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Tax Evasion, Income Inequality, and the Labor Income Laffer Curve in Brazil

Marcus A. F. Araripe
Frederico A. G. Alencar
Márcio V. Corrêa

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Marcus A. F. Araripe* **Frederico A. G. Alencar‡**

Márcio V. Corrêa†

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Abstract

This paper investigates the labor income Laffer curve and tax gap within a Bewley-Huggett-Aiyagari framework for Brazil. The analysis is conducted in aggregate and disaggregated terms by income groups, highlighting heterogeneous impacts of taxation and tax evasion across the income distribution. The model incorporates progressive labor income taxation, tax evasion decisions, and a tax audit policy enforced by the national tax authority. Our results reveal that Brazil's current labor income tax rate lies on the downward slope of the aggregate Laffer curve, suggesting that reducing the tax rate could increase government revenue. Disaggregating by income deciles shows significant heterogeneity, with the top three deciles contributing over 98% of total tax revenues. Additionally, tax evasion accounts for 3.11% of Brazil's GDP, with 93% concentrated in the wealthiest quartile. These findings underscore the unequal distribution of tax compliance and the importance of targeted fiscal reforms to enhance equity, improve enforcement, and expand fiscal space.

Keywords: Laffer Curve; Tax Evasion; Labor Income Taxation; cGeneral Equilibrium.

JEL Classification: E20; E60; D85; H26; I10

*CAEN - Graduate Studies in Economics, Federal University of Ceará, Brazil. Email: marcusafa@hotmail.com. ‡CAEN - Graduate Studies in Economics, Federal University of Ceará, Brazil. E-mail: fredericoalencar91@gmail.com; †CAEN - Graduate Studies in Economics, Federal University of Ceará, Brazil. Email: marciovcorrea@caen.ufc.br

1 Introduction

In this paper we study the impact of tax evasion on the empirical Laffer curve for Brazil. We build a standard Bewley-Huggett-Aiyagari model, with distortionary consumption, capital income and labor income tax rates and a tax audit policy conducted by the national tax authority. The government imposes a progressive taxation policy on labor income and collects taxes to fund public expenditures and tax enforcement measures. Agents are heterogeneous in their wealth endowments and labor productivity. They decide their working hours and the proportion of labor income taxes to evade. Households caught evading taxes face penalties, with fines proportional to the amount of unpaid taxes. Agents can also save and obtain personal loans from financial intermediaries. However, they also face a financial borrowing constraint that restricts indebtedness. There is a representative firm that rents labor and capital to produce a final consumption good, and households face idiosyncratic productivity shocks[1].

We develop a benchmark model calibrated for Brazil, both with and without tax evasion, to quantify the size and distribution of tax evasion across labor income groups[2]. Additionally, we simulate the empirical labor income Laffer curve for Brazil. In the scenario without tax evasion, it is well established that changes in distortionary labor income tax rates impact government tax collection through two main mechanisms: arithmetic and economic effects (Laffer (2004)). When tax evasion is included, however, a third component emerges: the effect of household tax evasion on overall tax collection. According to Laffer, the higher the tax rate, the greater the amount of tax revenue collected by the fiscal authority, a relationship he termed the arithmetic effect. However, he also identified an indirect effect that acts in the opposite direction: higher tax rates reduce the intensive margin of labor supply, consequently lowering labor income tax collection. Laffer argued that these opposing effects produce a single-peaked function, where the labor income tax rate that maximizes government revenue corresponds to the curve's peak.

Our benchmark model for Brazil shows that the Laffer curve is right-skewed and has an inverted

[1] Although we use a standard incomplete market model in this paper, there are alternative approaches to modeling informality that consider both the intensive and extensive margins of the shadow economy, for firms and workers. For related literature, see Ulyssea (2020).

[2] Our model without tax evasion is a straightforward extension of the general benchmark model with tax evasion, assuming that the monitoring policy fully prevents such practices.

U-shape, peaking at a maximum marginal tax rate of 25.33%. Compared to Brazil's current labor income tax rate of 27.50%, this finding suggests that the country is currently on the downward slope of the curve. Therefore, a reduction in the tax rate - shifting it to 25.33%, for example - would result in increased tax revenue. Furthermore, the labor income Laffer curve exhibits distinct behaviors on either side of its peak: on the left, it follows a parabolic trajectory, while on the right, it descends with varying slopes. This result underscores the role of household heterogeneity in shaping the elasticity of government tax revenue in response to changes in labor income tax rates.

The calibrated version of our benchmark model successfully replicates several empirical findings for the Brazilian economy. For the consumption-to-GDP and investment-to-GDP ratios, the model yields values of 65.3% and 17.1%, closely aligning with the Brazilian economy's figures of 65.0% and 17.1%, as reported by PWT data. The government consumption-to-GDP ratio is also well-aligned with the Brazilian data. Furthermore, the model accurately captures the labor income distribution across deciles, although it slightly overestimates shares for deciles 7, 8, and 9. Overall, the model provides an accurate representation of the labor income distribution across deciles, achieving a good fit with the Brazilian data.

We show the impact of incomplete markets, household heterogeneity, and tax evasion on government labor income tax collection. The main contribution of our paper lies in incorporating the three components of the aggregate Laffer curve for the Brazilian labor market into its construction and quantitatively characterizing its behavior across labor income deciles. Additionally, we also quantify the economic cost of labor income tax evasion in an economy with imperfect tax collection. In our view, this is important because it provides policymakers with insights into how labor income tax policies influence government revenue, highlighting the role of household heterogeneity in shaping tax efficiency. It also offers evidence to support targeted tax reforms aimed at enhancing compliance and increasing revenue without imposing excessive burdens on taxpayers.

A key contribution of this study is the disaggregated analysis of the Laffer curve by deciles of the labor income distribution in Brazil. The results reveal significant variations in tax collection patterns across income groups. For instance, while the first three deciles do not contribute to total tax revenues due to the absence of taxable income below the threshold of R$ 28,559.70, the top deciles dominate tax collection. Specifically, the tenth decile alone accounts for more than 65% of total individual labor income tax revenue, while deciles 8 and 9 contribute 13% and 20.5%, respectively. This disaggregation analysis demonstrates that the shape of the Laffer curve varies considerably across groups, with higher peaks observed for the top deciles, reflecting the greater impact of taxation on these income levels.

According to our findings, only the top three deciles lie above the aggregate Laffer curve, while the remaining deciles fall below it. Furthermore, the peaks of the segmented Laffer curves differ across income deciles: the top three deciles are located to the left of the aggregate curve's peak, placing these households on the downward slope of the aggregate labor income Laffer curve under Brazil's current tax code. Consequently, further increases in the labor income tax rate would reduce tax collection from this subset of agents.

In our view, this previous analysis is essential as it uncovers the heterogeneous impact of labor income taxation across different segments of the population. By disaggregating taxpayers by income levels, it highlights how tax policies affect groups differently and identifies those most responsive to changes in tax rates. This approach also reveals variations in tax collection efficiency, compliance, and evasion across deciles, offering valuable insights for designing targeted fiscal policies that promote equity and maximize government revenue while avoiding excessive burdens on specific income groups.

The impact of tax evasion on government revenues is also an important result of this study, especially when analyzed across different economic groups. Our results indicate that tax evasion significantly reduces total tax collection, accounting for up to 54% of potential revenue and representing 3.11% of Brazil's GDP. This loss is not uniformly distributed: while the first two quartiles of the labor income distribution do not evade taxes due to income thresholds below the taxable minimum, the fourth quartile alone is responsible for 93% of the total tax gap, followed by 7% in the third quartile. These findings underscore the concentration of tax evasion among wealthier households, revealing significant disparities in tax compliance[3]. This unequal distribution not only

[3]This result aligns with the economic literature, which consistently highlights that tax evasion is significantly higher among wealthier individuals (Alstadsaeter et al. (2023)).

constrains the government's ability to expand fiscal space but also highlights the need for targeted enforcement policies to address inequities in the tax system and improve revenue efficiency.

Literature Review. It is well established in the economic and public finance literature that several factors influence tax evasion and the shape of the empirical Laffer curve, both in models with representative households and in those with heterogeneous agents. One of the first attempts to develop a theoretical model of tax evasion in a representative agent economy was made by Allingham and Sandmo (1972). They built a portfolio selection problem, showing that if taxpayers were rational and risk-averse, the amount of evaded taxes varies inversely with the audit probability and the penalty imposed by the tax authority - a result consistent with our finding. According to their model, whenever the net benefits of tax evasion are positive, taxpayers will always avoid paying taxes.

In a related study, Alm (2012a) argued that tax evasion is not a straightforward policy issue that can be easily solved, as many have previously suggested. He examined various dimensions of the tax evasion literature, linking theoretical approaches to empirical evidence on its measurement, underlying motivations, and potential control strategies. In turn, within a heterogeneous-agent framework, Conesa and Krueger (2006) and Conesa et al. (2009) developed general equilibrium models where taxpayers cannot endogenously evade a portion of their labor income taxes[4]. The authors also explored optimal taxation and the relative advantages of taxing capital compared to other forms of taxation.

The present paper is more directly connected to the works of Trabandt and Uhlig (2011), Holter et al. (2019) and Alba and McKnight (2023). Trabandt and Uhlig (2011) analyzed the shape of the labor income Laffer curve under different tax policies and across various regions. While they characterized the Laffer curve for the United States and Europe, we examine its behavior for Brazil, both in aggregate terms and across the labor income distribution. In contrast to their approach, we demonstrate how tax evasion impacts government tax revenue and quantify its economic cost for Brazil.

[4]There are several extensions to these models in the literature. They introduce heterogeneity and multiplicity in monitoring rates and different types of sanctions for families caught evading taxes. They also consider different tax rates and tax progressivity, the mutual incidence of tax avoidance and evasion, as well as alternative audit policies. See Andreoni et al. (1998), Slemrod and Yitzhaki (2002), Slemrod (2007a), Alm (2012b), Luttmer and Singhal (2014) and Slemrod (2019) for more on this.

Holter et al. (2019), in turn, quantitatively assessed the effects of tax progressivity versus a flat labor income tax rate on the peak and slope of the Laffer curve within a heterogeneous-agent framework. According to their findings, transitioning the current US fiscal policy to a progressive tax system, similar to that of Denmark, would result in a substantially lower peak, while adopting a flat tax system would increase the peak of the Laffer curve by 6%. Their work highlights that household heterogeneity is a crucial factor in shaping the Laffer curve, which aligns with our findings. However, our paper differs in two key aspects. First, we analyze the impact of households' financial statuses on Brazilian aggregate tax collection and the shape of the Laffer curve. Second, we quantitatively evaluate how the heterogeneous labor income distribution affects tax evasion, the shape of the Laffer curves, and Brazilian GDP.

Alba and McKnight (2023) evaluated the impact of a large informal sector on the Laffer curve in developing economies. They showed that the presence of an informal sector causes a leftward shift in the Laffer curve and reduces its steepness. According to the authors, this effect arises from the elasticity of substitution between the formal and informal sectors. They argued that the higher the elasticity of substitution between these two sectors, the smaller the revenue the government can generate through changes in the tax rate. While there are similarities between their study and the present paper, our approach differs in some key aspects. Instead of explicitly modeling the informal sector, we calibrate our model to Brazil to replicate its main stylized facts. Additionally, we account for tax evasion - potentially linked to the shadow economy - and an imperfect tax policy[5].

The Brazilian Tax System. The Brazilian tax system is widely recognized for its complexity and the extensive number of taxes and contributions it encompasses. The 1988 Federal Constitution established a tax structure primarily based on three pillars: income, consumption, and property taxes. This structure was designed not only to ensure a broad tax base but also to create a revenue-sharing system among the central government, states, and municipalities, thereby securing both the financial autonomy and administrative independence of each level of government in Brazil. Furthermore, it aimed to address regional disparities and promote the decentralization

[5]See Kotamaki (2017) for insights on the relationship between home production and Laffer curves, and Wu (2021) on the connection between income inequality, tax progressivity, and the tax base.

of tax revenues, enabling each Brazilian region to set its own rates and rules for certain taxes, particularly those on consumption.

As a result, in addition to national consumption taxes such as PIS, COFINS, and IPI, states and municipalities are empowered to levy their own consumption taxes, including the state-level ICMS and the municipal ISS. However, this overlapping tax authority policy has also a downside. It leads to a high overall tax burden on consumption, making the Brazilian tax system particularly burdensome for low-income households. Since consumption taxes are impersonal (i.e., they do not account for the taxpayer's income or ability to pay), this regressive structure exacerbates inequality. Consequently, lower-income agents bear a disproportionately higher tax burden than higher-income individuals, reducing their purchasing power and limiting their capacity to save and invest (Lustig et al. (2014a), Lustig et al. (2014b) and Higgins and Pereira (2014)).

In contrast to consumption taxes, income tax policy in Brazil is exclusively managed by the central government. This tax is guided by the principles of generality, universality, and progressivity. The principle of generality requires that income tax be broadly applied to the entire population, while universality ensures that all sources of income are included in the tax base. Progressivity, the third principle, dictates that individuals with higher incomes should contribute a larger share of taxes. To implement progressivity, a system of marginal tax rates has been established, applying higher rates to higher income brackets after accounting for legally permitted deductions. This structure aims to enhance fairness by progressively increasing the tax burden on those with the greatest ability to pay.

However, despite being consistent with the principle of progressivity, the marginal tax rate system has a limited redistributive impact in practice. The effective tax rate does not rise as steeply as income, resulting in only moderate redistribution. For instance, a taxpayer with an annual taxable income (after deductions) of R$ 100,000 (US$ 24,813.90) faces an effective income tax rate of 17.06%, while someone with a taxable income of R$ 1 million (US$ 248,139.00) faces a rate of 26.46%. This indicates that, despite a tenfold increase in taxable income, the effective tax rate rises by only 55%. Consequently, the progressive nature of the tax system is limited, providing less redistributive impact than expected for such a disparity in income levels.

Furthermore, in 2019, only taxpayers with annual taxable income exceeding R$ 28,559.70 (US$ 7,086.77) were required to file an income tax return. This threshold excluded a significant portion of income-earning individuals from the tax system. According to the Brazilian Institute of Geography and Statistics (IBGE), the employed labor force in Brazil totaled 94.5 million people. However, the National Brazilian Fiscal Authority reported that only 30.5 million of these individuals filed an income tax return, representing just 32.26% of the employed workforce.

In addition to this introduction, the paper is organized into three main sections. The next section introduces the model. Section 3 characterizes the Laffer curve with and without the possibility of tax evasion, while Section 4 calibrates the benchmark model and presents the main analysis. Finally, Section 5 concludes the paper.

2 The Economy

The economy operates in discrete time and is characterized by a continuum of infinitely-lived agents, a representative firm, financial intermediaries, and a tax authority that imperfectly taxes households. Agents are endowed with one unit of time and make instantaneous decisions regarding consumption (c_t) and labor supply (l_t). They also determine next period's wealth (a_{t+1}) and the fraction of labor income taxes to evade (e_t). Households face idiosyncratic productivity shocks, and the financial market is incomplete, implying that self-insurance is the only mechanism available to mitigate these shocks. The economy includes a single risk-free financial asset, and agents are subject to a borrowing constraint.

There is a large, exogenous number of financial intermediaries, and both households and firms have free access to financial markets. Households can buy assets and obtain personal loans, while firms borrow capital. There is no aggregate uncertainty in this economy. The fiscal authority imposes taxes on households' consumption, labor income, and savings. However, due to limited monitoring capacity, the government can only partially enforce taxation. Agents are randomly monitored, and those caught evading labor income taxes are fined an amount equivalent to the evaded taxes. The representative firm combines labor and capital to produce a unique consumption good, whose price is normalized to one. The final consumption good can be either consumed or invested.

The timing of the model is as follows: At the beginning of period t, the household's asset endowment is given by a_t, which follows an endogenous wealth distribution H_t. A productivity shock then occurs, after which households and firms make optimal decisions. The tax authority monitors a subset of taxpayers and punishes labor income tax evaders. These steps are repeated from $t+1$ onward.

2.1 Preferences

In our economy, agents derive utility from leisure and consumption, while also incurring a disutility associated with tax evasion (Sandmo (2005)). Agents' preferences are represented by the following utility function:

$$E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\gamma}}{1-\gamma} - \chi \frac{l_t^{1+\frac{1}{\phi}}}{1+\frac{1}{\phi}} - \eta \frac{e_t^{\iota}}{\iota} \right], \tag{1}$$

where γ, ϕ and ι are parameters related to the relative degree of risk aversion, the Frisch elasticity of labor supply, and the tax evasion elasticity, respectively. A higher ι, for instance, suggests that agents are more likely to evade taxes as tax rates increase, amplifying the evasion response to higher taxation. The terms χ and η are positive weights associated with leisure and tax evasion in the utility function.

2.2 Tax Code and Households' Budget Constraints

The government imposes a progressive tax rate on labor income y_t, represented by the function $T(y_t)$. Households are also subject to taxes on consumption and asset returns. Agents are randomly monitored by the tax authority, and those who choose to evade labor income taxes face a probability p of being audited and penalized. The fiscal authority's penalty policy is defined by a punishment parameter $\mathcal{T} \geq 0$[6]. The household budget constraint is given by:

[6] Note that although we have evaluated the scenario where $\mathcal{T} \geq 0$, it is possible for it to take on a negative value. This would occur when the tax authorities tries to recover at least part of the amount of taxes owed by households. We avoid this situation in the present paper.

$$(1+\tau^c)c_t + a_{t+1} - a_t[1+(1-\varsigma\tau^a)r_t] = \begin{cases} y_t - T(y_t)(1+\mathcal{T}e_t), & \textit{if audited} \\ y_t - T(y_t)(1-e_t), & \textit{otherwise}; \end{cases} \tag{2}$$

where

$$y_t = \epsilon_t w_t l_t; \tag{3}$$

$$\varsigma = \begin{cases} 1, & \text{if } a_t \geq 0 \\ 0, & \text{otherwise}; \end{cases} \tag{4}$$

and

$$T(y_t) = \delta_0 \left[y_t - (y_t^{-\delta_1} + \delta_2)^{-\frac{1}{\delta_1}} \right]. \tag{5}$$

The previous expressions warrant further explanation. Let's begin with expression (2), the household budget constraint. On the right-hand side, y_t represents the agent's gross income in period t, which is then subject to taxation $T(y_t)$, as specified in expression (5). In the event of an audit, which occurs at rate p, the agent incurs an additional penalty proportional to the level of evasion e_t, captured by the factor $(1+\mathcal{T}e_t)$, where $\mathcal{T}$ represents the penalty rate[7]. If not audited, however, the agent benefits from reduced tax obligations by a fraction $(1-e_t)$, reflecting successful tax avoidance. The term $(1+\tau^c)c_t$, on the left-hand side, represents the gross consumption expenditure, while a_{t+1} denotes the agent's accumulation of assets for the subsequent period. Finally, $a_t[1+(1-\varsigma\tau^a)r_t]$ reflects the adjusted value of current assets in terms of the final consumption good, accounting for a net return of $(1-\varsigma\tau^a)r_t$. Here, τ^a represents the tax rate on asset returns, and ς is an indicator function that distinguishes agents by financial status, under the assumption that agents do not pay taxes on personal loans.

As previously mentioned, expression (3) defines the household's gross income in period t, where

[7] In the next section, we calibrate $\mathcal{T}$ for the Brazilian economy. Note, however, that if $\mathcal{T}=0$, agents audited by the fiscal authority face no punishment for tax evasion. Conversely, if the policy parameter is set to $\mathcal{T}>1$, a progressive penalty policy is enforced, meaning the tax authority penalizes evaders by an amount exceeding the value of the evaded labor income taxes. Finally, if $\mathcal{T}=1$, the fiscal authority's objective is solely to recover the exact amount of the evaded labor income taxes.

w_t is the wage rate. The indicator function ς, as defined in (4), categorizes agents based on their asset balance, distinguishing those who pay taxes on capital income from those who do not. Expression (5), in turn, specifies the functional form for the labor income taxation, following Gouveia and Strauss (1994) and Conesa and Krueger (2006). The parameter δ_0 scales the overall tax level, while δ_1 and δ_2 control the curvature and adjustment of the labor income threshold. More specifically, the term $(y_t^{-\delta_1} + \delta_2)^{-\frac{1}{\delta_1}}$ adjusts the taxable income base to ensure that the tax rate increases with y_t, capturing the progressive nature of the taxation scheme. Additionally, when $\delta_1 \to 0$, the function simplifies to $T_t^l(y_t) = \delta_0 y_t$, representing a proportional tax code. For $\delta_1 > 0$, it defines a progressive tax code, with the degree of progressivity intensifying as δ_1 increases. These parameters are calibrated to the Brazilian economy.

Households face an exogenous borrowing constraint[8]:

$$a_{t+1} \geq -\Omega, \tag{6}$$

and the household productivity shock follows an AR(1) process with mean μ and persistence coefficient ρ:

$$\log(\epsilon_t) = (1-\rho)\mu + \rho \log(\epsilon_{t-1}) + \upsilon_t, \tag{7}$$

where $\upsilon_t \sim \mathcal{N}(\mu_\upsilon, \sigma_\upsilon^2)$[9].

2.3 Households' and the Firm's Problems

Agents maximize the utility function (1), given prices, initial household endowments, and the tax code, subject to constraints defined by expressions (2) through (7). The solution to the household's maximization problem is characterized by the following conditions:

$$\chi l_t^{\frac{1}{\phi}} = \frac{c_t^{-\gamma}}{(1+\tau_t^c)} \left[\epsilon_t w_t - \frac{\partial T(\epsilon_t w_t l_t)}{\partial l_t} + (1 - p - \mathcal{T} p) e_t \frac{\partial T(\epsilon_t w_t l_t)}{\partial l_t} \right]; \tag{8}$$

[8]From (6), if $\Omega = 0$, the household is not allowed to borrow. For any other value of Ω, the household may borrow up to that exogenous amount.

[9]t is important to note that, although expression (7) is identical for all agents, its realization is specific to each individual.

$$\eta e_t^{\iota-1} = \frac{c_t^{-\gamma}}{(1+\tau_t^c)}(1-p-\mathcal{T}p)T(\epsilon_t w_t l_t); \tag{9}$$

$$\frac{c_t^{-\gamma}}{(1+\tau_t^c)} = \beta E_t\left[\frac{c_{t+1}^{-\gamma}}{(1+\tau_{t+1}^c)}[1+(1-\varsigma\tau_{t+1}^a)r_{t+1}]\right] + \Psi_t; \tag{10}$$

$$a_{t+1} = a_t + (1-\varsigma\tau_t^a)r_t a_t + \epsilon_t w_t l_t - T(\epsilon_t w_t l_t) + (1-p-\mathcal{T}p)e_t T(\epsilon_t w_t l_t) - (1+\tau_t^c)c_t; \tag{11}$$

$$\Psi_t[a_{t+1}+\Omega] = 0, \quad \Psi_t \geq 0; \tag{12}$$

$$a_{t+1} \geq -\Omega, \quad \Omega \geq 0 \quad c_t > 0, \quad 0 \leq l_t \leq 1, \quad 0 \leq e_t \leq 1; \tag{13}$$

where:

$$\frac{\partial T(\epsilon_t w_t l_t)}{\partial l_t} = \delta_0 \epsilon_t w_t \left(1 - \frac{(\epsilon_t w_t l_t)^{-1}}{(1+\delta_2(\epsilon_t w_t l_t)^{\delta_1})^{\frac{1}{\delta_1}+1}}\right)$$

and $T(\epsilon_t w_t l_t)$ is given by (5).

Equations (8) and (9) describe the optimal household choices regarding hours of work and labor income tax evasion, respectively. The subsequent expression corresponds to the consumption Euler equation, while the remaining two represent the household's budget constraint and the complementary slackness condition. The first two expressions demonstrate that the audit rate and the severity of penalties imposed by the fiscal authority directly influence agents' decisions regarding working hours and optimal tax evasion levels[10]. In the next section, we quantitatively examine these results and assess the impact of agents' optimal choices on the labor market Laffer curve.

The representative firm operates in a perfectly competitive final goods market, combining labor (L_t) and capital (K_t) according to the following production technology:

$$Y_t = K_t^{\alpha} L_t^{1-\alpha} \tag{14}$$

where $\alpha \in (0,1)$. The profit maximization problem is as follows:

$$\Pi = \max_{K_t, L_t > 0}\{Y_t - (r_t+\delta)K_t - w_t L_t\}, \tag{15}$$

[10]Tax evasion occurs only if the net benefits derived from evasion are positive. To ensure a more meaningful problem, we assume henceforth that $1-p-\mathcal{T}p > 0$.

where $0 < \delta < 1$ is the capital depreciation rate. The optimal capital and labor demand functions are given by:

$$r_t = \alpha(\frac{L_t}{K_t})^{1-\alpha} - \delta, \tag{16}$$

$$w_t = (1-\alpha)(\frac{K_t}{L_t})^{\alpha}. \tag{17}$$

2.4 Wealth Distribution

To characterize the law of motion of the wealth distribution, we assume that H_0 and H_t represent the initial and period t wealth distributions, respectively. Let $a \in Z = [a_l, a_h] \subset \mathbb{R}^+$ denote the household's wealth endowment at time t. We assume that $\mathcal{Z}$ is a σ-algebra in Z and H is a probability measure defined on the measurable space $(Z, \mathcal{Z})$. Here, H represents the cross-sectional wealth distribution among agents. Specifically, for any $V \subset Z$, with $V \in \mathcal{Z}$, $H(V)$ describes the mass of households with wealth defined in Z. Additionally, let F_t denote the distribution of labor productivity ϵ_t, where ϵ_t follows a log-normal distribution driven by a stochastic process with persistence ρ, as defined in (7). Therefore, a non-stationary transition probability function P_t is defined as follows:

$$P_t(a, l, V) = \text{Prob}[a_{t+1} \in V | a_t = a, l_t = l, \epsilon_t \sim F]. \tag{18}$$

The function $P_t(a, l, V)$ represents the probability that an agent with wealth a, labor state l, and productivity ϵ, distributed according to F, will have their wealth within the set V at time $t+1$. The law of motion of the wealth distribution is then expressed as:

$$H_{t+1} = \int\int P_t(a, l, V) H_t(da, dl). \tag{19}$$

which characterizes the evolution of the wealth distribution H_t as it adjusts according to wealth, labor status, and productivity dynamics across households.

2.5 Tax Authority and the Economy's Resource Constraint

Let Σ denote the support of the household productivity shock. The fiscal authority finances its consumption ($\mathcal{G}$) and the tax audit policy ($\mathcal{M}$) through taxes on consumption, labor and asset returns. The government budget constraint is expressed as follows:

$$\iiint \left[T(\epsilon_t w_t l_t) - (1 - p - \mathcal{T}p)e_t T(\epsilon_t w_t l_t) + \tau_t^c c_t\right] J_t(da, dl, d\epsilon) \\ + \iiint_{\mathbb{S}} \tau_t^a r_t a_t J_t(da, dl, d\epsilon) = \mathcal{G}_t + \mathcal{M}_t, \quad (20)$$

where $\mathbb{S} = \Sigma \times [0, a_h]$ represents the mass of non-indebted agents in the economy and $J_t(da, dl, d\epsilon)$ denotes the joint distribution of wealth, labor state and household productivity. Let $\mathbb{D}$ represent the subset of households with financial debts in the economy. The economy's resource constraint is:

$$Y_t = C_t + G_t + K_{t+1} - (1 - \delta)K_t, \quad (21)$$

where:

$$K_t + \iiint_{\mathbb{D}} a_t J_t(da, dl, d\epsilon) = \iiint_{\mathbb{S}} a_t J_t(da, dl, d\epsilon), \quad (22)$$

$$L_t = \iiint \epsilon_t l_t J_t(da, dl, d\epsilon), \quad (23)$$

$$C_t = \iiint c_t J_t(da, dl, d\epsilon), \quad (24)$$

$$G_t = \mathcal{G}_t + \mathcal{M}_t = \mathcal{G}_t + \mathcal{C} \frac{\iiint \mathcal{I} J_t(da, dl, d\epsilon)}{\iiint J_t(da, dl, d\epsilon)}, \quad (25)$$

and $\mathcal{I}$ is an indicator function that takes the value 1 if the individual of type (a, l, ϵ) is monitored by the tax authority and 0 otherwise. The term $\mathcal{C}$ represents the cost of the audit policy borne by the tax authority, with $\mathcal{M} = \mathcal{C}p$.

2.6 The Stationary Equilibrium

We now define the stationary equilibrium for our economy.

Definition 1. *Given an exogenous borrowing limit* Ω*, a stationary competitive equilibrium is characterized by:*

(i) The tax authority's set of policy instruments $(T, \tau^a, \tau^c, \mathcal{T}, \mathcal{G}, \mathcal{M})$*;*

(ii) A price system (w, r) *of wages and interest rates;*

(iii) Households' allocations (c, a, l, e)*;*

(iv) A joint distribution $J(a, l, \epsilon)$ *with marginal distributions for wealth,* $H(a, l)$*, and productivity,* $F(\epsilon)$*;*

such that:

I. The household and firm's optimal allocations are characterized by expressions $(8) - (13)$ *and* $(16) - (17)$*, respectively;*

II. The joint distribution $J(a, l, \epsilon)$ *remains constant over time;*

III. The government budget constraint and the economy's resource constraint, (20) *and* (21)*, respectively, are satisfied;*

IV. The wage rate and the economy's interest rate satisfy the market clearing conditions (22) *and* (23)*;*

V. The aggregate consumption of households and government are given by (24) *and* (25)*, respectively.*

The steady-state equilibrium is unique. Moreover, it can be shown that the economy converges to this steady-state equilibrium from any initial condition (Antunes et al. (2008)).

3 Labor Market Laffer Curve and the Tax Gap

Having characterized the decentralized steady-state equilibrium of our benchmark economy, we now utilize the equilibrium expressions derived in the previous section to quantitatively construct the steady-state labor income Laffer curve for Brazil. This curve theoretically relates labor income tax revenue to the labor income tax rate and is characterized by:

$$\begin{aligned}LC(a,l,\epsilon;w,r) &= \int\int\int \left[(1-e)T(\epsilon wl)\right] J(da,dl,d\epsilon) \\ &= \int\int\int (1-e)\delta_0 \left[(\epsilon wl) - \left[(\epsilon wl)^{-\delta_1} + \delta_2\right]^{-\frac{1}{\delta_1}}\right] J(da,dl,d\epsilon). \quad (26)\end{aligned}$$

According to Laffer (2004), a tax change impacts the labor income Laffer curve through two distinct mechanisms: one directly influences tax revenue, while the other has an indirect effect. These mechanisms are referred to as the arithmetic effect and the economic effect, respectively. We expand this analysis by introducing a third mechanism: the impact of tax evasion on labor income tax collection. Consider an increase in labor income tax rates. According to Laffer, higher labor income tax rates directly increase government revenue, a relationship he attributes to the arithmetic effect. This effect can be analyzed by evaluating how changes in tax rates influence tax revenue, keeping all other variables constant. In the context of our benchmark model, this corresponds to adjusting the policy parameters δ_0, δ_1, and δ_2 in expression (26) while holding the other terms fixed[11].

The second mechanism, the economic effect, captures the indirect impact of higher tax rates on government revenue through changes in household labor supply decisions. Laffer suggests that a higher labor income tax rate reduces the net return on labor, leading to an endogenous decrease in l[12]. Assuming the substitution effect dominates the income effect, this results in a reduction in labor income tax revenue[13]. Finally, beyond these two effects, we argue that a higher labor income tax rate has an additional impact on the Laffer curve through changes in households' optimal tax evasion decision, e, within $LC(a,l,\epsilon;w,r)$. As shown in expressions $(8)-(11)$, an increase in the tax rate leads to higher tax evasion, which further reduces labor income tax collection by the fiscal

[11]It is important to note that, unlike a flat tax rate policy, where the relationship between tax rate changes and tax collection is relatively straightforward, our model incorporates a more complex tax structure defined by δ_0, δ_1, and δ_2. These parameters introduce varying degrees of progressivity in the tax policy, creating different levels of tax burden distortion across the economy.

[12]Laffer argued that the interaction of these two effects gives rise to an inverted U-shaped curve. To the left of its peak, increases in the tax rate lead to higher tax revenue for the fiscal authority. However, beyond this maximum point, further increases in the tax rate result in lower tax revenue due to a reduction in agents' labor supply.

[13]This effect is also referred to in the macroeconomic literature as the tax wedge. It captures the inefficiency introduced in the labor market when a tax is levied, creating a discrepancy between pre-tax and post-tax wage rates and distorting optimal labor supply decisions (Hall (1997)).

authority.

In the next section, we quantitatively assess the contribution of these three impacts of a tax change on government labor income tax collection. To do so, we calibrate and numerically solve our benchmark model, deriving the Laffer curve both with and without tax evasion. This approach enables us to isolate the first two effects proposed by Laffer from the additional impact of tax evasion on the Laffer curve, allowing for a clearer assessment of each factor's role.

Let $TG(a, l, \epsilon; w, r)$ represent the difference between the fiscal authority's total labor income tax collection with and without tax evasion. It follows that:

$$TG(a, l, \epsilon; w, r) = LC(a, l, \epsilon; w, r)^{NE} - LC(a, l, \epsilon; w, r), \tag{27}$$

where

$$LC(a, l, \epsilon; w, r)^{NE} = \int\int\int \delta_0 \left[(\epsilon wl) - \left[(\epsilon wl)^{-\delta_1} + \delta_2\right]^{-\frac{1}{\delta_1}}\right] J(da, dl, d\epsilon), \tag{28}$$

is the government's labor income tax collection without tax evasion. From the two previous expressions, it can be observed that in an economy with a zero labor income tax rate, households would retain all income derived from their labor, leading to zero government tax revenue from labor income. Conversely, in an economy where 100% of labor income is taxed by the government, agents would have no incentive to work, resulting in zero government tax revenue. Laffer argued that, because the curve relating the labor income tax rate to tax revenue is continuous and differentiable, Rolle's Theorem guarantees the existence of a tax rate that maximizes labor income tax revenue.

A key feature of our benchmark model is that changes in labor income tax rates influence the fiscal authority's tax revenue differently across the wealth and labor productivity distributions. This framework enables us to assess how variations in labor income taxation shape the labor income Laffer curve for different cohorts of agents. The labor income Laffer curve for each labor income decile D_i is defined as:

$$LC_{D_i}(a, l, \epsilon; w, r) = \int_a\int_l\int_{\epsilon wl \in D_i(\epsilon wl)} (1-e)\delta_0 \left[(\epsilon wl) - \left((\epsilon wl)^{-\delta_1} + \delta_2\right)^{-\frac{1}{\delta_1}}\right] J(da, dl, d\epsilon); \tag{29}$$

for $i = 1, .., 10$. Additionally, to evaluate the distribution of tax evasion among households, we quantitatively derive the distribution of tax evasion across quartiles of the labor income distribution, Q_j, as follows:

$$TG_{Q_j}(a, l, \epsilon; w, r) = \int_a \int_l \int_{\epsilon wl \in Q_j(\epsilon wl)} \delta_0 \left[(\epsilon wl) - \left((\epsilon wl)^{-\delta_1} + \delta_2 \right)^{-\frac{1}{\delta_1}} \right] J(da, dl, d\epsilon)$$
$$- \int_a \int_l \int_{\epsilon wl \in Q_j(\epsilon wl)} (1 - e)\delta_0 \left[(\epsilon wl) - \left((\epsilon wl)^{-\delta_1} + \delta_2 \right)^{-\frac{1}{\delta_1}} \right] J(da, dl, d\epsilon); \quad (30)$$

where $j = 1, .., 4$.

4 Quantitative Analysis

In this section we present the quantitative implications of our model. To do this, we calibrate our benchmark model to match key characteristics of the Brazilian economy. Next, to examine the impact of the labor income tax rate on tax collection, we simulate the empirical Laffer curve for the Brazilian economy (equation (26)). Additionally, we derive the labor income Laffer curves for each decile of the labor income distribution (equation (29)) and compare them to the aggregate curve to determine their relative positions[14]. We then derive the Laffer curve under the assumption that the tax authority has the ability to completely eliminate tax evasion (equation (28)). Subsequently, we compare these two numerical Laffer curves to calculate the cost of tax evasion for Brazil (equation (27))[15]. This procedure is repeated for each quartile of the labor income distribution, as outlined in equation (30).

We employ the endogenous grid method (Carroll (2006), and Barillas and Fernández-Villaverde (2007)) to numerically implement our model, both with and without tax evasion. The basic premise of this method is straightforward: starting with an initial guess for the interest rate,

[14] The concept of relative position refers to the following: according to Laffer, at a given labor income tax rate, an economy may be at the peak of the curve or on either the upward-sloping or downward-sloping segment of the aggregate Laffer curve. We analyze whether the aggregate Laffer curve and those for labor income deciles align on the same segment, evaluating whether households across different deciles exhibit similar responses to changes in the tax rate and their corresponding impact on tax collection.

[15] This amount is commonly referred to in the literature as the tax gap. It is calculated as the difference between the taxes owed by agents and the amount of taxes not voluntarily paid (Slemrod (2007b) and Alstadsaeter et al. (2019)). Since the concepts of tax gap and tax evasion are closely related in our model, we use the terms interchangeably.

we solve the system of nonlinear equations, expressions $(8) - (13)$, that characterize the model's equilibrium. The optimal values of the control variables are obtained from the Cartesian product of the discretized state variables. This numerical procedure is performed for each combination of state variables. At every iteration, the household's budget constraint is verified, and in the case of models with tax evasion, it is also ensured that the omitted value of labor income lies within the range of acceptable values. This process is repeated until the equilibrium becomes stationary.

The main challenge in the numerical implementation of our benchmark model lies in simultaneously managing three distinct convergence procedures. First, optimal policy convergence is achieved by comparing norms at the end of each numerical iteration. Second, solving the system of nonlinear equations relies on a carefully selected set of initial guesses to accelerate the convergence process. Otherwise, the numerical solution becomes significantly slower. Finally, ensuring the stationary solution requires balancing the interest rate with the supply and demand for capital in the economy.

4.1 Model Calibration and Parameter Selection

The model is calibrated to an annual frequency, with parameters related to the borrowing constraint (Ω), disutility of work (χ), and tax evasion multiplier (η) defined to be consistent with target moments describing the Brazilian economy. These moments include total credit as a percentage of GDP, labor force participation, and total tax collection as a percentage of GDP. The calibrated values of the model parameters are summarized in Table I and each of these parameters is discussed in turn below[16].

According to the Brazilian Central Bank, the household volume of credit to GDP in Brazil is $27,31\%$[17]. Thus, we set the household borrowing constraint to 0.1881 to fit this number. The parameter related to the disutility of work (χ) is calibrated based on the labor force participation rate, which is approximately one-third of Brazil's total population. Accordingly, we set χ to 56.41. Finally, following data from the Brazilian tax authority, the tax evasion multiplier (η) is defined to align the model with total tax collection as a percentage of GDP, reported as 2.64%. We set η

[16] The calibrated parameters of our model are presented in the Benchmark Model column of Table I.

[17] Relatório de Economia Bancária - calendar year 2019, from the BCB.

to 0.185 in the benchmark model[18].

To calibrate the parameters related to the Brazilian tax policy, specifically those associated with the labor income tax function (δ_0, δ_1, and δ_2), we use public data released by the Brazilian Federal Revenue Service (RFB). The parameter δ_0 is set to match Brazil's current maximum marginal individual tax rate, which is 27.5%. Parameters δ_1 and δ_2 are jointly calibrated to ensure that the ratio of individual income tax to declared taxable income equals 0.1018. Consistent with the Brazilian tax code, the numerical model and parameter values reflect the requirement that only households earning more than R$ 28,559.70 in labor income are obligated to declare their taxes. The cost of the audit policy is normalized to $\mathcal{C} = 1$, and the discount factor (β) is set to 0.9673 to align with Brazil's capital-to-output ratio for 2019. Additionally, the capital depreciation rate (δ) is calibrated to match the ratio of aggregate investment to GDP ($I/Y = 17.15\%$) in Brazil, as reported by the Penn World Table (PWT).

We also calibrate the relative degree of risk aversion (γ) and the Frisch elasticity of labor supply (ϕ) based on information that is exogenous to the model and consistent with empirical studies in the literature, particularly those focusing on the Brazilian economy (Castro et al. (2011)). To obtain the capital share (α), we use the relationship $\alpha = (r + \delta)K/Y$. The consumption tax rate (τ_t^c) is also exogenously calibrated. We use the historical average of effective tax rates for Brazil, as calculated by Almeida et al. (2017), and set the consumption tax rate in the model to $\tau_t^c = 21.75\%$. To match 0.53% of total tax on capital investments as a percentage of GDP, the calibrated value of the tax rate on capital gains is $\tau_t^a = 9.28\%$. Finally, the elasticity parameter ι is fixed at 2.0, ensuring that utility remains a convex function in tax evasion.

We set $\mu = 0$ and normalize the mean of the household productivity shock to $\mu_v = 0$. Following Conesa et al. (2009), we assume a persistence term for the productivity shock of 0.98. The labor income process is then discretized. The parameters ρ and σ_v are derived for seven different realizations of the productivity shock, using a scale parameter of 3. This calibration ensures that the numerical distribution of income is consistent with Brazil's Gini index of 0.544 (Antunes and Cavalcanti (2013)).

The fine imposed by the government on tax evasion is set at 150% of the amount of unpaid

[18]Grandes Números do IRPF 2020 - calendar year 2019, from the RFB.

Table I: Model Parameters

Parameters	Benchmark Model	Target	Source
	Preferences		
β: Intertemporal Discount	0.96730	$K/Y = 2.43$	IPEA
Ω: Borrowing Constraint	0.18805	$Cred/Y = 27,31\%$	BCB and IBGE
γ: Risk Aversion	1.3	-	Castro et al. (2011)
ϕ: Frisch elasticity	1.0	-	Castro et al. (2011)
χ: Multiplier	56.4064	$L = 1/3$	Conesa et al. (2009)
η: Multiplier	0.185	$IT^l/Y = 2.64\%$	RFB and IBGE
ι: Elasticity of tax evasion	2.0	Fixed	-
	Technology		
α: Capital Share	0.2231	$r = 2.12\%$	BCB and IBGE
δ: Capital Depreciation	0.0706	$I/Y = 0.1715$	PWT 10.0
	Productivity		
ρ_ϵ: Shock Persistency	0.98	-	Conesa et al. (2009)
σ_v^2: Variance of Shocks	0.0451	$Gini = 0.544$	IBGE
r_ϵ: Scale Factor	3.0	-	Tauchen (1986)
	Tax Policy		
δ_0: Maximum marginal tax rate	0.275	-	RFB
δ_1: Progressivity parameter	0.52	$IT^l/Income = 10.18\%$	RFB
δ_2: Scale parameter	0.27	$IT^l/Income = 10.18\%$	RFB
τ_t^a: Capital Income Tax Rate	0.0928	$IT^a/Y = 0.53\%$	RFB and IBGE
τ_t^c: Consumption Tax Rate	0.2175	-	Almeida et al. (2017)
$\mathcal{T}$: Tax Penalty	1.5	-	RFB
p: Audit Rate	0.0274	-	RFB

Notes: BCB - Banco Central do Brasil - Brazilian Central Bank.
IBGE - Instituto Brasileiro de Geografia e Estatística - Brazilian Statistics Institute.
IPEA - Instituto de Pesquisa Econômica Aplicada - Institute of Applied Economic Research.
RFB - Secretaria Especial da Receita Federal do Brasil - Brazilian Federal Revenue Service.
Source: Authors.

taxes[19]. Accordingly, we calibrate the fine parameter to $\mathcal{T} = 1.50$[20]. For the probability of being audited, various alternatives have been proposed in the literature[21]. In this study, we adopt the ratio of the total number of audited taxpayers to the total number of taxpayers in the economy. Using public data from the Brazilian Federal Revenue Service (RFB), we find that, in 2020, approximately 2.74% of filed tax returns were retained for further inspection and enforcement. Consequently, we set the tax audit rate in our model to $p = 2.74\%$.

Table II presents the key target statistics for the Brazilian economy alongside the corresponding

[19]This value is based on the standard *ex-officio* fine of 75%, as provided in Law 9,430/96, which increases by 100% in cases involving tax evasion, fraud, or collusion, as defined in Law $4,502/64$.

[20]This value is also consistent with the literature on tax evasion. See Fullerton and Karayannis (1994) and references therein.

[21]See Chu et al. (2021), Hori et al. (2023), and references therein for more details.

outcomes from our calibrated benchmark model in the stationary equilibrium. The results indicate that the model matches the Brazilian economy fairly well along several dimensions. In particular, it accurately replicates the Brazilian consumption, investment and government expenditures to GDP ratios. Moreover, the calibrated model is consistent with the proportion of the economically active population that declares income tax, as well as with the observed Brazilian income distribution.

Table II: Key Statistics: Data and Benchmark Economy.

Variables	**Benchmark Model**	**Brazilian Economy**	**Source**
Consumption over GDP (C/Y)	65.33%	64.99%	
Investment over GDP (I/Y)	17.07%	17.15%	PWT 10.0
Government Expenditures over GDP (G/Y)	17.60%	18.35%	
Consumption Tax over GDP (CT/Y)	14.21%	14.25%	STN [i]
% EEAP that declares tax income [ii]	31.22%	32.26%	RFB [iii]
Taxable Labor Income over GDP ($Income/Y$)	26.1%	25.9%	RFB [iii]
Income Distribution			
Decile 1	0.9%	0.8%	
Decile 2	1.9%	2.1%	
Decile 3	2.5%	3.1%	
Decile 4	3.9%	4.2%	
Decile 5	5.2%	5.4%	IBGE [iv]
Decile 6	6.1%	6.8%	
Decile 7	9.1%	8.3%	
Decile 8	12.5%	10.9%	
Decile 9	17.4%	15.6%	
Decile 10	40.3%	42.8%	

Notes: [i] Brazilian Federal Treasury in https://sisweb.tesouro.gov.br/apex/f?p=2501:9::::9:P9_ID_PUBLICACAO:32076

[ii] The percentage of the employed economically active population that declares income tax.

[iii] RFB and PNAD (National Household Survey) from the IBGE

[iv] PNAD (National Household Survey) from the IBGE

Source: Authors.

4.2 Results

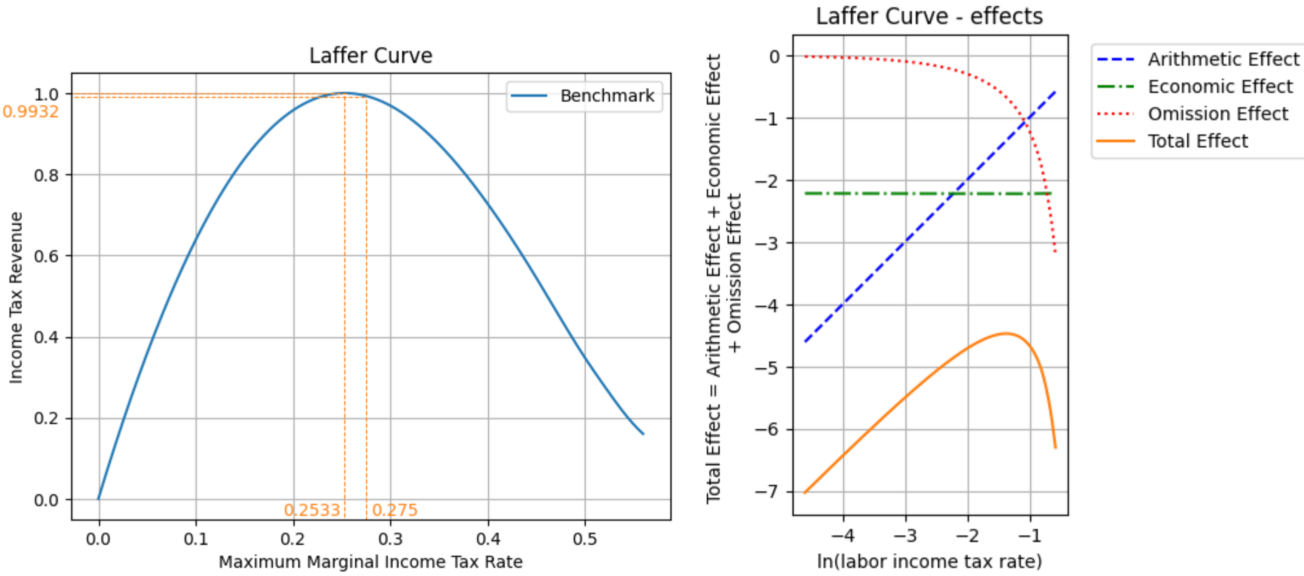
In this section we present our main results. We begin by analyzing the outcomes of our benchmark model, computing the numerical labor income Laffer curve for the Brazilian economy. Additionally, we construct the labor income Laffer curve for each labor income decile and decompose it into three main components: the arithmetic effect, the economic effect, as proposed by Laffer, and the tax evasion effect. Finally, we simulate aggregate labor income tax evasion in Brazil and examine the tax gap across labor income quartiles, quantifying its composition and its impact on the overall tax gap.

Laffer Curves. Figures 1, 2, and 3 summarize our main findings on the empirical labor income Laffer curve for Brazil. Figures 1 and 2 present the aggregate labor income Laffer curve, detailing its construction, components, overall shape, and composition across the top three quartiles of the labor income distribution. Figure 3, in turn, illustrates the Laffer curve across all labor income deciles, with a specific focus on the top three deciles.

First, consider Figure 1, which presents the numerical labor income Laffer curve and its main components in logarithmic terms. Panel 1.a illustrates the relationship between the labor income tax rate and the labor market tax revenue collected by the tax authority, representing the numerical counterpart of expression (26). It is worth noting that the curve exhibits a shape very similar to those derived by Trabandt and Uhlig (2011) for Europe and the United States, and by Alba and McKnight (2023) for the formal labor market segment of the Brazilian economy. Consistent with these studies, the Laffer curve has an inverted U-shape. Moreover, Brazil's current labor income tax rate lies to the right and close to the peak of the Laffer curve, indicating that a reduction in the labor income tax rate would lead to higher government tax revenue.

According to Figure 1.a, the Brazilian labor income Laffer curve is skewed to the right, with its peak occurring at a maximum marginal tax rate of 25.33%. Comparing this rate to the maximum marginal labor income tax rate of 27.5% observed in the Brazilian economy in 2019, we find that a reduction of nearly 8% in the current maximum marginal tax rate would be necessary to reach the peak of the curve in the benchmark model. Finally, the Laffer curve exhibits two distinct behaviors. To the left of the peak, it follows a parabolic shape. Beyond the peak, however, the curve descends with varying slopes, displaying some irregularity in its trajectory.

Now, consider Figure 1.b. Laffer argued that a change in the tax rate induces two opposing effects on aggregate tax collection, referred to as the arithmetic and economic effects (Laffer (2004)). The arithmetic effect occurs when an increase in the tax rate directly raises tax revenues. In contrast, the economic effect arises as higher tax rates increase the wedge between labor productivity and wage rates, leading to a reduction in labor supply and, consequently, a decrease in tax collection by the fiscal authority. Since these two effects act in opposite directions, the net impact on tax revenue depends on which effect dominates. To these effects, we incorporate the



(a) Extended Laffer Curve - Benchmark Model

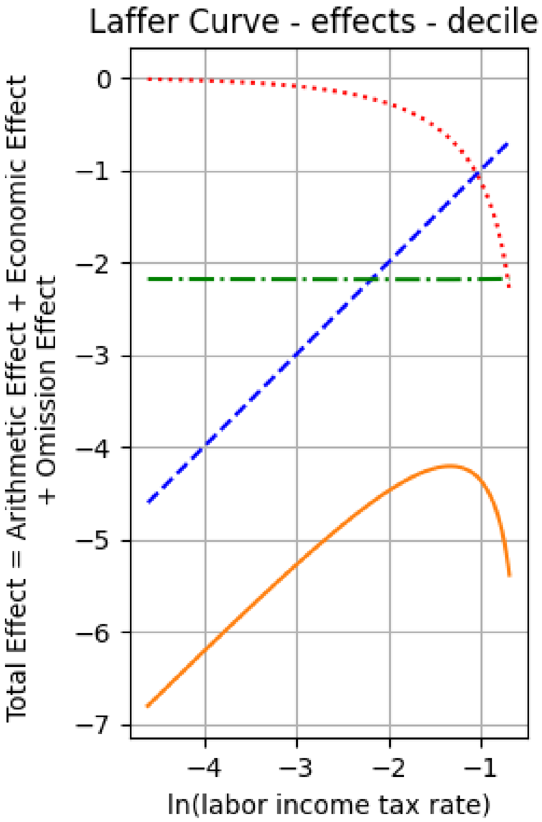
(b) Laffer Curve Components

Figure 1: Brazilian Labor Market Laffer Curve

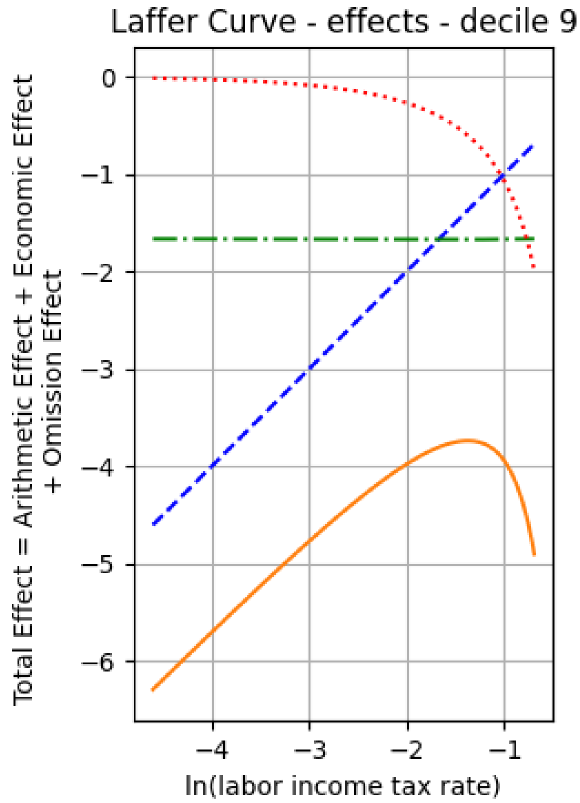
tax evasion effect, which further reduces the fiscal authority's labor income tax collection.

To better understand the impacts of a change on the tax rate on the labor income tax collection, consider an increase in the labor income tax rate from the initial value of a zero tax rate. We are on the upward slope of the Laffer curve. As the marginal rate increases, the arithmetic effect dominates the aggregate tax collection. Thus, the higher the tax rate, the bigger the fiscal authority's tax revenues. However, as the labor income tax rate continues to rise, the omission effect becomes increasingly significant, while the economic effect remains relatively constant. This dynamic persists until the point of maximum tax revenue is reached, corresponding to the peak of the Laffer curve. Beyond this point, the economy transitions to the downward slope of the curve, where the omission effect dominates, leading to a reduction in aggregate tax collection as the tax rate increases further. Regarding the role of tax evasion, higher labor income tax rates amplify the relative benefits of evasion under the fiscal authority's monitoring policy. Consequently, tax evasion becomes a monotonically increasing function of the labor income tax rate, further reducing government tax revenues.

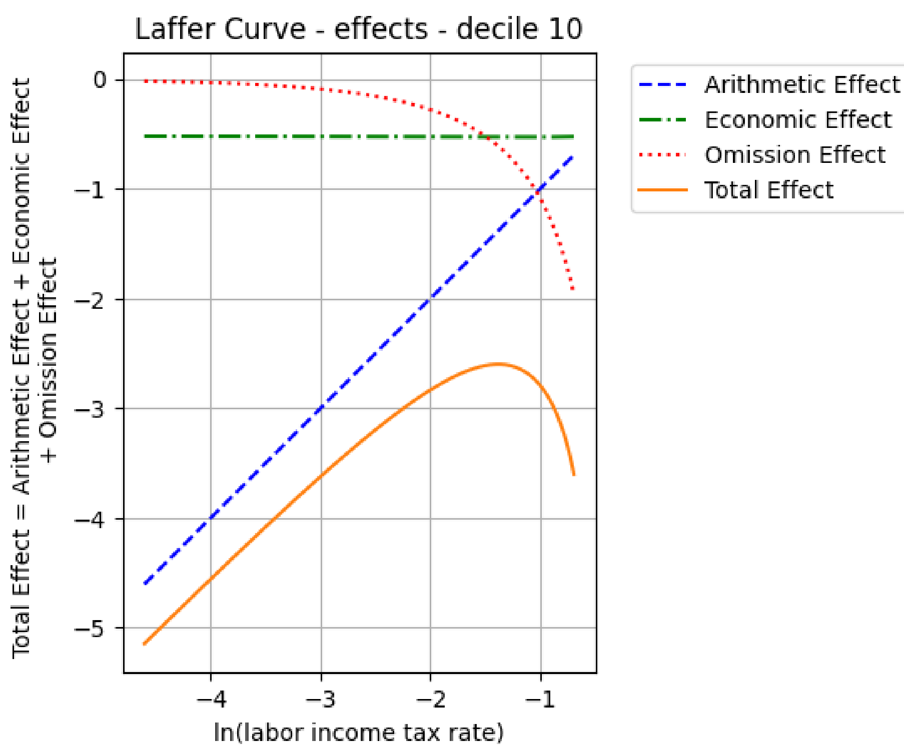
Figure 2 illustrates the components of the Laffer curve for deciles 8, 9, and 10. Note that the mechanism remains the same: as the tax rate increases, the arithmetic effect initially dominates



(a) Laffer Curve Components - decile 8

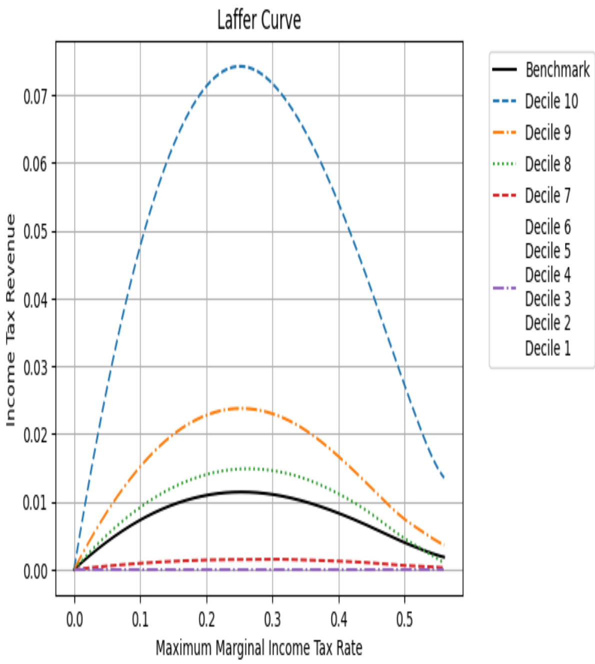


(b) Laffer Curve Components - decile 9

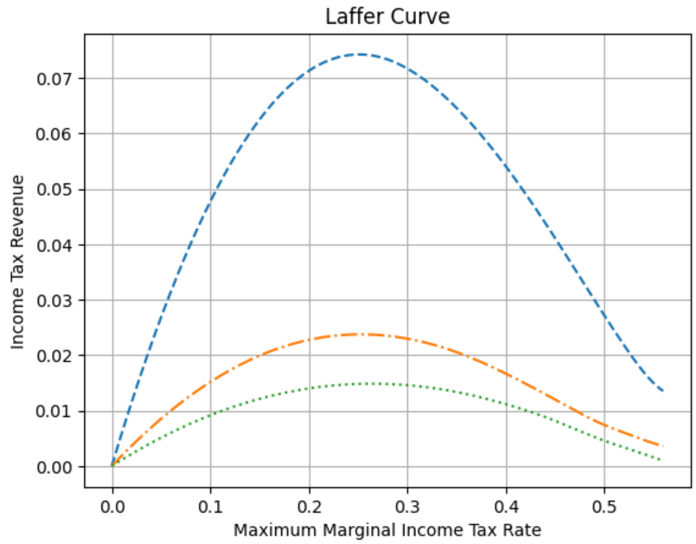


(c) Laffer Curve Components - decile 10

Figure 2: Laffer Curve Components - Deciles 8, 9 and 10



(a) Laffer Curve - Per Labor Income Decile



(b) Laffer Curve - Deciles 8, 9 and 10

Figure 3: Laffer Curve - Per Labor Income Decile

until the omission effect becomes the prevailing factor, while the economic effect remains nearly constant. The key difference lies in the magnitude of the economic effect, which varies across income deciles, increasing progressively from decile 8 to decile 10. This variation results in a higher peak for the Laffer curve at higher income levels. The contribution of each decile of the labor income distribution to total individual labor income tax revenue is tax rate-dependent. On average, decile 10 accounts for just over 65%, followed by decile 9 with 20.5%, and decile 8 with just under 13%.

Now, consider Figure 3. Figure 3.a depics the benchmark Laffer curve by decile of the taxable labor income distribution, alongside the average curve. Figure 3.b focuses on the Laffer curves for deciles 8, 9 and 10. Initially, it is worth noting that the economy's average labor income Laffer curve lies below the maximum of the top three deciles. The remaining labor income deciles all fall below the peak of the average curve for the Brazilian economy[22]. As a result, a given labor income tax rate corresponds to different levels of tax collection for agents in different labor income deciles.

[22]The first six deciles do not have a Laffer curve, as their taxable labor income in 2019 was below R$ 28,559.70, the minimum threshold for income taxation.

Secondly, the maximum point of each curve is not the same of the average one. Therefore, while for a group of agents, the current tax rate is to the left of the maximum, for others it is located to the right, that is, on the downward slope of the Laffer curve. Finally, the shape of the Laffer curves also varies across deciles. For some, the curve is right-skewed and asymmetric, while for others, it exhibits a different pattern.

Tax Gap. We now compare the solutions of our numerical model, with and without tax evasion, to assess the impact of tax evasion on total tax collection in Brazil, both in aggregate terms and across subgroups of taxable labor income. Specifically, we simulate expressions (27) and (30) to obtain a numerical estimate of the income tax gap in Brazil.

Estimating tax evasion poses significant challenges, primarily because individuals who engage in such practices have strong incentives to omit and conceal their actions to avoid penalties, including criminal charges. Another challenge lies in the variability of tax evasion estimates, which depend heavily on the assumptions, methodologies employed, and the degree to which the informal economy is accounted for.

Initially, using aggregate data, we identify a significant tax gap in the Brazilian economy. According to our model, there is an average discrepancy of 54.08% between the labor income taxes owed and the amount actually paid by households. This gap represents 3.11% of Brazilian GDP. This finding is consistent with the literature on the tax gap in Brazil. Siqueira (2004), for instance, extended the framework of Allingham and Sandmo (1972) to analyze the impact of tax evasion under two policies implemented by the Brazilian National Tax Authority: strengthening the punishment system and improving audit efficiency. Household decisions regarding personal income tax evasion were assessed using audit data from 1998, though the analysis excluded any consideration of the informal economy[23]. The findings also reveal significant variation in tax evasion across geographic regions, ranging from 12.47% to 33.26%, as well as by professional category, ranging from 12.53% to 33.90%. These results align with other studies, which estimate

[23]Accurately estimating tax evasion requires consideration of the informal economy. The Brazilian Statistics Institute (IBGE) employs various surveys and methods, such as the PNAD, to calculate GDP and partially capture the informal economy. For example, in 2019, Brazil's informal labor market was estimated to account for 41.1% of total employment. In our model, tax evasion is driven by the calibration of the parameter η, using the declared income tax-to-GDP ratio as a target. Consequently, as GDP includes more of the informal economy, IT^l/Y decreases, leading to higher tax evasion.

Table III: Tax Evasion Distribution

Quartile	Tax Evasion per Quartile (%)	Total Tax Evasion (%)
1	0.00	0.00 (0.00%)
2	0.00	0.00 (0.00%)
3	51.74	3.65 (6.76%)
4	54.26	50.43 (93.24%)
Total		54.08 (100.00%)

Source: Authors.

labor tax evasion rates varying from 20% to 69.9%. Additionally, a separate study estimates personal income tax evasion in several countries across Latin America and the Caribbean, with evasion rates ranging from 18.7% to 69.9%[24].

Table III presents the results for the quartiles of the labor income distribution in Brazil. This table highlights the effect of household heterogeneity on tax compliance. Notably, the first two quartiles report zero omission of labor income taxes[25]. For quartiles 3 and 4, the omission rates are 51.74% and 54.26%, respectively, contributing 6.76% and 93.24% to Brazil's total tax gap. Although the tax evasion rates are similar in these two quartiles, the aggregate value of evasion is significantly higher in the fourth quartile. This finding aligns with the academic literature, which emphasizes the importance of targeting tax evasion among the wealthiest individuals to increase tax revenue (Alstadsaeter et al. (2023)).

Table IV presents a numerical exercise that examines tax evasion across quartiles of the labor income distribution when varying the probability of an agent being monitored and the punishment parameter. Starting from our benchmark setup with $p = 2.74\%$ and $\mathcal{T} = 1.5$, these parameters are adjusted by $\pm 20\%$. As expected, increasing the probability of monitoring reduces tax evasion, while decreasing it results in higher evasion. The same effect is observed with changes to the punishment parameter. However, tax evasion is more sensitive to changes in the probability of monitoring than to adjustments in the penalty. Specifically, a 20% increase in probability and penalty reduces tax evasion by 1.28% and 0.76%, respectively, while a 20% decrease results in an increase in tax evasion of 1.26% and 0.78%. When analyzing tax evasion by quartile, we observe

[24]See Bárcena et al. (2020) for personal income tax evasion estimates in various Latin American and Caribbean countries. Unfortunately, data for Brazil is not available.

[25]This result is primarily due to the fact that their taxable labor income did not exceed R$ 28,559.70 in 2019, the minimum threshold required by law to pay income taxes in Brazil.

Table IV: Tax Evasion Distribution per Probability and Penalty

	Probability = 3.29% (+20%) and Penalty = 1.5	
Quartile	**Tax Evasion (%)**	**Total Tax Evasion (%)**
Quartile 1	0.00%	0.00%
Quartile 2	0.00%	0.00%
Quartile 3	51.03 (-1.37%)	3.60 (-1.37%)
Quartile 4	53.57 (-1.27%)	49.79 (-1.27%)
	Total	53.39 (-1.28%)
	Probability = 2.19% (-20%) and Penalty = 1.5	
Quartile 1	0.00%	0.00%
Quartile 2	0.00%	0.00%
Quartile 3	52.42 (+1.31%)	3.72 (+1.91%)
Quartile 4	54.95 (+1.27%)	51.04 (+1.21%)
	Total	54.76 (+1.26%)
	Probability = 2.74% and Penalty = 1.8 (+20%)	
Quartile 1	0.00%	0.00%
Quartile 2	0.00%	0.00%
Quartile 3	51.31 (-0.83%)	3.63 (-0.55%)
Quartile 4	53.85 (-0.76%)	50.04 (-0.77%)
	Total	53.67 (-0.76%)
	Probability = 2.74% and Penalty = 1.2 (-20%)	
Quartile 1	0.00%	0.00%
Quartile 2	0.00%	0.00%
Quartile 3	52.15 (+0.79%)	3.69 (+1.10%)
Quartile 4	54.68 (+0.77%)	50.81 (+0.75%)
	Total	54.50 (+0.78%)

Source: Authors.

that quartile 3 is more responsive to changes in both probability and penalty than quartile 4.

Sensitivity Analysis. We now assess the sensitivity of our results to the parameter values used in the benchmark model. Specifically, we examine whether the model's predictions change when an alternative calibrated value of the elasticity ι is used. As noted in the calibration section, the value of ι was chosen to ensure that utility remains a convex function of tax evasion[26]. Since there is no reference to this utility function or its associated elasticity in the literature, we perform a test to verify the consistency of the calibrated value of ι. In our sensitivity analysis, we use two alternative values of ι, 2.1 and 1.9, which are close to the initial calibrated value of 2.0. The other parameter values in the model are adjusted to ensure it continues to align with the same targets

[26] ι measures the sensitivity of tax evasion to changes in the tax rate. A higher value of ι indicates that tax evasion responds more strongly to variations in tax rates.

for the Brazilian economy, as listed in Table 1.

Table V presents the predictions of the baseline model ($\iota = 2.0$) alongside those of the two recalibrated models ($\iota = 1.9$ and $\iota = 2.1$). The recalibrated models remain consistent with the main targets of the Brazilian economy. Notably, the percentage of the employed economically active population declaring income tax, the tax gap, and the income distribution are unaffected by variations in the calibrated value of the elasticity ι.

Table V: Elasticity ι: Sensitivity Test

Variables	$\iota = 2.1$	$\iota = 2.0$	$\iota = 1.9$
Consumption over GDP (C/Y)	65.34%	65.33%	65.33%
Investment over GDP (I/Y)	17.06%	17.07%	17.07%
Government Expenditures over GDP (G/Y)	17.60%	17.60%	17.60%
Consumption Tax over GDP (CT/Y)	14.21%	14.21%	14.21%
% EEAP that declares tax income	31.22%	31.22%	31.24%
Tax Gap	54.08%	54.08%	54.08%
Income Distribution			
Decile 1	0.9%	0.9%	0.9%
Decile 2	1.9%	1.9%	1.9%
Decile 3	2.5%	2.5%	2.5%
Decile 4	3.9%	3.9%	3.9%
Decile 5	5.2%	5.2%	5.2%
Decile 6	6.1%	6.1%	6.1%
Decile 7	9.1%	9.1%	9.1%
Decile 8	12.5%	12.5%	12.5%
Decile 9	17.4%	17.4%	17.4%
Decile 10	40.3%	40.3%	40.3%

Source: Authors.

5 Conclusion

In this paper, we develop an incomplete market benchmark model to quantitatively evaluate the impacts of tax evasion and labor income distribution on the shape of the numerical labor income Laffer curve and the size of the tax gap in Brazil. Alongside the traditional arithmetic and economic effects, we introduce an omission effect to capture the dynamics of the Laffer curve in the presence of tax evasion. Our findings show that household heterogeneity is a critical factor for accurately quantifying both the aggregate magnitude and the distribution of tax evasion across labor income groups. According to Brazil's current tax code, some agents are situated on the downward slope of the Laffer curve, while others remain on its upward slope. We also quantify the cost of labor income tax evasion in a large economy characterized by imperfect tax collection.

This study highlights a substantial tax gap in Brazil's economy, underscoring the need for targeted policy measures. High evasion rates among wealthier income quartiles suggest that increasing audit frequency and enforcing stricter penalties could help reduce this gap, enhancing revenue and fostering a fairer tax burden. Furthermore, the results emphasize the importance of reassessing the progressivity of Brazil's tax system. The current structure disproportionately impacts income groups, leaving room for reforms that could strengthen progressivity and address inequality more effectively. By implementing tailored fiscal policies, Brazil could reduce the tax gap while simultaneously improving revenue generation and equity outcomes.

These findings highlight the potential for strategic reforms to Brazil's tax structure and enforcement mechanisms. Tailored policies targeting high-income groups with high tax evasion rates could not only improve compliance but also promote a more equitable distribution of the tax burden, contributing to a fairer and more efficient tax system.

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This paper investigates the labor income Laffer curve and tax gap within a Bewley-Huggett-Aiyagari framework for Brazil. The analysis is conducted in aggregate and disaggregated terms by income groups, highlighting heterogeneous impacts of taxation and tax evasion across the income distribution. The model incorporates progressive labor income taxation, tax evasion decisions, and a tax audit policy enforced by the national tax authority. Our results reveal that Brazil's current labor income tax rate lies on the downward slope of the aggregate Laffer curve, suggesting that reducing the tax rate could increase government revenue. Disaggregating by income deciles shows significant heterogeneity, with the top three deciles contributing over 98% of total tax revenues. Additionally, tax evasion accounts for 3.11% of Brazil's GDP, with 93% concentrated in the wealthiest quartile. These findings underscore the unequal distribution of tax compliance and the importance of targeted fiscal reforms to enhance equity, improve enforcement, and expand fiscal space.

Av. da Universidade, 2762 • Benfica • Fone: (085) 3366.7751
Cep: 60.020-181 • Fortaleza - CE - Brasil
http://www.caen.ufc.br • e-mail: sec_caen@caen.ufc.br