Redistribution and Entrepreneurship in Developing Economies*

Vitor Fancio
Insper
vitoratf@al.insper.edu.br

Marcelo Rodrigues dos Santos
Insper
marcelors2@insper.edu.br

PRELIMINARY AND INCOMPLETE

Abstract

Increasing inequality and disappearing routine jobs motivate Universal Basic Income (UBI) reforms. Especially in developing economies, entrepreneurs are concentrated at the bottom and top of the income distribution. Therefore, changing the current tax and transfer system to implement a UBI can impact entrepreneurship and, consequently, job creation and inequality. We build a general equilibrium model with endogenous entrepreneurship and labor market frictions to quantify the impact of UBI policies on the Brazilian economy. We find that the welfare-maximizing UBI reform implies moving the current transfer system to a UBI system with higher government transfer as the benchmark economy. However, large UBI reforms may reduce capital accumulation and labor supply, leading to an increase in unemployment and a decrease in entrepreneurship.

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1 Introduction

The issue of increasing income inequality has been a subject of both academic and public discussions. Governments often use tax and transfer systems to mitigate income inequality and provide insurance against labor market shocks, affecting agents at the top and bottom of the income distribution. It is well documented that entrepreneurs are disproportionately concentrated at the top of the income and wealth distribution. Nonetheless, less attention is given to the fact that entrepreneurs are also highly concentrated at the bottom of the income distribution as self-employed individuals [1], particularly in developing economies. This means that government transfers are often directed to poor self-employed agents that can be out of the wage employment market due to small worker productivity or as a substitute for unemployment. Poschke (2013) documents that the share of entrepreneurs starting a firm 'out of necessity' ranges from 13.4 percent in Western Europe to 42.9 percent in Latin America. Using Brazilian data, we document that self-employment corresponds to 27.9 percent of the Brazilian working force and receives 20.7 percent of federal government transfers. This paper analyzes how government transfers affect aggregate macroeconomic variables and agents' welfare, considering labor market frictions and entrepreneurial choices where individuals can be employers or self-employed. We consider the Brazilian economy as a benchmark and compare it with an alternative economy where a Universal Basic Income substitutes the current tax and transfer system.

Universal Basic Income (UBI) programs have received attention as a redistributive alternative due to their simplicity and non-distorting nature. They typically include three components as described in Marinescu (2018)[2]: the government provides an equal cash transfer to the individuals; everyone receives the supplement regardless of their income, wealth, labor market status, or other eligibility condition required by means-tested programs; and the program has a long-term horizon. One benchmark for the universal transfer is sufficient income for all households to be above the poverty line. Thus, UBI could guarantee a minimal standard of living for everyone.

UBI simplicity comes at some costs. On the one hand, the 'universal' feature of the program eliminates the monitoring costs associated with means-tested or conditional transfer programs. On the other hand, the fiscal instrument chosen to pay for the income transfer may distort individuals' incentives, such as labor supply and savings, besides the fiscal

[1] Herreno and Ocampo (2022) document the share of self-employment agents by earnings decile for several developing economies, indicating the 'U' shaped pattern.

[2] Marinescu (2018) analyzes labor market effects related to cash transfer programs in the U.S., such as negative income tax experiments, the Alaska Permanent Dividend Fund, and the Eastern Band of Cherokees.

burden to finance this policy. UBI can also have mixed effects on entrepreneurship, the decision to open a firm or become a worker. Employer entrepreneurs are responsible for job creation, business dynamism, and productivity growth. UBI could alleviate financial constraints inducing entrepreneurship and disincentive new businesses due to their risky nature. Also, since a large share of self-employed entrepreneurs is at the bottom of the income distribution, UBI could increase the incentives for unemployment.

We develop a general equilibrium model with incomplete-market as Aiyagari (1994), endogenous entrepreneurial choice, and labor market frictions to quantify the effects of UBI reforms on aggregate variables, cross-sectional distribution of income, and welfare. The model considers individuals who live an infinite number of periods, derive utility from consumption and leisure, and make entrepreneurial choices. Households are heterogeneous in the following aspects: assets, occupation, labor productivity, and entrepreneurial ability. Labor supply is endogenous for workers, while entrepreneurs supply a fixed amount of labor as Bruggemnann (2021). Entrepreneurs face financial frictions, limiting the capital demand as Kitao (2008), and have decreasing returns-to-scale in the production function as Lucas (1978), indicating that managerial capacity decreases with firm size so entrepreneurs can generate positive profits. They can be classified as either employers who demand labor in addition to their own time endowment or self-employed who rely solely on their own labor supply.

We calibrate the model to match the Brazilian economy. The presence of entrepreneurs allows us to generate a larger concentration of wealth and income at the top of the distribution compared to standard heterogeneous agents models as Aiyagari (1994). First, we solve the benchmark model assuming that government transfers are conditional to households' income and assets. We then consider that the government implements a UBI reform such that every household receives an income transfer that is a share of GDP per household in the benchmark. We consider five main UBI levels as percentages of the benchmark average income: 0, 0.6, 5, 10, and 15. The first case corresponds to an economy without government transfers. In the second case, the government keeps the same amount of transfers as the benchmark but redistributes the same quantity for all agents in the economy. The following experiments consider standard values discussed by the literature and public debate. Then, we analyze the impact on aggregate variables, distribution of earnings and wealth, and welfare decomposition.

We find that the welfare-maximizing UBI reform is achieved at 5.0 percent of GDP per household. In this case, agents at the bottom of the income distribution, predominantly unemployed and self-employed agents, receive a lower share of government transfer as a

comparison. In the benchmark economy, poor unemployed agents with receive approximately 12 percent of the average income. Hence, unemployment decreases by approximately 9 percent, and entrepreneurship increases by roughly 2.3 percent, considering both employers and self-employment. In this case, even though agents at the bottom of the income distribution receive lower government transfers, workers and entrepreneurs at the middle and top of the income distribution receive a higher amount, disincentivizing capital accumulation. Therefore, aggregate capital decreases by 5.84 percent, and aggregate output decreases by 2.72 percent. Capital accumulation is affected especially in large UBI reforms, such as transfers of 5 percent of GDP per household or larger.

Two main channels affect entrepreneurship in opposite directions in large UBI experiments. On the one hand, higher interest rates due to lower capital accumulation decrease entrepreneurs' profitability. On the other hand, an increase in basic income can buffer negative entrepreneurial shocks reducing entrepreneurial risk. The second channel dominates the first one for the UBI reform of 5 percent, as mentioned above. Nonetheless, the first channel dominates the second one for UBI levels of 10 percent and 15 percent, where the share of entrepreneurs decreases by 1.28 percent and 9.28 percent, respectively.

Opposite results occur when the government keeps the same amount of government transfer as the benchmark (expenditure-neutral experiment) or when the government completely eliminates transfers. The decrease in government transfers at the bottom of the income distribution, without a significant increase to other quantiles, leads to an increase in the precautionary saving motive, increasing aggregate capital and output. In the expenditure-neutral case, aggregate capital increases by 2.85 percent, and output increases by 1.18 percent. Moreover, the share of self-employed agents increases by 4.41 percent, and the share of employers increases by 4.3 percent. Since the transfers received by unemployed agents decrease substantially, the incentives to stay in the current occupation is higher, conditional on not receiving an unemployment shock. Therefore, the design of the transfer system may affect the agents' occupational choice and, consequently, output and welfare.

Related Literature

This paper contributes to the recent literature on the economic impact of self-employment and the literature on tax and transfer systems, which is recently concerned about the effects of UBI policy.

The literature has explored the relevance of entrepreneurship to match the income and wealth distribution as in Cagetti and De Nardi (2006) and its different policy implications. İmrohoroglu and Zhao (2020) describe the importance of entrepreneurship as a channel to explain the increase in wealth inequality in the U.S. in the last decades. Bruggemnann

(2021) computes the top marginal tax rate that maximizes welfare in a model with entrepreneurship, indicating that the top marginal tax rate is underestimated in the absence of entrepreneurs. Buera et al. (2021) study the aggregate and long-term effects of microfinance considering entrepreneurship. Salgado (2018) documents the decline in the share of entrepreneurs since the 1980s and quantifies the importance of skill-biased technical change and the decrease in the interest rate to explain this pattern. These papers restrict the analysis to entrepreneurs at the top of the income distribution. Poschke (2012) and Poschke (2013) document the concentration of self-employment at the bottom and top of the income distribution. Poschke (2022) explores the importance of labor market frictions to explain the high share of self-employment in poor countries. Feng and Ren (2022) analyzes the importance of financial frictions and skill-biased technological change to explain cross-country patterns in self-employment. Herreno and Ocampo (2022) explore the role of subsistence self-employment on the aggregate impact of expansions of credit supply. The papers above examine how entrepreneurship responds to different fiscal policies or economic change but do not consider the impact of reforms in the tax and transfer system, considering a broader definition of self-employment.

Even though UBI has received growing attention, it has never been implemented on a large scale, and its long-term results are still unclear. Recent papers quantify the macroeconomic impacts of UBI reforms on the U.S. economy. Marinescu (2018), Gentilini et al. (2020), and Hoynes and Rothstein (2019) describe the main features of UBI policy and evidence of income transfer programs that are the closest to UBI definition. Daruich and Fernandez (2020) build an OLG model with human capital accumulation and intergenerational skill transmission, and analyze an alternative economy with UBI transfer of 18 percent of GDP. Similarly, Luduvice (2021) compares the effects of a UBI transfer of 20 percent of output to a benchmark economy with human capital accumulation, intensive and extensive margins of labor supply, and a detailed U.S. tax and transfer system. While Luduvice (2021) finds a welfare gain in the long-term in terms of consumption equivalent variation, Daruich and Fernandez (2020) finds a welfare loss. Conesa et al. (2021) computes the welfare-maximizing UBI reform financed by different fiscal instruments in an economy with two types of consumption goods. Ferreira et al. (2021) compares UBI to a conditional cash transfer CCT in Brazil, a developing economy. Although these papers consider general equilibrium effects in macroeconomic models, they abstract from entrepreneurship.

We organize the subsequent sections as follows: Section 2 provides empirical evidence of self-employment at the bottom of the income distribution in the Brazilian economy, sec-

tion 3 describes the economic environment, section 4 includes calibration and quantitative analysis of distinct UBI reforms, and Section 5 concludes.

2 Empirical Analysis

We use the Brazilian household survey data POF 2017/2018 (*Pesquisa de Orçamentos Familiares*) to document the main characteristics of the Brazilian labor force. POF provides detailed information about occupation, labor income, and government transfers. Table 1 reports summary statistics by occupation. Individuals are classified as self-employed, workers, employers, or unemployed[3]. We restrict the sample to the head of households from 22 to 65 years old and classify the individuals without information about their occupation as unemployed. Self-employed agents represent 27.8% of the Brazilian labor force and receive 20.8% of total federal government transfers. This share is significant since, as expected, unemployed agents receive the largest amount of transfers. Also, it indicates that self-employed agents are not necessarily talented entrepreneurs at the beginning of their entrepreneurial life but agents with low income. Moreover, the share of self-employed individuals with a completed college degree is lower than workers and employers, suggesting that they may be out of the 'wage employment' market due to lower productivity. This evidence is in line with Poschke (2013). Also, the average income of the self-employed agents is lower than workers, and employers' average income is the highest among the different occupations as in other countries. On average, workers and self-employed agents work a similar amount of hours per week, which is lower than employers.

[3]Throughout the paper, we use the terms own account workers and self-employed agents interchangeably. We consider entrepreneurs as self-employed or employers. See Appendix A for details about the datasets.

Table 1: **Summary statistics**

	Self-Employed	**Worker**	**Employer**	**Unemployed**
Share in the labor force	28.3	63.4	4.54	3.81
Federal government transfers (*share*)	20.8	30.8	0.27	48.2
Federal government transfers (*mean*)	$215,0	$190,0	$251,0	$350,0
College degree (*share)*	12.3	21.8	37.2	1.1
Labor income monthly (*mean*)	$1,825	$2,505	$7,784	-
Labor income monthly (*std*)	$2,982	$3,552	$15,805	-
Labor income per hour (*mean*)	$12.7	$16.2	$44.1	-
Hours per week (*mean*)	40.6	41.2	47.5	-
35+ weekly hour (*share*)	69.7	84.2	87.1	-

Note: POF 2017. In the case of more than one job, we classify the individual according to the occupation with the highest labor income. Since there is no information about labor force participation, the 'Unemployed' classification also considers those not in the labor force. We exclude employed individuals with less than 10 and more than 112 hours worked per week. We exclude individuals who do not receive government transfers or labor income. We exclude individuals without labor income and government transfer. If we consider these individuals, the unemployment rate is 24.9 percent.

Figure 1 shows the share of entrepreneurs by labor income decile separated by self-employed and employers. In this case, we restrict the sample to individuals classified as self-employed, workers, and employers. We define entrepreneurs as the sum of self-employed and employers. Even though entrepreneurs are concentrated at the bottom and the top of the income distribution, the composition is different. Employers represent high-talent entrepreneurs that concentrate a disproportionate share of income, and self-employed represent low-talent entrepreneurs facing entrepreneurship as an alternative to unemployment or low-paid jobs. The prevalence of self-employed entrepreneurs at the first deciles of income distribution explains the large share of federal government transfers to agents in this occupation.

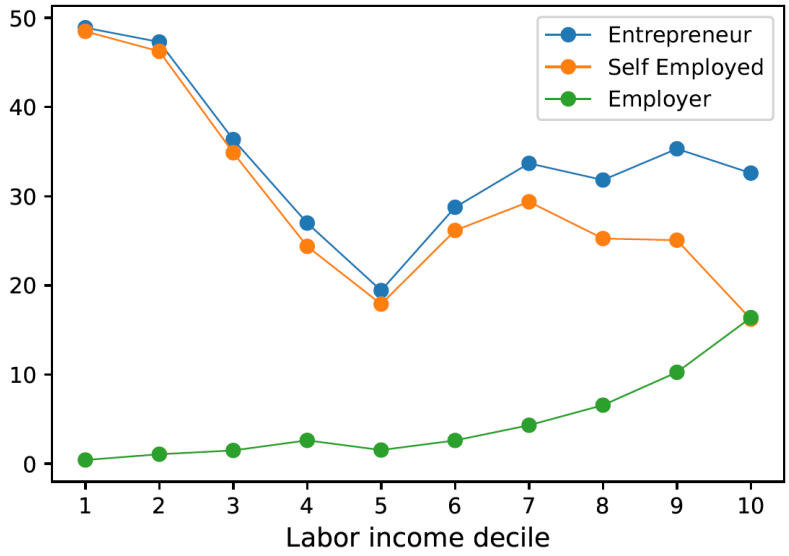

Figure 1: Share of entrepreneurs by labor income decile.
Note: This figure provides the share of entrepreneurs by labor income decile. Hence, it does not consider unemployed agents. 'Entrepreneur' considers the sum of 'Self-Employed' and 'Employer'.

3 The Environment

Demography

The economy is inhabited by infinitely-lived heterogeneous agents as in Aiyagari (1994). Agents are heterogeneous regarding assets, labor productivity, entrepreneurial ability, and occupation. In each period, workers are subject to unemployment shocks, and unemployed agents and entrepreneurs receive a job offer with a given probability. Workers and unemployed individuals do not know their entrepreneurial ability, and only realize it after deciding to open a firm.

Preferences

Agents choose consumption, c_t, and labor, h_t, to maximize their expected discounted lifetime utility given by:

$$\mathbf{E_0} \sum_{t=0}^{\infty} \beta^t u(c_t, h_t) \tag{1}$$

where $\beta \in (0,1)$ is the time discount parameter and $\mathbf{E_0}$ is the expectation operator conditional on information at $t = 0$. The flow utility function is given by

$$u(c_t, h_t) = \frac{c_t^{1-\mu}}{1-\mu} - \chi \frac{h_t^{1+\xi}}{1+\xi} \tag{2}$$

Labor productivity

Agents have a fixed time endowment per period. Worker's labor income is given by,

$$w_t h_t e^{z_t} \tag{3}$$

where w_t is equilibrium market wage; h_t is the endogenous labor supply, and z_t is the individual's productivity that follows an AR(1) process, $z_t = \rho z_{t-1} + \varepsilon_t$ with $\varepsilon_t \sim N(0, \sigma_z^2)$. Entrepreneurs' labor productivity is described below.

Technology

The economy is divided into two sectors: corporate and non-corporate. The first sector consists of large firms with constant returns to scale technology operating in a competitive market. The static profit maximization problem is given by

$$\underset{K_c, N_c}{max} \{AK_c^{\alpha} N_c^{1-\alpha} - wN_c - (r+\delta)K_c\} \tag{4}$$

where α indicates the share of capital in the production function, w is the market wage rate, r is the rental rate of capital, and δ indicates the depreciation. K_c represents capital, and N_c is the effective labor. Therefore, from the firm's first order condition, we have the following market prices,

$$r = A\alpha \frac{Y_c}{K_c} - \delta, \quad \text{where} \quad Y_c = AK_c^{\alpha} N_c^{1-\alpha} \tag{5}$$

$$w = A(1-\alpha) \frac{Y_c}{N_c} \tag{6}$$

The non-corporate sector consists of single entrepreneurs facing decreasing-returns-to-scale production function measured by the span-of-control parameter ν, as in Lucas (1978). Each entrepreneur has an idiosyncratic managerial ability s that follows an AR(1) process,

$$s_t = \eta s_{t-1} + \epsilon_t \text{ with } \epsilon_t \sim N(0, \sigma_s^2) \tag{7}$$

They supply a fixed amount of labor $\bar{h}$, and their capital demand is limited by their current wealth a. Entrepreneurs choose to become employers or self-employed. As in Allub and Erosa (2019) employers pay a per-period fixed cost and maximize profits as follows,

$$\pi_{emp.} = \max_{n,k} \; A_e e^s (k^\alpha (\bar{h} + n)^{1-\alpha})^\nu - wn - (r+\delta)k - c_e \tag{8}$$

$$\text{s.t. } k \leq da, \quad d \geq 1$$

Self-employed agents operate their firms by choosing only the capital input as follows,

$$\pi_{self-emp.} = \max_{k} \; A_s e^s (k^\alpha \bar{h}^{1-\alpha})^\nu - (r+\delta)k \tag{9}$$

$$\text{s.t. } k \leq da, \quad d \geq 1$$

Government sector

The government is responsible for three sources of expenditures: exogenous spending G, government debt D, and targeted transfers Tr. To finance total spending, the government levies proportional taxes on consumption, τ_c, and capital income, τ_k. Taxes on labor income are raised by the following non-linear function:

$$T(y_e) = \max\{y_e - \lambda y_e^{1-\tau}, 0\} \tag{10}$$

where y_e represents labor earnings, that is, the worker's labor income or the entrepreneur's profits. As in Heathcote et al. (2008), the parameters λ and τ measure the level and progressivity of the tax function, respectively. The tax function is progressive if the average tax rate is strictly increasing for all income levels y, that is, $\lambda\tau > 0$. We say the marginal tax rate is strictly increasing if $\tau(1-\tau)\lambda > 0$.

The targeted transfer function is based on Ferriere et al. (2022),

$$\omega(y_i) = m\bar{y}_i \frac{2\exp\left\{-\zeta \dfrac{y_i}{\bar{y}_i}\right\}}{1+\exp\left\{-\zeta \dfrac{y_i}{\bar{y}_i}\right\}} \tag{11}$$

where y_i represents total income $ra + y_e$, that is, labor and capital income. Average income is denoted by $\bar{y}_i$, m indicates transfers to an unemployed agent, and ζ measures

the phase-out rate. Therefore, the tax and transfer function is,

$$T(y_e, y_i) = \max\{y_e - \lambda y_e^{1-\tau}, 0\} - \omega(y_i) \tag{12}$$

Recursive formulation of individual's problem

Let $V_w(a,z)$, $V_u(a,z)$, and $V_e(a,s,z)$ indicate the value functions of worker, unemployed, and entrepreneur agents, respectively. The individual's problem can be characterized as follows:

Worker: In the current period, agents choose consumption, asset accumulation, and labor supply. In the next period, agents receive an unemployment shock with probability γ_u. Workers know their labor productivity but do not know their entrepreneurial ability. The workers' Bellman equation is

$$V_w(a,z) = \max_{c,h,a'} u(c,h) + \beta \mathop{\mathbf{E}}_{z'|z} \Bigg[\gamma_u \max \left\{ V_u(a',z'), \mathop{\mathbf{E}}_{s'} V_e(a',s',z') \right\} + \\ + (1-\gamma_u) \max \left\{ V_w(a',z'), V_u(a',z'), \mathop{\mathbf{E}}_{s'} V_e(a',s',z') \} \right\} \Bigg] \tag{13}$$

subject to

$$\begin{aligned} &(1+\tau_c)c + a' = [1 + (1-\tau_k)r]a + y_w - T(y_w, ra + y_w) \\ &a' \geq 0, \quad 0 \leq h \leq 3 \\ &y_w = whe^z \end{aligned} \tag{14}$$

Entrepreneur: In the current period, agents choose consumption and asset accumulation. In the next period, entrepreneurs receive a job offer with probability γ_s. Entrepreneurs know their labor productivity and entrepreneurial ability and can be self-employed or employers. When agents move from unemployment or wage-employment to entrepreneurship, they draw their ability from a stationary distribution associated with the process (7). The entrepreneurs' Bellman equation is

$$V^e(a,s,z) = \max_{c,a'} u(c,\bar{h}) + \beta \mathop{\mathbf{E}}_{z'|z} \mathop{\mathbf{E}}_{s'|s} \Bigg[\gamma_s \max\Big\{V^w(a',z'), V^u(a',z'), V^e(a',s',z')\Big\} + \\ (1-\gamma_s)\max\Big\{V^u(a',z'), V^e(a',s',z')\Big\}\Bigg] \tag{15}$$

subject to

$$\begin{aligned} &(1+\tau_c)c + a' = [1+(1-\tau_k)r]a + y_w - T(y_w, ra + y_w) \\ &a' \geq 0, \quad \bar{h} = 1 \\ &y_w = \max\{\pi_{emp.}, \pi_{self-emp.}\} \end{aligned} \tag{16}$$

Unemployed: In the current period, agents choose consumption and asset accumulation. In the next period, unemployed agents receive a job offer with probability γ_e. Unemployed individuals know their labor productivity but do not know their entrepreneurial ability. Since they do not receive labor income, their earnings come from a home production b. The unemployed agents' Bellman equation is

$$V^u(a,z) = \max_{c,a'} u(c,0) + \beta \mathop{\mathbf{E}}_{z'|z} \Bigg[\gamma_e \max\Big\{V^w(a',z'), V^u(a',z'), \mathop{\mathbf{E}}_{s'} V^e(a',s',z')\Big\} + \\ +(1-\gamma_e)\max\Big\{V^u(a',z'), \mathop{\mathbf{E}}_{s'} V^e(a',s',z')\Big\}\Bigg] \tag{17}$$

subject to

$$\begin{aligned} &(1+\tau_c)c + a' = [1+(1-\tau_k)r]a + b - T(0, ra) \\ &a' \geq 0 \end{aligned} \tag{18}$$

Recursive competitive equilibrium.

Individuals are characterized by the state variables $\omega_1 = (a,z,s)$ or $\omega_2 = (a,z)$, and occupation $oc = \{w,u,e\}$. A recursive competitive equilibrium is given by a set of value functions $\{V_w(\omega_2), V_u(\omega_2), V_e(\omega_1)\}$; policy functions for consumption $c_{oc}(\omega)$, asset holdings $a'_{oc}(\omega)$, and labor supply $h_{oc}(\omega)$[4]; aggregate variables K, N, Y; prices r, w and measures

[4] $\omega = \omega_2$ if $oc = \{w,u\}$ and $\omega = \omega_1$ if $oc = \{e\}$.

$\lambda(\omega)$ such that:

(i) The value function $V_{oc}(\omega)$ solves the Bellman equations above with the associated policy functions $c_{oc}(\omega)$, $a'_{oc}(\omega)$, $h_{oc}(\omega)$ for a given set of prices.

(ii) Good and factor markets clear.

$$K_c + \int_\Omega k(\omega)d\lambda = \int_\Omega a(\omega)d\lambda$$
$$N_c + \int_\Omega n(\omega)d\lambda = \int_\Omega h(\omega)d\lambda$$
$$Y = C + G + \delta K$$

(iii) The market wage and the interest rate are equal to the firms' profit maximization problem in the corporate sector as in (6) and (5), respectively.

(iv) Government budget constraint condition is satisfied in each period.

$$G + D + Tr = \tau_c \int_\Omega c(\omega)d\lambda + \tau_k r \int_\Omega a(\omega)d\lambda + \int_\Omega T(y(\omega))d\lambda$$

where, government spending is composed of exogenous expenditure, debt, and transfer. Government revenue is composed of taxes on consumption, capital income, and labor income.

4 Quantitative Analysis

4.1 Calibration and estimation

We calibrate the model to the Brazilian economy in the benchmark. We describe below the parameters that we set exogenously according to literature or available data, and the parameters that we set endogenously to match the model with the data.

Utility:
We follow the literature and consider the parameter associated with risk aversion, μ, as 1.5, and we set ξ to 1.7, leading to a Frish elasticity of labor supply of 0.59. χ measures the disutility of labor supply and is chosen so households work on average one-third of

their time endowment. Finally, we choose β to target the capital-output ratio of 2.55 as in Cavalcanti and Santos (2021).

Technology and financial friction:
We set the parameter related to the share of capital income, α, to 0.36 as Gomes and Ellery-Jr. (2005). This parameter is the same in the corporate and non-corporate sectors. We set the span-of-control parameter in the non-corporate sector, ν, to 0.90 as in Erosa et al. (2022), which is in the range of the literature and close to the value calibrated in Cagetti and De Nardi (2006). The parameter associated with the collateral constraint, d, is 0.7 and targets the credit-to-GDP ratio of 42.0 percent.

Stochastic process of labor productivity:
The entrepreneurs' labor income is given by π_t^e as indicated in (9), where s_t is a stochastic component that follows an AR(1) process. We approximate the stochastic process following Tauchen (1986) and use twenty grid points in the discretization. We calibrate the standard deviation $\sigma_s = 0.175$ such that households in the top percentile of the labor income distribution hold 40.0 percent of labor income and the persistence parameter $\eta = 0.90$ to match the persistence of entrepreneurs. The fixed cost paid by employers c_e equals 1.0 and matches the share of employers.

The workers' labor productivity z_t indicated in (3) follows an AR(1) process with persistence ρ and variance σ_z^2. We follow Azevedo and Santos (2022) and choose σ_z^2 to match the income distribution of workers by quintile. The parameter ρ is set according to $\sigma_\epsilon^2 = \frac{\sigma_z^2}{1-\rho^2}$, where σ_ϵ^2 is the residual variance from the Mincerian regression and is equal to 0.40 as estimated in PNAD 2014 (*Pesquisa Nacional por Amostra de Domicílios*).

Government policy and transfer programs:
We follow Azevedo and Santos (2022) and consider that the government debt is 33.1 percent of total output. Target transfer corresponds to 0.6 percent of GDP. To finance total expenditure, the government taxes consumption, labor income, and capital income. We follow Paes and Bugarin (2006) and choose a consumption tax rate of 29 percent and a capital tax rate of 15 percent.

The parameter that measures the degree of progressivity in the non-linear tax function (10), τ, is set to 0.087 as in Azevedo and Santos (2022). The parameter λ affects the post-tax earnings and is chosen such that the government balances its budget constraint. We calibrate the parameters of the transfer function (11), m = 0.12 and ζ = 5.0, to match the share of transfers over GDP of 0.6 percent and the phase-out of the transfers by labor income, respectively.

Model and Data:

Table 2 summarises the parameters calibrated internally and externally as discussed above, and Table 3 and 4 compare the outcomes of the model with Brazilian data.

Table 3 shows that the model closely replicates the target moments observed in the data, especially the distribution of agents by occupation. The good fit of the high share of entrepreneurs, including employers and self-employed agents, is important for the policy experiments below. Even though we do not target the distribution of entrepreneurs according to income, we can qualitatively replicate the presence of self-employed agents and employers at the bottom and the top of the income distribution, respectively. However, the model underestimates the presence of entrepreneurs in the middle of the income distribution, which is almost entirely composed of employed workers, as displayed in Figure 2

Table 4 shows the transition rate between occupations. We target three transition rates, which are indicated by an asterisk. These transitions are entrepreneur-entrepreneur, unemployment-worker, and entrepreneur-worker. The model can replicate these moments reasonably well, underestimating the share of individuals that stays as entrepreneur between two periods. The model can also qualitatively replicate the fact that the transition to self-employment is higher for unemployed than workers, although these moments were not directly targeted. This indicates that self-employment can be an alternative to low-productive agents.

4.2 UBI reforms

This section compares the benchmark economy in which government transfers depend on the agent's income and assets to an economy with universal basic income. We assume the government moves from the benchmark economy to an alternative economy by replacing the transfer function (11). In the counterfactual exercises, ω does not depend on income or asset level, and every household receives an equal income transfer, that is, $\omega(y_i) = \bar{\omega}$, where $\bar{\omega}$ is a fraction of the output in the benchmark. The UBI is not implemented on top of the target transfer system but replaces it. Therefore, the tax and transfer function is given, by

$$T(y_e, y_i) = \max\{y_e - \lambda y_e^{1-\tau}, 0\} - \bar{\omega} \tag{19}$$

We consider mainly five levels of UBI in percentage terms of output in the benchmark:

Table 2: **Calibration of the parameters of the model**

External calibration			
Parameter	**Description**	**Values**	**Source**
ξ	Labor elasticity	1.7	Literature
μ	Risk aversion	1.5	Literature
α	Capital Share	0.40	Literature
$\bar{h}$	Entrep. labor supply	1.0	1/3 of time endowment
τ_c	Consumption tax	0.29	Azevedo and Fasolo (2015)
τ_k	Capital income tax	0.15	Paes and Bugarin (2006)
ν	Span-of-control	0.88	Cagetti and De Nardi (2006)
τ	Income tax progressivity	0.087	Azevedo and Santos (2022)
m_0	Government Transfer unemployed	0.12	PNAD Contínua
Internal calibration			
Parameter	**Description**	**Values**	**Target**
β	Discount factor	0.91	$K_c/Y_c = 2.55$
χ	Labor disutility	0.70	Average hours = 1.0
d	Borrowing limit	1.3	Credit to GDP = 42%
c_e	Fixed cost	1.2	Share of employers = 6%
A_e	TFP employers	1.0	Normalization
$A_{self.}$	TFP self-employed	0.65	Share of self-employed = 26%
σ_s	Std deviation initial ability	0.125	Earnings top 10% = 40%
η	Auto-correlation z	0.95	Transition Entrep.-Entrep.
γ_u	Unemployment shock	0.10	Unemployment rate = 6.5%
γ_s	Job offer - unemployed	0.90	Transition Unemp.-Employment.
γ_e	Job offer - entrepreneur	0.50	Transition Entrep.-Employment.
ζ	Phase-out transfer	5.0	Government transfer distribution
m	Government Transfer unemployed	0.12	Government transfer to GDP = 0.6%
λ	Income tax level	0.825	Government budget constraint

Table 3: **Calibration results: Baseline economy. Source: PNAD Contínua**

Calibrated moments	**Data**	**Model**
Overall economy		
Capital-output	2.55	2.53
Credit-output	0.42	0.42
Hours worked	1.0	0.97
Income top decile (%)	40.0	37.8
Occupation (%)		
Unemployed	6.5	7.58
Worker	58.5	59.45
Employer	6.0	5.95
Self-employed	29.0	27.02

Table 4: **Calibration results: Transition between occupations**

Model/Data	Unemployed	Worker	Employer	Self Employed
Unemployment	18.5 / 30.92	47.3* / 51.35	1.7 / 1.16	32.2 / 16.57
Worker	4.6 / 3.06	85.4 / 90.0	0.03 / 1.12	9.4 / 5.81
Employer	3.3 / 0.69	4.6 / 9.9	80.5 / 67.5	11.49 / 21.8
Self-Employed	11.8 / 1.9	17.4* / 14.7	2.9 / 6.4	67.8* / 76.9

Note: The table specifies target and untargeted moments. An asterisk indicates target moments. We compute the transition rate on a yearly basis.

0.67, 5, 10, and 15. In the first case, the government keeps the same amount of transfers of the benchmark and only changes to a universal system. The second case represents the welfare-maximizing UBI level. The last two policy experiments are the usual UBI levels considered in the literature. Additionally, we also consider the case in which there is no government transfer. We keep the exogenous government expenditure and debt at the benchmark level in all the exercises. We focus the analysis on three main aspects: aggregate variables, inequality, and welfare.

4.2.1 Aggregate outcomes

Table 5 displays the main aggregate variables and the CEV for the five distinct UBI reforms compared to the benchmark economy. We observe similar results considering the policy experiments in Columns (1) and (2). Column (1) indicates an economy without government transfers, and Column (2) represents an economy with the same amount of total transfers as the benchmark. In both cases, the amount of government transfer received by low-income agents decreases significantly. Therefore, the precautionary savings motive increases, increasing capital accumulation and lowering the interest rate. Capital increases by 1.32 percent and 1.18 percent in the first and second UBI reforms, respectively. Additionally, the share of entrepreneurs (employers and self-employed) increases due to lower interest rates and since unemployment becomes less attractive because of lower transfers. Therefore, both employers and self-employed individuals are less likely to transition to unemployment. Unemployment is highly affected, decreasing approximately 20 percent in both cases.

Column (3) shows the results for a UBI experiment of 5 percent which is the welfare-maximizing policy. The CEV increases by 1.87 percent. As in the previous cases, low-income agents still receive a smaller amount of government transfers. As reported in Table 2, low-income agents receive government transfers of approximately 12 percent of

average income in the benchmark. Note that, to receive this amount, the agent must have neither labor nor capital income. Thus, being unemployed is insufficient to receive the highest amount of government transfer. Therefore, the unemployment rate is lower than the benchmark. Additionally, this amount of government transfer is sufficient to disincentivize capital accumulation, since the insurance against productivity shocks increases. Hence, capital decreases by 5.84 percent, and output decreases by 2.72. The share of entrepreneurs is lower than in the previous UBI experiments but slightly higher than the benchmark. Finally, we observe a decrease in average hours worked as a consequence of the income effect related to government transfers. Recall that only workers are allowed to adjust labor supply in the model.

Next, Column (4) and Column (5) show the results for UBI experiments of 10 percent and 15 percent. The outcomes are qualitatively similar to a UBI reform of 5 percent but quantitatively stronger. Specifically, as the government increases the amount of transfer the agents receive, capital accumulation decreases further. In the first case, capital and output decrease by 17.15 percent and 8.59 percent, respectively. In the second one, capital decreases by 31.27, and output decreases by 17.24 percent. As a consequence, the interest rate increases by 47.45 percent, reducing entrepreneurs' profitability. Additionally, in contrast to the situation where the government reduces or eliminates transfers, large UBI experiments make unemployment more attractive, resulting in a higher likelihood of transitioning to unemployment, especially for self-employed agents. Finally, welfare starts to decrease at the UBI level of 15 percent with a large decrease in consumption that is not by counterbalanced the insurance provided by the government transfer. Welfare is described in detail below.

Thus, in most of the analyzed cases, UBI policy experiments lead to a decrease in capital, average hours worked, and output. Although low-income agents may receive a lower government transfer compared to the benchmark, as UBI levels increase, insurance against low productivity shocks increases. Therefore, precautionary savings decreases, and, consequently, overall capital accumulation decreases. Finally, unemployment is higher than the benchmark economy at a UBI level of 10 percent or higher.

4.2.2 Inequality

We consider the Gini coefficient as the measure of inequality. Table 6 presents the Gini coefficient of consumption, assets, labor income, and total income. We also consider the Gini coefficient of pre and post-tax and transfer (t&t).

Table 5: **UBI reform**

Variable	Benchmark	Policy experiments (UBI)				
		0%	0.6%	5%	10%	15%
		(1)	(2)	(3)	(4)	(5)
Output, Y	1.0	+1.32%	+1.18%	-2.72%	-8.59%	-17.24%
Capital, K	1.0	+3.01%	+2.85%	-5.84%	-17.15%	-31.27%
Avg. hours worked	1.0	1.0	1.0	0.96	0.91	0.83
w	1.03	1.04	1.04	1.025	0.99	0.95
Interest rate, r (%)	5.9	5.72	5.73	6.30	7.22	8.70
Unemployed (%)	7.6	6.03	6.19	6.91	7.98	9.30
Self-Employed (%)	26.30	27.56	27.39	26.91	25.91	23.81
Employers (%)	5.57	5.66	5.81	5.72	5.55	5.10
Tax level (τ)	0.77	0.78	0.77	0.69	0.58	0.42
CEV (%)	-	0.08	1.06	1.87	0.71	-3.80

Note: Columns (1) to (5) correspond to the percentage of average income in the benchmark economy. CEV (consumption equivalent variation) is the welfare measure. Some variables are normalized to one hundred since their level does not have a clear economic interpretation.

As in the previous analysis, Column (1) and Column (2) show the results for an economy without government transfer and an economy with UBI of 0.6 percent, respectively. In both cases, the Gini coefficient is close to the values observed in the benchmark. The Gini coefficient of assets is the most affected measure in these two cases. Since asset accumulation increases due to a higher precautionary savings motive, asset inequality decreases. Moreover, there is a small increase in the Gini coefficient of labor income and total income after tax and transfer once agents at the bottom of the income distribution receive a lower transfer amount.

The welfare-maximizing UBI policy in Column (3) reduces almost all measures of the Gini coefficient. In this case, government transfer increases for most individuals, even though agents at the bottom may receive a lower share. Therefore, the Gini coefficients of consumption and income after tax and transfer decrease by approximately 7 percent. Moreover, agents at the top of the asset distribution reduce capital accumulation, leading to a lower Gini coefficient of assets compared to the benchmark.

Finally, Column (4) and Column (5) have similar effects of optimal UBI policy. The most affected Gini coefficients are related to consumption and income after tax and transfer. Again, high government transfers directly impact after transfers and leads to lower consumption inequality. Note also that the Gini coefficient of total income rises as UBI

reforms increase from 0.6 percent to 15 percent. This can be explained by the fact that the interest rate increases as capital dampens. Therefore, the capital income is higher in these cases. Nonetheless, large transfers do not necessarily lead to a welfare gain, as discussed in the next section.

Table 6: **Gini coefficient**

Variable	Bench.	UBI reform				
		0% (1)	0.6% (2)	5% (3)	10% (4)	15% (5)
Gini assets	0.722	0.703	0.698	0.694	0.702	0.712
Gini labor income	0.459	0.455	0.459	0.462	0.462	0.466
Gini labor income after t&t	0.411	0.418	0.414	0.383	0.336	0.272
Gini total income	0.484	0.475	0.475	0.478	0.482	0.484
Gini total income after t&t	0.444	0.446	0.442	0.411	0.380	0.335
Gini consumption	0.387	0.387	0.383	0.361	0.335	0.296

Note: This table exhibits the Gini coefficient for different variables. The UBI policy is a fraction of the output per household in the benchmark model. Total income corresponds to labor and capital income, and t&t corresponds to tax and transfer.

4.2.3 Welfare

We measure welfare as consumption equivalent variation (CEV). The CEV measures how much an agent is willing to decrease or increase her consumption to make her indifferent between the benchmark and the alternative economy, given her current state. The CEV can be expressed as follows:

$$\int_P \mathbf{E}_0 \sum_{t=0}^{\infty} \beta^t u((1+\Delta_{cev})c_t^0, h_t^0) d\lambda_j = \int_P \mathbf{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t^1, h_t^1) d\lambda_j \tag{20}$$

where the sequences $\{c_t^0, h_t^0\}_{t=0}^{\infty}$ and $\{c_t^1, h_t^1\}_{t=0}^{\infty}$ represent the competitive equilibrium allocations in the benchmark and the alternative economy, respectively. A positive Δ_{cev} indicates a welfare increase.

We follow Floden (2001) and Heathcote et al. (2008) and decompose the welfare effect in two terms: a level component, Δ_{lev}, and an uncertainty component, Δ_{unc}. These terms are associated with efficiency and risk sharing, respectively. The decomposition is described below and holds as an approximation, $\Delta_{cev} \approx \Delta_{lev} + \Delta_{unc}$.

Let C_0 and H_0 denote population averages of consumption and labor in the benchmark economy. Similarly, C_1 and H_1 denote average consumption and average labor in the alternative UBI experiment. We then define the level component, Δ_{lev}, as:

$$u((1+\Delta_{lev})C_0, H_0) = u(C_1, H_1) \tag{21}$$

Then, given the utility function in (2), we have the following closed-form solution,

$$\Delta_{lev} = \left[\frac{u(C_1, H_1)}{u(C_0, H_0)}\right]^{1/(1-\mu)} - 1 \tag{22}$$

We consider two terms to define the uncertainty component, Δ_{unc}.

$$u((1-p_0)C_0, H_0) = \int_P \mathbf{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t^0, h_t^0) d\lambda_j \tag{23}$$

and

$$u((1-p_1)C_1, H_1) = \int_P \mathbf{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t^1, h_t^1) d\lambda_j \tag{24}$$

Thus, the uncertainty component is defined as,

$$\Delta_{unc} = \frac{1-p_1}{1-p_0} - 1 \tag{25}$$

Table 7 shows the welfare effects of distinct UBI reforms compared to the benchmark.

The welfare gain associated with the optimal policy of 5 percent described in Column (3) is driven by the uncertainty component of the CEV. In this case, the overall increase in government transfers provides insurance for uninsurable idiosyncratic shocks in labor and entrepreneurial productivity, even though agents receive a lower transfer in the case of suffering an unemployment shock. This effect countervails the welfare loss from the efficiency term associated with a reduction in capital accumulation and output. Therefore, CEV increases by 1.87 percent, mainly due to a contribution of 4.54 percent related to the uncertainty component, despite the decrease of 2.51 percent associated with the level term.

A similar pattern holds for larger UBI reforms, that is, a welfare gain from better insurance (uncertainty term) and a welfare loss from lower consumption (level component). Nonetheless, the net effect of these two terms eventually becomes negative, as seen in Col-

umn (5), with a UBI reform of 15 percent. In this policy reform, welfare decreases by 3.80 percent, with a large reduction due to lower capital, output, and, consequently, consumption. Columns (1) and (2) show the welfare variation when the government eliminates transfers or keeps the total amount as the benchmark (expenditure-neutral). There is a welfare gain in the two cases due to the uncertainty component. Since capital accumulation increases in these policy experiments, agents are more insured against uninsurable idiosyncratic shocks. The level component contributes negatively to the CEV once hours worked increase, even though average also consumption increases. The overall effect is a welfare gain compared to the benchmark economy, but lower than the optimal level.

Table 7: **CEV decomposition:** $\Delta_{cev} \approx \Delta_{lev} + \Delta_{unc}$

	UBI reform				
Variable	0% (1)	0.6% (2)	5% (3)	10% (4)	15% (5)
Δ_{cev}	0.08	1.06	1.87	0.71	-3.80
Δ_{lev}	-0.01	-0.21	-2.51	-6.97	-14.91
Δ_{unc}	1.06	1.27	4.54	8.25	13.06

Notes: This table displays the CEV decomposed in terms of efficiency and uncertainty for different UBI policies. The UBI policy is a fraction of the output per household in the benchmark model. The UBI transfer that maximizes welfare is 5.0% of output per household.

We compute in Table 8 the CEV decomposition for the four occupational groups: workers, unemployed, employers, and self-employed households. We consider only the households that did not switch occupations (non-switchers) from the benchmark economy to the UBI economy. The UBI reforms have distinct quantitative effects on the different groups, but the overall pattern is similar. Larger UBI experiments lead to a welfare gain from the uncertainty component and a welfare loss from the level component. The mechanisms are similar to the ones described in the previous section.

Note that (non-switchers) self-employed agents are the only group that has a welfare gain with large UBI reforms, with a welfare gain of 7.73 percent in a UBI reform of 15 percent. In this case, the level and uncertainty components increase by 3.97 and 3.61, respectively. The level component increases due to the presence of self-employed agents at the bottom of the income distribution. Therefore, average consumption increases even with large UBI reforms. Moreover, higher interest rates and the increase in insurance with larger government transfers lead to a welfare gain in the uncertainty component. Note also that there is a welfare loss for unemployed agents from the level component. Recall that government transfers are conditional on labor and capital income. Therefore, rich

individuals that are eventually unemployed do not receive government transfers. Hence, large UBI transfers lead to a welfare loss to unemployed agents since there is a large decrease in capital accumulation and consumption, without necessarily being compensated by larger transfers as self-employed agents.

Additionally, a seemingly non-intuitive result is the welfare gain of 0.089 percent for unemployed agents at a UBI level of 0.6 percent in Column (2). This result can be explained by the increase in capital accumulation among unemployed individuals, leading to an increase in consumption. Therefore, the level component offsets the uncertainty component, which reduces due to a reduction in government transfer, especially for those at the bottom of the income distribution. Again, it is important to note that unemployment can be voluntary or due to an unemployment shock. Therefore, unemployment may include poor and rich agents.

Table 8: **CEV decomposition by occupation:** $\Delta_{cev} \approx \Delta_{lev} + \Delta_{unc}$

Variable	UBI reform				
	0% (1)	0.6% (2)	5% (3)	10% (4)	15% (5)
Unemployed					
Δ_{cev}	-0.07	0.089	0.92	0.74	-5.58
Δ_{lev}	0.09	0.24	-3.48	-9.20	-21.07
Δ_{unc}	-0.16	-0.19	4.56	10.96	19.31
Worker					
Δ_{cev}	1.91	1.68	0.30	-3.23	-10.66
Δ_{lev}	0.79	0.53	-2.31	-7.27	-16.95
Δ_{unc}	1.10	1.13	2.68	4.36	7.57
Employer					
Δ_{cev}	0.09	0.09	0.95	-2.55	-11.87
Δ_{lev}	1.68	1.47	-3.97	-13.74	-29.22
Δ_{unc}	-1.69	-0.55	5.12	12.98	24.51
Self-employed					
Δ_{cev}	-0.12	0.55	4.89	7.95	7.73
Δ_{lev}	1.26	2.04	4.96	6.02	3.97
Δ_{unc}	-1.37	-1.45	-0.06	1.81	3.61

Notes: The table displays the CEV decomposed in terms of efficiency and uncertainty for different UBI policies and considers distinct occupational groups. The UBI policy is a fraction of the output per household in the benchmark model. The UBI transfer that maximizes welfare is 5.0% of output per household.

5 Concluding remarks

In this paper, we examine the impact of Universal Basic Income (UBI) reforms in an equilibrium model that takes into account endogenous entrepreneurship and labor market frictions. In particular, we differentiate entrepreneurs as self-employed and employers, given their distinct characteristics. Self-employed individuals are disproportionately concentrated at the bottom of the income distribution, while employers are mainly concentrated at the top.

We then compare the steady-state equilibrium of a benchmark economy with an alternative economy in which the government replaces the current transfer system with a UBI reform. The results of our UBI experiments reveal that an equal transfer of 5 percent of the benchmark average income or greater leads to a decrease in capital and output, but with a lower level of inequality represented by the Gini coefficient of consumption and income after tax and transfer. We find that the welfare-maximizing UBI reform corresponds to a transfer of 5.0 percent of the average income, resulting in a 1.87 percent increase in welfare compared to the benchmark. This improvement is due to better insurance against labor and entrepreneurial productivity shocks.

Nonetheless, a UBI reform of 15 percent of the average income leads to a significant decrease in output and capital by 17.24 percent and 31.27 percent, respectively, negatively impacting entrepreneurship by reducing the number of self-employed and employers. Self-employed individuals experience a welfare gain with higher average consumption due to larger transfers. On the other hand, employers experience a welfare loss with lower average consumption due to lower profitability and capital accumulation.

This paper highlights the importance of considering entrepreneurship, especially with large UBI reforms, which can impact the design of government transfer policies. Employers are responsible for job creation, productivity, and output growth, while self-employment can serve as a labor opportunity for low-skilled agents or those experiencing unemployment. Thus, policymakers should consider the potential impact of UBI reforms on entrepreneurship and labor market outcomes.

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A Data

We rely on two data sources to compute summary statistics and regression analysis, PNADc (*Pesquisa Nacional por Amostra de Domicílio Contínua*) and POF 2017/2018 (*Pesquisa de Orçamentos Familiares*). PNAD Contínua is a rotating panel data at quarterly frequency conducted by IBGE from 2012 onwards, and POF is a cross-sectional data conducted every ten years starting in 2002/2003.

We use POF to compute government transfers by occupation and income quintile. We consider as government transfers the non labor income classified as federal social programs (*Programas sociais federais*). It includes the programs Brasil familia, Brasil carinhoso, Auxilio gas, Bolsa escola, Bolsa alimentação, Cartao ao programa nacional de acesso a alimentação, Programa de erradicação do trabalho infantil, Beneficio de prestação continuada, Auxilio a portadores de deficiência física, Auxílio morte. The results are similiar when we consider as government transfers the federal social programs (*Programas sociais federais*) and other transfers (*Outras Transferências*).

B Model

This section compares some statistics of the model and the data. Figure 2 shows the share of entrepreneurs, considering self-employed and employers, by labor income decile generated by the model. The empirical analog is represented by Figure 1. The model is able to generate a high concentration of entrepreneurs in the first and last deciles. Still, it does

not capture the presence of entrepreneurs in the middle of the labor income distribution. Moreover, it overestimates (underestimates) the share of self-employment at the bottom (top) of the labor income distribution. Consequently, since self-employment is highly prevalent at the bottom of the labor income distribution, they concentrate a disproportionate amount of government transfer compared to the data. In the model, they receive 40% of government transfers, and in the data, they concentrate 39.3% as shown in Table 1. Nonetheless, unemployed agents receive 48.2% of government transfers in the data and 46.9% in the model. Moreover, overall government transfer by income quintile matches the data reasonably well, as seen in Figure 3.

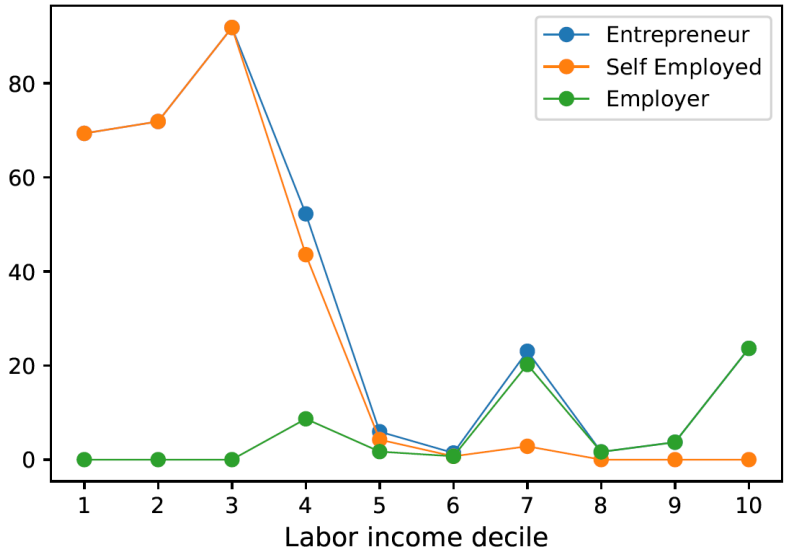

Figure 2: Share of entrepreneurs (Model)

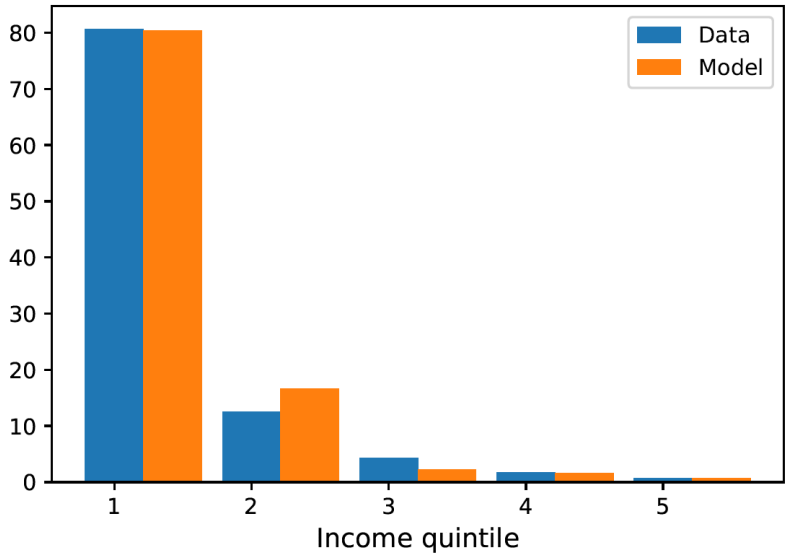

Figure 3: Government transfer by income quintile