No Credit, No Gain: Trade Liberalization Dynamics, Production Inputs, and Financial Development*

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Abstract

We study the role of financial development on the aggregate and welfare implications of reducing trade barriers on imports of physical capital and intermediate inputs. We document that financially underdeveloped economies feature a slower response of real GDP, consumption, and investment following trade liberalization episodes that improve access to imported production inputs. To quantify the role of financial development, we set up a quantitative general equilibrium model with heterogeneous firms subject to financial constraints and estimate it to match salient features from Colombian plant-level data. We find that the adjustment to a decline of import tariffs on physical capital and intermediate inputs is significantly slower in financially underdeveloped economies in line with the empirical evidence. These effects reduce the welfare gains from trade liberalization and make them more unequal across agents.

Keywords: financial development, trade liberalization, welfare, production inputs. JEL: F1, F4.

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1 Introduction

A key channel through which openness to international trade promotes growth and economic development is by making production inputs cheaper. Cheaper access to imports of physical capital and intermediate inputs allows firms to accumulate capital and increase productivity, leading to increased real GDP and consumption growth (Amiti and Konings 2007; Wacziarg and Welch 2008; Estevadeordal and Taylor 2013). Despite these potential benefits, trade liberalization is often resisted as a policy to promote economic development, particularly in less developed economies. In this paper, we investigate whether these economies have less to gain from trade liberalization.

Our starting point is novel empirical evidence showing that frictions in financial markets may limit the gains from lowering international trade barriers. We document that, following a reduction in import tariffs on capital and intermediate inputs, financially underdeveloped economies grow substantially slower than financially developed ones. Credit market frictions, a salient feature of developing economies, might limit the degree to which firms adjust their production in response to lower prices of imported physical capital and intermediates, thereby reducing the gains from trade liberalization in these economies (Manova 2010; Caggese and Cunat 2013; Brooks and Dovis 2019).

Motivated by this evidence, we set up a general equilibrium model of international trade with heterogeneous firms and financial frictions to quantify the role of financial development on the dynamics following trade liberalization. Importantly, our model is designed to capture the significant role of trade in allowing firms to access cheaper production inputs. We estimate the model to match salient features of plant-level data for Colombia and use it to investigate the impact of reducing tariffs on capital and intermediate inputs, as undergone in Colombia in the early 1990s.

We find that differences in financial development significantly reduce the short- and medium-run impact of lowering tariffs on production inputs, thereby reducing the welfare gains from trade liberalization. Moreover, welfare gains are not only lower in financially underdeveloped economies, but they are also more unequally distributed across agents. Finally, we show that our model's implications are consistent with the industry-level dynamics observed during Colombia's trade liberalization.

Importantly, accounting for the importance of capital and intermediates in international trade plays a fundamental role on the dynamics following trade liberalization and how these are shaped by financial frictions. These effects remain largely unchanged if consumption tariffs are reduced in addition to tariffs on capital and intermediate inputs. Thus, our findings show that a key channel through which frictions in financial markets distort the effects of

trade liberalization is by preventing firms from taking advantage of cheaper production inputs.

Our analysis contributes to the literature by showing that the aggregate and distributional effects of trade liberalization depend on the key interaction between cheaper access to production inputs and the extent of financial development. These effects are driven by (i) the extent to which tariffs on production inputs are liberalized and (ii) the role of imports on the overall use of intermediates and capital by domestic firms.

We first document that financially underdeveloped economies grow more slowly than their financially developed counterparts after reducing international trade barriers on capital and intermediate inputs. Our empirical approach extends the analysis conducted by Estevadeordal and Taylor (2013) to investigate the role of financial development on the dynamics of key aggregate outcomes following trade liberalization. We find that financially underdeveloped economies feature a persistently slower response of real GDP, consumption, and investment following trade liberalization.

To investigate the role of financial development in accounting for these findings, we set up a model of trade with frictions in financial markets. Our model consists of a small open economy populated with entrepreneurs that are heterogeneous in productivity who can trade internationally and are subject to financing constraints. Entrepreneurs produce differentiated varieties that they can sell both domestically and abroad, subject to trade costs as in Melitz (2003). Production requires physical capital, labor, and intermediate inputs (i.e. materials), and entrepreneurs face a collateral constraint that limits the amount they can borrow to accumulate capital. Capital and materials are produced using both domestic and imported varieties, with the latter subject to tariffs.

We estimate the model to match key features of Colombian plant-level data and use it to quantify the role of credit frictions in shaping the economy's response to lower tariffs on capital and intermediate inputs. We contrast our findings with those corresponding to an economy with higher financial development. Consistent with the data, we find that differences in financial development significantly reduce the short- and medium-run impact of trade liberalization on real GDP, consumption, and investment. These findings show that improved access to production inputs has a fundamentally different impact across economies with varying degrees of financial development.

Lower import tariffs on capital and intermediates allow firms to access these goods at a lower cost, leading them to increase their production scale. Access to finance plays a key role in allowing firms to do so, since cheaper inputs increase their optimal scale, increasing the optimal amount of physical capital that needs to be accumulated. Therefore, in economies with underdeveloped financial markets, the adjustment of firms' production scale

in response to trade liberalization and, thus, of aggregate output, consumption, and capital, is substantially slower. In the economy with financial frictions, we find that 10 years after trade liberalization real GDP, capital, and consumption only reach 15%, 60%, and 42% of the adjustment across steady-states. In contrast, in the financially developed economy these values are 63%, 85%, and 67%, respectively.

Cross-country differences in financial development have significant implications for the welfare and distributional effects of trade liberalization. First, we find that the welfare gains from trade liberalization are larger in financially developed economies (0.98% in consumption-equivalent units vs. 0.13% in the economy with financial frictions) since firms in these economies are able to reap the benefits from trade liberalization more quickly than those in financially underdeveloped economies. Second, we find that financial frictions exacerbate the unequal distribution of the gains from trade liberalization: These are larger among productive constrained firms, as cheaper capital and intermediate inputs allow them to relax their borrowing constraints, allowing them to achieve their optimal scale of operation. Moreover, welfare gains are larger across wealthy entrepreneurs (0.75% in consumption-equivalent units for wealthy entrepreneurs vs. 0.16% for poor ones) and exporters (1.03% for exporters vs. 0.12% for non-exporters).

In addition, we (*i*) decompose the welfare effects of trade liberalization to identify the key channels that account for our results and (*ii*) document the impact of trade liberalization on consumption, income, and wealth inequality. Our findings show, on the one hand, that the decline of tariff revenue has a particularly negative impact on the welfare of workers, low-income agents, and non-exporters, since this revenue represents a larger proportion of their income. On the other hand, changes in the exchange rate and the price of capital have a positive impact on welfare, especially for exporters and wealthy agents. Higher wages help redistribute some of these welfare gains towards workers, poor agents, and non-exporters; this channel is stronger in the financially developed economy. Finally, we find that trade liberalization increases consumption, income, and wealth inequality in both economies. This analysis contributes to recent studies on the unequal distribution of gains from trade (Autor et al., 2014, 2016; Carroll and Hur, 2020a,b; among others).

We then contrast the implications of our model with the cross-industry dynamics observed during the Colombian trade liberalization in the early 1990s. We find that finance-intensive industries experienced a lower and slower response of growth following trade liberalization, as in our baseline economy. Since firms in these industries rely more on credit, in a financially underdeveloped economy such as Colombia, we expect them to operate closer to their borrowing constraints and experience lower growth, as observed in the data.

Finally, we investigate the effects of jointly reducing tariffs on imports of consumption,

intermediates, and capital goods. We find that the overall impact of reducing import tariffs on both consumption and production inputs is dominated by the latter. In contrast to previous studies from the literature, our findings suggest that the impact of reducing international trade barriers on imports of capital and intermediate inputs differs substantially from lowering barriers on imports of final consumption goods.

Our findings provide a rationale for the higher resistance to trade liberalization in less developed economies: There might simply be less to gain from trade openness in these economies, particularly in the short- and medium-run, given the impact of frictions in financial markets in slowing down the adjustment to the post-liberalization environment.

Related literature

Our paper contributes to several strands of the literature that investigate the impact of trade liberalization. On the one hand, our work is related to a broad empirical literature on the aggregate impact of trade liberalization. For instance, Sachs et al. (1995) and Wacziarg and Welch (2008) consider a large number of trade liberalization episodes and show that, on average, they are associated with an increase in GDP and investment.[1] However, they document that there is substantial heterogeneity across countries. Our findings suggest that some of this heterogeneity can be explained by differences in financial development as well as by differences across the types of goods being liberalized.[2]

On the other hand, our work is related to recent quantitative studies that evaluate the gains from trade liberalization using dynamic models with heterogeneous firms in the spirit of Melitz (2003). Recent papers in this literature include Costantini and Melitz (2008), Burstein and Melitz (2011), Alessandria and Choi (2014), Alessandria et al. (2018), Fieler et al. (2018), Carroll and Hur (2020a,b), among others. These and other related studies point to the importance of firm-level dynamics in accounting for the aggregate effects of lowering international trade barriers.[3]

Moreover, recent empirical studies point to the importance of reducing international trade barriers on imports of capital and intermediate inputs for the gains from trade liberalization. For instance, Estevadeordal and Taylor (2013) point to the key role played by improved access to both of these types of goods in allowing countries to grow following trade liberalization. Similarly, Amiti and Konings (2007) documents the differential impact on productivity of improving access to imported intermediate inputs rather than final consumption goods. However, as pointed out by Minetti and Zhu (2011), Manova (2013), and Manova et al.

[1] See also Pavcnik (2002), Goldberg et al. (2009), and Topalova and Khandelwal (2011).

[2] Irwin (2019) provides a detailed survey of recent empirical work on the effects of lower import barriers on economic growth.

[3] Alessandria et al. (2020) provide a detailed review of recent developments in this literature.

(2015), among others, financial constraints can limit international trade. We contribute to these literatures by investigating the role of differences in financial development on the impact of reducing international trade barriers on imported capital and intermediate inputs.

As in Anderson et al. (2015) and Ravikumar et al. (2017), we find that capital accumulation and access to intermediates play a key role in the response to trade liberalization. Motivated by their findings, our work focuses on the role of international trade barriers on capital and intermediate inputs and their interaction with financial development. Thus, we contribute to the literature that investigates the impact of financial development on the gains from trade liberalization (Caggese and Cunat, 2013; Brooks and Dovis, 2019). We show that the role of financial frictions on the gains from trade liberalization depends crucially on the type of goods being liberalized and, in particular, that the dynamics of the economy following improved access to capital and intermediate inputs is shaped by the level of financial development.

More broadly, we contribute to a large literature that studies the aggregate consequences of financial frictions. Buera et al. (2011), Midrigan and Xu (2014), and Moll (2014) show that financial frictions induce capital misallocation, leading to potentially significant aggregate distortions. Chaney (2013), Manova (2013), Kohn et al. (2016, 2020), and Leibovici (2016), among others, study the impact of financial frictions on trade flows. We complement these studies by investigating how financial frictions shape the response of the economy to a trade liberalization.

In the next section we conduct the empirical analysis. We set up the model in Section 3. In Section 4 we discuss the mechanism through which financial frictions affect the response to trade liberalization in our model. In Section 5 we present the quantitative results. Section 6 presents the empirical cross-industry analysis and Section 7 concludes.

2 Empirical evidence

In this section, we document salient features of the dynamics of key aggregates after reducing barriers to international trade. We begin by contrasting countries that reduced average import tariffs relative to countries that did not. Then, we investigate whether these effects differ by financial development. To isolate the role of financial development in allowing countries to adjust productive capacity to trade liberalization, we focus on tariff reductions on imports of production inputs such as capital or intermediate goods.

Our data and approach build on the work of Estevadeordal and Taylor (2013), which we extend to investigate the implications for a broader set of aggregate outcomes as well as the role of financial development. Following their work, we focus on trade liberalization episodes

that took place during the 1990s (the period that Estevadeordal and Taylor (2013) refer to as the "Great Liberalization" experiment).

2.1 Data

Our empirical analysis employs three types of data. First, we use data on import tariffs to identify trade liberalization episodes. Second, we use data on the level of financial development to partition countries undergoing trade liberalization based on the intensity of the financial frictions. Finally, we use data on aggregate variables whose dynamics we contrast across countries based on whether they reduced trade barriers or by their level of financial development. We now describe the data we use in more detail.

Import tariffs We utilize two data series to measure the degree of trade openness across countries: average import tariffs across all goods and average tariffs on imports of capital and intermediate inputs. We follow Estevadeordal and Taylor (2013) and measure tariffs at two points in time around the "Great Liberalization" experiment: before or early in the trade liberalization process (1985-1993) and late or after the trade liberalization took place (1999-2004). All averages are computed without weights. Both series are obtained from Estevadeordal and Taylor (2013).[4]

Average import tariffs across all goods are collected from the Economic Freedom in the World 2005 database and available for 85 countries. Average import tariffs on capital and intermediate inputs are most favored nation (MFN) applied tariffs and compiled for 48 countries. The latter tariffs were obtained from UNCTAD's TRAINS (Trade Analysis and Information System) for the post-liberalization period, and the pre-liberalization tariffs were compiled from a variety of sources by Estevadeordal and Taylor (2013).

Aggregate outcomes We use data from the Penn World Tables 9.1 (Feenstra et al. 2015) to document the dynamics of the following variables: GDP, consumption, investment, investment of machinery and non-transport equipment, exports, and imports. All variables are per capita and expressed in constant prices in the national currency.

Financial development We measure the degree of financial development across countries using the World Bank's Global Financial Development database (Cihak et al. 2012). We restrict attention to the amount of domestic credit provided to the private sector as a share of GDP (GFDD.DI.14), which is the most popular measure used in the literature on

[4]A richer time-series analysis with greater time disaggregation is unfortunately not possible due to data limitations.

consequences of financial development (see, for example, King and Levine, 1993 or Manova, 2013).

2.2 Aggregate dynamics after trade liberalization

We begin by investigating the extent to which countries that underwent trade liberalization experienced aggregate dynamics that differed systematically from their counterparts whose trade barriers did not change.

Trade liberalization episodes

We focus on average import tariffs and identify countries that liberalized international trade based on the change of these tariffs between the pre-liberalization period (1985-1993) and the post-liberalization period (1999-2004). As in Estevadeordal and Taylor (2013), we identify liberalizers as those countries whose import tariff change was below the median over this period.

Table 1: Trade liberalization episodes based on all goods

	Avg. tariff change	Avg. initial tariff	Avg. final tariffs	# of countries
Nonliberalizers	−0.91%	10.08%	9.17%	43
Liberalizers	−18.58%	30.87%	12.29%	42

Table 1 presents the average initial and final tariffs as well as the average tariff change across liberalizers and nonliberalizers. We find that nonliberalizers experienced a negligible decline of average tariffs over this period, a reduction of 0.91 percentage points on average. Moreover, these countries already had low tariffs in the pre-liberalization period, 10.08% on average. In contrast, we find that liberalizers reduced their tariffs by 18.58 percentage points on average. These countries had very high tariffs in the pre-liberalization period, 30.87% on average, but they almost closed the gap in tariff levels with nonliberalizers in the post-liberalization period.[5]

Aggregate dynamics

We now investigate dynamics of key aggregate outcomes following a reduction in international trade barriers, contrasting countries that liberalized trade with those that did not. As described above, we focus on the dynamics of GDP, consumption, investment, investment in machinery and equipment, exports, and imports.

[5]In Section 5 below, we investigate the response of the economy to a change in import tariffs of similar magnitude to the one reported here, under different varying degrees of financial development.

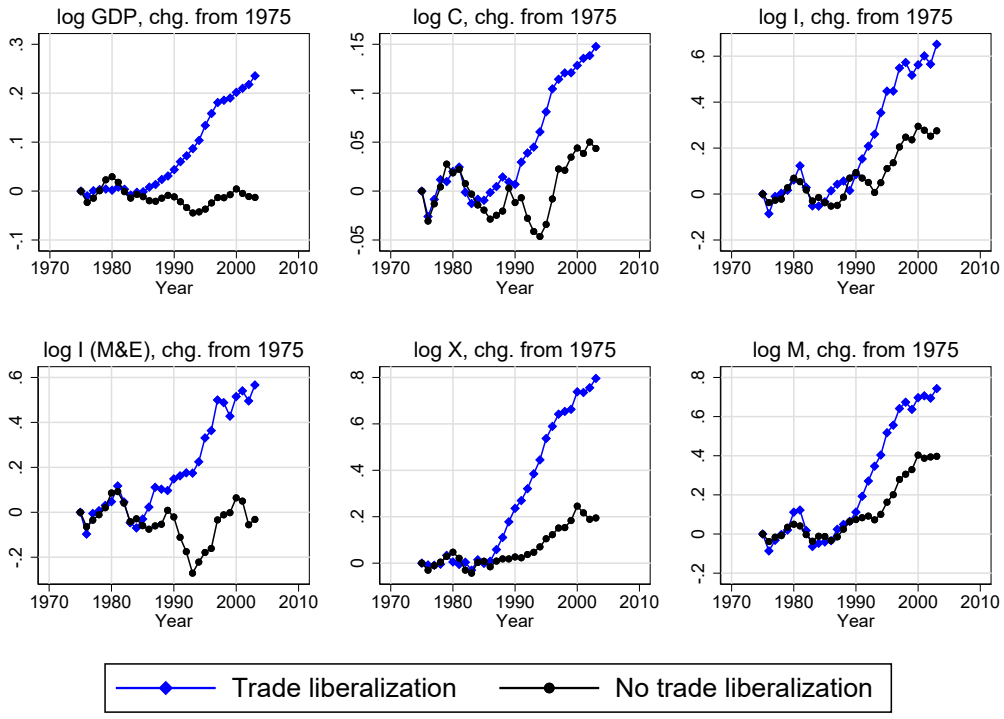

Figure 1: Aggregate dynamics after trade liberalization

To do so, for each outcome variable in each country, we first express it as a log deviation relative to its value in 1975. Then, for each year and variable, we compute the average log deviations relative to 1975 across liberalizers, and we then do the same for nonliberalizers. Liberalizers and nonliberalizers might have experienced different dynamics not only due to the impact of trade liberalization but also because they were already featuring different trend levels of growth prior to trade liberalization. We address this issue by expressing the variables as log deviations relative to a linear trend whose slope captures the average growth rate for the decade prior to the pre-liberalization period: 1975-1985.[6]

Figure 1 plots the average dynamics of each of the aggregate variables of interest across countries that liberalized international trade and those that did not, computed as described above. We find that all variables exhibit similar dynamics across liberalizers and nonliberalizers over the period 1975 to 1990; one exception is exports, which is already 0.20 log points higher across liberalizers by 1990. Their paths, however, diverge widely from 1990 onwards. For instance, real GDP in countries that reduced import tariffs is 0.20 log points higher in year 2000 relative to 1975 than it would have been expected based on the 1975-1985 trend. In contrast, real GDP in nonliberalizer countries did not differ in the year 2000 relative to

[6]We normalize the trend to ensure that the deviations from the trend are equal to 0 in 1975.

1975 from the value one would have expected based on the 1975-1985 trend.

While we observe very similar patterns for consumption and investment, there is a large difference in magnitudes across these variables. The difference in investment between liberalizers and nonliberalizers is approximately equal to 0.40 log points by the end of the period, whereas the gap in consumption across these country groups only reaches 0.10 log points by the early 2000s. Moreover, this gap is even wider when restricting attention to investment in machinery and equipment, allowing us to abstract from residential investment and investment in structures, which is less affected by changes in import tariffs. Liberalizers feature investment in machinery and equipment that is approximately 0.60 log points higher than their nonliberalizer counterparts by the end of the sample. Finally, we observe that liberalizers also feature a larger increase of both imports and exports following trade liberalization.

The above findings are consistent with those of Wacziarg and Welch (2008) and Estevadeordal and Taylor (2013), and we interpret this evidence as suggesting that trade liberalization has a strong effect on the aggregate dynamics of the economy, especially on capital accumulation.

2.3 Trade liberalization of production inputs and financial development

The above findings together with the results of earlier studies suggest that capital accumulation is likely to play a key role in accounting for the aggregate dynamics observed following trade liberalization. One implication of this finding is that insofar as financial underdevelopment prevents firms from undertaking their desired investment decisions, it might slow down the response of capital and other aggregate variables after trade liberalization, decreasing potential gains from reduction of tariffs. We now investigate the extent to which this is the case by restricting attention to tariff reductions on imports of capital and intermediate inputs, which are more likely to increase the economy's desired productive capacity than tariff reductions on other types of goods.

Trade liberalization episodes

As in the previous subsection, we classify countries as undergoing trade liberalization if the average change in their import tariffs for capital and intermediate inputs is below the median across countries. We then partition trade liberalizers as financially underdeveloped if their average domestic credit to GDP ratio over the whole period 1975-2004 is below the median across countries.

Table 2 presents the average tariff changes and credit-to-GDP ratios across nonliberalizers, liberalizers that are financially underdeveloped, and liberalizers that are financially developed. As in the analysis above, we observe that nonliberalizers feature much smaller tariff changes than liberalizers. Yet, we find that financially underdeveloped liberalizers on average reduced their import tariffs relatively more than countries with high credit-to-GDP ratios: 22.65 vs. 15.19 percentage point reductions in import tariffs, respectively. Note that the number of countries observed is reduced relative to Table 1 since there is more limited historical data available on tariffs by types of goods.

Table 2: Trade liberalization episodes based on capital and intermediate inputs

	Avg. tariff change	Avg. credit/GDP	# of countries
Nonliberalizers	−2.17%	0.62	25
Liberalizers, low credit/GDP	−22.65%	0.24	12
Liberalizers, high credit/GDP	−15.19%	0.66	11

Table 2 also shows that the partition of liberalizers by financial development features significant differences in their average credit to GDP ratios over the 1975 to 2004 period. While financially underdeveloped liberalizers have an average credit to GDP ratio equal to 0.24, this value is 2.75 times larger on average across countries classified as financially developed.[7]

Aggregate dynamics

We now investigate the extent to which financially underdeveloped economies indeed experienced a slower adjustment to trade liberalization than financially developed economies. As described above, we restrict attention to the average change of each outcome variable relative to 1975 after removing a linear trend for the growth over the period 1975-1985.

Given that economies with high vs. low credit-to-GDP ratios experienced trade liberalizations of different magnitudes, as shown in Table 2, we compute the elasticity of each outcome variable to changes in tariffs. In the rest of this section we therefore abstract from countries that did not reduce tariffs. Figure 2 plots the average dynamics of each of the aggregate variables of interest across economies with low vs. high average credit-to-GDP ratios that reduced import tariffs on capital and intermediate inputs.

We find that all variables exhibit similar dynamics over the period 1975-1990 across both types of economies, but the path of most variables diverges significantly from around 1990 onwards; one exception is exports, whose dynamics over the whole sample is very similar

[7] In Section 5 below, we investigate the response of a financially underdeveloped economy to a change in import tariffs of production inputs. Our baseline economy features a credit-to-GDP ratio equal to 0.24.

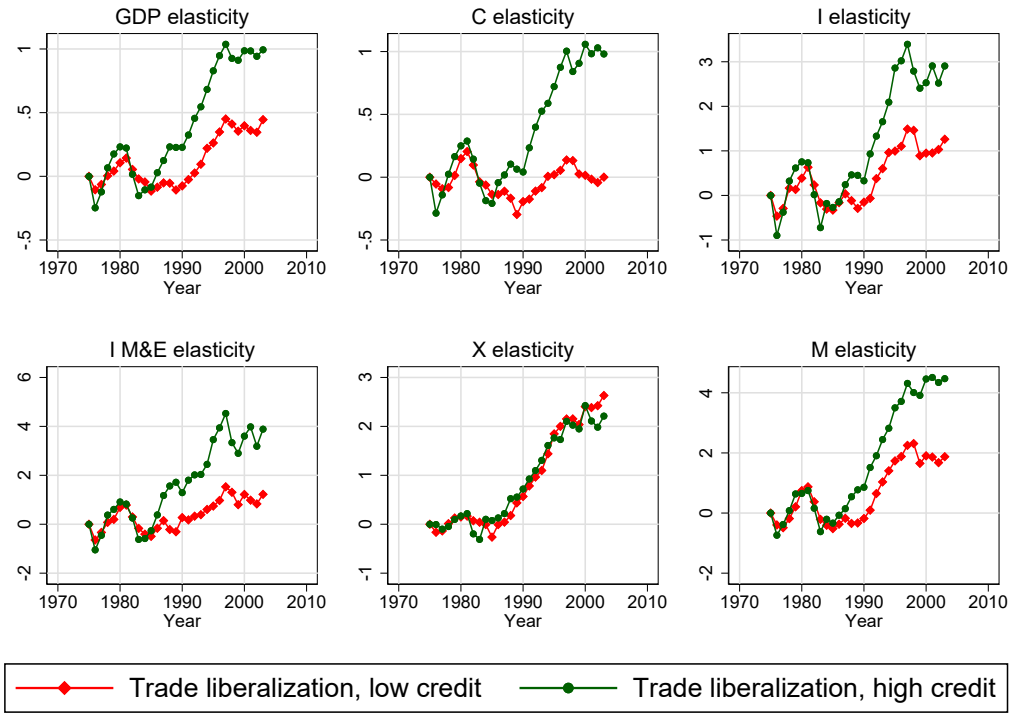

Figure 2: Trade liberalization of production inputs and financial development

across both types of economies. For instance, while the elasticity of GDP to changes in tariffs by the end of the sample is approximately equal to one in financially developed economies, this elasticity is approximately half as large in financially underdeveloped economies. Moreover, the elasticity of all variables except exports is at least twice as large in financially developed economies.

These findings suggest that differences in financial development across countries might have a significant impact on the aggregate dynamics following trade liberalization. We now investigate the extent to which this is the case using a quantitative general equilibrium model of international trade with frictions in financial markets.

3 Model

We consider a small open economy populated by a unit measure of entrepreneurs, representative producers of composite consumption goods, representative producers of composite investment goods, and the rest of the world. Entrepreneurs produce differentiated varieties by operating a firm and choose whether to sell their output internationally. Composite consumption and investment goods are produced by combining domestic and imported varieties.

Finally, the rest of the world demands the varieties produced by entrepreneurs and is the source of imported goods.[8]

3.1 Economic environment

3.1.1 Entrepreneurs

Entrepreneurs are infinitely lived and risk-averse. Preferences over streams of composite consumption goods are represented by the expected lifetime discounted sum of a constant relative risk-aversion period utility function, $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\gamma}}{1-\gamma}$, where γ denotes the coefficient of relative risk aversion and β is the entrepreneurs' discount factor. Finally, $\mathbb{E}_0$ denotes the expectation operator taken over the realizations of productivity shocks, described below, conditional on the information set in period zero.

Technology Entrepreneurs produce differentiated varieties by operating a production technology

$$y_t = z_t \left(k_t^{\alpha} n_t^{1-\alpha}\right)^{1-\alpha_m} m_t^{\alpha_m}, \tag{1}$$

where z_t denotes the entrepreneurs' idiosyncratic level of productivity, k_t is the capital stock, n_t is the amount of labor hired, and m_t denotes the amount of intermediate inputs used (e.g., materials). We assume that entrepreneurs use composite investment goods as intermediate inputs. We refer to $\alpha(1-\alpha_m) \in [0,1]$ as the capital share and to $\alpha_m \in [0,1]$ as the share of intermediate inputs in production. Labor is hired at a wage rate w_t denominated in units of final consumption goods. Idiosyncratic productivity z_t follows a time invariant AR(1) process, $\ln z_t = (1-\rho)\mu + \rho \ln z_{t-1} + \varepsilon_t$, where ε_t is normally distributed with mean zero and standard deviation σ_ε.

Every period, entrepreneurs are endowed with a unit of labor that they supply inelastically to a competitive labor market. Entrepreneurs can also accumulate capital internally by transforming composite investment goods purchased in period t into physical capital in period $t+1$. Capital depreciates at rate δ after being used for production, leading to a law of motion for capital that is given by

$$k_{t+1} = (1-\delta)k_t + x_t, \tag{2}$$

where x_t denotes gross investment.

[8] See Section 3 of the Online Appendix for details on the solution of the model.

Market structure Entrepreneurs are monopolistically competitive and choose the quantities and prices at which to sell domestically and abroad subject to their respective demand schedules. In the domestic market, the demand schedules solve the problem of the producers of composite consumption and investment goods, while the demand schedule in the international market is taken as given from the rest of the world.

International trade Entrepreneurs can choose to export, but exporting entails additional variable and fixed costs. In particular, firms pay a fixed cost F, in units of labor, every period that they export. Furthermore, exporters are subject to two ad-valorem trade costs: (i) a tariff τ_f charged by the rest of the world on the domestic economy's exports and (ii) an iceberg trade cost $\tau \geq 1$ which requires firms to ship τ units for every unit that arrives at destination. τ captures variable costs other than tariffs, such as shipping costs, foreign marketing costs, or costs due to damages incurred during transit of goods.

Financial markets Individuals have access to international financial markets, where they can borrow or save by trading a one-period risk-free bond at real interest rate r. The interest rate is taken as given from the rest of the world. However, entrepreneurs face a borrowing constraint that limits the amount they can borrow. They can only borrow up to a fraction of the value of the capital stock at the time that the loan is due for repayment.

In particular, let d_{t+1} denote the amount borrowed by entrepreneur i in period t, which is due for repayment in period $t+1$. Then, in addition to the natural borrowing limit, d_{t+1} has to satisfy

$$d_{t+1} \leq \theta P_{k,t} k_{t+1}, \tag{3}$$

where $\theta \in [0,1]$ and $P_{k,t}$ is the price of capital in period t so that $P_{k,t}k_{t+1}$ captures the current price of the total capital stock owned by the entrepreneur.

We denote the net worth of entrepreneurs in period t as a_t, which is given by $a_{t+1} = P_{k,t}k_{t+1} - d_{t+1}/(1+r)$.[9] Given this definition, the borrowing constraint can be alternatively expressed as:

$$P_{k,t}k_{t+1} \leq \frac{1+r}{1+r-\theta} a_{t+1} \tag{4}$$

Equation (4) shows that the borrowing constraint faced by entrepreneurs limits the amount of capital that they can operate with. In particular, the current value of next period's capital stock has to be lower than a multiple of the entrepreneur's net worth in period $t+1$.[10] Note

[9] We refer to a_t interchangeably as net worth or assets.

[10] As discussed below, the entrepreneurs' net worth in period $t+1$ is equal to their savings in period t. Since $k_{t+1} = (1-\delta)k_t + x_t$ it follows that constraint (4) is actually a constraint on entrepreneur's investment in period t. This explains why the capital is priced at the price $P_{k,t}$ rather than $P_{k,t+1}$.

also that the tightness of the borrowing constraint is increasing in the price of capital.

Timing The timing of the entrepreneurs' decisions is as follows. At the beginning of the period, entrepreneurs hire labor and purchase intermediate inputs to produce their differentiated variety to be sold domestically and possibly also abroad. If they decide to export, they also pay fixed export costs. Entrepreneurs are paid their labor and interest income, and then use these resources to repay debt due from the previous period as well as to consume and save up for next period.

At the end of the period, agents observe the following period's productivity shock. Then, they issue debt and choose next period's level of physical capital given the amount of net worth they chose to carry over.[11]

Entrepreneurs' problem Given the setup described above, the entrepreneurs' problem consists of choosing sequences of consumption (c_t), labor (n_t), intermediates (m_t), investment (x_t), export status (e_t), and prices and quantities ($y_{h,t}, p_{h,t}, y_{f,t}, p_{f,t}$) at which to sell the varieties in each of the markets (subscript h denotes the domestic market, while subscript f denotes the foreign market), in order to maximize their lifetime expected utility. In addition to the borrowing constraint described above and the market-specific demand schedules described below, entrepreneurs' choices are subject to a sequence of period-by-period budget constraints, given by

$$c_t + P_{k,t}x_t + d_t = w_t + [p_{h,t}y_{h,t} + e_t\left(\xi_t p_{f,t}y_{f,t} - w_t F\right) - w_t n_t - P_{k,t}m_t] + \frac{d_{t+1}}{1+r_t} + \mathcal{T}_t, \quad (5)$$

where ξ is the real exchange rate. The entrepreneurs' choices are also subject to a sequence of period-by-period laws of motion for capital, $k_{t+1} = [(1-\delta)k_t + x_t]$, and production technologies $y_{h,t} + \tau y_{f,t} = z_t \left(k_t^{\alpha} n_t^{1-\alpha}\right)^{1-\alpha_m} m_t^{\alpha_m}$. $\mathcal{T}_t$ is a lump sum transfer that reimburses entrepreneurs with the revenue collected from the tariffs levied on imports.

3.1.2 Composite consumption good

There is a representative producer of composite consumption goods that operates a constant elasticity of substitution technology to aggregate domestic varieties produced by entrepreneurs with imported varieties produced by the rest of the world. This composite consumption good is used by entrepreneurs for consumption. Each period, the problem of

[11] Following Buera and Moll (2015), this timing assumption allows us to eliminate uninsured idiosyncratic investment risk, thus simplifying the quantitative solution of the model by combining capital k and debt d, into a single state variable, net worth, a, where $a_{t+1} = P_{k,t}k_{t+1} - d_{t+1}/(1+r)$.

the producer of composite consumption goods is then given by

$$\begin{aligned} \max_{y_{h,c,t}(i),y_{m,c,t}} & Y_{c,t} - \int_0^1 p_{h,t}(i) y_{h,c,t}(i) di - (1+\tau_c)\xi p_{m,c,t} y_{m,c,t} \\ \text{s.t. } & Y_{c,t} = \left[\int_0^1 y_{h,c,t}(i)^{\frac{\sigma-1}{\sigma}} di + \omega_c y_{m,c,t}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \end{aligned} \tag{6}$$

where $\tau_c > 0$ denotes a domestic tariff on imported varieties used to produce the composite consumption good and ω_c is the relative weight of imported goods in the production of the consumption bundle. Notice that we normalize the price of the composite consumption good to 1.

3.1.3 Composite investment good

Similarly, there is a representative producer of composite investment goods that operates a constant elasticity of substitution technology to aggregate domestic varieties produced by entrepreneurs with imported varieties produced by the rest of the world. As described above, this composite investment good is used both to increase the stock of physical capital and as an intermediate input in the production of varieties by entrepreneurs. Each period, the problem of the investment good producer is then given by

$$\begin{aligned} \max_{y_{h,k,t}(i),y_{m,k,t}} & P_{k,t} Y_{k,t} - \int_0^1 p_{h,t}(i) y_{h,k,t}(i) di - (1+\tau_k)\xi p_{m,k,t} y_{m,k,t} \\ \text{s.t. } & Y_{k,t} = \left[\int_0^1 y_{h,k,t}(i)^{\frac{\sigma-1}{\sigma}} di + \omega_k y_{m,k,t}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \end{aligned} \tag{7}$$

where $\tau_k > 0$ denotes a domestic tariff on imported varieties used to produce the composite investment good and ω_k is the relative weight of imported goods in the production of the investment good. Finally, $P_{k,t}$ denotes price of the composite investment good relative to the price of the composite consumption good.

3.1.4 Import tariffs: Revenues and transfer

As described above, imports of varieties used to produce composite consumption goods are subject to a tariff given by τ_c, while imports of varieties used to produce composite investment goods are subject to a tariff given by τ_k. We assume that the total revenue collected by these tariffs is reimbursed to entrepreneurs as a lump-sum transfer $\mathcal{T}_t$. Then, we have that:

$$\mathcal{T}_t = \tau_c \xi p_{m,c,t} y_{m,c,t} + \tau_k \xi p_{m,k,t} y_{m,k,t} \tag{8}$$

3.1.5 Rest of the world

The rest of the world demand varieties from domestic entrepreneurs and supplies varieties to consumption and investment good producers. The foreign demand for domestic varieties is assumed to be given by a standard downward-sloping demand function $y_{f,t} = [(1+\tau_f)p_{f,t}]^{-\sigma} Y_{f,t}$, where $Y_{f,t}$ is an aggregate demand shifter for the rest of the world and $p_{f,t}$ is denominated in units of the foreign final good. The supply of varieties used to produce composite consumption goods is assumed to be perfectly elastic at a price $p_{m,c}$. Similarly, the supply of varieties used to produce composite investment goods is assumed to be perfectly elastic at the price $p_{m,k}$.

Finally, the rest of the world trades bonds with domestic entrepreneurs in financial markets. As described above, these bonds trade at real interest rate r.

3.2 Recursive formulation

We now present the recursive formulation of the entrepreneurs' problem in a stationary equilibrium. Let $v(k,d,z)$ denote the value function of an entrepreneur with capital k, debt d, and productivity z who decides how much to consume in the current period and how much to save for the future (i.e., how much net worth a' carry to the next period). Define $g(a,z)$ as the value function of an entrepreneur with net worth a and productivity z, who decides how to allocate his savings between capital and debt. Recall that we define $a' = p_k k' - \frac{d'}{1+r}$ to be the net worth that the agents accumulate for the future.[12] Then, we have that:

$$\begin{aligned} v\left(k,d,z\right) = & \max_{c,a'} \frac{c^{1-\gamma}}{1-\gamma} + \beta \mathbb{E}_{z'}\left[g\left(a',z'\right)\right] \\ & \text{subject to} \\ & c + a' + d = w + (1-\delta)P_k k + \pi(k,z) \\ & a' \geq 0, \end{aligned} \tag{9}$$

where $\pi(k,z)$ denotes the profits of an entrepreneur with capital k and productivity z:

$$\begin{aligned} \pi(k,z) = & \underset{\{p_h,y_h,p_f,y_f,n,m,e\in 0,1\}}{max} \quad p_h y_h + e\xi p_f y_f - wn - P_k m - ewF \\ & \text{subject to} \\ & y_h + e\tau y_f = z\left(k^{\alpha} n^{1-\alpha}\right)^{(1-\alpha_m)} m^{\alpha_m} \\ & y_h = p_h^{-\sigma}(Y_c + P_k^{\sigma} Y_k),\ y_f = \left(p_f(1+\tau_f)\right)^{-\sigma} Y_f. \end{aligned} \tag{10}$$

[12] We assume $a \geq 0$.

The value function $g(a', z')$ is given by

$$\begin{aligned} g(a', z') = &\max_{k', d'} v(k', d', z') \\ \text{subject to:} \quad &P_k k' = a' + \frac{d'}{1+r} \\ &d' \leq \theta P_k k' \end{aligned}$$

As in Buera and Moll (2015) and others, the above value functions can be combined such that the problem features only two state variables: productivity z and net worth a.

3.3 Equilibrium

Let $\mathcal{S} \equiv \mathcal{A} \times \mathcal{Z}$ denote the state space of entrepreneurs and let $s \in \mathcal{S}$ denote an element of the state space. Let ϕ denote a measure over $\mathcal{S}$. Then, for a given value of the interest rate r, a *recursive stationary competitive equilibrium* of this economy consists of aggregate prices $\{w, \xi, P_k\}$, policy functions $\{d', k', e, c, m, n, y_h, y_f, p_h, p_f, Y_c, Y_k, y_{m,c}, y_{m,k}\}$, value functions v and g, and a measure $\phi : \mathcal{S} \to [0, 1]$ such that:

1. Policy and value functions solve the entrepreneurs' problem
2. Policy functions solve the problem of producers of composite consumption goods
3. Policy functions solve the problem of producers of composite investment goods
4. Labor market clears:
$$\int_{\mathcal{S}} \left[n(s) + e(s)F \right] \phi(s) ds = 1$$
5. Market for consumption good clears:
$$\int_{\mathcal{S}} c(s) \phi(s) ds = Y_c$$
6. Market for investment good clears:
$$\int_{\mathcal{S}} \left[x(s) + m(s) \right] \phi(s) ds = Y_k$$
7. Measure ϕ is stationary

This definition of the stationary equilibrium is standard: It requires that all agents behave optimally taking prices w, ξ, P_k as given, that prices are such that markets clear, and that the measure of entrepreneurs is stationary.

4 Mechanism: The role of financial development

Throughout the rest of the paper we investigate the impact of lowering tariffs on imports of investment and intermediate inputs and the role played by financial development on the magnitude of these effects. In this section we describe the mechanism through which this policy change affects allocations in our model; in the following sections we examine these effects quantitatively.

4.1 Cheaper access to imported production inputs

A unilateral reduction of τ_k makes imports of intermediate inputs and investment goods cheaper. This affects the domestic economy through two channels. First, it reduces the cost of producing the composite investment good. As a result, both materials and capital become cheaper, decreasing the production costs. Second, it leads to a reallocation of demand by producers of the composite investment good from domestic to imported varieties. Thus, a reduction of τ_k has both positive and negative direct effects on the domestic economy.

The change of τ_k also induces general equilibrium effects. As domestic production costs decline, domestic producers reduce their prices and increase their competitiveness relative to imports competition. This effect offsets at least partially the reallocation of demand from domestic to imported varieties by producers of composite investment goods. But, more importantly, it also leads producers of composite consumption goods to reallocate their demand from imported to domestic varieties, as the latter become cheaper when tariffs on production inputs are reduced. Thus, total domestic sales are likely to increase. The higher demand for domestic varieties leads to an increase in the demand for labor and, thus, wages increase. The domestic economy thus becomes richer when tariffs on imported production inputs are reduced.

These gains, however, are not spread evenly across individuals: Productive and wealthy entrepreneurs capture most of the gains from the higher demand for domestic varieties. Yet, our model features significant channels through which these gains are redistributed. First, equilibrium wage changes allow our economy to automatically redistribute some of these gains to entrepreneurs with lower productivity or net worth. Real wages increase in response to the higher demand for domestic varieties and this effect disproportionately benefits lower productivity or net worth entrepreneurs for whom wages constitute a higher share of their total income. Second, these agents are negatively affected by the lower tariffs revenues, which affect more the low net worth agents for whom these constitute a higher share of their income.

Third, our model features redistribution from the domestic economy, which is better off

after the policy change, to the rest of the world, whose environment remains unchanged. The decline in the price of domestic varieties leads to a lower price of the consumption composite, leading to a real depreciation. This leads to higher exports and further increases domestic output.

Thus, we conclude that a reduction of tariffs on production inputs such as investment goods and intermediate inputs leads to an increase of consumption and exports. As a result, it leads to an economic boom with increased production by all entrepreneurs. While the gains are unevenly spread across entrepreneurs, significant forces exist to redistribute the gains across individuals.

4.2 The role of financial development

Financial development can limit the degree to which the domestic economy is able to benefit from the forces described above. In an economy with less developed financial markets (a lower θ), the pre-liberalization stationary equilibrium is likely to feature a higher share of constrained entrepreneurs. Thus, as tariffs and production costs are reduced, a higher fraction of entrepreneurs is unable to expand production to the extent desired, thereby limiting the degree to which firms in this environment can benefit from trade liberalization.

Over time, however, entrepreneurs are able to accumulate funds internally, relaxing the borrowing constraints and increasing their scale of production closer to their desired scale. Given that the lower tariffs increase the profitability of sales regardless of the scale of production, this allows firms to disproportionately relax their constraints, partially offsetting the initial dampening effects of lower financial development. Overall, however, financial underdevelopment limits the positive effects of reducing τ_k through its impact on the share of financially constrained entrepreneurs.

The above discussion treats the share of constrained exporters as unchanged. However, a lower τ_k also leads to a reduction in the share of financially constrained exporters: the resulting decline in the price P_k of the composite investment good effectively relaxes the borrowing constraint, allowing firms to purchase a higher amount of physical capital per unit borrowed in financial markets. Thus, this effect further amplifies the positive impact of the policy change.

The role of financial development on the impact of this policy change is, then, ambiguous ex ante. On the one hand, lower financial development tends to dampen the positive direct and indirect effects of a decrease in τ_k. On the other hand, it relaxes borrowing constraints, which tends to strengthen the effects of lowering τ_k. Determining which effect dominates as well as the aggregate and distributional effects requires a careful quantitative investigation,

which we perform in the following section.

5 Quantitative analysis

In this section, we investigate quantitatively how financial development affects the aggregate, distributional, and welfare effects of a unilateral trade liberalization that reduces tariffs on imports of intermediate and capital goods.[13]

To quantify the role of financial development we consider the unilateral trade liberalization that Colombia underwent in the late 1980s. We first calibrate the model to match key features of Colombian plant-level data, an economy characterized by a low level of financial development. We use the model to examine the aggregate effects of a decrease in import tariffs designed to resemble the one observed in Colombia between 1988 and 1992. We contrast our baseline economy with a counterfactual economy featuring a high-level of financial development but otherwise calibrated to match key features of Colombian plant-level data. In particular, we compare the aggregate, distributional, and welfare effects, both in the long-run and along the transition, between our baseline economy and those implied by the counterfactual economy with developed financial markets.

Colombia's unilateral trade liberalization is well-suited for our analysis. In the early 1990s the Colombian government undertook an ambitious trade reform program in an environment with underdeveloped financial markets. By the end of 1990, the government had eliminated the majority of non-tariff import barriers, while reducing average import tariffs from 32 to 12 percent between 1990 and 1992.[14] Yet, despite the large-scale trade liberalization, there was substantial skepticism about the economy's potential to accrue the large potential gains from trade. In particular, at the time of trade liberalization, the World Bank pointed out the lack of credit and underdeveloped capital markets as a major obstacle for fully realizing the potential benefits of trade reform; it was concerned that Colombian trade liberalization "is seriously constrained by the existing financial sector" (World Bank 1993, p. 5).[15] Thus, Colombia's trade liberalization is a suitable case for analyzing the effect of financial development on the gains from a unilateral trade liberalization.

[13]We focus on unilateral trade liberalizations, which were common in the 1980s and 1990s when many developing countries opened up to trade following the Washington consensus. In Section 1.7 of the Online Appendix, we present the results of a multilateral trade liberalization (i.e., trade liberalization featuring a simultaneous decrease of both import and export tariffs). In addition, we also report results for a unilateral reduction of tariffs charged by the rest of the world on the domestic economy's exports (Section 1.6 of the Online Appendix).

[14]See Fieler et al. (2018) for details.

[15]See World Bank (1993), Roberts and Tybout (1997), and Fieler et al. (2018), for more details on Colombia's trade liberalization during this period.

5.1 Calibration

To calibrate the model, we partition the parameter space into two groups. The parameters in the first group are pre-assigned either to values observed in the data or to values commonly used in the literature. The parameters in the second group are estimated jointly to match key moments of plant-level and aggregate data from Colombia.

Pre-assigned parameters The first group of parameters is presented in Table 3 and consists of γ, σ, δ, r, ρ, α, α_m, τ_c, τ_k, τ_f, τ, $p_{m,c}$, $p_{m,k}$, and Y_f. We set the risk aversion parameter γ to 2, the elasticity of substitution σ to 4, and the depreciation rate δ to 0.1; these are standard values used in the literature. In addition, we set the interest rate r to 0.06. Following previous studies (Buera et al. 2011; Midrigan and Xu 2014; Kohn et al. 2020), we let idiosyncratic productivity shocks be persistent with an autoregressive coefficient ρ equal to 0.90.

To be consistent with plant-level estimates for Colombia, we set the share of intermediates α_m to 0.50 and the capital share α to 0.60. Note that, given the distortionary impact of financial frictions on capital accumulation, the latter implies a measured capital share close to 0.50, which is in the range of the estimated values reported by Midrigan and Xu (2014) using the same data. Next, we set export and import tariffs –both to consumption and capital goods– equal to 32 percent, the value of average import tariffs observed in Colombia in 1988, just prior to trade liberalization. Import tariffs in the rest of the world are assumed to be equal to domestic import tariffs, which has a value of 0.32, and we normalize the iceberg trade cost to 1.[16] Finally, we normalize the foreign aggregate demand to 10 and the prices of imported capital and consumption goods to 1.

Calibrated parameters The set of calibrated parameters consists of the fixed export cost F, the standard deviation of the productivity shocks σ_ε, the relative weights of imported goods in the production of investment and consumption goods, ω_k and ω_c, the degree of financial development θ, and the discount factor β.

To estimate these parameters we target salient features of both plant-level data from Colombian manufactures and aggregate data. In particular, we study the Annual Manufacturing Survey, which is collected by the Departamento Administrativo Nacional de Estadistica (DANE) and surveys all manufacturing plants with at least 10 workers.[17] Following

[16] Given that we calibrate β to match the net-exports-to-GDP ratio, we cannot separately identify τ, ω_c, and ω_k. In particular, changing τ affects the imports-to-GDP ratio and the share of consumption imports in total imports, the two target moments that we use to calibrate ω_k and ω_c. Adjusting ω_k and ω_c to match these two moments following a change in τ undoes any impact of the initial change in τ.

[17] These data have been used before by Roberts and Tybout (1997), Ruhl and Willis (2017), and Fieler

Table 3: Pre-assigned parameters

Parameter	Value	Description
γ	2	Risk aversion
σ	4	Elasticity of substitution
δ	0.1	Capital depreciation rate
r	0.06	Interest rate
ρ	0.9	Persistence of prod. shocks
α	0.60	Share of capital
α_m	0.50	Share of intermediate inputs
τ_c	0.32	Consumption imports tariffs
τ_k	0.32	Capital imports tariffs
τ_f	0.32	Exports tariffs
τ	1	Iceberg trade costs
$p_{m,c}$	1	Price of $y_{m,c}$
$p_{m,k}$	1	Price of $y_{m,k}$
Y_f	10	Aggregate demand rest of the world

Fieler et al. (2018), we use data from 1982 to 1988 to calibrate the model for the period prior to tariff reduction implemented in subsequent years. We supplement this dataset with data from the World Bank.

We choose $\{F, \sigma_\varepsilon, \omega_k, \omega_c, \theta, \beta\}$ to match the following moments: (i) the share of firms that export, (ii) the size of exporters relative to non-exporters (as given by the ratio between the average domestic sales of exporters and the average domestic sales of non-exporters), (iii) the share of imports in consumption, (iv) the aggregate share of imports in GDP, (v) the average amount of domestic credit extended to the private sector as a percentage of GDP between 1988 and 1992 (credit-to-GDP ratio) as reported by the World Bank, and (vi) the net-exports-to-GDP ratio. In particular, we follow the Simulated Method of Moments, choosing these parameters to minimize the squared distance between the above moments of the model and their data counterparts.

We report the calibrated parameters and the target moments in Table 4. As observed in the table, our model can match the targets moments very closely.

Financially developed economy We contrast our baseline economy described above with a counterfactual economy with developed financial markets. Given our desire to contrast the welfare implications between these economies, we keep the discount rate unchanged across them; thus, we set $\beta = 0.84$, as in our baseline economy.[18] We then estimate F, σ, ω_c, ω_k, and

et al. (2018), among others.

[18]Otherwise, differences in the welfare implications of trade liberalization could be simply accounted for by differences in discount rates.

Table 4: Calibrated parameters

Parameter	Value	Target moment	Data	Model
F	0.47	Share of exporters	0.11	0.11
σ_ε	0.16	Exporters' domestic sales premium	5.68	5.68
ω_c	0.21	C imports share	0.27	0.27
ω_k	0.29	Imports / GDP	0.12	0.12
θ	0.21	Credit / GDP	0.24	0.24
β	0.84	Net exports / GDP	-0.03	-0.03

θ, to match moments (i)-(v) described above, except that we now target the average credit-to-GDP ratio across OECD countries between 1988 and 1992; a set of economically- and financially developed economies. Thus, examining the implications of trade liberalization in the counterfactual economy allows us to quantify the effect that trade liberalization would have had in Colombia had it had the level of financial development of the most financially developed economies at the time. Table 5 reports the calibrated parameters and targets for this counterfactual financially developed economy.

Table 5: Calibrated parameters – Financially developed

Parameter	Value	Target moment	Data	Model
F	0.74	Share of exporters	0.11	0.11
σ_ε	0.15	Exporters' domestic sales premium	5.68	5.68
ω_c	0.26	C imports share	0.27	0.27
ω_k	0.34	Imports / GDP	0.12	0.12
θ	0.80	Credit / GDP	1.25	1.25
β	0.84	Same as baseline	–	–

5.2 Trade liberalization on intermediate and investment goods

Using our calibrated baseline and counterfactual economies, we now investigate the extent to which financial development affects the aggregate dynamics following a trade liberalization and its welfare implications. To do so, we consider the stationary equilibrium of our calibrated model and examine the impact of a reduction in import tariffs on intermediate and capital goods of the magnitude observed in Colombia between 1988 and 1992. In particular, we consider a one-time, unexpected, and permanent reduction of import tariffs from 32 percent to 12 percent.

The timing of the trade liberalization is as follows. In period 1, the economy is in a stationary equilibrium, and we refer to it as the pre-liberalization period. In particular, at the end of period 1, agents choose assets, capital, and debt for the following period expecting

Table 6: Steady state effects ($\tau_k \downarrow$)

	$\theta = 0.21$	$\theta = 0.80$
Real GDP	1.41%	1.65%
Capital	6.61%	6.58%
Consumption	3.38%	3.43%
Real exports	26.4%	19.9%
Real imports	35.8%	42.3%
Price of capital	-1.71%	-1.79%
Wage	6.23%	6.47%
Real exchange rate	5.49%	4.22%

to remain in the pre-liberalization stationary equilibrium. At the beginning of period 2, trade liberalization occurs and agents learn the full path of tariffs from then on.[19] Thereafter, the economy begins its transition to its new steady state.

We divide our analysis into two parts. First, we examine how lowering import tariffs impacts aggregate variables and how these effects vary with financial development, θ. In particular, in Section 5.2.1 we examine the dynamics of aggregate variables following the tariff reduction, contrasting these dynamics across our baseline and financially developed economies. In Section 5.2.2 we then investigate the welfare effects of trade liberalization, its distributional consequences, and we analyze how these depend on the level of financial development.

5.2.1 Aggregate effects of trade liberalization

Long-run effects We begin by analyzing the long-run aggregate effects of decreasing imports tariffs for capital and intermediate goods on key aggregate variables: output, capital, consumption, exports, and imports. To do so, we contrast the steady-state values of these variables before and after trade liberalization. Table 6 reports the impact that a reduction of τ_k has on these variables in the baseline ($\theta = 0.21$) and in the financially developed ($\theta = 0.80$) economies.

Consider first the baseline economy. Table 6 shows that the long-run effects of decreasing τ_k are positive and quantitatively significant: Real GDP increases by 1.4%, capital by 6.6%, and consumption by 3.4%. Real exports increase by 26% in response to trade liberalization, while real imports increase by 36%.[20] Finally, the net-exports-to-GDP ratio improves from

[19] The results do not change significantly if agents learn about the trade liberalization one period in advance. See the results for "expected trade liberalization" in Section 1.5 of the Online Appendix for more details.

[20] We compute real variables using a Laspeyres price index, keeping prices constant at their initial steady-

-0.029 to -0.019 despite the large increase of imports.

To understand these results note that the lower import tariffs on intermediates and capital goods reduce the cost of production inputs, thus acting akin to a positive supply shock: Capital and intermediate goods become cheaper (the price of capital falls 1.7%), leading to an increase in capital and output. As the domestic final good becomes cheaper, the real exchange rate depreciates (by 5.5% in the baseline), inducing an increase of exports. The higher demand for capital and intermediates leads to an increase in the demand for labor which, along with the falling price of the final consumption goods, increases the real wage (by 6.2% in the baseline). Thus, consumption increases as a result of higher profits and wages.

We find that differences in financial development have a modest effect on the long-run impact of trade liberalization. In particular, GDP and imports increase somewhat more in the financially developed economy (1.65% vs. 1.41% and 42.3% vs. 35.8%, respectively), while capital and consumption increase almost identically in the two economies (6.58% vs. 6.61% and 3.43% vs. 3.38%, respectively). Somewhat surprisingly, exports increase relatively less in the financially developed economy (19.9% vs. 26.4%). This is accounted for by the lower exchange rate depreciation experienced by the financially developed economy following a reduction in τ_k.[21]

The above results show that differences in financial development have little impact on the aggregate effects of trade liberalization in the long run. However, we show below that these results mask large differences in aggregate outcomes along the transition as well as substantial differences in welfare gains.

Transitional dynamics We next examine the effects of lowering import tariffs on capital and intermediate goods along the transition to the new steady state. Figure 3 plots the response of real GDP, capital, real exports, and consumption following a reduction of τ_k in the baseline economy (blue solid line) and its counterfactual financially developed counterpart (red dashed line) while Figure 4 plots the respective dynamics of prices.

Consider first the baseline economy. The top left panel in Figure 3 shows that GDP declines on impact. This is driven by a decline in domestic sales, due to an increase in foreign competition that leads to a drop in capital good producers' demand for the varieties of the least-productive firms, which do not benefit as much from a decrease in the cost of produc-

state level.

[21]The aggregate effects of trade liberalization in the financially developed economy are similar to those found by Alessandria and Choi (2014) and Carroll and Hur (2020b) who also study quantitatively the effects of trade liberalization albeit in models without financial frictions. Brooks and Dovis (2019) find stronger effects in the context of a larger bilateral liberalization.

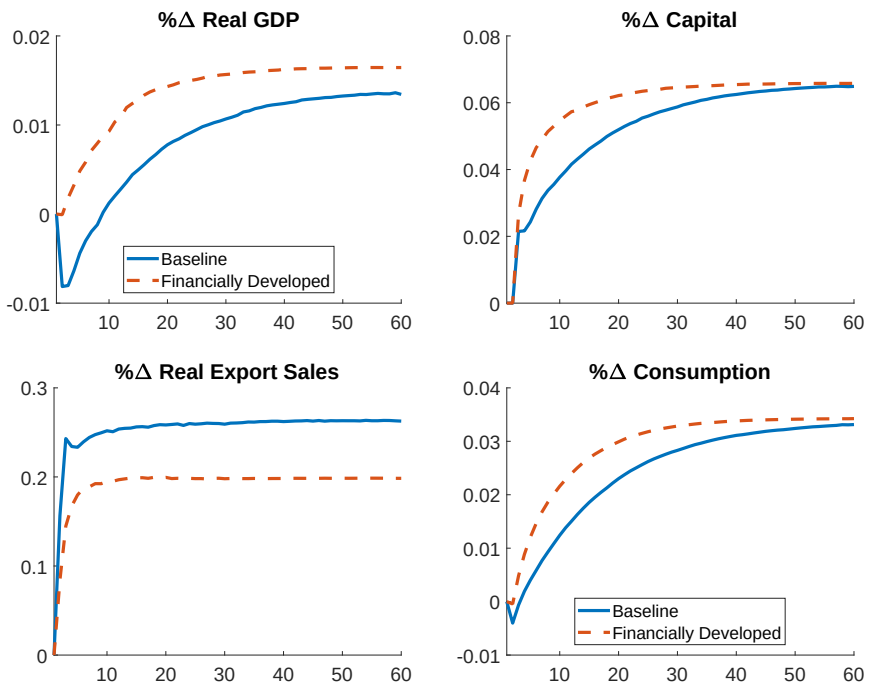

Figure 3: Transition dynamics following a reduction in τ_k

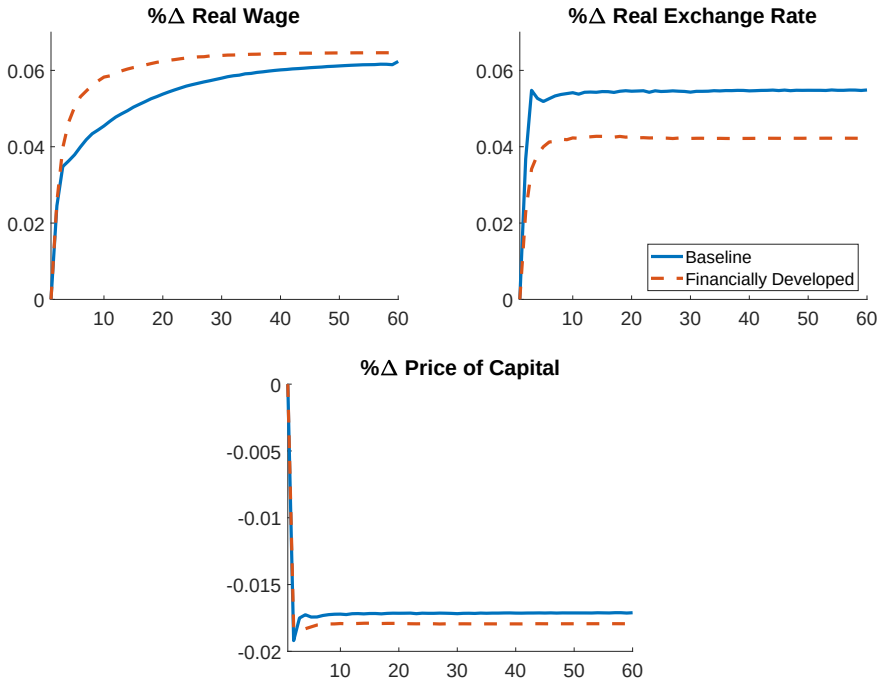

Figure 4: Prices dynamics following a reduction in τ_k

tion driven by a fall τ_k. The drop in the cost of capital and intermediate goods (bottom panel in Figure 4) results in an investment boom and increases the stock of capital between periods 2 and 3 as productive firms find it optimal to expand their scale. Aggregate consumption declines on impact, given the relatively large fraction of constrained entrepreneurs who increase their capital stock by initially sacrificing consumption (bottom right panel in Figure 3). Finally, we find that exports respond strongly on impact due to a large increase in the real exchange rate (top right panel in Figure 4), which makes exporting more profitable and encourages entrepreneurs to reallocate their sales towards the foreign market.[22]

After the initial period, the baseline economy converges slowly towards its final steady state driven by a slow accumulation of capital due to the presence to financial frictions. As capital increases so does the demand for labor, leading to higher wages. Thus, wages steadily increase throughout the transition (top left panel in Figure 4). To quantify the speed of the transition, we compute the proportion of the distance between the initial and the final steady states that real GDP, capital and consumption completed at any given point of time.[23] We find that 10 periods after the trade liberalization real GDP, capital, and consumption covered 15%, 61%, and 42% of the distance between the initial and final steady state, respectively.[24]

In contrast, we find that in the financially developed economy trade liberalization does not have a negative effect on impact: both GDP and consumption remain essentially unchanged. Moreover, we find that capital increases relatively more than in the baseline economy, since the looser financial constraint allows entrepreneurs to increase investment without sacrificing consumption. Thus, entrepreneurs are able to expand their sales at a higher rate than entrepreneurs in the baseline economy. As a consequence, the growth rates of GDP, capital, and consumption in the financially developed economy initially surpass those featured by the baseline economy, leading this economy to converge faster to its new steady state. We find that 10 periods after the trade liberalization real GDP, capital, and consumption covered 63%, 85%, and 67% of the distance between the initial and final steady states, respectively.

These differences in the aggregate variables across the two economies are mirrored by differences in the price dynamics across them. Figure 4 shows that wages increase by more in the financially developed economy driven by stronger demand for labor associated with a

[22]As discussed in Kohn et al. (2020), collateral constrains restrict firm-level sales but do not restrict entrepreneurs' allocation of sales across markets. Thus, following a depreciation, entrepreneurs increase their foreign sales (even if they cannot increase their total sales due to binding financial constraints) by reallocating some of their sales from the domestic to foreign market. See also Almunia et al. (2018) for empirical evidence on this reallocation channel.

[23]That is, for a given variable of interest x we compute $\frac{x(t)-x^*}{x^{**}-x^*}$, where x^* is the value of x at the initial steady state and $x^{**}$is its value at the final steady state.

[24]In Section 1.1 of the Online Appendix, we present the figures that depict the extent of convergence of these variables at any given point in time.

larger expansion of capital and output. On the other hand, in the more financially developed economy, the real exchange rate increases by less as entrepreneurs' demand for final domestic goods increases more. Finally, we see that the price of capital decreases by almost identical amounts in both economies in response to a decline in import tariffs.

We thus conclude that financial frictions significantly slow down the adjustment to trade liberalization consisting of reduced tariffs on imports of intermediates and capital goods. These findings are consistent with the cross-country differences in aggregate dynamics following trade liberalization documented in Section 2, suggesting frictions in financial markets play a significant role in accounting for these patterns. In the next subsection we investigate the welfare and distributional implications of our results.

5.2.2 Welfare and distributional effects

In this section, we analyze how financial development affects the welfare gains from trade liberalization, both in the aggregate and across the distribution of agents.

To understand how lower tariffs on intermediate and capital goods affect welfare, note that it has both positive and negative effects on entrepreneurs. Lower tariffs make investment goods cheaper, which decreases the cost of production and makes entrepreneurs more competitive. A decrease in the price of investment goods in turn has positive general equilibrium effects: it leads to a real depreciation that boosts the profits of exporting firms. Moreover, some of these gains to exporters are distributed to other entrepreneurs through an increase in wages.

However, lowering tariffs also leads to some negative effects on welfare. On the one hand, it decreases the demand of investment good producers for domestic varieties, with particular impact on non-exporters. On the other hand, lower tariffs also generate lower tariff revenues, hurting the poorest agents since these revenues are redistributed across all agents. Nevertheless, the overall impact of lowering τ_k is to lead to an economic boom, at least after the first few periods.

These positive and negative effects of trade liberalization are affected by the extent of financial development. In particular, financial underdevelopment limits the extent to which constrained entrepreneurs can benefit from a decrease in the cost of capital goods, since they are limited in their potential to expand production. However, the decrease in the cost of capital also relaxes firms' borrowing constraints. We quantify the net impact of these channels on welfare across the two economies in the rest of this section.

Aggregate welfare We first investigate how financial development affects aggregate welfare gains. To do so, we compute a "consumption-equivalent" welfare measure, as in Mendoza

et al., 2009. Specifically, we compute the aggregate welfare gains, $\boldsymbol{G}$, as:

$$\boldsymbol{G} = \left(\frac{\int_{\mathcal{S}} v_T(s)\phi_0(s)ds}{\int_{\mathcal{S}} v_0(s)\phi_0(s)ds} \right)^{\frac{1}{1-\gamma}} - 1 \tag{11}$$

where $\boldsymbol{G}$ consists of the permanent change of consumption across all agents required to make agents indifferent between remaining in the economy without trade liberalization and moving to one with lower tariffs as described above. Moreover, $\phi_0(s)$ is the stationary measure in the initial steady state, $v_0(s)$ is the value function of an entrepreneur in state s prior to trade liberalization, and $v_T(s)$ is the value function of an entrepreneur in state s in period 2 right after trade liberalization is announced and realized.

Table 7 reports our findings.[25] The first row reports the welfare gains of trade liberalization as defined in Equation 11. The second row reports the welfare gains excluding the transition –that is, restricting attention to the comparison between the initial and final steady states. Thus, comparing the first and second rows allows us to evaluate the welfare cost of the transition.

Table 7: ΔWelfare ($\tau_k \downarrow$)

	$\theta = 0.21$	$\theta = 0.80$
Overall	0.13%	0.98%
Excluding transition	2.58%	2.76%

We find that the welfare gains from trade liberalization are lower in the economy with financial frictions: only 0.13% compared to almost 1% in the financially developed economy. Notice that this difference is smaller once we exclude the transition: the second row shows that if both economies adjusted immediately to the final steady state, then welfare would increase by 2.58% in the baseline and 2.76% in the financially developed economy. Thus, we conclude that the difference in welfare gains between the two economies is largely accounted for by the faster transition to the final steady state in the financially developed economy. That is, financial frictions slow down the adjustment to the environment with lower tariffs, reducing the welfare gains from this policy change.

Welfare distribution We next investigate the welfare gains from a decrease in tariffs on capital and intermediate goods along the entrepreneurs' asset and productivity distribution.

[25] Specifically, we report $\boldsymbol{G} \times 100$.

To do so, we compute an individual-specific "consumption-equivalent" welfare measure that we use to contrast welfare changes across different types of agents. In particular, for every entrepreneur in a given state $s = (a, z)$ who lives in the steady-state of the economy without trade liberalization, we compute the permanent percentage change of consumption $g(s)$ that would make him indifferent from moving to an economy featuring the decline τ_k examined above.

Analogous to Mendoza et al. (2009), $g(s)$ can be computed as the solution to:

$$g(s) = \left(\frac{v_T(s)}{v_0(s)} \right)^{\frac{1}{1-\gamma}} - 1, \tag{12}$$

where $v_0(s)$ and $v_T(s)$ are defined as above. To compute the average welfare gains from trade liberalization across a given group of entrepreneurs with $s \in \mathcal{S}$, we define $\boldsymbol{G}_{\mathcal{S}}$ as

$$\boldsymbol{G}_{\mathcal{S}} \equiv \int_{\mathcal{S}} g(s)\phi_0(s)ds, \tag{13}$$

where $\phi_0(s)$ is the stationary measure at the initial steady state.

We are interested in understanding how the welfare gains from trade liberalization vary across the joint distribution of assets and productivity. To answer this question we partition the agents into asset and productivity quintiles. We then compute the welfare gains and the share of entrepreneurs with negative welfare gains (i.e., share of losers) in each bin (i, j), where i denotes the i-th quintile of the asset distribution ($i \in \{1, ..., 5\}$) and j denotes the j-th quintile of the productivity distribution ($j \in \{1, ..., 5\}$). Figure 5 presents our results.

The top panels of Figure 5 illustrate the welfare gains from trade liberalization across the different net worth and productivity quintiles. The top left panel presents the results for the baseline, while the top right panel presents the results for the financially developed economy. Not surprisingly, we observe that the welfare gains are higher on average in the more financially developed economy; the gains are uniformly higher across all net worth and productivity bins. However, we find that there are significant differences in the distribution of these gains across agents. In the baseline economy the gains are mostly concentrated among the richest and more productive entrepreneurs while in the financially developed economy the welfare gains are distributed more uniformly.

The bottom panels of Figure 5 illustrate the share of losers for each asset and productivity bin. The bottom left panel presents the results for the baseline economy, while the bottom right one presents those for the financially developed economy. We find that there are significant differences in the extent to which trade liberalization leads to losses across these economies. On the one hand, a substantial share of agents (14.2%) is made worse off by trade

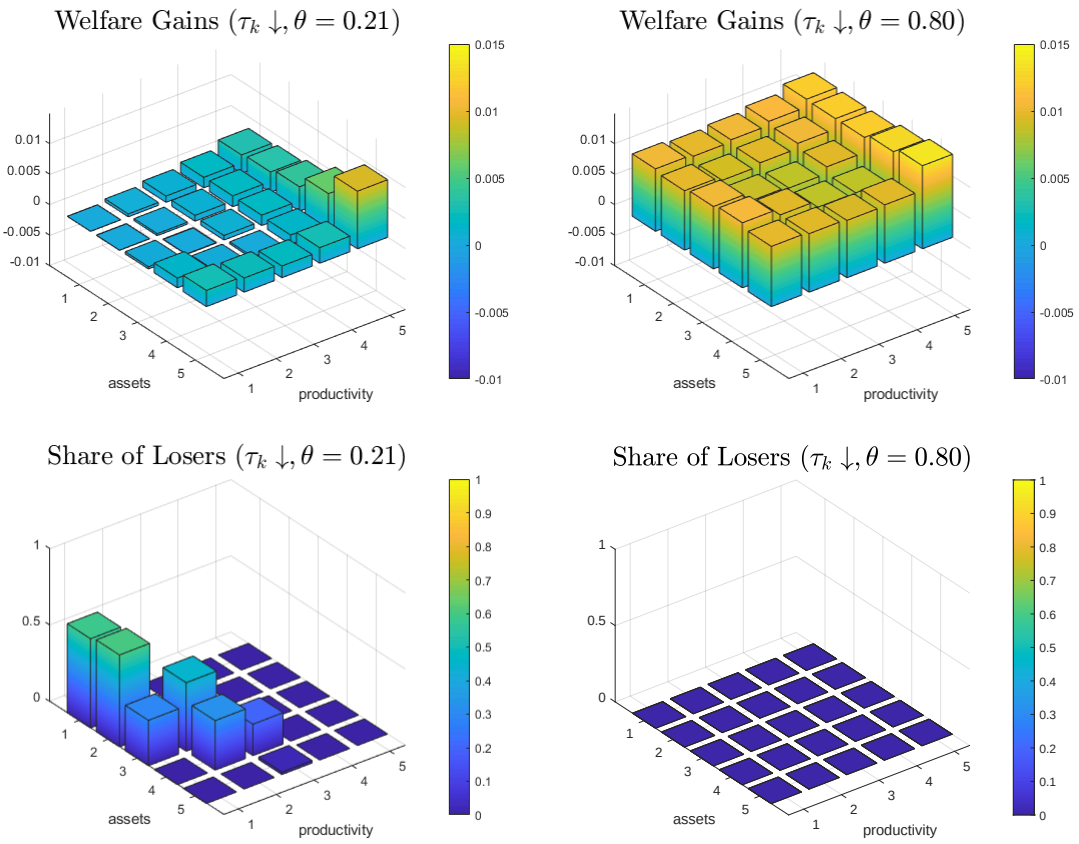

Figure 5: ΔWelfare ($\tau_k \downarrow$) distribution

liberalization in the baseline model: mostly agents with low productivity and low assets.[26] In contrast, all agents are better off in the financially developed economy.

To better understand the heterogeneous welfare gains from lowering tariffs on capital and intermediate goods, in Table 8 we now compute the welfare gains for exporters versus non-exporters, "wealthy" versus "poor" agents, and "entrepreneurs" versus "workers."[27] We find that exporters in both economies gain more than non-exporters. However, this difference is much larger in the baseline economy due to a smaller wage increase and a larger real depreciation. In the financially developed economy a sharp wage increase redistributes some of the welfare gains from exporters to non-exporters, while a larger increase in the demand for final goods leads to a lower real exchange rate depreciation further limiting the gains of exporters. These differential effects from wages can also be seen when comparing workers

[26]These entrepreneurs lose on average 0.02%, compared to an average gain of 0.26% enjoyed by the rest of the agents; see Table 8, below.

[27]We define wealthy agents as those in the top 10% of the wealth distribution, while the rest is defined as poor. We define individuals to be workers if they supply more labor than they hire ($n < 1$), while the rest is defined to be entrepreneurs ($n \geq 1$).

Table 8: ΔWelfare ($\tau_k \downarrow$)

	$\theta = 0.21$	$\theta = 0.80$
Winners	0.26%	1.02%
Losers	-0.02%	— %
Exporters	1.03%	1.48%
Non-exporters	0.12%	0.96%
Entrepreneurs	0.63%	1.24%
Workers	0.07%	0.94%
Wealthy	0.75%	1.19%
Poor	0.16%	1.00%

and entrepreneurs, as there are lower differences in welfare gains between entrepreneurs and workers in the more financially developed economy.

Table 8 also shows that assets play a minor role in determining the welfare gains in the financially developed economy, while these play an important role in the baseline economy. In the latter economy, wealth is crucial for agents to benefit from trade liberalization, as it allows individuals to adjust their production scale immediately; in the former economy wealth is not as necessary, as agents can borrow from deeper financial markets.

Decomposition of welfare gains We now investigate the channels that account for the welfare results reported above. To do so, we decompose the aggregate and group-specific welfare gains into four channels through which changes in τ_k affect welfare.

The first channel consists of the effect of changes in tariff revenue on welfare: the "tariffs income" channel. Following trade liberalization, tariff revenue declines, which reduces the amount of tariffs revenues that gets redistributed to the agents. The second channel consists of the impact of τ_k on the price of investment goods and the demand for domestic varieties by investment good producers: the "investment" channel.

The above two channels capture the "direct effects" of trade liberalization. The remaining two channels consist of general equilibrium effects. The third channel consists of the impact of trade liberalization on the real exchange rate: the "exchange rate" channel. Cheaper materials lead to cheaper domestic varieties and consumption good and, thus, to a depreciated real exchange rate.[28] Finally, wages increase following trade liberalization given the increased demand for labor: the "wage" channel.

[28]Note that part of this effect is driven by a change in the demand for domestic varieties by consumption good producers.

In order to quantify the strength of these channels, we perform a series of partial equilibrium computations. In particular, we follow Carroll and Hur (2020b) and introduce measure-zero agents: Agents that optimize in response to prices and aggregate quantities that are different from the ones observed in equilibrium, but do not affect equilibrium prices and aggregate quantities. Thus, to compute the "tariffs income" channel, we assume that along the transition and in the final steady state our zero-measure agents face the initial-steady-state prices and aggregate quantities but receive reduced tariff revenue as observed along the equilibrium path following a trade liberalization. Similarly, to compute the "investment channel" we assume that measure-zero agents only face the equilibrium changes in P_k and Y_k implied by a decrease in τ_k (with other quantities fixed at their initial steady-state level); for the "exchange rate" channel, we assume these agents only face the equilibrium changes of ξ and Y_c; and, finally, for the "wage" channel, the measure-zero agents only experience a change in wages as observed along the equilibrium path.

Table 9 reports the welfare decomposition for the baseline and financially developed economies. We find that the decline in tariffs income has a very large negative effect on welfare and is the main reason why welfare gains are modest in both economies. The average loss due to lower tariff income is -1.6% in both the baseline and financially developed economies. This negative effect is particularly strong among workers, poor agents, and non-exporters since tariff revenue represents a larger proportion of income for these agents.[29]

In contrast, the investment and the exchange rate channels contribute positively to welfare in both economies (0.7% and 0.3%, respectively, in the baseline economy and 0.9% and 0.5% in the financially developed economy) and are the main channels through which agents benefit in the aggregate. Entrepreneurs, wealthy agents, and exporters benefit relatively more since they can adjust their production by more in response to the higher domestic and foreign demand. These channels are even stronger in the financially developed economy as agents are able to expand their production more on impact.

Finally, we find that higher wages help redistribute part of the welfare gains from entrepreneurs, wealthy agents, and exporters (who benefit more from investment and exchange rate channels) towards workers, poor agents, and non-exporters, who gain on average between 1.0-1.2%. Since the strength of this channel is directly linked to the extent that agents can expand their production following trade liberalization, this channel is stronger in the

[29]In Colombia, following the trade liberalization tariffs revenues represented 1.3% of GDP in 1990 and dropped to 1.0% of GDP on average for the period 1992-1998 (OECD data). In Section 1.4 of the Online Appendix, we investigate the effects of trade liberalization in a counterfactual economy in which tariffs revenues do not decline after trade liberalization, but in which prices and quantities are allowed to adjust and clear the markets. Consistent with this exercise, we observe a much larger increase in welfare for all agents since we abstract from the negative "tariffs income" effect depicted here.

Table 9: Δ Welfare decomposition ($\tau_k \downarrow$)

$\theta = 0.21$	Tariffs income (τ_k)	Investment (P_k, Y_k)	Exchange rate (ξ, Y_c)	Wage (w)	Total
All agents	-1.6%	0.7%	0.3%	0.9%	0.22%
Exporters	-0.7%	1.0%	1.2%	-0.4%	1.03%
Non-exporters	-1.7%	0.6%	0.2%	1.0%	0.12%
Wealthy	-0.7%	0.8%	0.9%	-0.2%	0.75%
Poor	-1.7%	0.7%	0.2%	1.0%	0.16%
Entrepreneurs	-0.9%	0.9%	0.7%	-0.1%	0.63%
Workers	-1.8%	0.6%	0.1%	1.2%	0.07%
$\theta = 0.80$	Tariffs income (τ_k)	Investment (P_k, Y_k)	Exchange rate (ξ, Y_c)	Wage (w)	Total
All agents	-1.6%	0.9%	0.5%	1.2%	1.02%
Exporters	-0.8%	1.2%	1.5%	-0.4%	1.48%
Non-exporters	-1.7%	0.8%	0.4%	1.5%	0.96%
Wealthy	-0.8%	1.0%	1.1%	-0.1%	1.19%
Poor	-1.6%	0.9%	0.4%	1.4%	1.00%
Entrepreneurs	-1.0%	1.2%	1.1%	0.0%	1.24%
Workers	-1.7%	0.8%	0.3%	1.6%	0.94%

financially developed economy and varies between 1.4-1.6%.

We have thus shown how different equilibrium channels affect welfare following a trade liberalization and how these effects are distributed across agents. In the following section, we explore in detail how inequality changes following trade liberalization.

Trade liberalization and inequality Our findings above show that the gains from trade liberalization are heterogeneous across various population subgroups. We now investigate the extent to which these heterogeneous welfare gains account for changes in consumption, income, and wealth inequality observed over this period. Table 10 presents statistics on inequality changes between the final and initial steady-states for these variables, contrasting

the baseline and financially developed economies.[30] We focus on two measures of inequality: the Gini coefficient and the $P75/P25$ ratio, which consists of the ratio of the 75th percentile to the 25th percentile of the distribution for each variable of interest.

Table 10: Trade liberalization and inequality ($\tau_k \downarrow$)

	$\theta = 0.21$		$\theta = 0.80$	
	Pre-liberalization	% Change	Pre-liberalization	% Change
		Consumption		
Gini	0.34	1.37%	0.32	1.35%
P75/P25	2.08	0.15%	1.96	0.25%
		Income		
Gini	0.37	1.39%	0.34	1.40%
P75/P25	2.11	0.49%	1.94	0.01%
		Wealth		
Gini	0.61	0.83%	0.68	0.85%
P75/P25	4.16	6.50%	4.85	7.46%

First, we find that there is a pecking order of inequality across the various variables under analysis. In both economies and according to both inequality measures, consumption inequality is the lowest, it is slightly higher for income, and it is almost twice as high for wealth. Furthermore, we find that trade liberalization increases all measures of inequality in both economies. Interestingly, this is the case even for the financially developed economy, where trade liberalization increases welfare for all agents. Finally, we don't find a clear rank across the two economies in the impact of trade liberalization on inequality: Whether or not inequality increases more in one economy or the other appears to critically depend on the particular inequality measure under analysis. The increase of inequality following trade liberalization is primarily related to the reduction of the redistributed tariff revenue, which raises inequality since it consists of the reduction of an income source common to all agents.

Table 11 contrasts income inequality in the baseline model with data. To do so, we use data from the World Bank's Poverty Report for Colombia (World Bank 2002) and focus on years 1988 and 1995 as our empirical counterpart for the pre- and post-trade liberalization results. First, notice that inequality is much higher in the data according to both measures of inequality. This is to be expected since all agents in our model are both workers and

[30] Income is the sum of wages, profits from domestic and foreign markets, tariffs revenues, and asset income. Wealth is assets.

Table 11: Trade Liberalization and Income Inequality ($\tau_k \downarrow$)

	Baseline vs. Data	
	Pre-liberalization	% Change
	Model	
Gini	0.37	1.4%
P75/P25	2.11	0.5%
	Data	
Gini	0.54	3.7%
P75/P25	3.31	3.6%

Notes: Data from Colombia Poverty Report, World Bank, November 1992, Table 3. Pre- and post- trade liberalization correspond to years 1988 and 1995, respectively.

entrepreneurs. Because of this, our model doesn't feature, for instance, very poor unemployed or hand-to-mouth agents; our model also cannot account for the high degree of wealth concentration among the richest households. Second, notice that our model can explain 38% of the observed increase in the Gini coefficient from 1988 to 1995 (1.4% vs. 3.7%) and 14% of the observed increase in the $P75/P25$ ratio.

5.3 Trade liberalization on all goods (τ_k and τ_c)

In the quantitative analysis above we focus on the effects of a unilateral reduction of tariffs charged on imports of investment and intermediate goods. The reasons we focus on import tariffs charged on these goods are threefold: (i) a reduction of tariffs on capital and intermediate goods makes capital goods cheaper, leading firms to increase their capital stocks, thus making financial frictions more likely to distort allocations by limiting capital accumulation; (ii) most imports in emerging countries consist of these types of goods (3/4 of all Colombian imports, as reported in the calibration section); and, finally, (iii) there is an easier case to be made by policy-makers for reducing these tariffs, since they have a direct impact on domestic firms' productivity.

Yet, tariffs are usually reduced on all types of goods, not just on capital and intermediates. Thus, in this section we investigate the sensitivity of our findings to considering trade liberalization of consumption goods in addition to capital and intermediates.[31] To do so, we use our calibrated baseline and counterfactual economies to investigate the extent to which financial development affects the aggregate dynamics following trade liberalization and its welfare implications. As above, we consider the stationary equilibrium of our calibrated

[31]See Section 1.2 of the Online Appendix for the effects of reducing import tariffs on only consumption goods.

model and examine the impact of a reduction of import tariffs on consumption, capital, and intermediates, of the magnitude observed in Colombia between 1988 and 1992. In particular, we consider a one-time, unexpected, and permanent reduction of import tariffs from 32 percent to 12 percent. The timing of trade liberalization is analogous to the analysis above.[32]

5.3.1 Aggregate effects of trade liberalization

Long-run effects We begin by analyzing the long-run aggregate effects of decreasing imports tariffs on key aggregate variables: Output, capital, consumption, exports, and imports. To do so, we contrast the steady-state values of these variables before and after trade liberalization. Table 12 reports the impact that a reduction of τ_k and τ_c has on these variables in the baseline ($\theta = 0.21$) and in the financially developed ($\theta = 0.80$) economies.

Table 12: Steady state effects ($\tau_k \downarrow, \tau_c \downarrow$)

	$\theta = 0.21$	$\theta = 0.80$
Real GDP	-0.45%	-0.10%
Capital	4.80%	5.18%
Consumption	2.21%	2.66%
Real exports	32.5%	24.1%
Real imports	46.9%	55.9%
Price of capital	-0.92%	-0.93%
Wage	5.93%	6.66%
Real exchange rate	7.38%	5.90%

Consider first the baseline economy. Table 12 shows that the long-run effects of decreasing τ_k and τ_c are significatively lower than in the case in which only τ_k is reduced: Real GDP decreases by 0.45% (vs. an increase of 1.4% when only τ_k is reduced), capital increases by 4.8% (vs. 6.6%), and consumption by 2.2% (vs. 3.4%). In response to trade liberalization, real exports and imports increase by more in this case, 32.5% vs. 26% and 47% vs. 36%.

While a reduction of import tariffs on intermediates and capital goods reduces the cost of production inputs and has a positive overall effect in the economy, a reduction of τ_c negatively impacts all variables except exports. To understand why this is the case, note that as imported consumption varieties become cheaper, domestic consumption good producers switch from domestic to foreign varieties. Thus, a reduction of τ_c leads to a decrease in domestic sales. This decreases entrepreneurs' profits, leading to a fall in capital and consumption. On the other hand, these negative effects are partially offset by the lower price

[32]We present only the main results. See Section 1.3 of the Online Appendix for additional details.

of final consumption which results in a real depreciation. This increases exports, partially offsetting the negative impact on domestic sales. In addition, the lower price of final goods increases the real wage, yet not enough to offset the negative impact due to increased foreign competition.[33]

As in the previous section, differences in financial development have modest effects on the long-run impact of trade liberalization. In particular, GDP, capital, consumption, and imports increase somewhat more in the financially developed economy (or decrease by less, in the case of GDP). Exports increase relatively less in the financially developed economy. This is accounted for by the lower exchange rate depreciation experienced by the financially developed economy following a tariff reduction.

Transitional dynamics We next examine the effects along the transition to the new steady state. Figure 6 plots the response of real GDP, capital, real exports, and consumption following a reduction of τ_k and τ_c in the baseline economy (blue solid line) and its counterfactual financially developed counterpart (red dashed line).

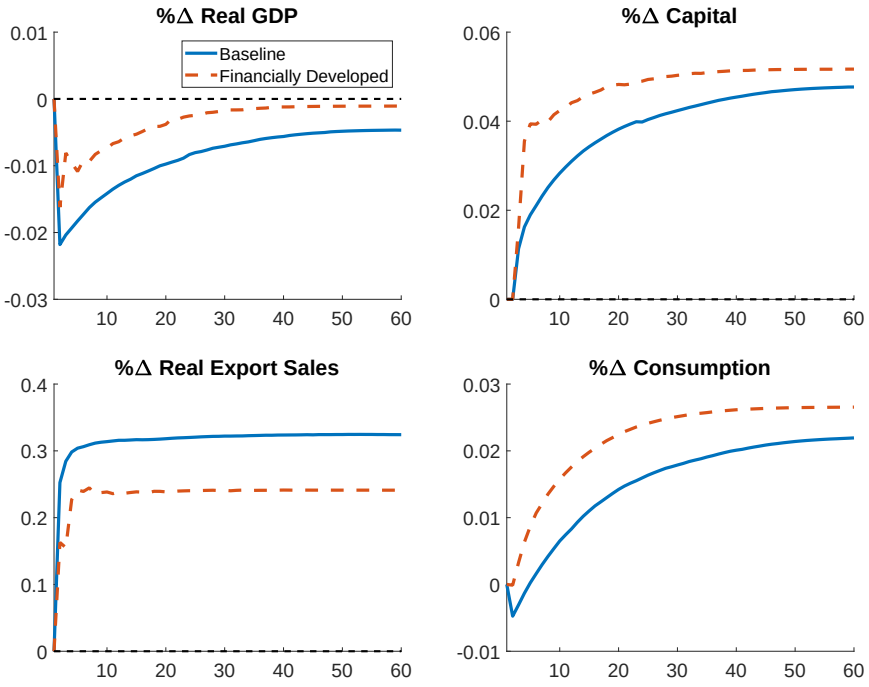

Figure 6: Transition dynamics following a reduction in τ_k and τ_c

[33]Note that a similar negative effect operates when only τ_k changes. However, in that case the resulting decline in the price of investment goods allows domestic entrepreneurs to compete more effectively in the foreign and domestic markets. This effect dominates the initial negative impact of an increase in foreign competition following a reduction of τ_k.

Notice that this figure looks similar to Figure 3, except that all lines are below their values when only tariffs on capital goods are reduced. Thus, when we additionally reduce tariffs on consumption goods, all aggregate variables are negatively affected (except exports), somewhat counteracting the positive effect of a reduction in tariffs on capital goods. As before, GDP, capital, and consumption increase slowly following the trade liberalization, but financial development allows for a much faster increase of these variables.

5.3.2 Welfare and distributional effects

Finally, we briefly discuss how financial development affects the welfare gains from trade liberalization, both in the aggregate and across the distribution of agents.

Table 13 reports the welfare effects implied by a simultaneous decrease in tariffs on all types of varieties (i.e., a decrease in τ_k and τ_c). A fall in tariffs on capital goods leads to an increase in welfare, while a drop in tariffs on consumption goods has a negative impact on welfare. Aggregate effects on welfare are negative in the baseline economy, equal to -0.42%, while they are positive in the financially developed economy, equal to 0.50%, when both tariffs are reduced at the same time.

Table 13: ΔWelfare following decrease in tariffs

	$\theta = 0.21$	$\theta = 0.80$
τ_k	0.13%	0.98%
τ_c	-0.84%	-0.59%
τ_k & τ_c	-0.42%	0.50%

Welfare distribution Finally, we consider the distribution of welfare effects across agents. To better understand the heterogeneous welfare gains from lowering tariffs, in Table 14 we now compute the welfare gains for exporters versus non-exporters, "wealthy" versus "poor" agents, and "entrepreneurs" versus "workers." As above, the average effects are negative in the baseline economy, while they are positive in the financially developed economy. We find that exporters in both economies gain more than non-exporters, entrepreneurs gain more than workers, and the top 10% of the agents wealth distribution gain much more than the bottom 90% in the wealth distribution. These differential effects are more unequal in the baseline economy than in the financially developed one.

Thus, these results are broadly consistent with the results presented in the previous section for the case in which only tariffs to capital and intermediate goods are reduced.

Table 14: ΔWelfare ($\tau_k \downarrow$,$\tau_c \downarrow$)

	$\theta = 0.21$	$\theta = 0.80$
All agents	-0.29%	0.57%
Winners	0.68%	0.57%
Losers	-0.46%	— %
Exporters	0.86%	1.47%
Non-exporters	-0.43%	0.46%
Entrepreneurs	0.28%	1.00%
Workers	-0.50%	0.43%
Wealthy	0.73%	1.06%
Poor	-0.30%	0.56%

6 Cross-industry evidence from Colombia

The quantitative analysis conducted in the previous section shows that, consistent with the cross-country evidence documented in Section 2, cross-country differences in financial development can significantly affect aggregate dynamics following trade liberalization. Since our analysis above uses a model estimated to match salient features of the Colombian economy during its trade liberalization in the early 1990s, we now contrast the implications of our model with the cross-industry dynamics observed during this episode.

We begin by classifying industries based on their finance-intensity as measured by the median firm-level debt to sales ratio. We assume that credit supply is homogeneous across industries and, thus, that differences in the use of finance across industries capture differences in their demand for external finance to carry out their operations.[34] Therefore, we interpret finance-intensive industries as the ones more likely to respond to trade liberalization as in our baseline economy, since these industries have a higher demand for credit in an economy where credit is scarce and, thus, are more likely to operate close to their financial constraint. Analogously, we interpret non-finance-intensive industries as the ones more likely to respond to trade liberalization in line with the dynamics observed in the financially developed economy.[35]

[34]This assumption is in line with previous studies such as Manova (2013) and others.

[35]Note our interpretation of differences in finance-intensity across countries and industries. Consistent with Buera et al. (2011) and Midrigan and Xu (2014), among others, we interpret cross-country differences in finance-intensity as primarily driven by differences in credit supply rather than credit demand. Consistent with Rajan and Zingales (1998) and Manova (2013), among others, we interpret differences in finance-intensity across industries within a country as primarily accounted by differences in credit demand rather than supply.

We then investigate whether finance-intensive industries increased their output relatively less than non-finance intensive industries after Colombia's trade liberalization in the early 1990s. Given that industries differ substantially in their production technologies as well as in the goods produced, we conduct our analysis as follows. First, we control for the heterogeneous impact of changes in intermediate input tariffs due to differences in the types of intermediate inputs used and the degree to which tariffs on different goods declined. Second, we follow Estevadeordal and Taylor (2013) in isolating the impact of trade liberalization from industry-specific trends by focusing on the change in industry-level growth between the post-liberalization and pre-liberalization periods.

Thus, we consider the following baseline empirical specification:

$$y_j^{\text{Post}} - y_j^{\text{Pre}} = \alpha + \left(\tau_j^{\text{Post}} - \tau_j^{\text{Pre}}\right) \times \left(\beta + \gamma \times \text{Finance-intensity}_j\right) + \varepsilon_j \tag{14}$$

where $j = 1, ..., J$ indexes industries, y_j^t and τ_j^t denote a measure of industry-level growth and input tariffs in industry j and period $t \in \{\text{Pre}, \text{Post}\}$, where Pre and Post refer to the pre-liberalization and post-liberalization periods, $\text{Finance-intensity}_j$ denotes a measure of industry-level finance intensity, and ε_j is industry j's error term.

6.1 Data

We now describe the data series that we use to estimate Equation (14) and any other relevant details of the empirical implementation. We define the pre- and post-liberalization periods as the periods 1982-1988 and 1995-1997, respectively. We conduct our analysis across 4-digit ISIC rev. 2 industries.

The dependent variable in the specification consists of the change in industry-level sales growth between the pre- and post-liberalization periods. We measure industry-level growth y_j^t in period $t \in \{\text{Pre}, \text{Post}\}$ and industry j as the median firm-level growth across all firms within the industry over this period. To do so, we use plant-level data from Colombia's annual survey of manufactures (Encuesta Anual de Manufacturas) collected by Colombia's statistical agency (DANE).[36]

We back out input tariff changes faced by each industry j from information on average tariffs and effective rates of protection at the industry-level obtained from Eslava et al. (2013), which is publicly available through the publisher's website. We use these tariffs series along with the effective rate of protection definition from Corden (1966) and data on the intermediate input expenditure-to-sales ratio from the Colombian plant-level data.

[36] We compute firm-level growth rates for all firms with positive sales at the initial and final year of period t and restrict attention to industries with at least 10 plants for which these growth rates can be computed.

Table 15: Cross-industry evidence on trade liberalization and finance

Dependent variable: Change in median sales growth (pre- vs. post-liberalization period)				
	(1)	(2)	(3)	(4)
Δ Input tariffs	-1.65	-0.75		
	(0.043)	(0.073)		
Δ Input tariffs × Debt-to-sales$_j$	6.85			
	(0.036)			
Δ Input tariff, med finance		0.68		
		(0.180)		
Δ Input tariff, high finance		1.63		
		(0.019)		
Δ Input tariffs × Intermediate share			-2.42	-1.11
			(0.168)	(0.415)
Δ Input tariffs × Intermediate share × Debt-to-sales$_j$			10.45	
			(0.099)	
Δ Input tariffs × Intermediate share, med finance				0.69
				(0.628)
Δ Input tariffs × Intermediate share, high finance				2.66
				(0.077)
Constant	-0.49	-0.48	-0.50	-0.49
	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.114	0.142	0.060	0.077
Observations	44	44	44	44

Notes: p-values are reported in parentheses. Industry-level shares of capital and intermediates are the median across firms. Pre-liberalization period is 1982-1988, post-liberalization period is 1995-1997.

We measure finance intensity across industries as the median debt-to-sales ratio in the Colombian plant-level data. To do so, we use information on interest rate expenditures from these data along with the 6% annual real interest rate featured by our baseline calibration to back out the stock of debt generating the observed flows of interest rate expenses. We measure industries' finance-intensity in the pre-liberalization period. Our results are robust to using external finance dependence (Rajan and Zingales 1998) as our measure of industry-level finance-intensity, see Section 2 of the Online Appendix for details.

Finally, we exclude outliers by removing observations whose values are more than four standard deviations away from the mean for any of the variables used in the analysis. We follow Eslava et al. (2013) in restricting attention to industries with at least 30 plants on average per year.

6.2 Results

The estimation results are reported in Table 15. The first column of this table reports the estimates of Equation (14). The rest of the columns report the estimated coefficients corresponding to variants of this specification, as described below.

The estimates reported in the first row show that, among firms with low debt, a reduction of input tariffs is associated with higher growth after trade liberalization. For instance, a 1 percentage point decline of input tariffs is associated with a 0.80 percentage point increase in the growth rate difference relative to the pre-liberalization period among industries at the 10^{th} percentile of the debt-to-sales distribution (with debt-to-sales ratio equal to 0.124). This economically significant effect is also statistically significant at the 5% level.

In contrast, we find that finance-intensive industries are estimated to experience relatively lower growth following trade liberalization. For instance, a 1 percentage point decline of input tariffs is associated with a 0.92 percentage point *decline* in the growth rate difference relative to the pre-liberalization period among industries at the 90^{th} percentile of the debt-to-sales distribution (with debt-to-sales ratio equal to 0.374). This economically significant effect is also statistically significant at the 5% level.

These findings are consistent with the implications of our model described in the previous section. Finance-intensive industries and economies with lower financial development operate closer to the borrowing constraint, thereby experiencing a lower and slower response of growth following trade liberalization.

The second column reports estimates based on partitioning industries into three groups according to their finance intensity (bottom third, middle third, top third); the estimated results are consistent with those of our baseline specification. The third and fourth columns report estimates analogous with those of the first two columns but interacting tariff changes with industry-level shares of intermediate inputs since changes in input tariffs are expected to impact output particularly in industries intensive in intermediates. Our findings are robust across these alternative specifications.

7 Conclusion

In this paper, we study the role of financial development on the aggregate effects and welfare implications of reducing international trade barriers on capital and intermediate inputs. We formulate a quantitative general equilibrium model with heterogeneous firms subject to financial constraints, estimate it to match salient features from Colombian plant-level data, and find that the adjustment to a trade liberalization is significantly slower in financially underdeveloped economies. Moreover, we find that financial development increases the welfare gains from trade liberalization: low-income agents benefit from higher wages while exporters benefit from a depreciated real exchange rate and lower capital costs.

Our paper contributes to the literature along three dimensions. First, we document that financially underdeveloped economies grow relatively slower than their financially de-

veloped counterparts after reducing import tariffs on capital and intermediate goods. Our second contribution is to quantify the extent to which cross-country differences in financial development account for the observed differences in aggregate dynamics following trade liberalization. Our third contribution is to investigate the implications of these findings for both aggregate welfare as well as for the distribution of welfare gains across various population sub-groups.

More broadly, our findings provide a rationale for the higher resistance to trade liberalization in less developed economies: There might be less to gain from trade openness in these economies, particularly in the short- and medium-run. Therefore, our results imply that trade liberalization might need to be pursued together with reforms aimed towards improving firms' access to finance (see also Manova (2008)). In addition, our findings suggest that financial development might not only provide the significant welfare gains that have already been documented in the literature (Buera et al. 2011, Midrigan and Xu 2014), but it might also help ensuring more equally distributed welfare gains from trade liberalization, thus increasing the support for such policies across different types of agents. Finally, note that we take the level of financial development as given. As suggested by Braun and Raddatz (2008) trade liberalization may often spur financial development by changing political economy equilibrium of financial sector.

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