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

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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 implications of reducing import tariffs on capital and intermediate inputs. We document empirically that financially underdeveloped economies feature a slower aggregate response following trade liberalization. To quantify these effects, we set up a general equilibrium model with heterogeneous firms subject to collateral constraints and estimate it using Colombian plant-level data. We find that low financial development substantially limited the gains from trade liberalization in Colombia in the early 1990s. More broadly, we find that low financial development substantially limits both the aggregate and welfare gains from tariff reductions.

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 cheaper production inputs. Cheaper access to imports of physical capital and intermediate inputs allows firms to accumulate capital and increase productivity, leading to increased real GDP, investment, and consumption (Amiti and Konings 2007; Wacziarg and Welch 2008; Estevadeordal and Taylor 2013). Despite these potential benefits, trade liberalization is often resisted as a means 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, financially underdeveloped economies grow substantially slower than financially developed ones. These findings suggest that credit market frictions, a salient feature of developing economies, limit the degree to which firms adjust their production in response to lower prices of imported intermediates and physical capital, thereby reducing the gains from trade liberalization in these economies.[1]

Motivated by this evidence, we set up a general equilibrium model of international trade with heterogeneous firms and frictions in financial markets to quantify the role of financial development on the dynamics following trade liberalization. We find that low financial development significantly limits the impact of lowering tariffs on production inputs, reducing the welfare gains from trade liberalization. Our findings show that 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.

Our model consists of a small open economy populated by entrepreneurs who are heterogeneous in productivity, can trade internationally, and are subject to financing constraints. Entrepreneurs produce differentiated varieties that they can sell both domestically and abroad, subject to fixed and variable 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. Capital and materials are produced using both domestic and imported varieties, with the latter subject to tariffs. Thus, our model is designed to capture the significant role of trade in allowing firms to access cheaper capital and production inputs.

We estimate the model to match key features of plant-level data in Colombia and use it

[1] See Manova (2010) for a review of theoretical and empirical developments on the role of credit constraints in the adjustment to trade reform.

to quantify the effects of the tariff reduction implemented in Colombia in the early 1990s and the impact of financial underdevelopment. To account for other potentially omitted factors that might have affected the economy at the time of trade liberalization, we estimate shocks to Colombia's TFP, endowment, and interest rates to match the observed dynamics of real GDP, the investment-to-GDP ratio, and the consumption-to-GDP ratio in Colombia from 1991 to 1995. Our findings suggest that the reduction in capital goods tariffs explained more than half of the observed GDP growth during that period.

To evaluate the role of financial development, we consider a counterfactual economy parameterized to resemble Colombia but with the level of financial development of the U.S. We find that if Colombia had the level of financial development of the U.S. at the time of trade liberalization, GDP would have been 4.6 percentage points higher than it was in 1995, mostly due to a larger investment boom. This suggests that Colombia's gains from trade liberalization were substantially limited by financial underdevelopment.

We then investigate the extent to which financial development can explain the empirical differences in aggregate dynamics following trade liberalization between financially developed and underdeveloped countries. To do so, we consider a one-time reduction in tariffs on imports of capital and intermediate inputs and contrast the effects of such trade liberalization between our benchmark economy calibrated to match key features of Colombian plant-level data and the counterfactual economy with the level of financial development of the U.S. We find that, over the 15 years following trade liberalization, the model accounts for 16% of the observed difference in GDP dynamics between the financially developed and underdeveloped economies. Similarly, the model accounts for 17% and 46% of the observed differences in consumption and capital dynamics, respectively, due to financial development. Our quantitative exercise is designed to isolate the causal effect of financial development on aggregate dynamics following trade liberalization while differences in the empirically estimated aggregate responses might be accounted for by other sources of cross-country variation that we do not account for in the regressions such as exogenous capital inflows or financial liberalization.

Finally, we find that cross-country differences in financial development have significant welfare implications. First, we show that the welfare gains from trade liberalization are larger in financially developed economies (3.0% in consumption-equivalent units vs. 0.5% in the financially underdeveloped economy) 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 gains from trade liberalization. In particular, trade liberalization creates winners and losers in the financially underdeveloped economy, while everyone is better off in the financially

developed economy. In addition, exporters gain more than non-exporters in the less financially developed economy while gains are more equally distributed across entrepreneurs in the more financially developed economy.

Overall, 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 frictions in financial markets that slow down the adjustment to the post-liberalization environment.

Related literature Our paper contributes to several strands of the literature. First, there is a broad empirical literature on the aggregate impact of trade liberalization. Previous studies, such as Sachs et al. (1995), Wacziarg and Welch (2008), and Estevadeordal and Taylor (2013), document that trade liberalization leads to higher GDP and investment.[2] We build on these studies to show that the previously documented effects of trade liberalization vary systematically with a country's pre-liberalization characteristics, such as the level of financial development. In particular, we show that the previously documented positive effects of trade liberalization are relatively larger in economies with developed financial markets.[3]

Second, our paper connects insights from growing literatures on the impact of reducing trade barriers on imported intermediate inputs (Amiti and Konings 2007) and capital goods (Anderson et al. 2015; Ravikumar et al. 2019) with those from studies that investigate the role of financial development on trade liberalization (Brooks and Dovis 2020; Caggese and Cunat 2013; Kohn et al. 2016).[4] We contribute to the former by showing that the impact of reducing trade barriers on imported intermediates and capital goods may significantly depend on a country's level of financial development and to the latter by showing that the role of financial development on the effect of trade liberalization depends critically on the types of goods included in the trade reform. In particular, our model allows us to separate the effect of reducing tariffs on capital and intermediate inputs from the effect of reducing tariffs on consumption goods. Our results suggest that most of the gains from trade are driven by reducing tariffs on the former.

Finally, our paper contributes 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

[2]See also Pavcnik (2002), Goldberg et al. (2009), and Topalova and Khandelwal (2011). Irwin (2019) surveys recent empirical work on the effects of lower import barriers on economic growth.

[3] Thus, our paper also relates to the literature on the effects of international financial integration; see Saffie et al. (2020), Tetenyi (2021), and references therein.

[4]Our paper is also related to the literature on the impact of cheaper imports, in particularly of capital goods, on labor markets and skill intensity of production (see, for example, Verhoogen (2008) or Burstein et al. (2013)).

distortions. Chaney (2016), Manova (2013), Kohn et al. (2016, 2020), Brooks and Dovis (2020), and Leibovici (2021), among others, study the impact of financial frictions on trade flows (see Kohn et al. 2022 for a recent review of this literature). This paper extends these frameworks to study the role of credit market frictions on the impact of reducing tariffs on imports of capital and intermediate inputs.

Most closely related to our work is that of Brooks and Dovis (2020), who show that the role of financial frictions on trade liberalization depends critically on whether borrowing constraints are backward or forward looking.[5] Motivated by the observed pervasiveness of collateral requirements to access external funds in poor and emerging economies, we model borrowing frictions as collateral constraints. Thus, while borrowing constraints are likely to be determined by both backward- and forward-looking forces, we restrict attention to the former in this study.[6] Our paper complements findings of Brooks and Dovis (2020) by estimating empirically the role of credit market frictions on the dynamics following trade liberalization across countries as well as by quantifying the role of reduced tariffs on imported intermediates and capital goods in accounting for the observed cross-country dynamics.

2 Empirical evidence

In this section, we investigate empirically the extent to which aggregate economic dynamics following trade liberalization differ by level of financial development. Our data and approach build on the work of Estevadeordal and Taylor (2013), which we extend to investigate the effect of trade liberalization across a broader set of aggregate outcomes as well as to study the role of financial development. Following their work, we focus on trade liberalization episodes that took place between then 1980s and 1990s — the period that they refer to as the "Great Liberalization" experiment.

2.1 Data

Import tariffs We measure the degree of trade openness across countries using data on average import tariffs across all goods. Following Estevadeordal and Taylor (2013), we use data from the Economic Freedom in the World 2005 database and measure tariffs at two points in time around the Great Liberalization experiment: before or early in the trade

[5] Also closely related are Caggese and Cunat (2013) and Kohn et al. (2016), though both study the role of financial frictions on trade liberalization on all goods in a partial equilibrium environment.

[6] We see our approach as complementary to the analysis of forward-looking constraints conducted by Asturias et al. (2016) and Brooks and Dovis (2020). More work is needed to determine the nature of borrowing constraints faced by firms in developing versus developed countries.

liberalization process (year 1985) and late in the trade liberalization process or after it took place (year 2000). Average tariffs are computed without weights.

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 a popular measure used in the literature to study the effects of financial development (see, for example, King and Levine 1993 or Manova 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, capital, investment, exports, and imports. All variables are per capita and expressed in constant domestic prices.

2.2 Trade liberalization dynamics and financial development

We now investigate the extent to which the aggregate dynamics following trade liberalization differ across countries with different levels of financial development. To identify the effect of trade liberalization, we control for several sources of confounding effects.

First, countries can differ in their growth trajectories after trade liberalization for reasons unrelated to tariff changes. For instance, developed economies typically grow more slowly than emerging economies. We control for differences in medium-term growth trajectories across countries by detrending all variables in a country relative to the country's average growth of real GDP over 1975-1985.

Second, countries differ in the extent to which they open up to trade. Thus, some countries might feature sharper dynamics following trade liberalization not because of the role of financial development but rather because they decreased tariffs by more. We control for cross-country differences in tariff changes by restricting attention to the elasticity of aggregate economic outcomes to changes in tariffs.

Third, while we are interested in the role of financial development on the effects of trade liberalization, previous studies have documented that the latter can also affect the former (Do and Levchenko 2007). We mitigate the potential for reverse causality by measuring a country's level of financial development as the average over 1975-1985, that is, prior to the beginning of the period that we study.

We estimate the average cross-country dynamics following trade liberalization and their

interaction with financial development with the following specification:

$$\Delta \ln y_{it} = \gamma + \sum_{k=1975}^{2000} \mathbb{I}_{\{t=k\}} \left[\alpha_k \, \Delta \ln \tau_i + \beta_k \, \Delta \ln \tau_i \times \frac{\text{Credit}_i}{\text{GDP}_i} \right] + \varepsilon_{it}, \tag{1}$$

where subscripts i and t index countries and years, respectively. The dependent variable $\Delta \ln y_{it}$ consists of the log-change of variable y in country i and year t relative to 1985, where y is one of the following six aggregate variables: GDP, consumption, capital, investment, exports, and imports. The elasticity of y in year k in response to a tariff change $\Delta \ln \tau_i$ is given by $\alpha_k + \beta_k \times \frac{\text{Credit}_i}{\text{GDP}_i}$, where $\frac{\text{Credit}_i}{\text{GDP}_i}$ denotes country i's average credit-to-GDP ratio prior to trade liberalization (over the period 1975-1985). Finally, ε_{it} is a zero-mean error and $\mathbb{I}$ is an indicator function.[7] The final dataset used to estimate this regression consists of a balanced panel of 79 countries over 26 years.

Figure 1 plots the elasticity over time associated with a 20-percentage-point decline in tariffs for each of the aggregate variables.[8] We present this elasticity for an economy with a credit-to-GDP ratio equal to 24.9%, the average value observed in Colombia over the period 1986-1990 — an economy with underdeveloped financial markets — and contrast it with the implied elasticities for an economy with a credit-to-GDP ratio equal to 113.8%, the average value over the same period for the U.S. — a financially developed economy. Both the tariff change and the level of financial development of each of these economies are set to make our empirical analysis comparable to the quantitative analysis that we conduct in Sections 5 and 6.

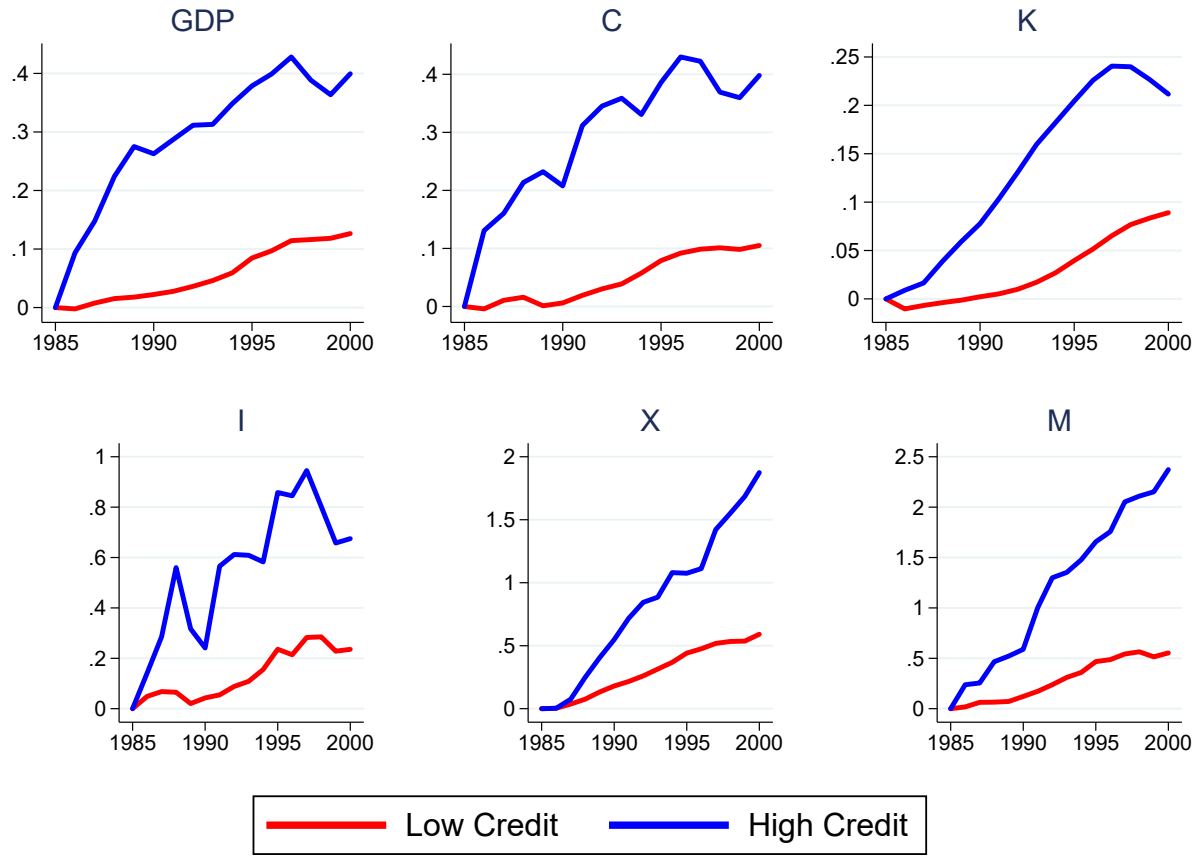
We observe that the economy with developed financial markets ("High Credit" in the figure) exhibits a faster rate of growth along all variables relative to the pre-1985 GDP trend than its financially underdeveloped counterpart ("Low Credit" in the figure). In particular, we find that 15 years following the start of our period, GDP and consumption are each approximately 40% larger in financially developed economies vs. approximately 10% larger in financially underdeveloped economies.

A similar pattern is observed for capital and investment. To the extent that 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 the potential gains from lower tariffs. Consistent with this potential mechanism, we observe that imports and exports increase substantially more in the financially developed

[7] Note that the data used to estimate this regression is not annualized. That is, for every variable that we consider, the regression is estimated using data on the changes between each year t and 1985. The idea is to contrast the adjustment dynamics across countries subject to similar changes in tariffs over this period but with different levels of financial development.

[8] We report confidence intervals and standard errors for these estimates in the appendix.

Figure 1: Trade liberalization dynamics and financial development



Note: This figure plots the estimated change in aggregate variables in response to a 20 percentage points reduction in tariffs, for a low-credit economy and a high-credit economy, respectively.

economy, suggesting that financially underdeveloped economies indeed have a systematically milder response to similar tariff changes.

These findings suggest that differences in financial development across countries might have a significant impact on aggregate dynamics following trade liberalization. Next, we investigate their robustness to controlling for other differences across countries.

2.3 Role of financial development versus other channels

Our above findings suggest that financial development affects aggregate dynamics following trade liberalization. However, potential omitted variables might be biasing these results.

First, countries may differ in their pre-liberalization initial conditions along dimensions that (i) are correlated with financial development and (ii) also impact the dynamics following

trade liberalization. For instance, in a country with weak institutions, changes in trade openness might not have a sizable impact on economic outcomes, as firms and households might be uncertain about the duration of these changes. Instead, in countries with strong institutions, governments' power to arbitrarily change the rules of the game is likely to be more limited, leading firms and households in these economies to see trade liberalization as a more persistent reform. Thus, a country's pre-liberalization institutional quality and level of economic development may affect its response to trade liberalization.

Second, countries are likely to have undergone several changes beyond trade liberalization during the period that we study. To the extent that these changes are correlated with (i) financial development and (ii) the aggregate outcomes that we focus on, these changes can be additional sources of omitted variables bias. In particular, it is likely that countries that liberalize trade also introduce other reforms. For instance, countries with low financial development might be more likely to improve the quality of their financial markets in parallel to reforms that increase trade openness. These additional financial market reforms are likely to impact the aggregate outcomes that we study, thus making it harder to identify the effects of trade liberalization.

Given these potential concerns, we now examine the robustness of the empirical relation between financial development and the dynamics following trade liberalization, controlling for some of these factors. To do so, we estimate the following specification:

$$\Delta \ln y_i = \alpha + \beta\ \Delta\tau_i + \gamma\ \text{HighCreditGDP}_i + \theta\ \left[\Delta\tau_i \times \text{HighCreditGDP}_i\right] + \sum_{k=1}^{K} \eta_k \times X_i^k + \varepsilon_i,$$

where i indexes countries. The dependent variable $\Delta \ln y_i$ consists of the average log change of variable y in country i over the period 1990-2000 relative to 1985. Following Estevadeordal and Taylor (2013), we focus on the period from 1990 onwards to control for the heterogeneous timing in which trade reforms where introduced during the 1980s. In contrast to the previous subsection, we simplify the econometric analysis by focusing on the average changes rather than on the time series dynamics. As above, we estimate the specification for the following six aggregate outcomes: GDP, consumption, capital, investment, exports, and imports. On the right-hand side of the specification, α is a constant, $\Delta\tau_i$ is the change in average tariffs between 1985 and 2000, and HighCreditGDP_i is an indicator function that is equal to 1 if country i's average credit-to-GDP ratio prior to trade liberalization (1975-1985) is above the median and zero otherwise. Finally, we control for K additional variables $\left\{X_i^k\right\}_{k=1}^{K}$.[9]

[9]This regression focuses on the average log changes of each variable over the period 1990-2000 relative to 1985 — the variables here are not annualized to make the analysis consistent with the dynamics estimated in the first regression and Figure 1

We control for potential differences in pre-liberalization initial conditions by focusing on institutional quality and economic development. We measure institutional quality in 1985 as legal and property rights according to the Economic Freedom in the World 2005 database, and we measure economic development using real GDP per capita from the Penn World Tables 9.1. Specifically, we add the following variables as controls: (i) an institutional quality indicator that is equal to 1 if above the median and zero otherwise and its interaction with tariff changes $\Delta\tau_i$, and (ii) a developed country indicator that is equal to 1 if GDP per capita is above the median and zero otherwise and its interaction with tariff changes $\Delta\tau_i$. The final data set used to estimate this regression consists of 78 countries given the institutional quality index is not available for Nepal.

We also control for other potential changes that might have taken place in parallel to trade liberalization by focusing on changes in financial development and institutional quality.[10] To do so, we add the following variables as controls: (i) the change in the credit-to-GDP ratio between 1985 and 2000 and its interaction with tariff changes $\Delta\tau_i$ over the same period, and (ii) the log change in the institutional quality index between 1985 and 2000 and its interaction with tariff changes $\Delta\tau_i$ over the same period.[11]

We report our findings in Table 1. Panel A reports the regression estimates without additional controls. Consistent with the patterns observed in Figure 1, we find that the relation between tariff changes and the aggregate outcomes that we study is systematically related to the countries' level of financial development. These estimates are positive for all variables, showing that the aggregate outcomes are estimated to increase relatively more following trade liberalization in economies that are financially developed. These relations are statistically significant at the 5% level for all variables except for investment and exports (significant at the 10% level).

Panel B of Table 1 reports our findings controlling for pre-liberalization institutional quality and economic development. The interactions between tariff changes and the high-credit dummy variable are larger than those reported in Panel A. All variables are significant at the 5% level except for capital and investment (significant at the 10% level).

Finally, Panel C of Table 1 reports our findings controlling for both pre-liberalization institutional quality and economic development as well as for changes in institutional quality and financial development. The interactions between tariff changes and the high-credit dummy are now estimated to be even larger than in Panel B. All of these interactions are positive, as expected, and statistically significant at the 5% level.

[10] We do not consider changes in economic development given its close link with the outcomes that we study. Yet, our findings are robust to additionally controlling for changes in economic development.

[11] See Lora (2012) for a discussion on the measurement of structural reforms.

Table 1: Trade liberalization dynamics and financial development

	$\Delta \ln$ GDP	$\Delta \ln$ C	$\Delta \ln$ K	$\Delta \ln$ I	$\Delta \ln$ X	$\Delta \ln$ M
Panel A: Baseline						
$-\Delta$ Tariff	0.12	−0.12	0.28	0.84	0.78	0.76
	(0.731)	(0.717)	(0.284)	(0.133)	(0.069)	(0.109)
$-\Delta$ Tariff × High credit	2.08**	2.60**	1.58**	2.24*	2.29*	3.59***
	(0.043)	(0.015)	(0.039)	(0.077)	(0.075)	(0.006)
R-sq	0.14	0.16	0.12	0.15	0.17	0.21
Obs.	78	78	78	78	78	78
Panel B: Controls for pre-liberalization institutions and GDP per capita						
$-\Delta$ Tariff	0.20	0.01	0.38	0.99	0.86*	0.99
	(0.589)	(0.972)	(0.173)	(0.077)	(0.085)	(0.073)
$-\Delta$ Tariff × High credit	2.57**	3.28**	1.82*	2.42*	2.60**	4.21**
	(0.032)	(0.028)	(0.066)	(0.097)	(0.048)	(0.020)
R-sq	0.24	0.26	0.19	0.23	0.28	0.29
Obs.	78	78	78	78	78	78
Panel C: Controls for pre-liberalization institutions and GDP per capita						
Controls for changes in institutions and financial development						
$-\Delta$ Tariff	−0.72	−0.85*	−0.49	0.08	0.60	0.83
	(0.130)	(0.098)	(0.224)	(0.879)	(0.319)	(0.327)
$-\Delta$ Tariff × High credit	2.93***	3.66***	2.12**	3.33**	3.09**	5.05***
	(0.005)	(0.008)	(0.015)	(0.013)	(0.013)	(0.005)
R-sq	0.40	0.40	0.39	0.47	0.38	0.41
Obs.	78	78	78	78	78	78

Note: Outcome variables are computed as the average values over 1990-2000. A constant and a high-credit dummy are included in all specifications. Panel B controls for (i) good-institutions dummy and its interaction with the tariff change, and for (ii) high-GDP-per-capita dummy and its interaction with the tariff change. Panel C controls for $(i) - (ii)$ as well as for (iii) the change in Credit/GDP between 1985 and 2000 and its interaction with the tariff change, and for (iv) the change in the institutional quality index between 1985 and 2000 and its interaction with the tariff change. p-values in parentheses. $*$, $**$, and $***$ denote statistical significance at 10%, 5%, and 1% levels, respectively.

These findings suggest that the role of financial development on the dynamics following trade liberalization documented in Figure 1 is robust to controlling for additional cross-country differences in pre-liberalization initial conditions as well as for other changes that might have taken place in parallel to trade liberalization. In fact, the estimated relations

are stronger in both magnitude and statistical significance once we control for these two additional sources of variation.

Note, however, that this analysis is not exhaustive. There might be other sources of cross-country variation that are simultaneously correlated with financial development and the aggregate outcomes that we study. In the rest of the paper we address these concerns by investigating the role of financial development on trade liberalization quantitatively, using a 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, a representative producer of composite consumption goods, a representative producer 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.[12]

3.1 Entrepreneurs

Entrepreneurs are infinitely lived with preferences described by the utility function

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(c_t, h_t), \tag{2}$$

where c_t is composite consumption goods, h_t is hours worked, $\beta \in (0,1)$ is the entrepreneurs' discount factor, and U is a period utility function increasing in consumption, decreasing in hours, and concave. $\mathbb{E}_0$ denotes the expectation operator taken over the realizations of productivity shocks, described below, conditional on the information set in period zero.

We assume that the period utility function takes the form

$$U(c,h) = \frac{\left(c - \zeta h^{\omega}/\omega\right)^{1-\gamma} - 1}{1-\gamma}, \tag{3}$$

with $\gamma > 0$, $\zeta > 0$, and $\omega > 1$. These preferences are typically referred to as GHH preferences (Greenwood et al. 1988) and imply that the labor supply is independent of the level of consumption, with a wage elasticity equal to $1/(\omega - 1)$. This period utility function also

[12] See Section 2 of the Online Appendix for details on the solution of the model.

displays constant relative risk aversion with intertemporal elasticity of substitution equal to $1/\gamma$. ζ is a parameter that we use to normalize to 1 the supply of labor in steady state.

Technology Each Entrepreneur owns a single firm that produces differentiated varieties with the production function

$$y_t = z_t \left(k_t^{\alpha} n_t^{1-\alpha}\right)^{1-\alpha_m} m_t^{\alpha_m}, \tag{4}$$

where z_t is the entrepreneurs' idiosyncratic level of productivity, k_t is the capital stock, n_t is the amount of labor hired, and m_t is the amount of intermediate inputs used (e.g., materials).[13] 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 distributed normal with mean zero and standard deviation σ_ε.

Every period, entrepreneurs choose how many hours to supply to a competitive labor market. They can also accumulate capital by transforming composite investment goods purchased in period t into physical capital in period $t+1$. Let δ denote the depreciation rate of capital and x_t denote gross investment; then capital's law of motion is given by

$$k_{t+1} = (1-\delta)k_t + x_t. \tag{5}$$

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 problems 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. Firms pay a fixed cost F, in units of labor, every period that they export. Furthermore, exporters are subject to an iceberg trade cost $\tau \geq 1$, which requires firms to ship τ units for every unit that arrives at a destination. τ captures variable costs such as shipping costs, foreign marketing costs, or costs due to damages during transit of

[13] In our model, all firms are privately owned. This is consistent with Colombian data that we use to estimate our model. In 1990, there were only 80 firms listed on Colombia Securities Exchange (Bolsa de Valores de Colombia). Source: World Bank Indicators.

goods.

Financial markets Agents 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.

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

$$d_{t+1} \leq \theta P_{k,t} k_{t+1}, \tag{6}$$

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 $a_{t+1} = P_{k,t}k_{t+1} - d_{t+1}/(1+r)$.[14] Given this definition, the borrowing constraint can be written as

$$P_{k,t} k_{t+1} \leq \frac{1+r}{1+r-\theta} a_{t+1}. \tag{7}$$

Equation (7) 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 $t+1$.[15] Note 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 choose how many hours to work; receive their income from labor, profits, interest, and lump-sum transfers; 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.[16]

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

[15] 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 (7) is actually a constraint on the entrepreneurs' investment in period t. This explains why the capital is priced at price $P_{k,t}$ rather than $P_{k,t+1}$.

[16] Following Buera and Moll (2015), this timing assumption allows us to eliminate uninsured idiosyncratic

Entrepreneurs' problem Given the setup described above, the entrepreneurs' problem consists of choosing sequences of consumption (c_t), supply and demand of labor (h_t, 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 (with subscript h denoting the domestic market and subscript f denoting 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

$$c_t + P_{k,t}x_t + d_t = h_t w_t + \left[p_{h,t}y_{h,t} + e_t\left(\xi_t p_{f,t}y_{f,t} - w_t F\right) - w_t n_t - P_{k,t}m_t\right] + \frac{d_{t+1}}{1+r} + \mathcal{T}_t, \quad (8)$$

where ξ is the real exchange rate and $\mathcal{T}_t$ is a lump-sum transfer that rebates the import tariffs revenue.[17] 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 $y_{h,t} + \tau y_{f,t} = z_t\left(k_t^{\alpha} n_t^{1-\alpha}\right)^{1-\alpha_m} m_t^{\alpha_m}$.

3.2 Composite consumption goods producer

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. Each period, the problem of the producer of composite consumption goods is then given by

$$\begin{aligned} \max_{y_{h,c,t}(i), y_{m,c,t}} \; & Y_{c,t} - \int_0^1 p_{h,t}(i)y_{h,c,t}(i)di - (1+\tau_c)\xi p_{m,c,t}y_{m,c,t} \\ \text{s.t. } & Y_{c,t} = \left[\int_0^1 y_{h,c,t}(i)^{\frac{\sigma-1}{\sigma}}di + \omega_c y_{m,c,t}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \end{aligned} \quad (9)$$

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

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 $a_{t+1} = P_{k,t}k_{t+1} - d_{t+1}/(1+r)$.

[17] Lump-sum transfers are a common way to rebate tariffs in models with representative agents, but their effects on the distribution of welfare gains are not innocuous in a model with heterogeneous agents (see, for example, Carroll and Hur 2020a).

3.3 Composite investment goods producer

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, composite investment goods are 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 goods producer is given by

$$\begin{aligned} \max_{y_{h,k,t}(i), y_{m,k,t}} \; & P_{k,t} Y_{k,t} - \int_0^1 p_{h,t}(i) y_{h,k,t}(i) di - (1+\tau_k) \xi p_{m,k,t} y_{m,k,t} \\ \text{s.t. } & Y_{k,t} = \left[\int_0^1 y_{h,k,t}(i)^{\frac{\sigma-1}{\sigma}} di + \omega_k y_{m,k,t}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \end{aligned} \tag{10}$$

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

3.4 Import tariffs: Revenues and transfers

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 $\mathcal{T}_t$.

$$\mathcal{T}_t = \tau_c \xi p_{m,c,t} y_{m,c,t} + \tau_k \xi p_{m,k,t} y_{m,k,t}. \tag{11}$$

3.5 Rest of the world

The rest of the world demands varieties from domestic entrepreneurs and supplies varieties to consumption and investment good producers. Foreign demand for domestic varieties is assumed to be given by a standard downward-sloping demand function, $y_{f,t} = p_{f,t}^{-\sigma} Y_{f,t}$, where $Y_{f,t}$ is an aggregate demand shifter for the rest of the world (including foreign tariffs) and $p_{f,t}$ is denominated in units of the foreign final good. The supply of varieties used to produce the composite consumption goods and the composite investment goods are assumed to be perfectly elastic at price $p_{m,c}$ and $p_{m,k}$, respectively. Finally, the rest of the world trades bonds with domestic entrepreneurs at real interest rate r.

3.6 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' to 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 her 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.

$$\begin{aligned} v\left(k,d,z\right) = & \max_{c,h,a'} \frac{\left(c-\zeta h^{\omega}/\omega\right)^{1-\gamma}-1}{1-\gamma} + \beta \mathbb{E}_{z'}\left[g\left(a',z'\right)\right] \\ & \text{subject to} \\ & c + a' + d = hw + (1-\delta)P_k k + \pi(k,z) + \mathcal{T} \\ & a' \geq 0, \end{aligned} \tag{12}$$

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

$$\begin{aligned} \pi(k,z) = & \max_{\{p_h, y_h, p_f, y_f, n, m, e \in 0,1\}} \quad p_h y_h + e\xi p_f y_f - wn - P_k m - ewF \\ & \text{subject to} \\ & y_h + e\tau y_f = z\left(k^{\alpha} n^{1-\alpha}\right)^{(1-\alpha_m)} m^{\alpha_m} \\ & y_h = p_h^{-\sigma}(Y_c + P_k^{\sigma} Y_k),\ y_f = p_f^{-\sigma} Y_f. \end{aligned} \tag{13}$$

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.

3.7 Stationary Competitive 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 $\mathcal{S}$. Assume that p_{mc} and p_{mk} are constant

and given. 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 $\{d', k', e, c, h, m, n, y_h, y_f, p_h, p_f, Y_c, Y_k, y_{m,c}, y_{m,k}\}$, value functions v and g, and a measure $\phi : \mathcal{S} \to [0, 1]$ such that the (i) policy and value functions solve the entrepreneurs' problem; (ii) policy functions solve the problem of producers of composite consumption goods; (iii) policy functions solve the problem of producers of composite investment goods; (iv) market for each variety clears; (v) labor market clears: $\int_{\mathcal{S}} [n(s) + e(s)F] \phi(s)ds = \int_{\mathcal{S}} h(s)\phi(s)ds$; (vi) market for composite consumption good clears: $\int_{\mathcal{S}} c(s)\phi(s)ds = Y_c$; (vii) market for composite investment good clears: $\int_{\mathcal{S}} [x(s) + m(s)] \phi(s)ds = Y_k$; and $(viii)$ measure ϕ is stationary.[18]

4 Mechanism: The role of financial development

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

4.1 Cheaper access to imported production inputs

A unilateral reduction in 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 production costs. Second, it leads to a reallocation of demand by producers of the composite investment goods from domestic to imported varieties. Thus, a reduction in τ_k has both positive and negative direct effects on domestic economic activity.

The change in τ_k also induces general equilibrium effects. As domestic production costs decline, domestic producers reduce their prices which increases their competitiveness both at home and abroad. The fall in the price of domestic varieties, in turn, leads to a decrease in the price of the final consumption good and a real depreciation. As a consequence, exports increase. Finally, the increase in the total demand for domestic varieties leads to an increase in the demand for labor and, hence, an increase in real wages which leads to an increase in labor supply further boosting domestic output.

[18] See Section 2.5 of the Online Appendix for a more general formal definition of a perfect foresight competitive equilibrium that also applies to the transitional dynamics.

Thus, a reduction in tariffs on production inputs leads to increases in consumption, exports, and output.

4.2 The role of financial development

Financial development can limit the degree to which the domestic economy benefits 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, there is a higher fraction of entrepreneurs that cannot expand their production as desired, limiting the degree to which firms can benefit from trade liberalization.

Over time, however, entrepreneurs are able to accumulate funds internally, relaxing their borrowing constraints and increasing the scale of production closer to their desired level. Since severely constrained firms have the highest marginal product of capital, these firms benefit the most from relaxation of their borrowing constraints which partially offsets the initial dampening effects of lower financial development.

Furthermore, a lower τ_k also leads to a reduction in the share of financially constrained exporters: the resulting decline in the price of the composite investment good, P_k, relaxes the borrowing constraint and allows 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. Again, this effect benefits the most severely constrained entrepreneurs more and, hence, it is stronger in the less financially developed economy.

The above discussion implies that financial development has an ambiguous impact on the effect of decreasing tariffs on intermediate inputs and investment goods. 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 and the next one, we use our model to quantify the role of financial development in shaping the effects of trade liberalization. We focus on a unilateral trade liberalization that reduces tariffs on imports of intermediate and capital goods, motivated by the experience of many developing countries in the 1990s following the Washington Con-

sensus. To do so, we first estimate the model to match key features of Colombian plant-level data, an economy characterized by low financial development, and use it to evaluate the effects of Colombia's trade liberalization. Next, we examine how much more Colombia would have gained if it had the level of financial development the U.S. had at the time. Further analysis is presented in Section 6, where we (1) contrast the predictions of our model with our cross-country empirical findings (as reported in Section 2) and (2) discuss how trade liberalization's aggregate and welfare effects vary with financial development.

5.1 Estimation

To estimate 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.

To estimate these parameters, we target salient features of both plant-level data from Colombian manufactures and aggregate data for Colombia. In particular, we use 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.[19] Following Fieler et al. (2018), we use data from 1982 to 1988 to estimate the model for the period prior to the tariff reduction implemented in subsequent years. We supplement this dataset with data from the World Bank.

Pre-assigned parameters The first group of parameters is presented in Table 2 and consists of γ, σ, ω, δ, r, α, α_m, τ_c, τ_k, 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, standard values used in the literature. We set ω, which governs the Frisch elasticity of labor supply to 1.455 as in Uribe and Schmitt-Grohé (2017) and much of the emerging markets business cycle literature. In addition, we set the interest rate r to 0.06.

To be consistent with plant-level data for Colombia, we set the share of intermediates α_m to 0.50 and the capital share α to 0.50. Given the distortionary impact of financial frictions on capital accumulation, the latter implies a measured capital share of output equal to 0.4, which is in the range of the values estimated by Midrigan and Xu (2014) using the same data. Next, we set import tariffs on both consumption and capital goods to 32%, the value of average import tariffs observed in Colombia in 1988, just prior to trade liberalization. We

[19] These data have been used before by Roberts and Tybout (1997), Ruhl and Willis (2017), and Fieler et al. (2018), among others.

Table 2: Pre-assigned parameters

Parameter	Value	Description
γ	2	Risk aversion
σ	4	Elasticity of substitution
ω	1.445	Labor supply elasticity = 2.2
δ	0.1	Capital depreciation rate
r	0.06	Interest rate
α	0.50	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

also normalize the iceberg trade cost to 1.[20] Finally, we set foreign aggregate demand to 3.3 and the prices of imported capital and consumption goods to 1.[21]

Estimated parameters The set of estimated parameters consists of the fixed export cost, F; the standard deviation and autocorrelation of the productivity shocks, σ_ε and ρ; 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; the discount factor, β; and the labor weight in preferences, ζ.

We choose $\{F, \sigma_\varepsilon, \rho, \omega_c, \omega_k, \theta, \beta, \zeta\}$ to match the following moments: (i) the share of firms that export, (ii) the size of exporters relative to non-exporters (as captured by the ratio between the average domestic sales of exporters and the average domestic sales of non-exporters), (iii) the autoregressive coefficient for total sales,[22] (iv) the share of consumption goods in imports, (v) the aggregate imports-to-GDP ratio, (vi) the average amount of domestic credit extended to the private sector between 1986 and 1990 as a percentage of GDP (credit-to-GDP ratio) as reported by the World Bank, and (vii) the net-exports-to-GDP ratio. [23] Finally, we choose the labor weight in preferences, ζ, such that the aggregate

[20]Given that we estimated 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 estimate 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.

[21]The values chosen for the aggregate foreign demand and the prices of imported goods are a normalization and do not affect the results of the paper.

[22]In the data, we consider firms with all years observed in the sample and estimate the autoregressive coefficient for total sales with fixed effects.

[23]Note that a negative net-export-to-GDP ratio implies that the country is a net saver. This is because in the steady state, by definition, agents do not accumulate assets or debt in the aggregate and, thus, the current account is equal to zero. Therefore, if net export is negative, it has to be the case that the income from net foreign assets (NFA) is positive. Our choice to match the net-exports-to-GDP ratio rather than the income from the NFA position was motivated by the desire to match the moments related to exports and imports and is consistent with the rest of our estimation strategy.

Table 3: Estimated parameters – Baseline

Parameter	Value	Target moment	Data	Model
F	0.38	Share of exporters	0.11	0.11
	(0.013)			
σ_ε	0.18	Exporters' domestic sales premium	5.69	5.69
	(0.005)			
ρ	0.87	Persistence of total sales	0.86	0.86
	(0.014)			
ω_c	0.22	Imported consumption / Imports	0.27	0.27
	(0.001)			
ω_k	0.30	Imports / GDP	0.12	0.12
	(0.002)			
θ	0.27	Credit / GDP	0.25	0.25
	(0.003)			
β	0.81	Net exports / GDP	-0.03	-0.03
	(0.010)			
ζ	0.03	Labor supply in steady state	–	1
	(0.001)			

labor supply is equal to 1 in steady state.[24] We follow the simulated method of moments and choose these parameters to minimize the squared distance between the moments of the model and their data counterparts.

Table 3 reports the target moments as well as estimated parameters and their standard errors (in parenthesis).[25] As observed in the table, our model can match the target moments closely. Moreover, all parameters are tightly estimated.

Financially developed economy We contrast the baseline economy with a counterfactual economy with developed financial markets. Given our interest in comparing the welfare implications between these economies, we keep the discount rate unchanged across them; thus, we set $\beta = 0.81$, as in the baseline.[26] We then estimate F, σ, ρ, ω_c, ω_k, and θ to match moments (i)-(vi) described above, except that we now target the average credit-to-GDP ratio between 1986 and 1990 for the U.S., a financially developed economy. Finally we choose

[24] This numerical choice does not affect our quantitative results and facilitate comparison with the version of our model with inelastic labor supply.

[25] We compute standard errors for the parameters as follows. First, we compute standard errors for the target moments based on firm-level data via bootstrapping. We draw 100 samples, where each sample is populated by 12,347 plants (number of plants in the dataset) drawn with replacement from the original dataset. Second, for each set of target moments, we re-estimate all the parameters of the model. Finally, we compute the standard error of each parameter.

[26] Differences in discount rates would mechanically lead to differences in the welfare effects of trade liberalization.

ζ such that the aggregate labor supply is equal to 1 in steady state. 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 U.S. at the time. Table 4 reports the estimated parameters with their standard errors and targets for this counterfactual financially developed economy.[27]

Table 4: Estimated parameters – Financially developed

Parameter	Value	Target moment	Data	Model
F	0.59	Share of exporters	0.11	0.11
	(0.033)			
σ_ε	0.14	Exporters' domestic sales premium	5.69	5.68
	(0.003)			
ρ	0.91	Persistence total sales	0.86	0.86
	(0.012)			
ω_c	0.26	Imported consumption / Imports	0.27	0.27
	(0.002)			
ω_k	0.34	Imports / GDP	0.12	0.12
	(0.003)			
θ	0.85	Credit / GDP	1.14	1.14
	(0.006)			
β	0.81	Predetermined at baseline value	–	–
	-			
ζ	0.05	Labor supply in steady-state.	–	1
	(0.002)			

5.2 Trade liberalization in Colombia

We now use our model to quantify the effects of Colombia's trade liberalization in the early 1990s, an ambitious trade reform program in an environment with underdeveloped financial markets. At the time of trade liberalization, there was substantial skepticism about the economy's ability to accrue the large potential gains from trade. In particular, the World Bank pointed to 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).[28]

[27] In Section 3.2 of the Online Appendix, we show the effects of trade liberalization in an economy with $\theta = 0.85$ but otherwise with the same parameters as in the baseline economy, isolating the effect of the change in θ.

[28] See World Bank (1993), Roberts and Tybout (1997), and Fieler et al. (2018) for more details on Colombia's trade liberalization during this period. Alessandria and Avila (2020) also study Colombia's trade

Trade liberalization To evaluate the effects of Colombia's trade liberalization in capital and intermediate goods on the country's subsequent economic performance, we simulate a unilateral reduction in import tariffs on both consumption varieties and investment goods from 32% to 12%, as observed in Colombia over 1988-1992. We also introduce shocks to aggregate productivity, interest rates, and agents' endowments shocks to match the observed dynamics of real GDP, the investment-to-GDP ratio, and the consumption-to-GDP ratio in Colombia from 1991 to 1995.[29] Allowing for shocks during the transition period helps us to account for other factors (beyond trade liberalization) that might have affected the economy at that time.[30] We then perform a counterfactual experiment with the same shocks but no reduction in tariffs on capital and intermediate goods. Thus, the difference between our baseline economy and the counterfactual captures the effects of trade liberalization in capital and intermediate goods.

We next examine how different the impact of trade liberalization would have been if Colombia would have had the level of financial development of the U.S. at the time. To do so, we estimate the parameters of a counterfactual economy as shown in Table 4, featuring the level of credit-to-GDP of the U.S. but otherwise the same moments as in the baseline economy. As with the baseline economy, we simulate a unilateral reduction in import tariffs on both consumption varieties and investment goods from 32% to 12% and estimate a sequence of shocks chosen to target the aggregate dynamics observed in Colombia between 1991 and 1995. We then perform a counterfactual experiment with the same shocks but no reduction in tariffs on capital and intermediate goods. As before, the difference between the simulations with and without reduction in tariffs captures the effects of trade liberalization in capital and intermediate goods.

The timing of 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 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 as well as path

liberalization through the lens of a quantitative general equilibrium model and find that the decline in tariffs accounted for most of the growth in manufacturing exports over this period; Bonfiglioli (2020) highlights the possibility that other reforms may have interacted with trade liberalization in shaping firms' export dynamics: in this exercise, we make a first attempt at controlling for these additional forces.

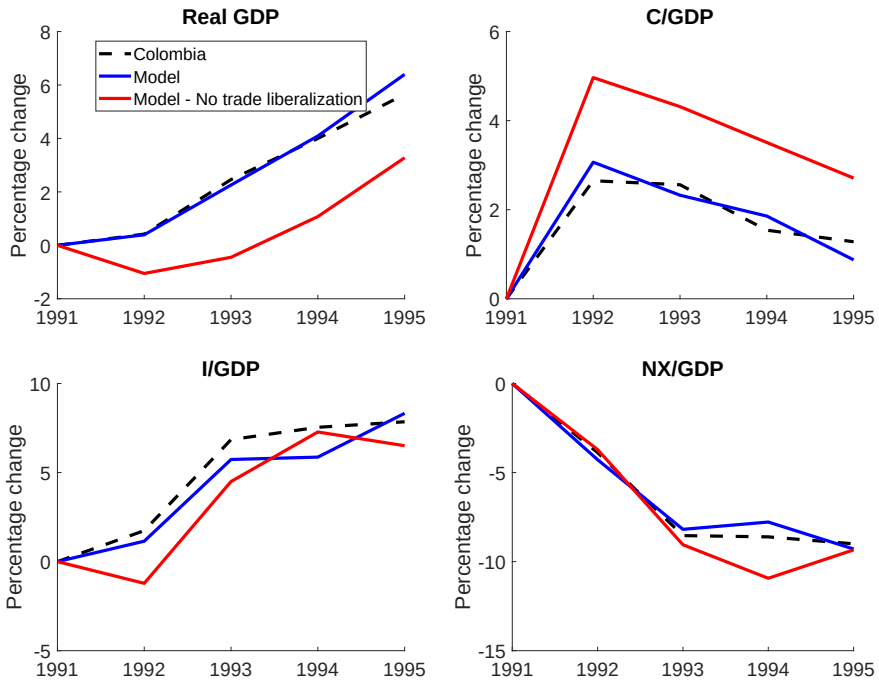
[29] Our choice to target ratios of investment and consumption to GDP rather than levels is consistent with Section 2, where we detrended variables with a common GDP trend.

[30] Aggregate productivity shocks and interest rate shocks are standard in the business cycle literature. Endowment shocks allow us to match the consumption-to-GDP dynamics. One interpretation is that these may capture exogenous capital inflows to developing countries in the 1990s (Calvo et al. 1996). In Section 3.8 of the Online Appendix we show how these shocks affect the model and report the sequence of shocks needed to match aggregate dynamics. We also discuss plausibility of estimated shocks' magnitudes.

of shocks to aggregate productivity, interest rates, and agents' endowments. Thereafter, the economy begins its transition to its new steady state.

Results Figure 2 depicts the dynamics following trade liberalization of GDP, consumption-to-GDP, investment-to-GDP, and net-exports-to-GDP for Colombia (black dashed line), the baseline model (blue solid line), and a counterfactual experiment with the same shocks but no reduction in tariffs on capital and intermediate goods (red solid line). Thus, the difference between the blue and red solid lines captures the effects of trade liberalization on capital and intermediate goods.

Figure 2: Trade Liberalization in Colombia



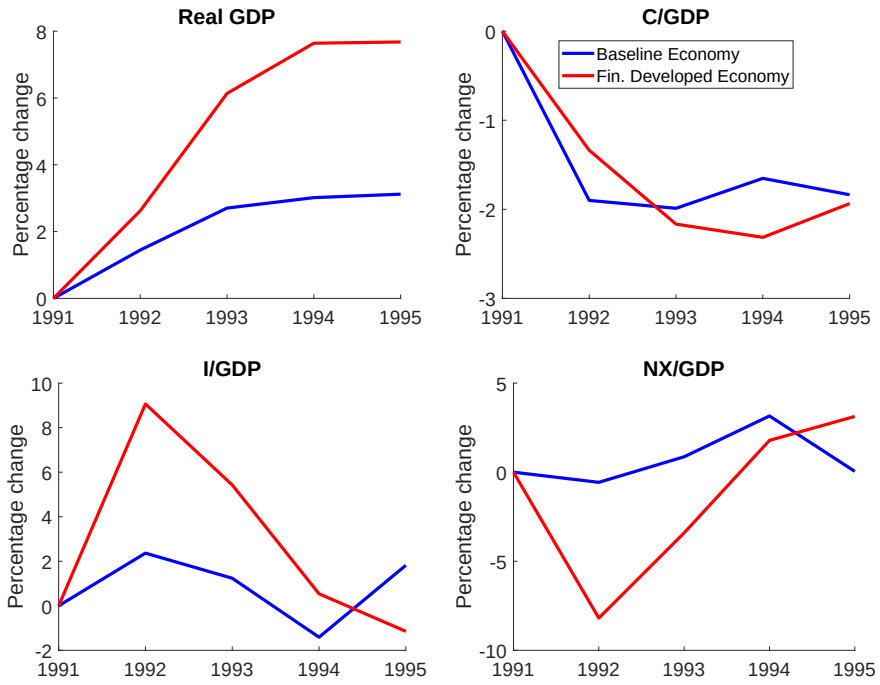
Note: This figure plots the percentage change with respect to the pre-liberalization period (1991 in the data) for the observed dynamics in Colombia (black dashed line), the baseline model (blue solid line), and a counterfactual experiment with the same shocks but no reduction in tariffs on capital and intermediate goods (red solid line).

Figure 2 shows that Colombia's trade liberalization explains a sizable portion of the growth between 1991 and 1995: The tariff decrease explains 3.1 percentage points of the 5.7-percentage-point growth in detrended GDP by 1995 (55% of the observed growth). Trade liberalization also led to lower consumption-to-GDP, higher investment-to-GDP and lower net-exports-to-GDP.[31]

[31] Notice that lower consumption-to-GDP does not imply lower consumption but instead that consumption

Figure 3 shows the effects of trade liberalization —that is, the difference between the blue and red solid lines in Figure 2— on GDP, consumption-to-GDP, investment-to-GDP, and net-exports-to-GDP for the baseline and for the financially developed economies. The effects of trade liberalization for the financially developed economy is calculated analogously, as explained above.[32] The difference between the red and blue solid lines captures the role of financial development in shaping the impact of trade liberalization in capital and intermediate goods.

Figure 3: Trade Liberalization in Colombia – Financially Developed



Note: This figure plots the predicted effects of trade liberalization for the baseline model (the difference between the blue and red solid lines in Figure 2) and for a counterfactual financially developed economy.

As shown in Figure 3, if Colombia would have had the level of financial development of the U.S. at the time, trade liberalization would have induced an increase of 7.7 percentage points in GDP by 1995 — more than twice the 3.1 percentage points implied by our baseline economy. Moreover, there would have been a much larger boom in investment and implied trade deficit. Finally, consumption would have also increased by more.[33] Thus, we find that

increased by less than GDP over this period as a consequence of trade liberalization.

[32] In Section 3.8 of the Online Appendix, we show an analogous figure to Figure 2 for the financially developed economy.

[33] Note that the financially developed economy experiences a larger increase in GDP while the ratio C/GDP changes by a similar amount in both economies.

in response to the trade liberalization, GDP, consumption, and capital in Colombia would have increase by more if Colombia have had a higher level of financial development.

In the model, trade liberalization leads to much larger investment boom in the financially developed economy since firms are able to expand their capital more easily being subject to more relaxed borrowing constraints. This in turn leads to a larger increase in GDP in the financially developed economy, which also translates into a larger increase in consumption. Finally, the larger investment boom in the financially developed economy is associated with a larger trade deficit as imports of investment goods increase to satisfy higher demand for capital and materials.

6 Financial development and gains from trade liberalization

In this section, we investigate the extent to which financial development can explain the differences in aggregate dynamics following trade liberalization between financially developed and underdeveloped countries documented in Section 2. To do so, we consider a one-time, unexpected, permanent, and unilateral reduction in import tariffs on intermediate and capital goods from 32% to 12% and contrast the effect of such change in our baseline and financially developed economies. In contrast to Section 5.2, trade liberalization is the only change in both economies, thereby isolating its impact from other concurrent changes.

As in the previous quantitative exercise, we assume that initially both economies are in stationary equilibrium and that at the beginning of period 2, trade liberalization occurs and agents learn the full path of tariffs from then on. Thereafter, the economy begins its transition to its new steady state.

6.1 Aggregate effects of trade liberalization

Long-run effects We begin by investigating the long-run effects of decreasing imports tariffs on the following key aggregate variables: output, capital, consumption, and exports. We also report the implications for the price of capital, wages, and the real exchange rate. We contrast the steady-state values of these variables before and after trade liberalization. Table 5 reports the impact of reducing τ_k in the baseline ($\theta = 0.27$) and in the financially developed ($\theta = 0.85$) economies.

Consider first the baseline economy. Table 5 shows that the long-run effects of decreasing τ_k are positive and quantitatively significant: real GDP increases by 9.8%, capital by 15.1%, and consumption by 11.9%. Moreover, real exports increase by 40% in response to trade

Table 5: Steady-state effects ($\tau_k \downarrow$)

	$\theta = 0.27$	$\theta = 0.85$
Real GDP	9.8%	11.6%
Capital	15.1%	15.7%
Consumption	11.9%	12.6%
Real exports	40.1%	33.3%
Price of capital	-1.7%	-1.7%
Wage	4.5%	4.7%
Real exchange rate	6.1%	5.1%

liberalization.[34] To understand these results, note that the lower import tariffs on intermediates and capital goods reduce the cost of production inputs, thus acting as a positive supply shock: Capital and intermediate goods become cheaper (the price of capital falls by 1.7%), leading to increases in capital and output. As the domestic final goods become cheaper, the real exchange rate depreciates by 6.1%, inducing an increase in exports. The higher demand for capital and intermediates leads to an increase in the demand for labor that, along with the falling price of final consumption goods, increases the real wage by 4.5%. Thus, consumption increases as a result of higher profits and wages.

We find that higher financial development leads to a higher long-run impact of trade liberalization. In particular, GDP grows approximately one-fifth more in the financially developed economy (11.6% vs. 9.8%), while capital and consumption are only mildly higher in this economy (15.7% vs. 15.1% and 12.6% vs. 11.9%, respectively). Exports increase relatively less in the financially developed economy (33% vs. 40%) due to the lower real depreciation following the reduction in τ_k.[35]

The above results show that differences in financial development have a modest positive impact on the long-run effects of trade liberalization. Below, we show 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 intermediates along the transition to the new steady state. Figure 4 plots the responses of real GDP, capital, real exports, and consumption following a reduction in τ_k in the baseline economy (blue solid line) and in the counterfactual financially developed economy (red

[34] We compute real variables keeping prices constant at their initial steady-state levels.

[35] 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.

dashed line), while Figure 5 plots the respective dynamics for prices.

Consider first the baseline economy. Following a reduction in τ_k, there is a decline in the cost of capital and intermediates (bottom panel of Figure 5). This decline leads to an investment boom that increases capital and GDP. The associated increases in profits and wages lead to an increase in consumption. Finally, we find that exports respond strongly on impact due to a large increase in the real exchange rate (top-right panel of Figure 5), which makes exporting more profitable and encourages entrepreneurs to reallocate their sales towards the foreign market.[36]

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 real wages. Thus, real wages steadily increase throughout the transition. 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. We find that 10 periods after trade liberalization, real GDP, capital, and consumption covered 56%, 50%, and 45%, respectively, of the distance between the initial and final steady states.[37]

Consider next the financially developed economy. In this economy with looser financial constraints, entrepreneurs are able to expand their capital faster, which leads to a more rapid increase in production. Thus, GDP, capital, and consumption grow faster in this economy than in the baseline. In particular, we find that 10 periods after trade liberalization, real GDP, capital, and consumption covered 85%, 83%, and 77%, respectively, of the distance between the initial and final steady states. Thus, the financially developed economy converges to its new steady state substantially faster than the baseline economy.

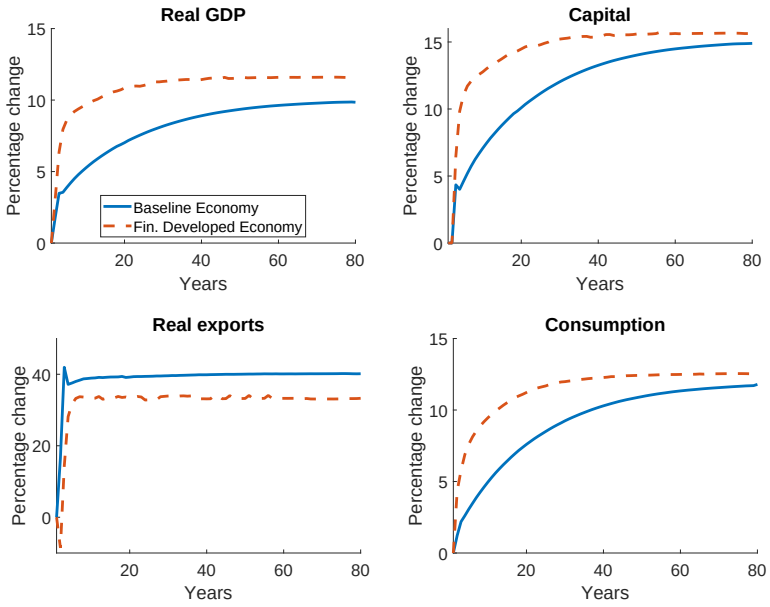
We thus conclude that financial frictions significantly slow down the adjustment to a reduction in tariffs on imports of intermediates and capital.

Quantifying the effect of financial development on trade liberalization We now compare the quantitative implications of our model with the aggregate cross-country dynamics documented empirically in Section 2. In particular, we contrast the impulse response functions implied by our model with the estimated dynamics in our data (Figure 1). These are comparable since both are computed in response to a 20-percentage-point tariff decrease

[36] 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, constrained entrepreneurs increase their foreign sales by reallocating some of their sales from the domestic to the foreign market. See also Almunia et al. (2021) for empirical evidence on this channel.

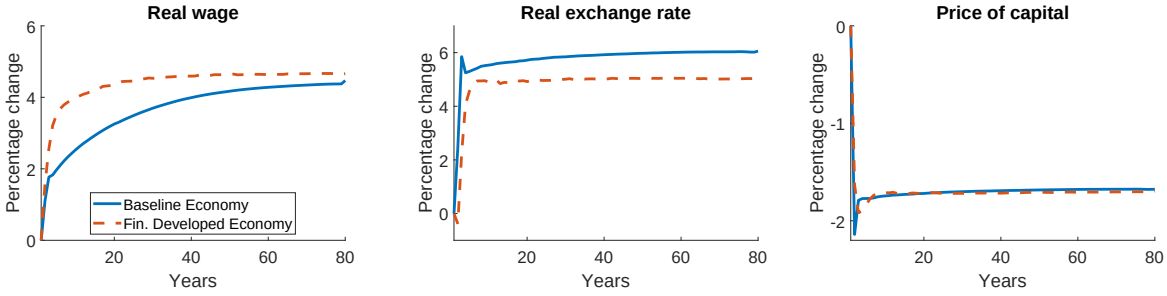
[37] For a given variable of interest x, we compute $\frac{x(t)-x^*}{x^{**}-x^*}$, where x^* is the value of x at the initial steady state and x^{**} is its value at the final steady state. In Section 3.1 of the Online Appendix, we present figures that depict the extent of convergence of these variables at any given point in time.

Figure 4: Transition dynamics following trade liberalization



Note: This figure plots the responses of real GDP, capital, real exports, and consumption following a reduction in tariffs on capital and intermediate goods in the baseline economy (blue solid line) and in the counterfactual financially developed economy (red dashed line).

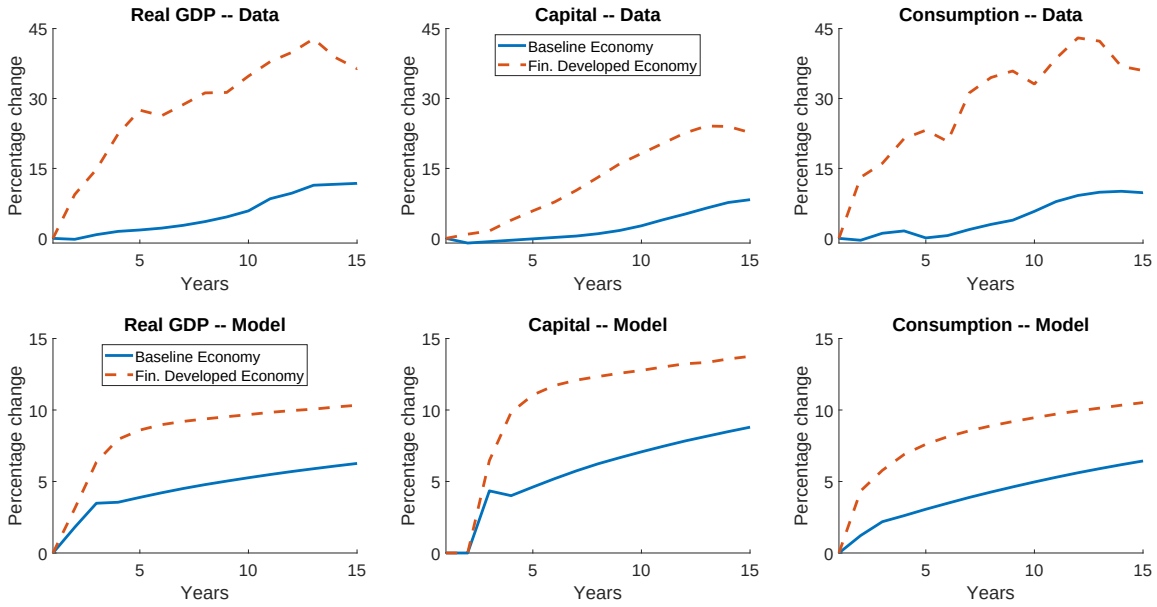
Figure 5: Price dynamics following a reduction in τ_k



Note: This figure plots the responses of real wage, real exchange rate and price of capital following a reduction in tariffs on capital and intermediate goods in the baseline economy (blue solid line) and in the counterfactual financially developed economy (red dashed line).

(as observed in Colombia between 1988-1992) and for countries with credit-to-GDP corresponding to Colombia (our target for the baseline economy) and to the U.S. (our target for the financially developed economy).

Figure 6: Trade liberalization: Model vs. data



Note: This figure plots the estimated dynamics of real GDP, capital and consumption in response to a 20 percentage points reduction in tariffs for a low-credit economy and a high-credit economy in the data (top panels) and in the model (bottom panels).

In both the data and the model, financially developed economies respond more than financially underdeveloped economies. Our model's baseline economy implies that GDP increases by 6.2% due to the reduction in tariffs in the 15 periods following trade liberalization while it increases by 10.3% in the financially developed economy. Instead, our empirical analysis suggests that 15 years after trade liberalization, an economy with Colombia's credit-to-GDP features an 11.8% higher GDP while an economy with the U.S.'s credit-to-GDP features a 36.4% higher GDP. Taking into account the whole period, our model explains 16.5% of the difference estimated in the data in the responses between the two economies in the first 15 years following trade liberalization.[38]

We obtain similar conclusions from contrasting the dynamics of consumption and capital implied by the model with those estimated in the data. Our model implies that consumption would have increased by 6.4% in the financially underdeveloped economy and 10.5% in

[38]To compute this value, we compare the area between the lines corresponding to the change in GDP in the financially developed and financially underdeveloped economies in the model with the analogous area implied by our regressions.

the financially developed while our empirical analysis implications are 9.8% and 36.0%, respectively. Overall, the model explains 16.5% of the difference in consumption responses between the two economies in the first 15 years following trade liberalization. Finally, our model implies that capital increases by 8.8% in the financially underdeveloped and 13.8% in the financially developed economy over the same period. The respective increases implied by the empirical analysis are 8.3% and 22.7%. When accounting for the first 15 years following the trade liberalization, the model explains 45.6% of the difference in the dynamics of capital between the two economies.

Thus, our model suggests that financial development would lead to larger increases in GDP (4.1 percentage points), consumption (4.1 percentage points) and capital (5 percentage points) due to trade liberalization. While these are significative increases with respect to the baseline economy (57% larger increase for capital and 65% larger for consumption and GDP), they are only a modest fraction of the changes predicted by our empirical analysis. In particular, for the 15 years following trade liberalization, the changes predicted by the model are between 17% (in the cases of GDP and consumption) to 46% (in the case of capital) of the differences between the financially developed and underdeveloped economies predicted by our empirical analysis. The differences in the estimated responses of the economies to trade liberalization could be related to other sources of cross-country variation that we are not able to account for in the regressions and are simultaneously correlated with financial development and the aggregate outcomes: For example, some of these countries may have experienced exogenous capital inflows or financial liberalization jointly with trade liberalization, or may have benefited from reduced tariffs by their trade partners. In this sense, the model is better able to capture the causal effect of trade liberalization and financial development on the aggregate dynamics of the economy.

Our study so far has focused on understanding the effects of a tariff reduction on intermediate and capital goods. In many of the countries we analyzed, however, tariffs on consumption goods were also reduced. As we show in Section 3.4 of the Online Appendix, reducing tariffs on all imports has similar effects as reducing tariffs only on intermediate and capital goods. Thus, while a decrease in consumption tariffs has a contractionary effect on the domestic economy in our model —because cheaper consumption imports crowd out domestic production—, our results suggest that most of the aggregate effects from trade liberalization are accounted for by the reduction in tariffs on intermediate and capital goods.[39]

[39] See Sections 3.3 and 3.4 of the Online Appendix for more details.

6.2 Welfare

In this section, we analyze how financial development affects the welfare gains from trade liberalization. To compute aggregate gains we use a "consumption-equivalent" welfare measure. That is, we ask how much agents' consumption would have to increase in the pre-liberalization steady-state to make them indifferent between the economy without trade liberalization and the one with lower tariffs examined above. Thus, our approach is similar to the one followed by Brooks and Dovis (2020) and Carroll and Hur (2020b).[40,41]

Aggregate welfare gains We focus first on aggregate welfare gains. Table 6 presents our findings. The first row reports the welfare gains from trade liberalization. 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 6: ΔWelfare ($\tau_k \downarrow$)

	$\theta = 0.27$	$\theta = 0.85$
Overall	0.5%	3.0%
Excluding transition	5.8%	5.8%

The first row of Table 6 shows that the overall welfare gains from trade liberalization are much lower in the economy with financial frictions: only 0.5% compared to 3.0% in the financially developed economy. Thus, low financial development substantially limits the welfare gains from a reduction in tariffs on capital and intermediates.

The second row of Table 6 instead shows that if the economies could immediately adjust to their final steady states, welfare would increase by 5.8% in both economies. That is, not only would welfare increase by much more in both economies in the absence of the slow transition due to financial frictions but welfare gains would be similar across the two economies. This suggests that the difference in welfare gains is accounted for by the faster transition to the final steady state in the financially developed economy.

Welfare gains across agents To better understand the heterogeneous welfare gains from trade liberalization, we investigate how welfare gains vary across different subsets of en-

[40] A formal definition of the welfare measure used can be found in Section 3.7 in the Online Appendix.

[41] Our model assumes a particular ownership structure of firms where each household owns exactly one firm. This assumption is standard in the literature that studies welfare in the environments with heterogeneous firms (see, for example, Buera and Shin (2011), Moll (2014), or Tetenyi (2021)). An alternative way to measure gains from trade liberalization is to compute changes in the present discounted value (PDV) of firms' profits. In Section 4 of the Online Appendix, we report results using that measure.

trepreneurs. In particular, we quantify the welfare gains for "winners" versus "losers," and for "exporters" versus "non-exporters." Table 7 reports our results.

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

	$\theta = 0.27$	$\theta = 0.85$
All	0.5%	3.0%
Winners	0.7%	3.0%
Losers	-0.2%	– %
Exporters	2.4%	5.1%
Non-exporters	0.5%	3.0%

In the financially underdeveloped economy, we find that the majority of entrepreneurs are better off following trade liberalization (winners), with average gains equivalent to 0.7% of their steady-state consumption. However, 8.5% of entrepreneurs are worse off (losers), with their average losses equal to 0.2% of their steady-state consumption. In contrast, welfare increases for all entrepreneurs in the financially developed economy.

Table 7 also shows that exporters in both economies gain more than non-exporters. However, gains for non-exporters are one-fifth of those for exporters in the economy with low financial development. In contrast, non-exporters' gains are about half of those of exporters in the financially developed economy. These differences are driven by the higher share of income of non-exporters accounted for by wages and tariff revenue, and the higher wage increase in the financially developed economy.

7 Conclusions

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 first show empirically that economies with developed financial markets exhibit a faster rate of growth for GDP, consumption, capital, investment, imports and exports, than financially underdeveloped economies. These findings are robust to controlling for additional cross-country differences in initial conditions as well as for other changes that might have taken place in parallel to trade liberalization.

However, it is possible that there are other sources of cross-country variation that might be simultaneously correlated with financial development and the aggregate outcomes that we study. To address these concerns, we set up a quantitative general equilibrium model with heterogeneous firms and frictions in financial markets, and use it to investigate the

role of financial development on trade liberalization quantitatively. We first evaluate the effects of Colombia's trade liberalization in the early 1990s —an economy characterized by low financial development— and ask how much more Colombia would have gained if it had been financially developed, considering a counterfactual economy parameterized to resemble Colombia but with the level of financial development of the U.S. We also contrast the predictions of our model with our cross-country empirical findings and find that low financially development substantially decreases the gains from trade liberalizations — both in terms of GDP and welfare.

More broadly, our findings provide a rationale for the 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 external finance.

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