The Non-traded Gains from Trade*

Selection in the non-traded sector: Evidence from Brazil

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First version: October 2020
This version: July 2025
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Using Brazil's import liberalization as a quasi-natural experiment, we uncover a new margin for the gains from trade: the reallocation of labor from smaller to larger producers in the non-traded sector. Larger non-traded producers self-select into importing, expanding as they incorporate foreign inputs. We develop a parsimonious model of heterogeneous producers consistent with the empirical findings, then show that this reallocation is welfare-enhancing but disappears when all non-traded producers make the same importing decision. The quantitative welfare effect of this margin is 0.02% for the average local labor market, reaching up to 0.2% for the largest regions in Brazil.

*The authors thank Steve Redding and seminar participants at Princeton University, the Federal Reserve Bank of St. Louis, Toronto Metropolitan University, and the UBC-UofT Summer Trade Workshop. Nardeen Abdulkareem provided excellent research assistance. Both authors gratefully acknowledge financial support from the International Economics Section at Princeton University. The views expressed in this paper do not necessarily reflect those of the IMF, its Executive Board, or its Management.

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1. Introduction

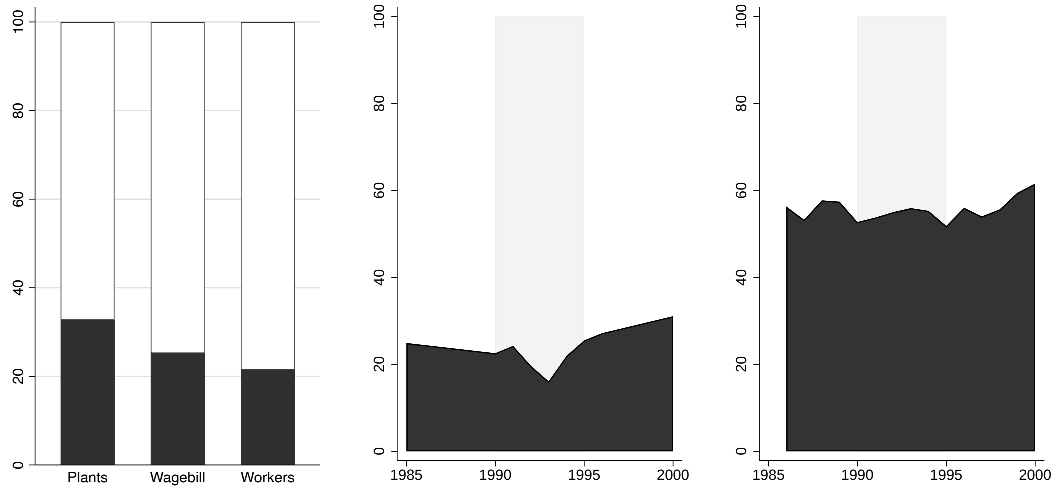
In recent years, the complex impacts of import competition have been at the heart of academic and policy debates. Though more competitive imports can harm import-competing industries, they can also help industries that use those goods as inputs. The outcome of the tug-of-war between these two effects rests on the economy's industry mix. A growing body of work highlights that, if workers incur costs when relocating within a country, each *local labor market*'s industry mix matters.[1] In this case, trade shocks can have large and uneven impacts across space.

This paper explores how large import shocks impact local labor markets in the long term, by reshaping the non-traded sector as inputs become more competitive. We focus on the non-traded sector both because it is big and because it directly ties to local outcomes. Using Brazil's import liberalization of the 1990s, we empirically show that import competition caused job reallocation *among* establishments within the non-traded sector, favoring large compared to small producers. To explain this pattern, we build a model of selection into importing. Job reallocation raises welfare because the non-traded sector's average productivity grows. Plugging the data straight in, we find that the welfare gains vary from -0.05% to 0.21%, with most regions seeing modest improvements.

The Brazilian import liberalization is a natural setting to study the impacts of import competition. At the start of the 1990s, a new government unexpectedly announced large tariff cuts, which ended the country's long history of protectionism. Average tariffs dropped 20 percentage points from 1990–1995, during which time imports-to-GDP grew from 10% to 30%. The share of imports-to-GDP continued to grow afterwards, as the economy adjusted to the new policy setting, settling at above 50% in the early 2000s.

The import liberalization opened the door for more producers in the non-traded sector to source inputs from abroad. Figure 1 sets the pre-liberalization scene. First, producers operating in the non-traded sector represented a sizable share of importers, accounting for over 25% of all importers' wage bill. Second, a significant share of inputs used by the non-traded sector were tradable, making up 20–30% of the total input value. Finally, a majority of imports in Brazil were intermediate inputs, at nearly 60% by value.

[1] For example, Autor, Dorn, and Hanson (2013, 2015), Dix-Carneiro and Kovak (2017), Pierce and Schott (2016), and Topalova (2010)



(a) Share of NT producers in importers (b) Share of tradables in NT sector inputs (c) Share of intermediates in imports

Figure 1: The potential for non-traded producers to import inputs

Panel 1a plots the share of importers that operate in the non-traded sector compared to the traded sector, weighted by establishment count, wage bill, and employment. Panel 1b plots the share of inputs used by the non-traded sector that originate from the traded sector, weighted by value. Panel 1c plots the share of import value for which intermediate inputs account, compared to other uses such as final consumption.

While Figure 1 suggests that importing would be a natural way for non-traded producers to source inputs, only a fraction of such producers actually import, even after the liberalization episode. This apparent contradiction can be explained by selection into importing. We build a simple model to formalize this mechanism and guide the empirical analysis. Because only the most profitable producers choose to use imported inputs, falling import tariffs spurs reallocation as importers, especially new importers, expand relative to non-importers. At the same time, the smallest producers are forced to exit, while the smallest surviving producers shrink.

Guided by the model, we investigate the impact of Brazil's import liberalization on job reallocation. To measure job reallocation across establishments, we take the long difference in establishment-level employment between 1990 and 1999. Thus, there can be substantial job reallocation when the relative sizes of establishments change, even if aggregate employment does not change; likewise, there is no job reallocation when the establishment's total employment stays the same, even if all individual workers turn over.

To identify the impact of import competition, we use a shift-share approach across Brazilian local labor markets. In particular, we compare regions whose employment concentrates in import-competing industries with regions whose employment composition shields them from foreign competitors. Our strategy is thus a difference-in-differences, comparing the evolution of regional outcomes in regions more exposed against those less exposed to the tariff shock. To separate the effects for small versus large establishments, we compare establishment-level outcomes with a triple-difference approach across time, establishment location, and initial establishment size.

Our empirical findings suggest selection into importing. Comparing across regions, those with higher exposure had more job reallocation among establishments in the non-traded sector. The triple-difference approach at the establishment level reveals that the tariff shock reallocated jobs away from the smallest establishments into larger ones. In particular, the smallest establishments were both more likely to exit and more likely to shrink, if they survived, compared to their larger counterparts. New importers expanding their workforce could drive these patterns: non-traded producers in more exposed regions were more likely to become importers compared to otherwise similar establishments in less exposed regions; and new importers were both initially large and grew more than any other type of establishment.

Finally, we use the structural model to isolate the welfare gains that our mechanism generates. Each industry's contribution to the aggregate welfare gains is weighted by its share in final consumption and has two components. The first is an *upstream effect*, which combines the cheaper input prices according to input-output linkages, and is stronger the more producers use imported inputs. The second is a *general equilibrium wage effect*, which describes the aggregate impact at the local labor market level. Both channels simplify to components we can measure directly in the data.

Taking the structural welfare gains to the data, we find that welfare in the average region improved by 0.02% through our mechanism. However, effects are uneven across regions. While some regions see nearly no welfare impact, others improve substantially. The most impacted region, which accounts for 7% of national wage bill, sees welfare improve by 0.2%; on the other hand, the worst off region sees welfare drop by 0.05%. These gaps highlight the role of local labor markets in adjusting to and transmitting the impacts of trade shocks.

A large literature studies the impact of trade shocks on local labor markets, focusing on worker outcomes, as Dix-Carneiro (2019) reviews for Brazil and Autor, Dorn, and Hanson (2016) for the US. Dix-Carneiro and Kovak (2017, 2019) study the Brazilian import liberalization, highlighting workers' long-term suffering earnings and employment, as well as their imperfect adjustment across space and industries. Autor, Dorn, and Hanson (2013) find similar negative effects for workers in the US from Chinese import competition. However, using the Chinese import shock on US local labor markets, Pierce, Schott, and Cristina (2024) emphasize that input-output effects drive worker gains in downstream and non-traded industries, a margin we study from the producer perspective.

Approaching from the producer side, similarly to this paper, are Asquith et al. (2019) and Felix (2022). Asquith et al. (2019) study the impact of Chinese import competition on job reallocation in US local labor markets, finding substantial gross job flows within both the traded and non-traded sectors. Felix (2022) studies the Brazilian liberalization event, finding that import competition increased employment concentration among producers, favoring already large exporters. The paper shows that this increase in concentration did not cause wider wage markdowns, leaving room for the aggregate productivity gains that we quantify.

Our paper also contributes to the body of work studying the impact of trade exposure, especially to imported inputs, on productivity. The seminal work of Amiti and Konings (2007) finds that productivity grows in Indonesian plants that import their intermediate inputs as tariffs fall. Subsequent work isolate the importance of various channels, including access to new imported input varieties (Pinelopi Koujianou Goldberg et al. 2010), quality upgrading (Fieler, Eslava, and Xu 2018), and skill complementarity (Bas and Paunov 2021). Bustos (2011) emphasizes that a firm's response to global access depends on its initial size, using Argentinean firm-level data to show that better export opportunities induced medium to large firms to upgrade technology. We establish similar size-based takeup of importing, which we link to local welfare gains.

Finally, our paper contributes to the literature on the gains from trade. Arkolakis, Costinot, and Rodríguez-Clare (2012) derives closed-form expressions for these gains in a wide class of trade models, which Costinot and Rodríguez-Clare (2014) quantify. Extensions to the analysis incorporate variable markups (Arkolakis, Costinot, Donaldson, et al. 2018), distortions (Bai, Jin, and Lu 2024), dynamics (Boehm et al. 2024), and firm heterogeneity (Melitz and Redding 2015). We use the Brazilian policy event to provide evidence of the selection mechanism among heterogeneous non-traded producers, then quantify its welfare impact.

2. Policy environment and data

We use the Brazilian import liberalization as the empirical setting of this paper. This section first describes the policy environment and the data. It then provides suggestive evidence on selection into importing among non-traded producers.

2.1. Policy environment

The Brazilian import liberalization was a set of significant and unexpected one-sided tariff cuts, heterogenous across industries, between 1990–1995. In March 1990, the newly elected administration of President Collor announced a *tarificação* ("tariffication"), in which nearly all non-tariff import barriers were replaced with tariffs that maintained the same gap between internal and external prices in Brazil. The import tariffs, now the main trade policy instrument, were then steadily lowered over the next five years.[2]

A large literature argues that this trade policy was plausibly exogenous not only in timing, but also in its variation across industries (e.g. Aquino Menezes-Filho and Muendler 2011; Dix-Carneiro and Kovak 2017; Felix 2022; Kovak 2013). Contemporaneous political economy factors likely did not influence the variation across industries in size of the tariff cuts because the main determinant for how much a tariff lowered was the pre-liberalization protection level, inherited from policies from 1957. This paper follows the literature by interpreting this variation as plausibly exogenous.

2.2. Data

Our main data source is the matched employer-employee panel data from Brazil's *Relação Anual de Informações Sociais* (RAIS). The RAIS dataset is collected by Brazil's Ministry of Labor for administrative purposes, including to verify worker eligibility for government benefits. RAIS contains information covering the universe of

[2] Dix-Carneiro (2019) provides a detailed description of the Brazilian import liberalization.

formal Brazilian economic activity.[3] It has been widely used because it is high-quality administrative data and also describes all formal economic activity in the country.

We use the microregions developed by the *Instituto Brasileiro de Geografia e Estatística* (IBGE), of which there are 404, as our local labor markets. Each microregion is a grouping of economically integrated municipalities that border each other while also being similar in terms of productivity.[4] In what follows, we use the terms "local labor market", "region", and "microregion" interchangeably.

We can measure regional job creation and destruction because RAIS encodes each establishment with its physical location and an identifier that persists over time. Then, for example, to measure the amount of regional job creation between two periods, we can select all establishments located there that report having more employees in the second period compared to the first, then add up their changes in employment. Because RAIS includes information on the universe of Brazilian formal employment, data sparsity is not a concern even at fine geographic levels.

We supplement RAIS with several data sets: first, data on industry-level import tariffs compiled by Kume, Piani, and Souza (2003); second, the distribution of industrial activity and the share of informal workers from the 1991 and 2000 *Censos Demográficos* (Demographic Censuses);[5] third, national input-output tables from the *Sistema de Contas Nacionais* (System of National Accounts) of the IBGE; and finally, the identity of all establishments that imported or exported over the sample period directly from the Brazilian Ministry of Economy.

We focus on the impact of trade shocks on resource reallocation in the non-traded sector and report all results for the traded sector, which are in line with previous studies, in Appendix B.

[3]A limitation of the data is that it omits self-employed and informal workers. Some work that has studied Brazil's informal sector in the context of trade liberalization have been Dix-Carneiro, Pinelopi K Goldberg, et al. (2021) and Dix-Carneiro and Kovak (2019).

[4]Using publicly available Census data, we find that only 3.4% of individuals lived and worked in different microregions in 2000.

[5]The Demographic Census is only conducted every ten years. We use the 1991 sample because it is the closest in time to the liberalization announcement in 1990.

2.3. Importers of the non-traded sector: a first look

Although Figure 1 suggests that importing is a potentially important way for producers in the non-traded sector to acquire inputs, we now show that in practice only the most productive producers actually import. In what follows, we index local labor markets with r, industries with k, traded status with $K \in \{$Traded, Non-Traded$\}$, and establishments with e.

We compare three groups of establishments: those that imported in both 1990 and 1999 ("always importers"), those that did not import in 1990 but did in 1999 ("new importers"), and those that did not import in either period ("never importers").

Importing behavior is rare, consistent with micro-data from other countries. In 1990, only 0.62% of non-traded sector establishments were importers, with 0.3% becoming importers in 1999. The remaining 99.09% of establishments did not import in either period.

To describe how the performance of establishment e correlates its importing status $g \in \{$always, new, never$\}$, we regress

$$y_e = \alpha_0 + \alpha_r + \alpha_k + \sum_g \mathbb{1}_e[g]\alpha_g^K + u_e \tag{1}$$

on surviving incumbents, where α_r and α_k are region and industry fixed effects, respectively, and y_e are measures of establishment performance before the import liberalization, in 1990. Our main outcomes of interest are log employment, log wage bill, log average wage, and skill intensity measured as the share of workers with at least a college degree. We allow the group-specific coefficient α_g^K to vary by the traded status K of the establishment industry.

Table 1 reports the regression results for α_g^{NT}. The omitted group is never importers. Consistent with previous work, always importers were the highest performing producers across all measures.[6] In particular, they employed on average 161% more employees, paid 62% higher wages, and hired 18 percentage points (pp) more college-educated workers than never importers.

Among establishments that did not import in 1990, those that became importers in 1999 were also initially performing better than producers that did not change importing status. The new importers originated from the middle of the distribution

[6]Producer-level data from many countries reveals that importing is rare and coincides with other measures of performance. Bernard et al. (2007, 2018) review.

Outcome variable:	$\ln(\text{Empl})_{90}$	$\ln(\text{WB})_{90}$	$\ln(\text{Wage})_{90}$	$(\text{Skill Share})_{90}$
Always importer	**1.616*****	**2.235*****	**0.618*****	**0.182*****
	(0.131)	(0.137)	(0.029)	(0.015)
New importer	**1.191*****	**1.649*****	**0.458*****	**0.119*****
	(0.097)	(0.099)	(0.031)	(0.020)
N	436281	436281	436281	436281

Table 1: Pre-liberalization characteristics by importing status

This table reports the α_g^{NT} coefficients for the regression (1) on surviving establishments, for each outcome variable (column). The comparison group is never importers. Each regression includes industry and microregion fixed effects. Standard errors in parentheses are clustered at the microregion level. Table 10a reports traded sector coefficients. $^{***}p < 0.1\%$, $^{**}p < 1\%$, $^{*}p < 5\%$

for all four performance measures, employing on average 120% more workers, paying 46% higher wages, and hiring 12 pp more college-educated workers than never importers.

3. Importing and selection: conceptual framework

Inspired by the suggestive evidence of the previous section and to frame the empirical approach of Section 4, this section develops a simple partial equilibrium model of selection into importing among non-traded producers. Appendix A provides the formal treatment of all results.

3.1. Framework

Within a particular local labor market, we focus on a single non-traded industry in partial equilibrium. A continuum of producers compete monopolistically within the industry. To keep notation simple, we omit the region and industry indices in this section.

Non-traded producers Each producer is characterized by its productivity z and its unique product variety ω. Anticipating that producers with the same efficiency act identically, we index producers by efficiency z rather than variety ω.

Production combines intermediate inputs and labor Cobb-Douglas, with weight α on intermediates and $1-\alpha$ on labor. The marginal cost of a producer with efficiency z is

$$\frac{w^{1-\alpha}m(\mathbb{1}^m)^{\alpha}}{z}, \qquad m(\mathbb{1}^m) = \begin{cases} m & \text{if } \mathbb{1}^m = 0 \\ m^* & \text{if } \mathbb{1}^m = 1 \end{cases},$$

where $\mathbb{1}^m$ is a dummy that represents whether the producer uses imported inputs, w is the wage rate, and $m(\mathbb{1}^m)$ is the producer's unit cost of intermediates.

While the wage rate w is common among all producers, the unit price of inputs $m(\mathbb{1}^m)$ depends on the producer's decision on whether to use imported inputs. If the producer does not use them, it faces a domestic price m. On the other hand, if the producer incorporates them in production, the unit cost of inputs is m^*.

Representing with Δ the marginal cost difference between otherwise identical producers incorporating imported inputs and those who do not, the marginal cost simplifies to

$$\frac{w^{1-\alpha}m^{\alpha}}{\left(\frac{m}{m^*}\right)^{\alpha\mathbb{1}^m} z} \equiv \frac{w^{1-\alpha}m^{\alpha}}{\Delta^{\mathbb{1}^m} z}.$$

As long as $\Delta > 1$, adopting imported inputs becomes a productivity-augmenting activity, since it lowers the variable cost of the producer.[7] The strength of this effect increases as the relative input cost advantage m/m^* grows.[8] Similarly, as α increases, inputs become a larger component of production, magnifying the strength this cost advantage. We therefore call Δ the "import advantage".

[7] Similar equivalences between globalization activities and productivity appear in other works: Grossman and Rossi-Hansberg (2008) develop a framework where offshoring has a productivity-enhancing effect and Bustos (2011) shows that exporters upgrade their technologies to produce at larger scales.

[8] All domestically-produced inputs need not be replaced by cheaper imported inputs; it suffices for the producer to face a lower unit input cost when it begins to use the imported inputs. For example, the two inputs could be combined with constant elasticity η, so that $m(\mathbb{1}^m)^{1-\eta} = P^{1-\eta} + \mathbb{1}^m (P^*)^{1-\eta}$, where P is the price of the domestic input and P^* is the price of the imported input.

Producers face a residual demand with constant elasticity σ for their differentiated variety, and take their marginal cost of production, contingent on import adoption status, as given. Optimal pricing is a constant markup $\sigma/(\sigma-1)$ over marginal cost, delivering total variable profits

$$\pi(z, \mathbb{1}^m) \equiv X \left(\frac{\sigma}{\sigma - 1} \frac{w^{1-\alpha} m^{\alpha}}{\Delta^{\mathbb{1}^m} z} \right)^{1-\sigma} \tag{2}$$

where X is a demand shifter common to all producers.

Producers may choose to pay a fixed cost of F^m to access import markets and update their production to incorporate imported inputs. For simplicity, we assume that these two actions cannot be separated. Then, a non-importer cannot use imported inputs sourced domestically, for example through a wholesaler, because it has not updated its production process to accommodate these imported inputs. This assumption therefore rules out the possibility of arbitrage, even if the imported inputs are both cheaper than and perfectly substitutable with the domestically produced inputs.

Producers trade off the variable benefit from importing against the fixed importing cost. Ultimately, producers only import if the marginal cost reduction generates enough variable profits to cover the fixed cost. We assume that $\Delta > 1$ to match the empirically relevant case where some producers import.

There is a threshold z^m satisfying the zero additional profits condition

$$F^m = \pi(z^m, 1) - \pi(z^m, 0) \tag{3}$$

above which producers will choose to import. Adopting imported inputs is thus a function of productivity, with $\mathbb{1}^m(z) = \mathbb{1}[z \geq z^m]$. At this point, we do not need to take a stand on the units in which the fixed costs are denominated.

Finally, in order to actively participate in the market, producers must pay a fixed overhead cost F^n. This gives rise to a participation threshold z^n satisfying

$$F^n = \pi(z^n, 0) \tag{4}$$

below which variable profits do not cover the fixed costs of operation. Producers with efficiency below this cutoff optimally choose not to produce. We assume that the fixed costs F^n and F^m are such that $z^n < z^m$ to match the empirically relevant pattern that some operating producers do not import.

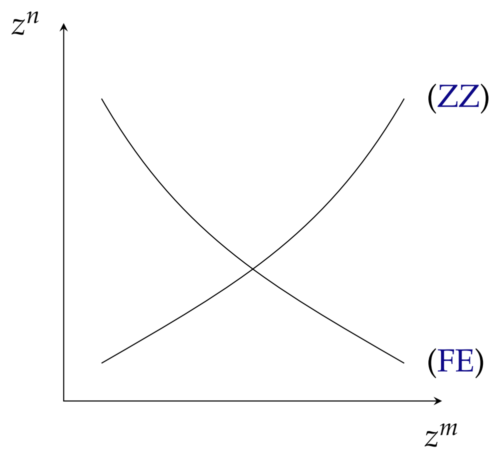


Figure 2: Industry equilibrium

The determination of the two productivity cutoffs, for participation z^n and importing z^m. Equations (FE) and (ZZ) determine the two simultaneously.

Industry equilibrium To enter, a producer must pay a fixed cost of F^e before learning their efficiency z. After the entry cost is sunk, efficiency is drawn from an exogenous distribution $G(z)$. Producers may freely enter, so there is entry until the cost of entry equates expected profits

$$F^e = \int_{z^n}^{\infty} [\pi(z, \mathbb{1}^m(z)) - F^n - \mathbb{1}^m(z)F^m] \, \mathrm{d}G(z). \tag{5}$$

Combining the free entry condition with the producer behavior described by expressions (2)–(4), we characterize the productivity cutoffs $\{z^n, z^m\}$ in terms of aggregates

$$\frac{F^m}{F^n} = \left(\frac{z^m}{z^n}\right)^{\sigma-1} \left[\Delta^{\sigma-1} - 1\right], \tag{ZZ}$$

$$\frac{F^e}{F^n} = \int_{z^n}^{\infty} \left\{ \left[\frac{z}{z^n}\Delta^{\mathbb{1}^m(z)}\right]^{\sigma-1} - 1 - \mathbb{1}^m(z) \frac{F^m}{F^n} \right\} \mathrm{d}G(z). \tag{FE}$$

The solid lines in Figure 2 illustrate this partial equilibrium system. There exists a unique pair of thresholds that solve the system.

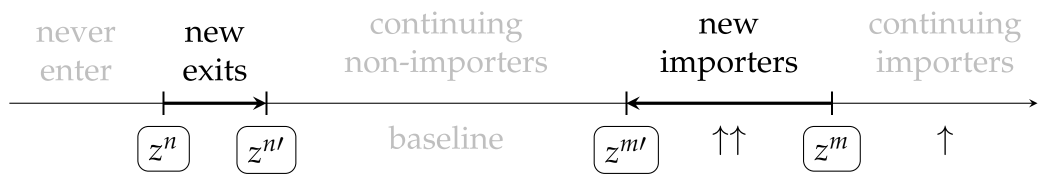


Figure 3: Reallocation following an import liberalization

This figure summarizes the impacts on cutoffs of an import liberalization in the theoretical framework. The import liberalization is either a decrease in either the relative fixed cost of accessing imported inputs or variable price of imported inputs. The figure lists extensive margin impacts above the productivity distribution, and impacts on producer sizes *relative* to the smallest surviving producers below.

3.2. Import liberalization and reallocation

We now show that an import liberalization will reallocate resources away from the smallest producers, both on the extensive and intensive margins, and especially toward new importers. Such a liberalization can be either an increase in the import advantage Δ or a decrease in relative fixed costs F^m/F^n. Both policies have the same qualitative effect on the industry equilibrium.

Reallocation among producers The top half of Figure 3 summarizes the extensive margin reallocation of an import liberalization.

The smallest producers exit following the liberalization. The looser import policy, whether from a higher importer advantage of lower fixed costs, increases the profitability of importing. In turn, the importing productivity threshold drops as lower-productivity producers can also cover the fixed importing cost. The growing share of importers then squeezes out the lowest productivity producers, pushing up the participation cutoff.

Together, the cutoff movements generate the empirical patterns of Table 1. In particular, incumbent importers have the highest productivity, as theirs must exceed the original cutoff z^m. Similarly, producers which begin importing after the liberalization must have a higher productivity than the new, lower, cutoff $z^{m\prime}$. They thus have lower productivity than the incumbent importers, but also have the highest productivity among the original non-importers.

The bottom half of Figure 3 summarizes the intensive margin reallocation, that is, changes in *relative* sizes of producers taking continuing non-importers as the comparison group. To align with the data in Section 4, we measure size as the wage bill

$$F^n(\sigma-1)(1-\alpha)\left(\frac{z}{z^n}\Delta^{\mathbb{1}^m(z)}\right)^{\sigma-1}. \tag{6}$$

Continuing non-importers shrink. As the average productivity of producers rises, resources are competed away from the least productive. Equation (6) formally captures this effect in the higher value of z^n.

Continuing importers never shrink as much as continuing non-importers. The liberalization's impact on their size depends on whether the fixed cost F^m falls or if the importer advantage Δ rises. If liberalization policy purely acts through the fixed cost, then continuing importers shrink identically to continuing non-importers. However, if the liberalization also increases the importer advantage, then the continuing importers grow relative to continuing non-importers, since the policy boosts their effective productivity. Regardless of the nature of the liberalization, then, continuing importers (weakly) grow *relative* to continuing non-importers.

Finally, new importers grow relative to all other producers. Their effective productivity rises as they access imported inputs, from z to $z\Delta$. In response, they expand production by more than a continuing importer. Intuitively, a new importer scales up not only because using imported inputs has become more advantageous, but also because it starts incorporating them in their production function.

The role of selection To highlight the importance of selection into importing, we now study a special case of the model without differentiated producer importing decisions, so that producers either all choose to import or all abstain.

Consider the case where importing is either completely frictionless with $F^m = 0$ or prohibitive with $F^m \to \infty$, and model the import liberalization as a change in the import advantage Δ. Then, all active producers have identical importing decisions, so the free entry conditions (FE) simplifies to

$$\frac{F^e}{F^n} = \int_{z^n}^{\infty}\left[\left(\frac{z}{z^n}\right)^{\sigma-1} - 1\right]\mathrm{d}G(z)$$

where the importer advantage is absent.

When all producers make the same importing decision, the import advantage Δ has no impact on the marginal producer's efficiency z^n, which is fully determined by the free entry condition. As a direct consequence, an import liberalization policy does not cause reallocation on the extensive margin.

Intuitively, the importer advantage is a wedge between the profitability of importers compared to non-importers. This wedge disappears when all producers make the same importing decisions, so that the liberalization policy affects all producers symmetrically.

Following the same intuition, changes in import advantage Δ have no effect on producer-level labor demand in equation (6) since the participation cutoff z^n does not move. Thus, because producers neither shrink nor grow, there is no intensive margin reallocation among them. Movements in import prices must be absorbed through other margins outside of the scope of the analysis thus far.

The special case of the model highlights the importance of *differential effects* of import policies on producers in generating job reallocation. Looser import policy benefits new importers but does not directly impact non-importers in the model with selection into importing, while affecting all producers identically in the no-selection case.

4. Empirical evidence

Guided by the predictions of the previous section, we now establish the patterns of reallocation in the Brazilian data. We begin by documenting that regions more exposed to the import liberalization experienced increased *labor reallocation* among establishments *within* the non-traded sector. We next show that, at the establishment level, relatively more workers were reallocated away from smaller producers. Changes in importing behavior accounts partially for these empirical patterns: establishments in more exposed regions were more likely to become importers after the liberalization, with those new importers comparatively growing the most in terms of employment and wage bill.

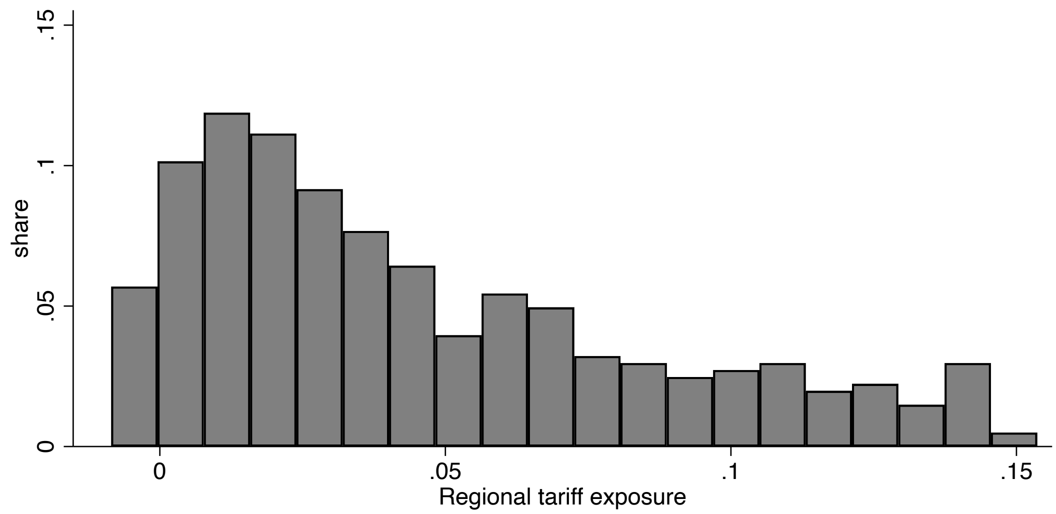


Figure 4: Distribution of regional tariff exposure measure

Regional tariff exposure is measured as a weighted average of industry-level tariff changes, weighted by initial regional industrial composition as in (7). There are 404 total microregions in the data.

4.1. Measuring local exposure to the trade liberalization

We follow a difference-in-differences strategy. In particular, we compare outcomes in local labor markets more exposed to the liberalization against outcomes in regions less exposed to the policy.

Our main explanatory variable is a microregion's effective exposure to the industrial tariff changes, sometimes interpreted as the effective regional tariff cut. For comparability with previous studies on the Brazilian liberalization, we use the measure developed by Kovak (2013) which subsequently has been used widely (see Dix-Carneiro and Kovak 2017, 2019; Dix-Carneiro, Soares, and Ulyssea 2018; Ponczek and Ulyssea 2021).[9] For a microregion r, this measure is defined

$$\text{lib}_r = -\sum_k \frac{\lambda_{rk}/\alpha_k}{\sum_j \lambda_{rj}/\alpha_j} d\ln(1+\tau_k) \tag{7}$$

[9] In Section 5, we develop a structural exposure measure, with which we replicate the regressions from this section. Appendix B reports the results, which are comparable.

where λ_{rk} is the initial share of employees working in microregion r that are employed in industry k, and α_k is the share of industry k's non-labor inputs. We calculate the employment share using 1991 Census data and the share of non-labor inputs using the 1990 input-output matrix. Together, they provide a snapshot of the composition of industrial activity for each microregion shortly after the trade policies were announced in 1990. The larger the weighted tariff cut, the higher the liberalization exposure measure.

A microregion has a higher degree of policy exposure if employment was initially skewed toward industries that would become import-competing, since the measure weights the industry-level tariff changes by the share of local employment for which the industry accounts, adjusted for the industry's labor intensity. Figure 4 plots the density of the effective regional tariff changes across all labor markets in the sample, reflecting that variation in initial industrial composition translates to considerable variation in regional liberalization exposure.

4.2. Job reallocation in local labor markets

We begin by establishing that local labor markets more exposed to the liberalization experienced higher job reallocation compared to those less exposed.

We measure job reallocation for each microregion-industry pair with the following four outcome variables

$$o_{rk}^{\text{exit}} = \sum_{e \in \text{exited}_{rk}} \frac{L_{e,1990}}{L_{rk,1990}} \qquad o_{rk}^{\text{contract}} = \sum_{e \in \text{contracted}_{rk}} \frac{L_{e,1990} - L_{e,1999}}{L_{rk,1990}}$$

$$o_{rk}^{\text{entry}} = \sum_{e \in \text{entered}_{rk}} \frac{L_{e,1999}}{L_{rk,1999}} \qquad o_{rk}^{\text{expand}} = \sum_{e \in \text{expanded}_{rk}} \frac{L_{e,1999} - L_{e,1990}}{L_{rk,1999}}$$

The first two measure the *destruction of jobs* that existed before the import liberalization while the second two the *creation of new jobs* after the liberalization.

These measures emphasize changes in the distribution of aggregate labor among establishments in a region-industry rather than individual worker transitions.[10] In particular, we take the long differences of employment in each establishment, regardless of the identity of the workers. An establishment with the same number of workers in both periods thus generates no job flows, even if it replaces all of its workers.

[10]Davis and Haltiwanger (1999) synthesizes the large literature on gross job flows.

We uncover the impact of the import liberalization on job reallocation using the empirical specification

$$o_{rk}^{\ell} = \alpha_0 + \alpha_s + \alpha_k + \theta^K \text{lib}_r + \beta X_{rk} + u_{rk} \tag{8}$$

for each margin $\ell \in \{\text{exit, contract, entry, expand}\}$. In particular, to separate the liberalization's impact on the non-traded sector, we allow for different effects on industries in the traded and non-traded sectors. The intercept subsumes the nation-wide effect of the liberalization.

The main specification also includes a constant α_0, fixed effects at the state level α_s and industry level α_k, and a vector of controls X_{rk}. These controls include the industry k's share of microregion r's total workers in 1990, the share of total payroll in microregion r attributable to industry k in 1990, the log mean wage in industry k in 1990, and the pre-trend in these variables. The pre-trend controls are calculated over 1986 to 1989 using the RAIS. For example, if w_{rk} denotes the log mean wage of industry k workers in region r, then the respective pre-trend control would be $(w_{rk,1989} - w_{rk,1986})$. We also control for the 1990 informal share in each region-industry pair, as well as this variable's change from 1990 to 1999.[11] Finally, pre-trend values of each margin o_{rk}^{ℓ} are also included within the controls.

Table 2 reports the impact of liberalization $\theta_{\text{NT}}^{\ell}$ for each jobflow type. In the non-traded sector, there was both increased higher job creation through establishment expansion, as well as lower job destruction through establishment exit, in more exposed areas when compared to less exposed areas. Consistent with previous literature, the *net* job impact of liberalization exposure is positive.[12]

To quantify this reallocation, we calculate how many jobs were additionally reallocated because of the import liberalization, net of the aggregate national effect, implied by the coefficients with statistical significance. For each microregion-industry pair, we generate the predicted changes in the allocation of labor along each margin by using the estimated coefficients, the effective tariff changes, and employment patterns in each region. For example, to calculate how many additional jobs were created due to establishment entry, we start with the share of jobs in 1999 that were created due to this respective margin of adjustment. Coupled

[11]We define an informal worker as either an employee that does not have its working card signed by its employer or a self-employed individual.

[12]Using the same data and policy event, Dix-Carneiro and Kovak (2017, 2019) and Felix (2022) each find a positive net worker flow from the traded to the non-traded sector.

	Job destruction		Job creation	
	Exit	Contract	Entry	Expand
$\theta_{\mathrm{NT}}^{\ell}$	**-0.300***	0.112	-0.144	**0.203*****
	(0.168)	(0.090)	(0.139)	(0.058)
N	6617	6617	6617	6617
	Distribution of quantified jobs			
Min	-0.623	—	—	-0.519
25th	0.431	—	—	0.484
50th	3.912	—	—	3.932
75th	27.63	—	—	25.55
Max	20847.6	—	—	17063.0

Table 2: Local labor market effects of the import liberalization on job flows

Each column reports the impacts of import liberalization on the corresponding margin of job reallocation. The first row shows the estimated values and robust standard errors for the coefficient θ_{NT}^{i} of regression equation (8). All regressions include a set of controls, including industry and state fixed effects. Table 11a reports traded sector coefficients. ***$p < 0.1\%$, **$p < 1\%$, *$p < 5\%$ The lower half of the table quantifies, in terms of jobs, the relative cross-region effects implied by the statistically significant estimates. The statistics summarize impacts over microregion-industry pairs with a non-zero impact.

with equation (8), the number of jobs in region-industry rk that were additionally created due to higher establishment entry in response to the import shock is $\hat{\theta}^{\mathrm{NT}} \times \mathrm{lib}_r \times L_{rk,1999}$. Similar calculations follow for each margin of adjustment.

The lower half of Table 2 reports summary statistics of quantified job impacts across microregion-industry pairs. We restrict attention only to the jobflow types with statistically significant coefficients, and to microregion-industry pairs with a non-zero quantified impact.[13]

The exposure to the liberalization caused not only large job reallocation effects, but also sizeable variation in these effects across microregion-industry pairs. The median microregion-industry impact was between 3 to 4 jobs for each jobflow type. In large or highly exposed regions, however, the effects of import liberalization was as high as several thousand jobs. The two statistically significant jobflow

[13]Some quantified impacts are zero, because the microregion-industry has zero employment either in the initial period (for job destruction measures) or in the final period (for job creation measures).

margins had comparable quantitative impacts.

Crucially, even though the point estimates in Table 2 are smaller than those for the traded sector in Table 11a, the quantified job flows are comparable or larger in the non-traded sector because the non-traded sector is substantially larger than the traded sector. It accounts for almost double the amount of total employment in Brazil, and therefore presents a potentially important margin for the effects of trade policy that has been so far underexplored.

4.3. Establishment-level employment patterns

Having established that the liberalization caused job reallocation, we now show that the workers were reallocated from initially small establishments to initially larger establishments within the non-traded sector, consistent with the results of Section 3.

To separately characterize reallocation on the extensive and intensive margins, as suggested by the model of Section 3, we define for each establishment e

$$\text{Surv}_e = \mathbb{1}\{e \text{ survives between 1990–1999}\}, \qquad g_e = \frac{L_{e,1999} - L_{e,1990}}{L_{e,1990}},$$

where $\mathbb{1}$ is a dummy that equals one if establishment e survives between 1990 and 1999, and $L_{e,t}$ denotes total employment in surviving establishment e and year t.

We begin by estimating the probability of survival

$$\text{Surv}_e = \Phi\left(\alpha_0 + \alpha_s + \alpha_k + \alpha_q + \sum_{q=1}^{4} \mathbb{1}_e[q]\theta_q^K \text{lib}_r + \beta X_e + u_e\right) \tag{9}$$

with a probit model. The index q captures the plant's 1990 regional employment quartile, which summarizes its position in the local initial size distribution. Appendix Table 8 repeats the regression with a logit and linear probability model.

The coefficients θ_q^{NT} capture, for each employment quartile q, the effect of liberalization exposure on the probability of survival for an establishment in the non-traded sector. We allow for the effect of the liberalization exposure to vary by the establishment's initial size, measured by its regional employment quartile. The regression thus effectively estimates a triple difference in outcomes across time, liberalization exposure, and initial establishment size. If the coefficients are not equal across different size quartiles, then exposure to liberalization caused labor reallocation among establishments of different sizes.

The specification also includes a constant, as well as fixed effects for state, industry, and initial employment quartile. This last fixed effect controls for the fact that establishments of different sizes may have different survival rates. Finally, there is a vector of controls X_e, including the establishment's initial share of employment and wage bill in microregion r and industry k, its log mean wage, the 1986–1989 pre-trends in these variables, its skill intensity in the initial period, and its employment growth in the pre-period. To account for informal employment, we also include the industry-region's initial share of workers informally employed, as well as this share's growth rate from 1990 to 1999.

Among survivors only, we estimate the second regression

$$g_e = \alpha_0 + \alpha_s + \alpha_k + \alpha_q + \sum_{q=1}^{4} \mathbb{1}_e[q]\theta_q^K \text{lib}_r + \beta X_e + u_e \tag{10}$$

where the right-hand side variables in this specification are identical to those in equation (9), but also include a Heckman correction to account for the fact that surviving incumbents are a selected group of establishments.

Table 3 presents the results for the extensive and intensive margins in the traded and non-traded sectors. Along both margins, the coefficients roughly follow an inverse-U shape across the initial size distribution, peaking at the second or third employment quartiles.

For otherwise similar establishments of different sizes, the same level of liberalization exposure had different impacts on survival probability. In particular, the inverse-U pattern of the coefficients for both extensive and intensive margins implies reallocation from the smallest (and largest) producers towards those in the top-middle of the size distribution. While this pattern of selection in the traded sector has been explored in previous literature, to the best of our knowledge the fact that it also appears in the non-traded sector is novel.

Along the extensive margin for the non-traded sector, exposure to the liberalization had a significant effect on the likelihood of survival for establishments initially in the bottom and top of the size distribution, but not for those in the middle. Appendix Table 7 makes the formal statistical comparison between the liberalization exposure coefficients, confirming that the reallocation effect is statistically

Reallocation margin:	Extensive	Intensive
Regression equation:	(9)	(10)
θ_1^{NT}	**-0.67***	**-3.82*****
	(0.27)	(0.99)
θ_2^{NT}	-0.02	0.62
	(0.26)	(0.59)
θ_3^{NT}	0.35	**4.91*****
	(0.31)	(0.64)
θ_4^{NT}	**-0.52***	**-3.71*****
	(0.23)	(0.90)
N	1003988	436282

Table 3: Differential effects of import liberalization on plants of different initial size

This table reports the θ_q coefficients for the extensive and intensive margin regressions in (9) and (10) respectively. Both regressions include a set of controls, with the intensive margin regression additionally including a Heckman correction term for survival. Standard errors are clustered at the microregion level. Table 11b reports traded sector coefficients. ***$p < 0.1\%$, **$p < 1\%$, *$p < 5\%$

different if an establishment initially was in the second and third quartile rather than the first.

A similar pattern emerges on the intensive margin, with all coefficients for higher quartiles statistically significantly different from the coefficient on the first quartile. In the first three quartiles of the initial size distribution, the coefficients steadily increase, implying that the distribution of labor tilts toward larger establishments compared to smaller ones in regions more exposed to the import liberalization.

4.4. Importing behavior and new importers

To complete the empirical evidence, we now focus on importing behavior. In particular, we show that importing uptake was more likely among otherwise similar

Specification:	Average firm	By initial size
θ^{NT}	**0.032***	
	(0.014)	
θ_1^{NT}		0.035
		(0.018)
θ_2^{NT}		0.028
		(0.019)
θ_3^{NT}		**0.037***
		(0.018)
θ_4^{NT}		0.029
		(0.021)
N	436282	436282

Table 4: Effects of the import liberalization on importing decision

Each column displays the θ-coefficient for a different specification of (11). Both columns include the full set of controls discussed in Table 5. The second column interacts the exposure variable with the initial size quartiles used in Table 3. We restrict attention to plants that survived throughout the sample period. Standard errors in parentheses are clustered at the microregion level. Table 11c reports traded sector coefficients. ***$p < 0.1\%$, **$p < 1\%$, *$p < 5\%$

producers in high-exposure regions; new importers were largely from the middle of the size distribution and grew the most during the liberalization period.

First, we show that otherwise similar producers in high exposure labor markets were more likely to become importers than those in low exposure regions by regressing

$$\mathbb{1}_e[\text{New importer}] = \alpha_0 + \alpha_s + \alpha_k + \alpha_q + \theta \text{lib}_r + \beta X_e + u_e \tag{11}$$

where we include the same control variables and fixed effects as the producer-level regressions (9) and (10).

Table 4 shows that import exposure increased the likelihood of import adoption. For example, the 0.032 coefficient in the first column implies that an establishment whose initial region faced a 10 pp larger effective tariff decline than another region had, on average, a 0.32 pp larger probability of becoming an importer compared to a similar establishment in the less-exposed region. This quantity corresponds to comparing otherwise similar establishments in a region at the 10th percentile of exposure with those in a region at the 90th percentile of exposure. This 0.32 pp increase is substantial, as it amounts to 48% of the overall share of new importers over the sample period.

To strengthen the link between liberalization and import entry, the second column in Table 4 repeats the regression, allowing the coefficient to vary by initial size quartile. The results establish that the effect of import exposure on the likelihood of import adoption was concentrated at initially larger establishments in the middle of the initial regional employment distribution.

Second, we show that the evolution of outcomes for incumbent importers, new importers, and never importers align with the predictions of the stylized model. To study how importing behavior correlates with post-liberalization performance, we regress

$$y_e = \alpha_0 + \alpha_r + \alpha_k + \alpha_q + \beta X_e + \sum_g \mathbb{1}_e[g]\alpha_g^K + u_e \tag{12}$$

where y_e are establishment outcomes in 1999 among: survival probability, change in log employment, and change in log wage bill. Since new importer status perfectly predicts survival, we omit this dummy in the survival probability regression only. The regression includes the same establishment controls as in the regressions (9) and (10).

Table 5 displays the results, which compares outcomes for producers that are similar in observables other than import status. Among all producers in 1990, incumbent importers were more likely to survive. Conditional on survival, however, it is the new importers that have the most growth. While incumbent importers grew relative to the surviving never importers, employment at new importers grew by even more, measured both by the number of employees and wage bill.

4.5. Robustness

Table 8 shows that the extensive margin findings are robust to different specifications: logit, probit or linear probability models. Figure 6 redoes the establishment-level regressions industry by industry to show that the key empirical patterns from this section are not driven by cross-industry reallocation. Section 5 develops an alternative structural measure based on the model presented in Section 3, and Appendix B repeats all empirical exercises in this section using the structural shock, to show that the main empirical results remain qualitatively unchanged.

Outcome variable:	Survive	d ln(Empl)	d ln(WB)
Importer_{90}	**0.100*****	**0.086***	**0.282*****
	(0.013)	(0.034)	(0.026)
$(\text{New importer})_{99}$		**0.699*****	**0.863*****
		(0.028)	(0.024)
N	1003988	436281	436281

Table 5: Exit and growth by importer status

This table regresses each outcome variable (columns) on a set of dummies for importing status (never importers, new importers, importers) as in equation (12). The comparison group is that of never importers. Since new importer perfectly predicts survival, this dummy is omitted in the survival probability regression. The last two columns focus on plants that survived throughout the sample period. All regressions include a set of controls identical to (9) and (10). Standard errors in parentheses are clustered at the microregion level. Table 10b reports traded sector coefficients. $^{***}p < 0.1\%$, $^{**}p < 1\%$, $^{*}p < 5\%$

5. Structural welfare: theory and quantification

We study the welfare implications of the reallocation among producers in the non-traded section driven by selection into importing. We embed the stylized industry-level partial equilibrium model in Section 3 into a general equilibrium framework of the Brazilian region. Finally, we quantify the welfare impact of the import liberalization attributable to this mechanism. Appendix A contains all proofs for this section.

5.1. Extended framework

The economy consists of a mass L of identical households, an intentionally simple traded sector, and a non-traded sector. Within each sector, there are multiple industries indexed by i in the traded sector and j in the non-traded sector.

We interpret each Brazilian local labor market as an instance of the model's economy. In general, these economies could interact with each other through, for example, factor mobility or goods trade. We abstract from factor mobility for ease of exposition.[14] Additionally, since we focus on the non-traded sector, leaving the traded sector intentionally general, we do not take a stand on the nature of cross-region trade. For notational simplicity, we omit the region index.

Households The representative household has Cobb-Douglas preferences over traded industries i and non-traded industries j as follows

$$U = \left[\prod_j \left(\frac{Q_j}{\beta_j}\right)^{\beta_j}\right] \left[\prod_i \left(\frac{Q_i}{\beta_i}\right)^{\beta_i}\right]$$

$$1 = \sum_j \beta_j + \sum_i \beta_i \quad , \quad Q_j = \left[\int_{\omega \in \Omega_j} q_j(\omega)^{\frac{\sigma-1}{\sigma}} \mathrm{d}\omega\right]^{\frac{\sigma}{\sigma-1}}$$

where Q_i is the good from traded industry i and Q_j is a basket of goods from non-traded industry j. Within each non-traded industry j, the household aggregates differentiated varieties $\omega \in \Omega_j$ with a constant elasticity of substitution σ.

Total household expenditure $wL + D$ is equal to labor income plus an exogenous deficit, of which each industry captures a share β_k where k indexes both non-traded and traded industries. Therefore, the household spends $\beta_i(wL + D)$ on traded industry i, while its demand for a particular variety ω from non-traded industry j is

$$\beta_j(wL + D)\left(\frac{p_j(\omega)}{P_j}\right)^{1-\sigma} \qquad , \qquad P_j = \left[\int_{\omega \in \Omega_j} p_j(\omega)^{1-\sigma} \mathrm{d}\omega\right]^{\frac{1}{1-\sigma}} \tag{13}$$

where P_j is the CES price index in non-traded industry j. In line with the empirical fact from Figure 1 that most imports are intermediate inputs rather than final consumption, we assume that households do not consume foreign imports.

[14] Dix-Carneiro and Kovak (2017, 2019) have found little evidence that Brazilian workers migrated away from microregions that were more exposed to the import liberalization. More recently, Borusyak, Dix-Carneiro, and Kovak (2022) revisits these empirical results, suggesting that migration responses to local shocks may be incorrectly estimated using standard shift-share approaches due to the bilateral nature of this variable. However, despite the potential misspecification, implications for non-bilateral local outcomes such as those in the non-traded sector remain relatively unaffected.

Producers Producers in traded industry i are identical and perfectly competitive. They operate a linear technology in labor, so that each unit of labor produces a_i units of the good in traded industry i. In perfect competition, their prices equals their marginal costs: $p_i = w/a_i$.

Producers in non-traded industry j behave as described in Section 3. In particular, they each produce a differentiated variety and compete monopolistically. Producers optimally choose whether to exit the market and, contingent on participation, whether to use imported inputs.

The input is a Cobb-Douglas bundle of traded inputs, combined with weights η_{ij}. More specifically, the unit cost of the input bundle is

$$m_j(\mathbb{1}^m) = \begin{cases} \prod_i \left(\frac{w}{a_i}\right)^{\eta_{ij}} & \text{if } \mathbb{1}^m = 0 \\ \prod_i \left(p_i^*\right)^{\eta_{ij}} & \text{if } \mathbb{1}^m = 1 \end{cases} \qquad \sum_i \eta_{ij} = 1$$

where p_i^* is the unit price for the input i faced by producers using imported inputs. This unit price is exogenous, following a small open economy assumption, so the foreign currency is taken as the numeraire. Producers that do not use imported inputs source their inputs domestically and face the domestic price for good i.

The importer advantage for producers in non-traded industry j is

$$\Delta_j = \left[w \prod_i \left(a_i p_i^*\right)^{-\eta_{ij}} \right]^{\alpha_j} \tag{14}$$

which increases as the importer unit price p_i^* falls, the domestic wage w increases, or as local productivity a_i falls.

To close the model, we assume that fixed costs are paid in labor, which is perfectly mobile across activities and industries.[15] In particular, the fixed cost of production in non-traded industry j is $F_j^n = wf_j^n$; the fixed cost of importing is $F_j^m = wf_j^m$; and the fixed cost of entry is $F_j^e = wf_j^e$. Taken together, there is one region-wide

[15]Since the model is static, it is best suited to describe long run outcomes, consistent with the jobflow approach of Section 4, rather than individual worker transitions. Labor mobility thus includes changes in the labor force composition that meets labor demands, rather than perfect mobility of any particular worker. A large complementary literature has studied the extent to which individual workers can switch across industries (e.g. Dix-Carneiro 2014), occupations (e.g. Traiberman 2019), or space (e.g. Caliendo, Dvorkin, and Parro 2019).

labor market clearing condition

$$\frac{D}{wL + D} = \sum_j \frac{\sigma - 1}{\sigma} \alpha_j \delta_j \beta_j \tag{15}$$

where δ_j the share of total sales in industry j for which importing producers account. This labor market clearing condition thus enforces balance of payments.

Definition (Regional equilibrium)**.** *The economy equilibrium is the cutoffs $\{z_j^n, z_j^m\}$, mass of entrants M_j, price indices P_j, importer advantages Δ_j, and wage w so that*

1. *non-traded industries are in equilibrium* (ZZ)–(FE)*;*
2. *the marginal type earns zero total profits* (4)*;*
3. *price indices and importer advantages satisfy the definitions* (13) *and* (14)*;*
4. *and the labor market clears* (15)

conditional on the exogenous deficit D and foreign prices p_i^*.

5.2. Welfare and selection

We now study the welfare impact of an import liberalization in general equilibrium. To emphasize the different effects across regions, we re-introduce the region index r.

Household welfare equals to real consumption in our setup, defined as

$$V_r = \left(1 + \frac{1}{L_r} \frac{D_r}{w_r}\right) \left[\prod_i a_{ir}^{\beta_i}\right] \left[\prod_j \left(\frac{w_r}{P_{jr}}\right)^{\beta_j}\right]$$

which divides per capita nominal expenditure with the ideal price index.

There are three channels that influence the welfare in region r: the per capita real deficit, the productivities in the traded sector, and the real prices in non-traded industries. In principle, each of these components could change during an import liberalization.

To isolate the role of selection into importing, we allow only the foreign input price p_i^* to change, holding fixed all other fundamentals. Then, the first two components of welfare do not adjust, so that welfare only moves from aggregate productivity changes in the non-traded industries.

Then, using the zero-profit condition (4) which determines the productivity of the marginal producer, the first order change in welfare is entirely summarized by changes in the participation cutoffs $\{z^n_{jr}\}_j$

$$\mathrm{d}\ln V_r = \sum_j \beta_j \mathrm{d}\ln z^n_{jr}$$

where each cutoff's change is weighted by the importance of industry j in household consumption β_j.

Selection cutoff We now determine, in turn, the impact of an import liberalization on the participation cutoff.

The first order change in the participation cutoff in non-traded industry j is

$$\mathrm{d}\ln z^n_{jr} = \delta_{jr}\alpha_j \cdot \left[\underbrace{-\mathrm{d}\ln \overline{p}^*_j}_{\text{upstream}} + \underbrace{\sum_{j'} \xi_{j'r}\mathrm{d}\ln \overline{p}^*_{j'}}_{\text{GE wage}} \right]$$

where

$$\mathrm{d}\ln \overline{p}^*_j \equiv \sum_i \eta_{ij}\mathrm{d}\ln p^*_i \quad , \quad \xi_{jr} \equiv \frac{\frac{\alpha_j}{1-\alpha_j}\delta_{jr}\lambda^w_{jr}\cdot \alpha_j(1-\delta_{jr})B_{jr}}{\sum_{j'}\frac{\alpha_{j'}}{1-\alpha_{j'}}\delta_{j'r}\lambda^w_{j'r}\cdot \alpha_{j'}(1-\delta_{j'r})B_{j'r}}$$

so that $\mathrm{d}\ln \overline{p}^*_j$ is the average upstream input price changes, weighted by the importance of industry i as part of the inputs for industry j, λ^w_{jr} is the share of region r wage bill for which industry j accounts, and B_{jr} is an economy aggregate that captures the shape of the exogenous productivity distribution G_j.

Following the import liberalization, the participation cutoff changes for two reasons: an *upstream effect* and a *general equilibrium wage effect*. The two channels combined, which summarize the change in input costs, translate to the cutoff via the importance of intermediate inputs in non-traded production α_j and by the size of importers before the liberalization δ_{jr}. Intuitively, the more input-intensive is production, the more changes in input prices affect profits, and therefore the participation cutoff. Similarly, the more the existing importers produce compared to non-importers, the more a change in their profitability will affect the balance of aggregate profits.

Notably, the upstream and wage effects decompose the liberalization's impact on input costs into a industry-specific effect and a region-specific effect. The upstream effect, which captures a direct effect, reflects how changes in the costs of other industries transmit through input-output relationships. The general equilibrium wage effect instead describes changes in the local wage w_r relative to the foreign numeraire. As the tariffs fall and the domestic demand for imported inputs rises, the relative wage must fall to maintain the economy's balance of payments.

In particular, the general equilibrium wage effect is an average over all industries' upstream tariff changes, weighted by the importance of each non-traded industry in the region's aggregate balance of payments ξ_j. A non-traded industry j receives higher weight the higher its importance in the initial balance of payments, summarized by $\frac{\alpha_j}{1-\alpha_j}\delta_j\lambda_j$. All else equal, industry j's effective upstream tariff change is more important the higher its initial employment share.

Quantitative welfare We now use the structural expression for welfare to quantify the welfare impacts of the reallocation among producers in non-traded industries during the Brazilian import liberalization.

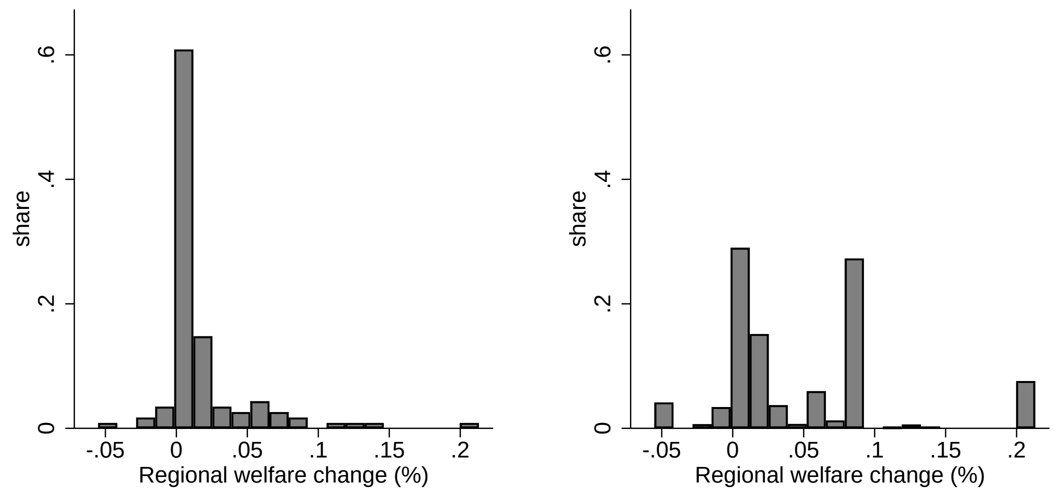
With the assumption that changes to the tariff directly translate to changes in the prices p_i^*, the first order change in welfare is

$$\mathrm{d}\ln V = \sum_j \beta_j \delta_{jr} \alpha_j \left[-\mathrm{d}\ln \overline{(1+\tau_j)} - (\text{s.lib})_r \right] \tag{16}$$

where $\mathrm{d}\ln \overline{(1+\tau_j)} = \sum_i \eta_{ij} \mathrm{d}\ln(1+\tau_i)$ is the industry's upstream tariff change and $(\text{s.lib})_r = -\sum_j \xi_{jr} \mathrm{d}\ln \overline{(1+\tau_j)}$ is the *structural* liberalization measure. Intuitively, welfare increases as effective upstream tariffs drop, but declines as the liberalization pushes down the real wage. To compute the structural weights ξ_{jr} directly from the data, we assume that the exogenous productivity distribution of producers G_j is Pareto.

Figure 5 plots the distribution of structural welfare effects across Brazilian local labor markets with non-zero welfare impact.[16] Panel 5a weights each region evenly,

[16]Some regions have zero welfare impact because there are no importers in any non-traded industry. These regions are small, accounting for 6.7% of total wage bill. The first order approximation of equation (16) does not apply to the inframarginal effect any new importers would cause.



(a) Unweighted

(b) Weighted by region wage bill

Figure 5: Distribution of regional welfare gains (%)

Percentage changes in regional welfare, implied by the structural expression (16), for regions with non-zero effect. Panel 5a weights each region equally while Panel 5b by initial wage bill. The average change in welfare is 0.02% (0.05% weighted by wage bill) and the standard deviation is 0.03 (0.06 weighted by wage bill). The most impacted region experienced 0.21% higher welfare. There are 289 regions with zero impact, accounting for 6.7% of Brazil's total wage bill.

while Panel 5b weights each region by its wage bill. We weight by wage bill to approximate the economic incidence of the effects on jobs.

As Figure 5 shows, most regions with non-zero effect experience small improvements to welfare. The average welfare effect is 0.02%, or 0.05% if weighting by initial wage bill. To contextualize this magnitude, Costinot and Rodríguez-Clare (2014) compute a 0.16% welfare loss from a unilateral 40% tariff against U.S. imports using 2008 data.

However, the average welfare effect masks the considerable dispersion across local labor markets. The most impacted region experiences 0.21% higher welfare, over ten times larger than the average effect. Moreover, Panel 5b shows that this single region is relatively large, accounting for over 7% of Brazil's total wage bill. Similarly, the worst off region loses 0.05% welfare while also accounting for a reasonable share of national wage bill. In general, though several large local labor markets benefit from the import liberalization, there are also many regions that do not gain much.

6. Conclusion

This paper studies a new margin for the gains from trade: the reallocation of labor within the non-traded sector, driven by selection into importing.

Using Brazil's import liberalization as a natural experiment, we first show that tariff cuts spurred job reallocation from smaller to larger producers in non-traded industries. Both exits and incumbent growth created these job reallocation patterns. The job reallocation coincided with producer entry into importing, where new importers were already medium- to large-sized and grew the most subsequently.

We develop a simple model of selection into importing in the non-traded sector, not only to illustrate how this mechanism can explain the patterns in the data, but also to quantify its welfare impact. Welfare improves because growing importers squeeze out small, unproductive producers. Thus, without selection, the model does not generate job reallocation; in turn, there are no welfare gains.

Quantifying the welfare gains of our mechanism in isolation from other sources of gains from trade, they vary from -0.05% to 0.21% across regions, with an average gain of 0.02%. Our results emphasize the importance of the local labor market, especially through the non-traded sector, in shaping the fate of jobs in the face of trade shocks.

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A. Mathematical appendix

This Appendix provides additional mathematical support for the main results in Sections 3 and 5.

A.1. Industry equilibrium and selection

Proposition (Existence and uniqueness industry equilibrium)**.** *Given* $\Delta > 1$*, the system* (ZZ)–(FE) *has a unique solution* $\{z^n, z^m\}$*.*

Proof. Begin by rewriting (ZZ) to express z^n as a linear function of z^m, as below.

$$z^n = \left[\frac{F^n}{F^m}\left(\Delta^{\sigma-1} - 1\right)\right]^{\frac{1}{\sigma-1}} z^m$$

Note that this expression is continuous, strictly increasing, unbounded above, and begins at the origin. Next, rewrite (FE) as below.

$$\frac{F^e}{F^n} = \int_{z^n}^{z^m} \left[\left(\frac{z}{z^n}\right)^{\sigma-1} - 1\right] \mathrm{d}G(z) + \int_{z^m}^{\infty} \left[\left(\frac{z}{z^n}\Delta\right)^{\sigma-1} - 1 - \frac{F^m}{F^n}\right] \mathrm{d}G(z)$$

Add and subtract $\int_{z^m}^{\infty} \left[\left(\frac{z}{z^n}\right)^{\sigma-1} - 1\right] \mathrm{d}G(z)$ on the right hand side, then use (ZZ) to get

$$\begin{aligned} &= \int_{z^n}^{\infty} \left[\left(\frac{z}{z^n}\right)^{\sigma-1} - 1\right] \mathrm{d}G(z) + \frac{F^m}{F^n} \int_{z^m}^{\infty} \left[\left(\frac{z}{z^m}\right)^{\sigma-1} - 1\right] \mathrm{d}G(z) \\ &= \Psi(z^n) + \frac{F^m}{F^n}\Psi(z^m) \end{aligned}$$

where define

$$\Psi(x) = \int_{x}^{\infty} \left[\left(\frac{z}{x}\right)^{\sigma-1} - 1\right] \mathrm{d}G(z)$$

and observe that Ψ is continuous and strictly decreasing, with $\Psi(0) = \infty$ and $\lim_{x\to\infty} \Psi(x) = 0$. Put together, there exists a unique solution $\{z^n, z^m\}$ to (ZZ)–(FE). $\square$

Proposition (Liberalization extensive margin impacts)**.** *Assume $\frac{F^e}{F^n}$ is unchanged. An import liberalization, either where Δ increases or $\frac{F^m}{F^n}$ falls, increases the participation cutoff z^n and decreases the importing cutoff z^m.*

Proof. Differentiate the system, beginning with (FE).

$$\begin{aligned}\mathrm{d}\ln z^n = & \frac{\int_{z^m}^{\infty}(z\Delta)^{\sigma-1}\mathrm{d}G}{\int_{z^n}^{z^m} z^{\sigma-1}\mathrm{d}G + \int_{z^m}^{\infty}(z\Delta)^{\sigma-1}\mathrm{d}G}\mathrm{d}\ln\Delta \\ & - \frac{F^m\left[1-G(z^m)\right]}{F^e + F^n\left[1-G(z^n)\right] + F^m\left[1-G(z^m)\right]}\frac{1}{\sigma-1}\mathrm{d}\ln\frac{F^m}{F^n}\end{aligned} \tag{dFE}$$

This expression directly implies that the participation z^n increases in the import advantage Δ and decreases in the (relative) fixed cost importing $\frac{F^m}{F^n}$. Differentiating (ZZ) and substituting in (dFE),

$$\begin{aligned}\mathrm{d}\ln z^m &= -\frac{\Delta^{\sigma-1}}{\Delta^{\sigma-1}-1}\mathrm{d}\ln\Delta + \frac{1}{\sigma-1}\mathrm{d}\ln\frac{F^m}{F^n} + \mathrm{d}\ln z^n \\ &= -\left[\frac{1}{\Delta^{\sigma-1}-1} + \frac{\int_{z^n}^{z^m} z^{\sigma-1}\mathrm{d}G}{\int_{z^n}^{z^m} z^{\sigma-1}\mathrm{d}G + \int_{z^m}^{\infty}(z\Delta)^{\sigma-1}\mathrm{d}G}\right]\mathrm{d}\ln\Delta \\ &\quad + \frac{F^e + F^n\left[1-G(z^n)\right]}{F^e + F^n\left[1-G(z^n)\right] + F^m\left[1-G(z^m)\right]}\frac{1}{\sigma-1}\mathrm{d}\ln\frac{F^m}{F^n}\end{aligned}$$

which shows that z^m falls in Δ and increases in $\frac{F^m}{F^n}$. □

Proposition (Liberalization intensive margin impacts)**.** *For continuing importers,*

- *wage bill increases if liberalization increases the import advantage Δ, but*
- *wage bill decreases if liberalization decreases the fixed cost F^m.*

Proof. Given the expression for labor demand (6), the change in labor for a continuing importer is summarized by

$$\begin{aligned}\mathrm{d}\ln\Delta - \mathrm{d}\ln z^n = & (\sigma-1)\frac{\int_{z^n}^{z^m} z^{\sigma-1}\mathrm{d}G}{\int_{z^n}^{z^m} z^{\sigma-1}\mathrm{d}G + \int_{z^m}^{\infty}(z\Delta)^{\sigma-1}\mathrm{d}G}\mathrm{d}\ln\Delta \\ & + \frac{F^m\left[1-G(z^m)\right]}{F^e + F^n\left[1-G(z^n)\right] + F^m\left[1-G(z^m)\right]}\mathrm{d}\ln F^m\end{aligned}$$

Thus, if $\mathrm{d}\ln\Delta > 0$ while $\mathrm{d}\ln F^m = 0$, then the producer's variable labor demand decreases while the fixed cost component stays constant. On the other hand, if $\mathrm{d}\ln F^m < 0$ while $\mathrm{d}\ln\Delta = 0$, then both the producer's variable labor demand and fixed costs decrease. $\square$

A.2. General equilibrium and structural shock

This section provides the results for theoretical results in Section 5.

The share of sales in industry j for which importers account is

$$\delta_j = \frac{\int_{z_j^m}^{\infty}\left(\frac{z}{z_j^n}\Delta_j\right)^{\sigma-1}\mathrm{d}G_j(z)}{\int_{z_j^n}^{z_j^m}\left(\frac{z}{z_j^n}\right)^{\sigma-1}\mathrm{d}G_j(z) + \int_{z_j^m}^{\infty}\left(\frac{z}{z_j^n}\Delta_j\right)^{\sigma-1}\mathrm{d}G_j(z)}$$

and the aggregate B_j is

$$\begin{aligned} 0 \leq B_j \equiv & \left[\frac{\left(z_j^m\right)^{\sigma} g_j\left(z_j^m\right)}{\int_{z_j^n}^{z_j^m} z^{\sigma-1} g_j(z)\,\mathrm{d}z} + \frac{\left(z_j^m\right)^{\sigma} g_j\left(z_j^m\right)}{\int_{z_j^m}^{\infty} z^{\sigma-1} g_j(z)\,\mathrm{d}z}\right]\left[\frac{\Delta_j^{\sigma-1}}{\Delta_j^{\sigma-1}-1} - \delta_j\right] \\ & + \frac{\left(z_j^n\right)^{\sigma} g_j\left(z_j^n\right)}{\int_{z_j^n}^{z_j^m} z^{\sigma-1} g_j(z)\,\mathrm{d}z}\delta_j + (\sigma-1) \end{aligned}$$

Totally differentiating the equilibrium gets the following system in changes $\{\mathrm{d}\ln z_j^n, \mathrm{d}\ln\Delta_j, \mathrm{d}\ln w\}$ given changes in fundamentals $\{\mathrm{d}\ln p_i^*, \mathrm{d}\ln a_i, \mathrm{d}\ln D\}$:

$$\mathrm{d}\ln z_j^n = \delta_j \mathrm{d}\ln\Delta_j \tag{17}$$

$$\mathrm{d}\ln\Delta_j = \alpha_j\left[\mathrm{d}\ln w - \sum_i \eta_{ij}\left(\mathrm{d}\ln a_i + \mathrm{d}\ln p_i^*\right)\right] \tag{18}$$

$$\mathrm{d}\ln w = \sum_j \xi_j \sum_i \eta_{ij}\left(\mathrm{d}\ln a_i + \mathrm{d}\ln p_i^*\right) + \frac{\frac{wL}{wL+D}\frac{D}{wL+D}}{\sum_{j'}\frac{\sigma-1}{\sigma}\alpha_{j'}\beta_{j'}\delta_{j'}(1-\delta_{j'})B_{j'}\alpha_{j'}}\mathrm{d}\ln\frac{D}{w} \tag{19}$$

$$\mathrm{d}\ln V = \frac{D}{wL+D}\left[1+\sum_j \frac{\beta_j}{\sigma-1}\right]\mathrm{d}\ln\frac{D}{w} \qquad (20)$$
$$+\sum_i \beta_i \mathrm{d}\ln a_i + \sum_j \beta_j\left[\alpha_j \sum_i \eta_{ij}\mathrm{d}\ln a_i + \mathrm{d}\ln z_j^n\right]$$

There are four components in the change in welfare: first, if the real deficit increases, then welfare benefits from increased consumption; second, if the productivity of a traded industry rises, then welfare benefits from cheaper traded goods prices; third, these price impacts are transmitted to the prices of non-traded goods, through input-output; and, finally, the selection effect in non-traded industries also drives changes in the price index.

Isolate the welfare impact of selection by assuming $\mathrm{d}\ln\frac{D}{wL} = \mathrm{d}\ln a_i = 0$. Then, the impact of the liberalization on welfare is

$$\mathrm{d}\ln V = \sum_j \beta_j\delta_j\alpha_j\left[\sum_{j'}\xi_{j'}\sum_i \eta_{ij''}\mathrm{d}\ln p_i^* - \sum_i \eta_{ij}\mathrm{d}\ln p_i^*\right]$$

which derives the welfare decomposition in Section 5.

Finally, if the productivities follow a Pareto distribution with shape ζ, then:

$$\frac{B_j}{\sigma-1} = \frac{\frac{\zeta}{\sigma-1}-1}{1-\frac{1}{\delta_j}\left[\left(\frac{z_j^m}{z_j^n}\right)^{-\zeta}\right]^{1-\frac{\sigma-1}{\zeta}}}+1\,.$$

B. Additional empirical details and results

This Appendix provides additional empirical results to complement the main patterns documented in Section 4.

B.1. Additional details

Sample description Throughout the empirical analysis, we exclude workers with faulty IDs or zero earnings, and restrict attention to the highest-paying job for each worker. At the establishment level, we drop producers with missing ID, municipality, or industry information. We do not consider producers in the mining, utilities, and public industries. All nominal variables are converted to 2000 Brazilian Reais.

Structural shock Each component of the structural shock of (16) has a direct data counterpart. We compute the non-labor share α and tariff changes identically to Section 4. Using the RAIS data, we directly calculate δ_{jr}, the share of industry j wage bill for which importers account, as well as λ^{w}_{jr}, the share of total wage bill for which industry j accounts. Similarly, the National Accounts input-output table allows computing the share β_j of each industry in final consumption, as well as the share of each input η_{ij}.

The final component of the structural shock is the aggregate $B_j/(\sigma-1)$ which, following the derivation from Appendix A.2 with Pareto-distributed productivity, can also be computed from the RAIS data. We measure the share of importers $(z^m_j/z^n_j)^{-\zeta}$ directly.

The probability that the wage bill of an establishment, in region r and non-traded industry j with productivity z, exceeds b is

$$\mathbb{P}[\text{wage bill} \geq b] = b^{-\frac{\zeta}{\sigma-1}} \left\{ \underline{z}_{jr} \left[\beta_j(w_r L_r + D_r)\right]^{\frac{1}{\sigma-1}} \frac{\sigma-1}{\sigma} \frac{\Delta_{jr}^{\mathbb{1}^m_e}}{w_r^{1-\alpha_j} m_{jr}^{\alpha_j}} \right\}^{\zeta}$$

where $\underline{z}_{jr}$ is minimum of the productivity distribution's support. Guided by the theory, we use the establishment data from 1990 to regress

$$\ln(\text{rank})_e = \alpha_0 + \alpha_{rk} + \alpha^m_{rk}\mathbb{1}^m_e - \alpha^w \ln(\text{wage bill})_e + \varepsilon_e \tag{21}$$

to recover the shape parameter $\zeta/(\sigma-1)$ as α^w, where $(\text{rank})_e$ is the establishment's rank in the wage bill distribution of its respective region r and industry k, α_{rk} is a region-industry fixed effect, and $\alpha^m_{rk}\mathbb{1}^m_e$ allows the fixed effect to differ if the establishment is an importer. T Since the tail parameter best describes the distribution of the largest establishments, we restrict attention to those above the 95th (or 99th) percentile of the wage bill distribution in their region-industry. We drop any region-industries with fewer than 100 (or 500) establishments. Though we keep only the top establishments, these sample restrictions still capture at least 30% of total wage bill.

	(1) $\ln(\text{rank})_e$	(2) $\ln(\text{rank})_e$	(3) $\ln(\text{rank})_e$	(4) $\ln(\text{rank})_e$
$\ln(\text{wage bill})_e$	**1.30*****	**1.23*****	**1.15*****	**1.11*****
	(0.01)	(0.01)	(0.00)	(0.00)
Sample selection within region-industry				
Percentile	99th	99th	95th	95th
Establishments	500	100	500	100
Wage bill share	30%	38%	47%	59%
N	6350	7886	31456	38343

Table 6: Wage bill distribution's Pareto tail

This table reports the results for the regression (21) to identify the Pareto tail of the wage bill distribution in the non-traded sector. The regression includes a set of region-industry fixed effects, which differ by establishment importer status. We use data from 1990 and restrict the sample to establishments above the 99th or 95th percentile in their region-industry; and to region-industries with at least 500 or 100 establishments. For each sample selection, we report the share of total wage bill for which the restricted sample accounts. $^{***}p < 0.1\%$, $^{**}p < 1\%$, $^{*}p < 5\%$

Table 6 reports the results. Across all specifications, the estimated tail parameter for the wage bill distribution is between 1.11–1.30. In the quantification, we use the estimate from column (1), which uses the largest establishments in regions with many establishments.

B.2. Additional results and robustness

Additional results We establish that the impact of import liberalization exposure was different for establishments of initially different size, in a statistically significant way. To do so, we use the following regression specifications.

$$\text{Surv}_e = \Phi\left(\alpha_0 + \alpha_s + \alpha_k + \alpha_q + \theta_q^K \text{lib}_r + \sum_{q=2}^{4} \mathbb{1}_e[q]\theta_q^K \text{lib}_r + \beta X_e + \varepsilon_e\right) \tag{22}$$

$$g_e = \alpha_0 + \alpha_s + \alpha_k + \alpha_q + \theta_q^K \text{lib}_r + \sum_{q=2}^{4} \mathbb{1}_e[q]\theta_q^K \text{lib}_r + \beta X_e + \varepsilon_e \tag{23}$$

	(22) Extensive	(23) Intensive
θ^{NT}	**-0.67*** (0.27)	**-3.82***** (0.99)
θ_2^{NT}	**0.64**** (0.21)	**4.43***** (0.95)
θ_3^{NT}	**1.02**** (0.32)	**8.73***** (1.12)
θ_4^{NT}	0.15 (0.17)	0.10 (0.91)
N	1003988	436282

Table 7: Differential effects of import liberalization on plants of different initial size

This table reports the θ coefficients for the extensive and intensive margin regressions in (22) and (23) respectively. These regressions are analoguous those in Table 3. The θ coefficient applies to all plants, with θ_q applying additionally for plants in initial size quartile $q \in \{2, 3, 4\}$. Standard errors are clustered at the microregion level. ***$p < 0.1\%$, **$p < 1\%$, *$p < 5\%$

These specifications replicate the regressions in (9) and (10), but with a coefficient θ on the liberalization variable that applies to all establishments. It then includes terms to account for an additional effects of liberalization on establishments from initial quartiles different from the smallest. These additional effects are captured by the θ_q^K coefficients. If they are statistically indistinguishable from zero, then the liberalization did not have a different impact for plants initially in the smallest size quartile compared to the others.

Table 7 reports the results. The first row captures the baseline impact of the liberalization on all plants. The following coefficients θ_q^{NT} summarize the *additional* impact of liberalization exposure on an establishment in initial size quartile $q \in \{2, 3, 4\}$. For example, the total impact of liberalization exposure on an establishment initially in largest size quartile would be $\theta^{\mathrm{NT}} + \theta_4^{\mathrm{NT}}$.

On the extensive margin, liberalization exposure affected establishments originally in the second and third employment quartile differently from those in the first. Moreover, the positive coefficient reflects the fact that these establishments

	(9) Probit	(9) Logit	(9) Linear	(11) Probit	(11) Logit	(11) Linear
θ_1^{NT}	**-0.67***	**-1.10***	**-0.24***			
	(0.27)	(0.44)	(0.10)			
θ_2^{NT}	-0.02	-0.05	-0.01			
	(0.26)	(0.43)	(0.10)			
θ_3^{NT}	0.35	0.54	0.14			
	(0.31)	(0.51)	(0.12)			
θ_4^{NT}	**-0.52***	**-0.85***	**-0.20***			
	(0.23)	(0.37)	(0.08)			
θ^{NT}				**2.479*****	**6.598*****	**0.032***
				(0.728)	(1.917)	(0.014)
N	1003988	1003988	1003988	436254	436254	436282

Table 8: Robustness: sensitivity to binary model specification

This table reports the results for binary outcome regressions (Tables 3 and 4) with different model specifications. The first and last columns replicate the baseline specifications, respectively. ***$p <$ 0.1%, **$p < 1\%$, *$p < 5\%$

were more likely to survive compared to their smaller, but otherwise comparable, counterparts. Similarly, among survivors, employment at these plants also responded differentially to liberalization exposure in a statistically significant way. The positive coefficients once again signal that establishments initially in the middle of the size distribution were more likely to grow (less likely to shrink) than their smaller counterparts.

Robustness Tables 8 replicates the regressions (9) and (11) with different specifications of the binary response variable.

The first three columns in 8 report the results for (9) for the logit and linear probability models. For convenience, it also replicates the baseline probit results from the main specification. Given the different functional forms of the probability specification, the coefficients are not directly comparable. However, the qualitative patterns remain identical. In particular, liberalization exposure decreased the chance of survival for initially small and large establishments, while having no impact on those from the middle of the size distribution. The -0.24 coefficient in the linear probability model indicates that a small plant active in the non-traded sector, whose initial region faced a 10 percentage point larger effective tariff decline, was 2.4 percentage points less likely to survive compared to a similar plant in a non-exposed region.

The last three columns perform a similar exercise with the importer entry decision of (11). The last column replicates the baseline specification. Regardless of the binary model functional form, establishments in more exposed regions were more likely to begin importing compared to similar establishments in unexposed regions.

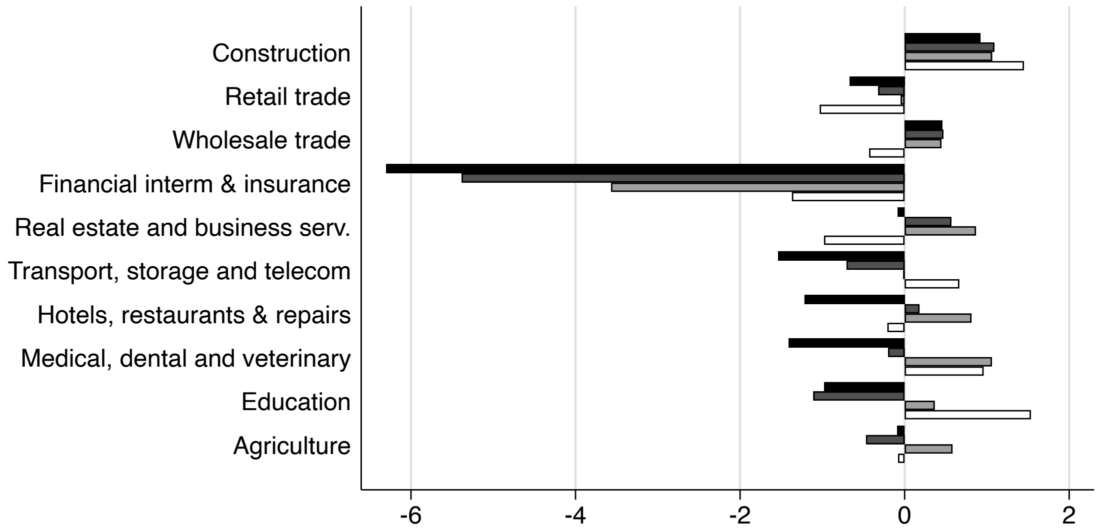
Finally, to show that the establishment-level results of Table 3 are not driven by reallocations across industries within sectors, we repeat the regressions of (9) and (10) but allow the coefficient on liberalization exposure to vary by industry rather than sector. In other words, we estimate the full set of coefficients θ_q^k where k indexes industry.

Figure 6 plots the coefficients for each non-traded industry, with the smallest quartile θ_1^k as the darkest bar up to the largest θ_4^k as the lightest bar. The patterns across initial establishment size *within industry* match those from the sector-level regressions of Table 3. In particular, medium to large establishments in high exposure areas were more likely to survive and grow compared to their smaller counterparts within the same area and industry.

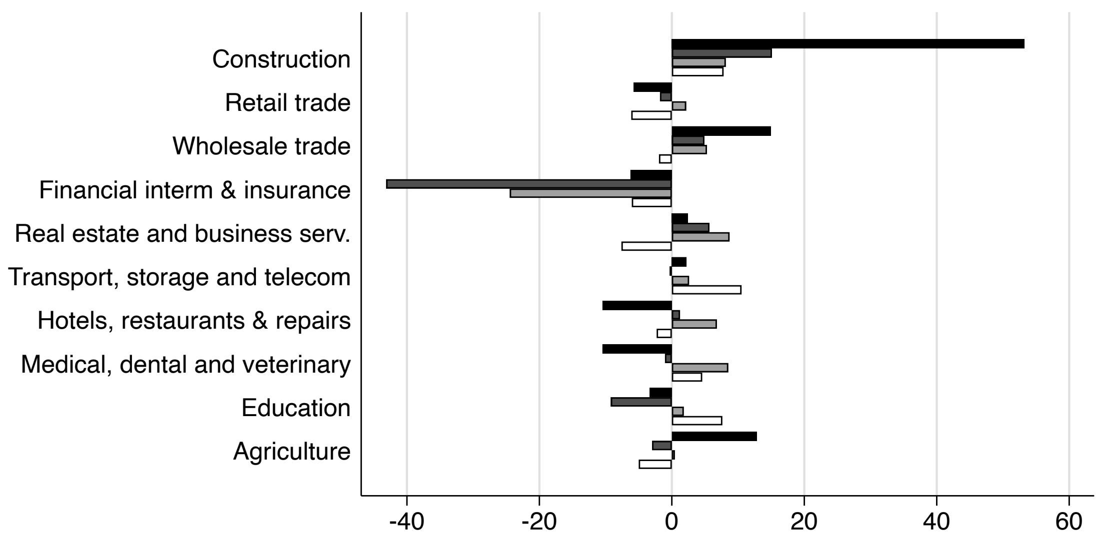
Structural shock Table 9 replicates the regressions from the main body, replacing the Kovak (2013) liberalization measure with the structural shock derived from the model in Section 5. We indicate the coefficients on the structural shock with a tilde, to differentiate from the main specification. Panel 9a reports the results analogous to Table 2, Panel 9b reports the results analogous to Table 7, and Panel 9c reports the results analogous to Table 4.

Qualitative patterns are similar with the structural shock. In particular, local labor markets with higher exposure to the import liberalization experienced different jobflow patterns relative to those less exposed, reallocating jobs from small to larger establishments and seeing increased import participation.

Panel 11a shows that the same margins are statistically significant as in the main specifications. The non-traded sector in regions more exposed experienced less job destruction from establishment exit and more job creation from establishment expansion.



(a) Survival



(b) Growth

Figure 6: Industry by industry: differential effects of import liberalization on plants of different initial size

This figure plots the coefficients from replicating the regressions (9) and (10) with θ_q^k that vary by industry, analogous to Table 3. Coefficients for the smallest quartile are the darkest bar, up to the largest quartile as the lightest bar.

Among establishments, job reallocation effects differed based on initial employment. Panel 11b replicates the regression specification of Table 7: that is, $\tilde{\theta}^{\mathrm{NT}}$ is the effect of liberalization exposure on the establishments in the first quartile of the size distribution; for each other quartile, the total effect of the liberalization is $\tilde{\theta}^{\mathrm{NT}} + \tilde{\theta}_q^{\mathrm{NT}}$. This specification performs the formal test of whether the effects on larger establishments are statistically significantly different from the effects on the smallest. They are for establishments in the second quartile of the size distribution.

Finally, establishments in regions more exposed to the import liberalization were more likely to become importers, compared to otherwise similar establishments in low-exposure areas.

B.3. Traded industries

All regressions in Section 4 included traded establishments and allow key coefficients to vary by sector tradedness. Since effects in non-traded industries is the main focus, all coefficients concerning traded impacts omitted from the main results. This section thus reports all results for the traded sector.

Importers Table 10a displays the results for qualitative importer characteristics before the liberalization's onset for establishments active in a traded industry. While initial importers were higher-performing than never importers, plants that go on to become importers are even more productive still. This pattern is independent of the measure of plant performance.

Table 10b displays the results for the outcomes following the liberalization of establishments active in the traded sector. While importer status was associated with a higher chance of survival, surviving incumbent importers were more likely to shrink in employment compared to never importers. On the other hand, new importers grew relative to never importers, both in employment and wage bill.

Jobflows Table 11a reports the results for the jobflow impacts of liberalization exposure on jobs active in the traded sector. In particular, it reports the coefficients from the pooled regression (8) for the traded sector.

Confining attention to the point estimates only, exposure to liberalization had qualitatively similar effects on gross job flow patterns in both the traded and non-traded industries. However, the coefficients with statistical significance imply very different effects in the traded sector compared to the non-traded sector. In particular, in the traded sector, there was a overall negative effect on employment in these region-industries. Regions that were relatively more exposed to the tariff cuts experienced more job destruction due to contraction and less job creation due to entry compared to regions that were not as exposed to the tariff cuts. These overall effects in traded industries are qualitatively in line with previous studies.

The rows below the regression results quantify the additional job loss attributable to variation in liberalization exposure. The exposure to the liberalization caused not only large job reallocation effects, but also sizeable variation in these effects across microregion-industry pairs. The median microregion-industry impact was between 3 to 5 additional jobs, with the most affected region losing nearly 20,000 traded sector jobs on net.

Plants Table 11b reports the results for establishment-level impacts of import liberalization exposure, for establishments active in a traded industry. In particular, the table on the left contains the coefficients for the main regressions (9) and (10) while the table on the right contains the comparable coefficients for regressions (22) and (23).

Focusing on the first and third columns to begin, exposure to import liberalization had an overall negative impact on establishment survival throughout the initial size distribution. The only exception is the third size quartile, which is relatively unaffected by liberalization exposure. On the other hand, the estimates in the third column show that establishments in all other size bins experienced an impact statistically indistinguishable from the smallest size quartile. The even effect across the employment distribution is in contrast to the differential impacts in the non-traded sector.

The difference between outcomes for traded and non-traded establishments becomes more apparent among survivors. Focusing now on the second and fourth columns, import liberalization had a nearly uniformly negative impact on establishment employment. Establishments active in the traded sector in all size quartiles, except the first, were more likely to shrink (less likely to grow) if in a high-exposure region compared to a low-exposure region. The inverse relationship between import exposure impact and initial size is consistent with the evidence from Holmes and Stevens (2014).

Taken together, the patterns in Tables 10a and 10b loosely suggest that new importers came from the top of the productivity distribution. Table 11c provides more supporting evidence. It reports the coefficients on liberalization exposure on the propensity to become an importer. Surviving plants in high-exposure regions were more likely to become importers than comparable survivors in low-exposure regions. However, disaggregating this impact by initial size quartile, the only statistically significant impact is on the plants from the top of the size distribution. In other words, among survivors, only initially large plants responded to liberalization exposure by entering the import market.

	Job destruction		Job creation	
	Exit	Contract	Entry	Expand
$\tilde{\theta}^{\ell}_{\mathrm{NT}}$	**-0.161***	0.030	0.010	**0.069****
	(0.074)	(0.042)	(0.058)	(0.026)
N	6617	6617	6617	6617

(a) Local labor market effects of the import liberalization on job flows

	(22) Extensive	(23) Intensive
$\tilde{\theta}^{\mathrm{NT}}$	**-0.36****	-1.64
	(0.14)	(0.84)
$\tilde{\theta}^{\mathrm{NT}}_2$	**0.28***	0.30
	(0.14)	(0.88)
$\tilde{\theta}^{\mathrm{NT}}_3$	0.24	0.52
	(0.22)	(0.86)
$\tilde{\theta}^{\mathrm{NT}}_4$	-0.13	-2.87*
	(0.13)	(1.12)
N	1003988	436282

(b) Differential effects of import liberalization on plants of different initial size

	(11) Probit	(11) Logit	(11) Linear
$\tilde{\theta}^{\mathrm{NT}}$	**3.622*****	**8.868*****	**0.040*****
	(0.527)	(1.368)	(0.009)
N	436282	436282	436282

(c) Effects of the import liberalization on importing decision

Table 9: Structural shock results

This table replicates the regressions using the structural shock to measure liberalization exposure. Panel 9a reports the results analogous to Table 2; panel 9b the results analogous to Table 7; and panel 9c the results analogous to Table 4. ***$p < 0.1\%$, **$p < 1\%$, *$p < 5\%$

	(1) $\ln(\text{Empl})_{90}$	(1) $\ln(\text{WB})_{90}$	(1) $\ln(\text{Wage})_{90}$	(1) $(\text{Skill Share})_{90}$
Always importer	**2.547*****	**3.257*****	**0.710*****	**0.112*****
	(0.183)	(0.210)	(0.033)	(0.010)
New importer	**1.636*****	**2.077*****	**0.441*****	**0.059*****
	(0.128)	(0.152)	(0.027)	(0.005)
N	436281	436281	436281	436281

(a) Pre-liberalization characteristics by importer status

	(12) Survive	(12) $d\ln(\text{Empl})$	(12) $d\ln(\text{WB})$
Importer_{90}	**0.067*****	**-0.155*****	0.021
	(0.007)	(0.022)	(0.019)
$(\text{New importer})_{99}$		**0.603*****	**0.724*****
		(0.049)	(0.053)
N	1003988	436281	436281

(b) Exit and growth by importer status

Table 10: Traded sector by importer status

This rable reports the results for the traded sector importers. Panel 10a reports the results analogous to Table 1 and panel 10b the results analogous to Table 5. ***$p < 0.1\%$, **$p < 1\%$, *$p < 5\%$

	Job destruction		Job creation	
	Exit	Contract	Entry	Expand
$\theta^{\ell}_{\mathrm{T}}$	-0.053	**0.300*****	**-0.397****	0.034
	(0.195)	(0.101)	(0.168)	(0.073)
N	6617	6617	6617	6617

(a) Local labor market effects of the import liberalization on job flows

	(9) Extensive	(10) Intensive
θ^{T}_1	**-0.86***	-2.77
	(0.38)	(2.38)
θ^{T}_2	-0.67	**-11.26*****
	(0.36)	(1.26)
θ^{T}_3	-0.40	**-8.86*****
	(0.31)	(0.95)
θ^{T}_4	**-1.08****	**-15.50*****
	(0.39)	(1.48)
N	1003988	436282

(b) Differential effects of import liberalization on plants of different initial size

	(11)	(11)
θ^{T}	**0.129****	
	(0.047)	
θ^{T}_1		-0.058
		(0.045)
θ^{T}_2		-0.049
		(0.050)
θ^{T}_3		-0.023
		(0.041)
θ^{T}_4		**0.333*****
		(0.062)
N	436282	436282

(c) Effects of the import liberalization on importing decision

Table 11: Traded sector: import liberalization effects

This table reports the import liberalization's impact on the traded sector. Panel 11a reports the results analogous to Table 2; panel 11b the results analogous to Table 3; and panel 11c the results analogous to Table 4. ***$p < 0.1\%$, **$p < 1\%$, *$p < 5\%$