clusters (country$\times$industry)	599	533	200	599
Differential in growth rate (%)	6.2	4.3	10.2	

Notes: An observation is an industry in a country in a year. The left-hand-side variable is the annualized growth of profits (i.e., value added minus wage bill) in the following five years (*log* differences divided by five). External-finance dependence is defined as the fraction of capital expenditures not financed with cash revenues for the U.S. publicly traded firms in the 1980s. Financial development is proxied by the country-level *log* of total credit to private sector divided by GDP (standardized by sample minimum and STD) at the beginning of the five-year growth period. See appendix A for more details on constructing variables. Column 1 shows regression results for the full sample, while Column 2 (Column 3) report the results for subsamples of countries that have not (have) experienced a significant reduction in tariffs over the sample period. Column 4 shows the full sample triple-difference 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 that 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: the "Trade Liberalization" subsample, for which the average reduction in tariffs is around 6% 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. The last row interprets the results and shows how much the profits of an industry at the 75th percentile of external-finance dependence grow 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. $^{***}p < 0.01$ $^{**}p < 0.05$ $^{*}p < 0.1$