# Inequality, Informality, and Optimal Progressivity

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**Abstract:** How should governments design progressive labor-income taxes when workers can shift labor supply into untaxed informal work? Using household surveys for Brazil, Colombia, Mexico, and Peru, we document steep gradients in informality, employment, and unemployment across the income distribution. We analyze non-linear tax schedules in a heterogeneous-agent model with search frictions, savings, and an endogenous formal–informal labor-supply margin. Progressivity operates through an *inclusion margin* at the bottom—negative income taxes increase formal attachment—and an *evasion margin* at the top, where higher marginal tax rates shift labor supply into the untaxed sector. These opposing forces imply that both welfare and formality are hump-shaped in progressivity; in a calibration to Mexico, the welfare-maximizing degree of progressivity is about five times the current level.

**JEL Codes**: E26, H24, H26, O17, D31. **Keywords**: Negative income taxes, Informality, Progressive taxation, Developing countries.

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# 1 Introduction

Should developing economies subsidize formal work through negative income taxes? While many OECD tax systems embed in-work subsidies at the bottom of the earnings distribution, such policies are rare in high-informality economies, where work-contingent transfers are often viewed as infeasible because much income is earned outside the tax net. Conventional wisdom says no. We show that this reasoning is incomplete. Informality is not merely subsistence activity at the bottom of the distribution; it is also an active margin of response to fiscal incentives. When households can allocate labor between taxed formal work and untaxed informal work, the central question is how far to tilt a progressive labor-income tax schedule toward work-contingent subsidies at the bottom, given the offsetting evasion response at the top.

We study this question by combining new evidence with a static and a quantitative model. Our empirical analysis uses nationally representative household surveys for Brazil (PNADC), Colombia (GEIH), Mexico (ENOE), and Peru (ENAHO) in 2023–24, covering over 1.5 million households. The data reveal steep gradients in employment, unemployment, and informality across the income distribution. In the bottom decile, employment rates hover around 50%, informality is nearly universal, and workers are 4–9 times more likely to be unemployed than their counterparts in the top decile. Yet informality is not confined to the poor: even in the top decile, 19% of workers in Brazil and 34% in Mexico remain outside the formal sector. Transition patterns reinforce these gaps: lower-income workers exit formal jobs more often and re-enter them more slowly, indicating systematically weaker attachment to formality.[1] Together, these regularities point to a segmented labor market in which heterogeneity is central to the incidence and effectiveness of taxation.

We build a simple framework in which informality is an endogenous choice, building on Heathcote et al. (2017), and extend it to a heterogeneous-agent model with search frictions and self-insurance through savings. Throughout, we focus on the household margin—households allocate labor between taxed formal employment and untaxed self-employment/informal work—and abstract from firm heterogeneity and formalization decisions. In this environment, progressive taxation operates through two opposing forces: an *inclusion margin* at the bottom, where work-contingent subsidies (negative income taxes) draw low earners into formal employment, and an *evasion margin* at the top, where higher marginal rates shift labor supply into the untaxed sector.

[1] In the data, informality is measured using each worker's *main job* classification; accordingly, we interpret transition gradients as unequal *attachment* to formality and later document mixed-household employment patterns as evidence that households diversify across formal and informal activities.

We characterize the welfare-maximizing degree of progressivity and find that, in our Mexico calibration, it is about five times the current level. Welfare rises by 0.4% of consumption (in CEV), the formal employment share increases by 2.2 percentage points, consumption inequality falls by 1.3%, and tax revenues expand by more than 2 percentage points of GDP. Among the fiscal instruments we consider, only progressivity can expand both welfare and the tax base; higher proportional labor or capital taxes instead generate monotone welfare losses.

We use a static model to build intuition. It generates informality by income endogenously: low-productivity workers choose informality because they face higher unemployment risk in the formal sector and lower opportunity cost of forgoing formal wages; high-productivity workers may choose informality to avoid high marginal tax rates. The model shows that both welfare and formality are hump-shaped in progressivity: optimal progressivity is interior and substantially lower than in economies without informality—approximately halved—but remains positive. Comparative statics show that higher inequality raises informality because more low-productivity households have weak formal-job attachment and choose informal work.

The quantitative model extends this logic to a heterogeneous-agent setting with incomplete markets, search-and-matching frictions in the formal sector, and self-insurance via savings. Wages and vacancies are determined in general equilibrium, so fiscal policy feeds back through labor demand, asset prices, and tax revenues. We calibrate the model to Mexico using simulated method of moments, targeting three groups of data: (i) wealth, earnings, and consumption inequality; (ii) labor-market outcomes, including formal-sector separation and job-finding rates by income decile; and (iii) fiscal variables, matching Mexico's tax structure. The estimated progressivity parameter is approximately 0.02, consistent with Mexico's near-flat effective tax schedule.

The quantitative results confirm the hump-shaped welfare and formality profiles from the static model and pin down the welfare-maximizing progressivity parameter at approximately 0.09—nearly five times the current level in Mexico, but roughly half the U.S. level of 0.18. Formality peaks slightly later, at approximately 0.12, while tax revenues peak earlier, around 0.07; the optima do not perfectly coincide because average productivity declines as higher progressivity draws lower-productivity workers into the formal sector. Attempting to replicate U.S. progressivity would overshoot, triggering evasion responses that erode the tax base and reduce welfare. Current Latin American progressivity is near zero, well below the optimum, implying that these economies should increase progressivity—albeit to levels lower than would be optimal in fully formal settings.

Increasing progressivity monotonically reduces inequality in consumption, income, and wealth,

with the largest gains for consumption inequality as low-income households gain access to formal employment. We use the quantitative model to examine how the welfare-maximizing degree of progressivity depends on underlying inequality. Higher idiosyncratic productivity risk raises informality and amplifies both the inclusion margin at the bottom and the evasion margin at the top. As a result, welfare rises more steeply at low progressivity but also falls more sharply beyond the peak: the welfare profile becomes more sharply hump-shaped. Despite this, the location of the optimum shifts only modestly, implying that higher inequality calls for modestly lower progressivity once informal labor supply is taken into account. This is in contrast to the model without informality.

Among fiscal instruments, only progressivity expands both welfare and the tax base; higher proportional labor and capital taxes deliver monotone welfare losses. Raising the average labor tax increases revenues but also informality, as higher tax pressure weakens formal labor supply across the distribution—lowering welfare. Capital income taxation has essentially no effect on informality or formal labor supply, since it does not directly affect the formal–informal margin; welfare declines monotonically as capital taxes rise, reflecting reduced disposable income and distorted savings incentives. Only progressivity generates a hump-shaped welfare profile that peaks above the baseline, simultaneously drawing low earners into formality and compressing the earnings distribution.

**Related Literature.** Our paper sits at the intersection of optimal redistribution with incomplete markets and the macro-development literature on informality. On the optimal-policy side, we follow the Mirrlees–Diamond–Saez tradition as implemented in quantitative heterogeneous-agent models (e.g., Heathcote et al., 2017). A key difference vis-à-vis Doligalski and Rojas (2023) is the operative margin and equilibrium environment. They model *moonlighting*—simultaneous formal and informal labor supply—and derive Mirrleesian formulas in partial equilibrium, treating informality as an avoidance technology that lowers optimal marginal tax rates. By contrast, we embed informality in a general-equilibrium setting with search frictions, precautionary saving, and an implementable progressive tax schedule. The interaction of *inclusion* at low progressivity and *evasion* at high progressivity, together with GE feedback through wages, vacancy posting, and revenues, delivers a hump-shaped welfare–progressivity relationship that moonlighting formulas do not produce.

We build on the macro tradition that quantifies optimal progressivity with heterogeneous agents in general equilibrium. Conesa and Krueger (2006) compute optimal progressivity and highlight the insurance role of the tax code; Kindermann and Krueger (2022) characterize optimal top marginal rates; and Holter et al. (2019) link progressivity to Laffer curves. We adopt the parametric tax

framework of Heathcote et al. (2014, 2017) and add a formal–informal labor-supply margin that endogenizes the tax base that dampens the redistribution motive in response to inequality. Closest in this literature is Ferriere et al. (2023), who show that implementable progressivity can approach second-best allocations in fully formal economies. We take a similarly implementable system, but make the tax base endogenous through formal–informal reallocation, using new micro evidence to discipline the inclusion margin at the bottom and the evasion margin at the top.

Our paper is also related to Bachas et al. (2023), who study how informality on the *consumption* side shapes consumption tax design. They document that poorer households purchase more from informal outlets, which affects VAT incidence. In contrast, we study informality on the *labor* side as an endogenous margin that interacts with progressive labor-income taxation. On labor markets, we connect to search-and-matching models with dual sectors: early frameworks study minimum wages and enforcement (Albrecht et al., 2009; Bosch and Esteban-Pretel, 2012), while recent work incorporates on-the-job search (Bobba et al., 2021) and documents wage–sorting patterns (Meghir et al., 2015). We embed an implementable progressive labor-income tax in this environment. Relatedly, Ulyssea (2018) studies firm-side informality, and Bachas et al. (2024) show that consumption taxes can redistribute even when evasion is widespread. We focus on how progressivity and informality jointly determine welfare when labor reallocation across sectors is an operative margin.

## 2 Empirical Evidence: Informality Across Incomes

We document how labor-market outcomes vary across the income distribution in developing economies. Using nationally representative household survey data for Brazil, Colombia, Mexico, and Peru, we compare labor earnings and employment patterns across labor-income deciles. These facts motivate the modeling assumptions and calibration in Section 4.

Across the four countries, three empirical regularities stand out. First, while levels differ, labor-market outcomes display similar gradients over the income distribution. Second, educational attainment rises steeply with income: households in the bottom deciles have substantially fewer years of schooling than those at the top, consistent with weaker labor-market prospects. Third, workers at the bottom of the distribution face markedly worse labor-market conditions—lower employment, higher unemployment, and near-universal informality—together with substantially lower earnings.

Table 1: Inequality measures, households' per capita labor earnings

| | Brazil | Colombia | Mexico | Peru |
|---|---|---|---|---|
| Gini | 0.543 | 0.580 | 0.424 | 0.498 |
| Variance of logs | 1.145 | 1.303 | 0.815 | 1.164 |
| Percentile ratio 90/10 | 13.200 | 16.833 | 7.998 | 13.339 |
| Percentile ratio 75/25 | 3.500 | 4.127 | 2.907 | 3.463 |
| Percentile ratio 90/50 | 3.451 | 4.040 | 2.544 | 3.159 |
| Percentile ratio 10/50 | 0.261 | 0.240 | 0.318 | 0.237 |
| Survey year | 2024 | 2023 | 2024 | 2023 |

**Notes:** This table reports summary measures of inequality in household per capita labor earnings for Brazil (2024), Colombia (2023), Mexico (2024), and Peru (2023). Inequality measures are computed over the distribution of household per capita labor earnings, defined as total household labor income divided by household size. The sample includes only households with strictly positive labor earnings. Estimates use survey weights and are nationally representative. Survey details are provided in the Appendix.

## 2.1 The Data

We use nationally representative household surveys from Brazil (PNADC, 2024), Colombia (GEIH, 2023), Mexico (ENOE, 2024), and Peru (ENAHO, 2023), all publicly available from the respective statistical offices. These surveys are representative at the national, urban, and rural levels and constitute the official source of labor-market statistics in each country.[2][3]

Despite methodological differences, the surveys contain harmonized individual-level information sufficient to reproduce each country's official labor-market statistics and to characterize outcomes across the income distribution. All four record labor earnings, labor-force status, informality identifiers (e.g., social-security contributions for salaried workers and business registration for the self-employed), and standard demographics (age, sex, and schooling). Brazil and Mexico have a quarterly panel structure (five consecutive quarters), Peru follows a subsample annually for up to five years, and Colombia includes retrospective labor-market questions; together these features allow us to reconstruct labor-force transitions and the dynamics of the income process.

[2]The four surveys are carried out continuously over the year. The number of households interviewed in each country was 708,340 in Brazil, 277,158 in Colombia, 496,153 in Mexico, and 33,886 in Peru.

[3]For Mexico, the official source of income inequality statistics is the National Household Income and Expenditure Survey (ENIGH), which has more detailed information about income sources but more limited information about labor market indicators. Despite their differences, both surveys exhibit similar trends in comparable indicators.

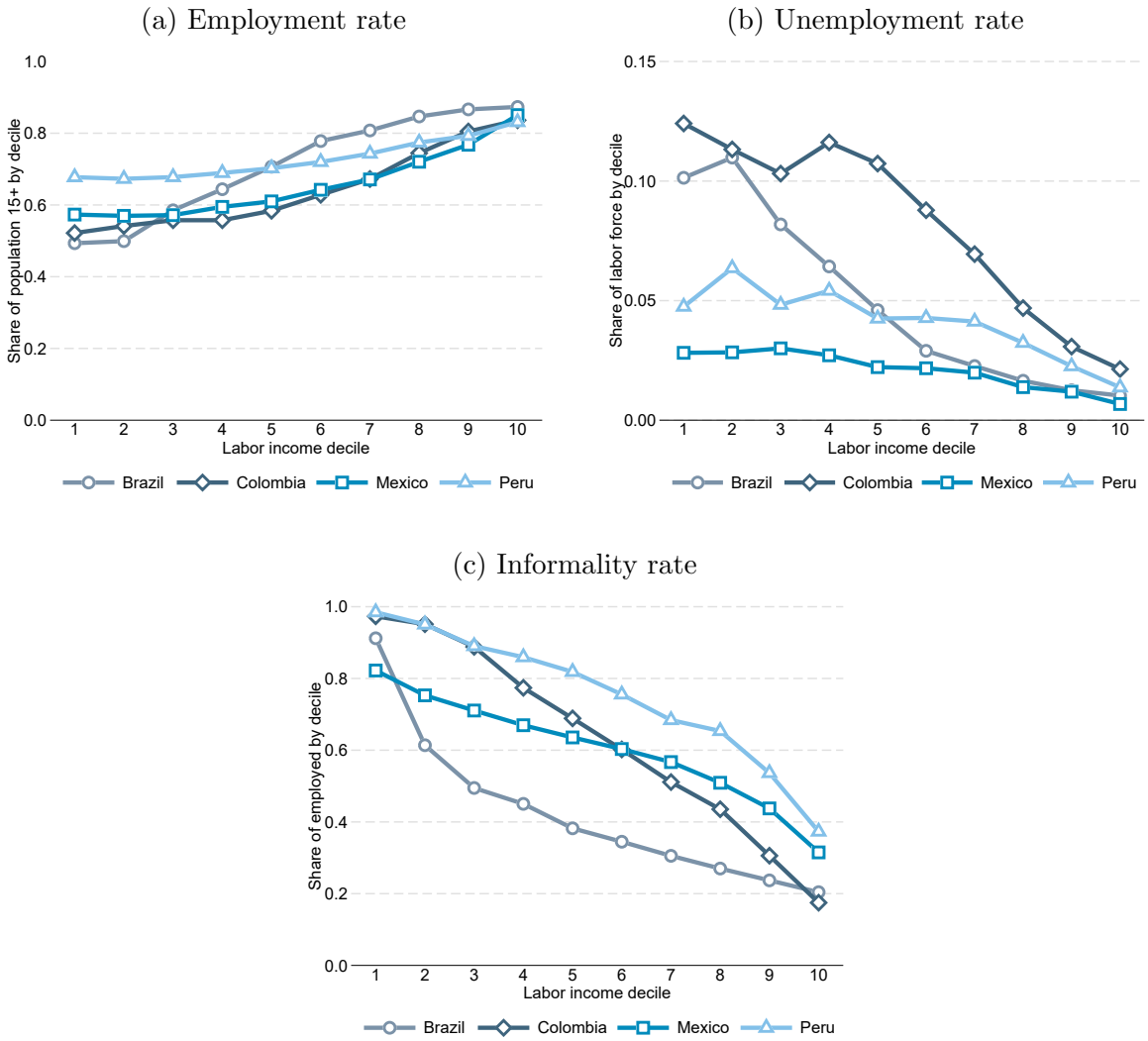
We measure the income distribution using household per-capita labor earnings, defined as total monthly labor earnings of all household members divided by household size. This measure excludes non-labor income (e.g., capital income and transfers) but captures the main income source for most Latin American households. Our analysis covers individuals aged 15+ in households with positive labor earnings; we form country-specific labor-income deciles and compare labor-market outcomes across deciles.

### 2.2 Labor Market Outcomes Across the Income Distribution

Labor earnings are highly unequal in all four countries (Table 1). Inequality ranges from a Gini of 0.42 in Mexico to 0.58 in Colombia, and the percentile ratios indicate that the bottom of the distribution lies particularly far below the median.

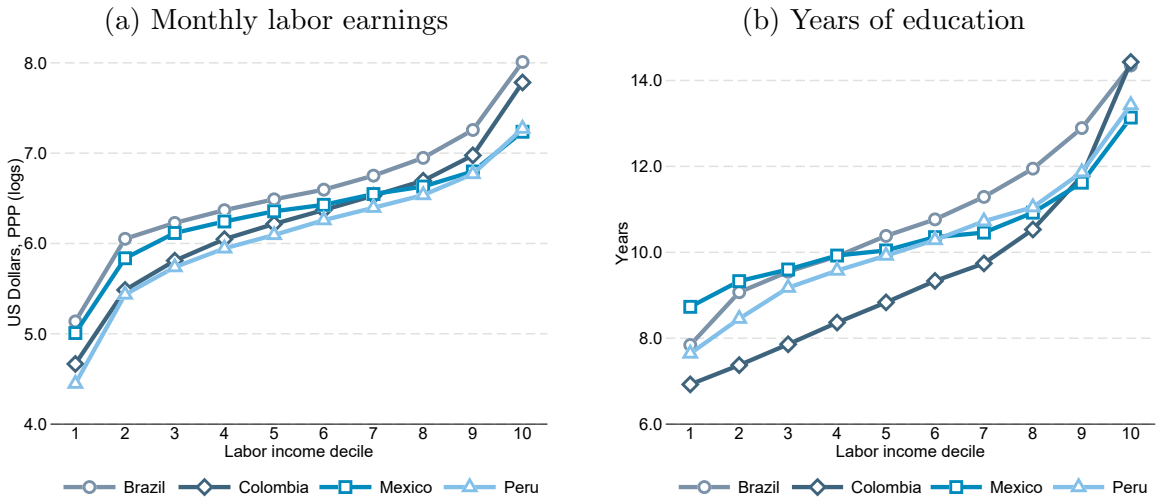
**Inequality in Labor Market Indicators.** Labor market indicators exhibit differential patterns across the income distribution. Those at the bottom of the income distribution are less likely to be employed and more likely to be unemployed or to work in the informal sector than those at the top. Figure 1 shows the employment rate (employed-to-population ratio, ages 15+), the unemployment rate (unemployed-to-labor-force ratio), and the informality rate (informal-to-employed ratio) by labor-income decile. We use each country's official measure of labor informality. Employment and unemployment follow each survey's standard definitions. Informality is based on survey-specific official criteria (e.g., social-security contributions for salaried workers and business registration or establishment characteristics for the self-employed). While operational definitions differ slightly across countries, they are designed to capture non-compliance with labor regulations and correlate closely with other markers of low-quality jobs.

Despite the differences between countries, employment and unemployment rates show a clear pattern over the income distribution: individuals at the bottom exhibit lower employment rates than their counterparts at the top. While the employment rate in the bottom decile is around 50% in Brazil, Colombia, and Mexico, the same indicator exceeds 90% in the top decile for all these countries. Also unemployment rates show a negative trend over the income distribution. Individuals at the bottom of the income distribution face disproportionately higher unemployment rates than those observed at the top. A person in the first income decile group is about 8.7 times more likely to be unemployed than in the top income decile group for Brazil, 4.7 times more likely in Colombia, 3.5 times more likely in Mexico, and 1.02 more likely in Peru.




**Notes:** This figure reports employment rates, unemployment rates, and informality rates by labor income decile for Brazil (2024), Colombia (2023), Mexico (2024), and Peru (2023). Labor income deciles are constructed separately within each country using the distribution of household per capita labor earnings. Labor market indicators are measured at the individual level for the working-age population (15+). All estimates use survey weights and are nationally representative. Definitions of informality and additional survey details are provided in the Appendix.

Figure 1: Labor market indicators by labor income decile, 2023/24



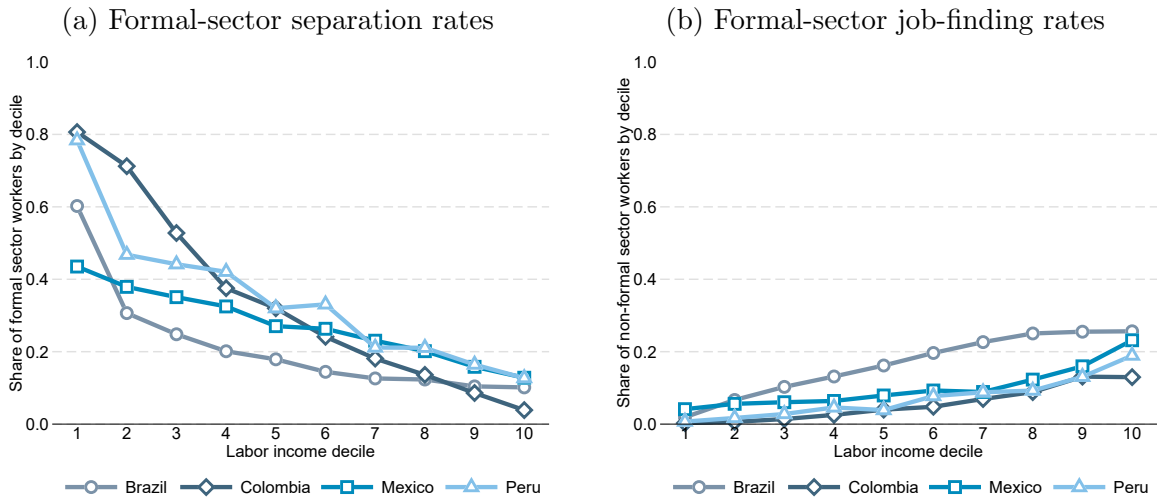

**Notes:** The figure reports average monthly labor earnings and average years of education by labor income decile for Brazil (2024), Colombia (2023), Mexico (2024), and Peru (2023). Labor income deciles are constructed separately within each country using the distribution of household per capita labor earnings. Monthly labor earnings correspond to total individual labor income (wage and self-employment income) for employed persons and are expressed in PPP-adjusted US dollars for the respective survey year. Years of education refer to completed years of schooling for individuals aged 15 and older. All estimates use survey weights and are nationally representative.

Figure 2: Monthly earnings and average years of education by labor income decile, 2023/24

Interestingly, informality is a prevalent characteristic of workers, even at the top of the income distribution. While it is very likely that workers located at the bottom part of the income distribution work in the informal sector, where informal employment rates are near 100%, informality is also present at the top of the income distribution, oscillating between 19% of total employment for Brazil to 34% in Mexico.

**Inequality in Earnings.** Along with the differential pattern in labor markets, Figure 2 presents the average monthly labor earnings reported by workers (left) and the average years of education (right) by income decile group. We present each country's labor earnings in dollars adjusted by PPP. The high level of inequality in these countries exhibits similar behavior, in which the most significant differences in average earnings are observed at the top and bottom of the distribution. Consistent with the low level of labor earnings inequality presented in Table 1, average earnings in Mexico exhibit a flatter gradient as a function of the income decile, and the average earnings from workers located in the top decile are moderated compared with the other countries.

The distribution of years of education follows a similar pattern to that observed in earnings, where workers at the top part of the distribution are more educated than workers at the bottom.




**Notes:** This figure reports annual formal-sector separation and job-finding rates by labor income decile for Brazil (2024), Colombia (2023), Mexico (2024), and Peru (2023). Labor income deciles are constructed separately within each country using the distribution of household per capita labor earnings. Transition rates are measured at the individual level for the working-age population (15+) and are computed as annual probabilities. The separation rate is defined as the probability that an individual in formal employment transitions to any non-formal state (informal employment, unemployment, or out of the labor force). The job-finding rate is defined as the probability that an individual in a non-formal state transitions into formal employment. All estimates use survey weights and are nationally representative. Definitions of formality and additional survey details are provided in the Appendix.

Figure 3: Annual formal-sector separation and job-finding rates, 2023/24

A remarkable case is Colombia, which systematically exhibits lower average schooling (9.1 years). Nevertheless, the population in the top part of the distribution is highly educated (13.9 years), comparable with households in Brazil and Peru. As for labor earnings, average years of schooling in Mexico tend to exhibit lower increases over the income distribution, even at top deciles.

**Inequality in Labor-Market Transitions.** Finally, we use the panel structure of the data (and retrospective questions in the case of Colombia) to compute transition rates into and out of formal-sector jobs by income decile. Figure 3 presents formal-sector separation rates (left) and job-finding rates (right) and shows large gradients over the income distribution: workers in the bottom deciles are less likely to find formal jobs and more likely to lose them than workers at the top.

The patterns of the informality rate and the transition rates provide empirical support to model informality as a phenomenon in which informality is the outcome of a few formal-sector jobs for low-productivity workers and the voluntary decision based on the incentives and constraints for other workers.

# 3 A Simple Model of Progressive Taxation with Informal Work

How can fiscal policy address the challenges of income inequality in economies with large informal sectors? To explore the relationship between progressive taxation, inequality, and informality, we present a static model with heterogeneous households and informal job opportunities. Informal work serves as a safety net for low-productivity households and, for high-productivity households, a margin of tax avoidance.

The economy consists of a continuum of ex-ante heterogeneous households who face unemployment risk. Depending on relative returns, households allocate their labor supply between salaried (formal) and self-employed (informal) work as a function of ability. Formal jobs are typically more productive, but supplying labor to the formal sector exposes households to uninsurable unemployment risk. Informality in the model therefore captures subsistence entrepreneurship: individuals become entrepreneurs to secure a basic income while avoiding unemployment risk (Schoar, 2009).[4]

In this economy, the government levies taxes only on formal-sector earnings through a progressive income tax schedule. Progressivity affects households' formal-sector labor supply through two channels that differ by productivity. At the bottom of the distribution, a progressive schedule delivers negative income taxes to low earners, raising the return to formal participation and drawing them into the tax base—an *inclusion margin*. At the top, high marginal tax rates discourage formal labor supply and push high-ability households toward the untaxed informal sector—an *evasion margin*. The balance between these opposing forces implies that there exists an optimal level of progressivity that maximizes welfare in an economy with informal job opportunities.

**Households.** Households are endowed with an exogenous ability level $h$ drawn from a log-normal distribution, $\log h \sim \mathcal{N}\left(-\frac{\sigma_h^2}{2}, \sigma_h^2\right)$, which determines their earnings capacity. At the beginning of the period, households choose the amount of labor $n \in [0,1]$ to supply and the fraction $\varpi \in [0,1]$ of their labor supply allocated to seeking or working in a formal-sector job. The remaining fraction $(1-\varpi)$ is allocated to informal self-employment. In the formal sector, households with ability $h$ earn labor income $w^f hn\varpi$ and pay income taxes $T\left(w^f hn\varpi\right)$,[5] but with probability $q$ they do not find a job, resulting in zero formal-sector earnings. Given income $y$, the income tax function $T(y)$ combines a proportional tax parameter $\tau^L$ and a degree of progressivity $\tau^P$ (Benabou, 2002; Ferriere

[4] Labor informality extends beyond self-employment (Ulyssea, 2018); salaried informal jobs are widespread in developing economies. However, a significant portion of salaried informal employment is concentrated in small informal (unregistered) firms, typically operated by self-employed individuals (La Porta and Shleifer, 2014).

[5] This assumption is consistent with the difficulty of observing income from informal work in developing economies, which effectively excludes many households from income taxation (Banerjee et al., 2023).

et al., 2023; Heathcote et al., 2017):

$$T(y) = y - \tau^L y^{1-\tau^P}. \tag{1}$$

Note that, in the absence of progressivity $\left(\tau^P = 0\right)$, the proportional tax rate on formal-sector earnings equals $1 - \tau^L$. In the informal sector, households do not face unemployment risk and earn income $w^s \Xi h^\xi$, where $\Xi < 1$ and $\xi < 1$. Productivity differences imply that, while household earnings increase with ability in both sectors, the marginal return to ability is lower in the informal sector. In addition to labor earnings, households may receive a lump-sum transfer $\tau^T$ regardless of their employment status.[6]

Given their ability $h$, a household chooses a consumption and labor supply plan to maximize the expected utility

$$u\left(c^f, c^s\right) = (1-q)\ln c^f + q \ln c^s - \frac{n^{1+\varphi}}{1+\varphi}, \tag{2}$$

where $c^f$ and $c^s$ are the consumption level of the household when they find and do not find a formal-sector job, subject to the budget constraints

$$c^f = w^s \Xi h^\xi n\left(1-\varpi\right) + \tau^L\left(w^f h n \varpi\right)^{1-\tau^P} + \tau^T \tag{3}$$

$$c^s = w^s \Xi h^\xi n\left(1-\varpi\right) + \tau^T. \tag{4}$$

**Production.** There is one competitive firm that produces a final good combining aggregate formal $(L^f)$ and informal $(L^s)$ labor via a CES production technology. The total output in the economy is determined by:

$$Y = \left[\left(L^f\right)^{\frac{\epsilon-1}{\epsilon}} + \left(L^s\right)^{\frac{\epsilon-1}{\epsilon}}\right]^{\frac{\epsilon}{\epsilon-1}}, \tag{5}$$

where $\epsilon$ is the elasticity of substitution between formal and informal labor. In this simple model, we abstract from modeling differences in aggregate productivity in the two sectors, to focus exclusively on the differences that arise from the skill composition of households. The quantitative model in Section 4 relaxes this assumption by allowing the two sectors to differ in productivity.

**Government.** The government levies income taxes on formal-sector earnings and finance exogenous government spending $G$ and the lump-sum transfers program $\tau^T$. A balanced budget in the

[6] While some may be conditional, social assistance programs based on unconditional transfers are increasingly used to assist vulnerable households. As of 2018, developing and transitioning countries allocate an average of 1.5 percent of GDP to social assistance programs (World Bank, 2018).

government implies that

$$G + \tau^T = (1-q)\int_0^\infty \left( w^f hn\varpi - \tau^L \left( w^f hn\varpi \right)^{1-\tau^P} \right) f_h(h)\, dh, \tag{6}$$

where $f_h$ represents the probability density function of the log-normal distribution.

**Definition 1** *An equilibrium in this economy consists of allocations* $\left\{n, \varpi, c^f, c^s, L^s, L^f, Y\right\}$ *and prices* $\left\{w^f, w^s\right\}$ *such that:*

- *Households choose* $n$ *and* $\varpi$ *to maximize their utility given wages* $w^f$ *and* $w^s$*, the tax schedule* $\left(\tau^L, \tau^P\right)$*, transfers* $\tau^T$*, and unemployment risk* $q$*.*
- *Firms maximize their profits given wages* $w^f$ *and* $w^s$*.*
- *Government keeps a balanced budget.*
- *Wages* $w^f$ *and* $w^s$ *are such that markets clear*

$$Y = (1-q)\int_0^\infty c^f f_h(h)\, dh + q\int_0^\infty c^s f_h(h)\, dh + G \tag{7}$$

$$L^f = (1-q)\int_0^\infty hn\varpi f_h(h)\, dh \tag{8}$$

$$L^s = \int_0^\infty \Xi h^\xi n(1-\varpi) f_h(h)\, dh. \tag{9}$$

### 3.1 Informal Job Decisions

The definition of competitive equilibrium implies that households make their labor supply decisions based on earnings in the formal and informal sectors, the tax schedule, and unemployment risk. Once households determine their labor force participation ($n$), they may choose to work exclusively in the informal sector, where they are fully insured against unemployment risk (consumption remains constant across states) and can avoid taxation, but at the cost of forgoing potentially higher earnings in the formal sector. At the optimum, households equate the expected gain from working in the formal sector, represented by the marginal utility of the formal-to-informal wage gap,

$$\tilde{w} = (1-\tau^P)\tau^L (w^f hn)^{1-\tau^P} \varpi^{-\tau^P} - w^s \Xi h^\xi n, \tag{10}$$

to the opportunity cost of not securing a formal-sector job, measured by the marginal utility of earnings while self-employed $\left(w^s \Xi h^\xi n\right)$:

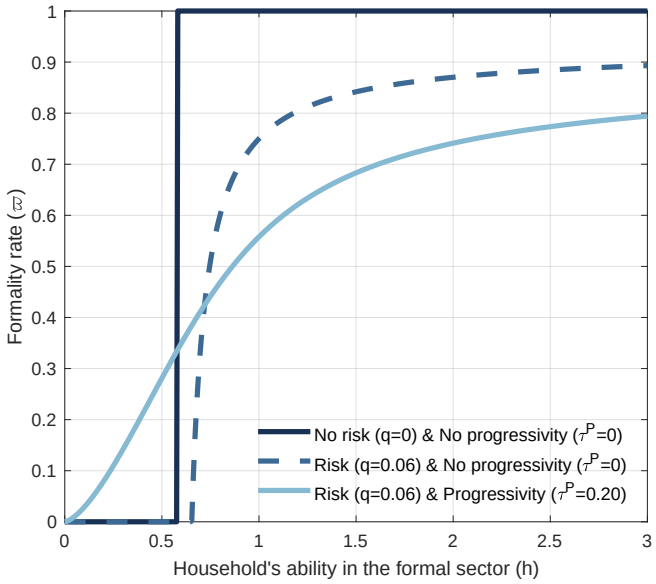
$$(1-q)\frac{\tilde{w}}{c^f} = q\frac{w^s \Xi h^\xi n}{c^s}. \tag{11}$$

Equation (11) implicitly defines the formal labor supply function $\varpi = \varpi\left(h, q, w^f, w^s, \tau^L, \tau^P\right)$. Under general conditions, formal-sector labor supply is increasing in ability $(h)$ and formal-sector wages $\left(w^f\right)$, and decreasing in unemployment risk $(q)$ and informal-sector wages $(w^s)$. With respect to the tax schedule, formal labor supply increases with the proportional tax parameter $\left(\tau^L\right)$. Crucially, higher progressivity $\left(\tau^P\right)$ has heterogeneous effects on formal labor supply: low-ability households face negative income taxes that increase their incentive to work in the formal sector, whereas high-ability households face higher marginal rates that reduce their formal labor supply.

The relationship between household productivity and formal-sector labor supply captures the complementary motives proposed for the existence of an informal sector (La Porta and Shleifer, 2014; Perry et al., 2007; Ulyssea, 2020). On the one hand, some households are effectively excluded from the formal labor market—an *inclusion margin*. Given labor market conditions (wages and unemployment risk) and the tax schedule, low-productivity households find it disadvantageous to work in the formal sector and therefore set their formal labor supply to zero ($\varpi = 0$). Even in the absence of taxes or unemployment risk, equation (11) implies that households whose earnings in the formal sector are lower than those in the informal sector ($w^f h < w^s \Xi h^\xi$) choose informal employment. The size of this group increases with a lower proportional tax parameter, which reduces the net gains from formal employment, and with higher unemployment risk, which strengthens the self-insurance motive.[7] Progressive taxation that delivers negative income taxes to low-productivity households incentivizes them to allocate part of their labor supply to the formal sector, thereby strengthening the inclusion margin and reducing the number of households excluded from formality.

On the other hand, some households that could participate in the formal sector may instead find informal work advantageous—an *evasion margin*. High-ability households may allocate part of their time to informal jobs in order to avoid taxation and to self-insure against unemployment risk. Progressive taxation has heterogeneous effects across the productivity distribution: it reduces the formal labor supply of high-ability households, who face higher marginal tax rates, but encourages low-ability households, who receive negative income taxes, to pursue formal employment. The

[7] Without progressivity, equation (11) implies that households for which $h < \left(\frac{w^s \Xi}{(1-q)\tau^L w^f}\right)^{\frac{1}{1-\xi}}$ set $\varpi = 0$.




**Notes:** This figure presents the share of time allocated for working in the formal sector ($\varpi$, vertical axis) versus the household's ability ($h$, horizontal axis). For the simulations, we used the solution of equation (11) assuming that wages in the formal and informal sector are $w^f = 1.04$ and $w^s = 1.26$), no lump-sum transfers ($\tau^T = 0$), an unemployment risk of $q = 0.06$, a proportional tax rate of $\tau^L = 0.2$, and two cases with progressive tax rates of either $\tau^P = 0$ or $\tau^P = 0.2$.

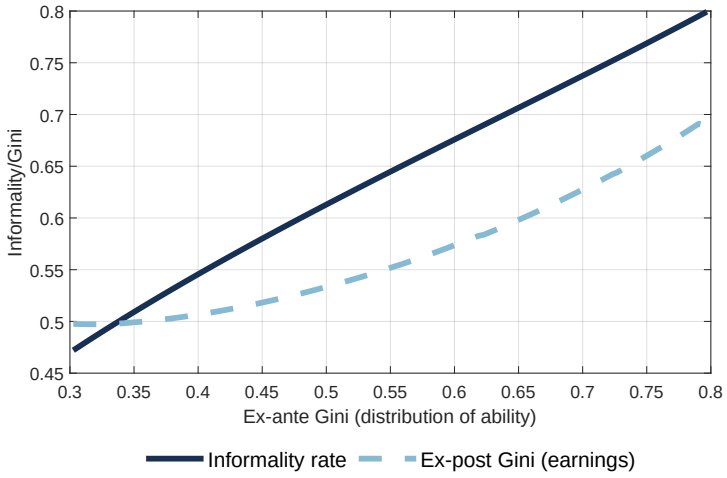
Figure 4: Formal-sector labor supply ($\varpi$)

balance between these inclusion and evasion margins determines the aggregate effects of progressivity on informality, output, and welfare.[8]

Figure 4 presents three cases of the allocation of time in the formal sector as a function of household ability.[9] In line with the trends presented in Section 2.2, the formal labor supply function ($\varpi$) shows that high-ability households allocate more time to the formal sector than low-ability households. The figure also illustrates how self-insurance and tax avoidance shape households' labor supply choices as a function of ability, and how these responses differ across households. In the absence of unemployment risk and tax progressivity, households allocate their labor supply entirely to either the informal or the formal sector, depending on their ability. When the model incorporates

[8] The model abstracts from the value households may place on non-monetary attributes of formal and informal jobs. These include time flexibility, independence in self-employment (Maloney, 2004), and mandated benefits associated with formal employment (Levy, 2008). Incorporating such features would typically require augmenting equation (11) with additional preference-based terms (Galiani and Weinschelbaum, 2012; Gerard and Gonzaga, 2021).

[9] For the figure, we assume wages of $w^f = 1.04$ and $w^s = 1.26$, lump-sum transfers of $\tau^T = 0$, a proportional tax rate of $\tau^L = 0.8$, and combinations of two unemployment risk probabilities and progressive tax rates: $q = 0$ (no risk) and $q = 0.06$, and $\tau^P = 0$ (no progressivity) and $\tau^P = 0.2$. In addition, for informal-sector productivity we set $\Xi = 0.5$ and $\xi = 0.5$. These parameters are used in the baseline simulations of the following section.




**Notes:** This figure presents the relationship between informality, income inequality and welfare (vertical axes) as a function of inequality in initial conditions (horizontal axis). For the simulation, we use the model described in Section 3 increasing the dispersion of the distribution of abilities ($\sigma_h$). For these simulations we set a probability of not getting a formal sector job of $q = 0.06$, a proportional tax rate of $\tau^L = 0.8$, a progressive tax rate of $\tau^P = 0$, a government expenditure to GDP ratio of $\frac{G}{Y} = 0.15$, and an elasticity of substitution of $\epsilon = 7.65$.

Figure 5: Inequality and informality

unemployment risk in the formal sector but no tax progressivity, high-ability households reduce their formal labor supply in order to self-insure against unemployment, while low-ability households remain in the informal sector. Progressivity further reduces the formal labor supply of high-ability households, as they use informal jobs to avoid taxes, while low-productivity households increase their formal labor supply because negative income taxes effectively raise formal-sector earnings.

### 3.2 Welfare Implications

The previous analysis indicates that households insure themselves against income shocks and avoid taxation by working in the informal sector. The consumption-smoothing motive is stronger for low-ability households, as their lower productivity in the formal sector results in smaller expected gains from formal employment. Consequently, changes in the underlying ability distribution shape informality, output, and welfare.

Figure 5 illustrates the aggregate effects of higher inequality in the distribution of abilities in the economy. The figure displays the informality rate and ex post income inequality (measured by the Gini coefficient of labor earnings) as functions of ex ante inequality, as captured by the dispersion parameter $\sigma_h$ of the ability distribution. We adjust the proportional tax rate to ensure consistency

with a government expenditure equal to 15% of GDP. For the distribution of abilities, the assumption that $\ln h \sim \mathcal{N}\left(-\frac{\sigma_h^2}{2}, \sigma_h^2\right)$ implies that average productivity remains constant across simulations, $\mathbb{E}(h) = 1$, while dispersion increases, leading to greater mass in the tails of the distribution.[10]

As shown in Figure 5, a more unequal distribution of ability leads to higher labor informality, as it implies a larger share of low-productivity households. This distributional effect dominates changes in relative wages, resulting in an overall increase in labor informality. Because of its role as a self-insurance mechanism, informality leads to substantial smoothing of the ex post earnings distribution: in the simulation, an increase of 50 points in the Gini coefficient of the ex ante ability distribution (from 0.30 to 0.80) corresponds to an increase of about 20 points in the ex post Gini (from 0.50 to 0.70).[11]

### 3.2.1 The Role of Fiscal Policy

Fiscal policy plays a crucial role in shaping informality and welfare. The tax schedule reduces consumption inequality and influences labor supply decisions by reallocating employment between the formal sector and the less productive informal sector. We explore this interaction through numerical simulations and show that welfare is maximized at an interior degree of progressivity that reduces both consumption inequality and informality.

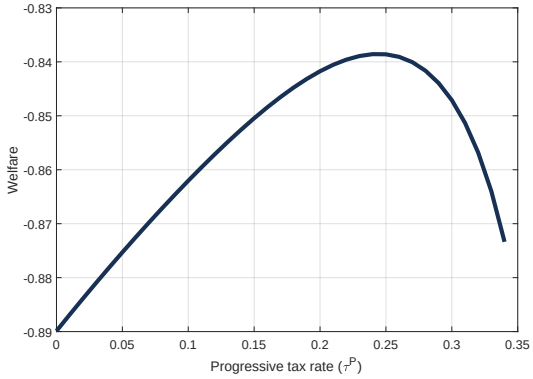
We set the unemployment risk probability to $q = 0.06$ and the elasticity of substitution between formal- and informal-sector employment to $\epsilon = 7.65$, following Leyva and Urrutia (2020). Regarding ability differences, we set informal-sector productivity parameters to $\Xi = 0.5$ and $\xi = 0.5$, and the standard deviation of log ability to $\sigma_h = 1$. For the tax function, we compute the equilibrium of the economy assuming no lump-sum transfers $\left(\tau^T = 0\right)$ and follow the approach in Ferriere et al. (2023) to calibrate the proportional tax rate $\left(\tau^L\right)$ such that, in all simulations, government expenditure equals 15% of total output. In a scenario with no progressivity $\left(\tau^P = 0\right)$, this calibration yields an economy with an informal employment rate of 62.6% and an ex post Gini coefficient of 0.54.

To illustrate the impact of progressive taxation on welfare, we compute the competitive equilibrium of the economy for different values of the progressive tax rate $\tau^P$. The resulting utilitarian welfare, labor force participation, and labor informality rates as functions of the progressive tax rate

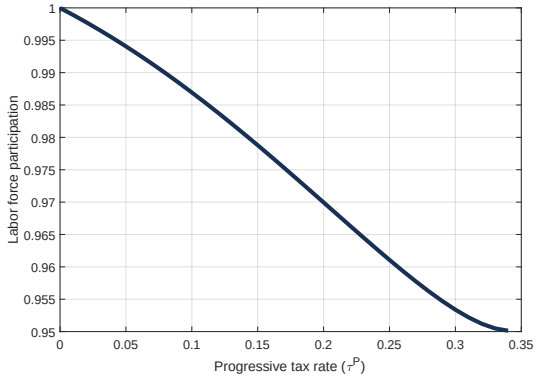
[10] Specifically, we set the probability of not finding a formal-sector job to $q = 0.06$, calibrate a proportional tax rate consistent with $\frac{G}{Y} = 0.15$, assume no progressivity ($\tau^P = 0$), and set the elasticity of substitution to $\epsilon = 7.65$. See Section 3.2.1 for details.

[11] These results are consistent with a positive cross-country correlation between informality and the Gini index documented in the literature linking inequality and informality in the presence of informal job opportunities (e.g., Chong and Gradstein, 2007; Rosser et al., 2000).

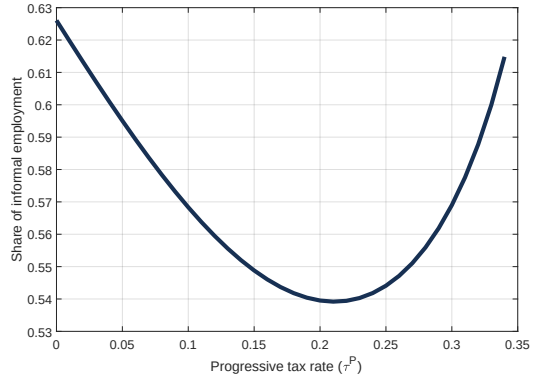
(a) Welfare (utilitarian)



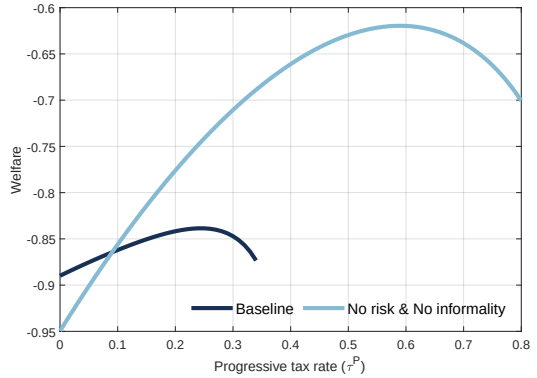

(b) Labor force participation




(c) Informality rate




(d) Welfare comparisons with an economy with no risk/no informality




**Notes:** This figure presents the relationship between the progressive tax rate and welfare and labor supply (labor force participation and informality rates). We use the model described in Section 3 to compute the level of welfare (under a utilitarian approach) in equilibrium given different values of $\tau^P$. For these simulations we set a probability of not getting a formal sector job of $q = 0.06$, a proportional tax rate $\tau^L$ consistent with a government to output ratio of $\frac{G}{Y} = 0.15$, and an elasticity of substitution of $\epsilon = 7.65$. Regarding the distribution of log ability, we assume that $\ln h \sim \mathcal{N}\left(-\frac{1}{2}, 1\right)$.

Figure 6: Effects of a progressive fiscal policy on welfare and labor supply

are presented in Figure 6, panels (a) through (c). Panel (a) shows that, in this economy, there is a welfare-maximizing level of progressivity, with an optimal progressive tax rate of $\tau^P = 0.24$, while panels (b) and (c) show that adjustments in the economy occur mostly through changes in labor informality. Panel (b) presents labor force participation as a function of the progressive tax rate. Labor force participation is relatively inelastic with respect to progressivity, and in the simulations an increase in the progressive tax rate from 0% to 35% leads to a reduction of only about 5% in labor force participation.

In contrast, informality rates respond strongly and display a U-shaped pattern as progressivity increases (panel (c)). Starting from low progressivity, informality first *declines*: negative income taxes induce low-ability households to allocate more time to formal-sector jobs, and this inclusion effect offsets the reduction in formal labor supply among high-ability households. The decline in informality, together with higher formal-sector earnings and greater compression of the earnings distribution, raises welfare. Beyond a threshold, however, the pattern reverses: informality *rises* as the evasion margin dominates. High marginal tax rates weaken incentives for high-ability households to work in the formal sector, shrinking the tax base and reducing aggregate output. Welfare peaks at moderate progressivity, where the inclusion margin at the bottom is maximized relative to the evasion margin at the top.

Compared with economies without informality, progressivity operates over a narrower range and generates lower welfare gains. Panel (d) compares welfare in the model with that in a benchmark without unemployment risk or informality, such as the one presented in Ferriere et al. (2023). Under the same distribution of abilities, optimal progressivity in the benchmark is substantially higher (around $\tau^P = 0.60$) than in our model with informality ($\tau^P = 0.24$). The evasion margin—absent in fully formal economies—binds at lower levels of progressivity when households can shift labor toward the untaxed sector, explaining why optimal progressivity is interior and lower than in settings that abstract from informality.

We also explore how structural features of the economy shape optimal progressivity in Appendix C.3. The results confirm that economies with pervasive informality should adopt moderate progressivity: higher unemployment risk and higher government expenditure requirements lower optimal progressivity, while greater ex-ante ability dispersion raises it.

# 4 Quantitative Heterogeneous-Agent Model with Informality

The quantitative model preserves the central mechanism of the static model: taxes are levied on formal earnings only, so households allocate labor between formal and informal activities. Informality therefore serves as a safety net, a margin of tax avoidance, and an insurance device against unemployment risk. The quantitative framework then adds three elements that let us discipline labor-market dynamics, savings behavior, and inequality in a unified general-equilibrium setting: (i) an intertemporal consumption–savings problem, (ii) search-and-matching frictions in the formal labor market that make unemployment risk endogenous and heterogeneous, and (iii) a production side with capital, equilibrium prices, and a richer fiscal system.

In the static model, formal labor supply is a risky activity at the intensive margin: households choose the fraction of time allocated to formal work, and this allocation yields earnings only with some probability. This reduced-form formulation captures, in a tractable way, both limited access to formal jobs and the role of informality as a self-insurance device. In the quantitative model, these mechanisms are separated. Access to formality is governed by search-and-matching frictions and skill-dependent job-finding and separation rates, while households respond to unemployment risk not only through labor reallocation across sectors, but also through intertemporal saving decisions.

## 4.1 Taxes and Transfers

The government levies a consumption tax $\tau^c$, a proportional capital-income tax $\tau^k$, and applies the same progressive labor-income tax on formal earnings introduced in Section 3 in equation (1). Tax revenues are used to finance government consumption $G$ and lump-sum transfers, $\tau^T$, equal for all households. The government balances its budget every period.

## 4.2 Production

We follow Leyva and Urrutia (2020) and model production as the combination of three technologies. Final output is produced using capital and intermediate inputs, subject to limited managerial capacity (a "span-of-control" constraint) that generates decreasing returns at the firm level and thus positive profits. Intermediate inputs are produced by combining formal and informal labor outputs under imperfect substitutability. In both sectors, labor outputs are produced using linear technologies in labor only. This preserves tractable aggregation and implies an aggregate production function in which measured TFP depends on the share of formal labor in total labor supply.

### 4.2.1 Final Good Production

A representative firm combines capital $K$ and intermediate inputs $H$ with a Cobb-Douglas technology that features decreasing returns to scale :

$$Y = A\left(K^{\alpha}H^{1-\alpha}\right)^{\nu}, \quad (\alpha,\nu) \in (0,1)^2, \tag{12}$$

with income shares $\alpha\nu$ and $(1-\alpha\nu)$ for capital and the intermediate composite respectively. The parameter $\nu$ captures the span-of-control limitation: when $\nu < 1$, production exhibits decreasing returns at the firm level, generating positive profits that are distributed to household-owners agents.

Under perfect competition, net of depreciation $\delta$, rental rate of capital $r$ and the price of intermediate inputs $p^H$ are given by:

$$r + \delta = \alpha\nu\frac{Y}{K}, \quad p^H = (1-\alpha)\nu\frac{Y}{H}. \tag{13}$$

### 4.2.2 Intermediate Goods Production

The intermediate input is produced by combining formal and informal labor outputs under imperfect substitutability. Formal employment and informal self-employment are denoted by $L^f$ and $L^s$, respectively. In the formal sector, output is linear in labor with productivity $\Omega$, while in the informal sector output is linear in labor with productivity $\varkappa$. The intermediate composite is therefore given by a CES aggregator with elasticity of substitution $\varepsilon$:

$$H = \left[(\Omega L^f)^{\frac{\varepsilon-1}{\varepsilon}} + (\varkappa L^s)^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}}. \tag{14}$$

From (14), the relative price of formal intermediate inputs $p^f$ and the income of self-employed informal workers $w^s$ satisfy:

$$p^f = (1-\alpha)\frac{Y}{H}\left(\frac{H}{\Omega L^f}\right)^{1/\varepsilon}, \tag{15}$$

$$w^s = \varkappa p^f \left(\frac{\Omega}{\varkappa}\cdot\frac{L^f}{L^s}\right)^{1/\varepsilon}. \tag{16}$$

**Aggregation.** Combining (12) and (14), we can express the aggregate production function as:

$$Y = \left\{ A \left[ (\Omega(1-\lambda^s))^{\frac{\varepsilon-1}{\varepsilon}} + (\varkappa\lambda^s)^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon\nu(1-\alpha)}{\varepsilon-1}} \right\} \left(K^\alpha L^{1-\alpha}\right)^\nu, \tag{17}$$

where $L = \left(L^f + L^s\right)$ and measured TFP depends on the informality rate in production $\lambda^s \equiv \frac{L^s}{L}$.

### 4.3 Labor Market

The labor market is segmented into formal and informal sectors. The formal sector is characterized by search and matching frictions, while the informal sector is assumed to be perfectly competitive. Households' formal employment status $F \in \{0, 1\}$ evolves through job-finding and separation, making unemployment risk endogenous, and heterogeneous across workers. As in the static model, households can always choose to supply labor in the informal sector, so informality acts as an outside option that provides income when formal employment is not available and also allows tax avoidance. The model allows for endogenous labor supply across both sectors, and earnings heterogeneity arising from productivity differences, sectoral allocation, and the nonlinear structure of taxation.

**Formal Labor Market.** The formal labor market is characterized by search and matching frictions. Workers without a formal job ($F = 0$) search for formal employment while having access to informal work as an outside option. A constant-returns-to-scale matching function determines the number of matches, the job-finding rate for workers, and the job-filling rate for firms:

$$M(I, V) = \chi\, I^\psi V^{1-\psi}, \tag{18}$$

$$f(\theta) = \frac{M}{I} = \chi\, \theta^{1-\psi}, \tag{19}$$

$$q(\theta) = \frac{M}{V} = \chi\, \theta^{-\psi}, \tag{20}$$

where $\theta \equiv \frac{V}{I}$ is labor market tightness, $I$ is the mass of searching workers (i.e., households with $F = 0$), and $V$ is the number of vacancies posted in the formal sector.

### 4.4 Households

There is a continuum of infinitely lived households deriving utility from consumption and leisure. Households are endowed with one unit of time, which they can allocate to formal or informal labor

supply (or both). They can save in a risk-free asset, which pays a constant interest rate $r$ subject to a capital income tax $\tau^k$. They pay a proportional tax on consumption expenditures $\tau^c$ and a progressive tax on formal labor income (1). All households receive a lump-sum transfer $\tau^T$ from the government, financed by tax revenues. The household's problem is to choose consumption, savings, and labor supply across sectors in order to maximize expected lifetime utility.

**Idiosyncratic Risk.** Households face idiosyncratic risk in labor productivity, formal employment attachment, and ownership status. Labor productivity evolves stochastically according to a log-AR(1) process:

$$\log h' = \rho \log h + \sigma_h \epsilon_h, \qquad \epsilon_h \overset{\text{iid}}{\sim} \mathcal{N}(\mu_h, 1). \tag{21}$$

with persistence $\rho$ and innovation standard deviation $\sigma_h$.[12]

**Sector-Specific Worker Productivity.** Formal and informal sectors differ in technology, captured by the sectoral productivity factors $\Omega$ and $\varkappa$ (see Section 4.2.2). At the worker level, we adopt the same sector-specific productivity mapping as in the static framework: effective productivity in the formal sector equals potential productivity, $h^f = h$, while effective productivity in the informal sector is $h^s = \Xi h^\xi$. The parameters $\Xi$ and $\xi$ govern the level and curvature of informal-sector productivity. We restrict $\Xi$ so that low-productivity workers (i.e., those with $h < \mathbb{E}[h]$) do not counterfactually exhibit higher effective productivity in the informal sector, and we set $\xi \in [0, 1]$ to control the degree of productivity equalization among informal workers.[13]

**Skill-Dependent Transition Rates.** The formal employment status is a binary variable indicating whether the household is employed in the formal sector ($F = 1$) or not ($F = 0$). The average job-finding rate into the formal sector depends endogenously on labor market tightness, $\mathbb{E}(f) = f(\theta)$, while the average separation rate $\bar{\iota}$ is exogenous. To capture the systematic heterogeneity in transition probabilities observed across the labor-income distribution, we assign productivity-specific job-finding and separation rates directly over the $h$-productivity grid.

Formally, each productivity type $h_i \in \{h_1, \ldots, h_{n_h}\}$ is associated with a pair of transition probabilities $\{\Delta f_{h_i}, \iota_{h_i}\}$, where $\Delta f_{h_i}$ captures the deviation around the endogenous equilibrium

[12] In line with the static model, innovation mean parameter $\mu_h$ is set to satisfy the steady-state normalization condition $\mathbb{E}[h] = 1$.

[13] This assumption, together with differential linear productivity factors ($\Omega > \varkappa$), captures technological differences between formal and informal sectors along two dimensions: (i) on average the formal sector is more productive, and (ii) the informal technology entails less specialization than its formal counterpart.

job-finding rate $f(\theta)$, and $\iota_{h_i}$ denotes the exogenous separation rate. The arrays $\{\Delta f_{h_i}\}$ and $\{\iota_{h_i}\}$ are calibrated to match the empirical profiles of job-finding and separation rates across labor-income deciles, ensuring that heterogeneity in labor market dynamics is consistent with the data.[14]

**Risky Firm-Ownership Status.** We assume that only workers with the discretized highest labor productivity level who are attached to the formal sector can access the ownership status with some probability $\pi^{\text{up}}$. Following Castaneda et al. (2003), we assume this "awesome" status has a shorter expected duration relative to other idiosyncratic states pinned down by the probability of losing this status $\pi^{\text{fall}}$. Conditional on falling, the probability of ending up in any of the discretized productivity level follows an exponential distribution with rate $\pi^{\text{unlucky}}$.

### 4.4.1 Self-Employed Households' Problem

Self-employed households are assumed to be informal workers, who supply labor in the informal sector. They supply their labor $\ell$ in a perfectly competitive market, where they receive the informal wage $w^s$ per efficiency units $h^s$. The self-employed households' problem is given by:

$$
\begin{aligned}
V^s(a,h) = \max_{a',\ell} \Big\{ & u(c,1-\ell) + \beta \mathbb{E}_h \left[ f_{h'} V^f(a',h') + (1-f_{h'}) V^s(a',h') \right] \Big\}, \\
\text{s.t.} \qquad & (1+\tau^c)c + a' = \underbrace{\left[1 + (1-\tau^k)r\right]}_{\equiv \tilde{R}} a + \ell w^s h^s + \tau^T, \\
& \log h' = \rho \log h + \sigma_h \epsilon'_h, \quad \epsilon'_h \overset{\text{iid}}{\sim} \mathcal{N}(\mu_h, 1), \\
& c \geq 0, \quad a' \geq 0, \quad \ell \in [0,1].
\end{aligned}
\tag{22}
$$

where $V^s$ is the value function of self-employed households, $V^f$ is the value function of formally employed households, and $\mathbb{E}_h$ is the conditional expectation operator given household's current potential productivity level $h$.

The optimal intratemporal labor choice of the self-employed solves: $\frac{w^s h^s}{1+\tau^c} \cdot u_c = u_\ell$.

### 4.4.2 Formally Employed Households' Problem

Formally employed households can supply labor in both sectors choosing the share of labor allocated to formal employment $\kappa$ and the total labor supply $\ell$. The formal-informal trade-off is generated by

[14] Worker productivity is discretized over a grid of length $n_h$ using importance sampling, which enables the model to replicate observed separation rate profiles across labor–income deciles by projecting the data-decile rates onto the discretized grid. Idiosyncratic transition rates satisfy: $\mathbb{E}\ \Delta f_h = 0$ and $\mathbb{E}\ \iota_h = \bar{\iota}$

progressive labor taxation in the formal sector and productivity differentials across the two sectors. The formally employed households' problem is given by:

$$\begin{aligned} V^f(a,h) = \max_{a',\ell,\kappa} & \left\{ u(c,1-\ell) + \beta \mathbb{E}_h \left[ \iota_{h'} V^\iota(a',h') + (1-\iota_{h'}) V^f(a',h') \right] \right\}, \\ \text{s.t.} \quad & (1+\tau^c)c + a' = \tilde{R}a + y(\kappa,\ell,h) + \tau^T + \Pi(h), \\ & y(\kappa,\ell,h) = (1-\kappa)\ell w^s h^s + \tau^L \left( \kappa \ell w^f h^f \right)^{1-\tau^P}, \\ & \log h' = \rho \log h + \sigma_h \epsilon'_h, \quad \epsilon'_h \overset{\text{iid}}{\sim} \mathcal{N}(\mu_h, 1), \\ & c \geq 0, \quad a' \geq 0, \quad (\ell,\kappa) \in [0,1]^2. \end{aligned} \tag{23}$$

Households employed in the formal sector optimal labor supply and allocation of labor between formal and informal sectors jointly solve:

$$\begin{aligned} u_\ell &= \frac{(1-\kappa)w^s h^s + \tau^L (1-\tau^P) \ell^{-\tau^P} (\kappa w^f h^f)^{1-\tau^P}}{1+\tau^c} \cdot u_c, \\ \ell w^s h^s &= \tau^L (1-\tau^P) \kappa^{-\tau^P} (w^f \ell h^f)^{1-\tau^P}. \end{aligned} \tag{24}$$

#### 4.4.3 Household's Intertemporal Optimality Conditions

Regardless of the employment status, the household's intertemporal optimality condition is given by the standard Euler equation: $u_c = \beta \tilde{R} \mathbb{E}_{h,F} u'_c$.

### 4.5 Formal Labor Agency

Formal intermediate goods are contracted through a representative labor agency that posts vacancies to hire formal workers in a frictional labor market. The labor agency is owned by risk neutral entrepreneurs and its revenues depend on the effective units of formal labor supplied: $L^f = \int \underbrace{\kappa \ell h}_{\equiv \ell^f} \, d\mu(a,h,F)$. The labor agency recursive problem is given by:

$$\begin{aligned} J(L^f) = \max_V \; & -cV + (\Omega p^f - w^f) L^f + \beta J(L^{f'}) \\ \text{s.t.} \quad & L^{f'} = \int \left[ (1-\iota_h) \mathbf{1}_{\{F=1\}} + f_h \mathbf{1}_{\{F=0\}} \right] \ell^{f'} \, d\mu(a,h,F), \end{aligned} \tag{25}$$

where $J$ is the value of the labor agency, $c$ is the cost of posting a vacancy $V$, and $\{\iota_h, f_h\}$ are the average separation and job-finding rates, respectively. The steady state equilibrium condition is

given by the zero-profit condition for the labor agency in a stationary labor market, i.e. $L^f = L^{f'}$:

$$c = \beta \frac{\left(\Omega p^f - w^f\right) L^f}{V} \tag{26}$$

The zero-profit condition (26) implies that the cost of posting one vacancy $c$ is equal to the expected average revenue from hiring a formal worker. The effect of the number of vacancy posted on the labor agency's value function is captured implicitly by the invariant measure of households in the formal sector conditional on their state $\mu(F = 1 \mid a, h;\ \theta)$ being a function of the labor market tightness.

There are two wages for formal labor in the model: $p^f$ is the wage paid by intermediate goods producers to the labor agency, and $w^f$ is the wage paid by the labor agency to formally employed households. Due to search frictions, there exists a range of wages between the reservation values of households and the labor agency. A Nash-bargaining setup would require tracking household-specific outside options and deliver a loaded wage schedule depending, under KPR-type preferences, on both wealth and productivity, substantially increasing computational complexity without clear empirical gains. We therefore adopt a minimalist wage rule that captures relative bargaining positions:[15]

$$w^f = \left(p^f\right)^{\eta} \cdot \left(w^s\right)^{1-\eta}. \tag{27}$$

### 4.6 Equilibrium

A stationary equilibrium in this economy is defined by a set of value and policy functions for the household $\left\{V(a,h,F), g^a(a,h,F), g^\ell(a,h,F), g^k(a,h,F)\right\}$, capital demand for the final good producer and labor demand for the intermediate goods $\left\{K, L^\iota, L^f\right\}$, factor prices $\left\{r, p^M, p^f, w^\iota, w^f\right\}$, a value and vacancy-posting functions for the labor agency $\{J(N), V\}$, job-finding rate and market tightness $\{f, \theta\}$, a set of government fiscal tools $\left\{\tau^c, \tau^k, \tau^L, \tau^P, \tau^T\right\}$, and an invariant cumulative distribution function of households over individual states $\mu(a,h,F)$, such that:

1. households solve their optimization problem given prices, labor market transition rates, and fiscal tools,
2. factor prices satisfy (13), (16), (15), and (27),
3. the zero-profit condition for the labor agency (26) holds,

[15] Similar wage rules are used in Gornemann et al. (2016), Den Haan et al. (2018), and Graves (2025).

4. government budget is balanced:

$$G + \tau^T = \int \left\{ T\left(g^k \circ g^\ell(a,h,F) w^f h^f\right) + \tau^c g^c + \tau^k r \cdot a \right\} d\mu(a,h,F), \tag{28}$$

5. the distribution $\mu(a,h,F)$ is stationary and satisfies all agents policy functions and aggregate consistency conditions,

6. all markets clear.

### 4.7 Market Clearing

The market clearing conditions for the economy are given by:

$$\begin{aligned} K &= \int g^a(a,h,F)\, d\mu(a,h,F), \\ L^f &= \int \left(g^k \circ g^\ell\right)(a,h,f) \cdot h^f \, d\mu(a,h,F), \\ L^s &= \int \left[\left(1 - g^k\right) \circ g^\ell\right](a,h,f) \cdot h^s \, d\mu(a,h,F), \\ Y &= \int \frac{\Pi(h)}{1-\nu} \, d\mu(a,h,F) \end{aligned} \tag{29}$$

### 4.8 Calibration

The calibration is designed to discipline the joint distribution of wealth, earnings, and consumption in order to quantify how progressive labor taxation reshapes inequality, informality, and welfare. In addition, the calibration pins down heterogeneous formal labor market frictions and a parsimonious but comprehensive fiscal policy environment consistent with Mexico's public finances.

Households have additively separable preferences over consumption and leisure with constant relative risk aversion, following the King et al. (1988) paradigm, which allows for wealth effects in labor supply decisions. Flow utility is given by

$$u(c, 1-l) = \frac{c^{1-\zeta} - 1}{1-\zeta} + \Phi \frac{(1-l)^{1-\phi} - 1}{1-\phi}. \tag{30}$$

The model is calibrated using a simulated method of moments to match aggregate and cross-sectional moments for Mexico in 2024. Calibration targets are grouped into three blocks: (i) inequality and redistribution; (ii) labor market outcomes; and (iii) fiscal variables. Table 2 reports

the targeted moments and their associated parameters, while Table 3 summarizes parameters taken from the literature or directly from the data.

**Inequality and Redistribution.** The first group of moments disciplines the cross-sectional distribution of wealth. Aggregate wealth accumulation is pinned down by the capital-to-output ratio, which identifies the discount factor. To reproduce the observed concentration of wealth at the top of the distribution, the model features a stochastic high-income ownership state following Castaneda et al. (2003). Entry into this state is restricted to top-productivity formal workers, with an access rate chosen to deliver a 1% share of owners in the stationary distribution. Conditional on entry, the expected duration of the ownership state—governed by the downward transition rate—is calibrated to match the Gini coefficient of wealth, as shorter expected durations amplify top-end wealth concentration when access to ownership is limited.

Earnings inequality is disciplined using moments that characterize both cross-sector and within-sector dispersion. Parameters governing informal-sector productivity and the mapping of idiosyncratic productivity across sectors are chosen to match the formal-to-informal average log-earnings ratio, the relative variance of log earnings across sectors, and the 20th–to–80th percentile ratio of informal earnings. These moments allow the model to reproduce the empirical formal–informal earnings patterns documented in our data, with informal earnings exhibiting lower average levels but higher dispersion than formal earnings.

Conditional on the implied wealth and earnings distributions, consumption inequality identifies the degree of progressivity in the labor-income tax schedule. Labor tax progressivity reshapes households' exposure to sector-specific earnings risk by altering the transmission of income fluctuations into disposable income. For a given level of wealth inequality, changes in progressivity therefore map directly into differences in consumption inequality. Matching the Gini coefficient of consumption thus disciplines the curvature of the labor-income tax function (1) by pinning down how much disposable-income risk households retain after redistribution.

**Labor Market Outcomes.** The calibration of the labor market block targets moments describing the allocation of workers across sectors and the flows between employment states. Parameters governing labor supply, search frictions, and wage formation are chosen to match the aggregate labor force participation rate, the informality rate, the average job-finding rate in the formal sector, and the job-finding and separation rates by labor-income decile. These moments are informative about the weight of leisure in utility, the elasticity of the formal-sector wage rule to the price of

Table 2: Calibration targets and parameter identification

| **Target** | **Data** | **Model** | **Parameter** | **Description** | **Value** |
|---|---|---|---|---|---|
| $K/Y$ | 2.44 | 2.47 | $\beta$ | discount factor | 0.91 |
| Gini wealth | 0.71 | 0.74 | $\pi^{\text{fall}}$ | transition out of owner state | 0.20 |
| avg(form./inf.) log-earnings | 0.72 | 0.71 | $\varkappa$ | informal lin. prod. technology | 0.94 |
| var(inf./form.) log-earnings | 0.35 | 0.34 | $\Xi$ | informal skills scaling | 0.81 |
| informal p20/p80 log-earnings | 0.30 | 0.27 | $\xi$ | informal skills curvature | 0.90 |
| Gini consumption | 0.41 | 0.42 | $\tau^P$ | earnings tax rate progressivity | 0.02 |
| $L = L^f + L^s$ | 0.63 | 0.67 | $\Phi$ | leisure weight in utility | 0.39 |
| informality rate | 0.55 | 0.54 | $\eta$ | formal wage rule | 0.62 |
| avg. job-finding rate | 0.09 | 0.08 | $c$ | vacancy cost | 0.06 |
| separation rates | see Fig. 7a | | $\iota_h$ | $h$-specific sep. rates | see[a] |
| job-finding rates | see Fig. 7b | | $\Delta f_h$ | $h$-specific job-f. rate diffs | see[a] |
| consumption tax revenues / Y | 0.04 | 0.03 | $\tau^c$ | consumption tax rate | 0.05 |
| income tax revenues / Y | 0.08 | 0.07 | $\tau^k$ | capital tax rate | 0.10 |
| mean-earnings avg. tax rate | 0.12 | 0.16 | $1 - \tau^L$ | average labor tax rate | 0.18 |

**Notes:** This table reports the moments targeted in the simulated-method-of-moments calibration and the corresponding parameter values. Wealth accumulation and concentration are disciplined by the capital to-output ratio and the transition dynamics of the high-income ownership state. Earnings inequality across sectors is disciplined by moments capturing differences in average earnings and dispersion between formal and informal work. Conditional on the implied wealth and earnings distributions, the curvature of the labor-income tax schedule is identified by the Gini coefficient of consumption. Data targets come from the Mexican National Survey of Occupation and Employment (ENOE), OECD Taxing Wages (OECD, 2025), and OECD Revenue Statistics (OECD, 2024).

[a] Worker productivity is discretized over a grid of length $n_h$ using importance sampling, which enables the model to replicate observed job-finding and separation rate profiles across labor–income deciles by simply projecting data-decile rates onto the discretized grid.

Table 3: Fixed parameters for the baseline economy

| Parameter | Symbol | Value | Parameter | Symbol | Value |
|---|---|---|---|---|---|
| Risk aversion | $\zeta$ | 2.00 | Income persistence | $\rho$ | 0.98 |
| Inverse Frisch elasticity | $\frac{1-L}{L}\phi^{-1}$ | 0.30 | Income st. deviation | $\sigma_h$ | 0.20 |
| Formal productivity | $\Omega$ | 1.13 | Capital depreciation | $\delta$ | 0.06 |
| Matching function TFP | $\chi$ | 0.09 | Matching function exp. | $\psi$ | 0.60 |
| Span-of-control (DRS) | $\nu$ | 0.96 | Capital share | $\alpha$ | 0.23 |
| "Awesome" upgrade | $\pi^{\text{up}}$ | 0.04 | Unlucky fall rate | $\pi^{\text{unlucky}}$ | 2.00 |
| Intermediate-good elasticity of substitution formal & informal inputs | | | | $\epsilon$ | 7.70 |

**Notes:** This table lists all parameters held fixed in the baseline calibration. Preference and income-process parameters are taken from Mexican household panel data and Leyva and Urrutia (2020). Production-side parameters follow standard values in the emerging-market macro literature. Labor-market matching parameters replicate aggregate matching rates observed in the ENOE. The probability of entering the high-income ("awesome") state and the downward transition probability $\pi^{\text{unlucky}}$ jointly discipline the 1% share of top-productivity formal workers.

the formal intermediate good, the cost of posting vacancies, and the productivity-specific slopes of job-finding and separation schedules.

**Fiscal Tools.** The level parameter governing the progressive labor-income tax function (1) is calibrated to match the observed average labor-income tax rate of 12.24%, consistent with OECD (2025). The remaining fiscal instruments $\{\tau^c, \tau^k, \tau^L, \tau^P, \tau^T\}$ are calibrated to match the structure of Mexico's public finances as reported by OECD (2024). Equilibrium government expenditure is set at 15% of GDP,[16] financed through tax revenues from consumption (4.3 pp), household income—both labor and capital—(7.9 pp), and lump-sum transfers for the remaining share.

**Fixed Parameters** The other parameters are taken from the literature or directly from the data. For the household side, we set the relative risk aversion to 2 and the leisure curvature parameter to obtain a Frisch elasticity of 0.3; see Leyva and Urrutia (2020). We estimate the idiosyncratic income process from Mexican household panel data. The covariance and variance of residualized household income yields a persistence of $\rho = 0.98$ and a standard deviation of $\sigma_h = 0.20$. For the

[16]Total public expenditure in Mexico is around 25% of GDP; the remaining 10% is financed through oil revenues, other non-tax revenues, and fiscal deficits.

firm side, we set the capital share in production, $\alpha$, to 23 percent. The depreciation rate is 1.25 percent per quarter. As in Leyva and Urrutia (2020), the productivity is 1.13 in the formal sector and the elasticity of substitution between formal and informal intermediate goods is set to 7.70. For the labor market, we set the elasticity of the matching function to 0.6, and the matching TFP to the average matching rate from the data (0.09). Parameters governing access to and exit from the ownership state are set to reproduce the concentration of wealth at the top of the distribution.

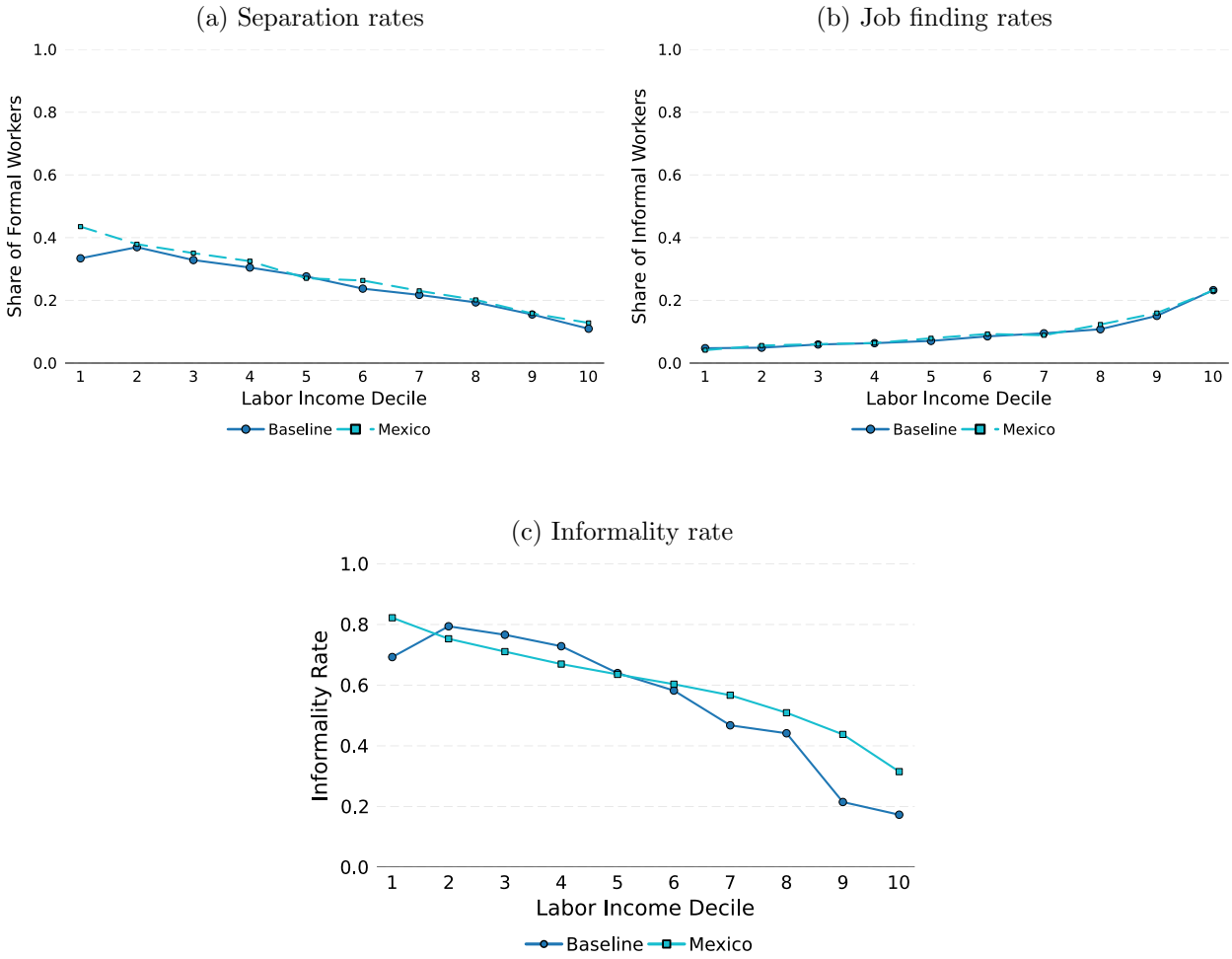
#### 4.8.1 Fit of the Baseline Economy

The baseline economy provides a quantitative benchmark for assessing the model's fit before turning to policy counterfactuals. Households face risk through idiosyncratic productivity shocks and transitions into and out of formal employment, while making labor-supply and sectoral-allocation decisions conditional on their current employment status and realized productivity. These features determine how households trade off formal and informal work, accumulate assets, and insure against income risk in the presence of progressive taxation and incomplete markets.

Figure 7 summarizes the key cross-sectional labor-market gradients that discipline the baseline calibration and motivate the policy analysis that follows. Panels 7a and 7b compare model-implied formal-sector separation and job-finding rates across labor-income deciles to their empirical counterparts in ENOE (2024). The calibration allows transition rates to vary by productivity type, and these decile profiles pin down the slope of productivity-specific separation rates ($\iota_h$) and deviations in job-finding rates ($\Delta f_h$), thereby capturing unequal attachment to formality along the earnings distribution. In the model, lower-income households face both higher separation risk and lower job-finding rates, which raises the value of informality as an option and as an insurance margin.

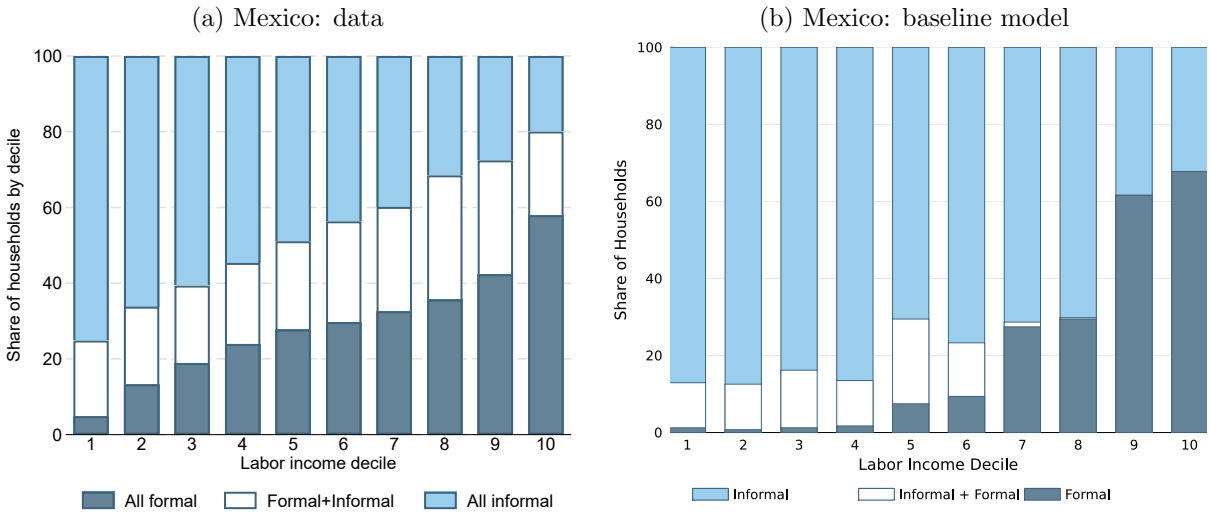
Panel 7c reports the resulting informality gradient in the baseline economy, measured as the income-decile specific informality rate $s = \int_d g^\ell \circ (1 - g^\kappa)\, d\mu(\cdot \mid y \in d)$. The model reproduces the downward slope observed in the data: informality is very high at the bottom of the earnings distribution and remains economically meaningful even at the top. This gradient is a joint implication of (i) heterogeneous formal-sector transition risk (Panels 7a–7b), which governs ex-ante access to and durability of formal jobs, and (ii) households' optimal within-period allocation of labor between taxed formal work and untaxed informal activities conditional on formal attachment. Put differently, the transition-rates discipline the *exclusion* channel at the bottom, while the household labor-allocation governs the *reallocation* margin that becomes relevant throughout the distribution.

A distinctive feature of the quantitative model is that households are allowed to allocate labor




**Notes:** This figure summarizes labor market gradients in the baseline economy vis-á-vis Mexican data. Panels 7a and 7b respectively show the job-separation and job-finding rates by labor-income decile in the baseline economy compared with ENOE (2024). Decile-specific profiles discipline the parameters governing productivity-specific separation rates ($\iota_h$) and deviations in job-finding rates across productivity types ($\Delta f_h$). Panel 7c plots the income-decile specific informality rates of the baseline economy $s = \int_d g^{\ell} \circ (1 - g^{\kappa})\, d\mu(\cdot | y \in d)$.

Figure 7: Baseline economy labor-market gradients




**Notes:** Panel 8a reports Mexican data, classifying households by whether they supply labor exclusively to the informal sector, exclusively to the formal sector, or to both sectors within the period, across labor-income deciles. Panel 8b reports the corresponding distribution in the baseline economy. In the model, classification is based on the household time-allocation choice $g^{\kappa}$: $g^{\kappa} = 0$ denotes exclusively informal work, $g^{\kappa} \geq 1/2$ formal work, and intermediate values correspond to mixed sectoral labor supply (not targeted in the calibration).

Figure 8: Joint formal–informal labor supply by income decile: data and model

supply across the formal and informal sectors within each period. This contrasts with much of the existing literature, where workers are typically restricted to supplying labor to a single sector at a time. In the model, access to informal work is frictionless, so partial allocation to the informal sector provides an insurance margin against formal-sector transition risk, particularly for households with weak attachment to formality.

Figure 8 assesses this mechanism by comparing the joint distribution of sectoral labor supply in the data and in the baseline economy. Panel 8a reports Mexican data, classifying households by whether they supply labor exclusively to the informal sector, exclusively to the formal sector, or to both sectors within the period, across labor-income deciles. A non-negligible fraction of households supply labor to both sectors throughout the distribution, with the prevalence of mixed sectoral participation declining with income. Panel 8b reports the corresponding distribution in the model, constructed using the household time-allocation across sectors choice $g^{\kappa}$, where $g^{\kappa} = 0$ denotes exclusively informal work, $g^{\kappa} \geq 1/2$ formal work, with the residual category corresponding to mixed sectoral supply.

Although this distribution is not directly targeted in the calibration, the model reproduces

its main qualitative features. In particular, mixed sectoral labor supply arises endogenously for households facing high formal-sector transition risk, but does not dominate equilibrium behavior. As income and productivity rise, households increasingly concentrate labor supply in the formal sector, reflecting both higher expected returns and stronger attachment to formal employment. The decline in mixed sectoral participation along the income distribution therefore emerges from the interaction of formal-sector frictions and productivity differences across sectors, rather than from ad hoc restrictions on household behavior.

Taken together, these results show that allowing for within-household cross-sector labor allocation introduces a quantitatively relevant insurance margin without overturning the model's core labor-market structure. Informal labor supply acts as a buffer primarily for low-income households with unstable access to formal jobs, while higher-income households optimally specialize in formal work. This mechanism helps reconcile the presence of mixed sectoral participation in the data with the persistence of strong formal–informal gradients in earnings and employment.

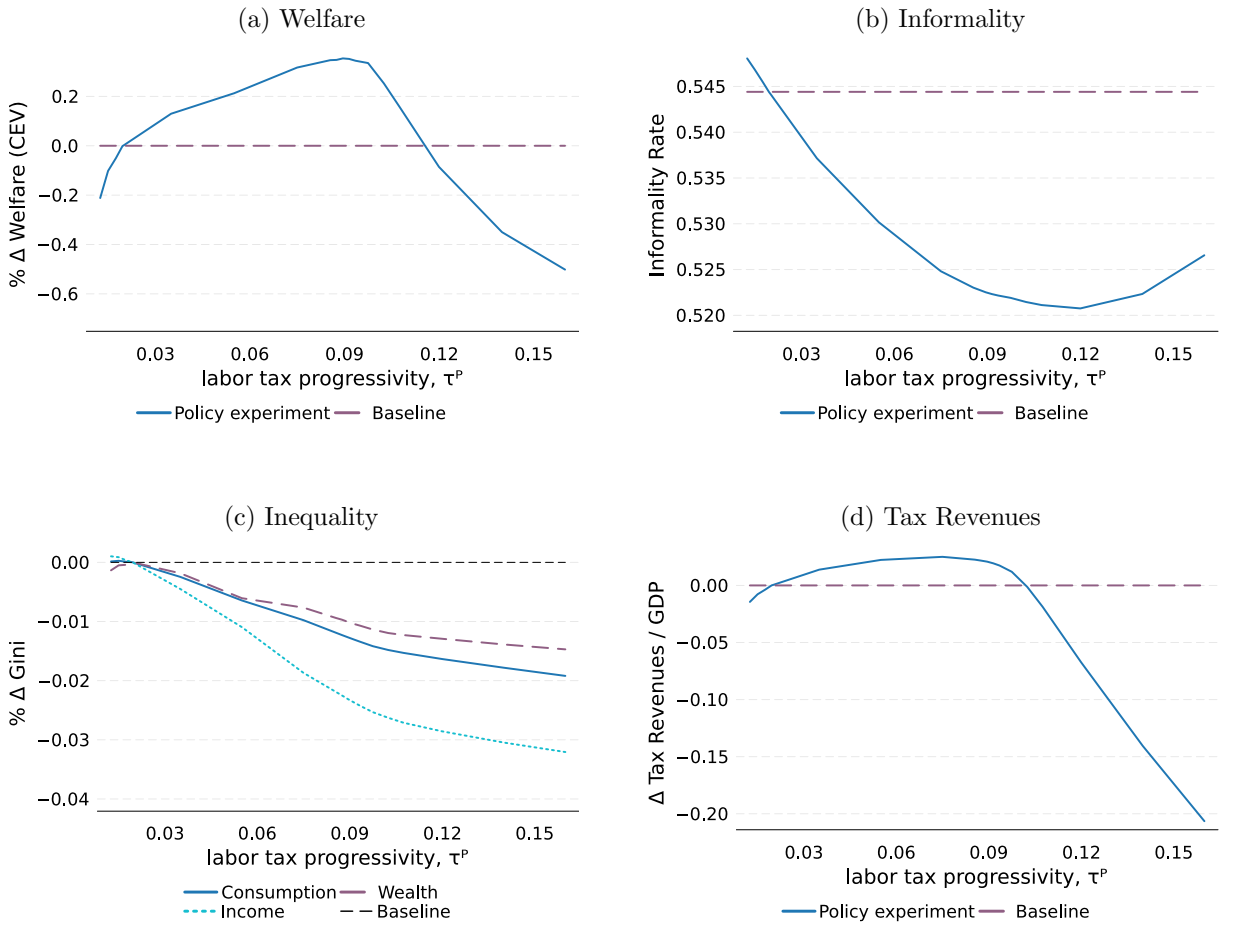
# 5 Optimal Progressivity with Informality: Quantitative Results

We run three counterfactual policy experiments. Section 5.1 varies labor tax progressivity while holding all other parameters fixed and shows that welfare is hump-shaped in progressivity, with informality moving in the opposite direction—falling at first through an *inclusion margin* at the bottom of the earnings distribution and then rising as *evasion* at the top dominates—confirming in a quantitative setting the core mechanisms of the static model (Section 3). Section 5.2 increases underlying inequality and shows that it sharpens the welfare–informality trade-off by strengthening both margins, reducing the range over which additional progressivity is welfare improving. Finally, Section 5.3 compares progressivity to other fiscal instruments: progressivity is distinctive in that, over a relevant range, it can increase welfare while expanding the formal tax base, whereas changes in average labor taxation or capital income taxation generate welfare losses even when they raise revenues.

## 5.1 Optimal Progressive Labor Taxation

We conduct our main counterfactual experiment varying the degree of labor tax progressivity $\tau^P$ while keeping all other parameters at their baseline values. To maintain a balanced government

budget, aggregate government spending $G$ adjusts endogenously.[17] Welfare is measured in units of consumption equivalent variation (CEV) relative to the baseline economy,[18] and results are summarized in Figure 9.




**Notes:** This figure reports the effects of varying labor tax progressivity parameter $\tau^P$ around the calibrated baseline ($\tau^P = 0.02$), holding all other parameters fixed while allowing aggregate government spending $G$ to adjust to balance the budget. Panel 9a shows welfare changes in consumption-equivalent variation (CEV) relative to the baseline economy. Panel 9b displays the aggregate informality rate, while Panel 9c shows the corresponding changes in Gini-index measured inequality along consumption, income, and wealth. Panel 9d plots changes in total tax revenues as a share of GDP.

Figure 9: Policy counterfactuals: welfare, informality, inequality, and tax revenues

Welfare is hump-shaped in progressivity (Panel 9a), peaking at $\tau^P \approx 0.09$—almost five times

[17] Appendix C presents an alternative experiment in which the lump-sum transfer $\tau^T$ is adjusted instead, keeping the government spending share $G/Y$ constant. Under this alternative closure, labor-market responses remain very similar to those in the baseline experiment.

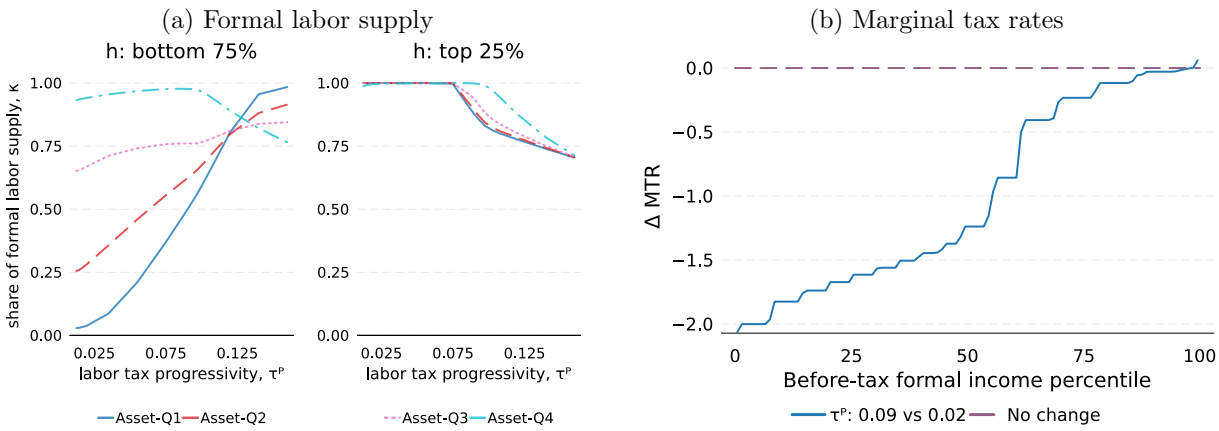
[18] CEV comparisons abstract from the utility component of leisure.

the calibrated baseline of about 0.02. This non-monotonicity is the quantitative counterpart of the static mechanism: at low progressivity, redistribution and consumption-smoothing gains dominate, while at high progressivity the contraction of the formal tax base reduces output and welfare (Section 3.2.1). A distinct feature of the quantitative environment is that the welfare-maximizing and formality-maximizing levels of progressivity do not perfectly coincide: formality peaks slightly later, at $\tau^P \approx 0.12$, because bringing lower-productivity workers into formality lowers average formal productivity and attenuates the welfare gains from further formalization.

Informality traces a U-shaped pattern as progressivity rises (Panel 9b). Moderate increases in $\tau^P$ reduce informality through an *inclusion margin*: negative effective tax rates lower the relative tax burden on low-income workers and raise formal attachment at the bottom of the earnings distribution. Beyond a threshold, informality increases as the *evasion margin* becomes dominant: higher marginal tax rates induce high-productivity households to reallocate labor effort toward untaxed informal activities, eroding the formal tax base. The quantitative model thus preserves the inclusion–evasion logic of the static framework while embedding it in a setting with search frictions, savings, and endogenous sectoral labor allocation.

Higher progressivity monotonically reduces inequality (Panel 9c), with the largest decline for consumption inequality, reflecting both redistribution and improved insurance once low-income households become formally attached. Fiscal effects are non-monotone (Panel 9d): revenues as a share of GDP initially rise with progressivity but eventually fall once the evasion margin dominates and the formal employment base contracts. As a result, the welfare-maximizing degree of progressivity lies above the revenue-maximizing level.

The mechanisms underlying these results are illustrated in Figure 10. Panel 10a decomposes changes in formal labor supply across the asset and productivity distributions. Households in the lower part of the productivity distribution—especially those with low assets—expand formal labor supply as progressivity rises, reflecting the inclusion margin induced by negative effective tax rates. By contrast, high-productivity households respond little at low levels of progressivity but gradually reduce formal labor supply at higher $\tau^P$, reallocating effort toward informal activities. Panel 10b complements this evidence by showing the marginal tax rate schedules associated with the baseline and welfare-maximizing tax systems. At the welfare-maximizing $\tau^P$, marginal tax rates are negative over a non-trivial range of the lower income distribution, while remaining moderate at the top. Therefore, the top earners are responsible for the overall increase in the tax base, as depicted in Figure 9.




**Notes:** This figure illustrates the mechanisms behind the effects of labor tax progressivity in the counterfactual fiscal experiment. Panel 10a shows the changes in formal labor supply across the asset and productivity distributions. Panel 10b shows the change in marginal tax rates for two values of the policy parameter $\tau^P$ (welfare-maximizing vs baseline) along the income distribution.

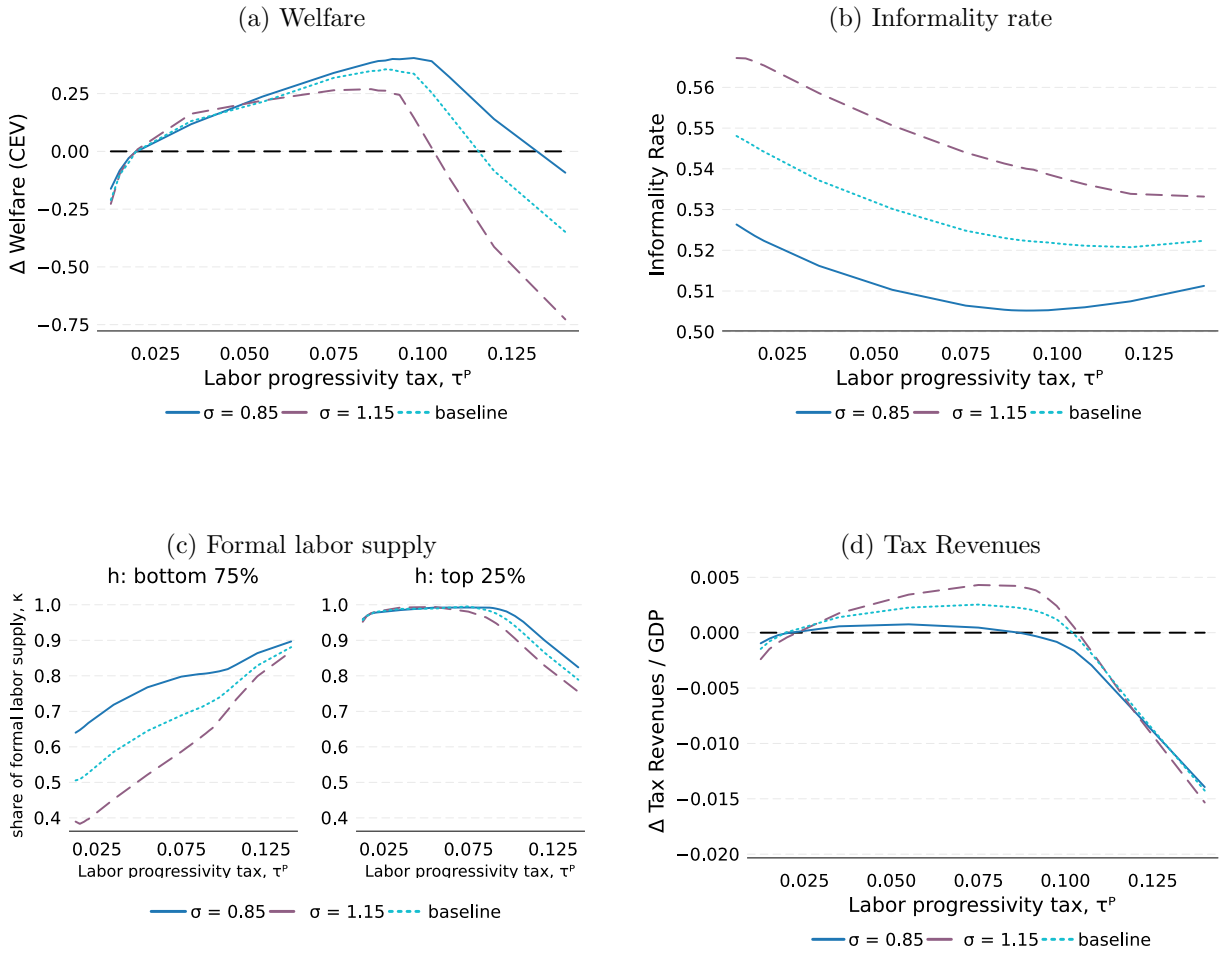
Figure 10: Policy counterfactuals: mechanism

## 5.2 Inequality and Optimal Progressivity

We now study how underlying inequality shapes the welfare and allocation effects of labor tax progressivity. In the quantitative model, inequality is governed by the dispersion of idiosyncratic productivity shocks across households. Given the productivity process in (21), long-run inequality in productivity is summarized by the volatility of log productivity, $\sigma_{LR} = \sigma_h/\sqrt{1-\rho^2}$. In the baseline calibration, $\sigma_{LR}^{\text{base}} = 1.00$. Figure 11 compares policy counterfactuals across three economies that differ only in this dimension: a low-inequality economy with $\sigma_{LR}^{\text{low}} = 0.85$, the baseline economy, and a high-inequality economy with $\sigma_{LR}^{\text{high}} = 1.15$, holding all other structural parameters fixed.

Differences in $\sigma_{LR}$ generate sizable differences in cross-sectional inequality across the three economies. At the baseline tax system, moving from the low- to the high-inequality economy raises the Gini coefficient of labor income from 0.37 to 0.48, while the Gini coefficient of wealth falls from 0.78 to 0.71.[19] On the other hand, consumption inequality rises sharply, with the variance of log consumption increasing from 0.51 to 0.90 when moving from $\sigma_{LR}^{\text{low}}$ to $\sigma_{LR}^{\text{high}}$. These changes reflect greater dispersion in lifetime earnings and weaker self-insurance when idiosyncratic productivity risk—and hence inequality—is higher.

[19] Higher idiosyncratic risk strengthens precautionary saving incentives throughout the distribution. In general equilibrium, however, lower equilibrium interest rates (Aiyagari, 1994; Huggett, 1996), combined with accumulation dynamics (Benhabib et al., 2011), disproportionately dampen wealth accumulation at the top, which can compress the right tail of the wealth distribution.




**Notes:** This figure compares the effects of changing labor tax progressivity $\tau^P$ across three economies that differ in the long-run volatility of idiosyncratic log-productivity, $\sigma_{LR} = \sigma_h/\sqrt{1-\rho^2}$ (21), while sharing the same structural parameters otherwise. Panel 11a reports welfare changes in CEV units relative to each economy's baseline with its own $\sigma_{LR}$. Panels 11b and 11c display the corresponding responses of aggregate informality and formal labor supply, respectively, as progressivity varies. Panel 11d shows the implied changes in total tax revenues as a share of GDP for each level of idiosyncratic risk.

Figure 11: Policy counterfactuals: welfare and informality

Welfare remains hump-shaped in $\tau^P$ across all three economies, but the profile becomes substantially steeper when inequality is higher (Panel 11a). In high-inequality economies, welfare rises faster at low progressivity and falls more sharply beyond the peak. This pattern reflects stronger sectoral reallocation responses at both ends of the productivity distribution: the gains from increasing progressivity are front-loaded, while the costs of further increases materialize sooner. Accordingly, the welfare-maximizing degree of progressivity is slightly lower in the high-inequality economy than in the low-inequality one, and the range over which progressivity is welfare improving is narrower.

The allocation mechanisms behind this steeper welfare profile are shown in Panels 11b and 11c. Higher inequality is associated with higher average informality, reflecting a larger mass of low-productivity households with weak formal attachment. At the same time, changes in progressivity trigger stronger responses at both margins: negative effective tax rates generate a sharper increase in formal attachment among low-productivity households (a stronger inclusion margin), while formal labor supply at the top becomes more sensitive to marginal taxation (a stronger evasion margin). Together, these forces imply larger reallocations for a given increase in $\tau^P$ when inequality is higher.

Fiscal outcomes mirror this interaction (Panel 11d). Changes in tax revenues are quantitatively larger in high-inequality economies, both for small increases in progressivity and for larger deviations from the baseline. This reflects a level effect—greater dispersion increases the concentration of taxable income—and a composition effect, as formal labor supply at the top responds more elastically to marginal taxation. As a result, revenues become more sensitive to progressivity when inequality is higher, reinforcing the steeper welfare profile.

Despite these differences, the distributional effects of progressivity at each economy's welfare optimum are similar across economies. Moving from the baseline tax system to the welfare-maximizing degree of progressivity reduces labor-income Gini coefficient by about one percentage point and lowers consumption risk, measured by the variance of log consumption, by roughly 0.01–0.02 in all three cases. Thus, higher volatility in idiosyncratic productivity raises the level of inequality that progressive taxation partially offsets, but it does not generate disproportionately larger inequality reductions at the welfare-maximizing policy.

Overall, higher inequality sharpens the welfare–informality trade-off without overturning it. In environments where inequality reflects greater residual income risk, standard optimal-tax arguments would predict higher progressivity, as redistribution and insurance motives strengthen (e.g., Heathcote et al., 2020). In our setting, however, the presence of an untaxed informal sector introduces an endogenous evasion margin that operates in the opposite direction. As inequality rises, both inclu-

sion and evasion responses strengthen, so that welfare gains from progressivity accrue more quickly at low levels of progressivity but dissipate sooner as progressivity increases further. Consequently, higher inequality does not translate into substantially higher optimal progressivity once informal labor supply is taken into account.

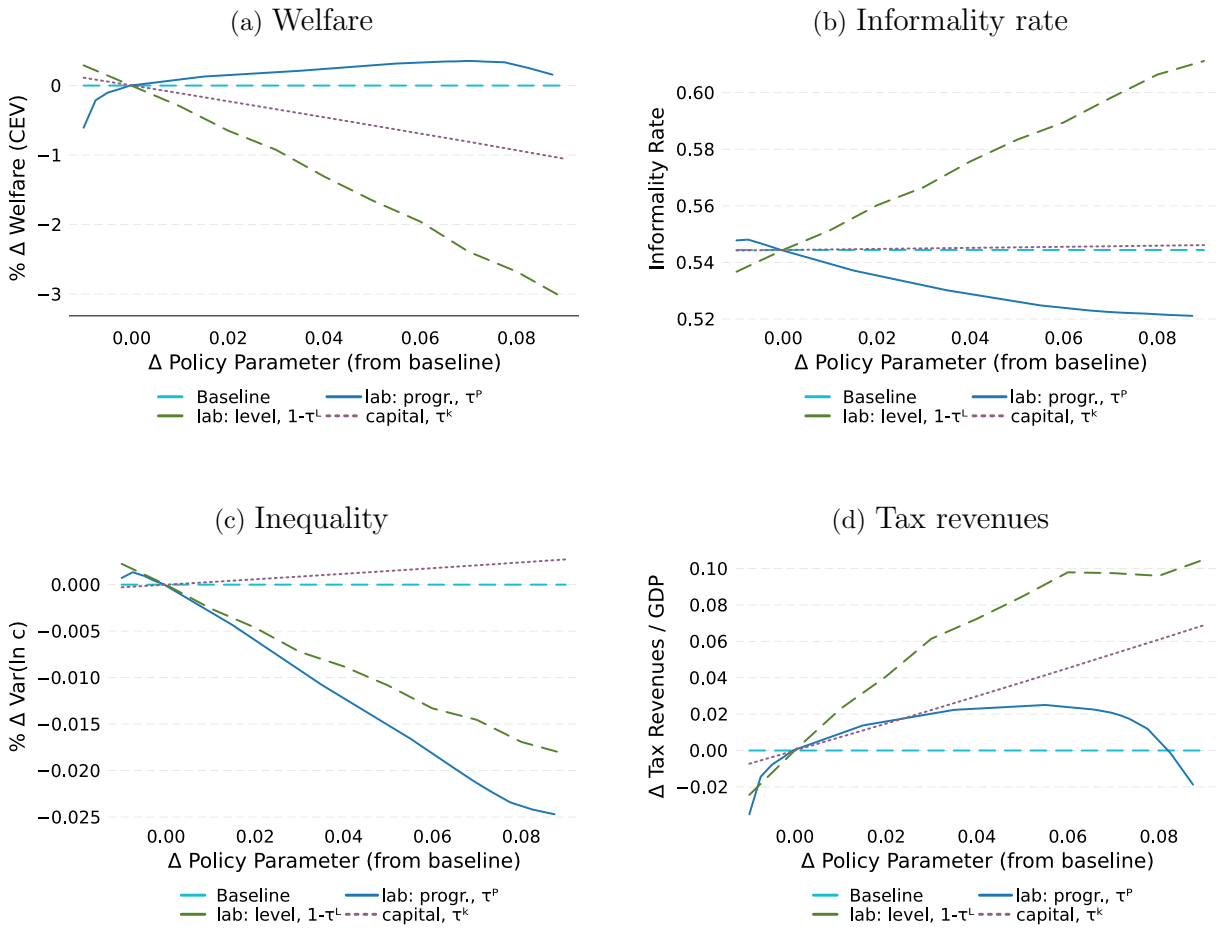
### 5.3 Comparative Fiscal Experiments

Figure 12 compares labor tax progressivity to other income-related fiscal instruments available in the quantitative model. While Section 5.1 focused on the effects of varying progressivity alone, this subsection asks whether similar welfare gains can be achieved by adjusting the level of labor taxation or capital income taxation instead.

Panel 12a shows a stark contrast across instruments. Only increases in labor tax progressivity ($\tau^P$) generate welfare gains relative to the baseline. In contrast, increases in the average labor tax rate ($1 - \tau^L$) or in the capital income tax ($\tau^k$) uniformly reduce welfare. These welfare losses arise because level taxes distort households' labor-supply and sectoral-allocation decisions without activating the inclusion margin that draws low-income households into formal employment. In the case of capital taxation, higher taxes directly reduce disposable income and distort savings incentives without affecting formal attachment.

Panels 12b and 12c highlight the labor-market and distributional channels behind these results. As in Section 5.1, raising labor tax progressivity generates a non-monotonic informality response, reflecting inclusion at the bottom and evasion at the top of the earnings distribution. By contrast, increasing the average labor tax rate ($1 - \tau^L$) raises informality monotonically: higher tax pressure weakens incentives to supply formal labor throughout the distribution. Although higher average labor taxes reduce consumption inequality (Panel 12c), these gains come at the cost of higher informality and lower aggregate efficiency. Capital income taxation has negligible effects on informality and consumption risk because it does not directly affect households' formal–informal labor choices.

Fiscal implications are reported in Panel 12d. Higher progressivity raises tax revenues as a share of GDP at low and intermediate levels, but revenues eventually decline once rising informality erodes the formal tax base. Changing the average labor tax rate ($1 - \tau^L$) yields a different pattern: revenues increase initially but flatten around $\Delta(1 - \tau^L) \approx 0.06$ relative to the baseline. This plateau reflects an endogenous contraction of the formal tax base driven by behavioral responses among high-productivity households, who gradually reduce formal labor supply and reallocate effort toward informal activities. Further increases in ($1 - \tau^L$) therefore generate little additional revenue




**Notes:** This figure compares policy counterfactuals in which each income-related tax instrument is varied individually: labor tax progressivity ($\tau^P$), the average labor tax rate ($1-\tau^L$), and the capital income tax ($\tau^k$). All other parameters are kept at their baseline values, and vertical markers indicate the calibrated baselines for each tax. Panel 12a shows welfare changes in CEV units relative to the baseline. Panels 12b and 12c report the associated responses of inequality measured by population variance of log-consumption. Panel 12d displays the resulting changes in total tax revenues as a share of GDP for each tax experiment.

Figure 12: Policy counterfactuals: comparative fiscal experiments

despite substantially larger distortions. Capital income taxation raises revenues monotonically over the explored range, but (Panel 12a) these gains come with welfare losses, reflecting lower disposable income and distorted saving incentives rather than improved labor-market allocation or insurance.

Overall, the comparative experiments underscore that labor tax progressivity is uniquely effective among these income-related instruments. Over a relevant range, it is the only policy that can raise welfare while expanding revenues and improving labor-market allocation, precisely because it activates the inclusion margin that is absent under level labor taxation and capital income taxation. In contrast, higher average labor taxes and capital income taxes raise revenue primarily through distortionary channels, generating welfare losses despite limited distributional gains.

# 6 Conclusion

This paper studies progressive labor taxation with informality. Using household survey data from Brazil, Colombia, Mexico, and Peru, we document sharp gradients in informality and labor market outcomes across the earnings distribution, implying heterogeneous attachment to formality. We then develop a heterogeneous-agent model with search frictions in which informality by income emerges endogenously from optimal household decisions. Progressivity operates through two opposing forces: negative income taxes draw low earners into the tax base (inclusion margin), while rising marginal rates push high earners toward the untaxed sector (evasion margin). Both welfare and formality are hump-shaped in progressivity, generating an interior optimum. In a model calibrated to Mexico, raising the progressivity parameter fivefold is optimal and robust to varying inequality.

A large literature emphasizes that firms choose whether to operate formally or informally based on regulatory costs, enforcement intensity, and access to credit. We focus instead on the household margin: given a menu of formal and informal job opportunities, how do workers sort across sectors? This perspective is well suited to studying labor income taxation, where the incidence falls directly on workers. A related limitation is that our framework treats formal-sector access as unconstrained on the supply side. In practice, insufficient formal job creation—due to entry costs, regulations, or credit frictions—may ration workers out of the formal sector, so that informality reflects exclusion rather than choice. Integrating firm heterogeneity and formal job creation with the household margin is an important direction for future research.

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# A Data Sources

In this appendix, we discuss the sources of information to construct labor market indicators and inequality, and the details entailed in each general definition. Overall, our main sources of information are household surveys for Brazil, Colombia, Mexico and Peru. In what follows, we describe some considerations for the construction of the statistics used throughout the paper. In all countries, we restrict our samples to people age 15 and older.

## A.1 Brazil

The main source of data for the analysis of labor market outcomes over the income distribution is the *Pesquisa Nacional por Amostra de Domicilios Continua* (PNADC) carried out by the Brazilian Statistics Bureau (IBGE). The PNADC is a nationally representative survey of Brazilian households that provides information of the characteristics of the households and their members, and their labor market status. All households in the PNADC are interviewed by five consecutive quarters. The current version of the PNADC has run continuously since 2012, and the data are publicly available on the IBGE website.

Throughout the paper (see Section 2), we use information of labor force participation, employment, and unemployment, formality status (formal or informal) and labor earnings. Labor force status follows standard classification used by the IBGE and is available for all people age 14 and older.[20] For those employed, the survey asks questions to characterize the job. We proxy formality status based on a definition used by the IBGE (IBGE, 2020). Using the worker's main job, a worker is considered a formal-sector worker if he or she works for a person or a firm and reports having a registered job, which in Brazil is mandatory and implies having a work card (*carteira de trabalho*) signed by the workers' employer. For self-employed workers and employers, we define the formality status based on whether they have their businesses registered with the tax authorities (CNPJ).

The PNADC also collects information about the workers' labor earnings. Information about self-reported earnings for all jobs (including salaried and independent work) and refers to monthly earnings. Earnings are in current Brazilian Reais (BRL$).

[20] The definitions among countries are very similar and resemble those used by the US Current Population Survey.

## A.2 Colombia

The source of data for Colombian labor market is the *Gran Encuesta Integrada de Hogares* (GEIH) carried out by the Colombian Statistics Bureau (DANE). The GEIH is a national representative survey that collects information of labor market outcomes and social conditions of the households. It is the official source of employment statistics, incidence of monetary poverty and income inequality. The GEIH is a repeated cross section dataset collected monthly and has run continuously since 2008. Data are publicly available in the DANE website.

We define the labor force status following DANE's standard definitions, which are available for all people age 12 and older (10 and older in rural areas). We use DANE's official definition for informal employment, which defines an informal worker as a person who either works in small production units (up to five workers), excluding public-sector workers and professional self-employed (DANE, 2009). This definition applies for all workers. Although the official statistics is reported for urban areas only, we also apply the definition of informality for workers in rural areas.

Regarding labor earnings, we use monthly labor earnings from the main job, reported in Colombian Pesos (COP$).

In contrast to the other countries, the GEIH is a repeated cross section dataset, which implies that is not possible to follow individuals over time to get labor market transitions by comparing individuals over time. Nonetheless, the GEIH includes retrospective questions (e.g., tenure on the job, the type of job the person had before, how many weeks an unemployed person has been looking for a job and so on) that allow to infer labor transitions.

## A.3 Mexico

The main source of data for Mexico is the *Encuesta Nacional de Ocupación y Empleo* (ENOE) carried out by the Mexican Statistics Bureau (INEGI). The ENOE is a nationally representative survey of Mexican households used to characterize their labor market outcomes. The survey is the official source of labor force statistics. In contrast to other datasets used in this analysis, the ENOE is not the dataset used to measure monetary poverty and income inequality. As in the case of Brazil's PNADC, the ENOE interviews all households by five consecutive quarters. The ENOE has run continuously since 2005. Data are publicly available on the INEGI website.

In the information of labor market status (employed, unemployed, out of the labor force) we follow the classification elaborated by INEGI. The data about labor market outcomes are available for all people age 12 and older, however, official statistics are reported for people age 15 and more

only. Regarding the informality definition, the ENOE contains a variable to classify workers between formal and informal employment. As in the case of Colombia, the definition in Mexico follows the guidelines proposed by the International Labor Organization for the measurement of informal employment (ILO, 2003). Broadly speaking, an informal worker is a person working in a job outside the scope of government regulation – and therefore is unprotected by labor legislation – either because he or she works in a small, low-productivity unit (typically unincorporated, including self-employment and subsistence activities), his or her job are uncovered by the law, or their employer keep his or her job off-the-books (INEGI, 2014). Compared to Colombia and Brazil, the operational definition of informality in Mexico is more detailed, as it includes specific questions to characterize the features of an informal job.

We use monthly labor earnings from the main job, reported in Mexican Pesos (MXN$).

### A.4 Peru

The main source of data for Peru is the Encuesta Nacional de Hogares (ENAHO) carried out by the Peruvian Statistics Bureau (INEI). The ENAHO is a nationally representative survey of Peruvian households used to characterize labor market outcomes, and households' living standards. It is the official source of employment statistics, incidence of monetary poverty and household income inequality. The ENAHO has a mixed structure in which a subsample of households (about 25% of total) are interviewed every year for up to five years. ENAHO data are available continuously since 2008. Data are publicly available in the INEI website.

Information about labor market outcomes is available for all people age 14 and older, and we follow the classification made by the INEI. As in the case of the ENOE in Mexico, the ENAHO includes detailed information that allow to classify an informal worker depending on the type of production unit they work and whether they are covered by labor regulation.

The ENAHO collects information about the workers' labor earnings in all jobs to compute measures of annual labor earnings. Throughout the paper, we take this measure of annual labor earnings divided by 12 to get a measure of monthly labor earnings. Earnings are in current Peruvian Soles (PEN$).

# B Inequality and Informality

Several confounding variables, such as income levels or human capital in a country, might influence the relationship between inequality and informality. A thorough analysis of this relationship is beyond the scope of this document; here, we simply compare the relationship between the Gini index of income inequality reported by the World Bank with informality measures produced and updated by Kose et al. (2021). Given its multidimensional nature, we employ multiple direct and indirect estimation methods to account for the difficulty in measuring informality. We focus on measures with sufficient variation across countries and time.

The analysis includes two indirect measures: The general equilibrium model (*DGE*) and the multiple indicator multiple causes model (*MIMIC*). The *DGE* model estimates the size of the informal economy as a percentage of GDP using the approach in Elgin and Oztunali (2012), which is available for 158 countries. The *MIMIC* model measures the size of the informal sector as a percentage of GDP using the model of Schneider et al. (2010), available for 160 countries.

We also include two direct measures of informality based on country surveys. The first measure is the share of self-employment in total employment (*Self-Emp*). This category encompasses four sub-categories of jobs: employers, own-account workers, members of producers cooperatives, and contributing family workers. The share of *Self-Emp* is obtained from the labor force and household surveys for a sample of 180 countries. The second direct measure corresponds to the share of informal employment in percent of total employment (*Informal-Emp*), obtained from household and labor surveys and available for 72 countries.

Figure B.1 presents the cross-sectional scatter plot between the Gini index average and the four inequality measures from 2002 to 2022. In general, we observe a positive correlation between inequality and indirect measures of informality and the share of self-employment, as observed in Panels A to C. However, there is no correlation between inequality and the measure of informal employment. However, it is important to point out that the number of observations for this variable is more limited relative to the other measures.

Finally, taking advantage of the historical variation, we conduct a panel regression with and without fixed effects for each informality measure on the Gini coefficient. The results reported in Table B.1 corroborate the positive and significant correlation between inequality and informality. However, unlike the previous exercise, we found a positive and significant correlation between the share of informal employment over total employment and inequality after controlling for country


Figure B.1: Cross-Sectional Correlations Inequality and Informality

Table B.1: Historical Correlations Between Inequality and Informality: 1990-2022

| | Informality Measures | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Indirect | | | | Direct | | | |
| | *DGE* | | *MIMIC* | | *Self-Emp* | | *Informal-Emp* | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Gini Index | 0.636*** | 0.222*** | 0.688*** | 0.215*** | 1.017*** | 0.105 | 0.415 | 0.939** |
| | (0.13) | (0.05) | (0.14) | (0.03) | (0.14) | (0.12) | (0.33) | (0.42) |
| Observations | 1746 | 1746 | 1673 | 1673 | 1530 | 1530 | 329 | 329 |
| Country FE | No | Yes | No | Yes | No | Yes | No | Yes |

Notes: DGE=Dynamic General Equilibrium Model. MIMIC= Multiple Indicators Multiple Causes Model. Self-Emp=Self employment. Informal-Emp= Informal employment.

Source: World Development Indicators (World Bank) and Kose et al. (2021).

effects, as reported in column (6).

# C Additional Model Results

This appendix reports additional results from the quantitative model. Section C.1 repeats the labor tax progressivity experiment with lump-sum transfers adjusting to balance the government budget, yielding the same qualitative patterns but larger welfare effects. Section C.2 presents results from an economy with homogeneous labor-market transitions, showing that the negative informality profile over the income distribution persists even without skill-specific transition rates.

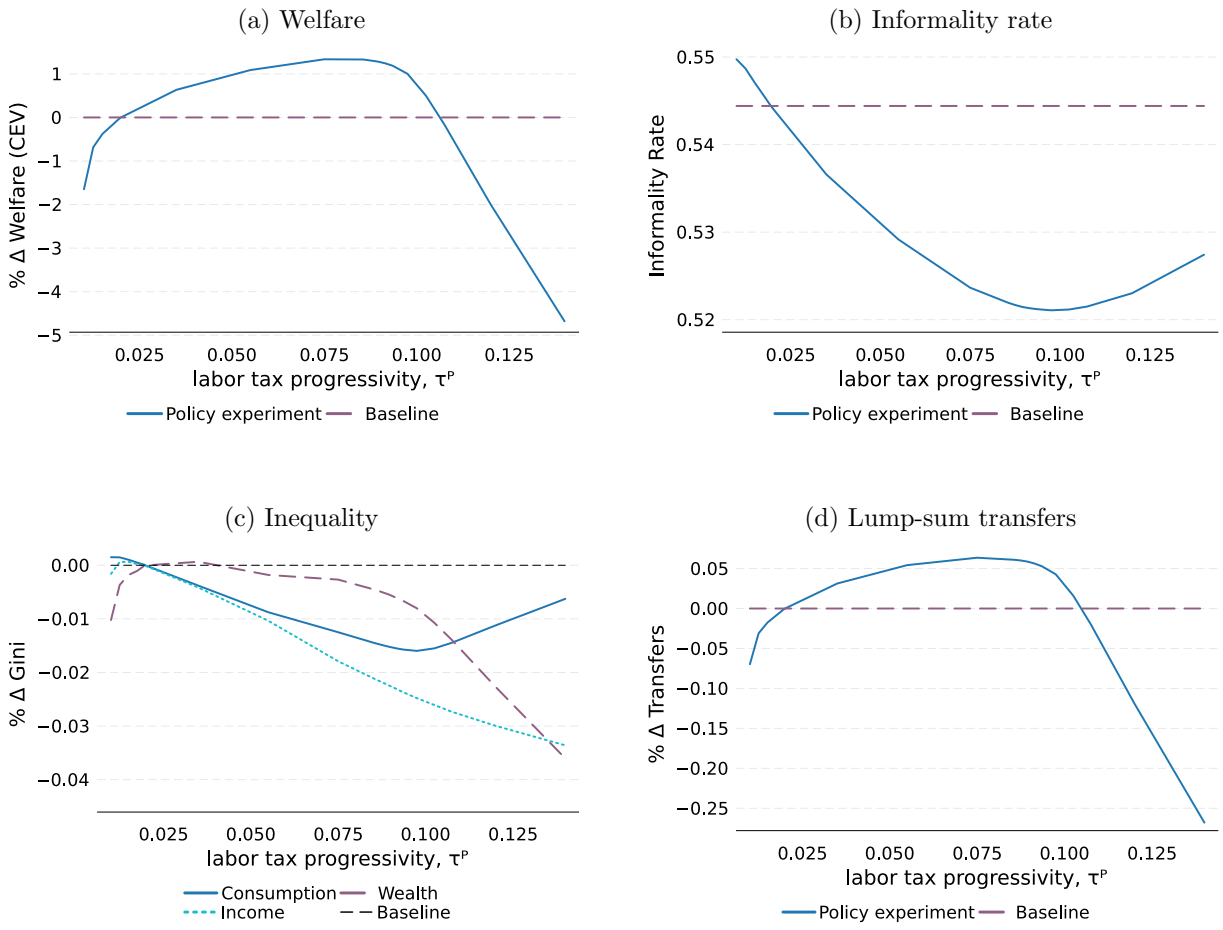
## C.1 Alternative Fiscal Adjustment: Lump-Sum Transfers

Figure C.1 reports the results of repeating the labor tax progressivity experiment from Section 5.1 under an alternative fiscal adjustment, where changes in tax revenues are rebated directly to households through lump-sum transfers rather than offset by variations in government spending. The qualitative patterns are identical to those in the baseline experiment: welfare, informality, and inequality display the same non-monotonic responses to increasing labor tax progressivity. The main difference lies in the magnitude of welfare effects, which are uniformly larger when tax revenues are rebated. By returning additional revenues to households, the adjustment through lump-sum transfers amplifies both the welfare gains at moderate progressivity levels and the welfare losses beyond the optimal range.

The similarity across Figures 9 and C.1 highlights an important feature of the quantitative model. Unlike in the analytical framework of Section 3, lump-sum transfers do not directly affect households' incentives on the formal–informal labor margin. In the quantitative model, formal labor effort is not itself risky: conditional on being formally employed, households choose labor supply after idiosyncratic productivity is realized and face no uncertainty in returns to effort. Consequently, rebating additional tax revenues through lump-sum transfers primarily affects welfare through consumption smoothing and savings decisions, while leaving sectoral labor allocation largely unchanged. This explains why adjusting the government budget through transfers rather than government spending alters the magnitude of welfare gains but leaves the responses of informality and formal labor supply essentially identical across the two experiments.

## C.2 Homogeneous Labor-Market Transitions

Figure C.2 reports results for an economy in which all workers face identical formal-sector labor market dynamics. Panels C.2c and C.2d show the flat profiles of separation and job-finding rates




**Notes:** This figure reports the effects of changing labor tax progressivity $\tau^P$ when the government budget is balanced through lump-sum transfers rather than changes in government spending. Panel C.1a shows welfare changes in consumption-equivalent variation (CEV) relative to the baseline calibration. Panel C.1b displays deviations in the aggregate informality rate, and Panel C.1c shows the corresponding response of consumption, income, and wealth inequality. Panel C.1d plots changes in the equilibrium lump-sum transfer, which adjusts endogenously to rebate tax-revenue changes back to households.

Figure C.1: Policy counterfactuals: welfare, informality, formal labor supply, and tax revenues

across the labor-income distribution, confirming the absence of skill-dependent transition probabilities. As a consequence, the distribution of productivity across sectors skews marginally towards the informal sector with respect to the baseline economy, as shown in Panel C.2b. Low-skilled households now face more favorable transition rates and the opposite happens to high-skilled ones; this improves labor productivity in the informal sector and lowers it in the formal one.

Importantly, even under these homogeneous labor market conditions, the model continues to generate a downward-sloping informality rate over the labor-income distribution. This outcome reflects the optimal labor supply and sectoral allocation implied by households' intratemporal first-order conditions (24). Sectoral labor supply responds to household-specific incentives, particularly among low-productivity workers, whose higher wealth-effect elasticities amplify the reallocation margin between formal and informal activities. In contrast, the profile of informality flattens in the upper tail of the income distribution, where the absence of skill-specific transition rates limits further reallocation toward the formal sector.

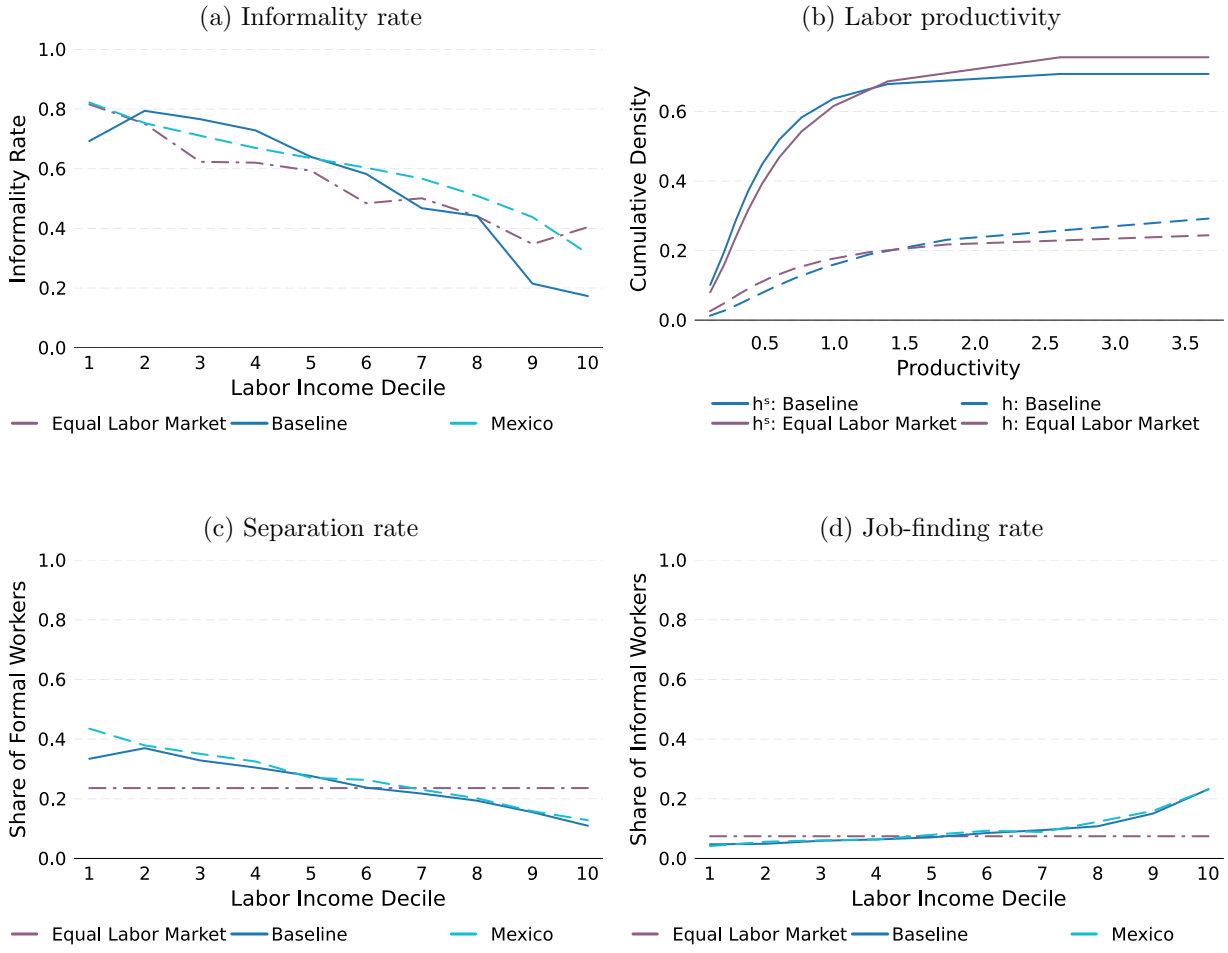
### C.3 Comparative Statics in the Analytical Model

This section reports comparative statics from the analytical model of Section 3, examining how structural features of the economy shape optimal progressivity.

Table C.1 reports simulation results for the baseline economy, varying parameters that determine inequality and informality. Panels A and B examine optimal progressivity under different levels of government expenditure and unemployment risk. Panel C considers lump-sum transfers.

Higher public financing needs and higher unemployment risk lead to higher informality and lower welfare, while lowering optimal progressivity. Lower government expenditure and lower unemployment risk lead to higher welfare-maximizing progressive tax rates $\tau^P$, ranging between 28% and 31%.

Panel C considers progressive taxation with lump-sum transfer programs providing 1% or 2% of GDP to all households. Scenarios with transfers exhibit higher welfare, as transfers act as a safety net for low-ability households and as insurance for those not excluded from the formal sector. The welfare-maximizing progressive tax rates tend to be slightly lower with transfers, but the ex post earnings distribution is more egalitarian and overall welfare is higher.




**Notes:** This figure compares the baseline economy with an alternative specification in which all workers face identical formal-sector transition rates. Panel C.2a shows the informality rate across the labor-income distribution in the two economies. Panel C.2b reports the resulting sectoral distributions of labor productivity, highlighting the more homogeneous allocation of productivity when transition rates are identical. Panels C.2c and C.2d display separation and job-finding rates by income decile, confirming that the alternative economy features flat profiles by construction, in contrast with the slope present in the baseline calibration.

Figure C.2: Informality rate, productivity distribution, and formal-sector transition rates

Table C.1: Effects of progressive fiscal policy: comparative statics

| | Optimal policy | | Welfare | Ex-post Gini | Informality | | |
|---|---|---|---|---|---|---|---|
| | $\tau^P$ | $\tau^L$ | | | Average | Bottom 25 | Top 25 |
| Baseline | 0.24 | 0.834 | -0.839 | 0.468 | 0.542 | 0.837 | 0.259 |
| A: Government expenditure to GDP ratio, $G/Y$ (Baseline 0.15) | | | | | | | |
| 0.10 | 0.28 | 0.893 | -0.782 | 0.431 | 0.494 | 0.746 | 0.269 |
| 0.20 | 0.20 | 0.762 | -0.899 | 0.501 | 0.606 | 0.920 | 0.259 |
| B: Unemployment risk, $q$ (Baseline 0.06) | | | | | | | |
| 0.01 | 0.31 | 0.879 | -0.701 | 0.396 | 0.400 | 0.705 | 0.111 |
| 0.10 | 0.21 | 0.803 | -0.914 | 0.504 | 0.625 | 0.898 | 0.344 |
| C: Lump-sum transfers as a fraction of GDP, $\tau^T/Y$ (Baseline 0.0) | | | | | | | |
| 0.01 | 0.23 | 0.821 | -0.830 | 0.467 | 0.550 | 0.857 | 0.250 |
| 0.02 | 0.22 | 0.808 | -0.823 | 0.463 | 0.560 | 0.876 | 0.242 |

**Notes:** This table presents the welfare-maximizing progressive tax rate $\tau^P$ under different structural characteristics of the economy, using the analytical model of Section 3. The proportional tax rate $\tau^L$ adjusts to match a given level of government expenditure. Panel A varies the government expenditure to output ratio ($G/Y$), Panel B varies unemployment risk ($q$), and Panel C introduces lump-sum transfers. Baseline parameters: $q = 0.06$, $\tau^L = 0.8$, $G/Y = 0.15$, $\epsilon = 7.65$, and $\sigma_h = 1$.