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 import tariffs on capital and intermediate inputs. We document that financially underdeveloped economies feature a slower aggregate response following trade liberalization. We set up a quantitative general equilibrium model with heterogeneous firms subject to collateral constraints and estimate it to match salient features from Colombian plant-level data. Our model explains a substantial fraction of the differences in the empirical responses of GDP, consumption, and capital across economies with different levels of financial development. Slow adjustment due to collateral constraints reduces welfare gains from trade liberalization.

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 suggests 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 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 capital and 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. We find that low financial development significantly limits the impact of lowering tariffs on production inputs, reducing the welfare gains from trade liberalization. Moreover, our model accounts for a substantial fraction of the empirical dynamics following trade liberalization across countries that differ in financial development.

Our paper contributes to the literature along three dimensions. First, we document that financially underdeveloped economies grow relatively slower than their financially developed counterparts after trade liberalization. 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. Importantly, 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

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

by financial frictions. 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 subgroups.

We begin by documenting that financially underdeveloped economies grow more slowly than their financially developed counterparts after reducing import tariffs. Our empirical approach extends the analysis conducted by Estevadeordal and Taylor (2013) and investigates the role of financial development on the dynamics of key aggregate outcomes following trade liberalization. We find that financially underdeveloped economies feature persistently slower responses of GDP, consumption, and capital following trade liberalization. In particular, we find that 15 years after trade liberalization, GDP, consumption, and capital are 25% to 40% larger on average across financially developed economies versus approximately 10% larger on average across financially underdeveloped economies.

We show that these differences in the post-liberalization dynamics across economies with different levels of financial development are robust to controlling for pre-liberalization differences in institutional quality and economic development as well as to controlling for other potential changes that might have taken place in parallel to trade liberalization such as changes in financial development and institutional quality. As standard across empirical analyses based on observational data, other variables might nevertheless remain omitted, potentially biasing some of our findings.

We investigate the role of financial development in accounting for these findings by setting up a quantitative general equilibrium model of international trade with frictions in financial markets. 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.

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 imports of capital and intermediate inputs. We contrast our findings relative to a counterfactual economy with developed financial markets parametrized to resemble financial development in the U.S. Consistent with the data, we find that differences in financial development significantly reduce the short- and long-run impacts of trade liberalization on GDP, consumption, and capital. These findings show that improved access to production inputs has a fundamentally different impact across economies that differ in 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 allows firms to accumulate physical capital in order to achieve their optimal scale. Therefore, in economies with underdeveloped financial markets, the adjustment of firms' production scale in response to trade liberalization is substantially slower — and thus are the responses of aggregate output, consumption, and capital. In particular, we find that 10 years after trade liberalization GDP, capital, and consumption only reach 56%, 50%, and 45%, respectively, of the transition to the post-liberalization steady state. In contrast, in the financially developed economy these values are 85%, 83%, and 77%, respectively.

We then contrast the aggregate dynamics implied by the model with their empirical counterparts as described above. We investigate the responses of key aggregate variables (GDP, capital, and consumption) to a 20-percentage-point reduction in tariffs on imports of capital and intermediates inputs, as observed in Colombia over 1988-1992. We find that our model accounts for a significant fraction of the patterns observed in the data. Over the 15 years following trade liberalization, the model accounts for 16% of the empirical difference in GDP dynamics between the financially developed and underdeveloped economies. Similarly, the model accounts for 17% and 46% of the differences in consumption and capital dynamics, respectively, due to financial development observed in the data over the 15 years following trade liberalization.

We find that cross-country differences in financial development have significant implications for the welfare and distributional effects of trade liberalization. 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 the gains from trade liberalization: These are larger among productive firms that are financially constrained, as cheaper capital and intermediate inputs relax their borrowing constraints, allowing them to increase their scale of operation. Moreover, welfare gains are larger across wealthy entrepreneurs (1.7% in consumption-equivalent units for wealthy entrepreneurs vs. 0.5% for poor ones in the baseline) and exporters (2.4% for exporters vs. 0.5% for non-exporters in the baseline).

We additionally decompose the welfare effects of trade liberalization to identify the key channels that account for our results. Our findings show, on the one hand, that the decline in tariff revenue (which is redistributed lump-sum across agents) has a particularly negative impact on the welfare of low-income agents and non-exporters, since this revenue represents a larger proportion of their income. On the other hand, changes in the real 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 poor agents and non-exporters; this channel is stronger in the financially developed economy. 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 use our model to quantify the effects of the tariff reduction implemented in Colombia in the early 1990s and investigate the extent to which financial underdevelopment might have slowed down the post-liberalization adjustment. To account for other potentially omitted factors that might have affected the economy at the time of trade liberalization, this alternative quantitative experiment considers the impact of additional shocks chosen 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 trade liberalization in Colombia explains more than half of the growth between 1991 and 1995. In particular, by 1995, the decrease in capital goods tariffs explained 3.1 percentage points of the 5.7-percentage-points growth in observed GDP. In the financially developed economy, instead, GDP growth by 1995 due to trade liberalization would have been equal to 7.7 percentage points. That is, our model suggests that if Colombia would have 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.

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.

Our paper contributes to several strands of the literature. First, we contribute to 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), argue 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

[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.

(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). 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 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.[4] 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 versus consumption in accounting for the observed cross-country dynamics.

[4]See Kohn et al. (2022) for a review of this literature.

[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.

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

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 contrast countries undergoing trade liberalization under alternative financial environments. Finally, we use data on aggregate variables. The data used throughout the analysis is at annual frequency, and we now describe it in more detail.

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 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.

Figure 1 plots the elasticity over time associated with a 20-percentage-point decline in tariffs for each of the aggregate variables. 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

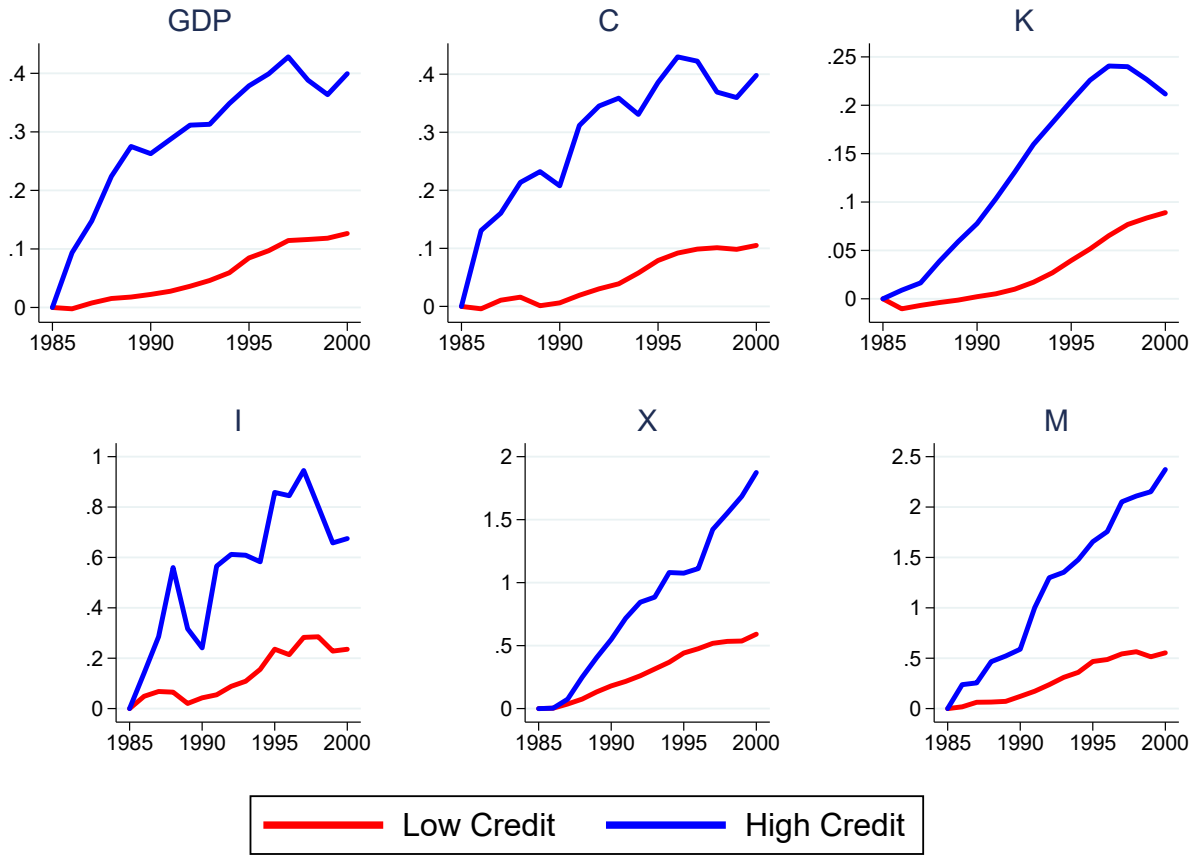

Figure 1: Trade liberalization dynamics and financial development

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 Section 5.

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 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:

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

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 $\left\{X_i^k\right\}_{k=1}^K$.

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 $\Delta\tau_i$.

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.[7] 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.

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

[7]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.

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.

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.

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. 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. 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.[8]

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

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

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

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

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 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 Entrepreneurs produce 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). 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 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 $a_{t+1} = P_{k,t}k_{t+1} - d_{t+1}/(1+r)$.[9] 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 $t+1$.[10] 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

[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 (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 $P_{k,t+1}$.

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.[11]

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.[12] 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

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

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

[12] 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). In Section 5.2, we discuss their implications for our welfare results.

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.

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.[13]

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 and increase their competitiveness relative to imports competition, which offsets at least partially the reallocation of demand from domestic to imported varieties by producers of composite investment goods. More importantly, it also leads producers of composite consumption goods to reallocate their demand from

[13] 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.

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 increase in wages leads to an increase in labor supply, which further increases domestic output and investment (since labor and capital are complements). The domestic economy thus becomes richer when tariffs on imported production inputs are reduced. Finally, the decline in the price of domestic varieties leads to a lower price of the consumption composite goods, leading to a real depreciation. This depreciation leads to higher exports and further increases domestic output.

The gains from a unilateral reduction in τ_k, however, are not evenly spread across individuals: exporters, productive and wealthy entrepreneurs benefit directly more from higher demand for domestic varieties. Yet, these gains are redistributed through several channels. First, real wages increase in response to the higher demand for domestic varieties, which disproportionately benefits low-productivity and low-net-worth entrepreneurs for whom wages constitute a higher share of their total income. Second, low-net-worth agents are negatively affected by the lower tariff revenues, since tariff revenues constitute a higher share of their income.

Thus, a reduction in tariffs on production inputs leads to increases in consumption and exports. As a result, it also leads to an economic boom with increased production by all entrepreneurs. While these gains are unevenly spread across entrepreneurs, there is substantial redistribution of gains across individuals.

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 ex-

porters: The resulting decline in the price of the composite investment good, P_k, 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. 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, we investigate quantitatively how financial development affects the aggregate, distributional, and welfare effects of unilateral trade liberalization that reduces tariffs on imports of intermediate and capital goods.[14]

To quantify the role of financial development, we consider a unilateral trade liberalization as the one that Colombia underwent in the early 1990s. We first calibrate the model to match key features of Colombian plant-level data, an economy characterized by a low level of financial development, and then 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 (the level of financial development of the U.S. at the time) but otherwise calibrated to match the same key features of Colombian plant-level data as in the baseline. We interpret differences in the effects of trade liberalization across these economies as accounted for by differences in financial development. In particular, we compare the aggregate, distributional, and welfare effects, both in the long run and along the transition, between the baseline economy and those implied by the counterfactual economy with developed financial markets. Finally, we contrast our findings in this section with those in Section 2 to quantify the extent to which differences in financial development in the model can account for the differences estimated in the cross-country data.

[14]We focus on unilateral trade liberalizations motivated by the experience of many developing countries in the 1990s following the Washington Consensus.

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

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 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; these are 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. Note that, 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 also normalize the iceberg trade cost to 1.[15] Finally, we set foreign aggregate demand to 3.3 and the prices of imported capital and consumption goods to 1.

[15]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.

Calibrated parameters The set of calibrated 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.

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

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[17], (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. Finally, we choose the labor weight in preferences, ζ, such that the aggregate labor supply is equal to 1 in steady state. 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 calibrated parameters and their standard errors (in parenthesis).[18] 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;

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

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

[18]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.

Table 3: Calibrated 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)			

thus, we set $\beta = 0.81$, as in the baseline.[19] 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 ζ such that the aggregate labor supply is equal to 1 in steady state.[20] 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 calibrated parameters with their standard errors and targets for this counterfactual financially developed economy.

5.2 Trade liberalization on intermediate and investment goods

We now investigate the extent to which financial development affects the aggregate dynamics following trade liberalization and its welfare implications. To do so, we contrast our calibrated baseline and counterfactual economies. We consider the stationary equilibrium of each of our calibrated models and examine the impact of reducing import tariffs on intermediate and capital goods by the magnitudes observed in Colombia between 1988 and 1992. In

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

[20] 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.

Table 4: Calibrated 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)			

particular, we consider a one-time, unexpected, and permanent reduction in import tariffs from 32% to 12%.

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. Thereafter, the economy begins its transition to its new steady state.

We begin by examining how lowering import tariffs affects 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 between the baseline and financially developed economies. We then contrast our findings on the effects of financial development with the estimates from cross-country data documented in Section 2. We conclude this section by investigating the welfare effects of trade liberalization, its distributional consequences, and the role of financial development.

5.2.1 Aggregate effects of trade liberalization

Long-run effects We begin by analyzing the long-run aggregate effects on the following key aggregate variables of decreasing imports tariffs on capital and intermediates: 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.

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%

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 liberalization.[21] To understand these results, note that the lower import tariffs on intermediates and capital 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). In contrast to the evidence reported in Section 2, exports increase relatively less in the financially developed economy (33% vs. 40%) due to the lower real depreciation following the reduction in τ_k.[22]

The above results show that differences in financial development have a modest positive impact on the aggregate effects of trade liberalization in the long run. Below we show that

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

[22] 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.

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 2 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 dashed line), while Figure 3 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 3). This decline leads to an investment boom that increases capital and GDP. The associated increases in profits and wages (see Figure 3) 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 3), which makes exporting more profitable and encourages entrepreneurs to reallocate their sales towards the foreign market.[23]

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. 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.[24]

Consider next the financially developed economy. In this economy, entrepreneurs are able to expand their capital faster (as they face looser financial constraints), 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.

[23] 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 (even if they cannot increase their total sales due to binding financial constraints) 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.

[24] 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.

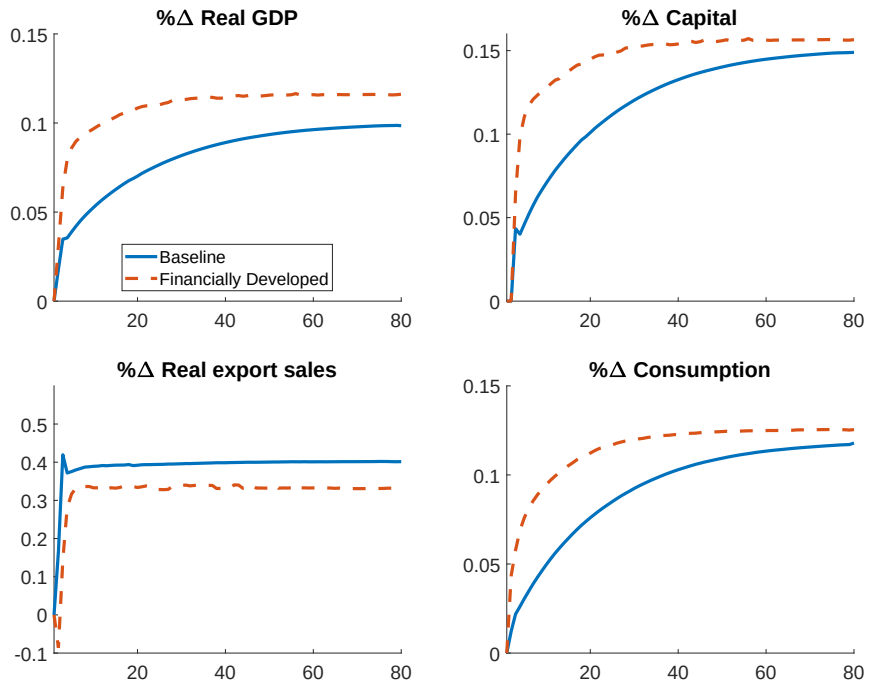

Figure 2: Transition dynamics following a reduction in τ_k

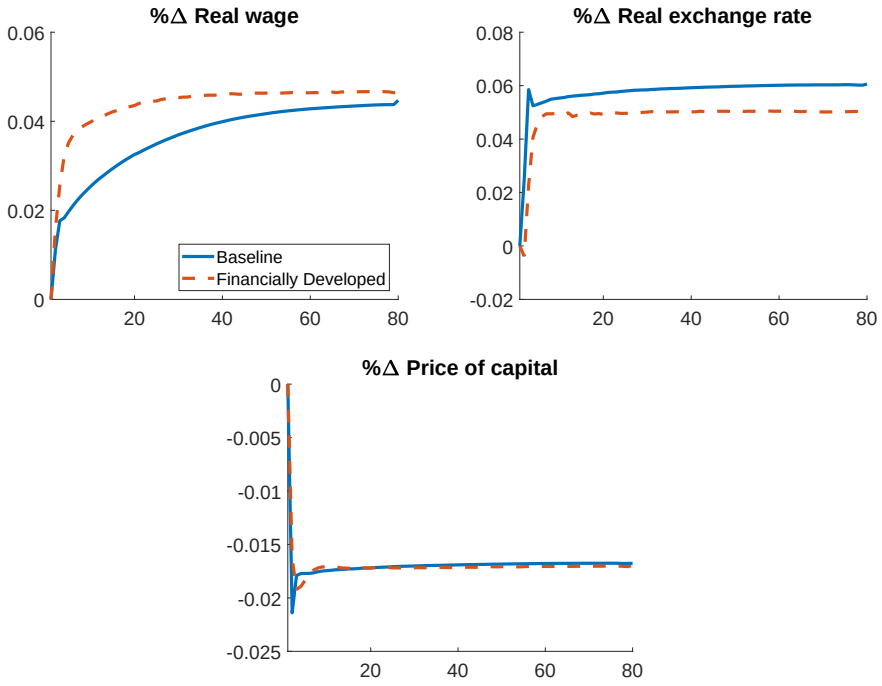

Figure 3: Price dynamics following a reduction in τ_k

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

Quantifying the effect of financial development on trade liberalization We now compare the quantitative implications of our model with the aggregate 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). Note these are comparable since both are computed in response to a 20-percentage-point tariff decrease (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).

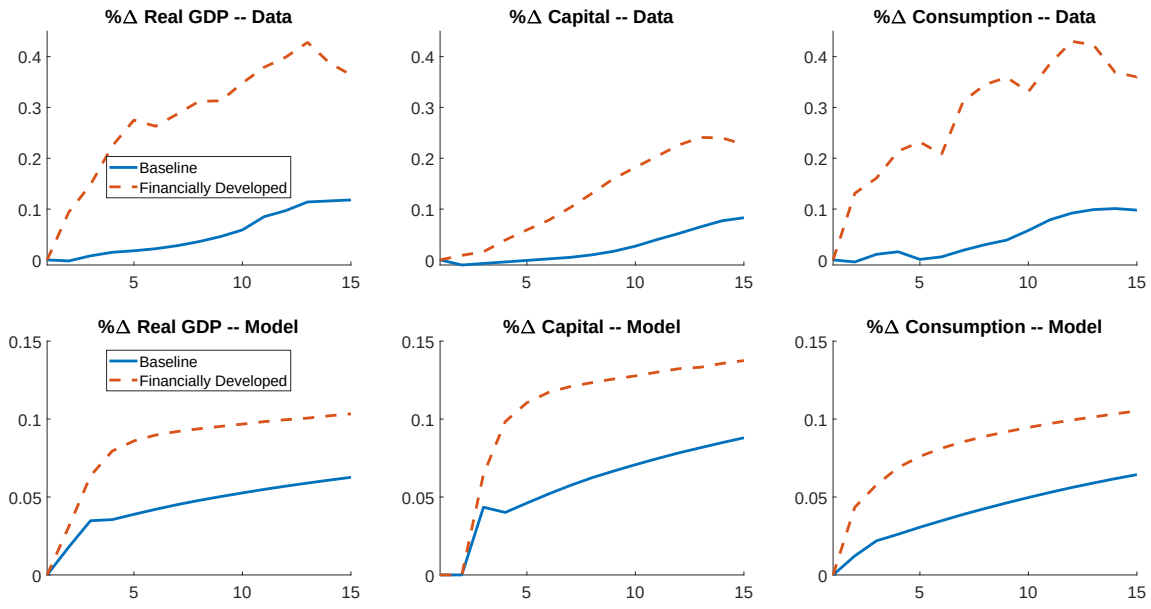

Figure 4: Trade liberalization: Model vs. data

In both the data and the model, financially developed economies respond more and do so more rapidly than financially underdeveloped economies. Starting with GDP, our empirical analysis shows 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 — a 208% larger increase. Our model implies that the financially developed economy experiences a 65% larger GDP increase relative to the

financially underdeveloped economy. Overall, our model can explain 16.5% of the difference estimated in the data in the responses between the two economies in the first 15 years following trade liberalization.[25]

We obtain similar conclusions from contrasting the dynamics of consumption and capital implied by the model with those estimated in the data. Our empirical analysis implies that consumption would have increased by 9.8% in the financially underdeveloped economy and 36.0% in the financially developed economy, while our model's respective implications are 6.4% and 10.5%. 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 empirical analysis implies that capital increases by 8.3% in the financially underdeveloped and 22.7% in the financially developed economy over the same period. The respective increases implied by the model are 8.8% and 13.8%. 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.

These results show that, for the 15 years following trade liberalization, the model explains between 17% (in the cases of GDP and consumption) to 46% (in the case of capital) of the observed differences between the financially developed and underdeveloped economies. Some of the differences in the estimated responses of the economies to trade liberalization could be related to other factors that we are not able to account for in the regressions: 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 Section 6, we revisit our findings in a quantitative analysis that incorporates other shocks during the transition, to match the aggregate dynamics observed in Colombia, accounting for some of the factors omitted in this section.

Trade liberalization on all imports It is useful to compare the effects of trade liberalization on intermediate and capital goods to the effects of trade liberalization on all imports, including consumption goods. As we show in Section 3.4 of the Online Appendix, the effects of reducing tariffs on all imports have similar effects as reducing tariffs only on intermediate and capital goods. In the baseline economy, following a decrease in τ_c *and* τ_k from 32% to 12%, in the long run, GDP increases by 9.4%, capital by 14.6%, consumption by 11.8%, and real exports by 48.8%. Thus, except for exports, aggregate variables increase by less than when only tariffs to investment goods are reduced: A decrease in τ_c has a contractionary effect on domestic economy because cheaper consumption imports crowd

[25]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.

out domestic production.[26] Similar effects shape the dynamics in the financially developed economy. However, we find that the speed of transition to the new steady state following decreases in τ_c and τ_k is very similar to the one observed following a decrease in only τ_k. Therefore, our results suggest that most of the aggregate effects from trade liberalization are accounted for by tariffs on intermediate and capital goods.

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 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 steadystate 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).[27]

Formally, let $v_0^g(s)$ be the value function of an entrepreneur in state s in the initial steady state when its consumption has been increased by g percent forever. That is,

$$v_0^g(k,d,z) = U((1+g)c_0^*(s), h_0^*(s)) + \beta \mathbb{E}[v_0^g(k_0^{*\prime}, d_0^{*\prime}, z')], \tag{14}$$

where c_0^*, h_0^*, k_0^*, and d_0^* are entrepreneurs' optimal consumption, labor supply, capital, and debt choices in the initial steady state. Note that when $g = 0$, v_0^g is simply the value function in the initial steady state. Recall that we defined $s = \{k, d, z\}$ to be the vector of entrepreneurs' states and $\mathcal{S}$ to be the state space. To compute aggregate welfare gains, we solve for g such that

$$\int_{\mathcal{S}} v_0^g(s)\phi_0(s)ds = \int_{\mathcal{S}} v_T(s)\phi_0(s)ds, \tag{15}$$

where $\phi_0(s)$ is the initial steady state's stationary measure and $v_T(s)$ is the value function of an entrepreneur in state s in period 2 right after trade liberalization.

Similarly, we compute the welfare gains for a group of entrepreneurs whose state just before the trade liberalization belonged to a subset $\mathcal{S}_0$ of the state space (for example,

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

[27] It should be pointed out that 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)).

exporters and non-exporters) and we solve for g such that

$$\int_{\mathcal{S}_0} v_0^g(s)\phi_0(s)ds = \int_{\mathcal{S}_0} v_T(s)\phi_0(s)ds, \tag{16}$$

As mentioned above, the above measures of welfare gains are standard in the literature. However, in a model with heterogeneous firms, alternative way to measure gains from trade liberalization is to compute change sin present discounted value (PDV) of firms' profits. In Section 4 of the Online Appendix, we report results using that measure, which are qualitatively similar to those reported below.

Aggregate welfare We focus first on aggregate welfare gains. Table 6 presents our findings. The first row reports the welfare gains from trade liberalization as defined in Equation (15). 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 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 economies could immediately adjust to their final steady states, then welfare would increase by 5.8% in both economies. That is, not only would welfare increase much more in both economies in the absence of the slow transition due to financial frictions, but gains would be the same across the two economies. This finding indicates that the difference in welfare gains between the two economies is fully accounted for by the faster transition to the final steady state in the financially developed economy.

Welfare distribution To better understand the heterogeneous welfare gains from trade liberalization, we next investigate how welfare gains vary across different subsets of entrepreneurs and across the joint distribution of assets and productivity.

We first investigate welfare gains for "winners" versus "losers," exporters versus non-exporters, and "wealthy" versus "poor" agents.[28] We compute the average welfare gains for each subset of entrepreneurs using Equation (16). 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%
Wealthy	1.7%	4.0%
Poor	0.5%	3.0%

In the financially underdeveloped economy, we find that the majority of entrepreneurs are better off following the 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, in the economy with low θ, gains for non-exporters are one-fifth of those for exporters. In contrast, in the financially developed economy, non-exporters' gains are about half of those of exporters. Similar effects can also be seen when comparing wealthy and poor agents, with poor agents experiencing high welfare gains in the financially developed economy. These differences are driven by the higher share of income of these agents accounted for by wages and tariff revenue, and the higher wage increase in the financially developed economy.

To further understand the heterogeneous effects of trade liberalization across agents, we compute welfare gains across the joint distribution of assets and productivity. To do so, we partition the agents into asset and productivity quintiles. Using Equation (16), we compute the average welfare gains across agents 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 ($j \in \{1, ..., 5\}$). In addition, for each bin (i, j), we compute the measure of entrepreneurs with negative welfare gains (i.e., the share of losers out of all agents). Figure 5 presents our results.

[28] We define "losers" ("winners") as entrepreneurs in state s such that $v_0^0(s)$ is greater (smaller) than $v_T(s)$. We define wealthy (poor) agents as those in the top 10% (bottom 90%) of the wealth distribution.

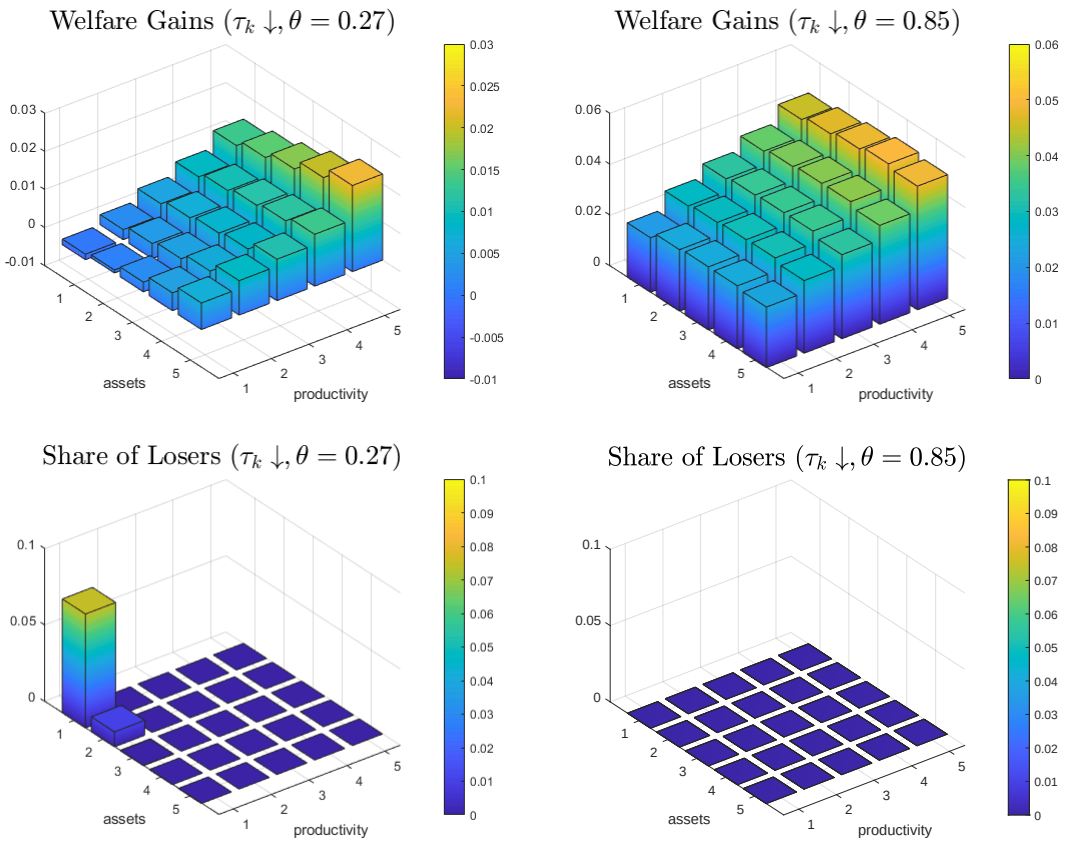

Figure 5: ΔWelfare ($\tau_k \downarrow$) distribution

The top row of Figure 5 illustrates the welfare gains from trade liberalization across different net worth and productivity quintiles for the baseline economy (top-left panel) and for the financially developed economy (top-right panel). We observe that average welfare gains are much higher in the financially developed economy: Gains are uniformly higher across all net worth and productivity bins. However, there are also significant differences in the distribution of these gains across agents. In the baseline economy, gains are mostly concentrated among the richest and most productive entrepreneurs, while in the financially developed economy, welfare gains are distributed more uniformly across the assets distribution.

The bottom panels of Figure 5 plot the share of losers in each asset and productivity bin for the baseline economy (bottom-left panel) and for the financially developed economy (bottom-right panel). While a substantial share of agents (8.5%) is made worse off by trade liberalization in the baseline model — those agents with the lowest productivity and net worth — all agents are better off in the financially developed economy.

Table 8: Δ Welfare decomposition ($\tau_k \downarrow$)

	Tariffs income (τ_k)	Investment (P_k, Y_k)	Exchange rate (ξ, Y_c)	Wage (w)	Total
$\theta = 0.27$	-1.7%	0.8%	0.5%	0.8%	0.5%
$\theta = 0.85$	-1.3%	1.6%	1.2%	1.5%	3.0%

Decomposition of welfare gains We now investigate the channels that account for the welfare results reported above. To do so, we decompose the aggregate welfare gains into four channels through which changes in τ_k affect welfare.[29]

The first channel captures the effect on welfare of the decline in tariff revenue redistributed to agents following trade liberalization, the "tariffs income" channel. The second channel captures the effect of τ_k on the price of investment goods and the demand for domestic varieties by investment good producers, the "investment" channel. These two channels capture the "direct effects" of trade liberalization. The remaining two channels capture general equilibrium effects. In response to trade liberalization, cheaper materials lead to a decline in the price of the final consumption goods and, thus, to a depreciation of the real exchange rate, the "exchange rate" channel. Finally, wages increase following trade liberalization given the increased demand for labor, the "wage" channel.

To quantify the strength of these channels, we perform a series of partial equilibrium computations. In particular, to compute the tariffs income channel, we assume that along the transition and in the final steady state, agents face the initial steady-state prices and aggregate quantities but receive reduced tariff revenue as observed along the equilibrium path following trade liberalization. Similarly, to compute the investment channel, we assume that agents only face the equilibrium changes in P_k and Y_k, with other quantities fixed at their initial steady-state levels; for the exchange rate channel, we assume that agents only face the equilibrium changes of ξ and Y_c; and, finally, for the wage channel, we assume agents only experience the equilibrium change in wages.[30]

Table 8 reports the welfare decompositions for the baseline and financially developed economies. We find that the decline in tariff income has a large negative effect on welfare: The average loss due to lower tariff income is -1.7% in the baseline economy and -1.3% in the financially developed one. In contrast, the investment, exchange rate, and wage chan-

[29] As above, aggregate welfare gains are computed using Equation (15). In Section 3.7 of the Online Appendix, we also present group-specific welfare gains computed using Equation (16).

[30] For these computations, we follow Carroll and Hur (2020b) and introduce measure-zero agents that optimize in response to prices and aggregate quantities different from the ones observed in equilibrium but do not affect equilibrium prices and aggregate quantities.

nels contribute positively to welfare in both economies, but are stronger for the financially developed one, as agents in that economy can expand their production relatively more on impact.[31]

As we show in Section 3.7 of the Online Appendix, the negative tariff income effect is particularly strong among poor agents and non-exporters since tariff revenue represents a larger proportion of income for these agents. In contrast, the investment and exchange rate channels benefit wealthy agents and exporters more since they can adjust their production relatively more in response to the higher demand and thus take more advantage of cheaper capital goods. Finally, we find that higher wages following trade liberalization help redistribute part of the welfare gains from wealthy agents and exporters towards poor agents and non-exporters, and substantially more so in the financially developed economy.

6 Trade liberalization in Colombia

In this section, we 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. 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% between 1990 and 1992. 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 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).[32]

To evaluate the effects of Colombia's trade liberalization on the country's subsequent economic performance, we perform a quantitative experiment that allows for other shocks during the transition to match the aggregate dynamics observed in Colombia. We also examine how different the impact of trade liberalization would have been if Colombia would

[31] In Section 3.5 of the Online Appendix, we investigate the effects of trade liberalization in a counterfactual economy in which tariff revenues do not decline after trade liberalization but in which prices and quantities are allowed to adjust and clear the markets. We find that while aggregate welfare increases more in both the baseline and in the financially developed economies because there is no decline in tariff revenue, the difference between them due to financial development is robust.

[32] 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 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.

have had the level of financial development of the U.S. at the time. 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. Therefore, this analysis complements the findings reported in Section 5.2.1, which omitted other factors that might have affected the economy at the time of trade liberalization.

More specifically, we investigate the effects of 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 assume the economy is subject to a sequence of shocks that we choose to match the dynamics of real GDP, the investment-to-GDP ratio, and the consumption-to-GDP ratio in Colombia from 1991 to 1995. To do so, we introduce shocks to aggregate productivity, interest rates, and agents' endowments. 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.[33,34]

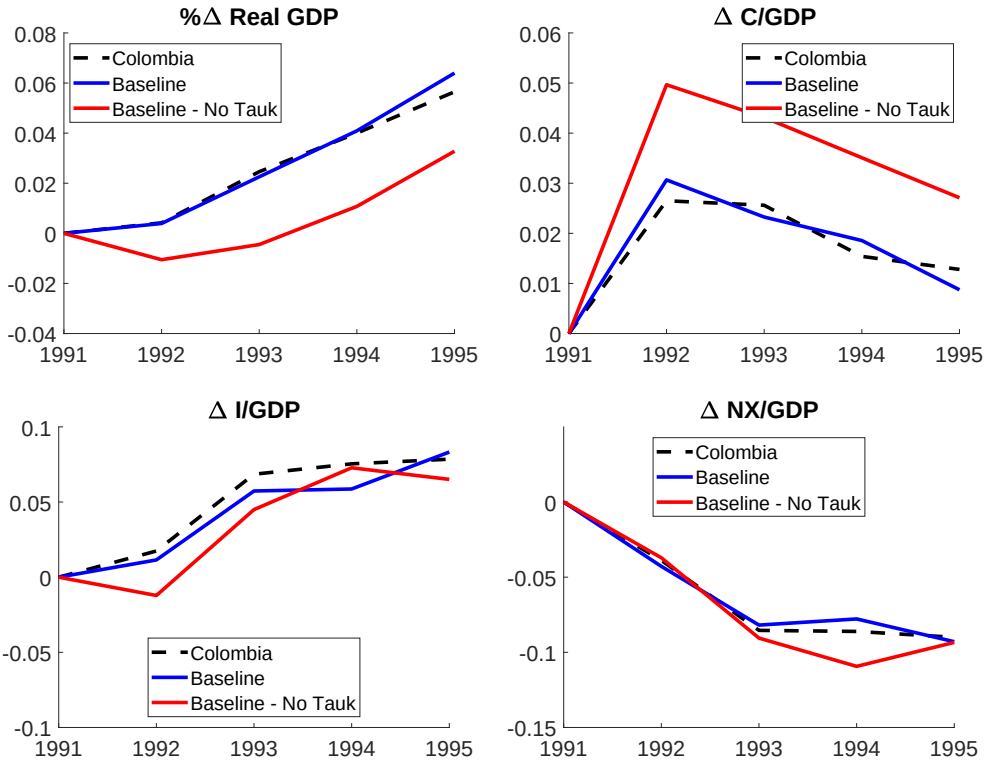

Figure 6: Trade Liberalization in Colombia

[33]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.

[34]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).

Figure 6 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 6 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.[35]

We then perform an analogous exercise for our financially developed economy. Recall that this is an economy calibrated to feature the level of credit-to-GDP of the U.S. but that otherwise targets the same moments as in the baseline economy. In the same spirit, we estimate an alternative sequence of shocks chosen to target the aggregate dynamics observed in Colombia between 1991 and 1995. Figure 7 shows the effects of financial development (the difference between the blue and red solid lines in Figure 6) on GDP, consumption-to-GDP, investment-to-GDP, and net-exports-to-GDP for the baseline and for the financially developed economies.[36]

As shown in Figure 7, if Colombia would have had the level of financial development of the U.S., 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. Our findings confirm the results in Section 5: In response to trade liberalization, GDP, consumption, and capital increase more in financially developed economies.

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 set up 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 trade liberalization is significantly slower in financially underdevel-

[35]Notice that lower consumption-to-GDP does not imply lower consumption but instead that consumption increased by less than GDP over this period as a consequence of trade liberalization.

[36]In Section 3.8 of the Online Appendix, we show an analogous figure to Figure 6 for the financially developed economy.

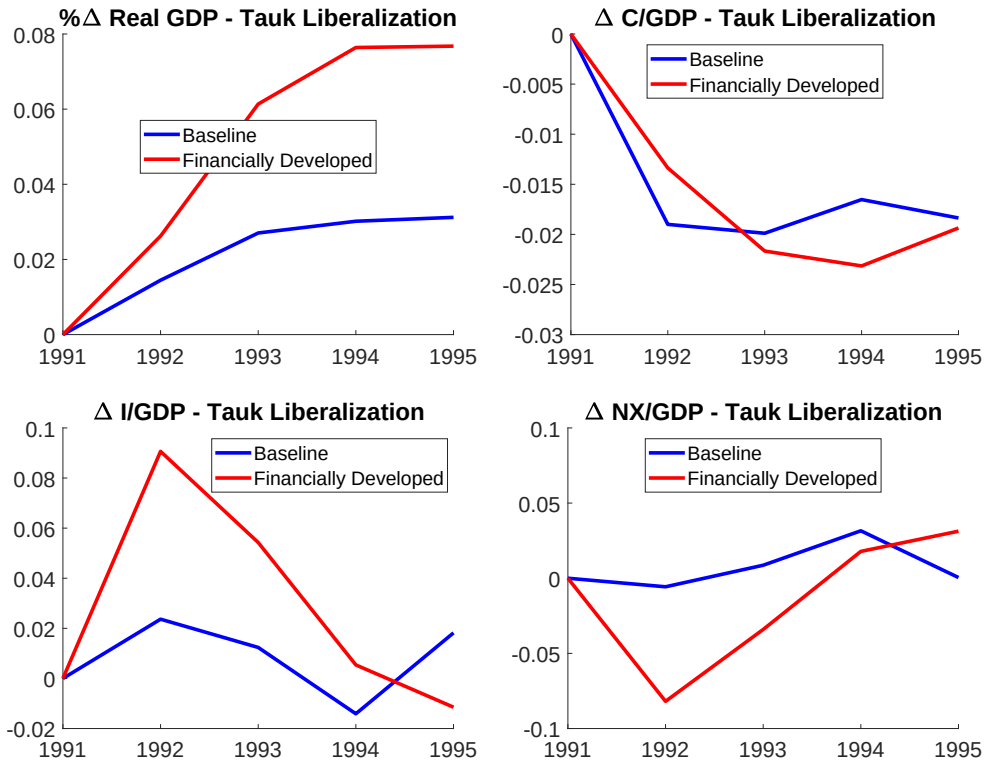

Figure 7: Trade Liberalization in Colombia – Financially Developed

oped 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 developed counterparts after trade liberalization: 15 years after trade liberalization, GDP, consumption, and capital are 25% to 40% larger on average across financially developed economies vs. approximately 10% larger on average in economies with weaker financial development. Our second contribution is to use a general equilibrium model to quantify the extent to which these cross-country differences in aggregate dynamics are accounted for just by financial development: we find that between 16% to 44% of the observed differences can be explained by financial development alone. 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 subgroups: we find that welfare gains in the financially developed economy are six times higher than in the financially underdeveloped economy (3.0% versus 0.5%).

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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