

Can Taxes Help Ensure a Fair Globalization?

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Abstract

This paper analyzes whether taxation can be successfully used to reduce the incidence of labor informality and achieve higher equality in a globalized economy. To this purpose, it develops a two-area model: a developed country and an emerging country. The two areas differ according to the size of the informal sector, which is characterized by a more flexible labor market and lower productivity. To illustrate the potential role of taxation in achieving a more fair income distribution, the paper introduces a trade shock to simulate the effects of trade liberalization. Trade expansion has often been blamed for leading to an expansion of the informal sector and a widening of wage income

disparities. In this context, the paper analyzes whether a

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Can taxes help ensure a fair globalization?

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1 Introduction

ployment and create more formal jobs. This strand of the literature suggests that the best approach to reduce the size of the informal sector is using taxation to reduce the costs of being formal and create the right incentives for companies and workers intending to switch to the formal sector. However, different tax instruments may have different effects in promoting the transition to the formal economy. For instance, lower taxes on social security contributions or on capital translates to a lower degree of informality, whereas cutting taxes on labor income has the opposite effect. Reducing personal income taxes increases gross wages, thus making the informal sector – which is labor intensive – more attractive.

Our analysis highlights a number of interesting results. We start by introducing a trade shock which simulates the effect of trade liberalization in a globalized economy. Simulations in our model point out that in the short term trade liberalization boosts economic activity and employment in both the formal and informal sectors. However, this employment expansion is biased toward the informal sector, which is not subject to labor regulation and hence is more flexible. In addition, in the long run – after the strong employment gains recorded during the initial phase of trade expansion – there is a phase characterized by a contraction on the labor market. We then investigate whether it is possible to correct this bias in favor of the informal sector by reducing payroll taxes paid by firms operating in the formal sector. This policy exercise simulates the effects of several programs implemented in emerging economies (e.g. SIMPLES and S PERSIMPLES in Brazil and the Monotax in Ai3Mnteinastei79s

There are four actors in each country: households, firms producing intermediate goods, firms producing final goods and the government. The model features heterogeneous households: Ricardian and non-Ricardian. Ricardian households hold bonds but do not supply labor, whereas non-Ricardian households do not have access to financial markets to finance their consumption needs. Therefore, non-Ricardian households need to supply labor in order to finance their consumption needs. Since recent evidence shows that there is no segmentation between the formal and the informal sector (see Charlot et al. (2015)), we assume that workers can move between the two sectors.⁵ They may decide to either supply labor in the formal sector, or supply labor in the informal sector or be unemployed. Labor is hence supplied only by non-Ricardian households to intermediate good producers. Intermediate good producers operate in a perfect competitive market and hire labor – either on the formal or informal market – to produce intermediate goods which are sold to final good producers. Final good producers combine intermediate goods into a final good which is sold on a monopolistically-competitive market.⁶ Finally, to provide public goods and unemployment benefits, the government collects taxes paid on consumption by all households as well as payroll taxes paid only by employees and employers (i.e. intermediate good producers) operating in the formal sector.

For the sake of simplicity, the model does not feature nominal price rigidities and goods are produced using only labor without capital.

2.1 Households

There are two types of households in the economy: Ricardian and non-Ricardian. Ricardian households (indexed by a) do not work, hold assets and have access to international financial markets. Non-Ricardian households supply labor, but have no access to financial markets. Non-Ricardian households can work in the formal sector (indexed by F), work in the informal sector (indexed by I) or being unemployed (indexed by U).

For all agents, the consumption basket C_t aggregates Home and Foreign consumption in a Dixit-Stiglitz form:

$$C_t = \left(\int_0^1 C_t(i)^{\frac{1}{\sigma}} di \right)^{\sigma} \quad (1)$$

⁵For the sake of simplicity, we focus only on labor informality and we abstract from business informality, i.e. we abstract from modeling how firms can switch from the formal to the informal sector and vice versa. Chacaltana et al. (2018) show that business informality does not imply labor informality and vice versa. The decision of a firm to go formal is the product of a complex evaluation based not only on the tax burden but also on other factors, such as the opportunity to have access to credit. Modeling firms' choice to switch between the formal and informal sector would require embedding the financial sector into the model, which will pose challenges to the analytical manageability of the model. Becker (2018) provides an example of a model featuring a sector-switching mechanism.

⁶The distinction between formal and informal labor arises only for firms producing intermediate goods which are used by final good producers as the sole input. Intermediate good producers are not allowed to directly export abroad. This assumption is needed because exporting means some minimal formality and respect of customs requirements and are more subject to control and customs inspection.

where $\sigma > 1$ is the symmetric elasticity of substitution across goods. The corresponding consumption-based price index, P_t , is given by:

$$P_t = \int_0^1 P_t(i)^{\frac{1}{\sigma}} di^{\frac{1}{\sigma}} \quad (2)$$

Ricardian agents smooth their consumption, C_{at} , over time and thus maximize the life-time utility function $E_0 \prod_{t=0}^{\infty} \beta^t \frac{(C_{at})^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}}$, where β is the risk aversion parameter and β is the discount factor. Utility maximization is subject to the following budget constraint:

$$\begin{aligned} & A_{t+1} + S_t A_{t+1} + P_t \frac{A_{t+1}^2}{2} + S_t P_t \frac{A_{t+1}^2}{2} + (1 + i_t^c) P_t C_{at} \\ = & (1 + i_t^N) A_t + (1 + i_t^N) A_t S_t + P_t (T_t^A + T_t^i + T_t^f) \end{aligned}$$

Ricardian agents hold domestic assets A_t (denominated in domestic currency) on which they receive the nominal interest rate i_t^N

where i_t and i_t^* are respectively the real interest rates on domestic and foreign assets.

The Euler equations for domestic and foreign asset holding are respectively:

$$(1 + a_{t+1}) = (1 + i_{t+1}) E_t \frac{C_{at+1}^c}{C_{at}^c} \frac{1 + \frac{c}{t}}{1 + \frac{c}{t+1}} \quad (4)$$

$$(1 + a_{t+1}^*) = (1 + i_{t+1}^*) E_t \frac{C_{at+1}^c Q_{t+1}}{C_{at}^c Q_t} \frac{1 + \frac{c}{t}}{1 + \frac{c}{t+1}} \quad (5)$$

On the other hand, non-Ricardian households do not have access to financial markets and hence they can finance their consumption needs either through labor income (W_{Ft} if they supply labor to the formal sector and W_{It} if they supply labor to the informal sector) or through unemployment benefits (b_t) if they do not work.

The following equations define non-Ricardian agents' consumption depending on whether they work in the formal sector, or they work in the informal sector, or they are unemployed:

$$C_{Ft} = \frac{(1 + \frac{w}{t})}{(1 + \frac{c}{t})} W_{Ft} \quad (6)$$

$$C_{It} = \frac{W_{It}}{(1 + \frac{c}{t})} \quad (7)$$

$$C_{ut} = \frac{b_t}{(1 + \frac{c}{t})} (1 - U_t) \quad (8)$$

The payroll tax on employees, $\frac{w}{t}$, is borne only by non-Ricardian agents employed in the formal sector. Total labor supply, l_t , is the sum of labor supplied by non-Ricardian households in the formal and informal sectors, i.e. $l_t = l_{Ft} + l_{It}$. In equilibrium, aggregate unemployment is given by:

$$U_t = 1 - (l_{Ft} + l_{It}) \quad (9)$$

Total consumption C_t is defined as the weighted sum of consumption of Ricardian households (C_{at}) and non-Ricardian households working in the formal sector (C_{Ft}), in the informal sector (C_{It}) or unemployed (C_{ut}):

$$C_t = \beta C_{at} + (1 - \beta)(C_{Ft} + C_{It} + C_{ut}) \quad (10)$$

where β is the share of Ricardian households.

2.2 Production

There are two vertically integrated production sectors. In the upstream, in both the formal and informal sectors, production is done by non-Ricardian households using capital and labor. The production function in the formal sector is given by $Y_{Ft} = A_{Ft} K_{Ft}^\alpha l_{Ft}^{1-\alpha}$ and in the informal sector by $Y_{It} = A_{It} K_{It}^\alpha l_{It}^{1-\alpha}$. The capital stocks in the formal and informal sectors are given by $K_{Ft} = \frac{I_{Ft}}{\delta}$ and $K_{It} = \frac{I_{It}}{\delta}$ respectively. The total capital stock is $K_t = K_{Ft} + K_{It}$. The total labor supply is $l_t = l_{Ft} + l_{It}$. The total output is $Y_t = Y_{Ft} + Y_{It}$. The total factor payments are $W_{Ft} = \alpha Y_{Ft} \frac{l_{Ft}}{l_t}$ and $W_{It} = \alpha Y_{It} \frac{l_{It}}{l_t}$. The total labor income is $W_t = W_{Ft} + W_{It}$. The total labor supply is l_t . The total factor payments are $W_t = W_{Ft} + W_{It}$.

2.2.1 Intermediate goods

We assume a unit mass of intermediate good producers, which operate both in the formal and informal sectors. Both sectors are subject to search and matching frictions as in the Diamond-Mortensen-Pissarides framework. Unemployed agents search for a job in both sectors and search efforts are endogenous. Wages are set through an individual bargaining process.

We assume a constant-return-to-scale matching technology in each sector j , for $j = F, I$, where F and I refer respectively to the formal and the informal sector. The matching technology converts aggregate unemployed workers, U_t , and aggregate vacancies, V_t , into aggregate matches, M_t . The matching rate in each j sector is:

$$M_{jt} = \beta_j (e_{jt} U_t)^{\alpha} V_{jt}^{1-\alpha} \quad (11)$$

where U_t is the total number of unemployed workers and V_t is the number of vacancies. The parameters β_j and α measure respectively the matching efficiency and the matching function elasticity, with $\alpha > 0$ and $0 < \beta_j < 1$. Let e_{jt} denote search efforts for the job type j when agents are unemployed.

The job filling rate, q_t , is:

$$q_{jt} = \frac{M_{jt}}{V_{jt}} = \beta_j \frac{e_{jt} U_t}{V_{jt}}^{\alpha} \quad (12)$$

The job finding rate, f_t , is:

$$f_{jt} = \frac{M_{jt}}{U_t} = \beta_j \frac{V_{jt}}{e_{jt} U_t} e_{jt} \quad (13)$$

As in Pissarides and Lubik (2007), we assume that newly created matches become productive only in the next period. The law of motion of employment, l_{jt} , is:

$$l_{jt} = (1 - \delta_j) l_{jt-1} + q_{jt-1} v_{jt-1} \quad (14)$$

where $\delta_j \in (0, 1)$ is the exogenous separation rate and v_{jt} is the number of vacancies posted by the firm in period t . In equilibrium $v_{jt} = V_{jt}$.

Firms, both in the formal and informal sector, hire labor l_t to produce an intermediate good y_{jt} according to the following technology :

$$y_{jt}^{int} = Z_{jt} l_{jt} \quad \forall j = F, I \quad (15)$$

where Z_{jt} is an exogenous technology term which follows an autoregressive process AR(1):

$$\log Z_{jt} = \rho^1 \log Z_{jt-1} + \rho^2 \log Z_{jt-2} + \epsilon_{jt} \quad (16)$$

In both sectors $j = F, I$, intermediate firms choose the number of vacancies, v_{jt} , and employment, l_{jt} , to maximize the discount value of their profits:

$$E_0 \sum_{t=0}^{\infty} \frac{U_{C,t}}{U_{C,0}} \lambda_{jt} Z_{jt} l_{jt} - w_{jt} l_{jt} (1 + \tau_{jt}^f) - \eta_{jt} v_{jt} \quad (17)$$

subject to the law of motion for labor: $l_{jt} = (1 - \delta_{jt}) l_{jt-1} + q_{jt-1} v_{jt-1}$, where λ_{jt} is the real price at which intermediate goods producers sell their goods to final good producers and it is expressed in units of consumption⁹; w_{Ft} is the wage paid to workers in the formal sector (l_{Ft}), while w_{It} is the wage paid to workers in the informal sector (l_{It}). In both sectors, intermediate good producers incur a cost of η_{jt} units of consumption per vacancy posted v_{jt} . The term τ_{jt}^f represents a payroll tax on employers. These taxes are paid only by firms operating in the formal sector. Hence $\tau_{Ft}^f > 0$, whereas $\tau_{It}^f = 0$.

The first order conditions (hereafter, FOCs) on v_{jt} and l_{jt} in the formal and informal sector are respectively:

$$\frac{\lambda_{jt}}{q_{jt}} = E_t[\lambda_{j,t+1} - \delta_{jt} \lambda_{j,t+1}] \quad (18)$$

$$\lambda_{jt} = \lambda_{jt} Z_{jt} - w_{jt} (1 + \tau_{jt}^f) + E_t[\lambda_{j,t+1} (1 - \delta_{jt}) - \delta_{jt} \lambda_{j,t+1}] \quad (19)$$

where λ_{jt} is the Lagrangian multiplier for labor adjustment and measures the current value of an additional worker. Combining both FOCs leads to the job creation conditions in both sectors:

$$\frac{\lambda_{jt}}{q_{jt}} = E_t[\lambda_{j,t+1} - \delta_{jt} \lambda_{j,t+1}] - w_{jt} (1 + \tau_{jt}^f) + E_t[\lambda_{j,t+1} (1 - \delta_{jt}) - \delta_{jt} \lambda_{j,t+1}]$$

The worker's value of being matched, in both the formal and informal sector, is given by the sum of real wage received and the expected discounted future value of being matched by the firm:

$$W_{jt} = \frac{(1 - \beta_j)}{(1 + \beta_j)} w_{jt} + E_t \beta_j [(1 - \beta_j) W_{jt+1} + \beta_j U_{u;t+1}] g \quad (23)$$

The expected future value of being matched by the firm (the last term on the right-hand side of Eq.(23)) is a weighted average of probability $1 - \beta_j$ that the match will survive or the probability β_j that the worker will become unemployed.

The value of being unemployed is defined as:

$$U_t = \frac{b_t}{(1 + \beta_u)} - \frac{e_{Ft}^{1+\beta_u}}{1 + \beta_u} - \frac{e_{It}^{1+\beta_u}}{1 + \beta_u} + E_t \beta_u [\beta_{Ft} W_{Ft+1} + \beta_{It} W_{It+1} + (1 - \beta_{Ft} - \beta_{It}) U_{u;t+1}] g \quad (24)$$

where $\frac{e_{jt}^{1+\beta_u}}{1+\beta_u}$ is a convex search cost and β_u is the elasticity of disutility of searching. Therefore, the value of being unemployed is the sum of unemployment benefits¹⁰ – net of search costs – and the expected discounted future value of future states, where β_{Ft} and β_{It} are the probability of becoming employed respectively in the formal or informal sector.

We define worker's surplus $H_{jt} = W_{jt} - U_t$. The worker surplus in the formal and informal sector is given by:

$$H_{Ft} = \frac{(1 - \beta_j)}{(1 + \beta_j)} w_{jt} - \frac{b_t}{(1 + \beta_u)} - \frac{e_{Ft}^{1+\beta_u}}{1 + \beta_u} - \frac{e_{It}^{1+\beta_u}}{1 + \beta_u} + (1 - \beta_{Ft} - \beta_{It}) U_{u;t+1} g$$

The bargained wage satisfies the following condition, respectively in the formal and informal sector:

$$W_{Ft} = \frac{b_t}{1 + \frac{w}{Ft}} \left(\frac{e_{Ft}^{1+\%}}{1 + \%} \right)^{\#} \left(\frac{e_{It}^{1+\%}}{1 + \%} \right)^{\#} + \frac{1}{1 + \frac{f}{Ft}} [{}_tZ_{Ft} + E_t ({}_{t,t+1}J_{Ft+1})] (1 - F) (1 - F - Ft) \frac{1 + \frac{f}{Ft}}{1 + \frac{f}{Ft+1}} \frac{1}{1 + \frac{w}{Ft}} \frac{W_{Ft+1}}{Ft} \quad (29)$$

$$W_{It} = \frac{b_t}{(1 + \frac{c}{t})} \left(\frac{e_{Ft}^{1+\%}}{1 + \%} \right)^{\#} \left(\frac{e_{It}^{1+\%}}{1 + \%} \right)^{\#} + (1 -) [{}_tZ_{It} + {}_{t}E_t ({}_{t,t+1}J_{It+1})] \quad (30)$$

Wages are a linear combination – determined by the bargaining power parameter – of

We assume that $G(\cdot)$ is Pareto with shape parameter $k_p > 1$.¹¹ As a result, $\vartheta_d = \frac{1}{k_p} Z_{min}$ and $\vartheta_{x,t} = \frac{1}{k_p} Z_{x,t}$, where $k_p = k_p$.

2.4 Closing conditions

Aggregate demand is the sum of private and public consumption and is defined as:

$$Y_t^C = \beta C_{at} + (1 - \beta)(C_{Ft} + C_{It} + C_{ut}) + \beta_F V_{Ft} + \beta_I V_{It} + G_t \quad (48)$$

We assume that the cost of opening new vacancies are socially shared.

Assets are in zero net supply, which implies the equilibrium condition:

$$a_{t+1} + a_{t+1} = 0 \quad (49)$$

Net foreign assets are determined by:

$$(a_{t+1} - a_t) + Q_t(a_{t+1} - a_t) = i_t a_t + Q_t i_t a_t + Q_t N_{x;t \sim x;t} y_{x;t} - N_{x;t \sim x;t} y_{x;t} \quad (50)$$

where the last term in brackets represents the trade balance: $TB_t = Q_t N_{x;t \sim x;t} y_{x;t} - N_{x;t \sim x;t} y_{x;t}$.

Calibration

We calibrate the model using quarterly data from the U.S. and Brazilian economies. We believe that Brazil is an illustrative example of an emerging country which, starting from a high level of informality in the late 1990s, has adopted a set of policy initiatives to facilitate the move to formality.¹² A first program, called SIMPLES, was launched in 1996 and was followed by a second one, the SIMPLES program, in 2006. Since, in Brazil there is a strong correlation between size of company and prevalence of informality, these programs aimed at reducing the costs of formalization through a simplification and a reduction of tax rates and tax regulations for Brazilian micro firms with no more than five paid employees.¹³ Since the SIMPLES came into force in July 2007, some 9 million businesses have joined this system of taxation and the formal rate has increased by 11 percentage points (see Fajnzylber et al. (2011)).¹⁴

In this section we discuss the calibration strategy. Broadly speaking, we choose some parameter values from the literature, while other parameters are set so to match macroeconomic series observed for the United States and Brazil. We assume that the two countries are asymmetric, hence some parameters describing labor and goods markets may differ across countries. Table 1 summarizes the asymmetric calibration.

¹²See ILO (2014) for a discussion and an evaluation of other programs launched in emerging countries to move to formalization.

¹³The SIMPLES program combined six different federal taxes and social contributions into a single monthly-based rate. The two reforms also reduced the tax burden considerably.

¹⁴While Fajnzylber et al. (2011) find very large effects of the SIMPLES program on formality rates, Monteiro and Assunção (2012) find positive and significant effects on formalization rates only among firms in the retailer sector. For a reconciliation of these two studies, see Piza (2011).

We set the discount factor β at 0.99, implying that the annual real interest rate is 4 percent. The value of the risk aversion parameter, σ , is equal to 2. Following Bernard et al. (2003), we set the elasticity of substitution across product varieties, σ_v , equal to 3.8. Following Ghironi and Melitz (2005), we set the elasticity of substitution across Home and Foreign goods, σ , equal to σ_v , and the dispersion of firm productivity k_ρ equal to 3.4. We normalize Z_{min} to 1. We set iceberg trade costs τ equal to 1.7, following the estimates of trade costs reported by Anderson and van Wincoop (2004). We calibrate prodtopF

wage gap. Firms tend to recoup high employers' payroll taxes paid to hire formal workers, which could partly explain low informal wage gaps. In Brazil informal wage penalties may only partly be related to the firm size effect, since many informal workers are to be found in large formal firms.

Finally, we set the initial value of tax rates at their respective steady-state levels. The United States employs a retail sales tax rather than a value added tax (VAT) as the principal consumption tax. The retail sales tax in the United States is not a federal, but it is a tax imposed at the state and local government levels. The total tax rate ranges between 0 percent (e.g. in Delaware, Oregon, New Hampshire, Montana) and 13.5 percent (in Alabama). We decide to set τ^c for the United States at the average rate, 7.8 percent. Brazil operates a

Table 1: Calibration

Targets and parameters	Notation	Developed	Emerging	Source
Calibration targets				
Formal employment	$l_F = (l_F + l_I)$	93%	70%	ILO, Trends Econometric Models
Informal employment	$l_I = (l_F + l_I)$	7%	30%	ILO, Trends Econometric Models
Unemployment rate	U	%	8.7%	ILO, Trends Econometric Models

4 The impact of trade liberalization

to unskilled workers, the so called skill premium. As a consequence, income inequality has

Figure 1: The final good sector

Note: H and F indicate respectively the “Home” country (i.e. the developed country) which is represented by a solid line and the “Foreign” country (i.e. the emerging country) which is represented by a dotted line. The blue lines display the dynamics with only trade liberalization, and the red lines display the dynamics when the tax reform is implemented.

stead, higher home prices in the developed country, combined with the decrease in the real exchange rate, lead consumers in the developed country to redirect their demand toward their trade partner (i.e. the emerging economy). This increase in demand addressed to emerging economy motivates more exporting firms in the emerging country. This, in turn, leads to a rise in input demand, and thus to a rise in the production costs (see Figure 1). As a consequence, input demand and production costs increase, which ultimately reduce profits for low-productive domestic firms. As a consequence, the number of new firm entries: the number of firms ($N_f = \text{"Domestic producers - F"}$) declines in the emerging country.

In the medium run, trade liberalization also affects the emerging country, where iceberg costs also decline, although with a delay. Hence, higher firms' profits worldwide boost income and labor demand leading to higher wages. The increase in labor costs leads both economies to be more selective: the number of firms declines, but the share of exporting firms, which are more productive, increases.

In the emerging economy, in the medium run, trade liberalization ultimately induces more firms to export, thereby increasing labor demand and real wages. As in the developed economy, this leads to high share of exporters and informality in emerging economy.

In the long run, when the developed country has reached its long-run level of iceberg costs, in the emerging country trade expansion is still ongoing. In the emerging country, revenue growth is now driven by iceberg cost reduction which takes place only in the emerging country and still generates growth gains. Growth gains, in this phase, are obviously more modest than during the first phase of trade expansion.

The impact on prices and exchange rate. In the developed country, at each period, domestic market prices ($p_{d,t}$ in the model notation and "Price in H - H" in the figures) and export prices ($p_{x,t}$ in the model notation and "Price in F - H" in the figures) are given by the following equations:

are modeled as in the developed economy, in a symmetric way:

$$\begin{aligned}
 d;t &= \frac{p_t}{1 - \epsilon_d} \\
 x;t &= Q_t \frac{p_t}{1 - \epsilon_{x,t}}
 \end{aligned}$$

It is clear that the rise of input price causes the rise in the domestic price (p_d). The increase of the input price (p) as well as the decline of productivity of exporters (ϵ_x) raises the export price, even though the real exchange rate (Q_t) declines.

In the medium run, the larger participation of the emerging country to the world trade stabilizes export prices in the developed country: the real exchange rate is more stable and the bias cost in favor of the developed country slows down (see Figure 1).

In the long run, when the developed country has reached its long-run level of iceberg costs, in the emerging country trade expansion is still ongoing. Therefore, the emerging country still benefits from decreasing iceberg costs. Hence, its competitiveness is restored and the real exchange rate increases (see Figure 1).

The impact on the labor market. In the developed country, higher input prices for final producers translate into higher marginal revenues for the intermediate good producers, and ultimately into higher wages. Figure 2 shows that labor demand increases in both the formal and the informal sector, driven by the increase in the price of intermediate goods sold to final producers. A part of this increase in the job surplus is redistributed to workers via wage increases. Figure 2 shows that wages increase in both the formal and the informal sector. Given that these wage increases are driven by the rise in the price of intermediate

In the medium run, the increasing participation of both countries in the world trade, by increasing incomes and thus the demand for goods, boosts labor demand (see Figure 2) and reduces unemployment (see Figure 3).

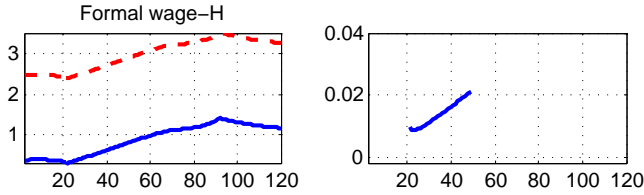
In the long run, when trade costs drop only in the emerging country, income growth generated by new exports is marginal: employment gains become smaller and smaller in both countries (i.e. developed and emerging) and both sectors (i.e. formal and informal). When iceberg costs converge to their long-term levels in both countries, variables converge towards the new steady-state levels. This phase is characterized by an over-adjustment, which is the result of vacancy-posting strategies adopted by firms (see Figure 2). As long as profit opportunities grow, there are strong incentives to post vacancies to benefit from growth. This competition leads firms to over-hiring. Once growth falters, employment starts decreasing through the exogenous rate of destruction and the slowdown in new job opportunities. This process takes time and explains why, after the strong employment gains recorded during the period of trade expansion, both countries enter a phase characterized by a contraction on the labor market. Since the separation rate is higher in the informal sector than in the formal sector, the decline in employment is faster in the informal sector, which explains the rise in the share of formal employment in this phase of the long-term adjustment.

To sum up, we observe that following a decline in trade costs wages increase in both the formal and the informal sector without changing the wage gap. Lower trade costs, although not harmful to equity, are biased toward labor informality.

5 Tax reform

In order to reduce the increasing incidence of informality induced by trade liberalization, both countries should introduce incentives to develop businesses in the formal economy. An easy way to promote formal employment is to reduce the payroll tax paid by firms operating in the formal sector. Nevertheless, the cost of this policy is a reduction of public revenues which the government may use to finance public expenditures on social security. An alternative solution might be implementing a “budget-neutral” tax reform, consisting in increasing the consumption tax to fund the cut in payroll taxes. An advantage of this strategy is that the consumption tax has a larger base, it is easier to collect and more difficult to evade. This policy mix, called "social VAT", has been implemented in many European countries.

Figure 2: The labor market



Note: H and F indicate respectively the “Home” country (i.e. the developed country) and the “Foreign” country (i.e. the emerging country). The blue lines display the dynamics with only trade liberalization, and the red lines display the dynamics when the tax reform is implemented.

they are displayed in Figure 2 and Figure 3. The scenario simulating the effects of the tax

the share of productivity paid to employees in the formal sector. On the other hand, the increase in the consumption tax reduces the disposable wage. However, this moderation is proportional to the weight of the unemployment benefits in the wage: as it is weak for workers in the formal sector, this wage moderation induced by the increase of the consumption tax is of small amplitude for the formal sector. The first channel clearly dominates and leads to wage increases in the formal sector after the tax reform.

Given that the search effort is endogenous, the tax reform also changes workers' reservation wage. Indeed, the cut in payroll taxes stimulates firms to open new vacancies in the formal sector, which in turn increases the chance for unemployed agents to find a job in the formal sector. The optimistic job prospect in the formal sector encourages unemployed to focus their search efforts more on this sector. Hence, search efforts increase in the formal sector and decline in the informal sector (see Figure 3, red dotted lines). Overall, the tax

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A Dynare equation

To solve the model, we use the Dynare software (see Adjemian et al. (2011)). After solving the steady state of the model, we use the following equation set in order to obtain the equilibrium paths.

The equilibrium price index

$$1 = \tilde{\alpha}_{d,t}^{-1} N_{d,t}^{\frac{1}{\sigma}} + \tilde{\alpha}_{x,t}^{-1} N_{x,t}^{\frac{1}{\sigma}}$$

Average export productivity

$$\tilde{\alpha}_{x,t} N_{x,t}^{\frac{1}{\sigma}} Y_t^C = \frac{1}{k_f} \frac{1}{(1 - \tau_x)} \frac{Z_{x,t}}{t} f_{x,t}$$

Labor market clearing

$$Z_F l_{F,t} + Z_I l_{I,t} = N_{d,t} \frac{y_{d,t}}{Z_d} + N_{x,t} \frac{y_{x,t}}{Z_{x,t}} + N_{e,t} f_{e,t} + N_{x,t}$$

Law of motion of employment

$$l_{j,t} = (1 - \delta_j) l_{j,t-1} + q_{j,t-1} V_{j,t-1}$$

New variety (product) creation

$$1 = (1 - \delta) E_t \frac{C_{t+1}^c}{C_t^c} \frac{1 + \frac{c}{t} \tilde{\alpha}_{d,t+1}}{1 + \frac{c}{t+1} \tilde{\alpha}_{d,t}} \frac{f_{e,t}}{f_{e,t+1}} \frac{N_{x,t+1} f_{x,t+1}}{N_{x,t} f_{x,t}} + \frac{N_{x,t+1} \frac{t+1}{Z_{x,t+1}} y_{x,t+1}}{N_{d,t+1} \frac{t+1}{Z_{x,t+1}} y_{x,t+1}} \quad ! \#$$

Job creation

$$1 = E_t \frac{C_{t+1}^c}{C_t^c} \frac{1 + \frac{c}{t}}{1 + \frac{c}{t+1}} (1 - \delta_j) \frac{q_{j,t}}{j} + \frac{q_{j,t}}{j} \frac{t+1}{Z_{j,t+1}} w_{j,t+1} (1 + \frac{f}{j_{t+1}})$$

Wage determination

$$w_{F,t} = \frac{b}{1 + \frac{w}{F_t}} \frac{1}{(1 + \frac{c}{t})} \# e_{F,t}^{1+\%}$$

Search intensity

$$\#e_{Ft}^{\%} = \frac{1}{F} \frac{V_{Ft}}{e_{Ft}U_t} \frac{1}{(1 + \frac{f}{t+1})(1 + \frac{c}{t+1})} \frac{w_{t+1}}{q_{Ft}}$$

$$\#e_{It}^{\%} = \frac{1}{I} \frac{V_{It}}{e_{It}U_t} \frac{1}{1 + \frac{c}{t+1}} \frac{I}{q_{It}}$$

Euler equation for domestic bond holding

$$(1 + a_{t+1}) = (1 + i_{t+1}) E_t \frac{C_{at+1}^c}{C_{at}^c} \frac{1 + \frac{c}{t}}{1 + \frac{c}{t+1}}$$

Euler equation for foreign bond holding

$$(1 + a_{t+1}) = (1 + i_{t+1}) E_t \frac{C_{at+1}^c}{C_{at}^c} \frac{Q_{t+1}}{Q_t} \frac{1 + \frac{c}{t}}{1 + \frac{c}{t+1}}$$

Bond market clearing

$$a_{t+1} + a_{t+1} = 0$$

Net foreign assets

$$(a_{t+1} - a_t) + Q_t(a_{t+1} - a_t) = i_t a_t + Q$$

Average output of a domestic variety

$$y_{d;t} = \tilde{\alpha}_{d;t} N_{d;t}^{\overline{1}} Y_t^C$$

Average output of an exported variety

$$y_{x;t} = \tilde{\alpha}_{x;t} N_{x;t}^{\overline{1}} Y_t^C$$

Aggregate demand

$$Y_t^C = \lambda C_{at} + (1 - \lambda)(C_{Ft} + C_{It} + C_{Ut}) + \beta_F V_{Ft} + \beta_I V_{It} + G_t$$

Formal workers' consumption

$$C_{Ft} = W_{Ft} l_{Ft} \frac{1 + \frac{w}{c}}{1 + \frac{w}{c}}$$

unemployed agents' consumption

$$C_{Ut} = \frac{b_t(1 - l_t)}{1 + \frac{c}{t}}$$

Informal workers' consumption

$$C_{It} = W_{It} \frac{l_{It}}{1 + \frac{c}{t}}$$

Total consumption

$$C_t = \lambda C_{at} + (1 - \lambda)(C_{Ft} + C_{It} + C_{Ut})$$

unemployment

$$U_t = 1 - l_{Ft} - l_{It}$$

Job filling rate

$$q_{jt} = \beta_j \frac{e_{jt} U_t}{V_{jt}}$$

Job finding rate

$$f_{jt} = \beta_j \frac{V_{jt}}{e_{jt} U_t}$$

Productivity shock

$$\log Z_{jt} = \alpha^1 \log Z_{jt-1} + \alpha^2 \log Z_{jt-1} + \epsilon_{jt}$$

Government spending

$$G_t = \beta_I [\lambda C_{at} + (1 - \lambda)(C_{Ft} + C_{It} + C_{Ut})] + (\beta_F \frac{w}{c} + \beta_I) W_{Ft} l_{Ft} - b_t U_t$$

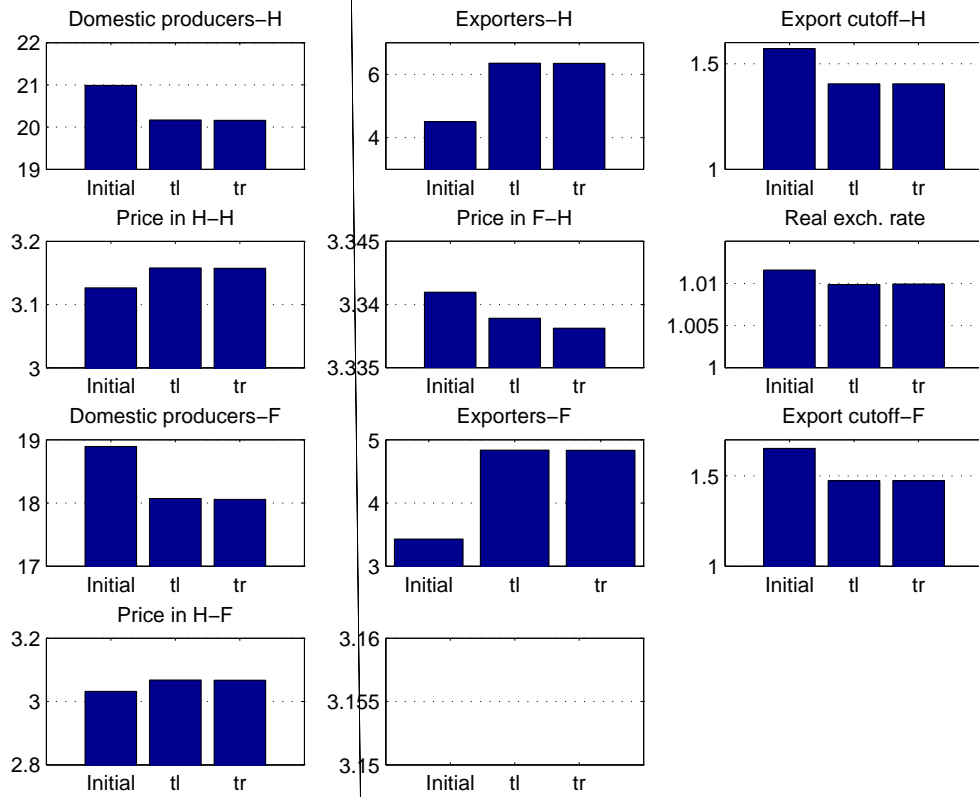
Steady state

Figure 4: Wage inequality



Note: H and F indicate respectively the “Home” country (i.e. the developed country) and the “Foreign” country (i.e. the emerging country). Wage inequality is defined by $w_{Ft}=w_{Ht}-1$.

Figure 5: Goods markets



Note: H and F indicate respectively the “Home” country (i.e. the developed country) and the “Foreign” country (i.e. the emerging country).

Figure 6: Labor markets

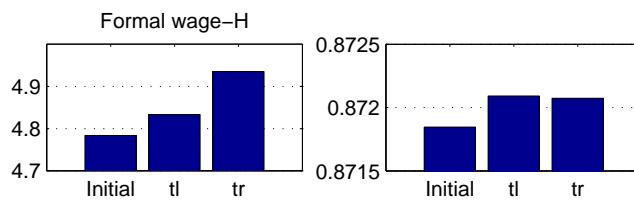
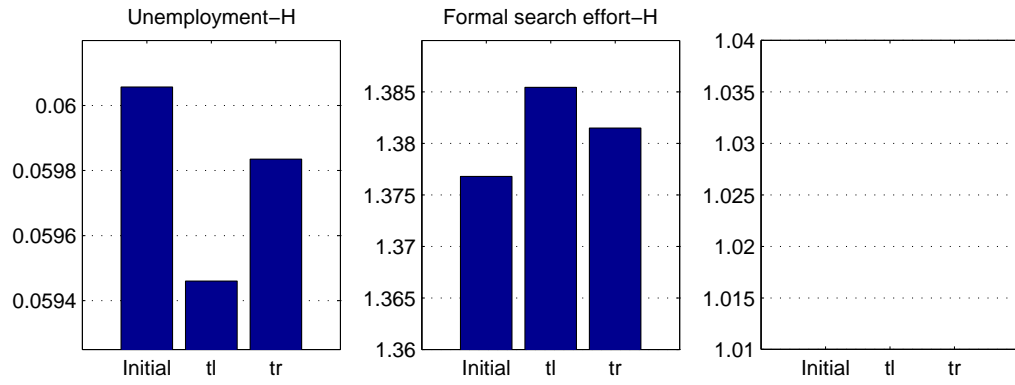


Figure 7: nemployment



Note: