

The Price of Globalization

Job Reallocation and Risk Aversion in an Open Economy*

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PRELIMINARY AND INCOMPLETE

Abstract

How does globalization affect workers' wealth and welfare? To answer this question, this paper develops a dynamic open economy model with search frictions and endogenous savings. Heterogeneous, risk-averse workers carry wealth to smooth their consumption during unemployment spells, but borrowing constraints leave low-wealth households with uninsurable income risk. These risks are heightened by globalization, which increases income volatility and reduces job security. We fit the model to data from Colombia, and use it to quantify the welfare gains and losses from globalization for different types of households. Counterfactual experiments show that lowering trade barriers results in an average welfare gain of over 2%. However, while workers who begin their working lives with wealth below the median incur welfare losses of around 2%, those who start at the top of the wealth distribution see significant increases.

Keywords: Globalization, firm dynamics, precautionary savings, incomplete markets, welfare

JEL Classification: F62, E21, D52, D60

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1 Introduction

Few economists would dispute that countries can improve their efficiency by engaging with global markets. But in recent decades, an explosion of empirical work has highlighted some undesirable collateral effects of globalization on domestic workers. Perhaps the most widely documented finding is that greater openness often leads to higher income inequality. (Goldberg and Pavcnik (2007), Pavcnik (2017), Helpman (2017), and Dix-Carneiro and Kovak (2023) provide literature reviews.) A second finding is that trade liberalization episodes are associated with increased unemployment and, especially in developing countries, more informality (Autor et al., 2013, 2014; Acemoglu et al., 2016; Dix-Carneiro and Kovak, 2019; Ruggieri, 2019; Dix-Carneiro and Kovak, 2023). Third, trade openness has often correlated with heightened labor income risk (Krishna and Senses, 2009; Dynan et al., 2012). And finally, some have found an association between globalization and household debt (Barrot et al., 2018).

Motivated by these findings, a growing body of research explores possible linkages between openness, employment patterns, and inequality. One major strand of this literature uses dynamic structural models to quantify, inter alia, the frictions that limit labor mobility across occupations, regions, and firms (Kambourov, 2009; Artuc et al., 2010; Felbermayr et al., 2011; Helpman and Itskhoki, 2010; Helpman et al., 2010; Dix-Carneiro, 2014; Artuc and McLaren, 2015; Coşar et al., 2016; Bellon, 2018; Helpman et al., 2017; Traiberman, 2019; Caliendo et al., 2019; Carrere et al., 2020; Fajgelbaum, 2020).¹ However, it generally presumes risk neutrality and perfect credit markets.² Thus, it potentially understates the welfare losses of those hurt by openness, particularly lower-income households. This is in contrast with the heterogeneous agents model in macroeconomics, where consumers' ability to smooth their consumption through savings and borrowing is crucial for understanding how income shocks affect welfare.³

In this paper, we bridge the trade and macro literature to develop a dynamic open economy model with search frictions and heterogeneous, risk-averse workers. We

¹McLaren (2017, 2022) provides some partial reviews.

²Lyon and Waugh (2018) and Ferriere et al. (2021) do analyze trade shocks in settings with risk aversion, idiosyncratic income fluctuations, and incomplete financial markets. Their models do not incorporate search frictions, however, and thus they do not generate involuntary unemployment or bargaining over match rents. Several other papers, including Dix-Carneiro et al. (2023) and Dix-Carneiro and Traiberman (2023), allow for diminishing marginal utility but assume workers insure each other against idiosyncratic income shocks. These assumptions create a role for savings, but they rule out any welfare costs due to idiosyncratic income volatility. Other papers, such as Alessandria and Avila (2024), focus on welfare gains and losses with a representative household model

³In those models, households face income (or health) risks and use their savings and labor supply to maximize utility. Government policies (progressive taxation, means-tested transfers, and social security) provide additional social insurance. See Heathcote et al. (2009) and Quadrini and Rios-Rull (2015) for reviews.

consider a small open economy with firms and workers in two sectors: a tradable industrial sector with heterogeneous firms operating in a monopolistically competitive market, and a non-tradable outside sector with a representative firm selling in a competitive market. Industrial firms face idiosyncratic productivity shocks, leading to firm dynamics of expansion, contraction, exit, and entry. These firms produce unique consumer goods using labor and sell them domestically or through exports; exporting involves a fixed cost that limits it to the most productive firms. Frictions in the labor market require firms to post vacancies resulting in wages being set through bargaining, leading to wage dispersion.

Workers choose between the higher-paying but riskier industrial sector due to search frictions, and the lower-paying but safer outside sector. Unemployed workers, similar to the representative firm in the outside sector, produce a homogeneous non-tradable good, but with less efficient technology. Risk-averse workers can save in risk-free bonds, and as they move between employment states, they accumulate or deplete assets, thus creating a wealth distribution. Workers' earnings and assets depend on their labor market outcomes, with no permanent productivity differences among them. As consumers, they purchase various industrial and outside sector goods.

The model economy has three key features: international trade with firm heterogeneity (following [Melitz \(2003\)](#), [Coşar et al. \(2016\)](#), and [Fajgelbaum \(2020\)](#), among others), labor market frictions (following [Mortensen and Pissarides \(1994\)](#) and [Pissarides \(2000\)](#)) and heterogeneous households/workers (following [Bewley \(1987\)](#), [Huggett \(1993\)](#) and [Aiyagari \(1994\)](#)). As in [Coşar et al. \(2016\)](#), firms face idiosyncratic productivity shocks and decide how many workers to hire. Hiring is, however, not immediate due to search frictions. Furthermore, search frictions create a matching surplus that must be split between workers and firms, and wages are determined by bargaining. Firms can lose workers due to endogenous and exogenous separations and must post new vacancies to replenish them.

Several forces in the model link trade openness to job turnover, unemployment spells, and wages. First, among the firms that self-select into exporting, greater openness amplifies the sensitivity of their revenues and employment levels to their idiosyncratic productivity shocks. This makes their job turnover rates higher and, in itself, tends to increase aggregate unemployment. Second, however, greater openness also tends to concentrate workers at larger, more stable firms, which exerts *downward* pressure on aggregate turnover and unemployment rates. Finally, openness tends to create larger rents for the more successful firms, which increases wage dispersion.

In the model economy, trade openness and uninsurable idiosyncratic unemployment risks are intimately related. The probability of remaining unemployed for many periods depends on not finding a job between one period and the next. Precautionary

savings help individuals insure against short unemployment spells. However, if the economy becomes more open to trade, the unconditional probability of experiencing an exceptionally long unemployment spell—one that could deplete their savings—significantly increases. This happens because trade exposure induces variation in firm hiring and firing policies, thus increasing the riskiness of labor income by changing the persistence of unemployment spells.

The standard heterogeneous-agents models in macroeconomics often summarize workers’ heterogeneity in earnings by idiosyncratic shocks. These shocks could have permanent, persistent, or idiosyncratic components and be modeled under the assumptions of linearity and normality, as in [Storesletten et al. \(2004\)](#), or can be non-linear and non-Gaussian, as in [Arellano et al. \(2017\)](#) and [Guvenen et al. \(2021\)](#). Our approach here is different. Workers’ earnings change as they move from firm to firm, and from employment to non-employment, with earnings reflecting workers’ search decisions together with hiring, firing, and exit decisions of the firms, all endogenously determined. This is in the spirit of basic search and matching models with labor market frictions but extended to include large firms facing idiosyncratic productivity shocks that generate industry dynamics.

The model economy with firm dynamics and wealth inequality poses theoretical and computational challenges. The basic Diamond-Mortensen-Pissarides is based on a one-worker-one-firm abstraction. However, firm size is key to the extensive literature on firm dynamics and trade ([Melitz and Redding, 2014](#); [Alessandria et al., 2021](#)). With large firms, a decision has to be made on how firms bargain with many workers. Following [Stole and Zwiebel \(1996\)](#), a standard assumption is that the firm bargains bilaterally with each worker, treating each as the marginal employee (see [Bertola and Caballero \(1994\)](#), [Elsby and Michaels \(2013\)](#), and [Coşar et al. \(2016\)](#) for applications).

Once workers are heterogeneous, as they will be in this model due to different employment histories and the resulting asset levels, bargaining between firms and workers is nontrivial, as asset distribution of its workers becomes a state variable for the firm. This is because each worker comes to the table with her wealth stock and thus—given imperfect credit markets—her reservation wage. Computationally, this creates a dimensionality problem, which is one reason why most previous studies involving wage bargaining have avoided introducing risk aversion.⁴ We circumvent this challenge by assuming that a breakdown in bargaining results in a delay in production rather than destroying the match. We follow [Costain \(1998\)](#) and assume that each firm plays an alternating-offers bargaining game with a *representative* employee, i.e., a union leader, within the firm. Under this bargaining protocol, neither party has a credible incentive to exit the match if negotiations fail, as doing so would reduce their expected future

⁴Some exceptions, in the context of one-worker-one-firm models, are [Krusell et al. \(2010\)](#), [Bils et al. \(2011\)](#), and, more recently, [Eeckhout and Sepahsalari \(2021\)](#) and [Baley et al. \(2022\)](#).

utility. This approach results in a wage solution that depends solely on the current average surplus and is unaffected by the level and distribution of workers' wealth.

The benchmark economy is calibrated to Colombia in 2010, following major reforms that substantially increased trade openness. The economy is calibrated to match data across several dimensions: labor market outcomes (such as employment in the industrial sector, unemployment, employment in the informal economy, and flows between these states), firm dynamics (including firm size distribution, average firm growth and its dispersion, and the share of exporting firms), and wealth distribution (e.g., the wealth-to-income ratio). We then examine a pre-liberalization steady state and compare the benchmark economy with low trade barriers to a counterfactual economy with high trade barriers. Our findings reveal that earnings become significantly more uncertain in the post-liberalization regime, and earnings inequality rises notably. Specifically, trade liberalization leads to a 13% increase in the standard deviation of wages and a 12% rise in the volatility of labor income.

We also evaluate the impact of trade openness on welfare. On average, welfare increases by approximately 2%, primarily due to a more efficient allocation of resources that reduces prices. However, these benefits are not evenly distributed. A worker starting with assets below the median in the benchmark economy experiences a welfare loss of about 2%.⁵ Conversely, workers who start with wealth levels above the median see welfare gains, with these gains rising significantly with higher initial wealth.

2 The Model

Consider a small open economy populated by firms and workers. There are two sectors: a tradable *industrial* sector populated by heterogeneous firms operating in a monopolistic competitive output market, and a non-tradable *outside* sector with a representative firm and a competitive output market. Firms in the industrial sector face idiosyncratic productivity shocks that generate industry dynamics, with firms expanding, shrinking, exiting, and new firms entering each period. Each firm in this sector produces a differentiated variety of consumer goods using labor as the sole input, with the option to sell domestically or export to foreign markets. Exporting incurs a fixed cost, and, as a result, only the more productive firms engage in exporting. There are labor market frictions in the industrial sector, so if a firm wants to hire workers, it has to post vacancies that enter an aggregate matching function. Due to search frictions, wages are determined by bargaining, generating wage dispersion across industrial firms.

⁵Consider this as an exercise in which we drop a worker on a particular point in the wealth distribution and measure her lifetime utility in each of the two economies.

Workers choose to work in the outside sector or look for an industrial job. The industrial sector pays higher wages, but there is a risk of unemployment due to search frictions. The outside sector is safe but pays lower wages. Unemployed workers sustain themselves by producing outside goods with less efficient technology. Workers are risk averse and can save in a risk-free bond. As workers transition between employment, unemployment, and working in the outside sector, they accumulate and deplete assets, creating a wealth distribution within the economy. Those employed are distributed across firms that differ in productivity and size and earn different wages. There are no permanent or idiosyncratic productivity differences among workers. Their earnings, and, as a result, their assets are tied to their fortunes in the labor market. As consumers, workers consume different varieties of industrial goods, domestic or imported, and goods produced in the outside sector.

2.1 Preferences

Time is discrete, and the horizon is infinite. The economy is populated by a unit measure of workers indexed by j . In each period, workers face a stochastic probability of death $\delta_w > 0$. Worker j derives utility from consuming a Cobb-Douglas bundle of a homogeneous non-tradable good o_t , and a composite tradable good C_t ,

$$C_{j,t} = C_{j,t}^\alpha o_{j,t}^{1-\alpha} \quad \text{for } \alpha \in (0, 1). \quad (1)$$

The composite tradable good $C_{j,t}$ is a constant elasticity of substitution (CES) aggregate of differentiated varieties indexed by ω and defined as

$$C_{j,t} = \left(\int_0^{\Omega_t} c_{j,t}(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}, \quad (2)$$

where $c_{j,t}(\omega)$ is the quantity consumed of variety $\omega \in [0, \Omega_t]$ available in the domestic country. Varieties $\omega \in [0, \Omega_t^F)$ are produced domestically, and the remaining varieties, $\omega \in [\Omega_t^F, \Omega_t]$, are imported. The parameter $\sigma > 1$ denotes the elasticity of substitution between varieties.

Workers are risk-averse and maximize the expected present value of their lifetime utility

$$\mathcal{U}_j = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t (1 - \delta_w)^t \frac{(C_{j,t} - \bar{c})^{1-\gamma}}{1 - \gamma}, \quad (3)$$

where $\beta \in (0, 1)$ denotes the discount factor, $\gamma > 1$ is the constant relative risk aversion parameter, and $\bar{c} > 0$ is a minimum consumption requirement. In what follows, unless necessary, we suppress subscripts j and t .

2.2 Technology

The homogeneous non-tradable good o is produced by firms and, less efficiently, by unemployed workers engaged in home production. Regardless of the source, the homogeneous non-tradable good o is produced using only labor and is sold in competitive markets. The differentiated varieties in the composite tradable good C are produced domestically and abroad and are sold in monopolistically competitive markets. Each domestic variety $\omega \in [0, \Omega^F) \subset \Omega$ is produced by a firm, using labor as the only input.

2.2.1 Homogeneous non-tradable good

The outside sector produces one unit of the output per worker without incurring any hiring or firing costs. The homogeneous non-tradable good o good is also home-produced by unemployed workers who generate $b < 1$ units of output. Consequently, the overall supply of the homogeneous non-tradable good o is

$$Y_o = L_o + bL_u, \quad (4)$$

where L_o is labor employed in the outside sector, and L_u is unemployed labor. The wage rate in the outside sector is normalized to one. Given the linear production technology and the perfectly competitive output markets, this normalization means that both the price of the homogeneous non-tradable good o and the wage in the outside sector w_o are the numéraires of the model economy.

2.2.2 Composite tradable good

Firms in the industrial sector are characterized by idiosyncratic productivity z that follows an AR(1) process given by

$$\log z' = \rho_z \log z + \varepsilon_z, \quad (5)$$

where $\rho_z \in (0, 1)$ and the innovation $\varepsilon_z \sim \mathcal{N}(0, \sigma_z^2)$, so that σ_z is the standard deviation of the innovation (not of the stationary distribution of $\log z$). Firms use only labor to produce using a linear technology,

$$y = zn. \quad (6)$$

As firms differ in their productivity z and employment n , and each domestic variety is produced by a single firm, we will use variety ω and (z, n) interchangeably. Note that, as in ?, productivity variation can be equally thought of as variation in product quality. In each period, firms face an exogenous probability of exit, denoted by δ_f .

2.3 Demand

Given the Cobb-Douglas structure of the consumption bundle, the demand for the homogeneous non-tradable good o is given by

$$o = (1 - \alpha)\mathcal{PC}, \quad (7)$$

where $\mathcal{PC} = \mathcal{P} \int \mathcal{C}_j dj$ denotes the aggregate consumption expenditures,

$$\mathcal{P} = P^\alpha \alpha^{-\alpha} (1 - \alpha)^{\alpha-1} \quad (8)$$

is the Cobb-Douglas price index for the consumption bundle, and

$$P = \left(\int_0^\Omega p(\omega)^{1-\sigma} d\omega \right)^{\frac{1}{1-\sigma}} \quad (9)$$

is the price index for the CES composite of tradable varieties. Recall that the price of the homogeneous non-tradable good o in equation (7) is normalized to 1.

The domestic demand for a domestically produced variety ω is given by

$$c(\omega) = \left(\frac{p(\omega)}{P} \right)^{-\sigma} \frac{\alpha \mathcal{PC}}{P} \quad \text{for } \omega \in [0, \Omega_t^F], \quad (10)$$

which can be rewritten as

$$c(\omega) = D p(\omega)^{-\sigma}, \quad (11)$$

where $D = \alpha^{1-\alpha} (1 - \alpha)^{\alpha-1} \mathcal{C} P^{\sigma+\alpha-1}$ is a home demand shifter.

Similarly, the domestic demand for an imported variety ω^* is

$$c(\omega^*) = D [\tau p^*(\omega^*)]^{-\sigma} \quad \text{for } \omega^* \in [\Omega_t^F, \Omega_t] \quad (12)$$

where $p^*(\omega^*)$ is the price of the imported variety ω^* in the foreign market, and τ captures iceberg trade costs.

Lastly, the foreign demand for a domestically-produced variety ω is

$$c^*(\omega) = D^* p^*(\omega)^{-\sigma}, \quad (13)$$

where $p^*(\omega)$ is the price of the domestically-produced variety ω in the foreign market. The foreign demand shifter D^* is treated as exogenous by firms due to the small open economy assumption.

2.4 Revenues

A domestic firm producing $q(\omega)$ units of its distinct variety ω that sells its entire output domestically will earn gross revenues

$$G(\omega) = p(\omega)q(\omega) = D^{1/\sigma}q(\omega)^{\frac{\sigma-1}{\sigma}}, \quad (14)$$

where the last equality follows from the fact that in equilibrium supply must equal demand,

$$q(\omega) = c(\omega) = Dp(\omega)^{-\sigma}. \quad (15)$$

Conversely, if the domestic firm sells both domestically and abroad, it will earn gross revenues

$$G(\omega) = \max_{\chi} \left\{ p(\omega)(1 - \chi)q(\omega) + p^*(\omega)\chi \frac{q(\omega)}{\tau} \right\}, \quad (16)$$

where χ is the fraction of output sold in the foreign market. The solution to this problem implies that all exporting firms allocate the same share of their output to the foreign market, given by

$$\chi = \frac{D^* \tau^{-(\sigma-1)}}{D + D^* \tau^{-(\sigma-1)}}, \quad (17)$$

which is increasing in the foreign demand shifter D^* , and decreasing in the trade cost τ and the domestic demand shifter D . Using equations (11) and (13), we can express the revenues of the exporting firm as

$$G(\omega) = \left(D + \tau^{-(\sigma-1)} D^* \right)^{\frac{1}{\sigma}} q(\omega)^{\frac{\sigma-1}{\sigma}}. \quad (18)$$

The gross revenues of both domestic and exporting firms can be succinctly written as

$$G(\omega) = \Delta(\omega)^{\frac{1}{\sigma}} q(\omega)^{\frac{\sigma-1}{\sigma}}, \quad (19)$$

where

$$\Delta(\omega) = D \left(1 + \mathbf{1}^x(\omega) d_f \right). \quad (20)$$

The indicator $\mathbf{1}^x(\omega)$ represents the export decision for firm ω , and d_f is the revenue premium from exporting, equal to

$$d_f = \tau^{-(\sigma-1)} \frac{D^*}{D}. \quad (21)$$

In the quantitative model we treat the export premium d_f as the primitive: it is measured from firms' export revenue share and held fixed within a given equilibrium, and counterfactual trade liberalizations are implemented as direct changes in d_f . Equation (21) then provides its structural interpretation in terms of the iceberg cost τ and the foreign demand shifter D^* .

2.5 The Labor Market

The labor market in the industrial sector is subject to search frictions. To hire workers, firms need to post vacancies. To find a job, workers need to search. The search is random, and the number of new matches depends on the total measure of workers searching for a job, U , and the vacancies posted, v . New matches are formed according to the Leontief matching function

$$m(v, U) = \min\{v, U\}. \quad (22)$$

In the relevant region in which searchers outnumber vacancies ($v \leq U$), every posted vacancy is filled, so the probability of filling a vacancy for firms is

$$\phi_f = \frac{m(v, U)}{v} = 1, \quad (23)$$

and the probability of finding a job for workers is

$$\phi_w = \phi_f \frac{v}{U} = \frac{v}{U}. \quad (24)$$

When a worker and a firm match, if there is a positive surplus, they bargain over a wage, and production occurs. Workers who fail to get matched end up unemployed and support themselves by home-producing $b < 1$ units of the non-tradable good o .

Finally, we assume the cost of posting v vacancies for a firm with n employees is

$$h(v, n) = \lambda_0 \left[\frac{v}{n^{\lambda_1}} \right]^{\lambda_2}, \quad (25)$$

where λ_0 and λ_2 govern the level and the convexity of vacancy posting costs respectively, and λ_1 captures any economies or diseconomies of scale.

2.6 The Problem of the Firm

We now focus on the decisions of a firm that enters the period with productivity z and workers n . Given (z, n) , the firm can exit or stay and produce. If it decides to stay, the firm chooses the current number of employees by hiring or firing workers, taking into account any potential quits. Each period, firms lose a fraction δ_s of their workers due to exogenous match destruction. The firm also decides on whether to export. Figure 1 summarizes the problem of the firm.

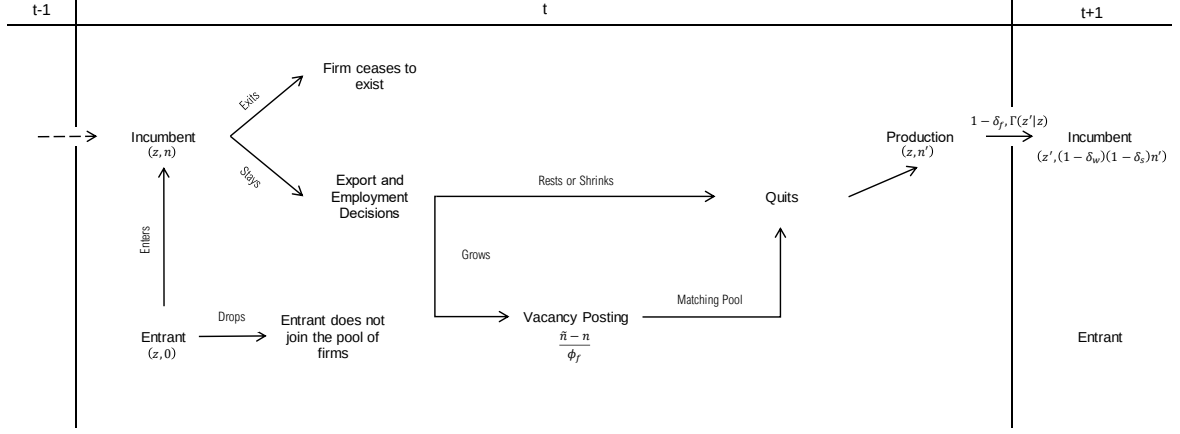


Figure 1: The problem of the firm.

2.6.1 Export decision

An incumbent firm with productivity z and workers n decides whether to export in order to maximize their net revenues, solving the following problem:

$$R(z, n) = \max_{\mathbf{1}^x(z, n) \in \{0, 1\}} \left\{ [D (1 + \mathbf{1}^x(z, n) d_f)]^{\frac{1}{\sigma}} (zn)^{\frac{\sigma-1}{\sigma}} - \kappa_x \mathbf{1}^x(z, n) \right\}, \quad (26)$$

where κ_x is a per-period fixed cost of exporting. A solution to this problem is an indicator function $\mathbf{1}^x(z, n)$ that takes the value 1 if the firm exports and 0 otherwise.

2.6.2 Employment and exit decision

Consider a firm with productivity z and number of employees n at the start of a period. Upon observing z , and before making any hiring or firing decisions, the firm can exit. If the firm stays in the industry, it chooses a new employment level, denoted by $\tilde{n}$, which can be larger (hiring) or smaller (firing) than n . The firm, however, does not produce with $\tilde{n}$ workers since, upon observing $\tilde{n}$, some of its workers might decide to quit. The fraction of quitters depends on workers' decisions and is denoted by $\delta(z, \tilde{n})$. The number of workers who produce this period, n' , is obtained by subtracting quitters from $\tilde{n}$. The value of the firm is then given by

$$V(z, n) = \max\{0, \tilde{V}(z, n)\}, \quad (27)$$

where

$$\begin{aligned} \tilde{V}(z, n) = \max_{\tilde{n} \geq \tilde{n}} \left\{ R(z, n') - w(z, n')n' - \kappa_0 - \lambda_0 \left(\frac{\tilde{n} - n}{\phi_f n^{\lambda_1}} \right)^{\lambda_2} \mathbf{1}_{\tilde{n} > n} - c_f (n - \tilde{n}) \mathbf{1}_{\tilde{n} < n} \right. \\ \left. + \frac{(1 - \delta_f)}{1 + r} \int V(z', (1 - \delta_w)(1 - \delta_s)n') d\Gamma(z'|z) \right\}, \end{aligned} \quad (28)$$

subject to

$$n' = \tilde{n}(1 - \delta(z, \tilde{n})).$$

The current profits of the firm $\pi(z, n)$, are given by its revenues net of exporting costs, labor costs $w(z, n')n'$, per-period operating costs κ_o , and hiring costs $h(v, n)$. Note that, given the search frictions, a firm that wants to grow n to $\tilde{n}$ must post $(\tilde{n} - n) / \phi_f$ vacancies. If the firm posts vacancies to expand, i.e., $\tilde{n} - n > 0$, it pays the convex vacancy-posting cost $h(v, n)$. If instead the firm shrinks, $\tilde{n} - n < 0$, it pays a linear firing cost $c_f(n - \tilde{n})$, where $c_f > 0$ is the per-worker cost of reducing employment. The last constraint shows how quits affect the workers who are engaged in production during this period. As will become clear below, the quits are endogenous and will be determined by the decisions of workers who are employed in firm (z, n) .

If a firm survives to the next period, which happens with probability $1 - \delta_f$, a δ_s fraction of its matches disappear, and a δ_w fraction of its workers die. As a result, it starts next period with $(1 - \delta_w)(1 - \delta_s)n'$ workers and a new productivity shock z' . A solution to this problem delivers a policy function for firm exit $\mathbf{1}^t(z, n)$, taking value 1 if $\tilde{V}(z, n) \leq 0$ (so that $V(z, n) = 0$) and 0 otherwise, and a policy function for employment $\tilde{n} = g_n(z, n)$ for firms that do not exit.

Two further comments about the problem of an incumbent firm are in order. First, the wage rate does not depend on the level of assets held by the employee. In subsection 2.9, we show that this results from the assumptions we impose on the bargaining process, particularly from the assumption that a firm-specific union bargains on behalf of the entire workforce with the goal of maximizing income per worker. Second, we differentiate between match-level and firm-level destruction of jobs. A job may be destroyed with probability δ_s , and the firm may die with probability δ_f . If the match is destroyed due to the worker's death, a shock to that specific job, or the firm's decision to shrink, then the firm retains its remaining matches. If the firm exits (either exogenously or endogenously), all matches are destroyed, and the firm ceases to exist.

2.6.3 Entry

In general equilibrium, the measure of firms in the economy is determined through the free entry condition. Potential entrants face an entry cost κ_e and draw productivity z from the distribution $\Gamma^e(z)$, which we take to be the stationary distribution of the productivity process (5). An entrant begins operations with $\bar{n} > 0$ workers: because the vacancy-posting cost $h(v, n) = \lambda_0 [v/n^{\lambda_1}]^{\lambda_2}$ is unbounded as $n \rightarrow 0$, hiring the first worker of an empty firm is prohibitively costly, so both entry and continued operation require a strictly positive minimum scale $\bar{n}$. These $\bar{n}$ workers are endowed to the entrant rather than drawn from the matching pool. Upon learning their type, firms

decide whether to exit immediately or to keep operating in the industry; a firm that would optimally employ fewer than $\bar{n}$ workers exits. In an equilibrium with a positive measure of firms, the following free-entry condition holds with equality,

$$\int V(z, \bar{n}) d\Gamma^e(z) = \kappa_e, \quad (29)$$

which implies that a potential entrant must be indifferent between entering or not.

2.7 Government

The government levies a proportional tax at rate $\tau_\ell \in [0, 1)$ on formal-sector (industrial) labor earnings and pays a transfer to every household. A worker employed in the industrial sector at wage $w(z, n)$ keeps after-tax labor income $w(z, n)(1 - \tau_\ell)$; earnings in the outside sector and home production are untaxed. Each household additionally receives a transfer

$$T(y) = T_a - T_b y, \quad (30)$$

consisting of a lump-sum component $T_a \geq 0$ net of a proportional clawback at rate $T_b \geq 0$ in the household's total current income y . Current income is the sum of capital income ra and labor income — after-tax formal earnings $w(z, n)(1 - \tau_\ell)$ for the employed, the outside wage $w_o = 1$ for outside workers, and home production b for the unemployed.

The government budget is *not* required to balance: labor-tax revenue need not equal aggregate transfers, and any residual is financed externally.

2.8 The Problem of the Worker

At the start of each period, some workers are employed in the industrial sector. A worker who is employed in a firm with productivity z and n workers engaged in production earns $w(z, n)$. Next period, the worker might continue to work in the same firm with a new productivity level z' . Her match might also be destroyed, or she might be fired. In that case, she has to decide whether to look for another job in the industrial sector or take a job in the outside sector. The worker might also quit (recall that this happens after the firm's hiring/firing decision) and end up unemployed the next period.

If a worker is employed in the outside sector during this period, then she earns $w_o = 1$ this period. Next period, she decides whether to search for an industrial job or stay in the outside sector. Similarly, unemployed workers produce b this period and can make a sectoral choice next one. Besides their employment state, all workers also differ by their asset holding, a . Figure 2 summarizes the problem of the worker.

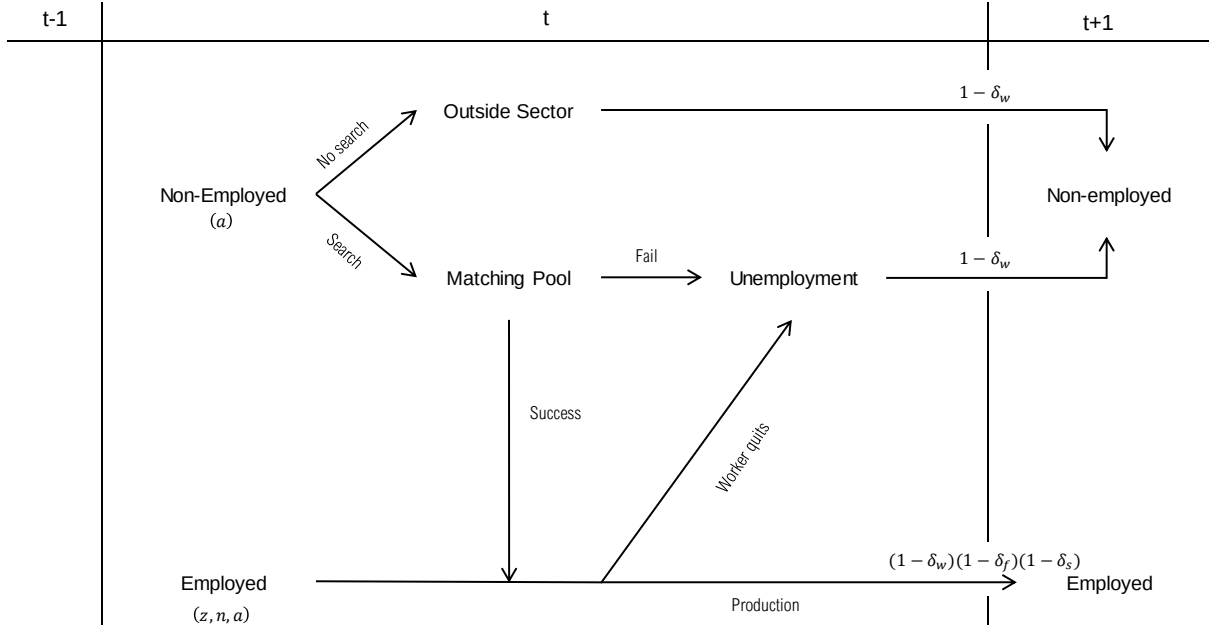


Figure 2: The problem of the worker.

2.8.1 Sectoral choice

At the start of each period, workers who are not employed in the industrial sector decide whether to work in the outside sector or enter the matching pool to search for a job in the industrial sector. Let their current assets be denoted by a , and let their search and no-search decisions be denoted by s and ns , respectively. Workers receive an *iid* taste shock ε , drawn from a logistic distribution ψ_ε , with location parameter 0 and scale parameter 1. Given these shocks, the value of being non-employed is

$$J^s(a, \varepsilon) = \max \left\{ J^o(a) + \varepsilon, J^i(a) \right\}, \quad (31)$$

where J^o is the value that the worker gets from working in the outside sector, and J^i is the value of searching for a job in the industrial sector.

Workers in the outside sector earn $w_o = 1$. Given their total income, $1 + T(1 + ra) + a(1 + r)$ (including the transfer in equation (30)), they decide how much to consume and how much to save. Next period, they face the sectoral choice again with a new taste shock ε' . The value of choosing the outside sector is then given by:

$$J^o(a) = \max_{\{C, a'\} \in \mathcal{A}^o(a)} \left\{ \frac{(C - \bar{c})^{1-\gamma}}{1-\gamma} + \beta(1 - \delta_w) \int J^s(a', \varepsilon') \psi_\varepsilon(\varepsilon') d\varepsilon' \right\}, \quad (32)$$

subject to

$$\mathcal{A}^o(a) = \left\{ C \in [\bar{c}, \infty), a' \in [-\underline{A}, \infty) : PC + a' \leq 1 + T(1 + ra) + a(1 + r) \right\}. \quad (33)$$

Given the assumption on the distribution of ε , the expected value of the non-employed worker before the realization of the shock can be written as

$$\int J^s(a, \varepsilon) \psi_\varepsilon(\varepsilon) d\varepsilon = \log \left(\exp J^i(a) + \exp J^o(a) \right). \quad (34)$$

A worker who decides to search for a job in the industrial sector might match with a firm with probability ϕ_w . In that case, she takes a random draw from the vacancies posted by expanding firms, and if there is a positive surplus, she will be hired. If she is not matched with a firm, then she is unemployed during this period. Hence, the value of the search for a worker with assets a is given by

$$J^i(a) = \phi_w \mathbb{E}_{z,n} \left[J^h(z, n, a) \right] + (1 - \phi_w) J^u(a). \quad (35)$$

The expected value of a match with a firm is given by

$$\mathbb{E}_{z,n} \left[J^h(z, n, a) \right] = \int \int J^h(z, n, a) \psi_v(z, n) dz dn, \quad (36)$$

and

$$J^h(z, n, a) = \int \max \left\{ J^e(z, (1 - \delta(z, \tilde{n})) \tilde{n}, a) + \xi, J^u(a) \right\} \psi_\xi(\xi) d\xi, \quad (37)$$

where $\psi_v(z, n)$ is the distribution of vacancies among hiring firms, whose policy function for employment is $\tilde{n} = g_n(z, n)$.

Workers receive an *iid* taste shock ξ drawn from a logistic distribution ψ_ξ , with location parameter 0 and scale parameter 1. Given these shocks, the value of a job offer is

$$J^h(z, n, a) = \log \left(\exp J^e(z, (1 - \delta(z, \tilde{n})) \tilde{n}, a) + \exp J^u(a) \right). \quad (38)$$

The value of being unemployed, on the other hand, is defined by

$$J^u(a) = \max_{\{C, a'\} \in \mathcal{A}^u(a)} \left\{ \frac{(C - \bar{c})^{1-\gamma}}{1 - \gamma} + \beta(1 - \delta_w) \int J^s(a', \varepsilon') \psi_\varepsilon(\varepsilon') d\varepsilon' \right\}, \quad (39)$$

subject to

$$\mathcal{A}^u(a) = \left\{ C \in [\bar{c}, \infty), a' \in [-\underline{A}, \infty) : \mathcal{P}C + a' \leq b + T(b + ra) + a(1 + r) \right\}. \quad (40)$$

Let $g_a^o(a)$, $g_c^o(a)$, $g_a^u(a)$, and $g_c^u(a)$ be the policy functions for savings and consumption for workers in the outside sector and those who are unemployed, respectively. Let $\mathbf{1}^s(a, \varepsilon)$ be an indicator function denoting the sectoral decision of the non-employed worker that takes a value of 1 if she decides to search for a job in the industry and 0 otherwise.

2.8.2 Value of employment

Consider now the problem of a worker who is employed in the industry. During this period, she earns $w(z, n)$, a firm-specific wage rate that is determined by bargaining, as we will describe below. Given her total income and expectations about the future, she decides how much to consume and how much to save. Next period, if she survives, she can separate from her job because of match destruction, δ_s , or firm exit, δ_f , or because she is fired. Then she has to decide whether to look for a job in the industrial sector or work in the outside sector. She can also choose to quit. In that case, she becomes unemployed and does not have the option of re-entering the matching pool in the current period. If the worker keeps her job, she starts the next period as employed in the same firm with new values for firm productivity and size. On-the-job search is not allowed.

Consider a worker with assets a who is employed in a firm with productivity z and employment n . Next period the firm will have a new productivity level z' . Then, it will decide how many workers to hire, determined by its policy function $\tilde{n} = g_n(z', n)$. Given $\tilde{n}$, a worker might end up being fired if $\tilde{n} < n$. Even if $\tilde{n} > n$, and the firm hires, the worker might choose to quit if the firm's wages are sufficiently unattractive and/or she has accumulated sufficient wealth. The problem of an employed worker then reads:

$$J^e(z, n, a) = \max_{\{C, a'\} \in \mathcal{A}^e(z, n, a)} \left\{ \frac{(C - \bar{c})^{1-\gamma}}{1-\gamma} + \beta(1 - \delta_w) \int \tilde{J}^e(z', n', a') d\Gamma(z'|z) \right\} \quad (41)$$

subject to

$$\begin{aligned} \mathcal{A}^e(z, n, a) = \left\{ C \in [\bar{c}, \infty), a' \in [-\underline{A}, \infty) : \right. \\ \left. \mathcal{P}C + a' \leq w(z, n)(1 - \tau_\ell) + T(w(z, n)(1 - \tau_\ell) + ra) + a(1 + r) \right\}, \quad (42) \end{aligned}$$

and

$$n' = (1 - \delta_w)(1 - \delta_s)n, \quad (43)$$

where

$$\begin{aligned} \tilde{J}^e(z, n, a) = \left[1 - (1 - \delta_s)(1 - \delta_f)(1 - p^f(z, n)) \right] \int J^s(a, \varepsilon) \psi_\varepsilon(\varepsilon) d\varepsilon \\ + (1 - \delta_s)(1 - \delta_f)(1 - p^f(z, n)) J^h(z, n, a) \end{aligned}$$

is the continuation value of being employed, and

$$p^f(z, n) = \mathbf{1}^t(z, n) + (1 - \mathbf{1}^t(z, n)) \frac{\max\{0, n - g_n(z, n)\}}{n}, \quad (44)$$

is the endogenous probability that the worker is fired.

The $\max$ operator in equation (37) also determines quits. Conditional on surviving and on neither separating nor being fired, a retained worker keeps her job only if the value of continued employment with $(1 - \delta(z', \tilde{n}))\tilde{n}$ co-workers, $J^e(z', (1 - \delta(z', \tilde{n}))\tilde{n}, a') + \zeta$, exceeds the value of becoming unemployed, $J^u(a')$; otherwise she quits. Because ζ is logistically distributed, a worker with assets a' quits with the logit probability $\exp J^u(a') / [\exp J^u(a') + \exp J^e(z', (1 - \delta(z', \tilde{n}))\tilde{n}, a')]$. The fraction of a firm's workforce that quits is the average of this probability over the asset distribution of its employees:

$$\delta(z', \tilde{n}) = \int \frac{\exp J^u(a')}{\exp J^u(a') + \exp J^e(z', (1 - \delta(z', \tilde{n}))\tilde{n}, a')} \mu(a' | z', n) da', \quad (45)$$

where $\mu(a' | z', n)$ is the distribution of assets across workers in a (z', n) firm. Equation (45) defines $\delta(z', \tilde{n})$ implicitly: the quit rate appears on the right-hand side through the post-quit workforce $(1 - \delta(z', \tilde{n}))\tilde{n}$ that determines the continuation value of those who stay. The firm internalizes this behavior when choosing $\tilde{n}$ in equation (28).

Let $g_a^e(z, n, a)$ and $g_c^e(z, n, a)$ be the policy functions for savings and consumption that solve the problem of employed workers.

2.9 Wage Determination

Due to labor market frictions, a worker-firm match creates a surplus value in excess of the sum of what both parties would get without the match. This match surplus must be bargained over and split between the firm and its workers. We assume that bargaining occurs on a period-by-period basis for both new and ongoing matches. At the time of bargaining, search costs are already sunk, so if the current match does not materialize, the worker stays unemployed, and the firm has to produce with one less worker.

To determine wages, we make two assumptions. First, following ?, we assume the only credible threat is a production delay rather than match destruction. Thus, the bargaining is over the period's surplus, defined as the sum of the differences between the current payoffs of the worker and the firm and their outside values. Second, following ?, we assume that a union negotiates on behalf of the firm's entire workforce, which aims to maximize the income per worker. As a result, both parties agree on wages that satisfy the following Nash splitting rule:

$$n(w(z, n) - b) = \zeta [G(z, n) - w(z, n)n + n(w(z, n) - b)], \quad (46)$$

where $\zeta \in (0, 1)$ is the workers' bargaining power. The solution to this problem im-

plies the following wage rule

$$w(z, n) = \max \left\{ \underline{w}, (1 - \zeta)b + \zeta \frac{G(z, n)}{n} \right\}, \quad (47)$$

which is independent of the worker's assets. The Nash solution $(1 - \zeta)b + \zeta G(z, n)/n$ awards the worker a share of her outside option plus a share of gross revenue per worker; it applies whenever it exceeds the binding formal-sector minimum wage $\underline{w}$, which otherwise floors the wage.

2.10 Assets and the Interest Rate

Households cannot insure against idiosyncratic employment and earnings risk. They hold only two assets: a one-period risk-free bond in zero net supply, with individual position B , and equity x , a claim on the aggregate profits of domestic firms, with total supply $\bar{x}$. Let r denote the return on the bond and d the dividend paid per unit of equity. The equity price p satisfies the no-arbitrage condition

$$1 + r = \frac{p + d}{p}, \quad (48)$$

where the dividend equals aggregate firm profits,

$$d = \Pi = N_h \bar{\pi}, \quad (49)$$

with N_h the measure of operating domestic firms, $\bar{\pi}$ the average per-firm profits, and $\pi(z, n)$ the per-firm profits defined in the firm's problem above. Because the bond and equity are both riskless and earn the same return r , their composition is indeterminate from the household's viewpoint, so it suffices to track a single state, the household's beginning-of-period wealth

$$a = B + p x, \quad (50)$$

the value of her portfolio before the period's interest and dividend accrue, without keeping track of its composition (see ?). This wealth earns the common return r within the period, so it enters the budget constraints as $a(1 + r)$. Consistently, the firm's continuation value is discounted at the risk-free rate $1/(1 + r)$ in equation (28), reflecting that equity in domestic firms is priced to earn r . Since bonds are in zero net supply and equity sums to $\bar{x}$, asset-market clearing requires

$$\int a_i di = \underbrace{\int B_i di}_{=0} + p \underbrace{\int x_i di}_{=\bar{x}} = p \bar{x}. \quad (51)$$

The interest rate r is pinned down by no-arbitrage. In the small-open-economy closure used for the benchmark calibration, r is fixed at the world rate and the equity supply $\bar{x}$ adjusts as the residual that clears the asset market, $\bar{x} = \int a_i di / p$; in the general-equilibrium closure, $\bar{x}$ is held fixed and r together with the equity price p is determined by equation (48).

2.11 Equilibrium

A stationary recursive competitive equilibrium — for a given world interest rate r in the open-economy closure, or a given equity supply $\bar{x}$ in the general-equilibrium closure — satisfies the following conditions:

1. *Optimality*: the value functions, defined by equations 27, 31, 32, 35, and, 41, attain their maximum, and the policy functions solve the corresponding problems.
2. *Free entry*: firms enter the industry until condition 29 is satisfied with equality.
3. *Bargaining*: the wage schedule satisfies equation 47.
4. *Market clearing*: the goods, labor, and asset markets clear. All firm-level costs—vacancy posting, firing, the per-period operating cost κ_o , the export cost κ_x , and the entry cost κ_e —are incurred in units of the homogeneous non-tradable good, so market clearing for that good,

$$L_o + b L_u = (1 - \alpha) \mathcal{PC} + N_h \bar{\kappa}, \quad (52)$$

pins down the measure of operating firms N_h , where $\bar{\kappa}$ is the average per-firm resource cost in the industrial sector (hiring, firing, operating, export, and entry costs). Asset-market clearing (51) holds and the equity price satisfies the no-arbitrage condition (48).

5. *Aggregate consistency*: firms', workers' and vacancy distributions replicate themselves through workers' and firms' policy functions.

The interest rate r and the equity supply $\bar{x}$ are jointly disciplined by no-arbitrage and asset-market clearing: in the benchmark calibration r is fixed at the world rate and $\bar{x}$ clears the asset market, whereas in the general-equilibrium closure $\bar{x}$ is fixed and r is determined by no-arbitrage.

3 Quantitative Analysis

The quantitative analysis focuses on Colombia. Between 1984 and 1998, Colombia experienced a dramatic trade liberalization, with the average tariff declining from 27% to about 10% (Figure 3). Before the trade reform, the average tariff was 50%, and some

sectors, such as textiles, had tariffs as high as 90% (Attanasio et al., 2004). After the reform, the average tariff in manufacturing declined to 13%, and tariffs across different industries became more uniform. During this period, non-tariff barriers (NTBs) decreased significantly, making Colombia a more open economy. Trade liberalization also changed the protection structure, i.e., the correlation across industries between pre- and post-liberalization tariffs was relatively low, providing strong incentives for reallocating resources across sectors (Goldberg and Pavcnik, 2005).

The extent of reforms and the availability of good data made Colombia an ideal case study to explore how trade openness affects households and firms. As Figure 3 shows, the post-liberalization period was characterized by higher inequality (Attanasio et al., 2004; Goldberg and Pavcnik, 2005), unemployment, and informality rate (Koujianou Goldberg and Pavcnik, 2003).

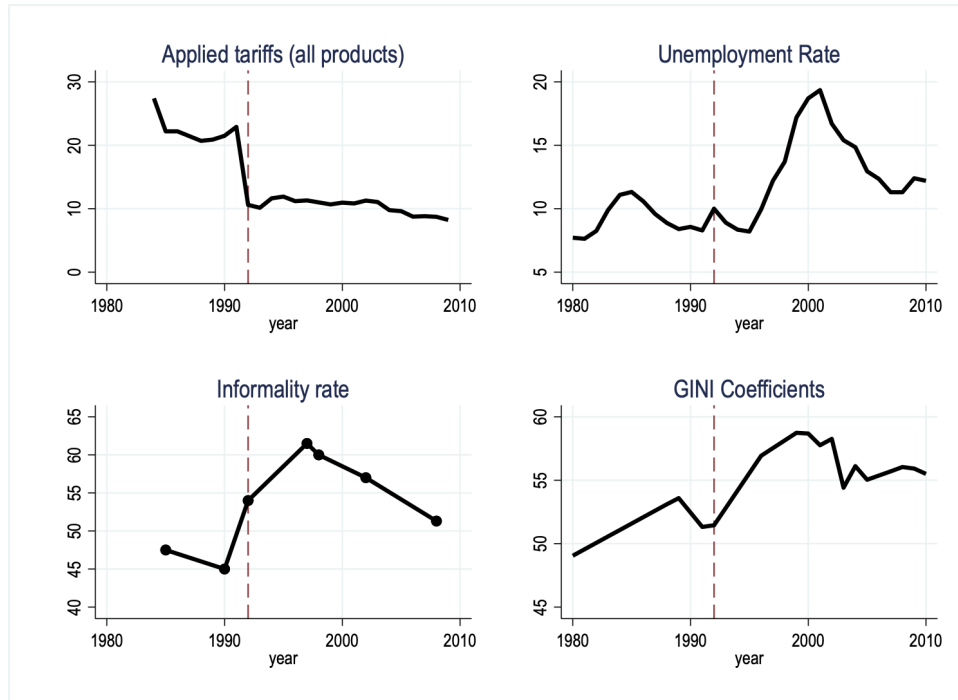


Figure 3: Trade reform in Colombia.

3.1 Bringing the model to the data

The benchmark economy is calibrated to 2010 Colombian data, which characterizes the post-reform (low tariff) world. A model period is a quarter. Table 1 reports the list of parameters calibrated outside the model or taken from the literature. The interest rate is equal to 2.3% and is chosen to match an annual lending rate of 9.4% (World Bank, 2024b). We assume the workers in the model spend 40 years in the labor market on average, corresponding to ages 25-64. This implies a quarterly retirement probability of 2.5%. The elasticity of substitution across varieties σ is taken from Baier and Bergstrand (2001) and assumed to be 6.43. The matching elasticity ζ is taken from

Coşar et al. (2016), who estimate a quarterly value of 1.54 for Colombia. Finally, we set the bargaining power ζ to 0.5, risk aversion γ to 2, and the borrowing limit $\underline{A}$ to 0.

Parameters	Description	Value	Target/Source
r	Interest rate	0.023	Annual lending rate=0.094
δ_w	Retirement rate	0.025	40 years in the labor market
σ	Elasticity of substitution	6.43	Baier and Bergstrand (2001)
η	Matching elasticity	1.54	Coşar et al. (2016)
ζ	Worker's bargaining power	0.5	standard
γ	Risk aversion	2	standard
$\underline{A}$	Borrowing limit	0	standard

Table 1: Parameters set outside the model.

The remaining parameters are calibrated to match firm- and household-level moments. Table 2 reports the list of targeted moments and their model counterpart. To construct the targeted moments, we use multiple sources of data.

First, we discuss the moments that pertain to firms. The industrial sector in the model corresponds to the pool of formal firms operating in the economy. We use the World Bank Enterprise Survey (WBES), World Bank (2024a), which provides a firm-level survey of a representative sample of the formal sector in Colombia, to construct several statistics for 2010. We use the number of employees recorded at the end of the fiscal year to measure firm size, which allows us to construct different measures of firm size distribution. As targets, we use the average (log) firm size and its dispersion of (log) firm size, as well as the distribution of firms and employment across different firm-size bins. The WBES also allows us to measure the average firm age, which we use as another target. The information on firm size in the first year of operation is used to construct average and dispersion in firm growth, measured as log deviation between current and initial firm size. Finally, we use information on firm-level export activity to target the share of firms that export and the share of firm revenues from exporting.

For the household-level targets, the first source of data is the Household Survey of Finances and Financial Education (DANE, 2024). This data collects cross-sectional information on the financial situation of Colombian households. We use this data to construct two statistics for households where the head is between 25 and 64 years old. First, the average wealth-to-income ratio, calculated as the average financial wealth of households per unit of household income, is used as a measure of wealth accumulation. For Colombian households, the ratio was 2.169 in 2010. Second, the share of households whose overall financial wealth is lower than their annual income is used as a measure of households with borrowing constraints. The share of should with

Target	Source	Model	Data
<i>Firm Dynamics and Size</i>			
Average (log) firm size	WBES	3.341	2.688
Dispersion (log) firm size	WBES	0.558	1.170
Share of exporting firms	WBES	0.167	0.182
Average firm growth	WBES	2.280	1.195
Dispersion in firm growth	WBES	0.311	1.068
Share of firms with 1-19 employees	WBES	0.155	0.736
Share of firms with 20-49 employees	WBES	0.841	0.165
Share of employment firms 1-19 employees	WBES	0.054	0.156
Average firm age (years)	WBES	15.933	16.500
<i>Households Assets</i>			
Avg. wealth to income ratio	IEFIC	1.865	2.169
Share of hand-to-mouth	IEFIC	0.748	0.727
<i>Labor Market</i>			
Informal employment rate	ILO	0.654	0.663
Unemployment rate	ILO	0.090	0.084
Quarterly separation rate	Flórez et al. (2021)	0.090	0.148

Table 2: Targeted moments.

borrowing constraints is 72.7% in the data.⁶

Finally, We calibrate the outside sector and the pool of unemployed to reflect informal employment and unemployment rate, as reported by the International Labour Organization (ILO, 2024), and target the quarterly worker's separation rate from formal jobs using data from Flórez et al. (2021).

Table 3 reports the list of calibrated parameters. While in a general equilibrium model, all parameters affect all targeted moments; some parameters have a larger influence on some specific targets. On the households side, the discount factor, β , is determined by the asset-to-income ratio, while the minimum consumption requirement $\bar{c}$ is disciplined by the share of hand-to-mouth workers. The consumption share of the outside sector $1 - \alpha$ is chosen to match a share of informal employment, while the value of home production, b , is chosen to match the unemployment rate.

For firm-level target, entry, and operating costs, κ_e and κ_o , determine the average (log) firm size and its dispersion. The fixed cost of exporting, κ_x is set to match the share of exporters, while the revenue premium of exporters, d_f , is calibrated to match the revenue share from exporting, which in the model, given the CES structure of preferences, is equal to $1 - (1 + d_f)^{-1}$.

⁶This measure, which follows Hubbard et al. (1995), is standard in the literature.

Parameters	Description	Value
β	Discount factor	0.97
$\bar{c}$	Minimum consumption requirement	0.06
$1 - \alpha$	Consumption share of outside sector	0.15
b	Home production	0.20
κ_e	Entry cost	398.46
κ_o	Operating cost	0.40
κ_x	Export costs	20.00
d_f	Export premium	0.32
ρ_z	Persistence of productivity	0.85
σ_z	Variance of productivity shock	0.40
λ_0	Adjustment costs, scalar	1.50
λ_1	Adjustment costs, scale	0.04
λ_2	Adjustment costs, convexity	2.10
δ_s	Exogenous job destruction	0.07
δ_f	Exogenous firm exit	0.02

Table 3: Internally calibrated parameters.

The parameters of the productivity process, ρ_z and σ_z are informed by firm size growth statistics, average firm growth, and its dispersion, while the parameters of hiring costs function, λ_0 , λ_1 and λ_2 are identified by firm and employment distributions across firm size bins. Finally, the average firm age and worker separation rates pin down the exogenous probability of firm exit, δ_f , and worker separation, δ_s , respectively.

3.2 Mechanisms at play

Before proceeding to the counterfactual analysis, we describe some key mechanisms of the model. In the model, risk-averse workers would like to smooth consumption throughout their lifespan. Unemployment and labor income risks, driven by firms' dynamics, and hiring and firing decisions, might prevent them from doing so. Workers can partially insure themselves against this risk by accumulating savings through a risk-free bond.

Figure 4 illustrates how saving decisions differ depending on employment status and its duration. In the left panel, we report the average asset holding of workers employed in the industry as a function of the duration of their employment spell. In the right panel, we report the average asset holding of workers who are not employed in the industry (they could be either unemployed or employed in the outside sector) as a function of the duration of their non-employment spell. Workers accumulate assets when employed in the industry and earn (on average) more, and deplete those savings to smooth consumption during periods of unemployment or employment in the outside sector, when they earn less.

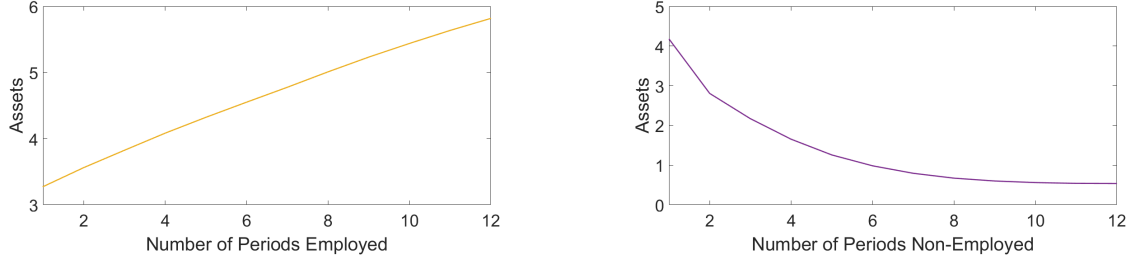


Figure 4: Asset accumulation (depletion) during employment (non-employment) spells.

Workers can hedge risk also through their search decisions.⁷ While an industrial job could yield higher earnings on average, searching for it is costly, and earnings in the industry are volatile, while being employed in the outside sector ensures a secure income. Figure 5 shows the probability of searching for a job in the industry for workers with different asset holdings. Wealth-poor workers are less likely to seek employment in the industry than those in the middle of the asset distribution. This is because if they are unsuccessful in the matching pool, they give up $1 - b$. For poor workers, whose marginal utility of consumption is large, the potential consumption loss from not being successful in the matching pool is too large to be offset by the additional consumption they would obtain if they found a job in the industrial sector. The minimum consumption requirement strengthens this channel for the working poor.

Notice also that wealthy workers are less likely to search compared to workers in the middle of the asset distribution. This is because if a worker enters the matching pool, she gives up the utility benefit ε - recall equation (31). For the very rich, whose marginal utility of consumption is low, this cost can outweigh the utility value of any additional consumption they could get from being hired in an industrial job.

4 Simulated Effects of the Trade Reforms

We are now ready to examine the effects of falling trade barriers. To do so, we simulate a counterfactual, pre-globalization (high trade barrier) steady state, and then compare it to our baseline, post-globalization (low trade barrier) economy. More precisely, we simulate the pre-globalization equilibrium by scaling down the revenue premium of exporters, d_f , by 9.1 percent. This ensures that our globalization shock increases the share of firms that export by the amount we observe in the data: 10.2% to 16.7%.

Trade liberalization induces changes in the composition of the industrial sector, which

⁷This is also a feature of Chaumont and Shi (2022)'s directed search model. There, however, the expected duration of unemployment spells is the only source of cross-labor-market variation in risk.

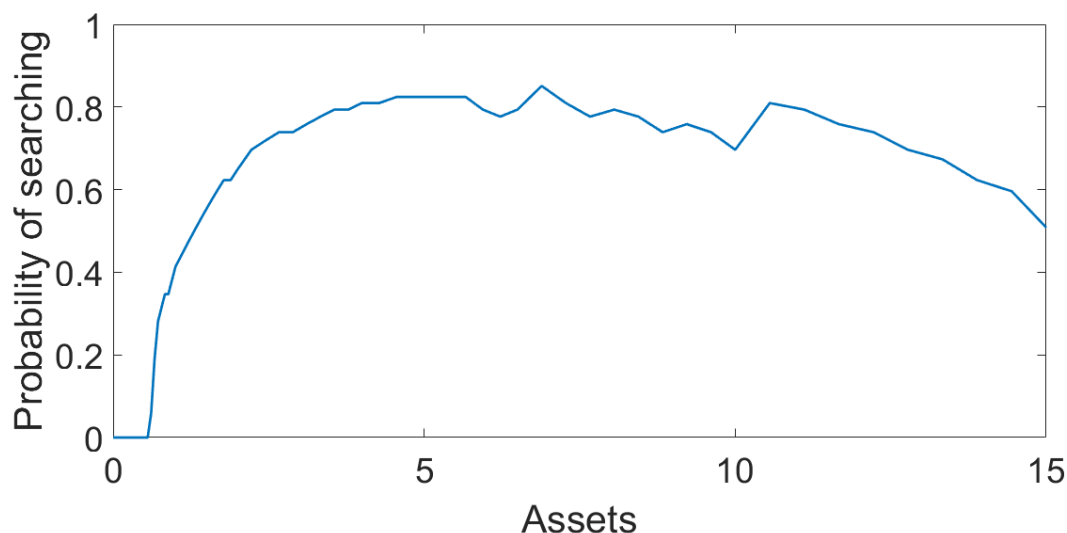


Figure 5: Search behavior against assets.

becomes more skewed towards larger and more productive firms, but also more dispersed. The average log firm size increases by 1.40%, while the standard deviation grows by 3.02%. These changes also affect the upper end of the distribution. The proportion of large firms, defined as those with more than 49 employees, increases by 0.4 percentage points.

Trade liberalization drives firm growth by increasing export opportunities. Following the reform, the proportion of exporters rises from 10.2% to 16.7%. Larger, more productive exporting firms make more substantial workforce adjustments in response to their idiosyncratic productivity shocks. As a consequence, the job turnover rate increases by 0.34 percentage points with trade openness.

The changes in the composition of the industrial sector and the rise in job turnover affect wages. The rightward shift in the firm size distribution indicates a reallocation from low- to high-productivity units and from low- to high-paying firms. This shift contributes to rising earnings and widens the income gap between top earners and the rest. Following the reform, real wages increase by 0.85%, while wage inequality, measured by the standard deviation of wages, rises by 13.03%.

The growing wage inequality and higher labor turnover imply increased labor income risk for industrial workers. At the extensive margin, firms become more responsive to productivity shocks, resulting in higher hiring, firing, exiting, and entering rates. At the intensive margin, wage dispersion increases. Consequently, the volatility of labor income rises significantly, with its standard deviation increasing by 11.81%.

The increased exposure to risk affects the two margins of adjustment of workers: their savings decisions and their choice of whether to seek employment in the industry. With trade liberalization, the ratio of assets to income rises by 2.14%, due to higher

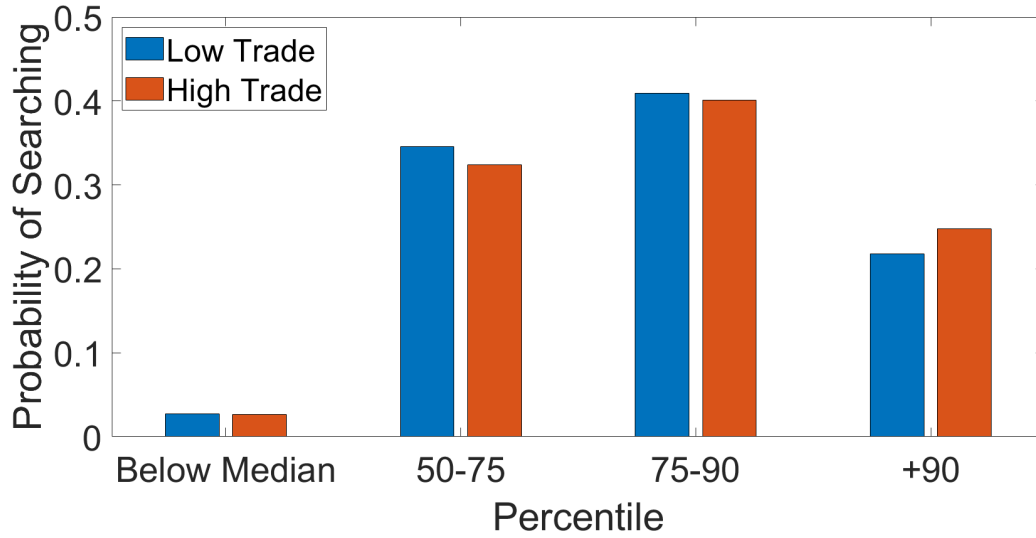


Figure 6: Probability of seeking work in the industry as a function of assets before and after the trade liberalization reforms.

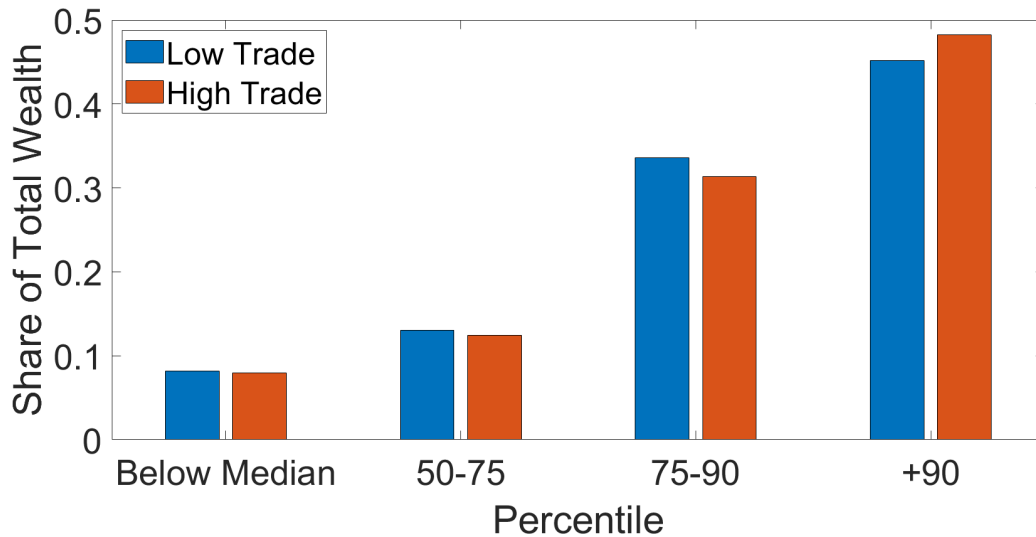


Figure 7: Effect of trade openness on the workers' asset distribution.

precautionary savings. At the same time, the likelihood of pursuing a job in the industrial sector decreases as labor income risk grows. Figure 6 illustrates this trend. We report the probability of searching for workers grouped by their asset holdings. Red bars refer to the baseline (high-trade), and blue bars refer to the counterfactual (low-trade). Except for those at the top of the asset distribution, workers increasingly turn to informal employment to manage higher risk following the trade reform.

Changes in the industrial firm dynamics and income profiles have important implications for workers' wealth. Figure 7 reports the share of total wealth held by workers grouped by their asset holdings. Again, red bars refer to the baseline (low-trade barriers), and blue bars refer to the counterfactual (high-trade barriers). Trade liberalization

increases wealth inequality. The Gini coefficient rises from 0.66 to 0.67, and the share of total assets held by the richest 10% increases by over 3.01 p.p., while that of those below the median decreases by 0.2 p.p.

Asset inequality rises for two reasons. First, increasing wage inequality within the industrial sector amplifies the earnings gap between workers in the most and least productive firms. Second, higher labor income risk forces a greater proportion of workers to reallocate towards the outside sector, which grows by 1.5 p.p. Both dynamics reduce the savings capacity of low earners relative to the rest.

What are the welfare implications of trade liberalization? Figure 8 reports the welfare gains achieved from an increase in trade openness for different types of workers. To construct this graph, we first calculate the answer to the following question for each worker: Given her wealth upon entering the benchmark (post-globalization) labor market, how much would she need to be compensated in order to start with the same wealth in the counterfactual (pre-globalization) labor market? We then aggregate these compensating differentials, grouping workers by their initial wealth quantiles.

The average gain is positive and primarily driven by the price reduction achieved with greater trade openness. The most productive firms in the domestic economy benefit from expanded export opportunities, while the less productive ones contract or exit due to heightened import competition from abroad. The reallocation of resources within the industry lowers prices by 3.00% and enhances consumer welfare on average by 2.16%, a value that is comparable to the one obtained in models of trade with a representative household (Alessandria and Avila, 2024). On the other hand, not everybody gains from the trade reform: the poor-wealth workers, i.e., those below the median of the asset distribution, face a welfare loss of -2.10%, which is the result of enhanced risk and increased asset depletion.

5 Conclusion

We study how trade openness affects welfare in a model with heterogeneous workers and firms. In the model, all workers are ex-ante identical, but due to labor market frictions, they experience very different earnings trajectories. Some workers are lucky and work for high-productivity firms, while others end up with low-productivity firms or spend extended periods unemployed. Workers try to smooth their consumption by accumulating and de-accumulating assets. When the economy opens up for trade, earnings become more uncertain. As a result, while trade openness implies lower prices and higher consumption opportunities, it makes earnings riskier. We focus on Colombia, a country that experienced significant trade liberalization at the end of the 1980s and early 1990s. We find that trade openness increased earning inequality and

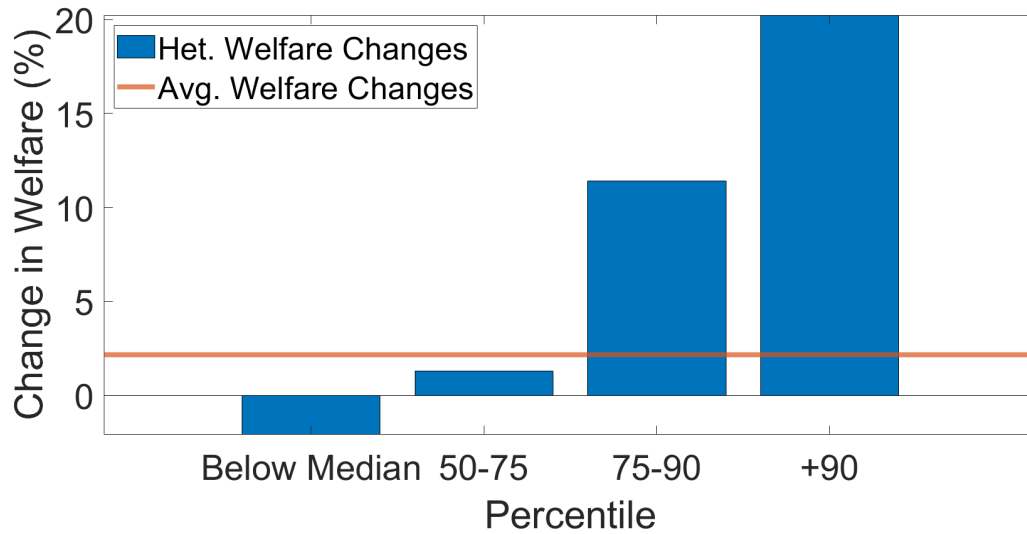


Figure 8: Welfare gains from trade openness.

the size of the informal economy. However, on average, workers were happier in a more open economy. The average steady-state welfare gains were about 2.16%. But there were winners and losers: those workers who started their lives at the bottom of the wealth distribution experienced welfare losses. In contrast, the ones who started with more wealth and could shield themselves against higher risk gained significantly from lower trade barriers.

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