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ABSTRACT

What are the most efficient means of redistribution in an unequal economy? We answer this question by characterizing the optimal shape of non-linear income and wealth taxes in a dynamic general equilibrium model with uninsurable idiosyncratic risk. Our analysis reproduces the distribution of income and wealth in the United States and explicitly takes into account the long-lived transition dynamics after policy reforms. We find that a uniform flat tax on capital and labor income combined with a lump-sum transfer is nearly optimal. Though allowing for increasing marginal income and wealth taxes raises welfare, the incremental gains are small due to strong behavioral and general equilibrium effects. This result is robust to changing household preferences, the distribution of ability, the planner's preference for redistribution, as well as to explicitly modeling private business ownership and the ensuing heterogeneity in rates of return.

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1 Introduction

Increased income and wealth inequality is a pressing economic concern in the United States and the rest of the world. This concern has led to numerous calls for redistribution using more progressive income and wealth taxes. Since redistribution through taxes and transfers entails deadweight losses, an important question that emerges is: what are the most efficient means to redistribute in an unequal economy?

Our paper answers this question by characterizing the optimal shape of non-linear income and wealth tax schedules. We do so using a dynamic general equilibrium model with idiosyncratic risk and incomplete markets that reproduces the distribution of income and wealth in the United States and takes into account the long-lived transition dynamics after policy reforms. The reforms we consider are once-and-for-all changes in the income and wealth tax schedules. The revenue raised with these taxes is used to finance lump-sum transfers to households.

We find that a flat uniform tax on income is nearly optimal in that the additional welfare gains from non-linear income and wealth taxation are small. Though it is optimal to allow for positively sloped marginal income and wealth taxes, a flat tax levied uniformly on both labor and capital income achieves a large fraction of the welfare gains attainable with more complex instruments. This result is robust to perturbations of the preference parameters, the distribution of household ability, and the planner's preference for redistribution.

To make our results as transparent as possible, we conduct most of our analysis in the standard incomplete markets framework, a Bewley-Aiyagari model in which households only differ in their labor market ability. Because in the data wealth and income are highly concentrated in the hands of private business owners, we also extend our framework to allow for entrepreneurial activity. We find once again that a uniform flat tax on labor and capital income is nearly optimal, despite the underlying heterogeneity in rates of return.

The benchmark economy we study consists of a large number of households who work and face idiosyncratic shocks to their labor market ability which they can partially insure by saving in a risk-free asset. The government redistributes by taxing income and wealth, using the proceeds to finance lump-sum transfers. We characterize the mix of instruments that maximize social welfare under different preferences for redistribution. As in the United States, we assume that the tax base for the income tax includes both labor and capital income. We assume a functional form for income and wealth taxes of the Benabou (2000) and Heathcote et al. (2017) type.

We calibrate the parameters of the model to match moments of the wealth and income distribution, as well as the extent of redistribution embedded in the current tax and transfer system in the United States. Since the distribution of ability is critical in shaping optimal tax policy (Saez, 2001), we follow Castaneda et al. (2003) in allowing for a fat-tailed ability distribution that allows the model to match the top income and wealth shares.

We measure welfare by calculating, for each household, the constant consumption stream that delivers the same level of life-time utility as in the competitive equilibrium. We consider several ways in which a planner aggregates the welfare of individual households. On one end, we consider average welfare, as do Benabou (2000) and Bakis et al. (2015). As pointed out by Benabou (2000), who refers to it as risk-adjusted GDP, this objective captures pure economic efficiency and disregards equity considerations in and of themselves. On the other end, we consider objectives that place increasingly higher weights on the welfare of the poor, such as utilitarian and Rawlsian welfare.

We begin our analysis by characterizing the relative benefits and costs of income and wealth taxes. To that end, we first consider partial reforms and change the parameters of the income and wealth tax schedules in isolation, tracing out the implications for the welfare of households in various parts of the distribution. We show that all instruments of redistribution – higher average marginal tax rates, higher top marginal tax rates, as well as wealth taxes – allow the planner to increase the welfare of the poor. We find, however, that redistributing solely by increasing top marginal income taxes or wealth taxes leads to lower welfare gains compared to raising marginal income taxes on all households.

We then turn to the optimal tax experiments and study the problem of a planner that seeks to maximize social welfare using once-and-for-all joint reforms. We assume that government debt is constant and that lump-sum transfers adjust at every date to ensure that the government budget is balanced. The restriction that government debt is constant is inconsequential because we find, as do Aiyagari and McGrattan (1998), that the incremental gains from allowing the government to change its debt are small. Since optimal tax reforms involve large and gradual changes in equilibrium prices and macroeconomic aggregates, we explicitly compute welfare by taking transition dynamics into account.

We proceed incrementally, by first allowing the planner to only use a flat income tax and then augmenting the set of instruments with non-linear income and wealth taxes. We find that an optimally chosen flat income tax delivers most of the welfare gains that the planner can possibly achieve with the more complex instruments. Consider, for example, a utilitarian social planner. If this planner is restricted to setting a flat uniform tax on both capital and labor income, it sets it equal to 56%, raising the consumption-equivalent utilitarian welfare by 7.4%. If the planner can use the unrestricted set of tax instruments, it chooses upward sloping marginal income and wealth taxes, but the incremental gains from doing so are relatively small: utilitarian welfare only increases by an additional 1.1 percentage points. Overall, an optimally chosen flat income tax delivers 87% of the welfare gains that can be achieved with more complex income and wealth taxes. Interestingly, the incremental gains from a richer set of tax instruments are smaller, the stronger is the planner's concern for redistribution: a Rawlsian planner can achieve 97% of the maximum attainable welfare gains by using a flat uniform income tax.

At a first glance, the result that positively sloped marginal income and wealth taxes deliver small welfare gains seems to contradict the findings of our partial reform experiments. We show that there is, in fact, no contradiction. Rather, the result reflects that starting from the optimal flat income tax that is high to begin with, steeper marginal income or wealth taxes place the economy on the wrong side of the Laffer curve. We illustrate this point by considering reforms that increase the slope of the marginal income tax schedule or the level of wealth taxes, starting from either high or low average marginal income taxes. Such reforms greatly increase the tax revenue collected from rich households if marginal income taxes are low to begin, as under the status quo. However, these reforms generate little additional tax revenue when marginal income taxes are high to begin with, as under the optimally chosen flat income tax, due to the larger drop in the labor supply of high-ability households and the general equilibrium implications of depressed capital accumulation.

We emphasize that in our economy income taxes apply to both labor and capital income, so the result that the gains from taxing wealth are small implies that the gains from taxing capital and labor income at different rates are low, not that there are no gains from capital income taxation. We show that a planner that can only tax labor income achieves smaller gains from implementing the optimal tax reform, suggesting that taxing capital income is important for redistribution. Taxing capital in our economy is optimal for several reasons. First, as pointed out by Aiyagari (1995), our economy features capital over-accumulation relative to an economy with complete markets. Second, taxing capital prevents high ability households from accumulating wealth and leads them to supply more labor. Third, since the stock of wealth is inelastic in the short-run, taxing it generates government revenue.

In our economy taxing wealth depresses capital accumulation, reducing the capital-labor ratio and the equilibrium wage. We show that these equilibrium forces greatly constrain the planner's ability to redistribute using a wealth tax by re-computing optimal policy in a small open economy setting. In this alternative environment, the optimal wealth tax schedule is much steeper than in the benchmark economy: in effect, the planner immediately redistributes wealth from the rich to the poor, since it no longer faces the production consequences of depressing wealth accumulation.

As is well known, optimal tax policy is critically shaped by household preferences and the underlying distribution of ability. We show that even though the optimal tax schedules indeed change as we vary the households' elasticity of intertemporal substitution, the Frisch elasticity of labor supply and the distribution of labor ability, our result that a flat income tax achieves a large fraction of the maximum attainable welfare gains stands. In all the experiments we considered, an optimally chosen flat income tax achieves between 72% and 96% of the welfare gains attainable with more complex tax instruments.

We also extend our analysis to allow for heterogeneity in rates of return by modeling entrepreneurial activity. Our motivation for doing so is that in the United States much of wealth and income is concentrated in the hands of private business owners. Though entrepreneurs represent only 12% of households, they hold nearly half of all wealth and earn a third of all income. An important characteristic of private businesses (Dyrda and Pugsley, 2018) is that they disproportionately rely on collateralized borrowing and internal savings. This generates heterogeneity in rates of return (Quadrini, 2000, Cagetti and De Nardi, 2006) which, as Guvenen et al. (2019) show, gives rise to an important distinction between capital income and wealth taxation. Taxing private business income distorts entrepreneurs' incentives to accumulate wealth, amplifying the misallocation induced by collateral constraints.

We study optimal policy in this richer setting and once again find that a flat income tax is nearly optimal. Specifically, a utilitarian planner can increase welfare by 9.1% by taxing labor, interest and business income at a uniform rate of 58%. Though the planner once again prefers taxing top wealth and incomes more heavily, the welfare gains achieved with more complex instruments are only 10.3%, not much larger than the 9.1% achieved with flat income taxes. Taxing interest income and entrepreneurial profits is critical for achieving redistribution: with labor income taxes only, utilitarian welfare would actually fall. Interestingly, we find that, unlike in Guvenen et al. (2019), in our setting the planner prefers taxing capital income as opposed to wealth. Even though capital income taxes indeed increase misallocation and amplify the effects of financial distortions, these efficiency considerations are swamped by the planner's desire to redistribute from relatively rich entrepreneurs towards workers. Intuitively, a wealth tax falls on both workers and entrepreneurs, while a capital income tax disproportionately falls on the latter, who are much richer on average.

Related Work. Our paper builds on the quantitative literature on the optimal design of income, wealth and capital taxes. We find that a flat uniform tax on all sources of income is nearly optimal, in that it can achieve a large fraction of the gains attainable using non-linear income and wealth taxes. In that sense, our result is reminiscent of the findings of Conesa and Krueger (2006) and Conesa et al. (2009). Relative to these papers, not only do we allow for a richer set of instruments, but also study the problem of a planner who maximizes welfare taking transition dynamics into account. In our framework a planner concerned only with long-run welfare would subsidize wealth accumulation and eliminate lump-sum transfers in an effort to encourage precautionary savings and capital accumulation, ignoring the large welfare losses that such policies would entail during the transition.

A related complementary paper that studies optimal capital and labor income taxation is Dyrda and Pedroni (2020). In contrast to their work, which restricts attention to linear taxes, we characterize the optimal shape of non-linear income and wealth tax schedules. In addition, we restrict attention to once-and-for-all tax reforms. Optimal policy in our setting therefore balances the desire to reduce the initial wealth inequality against the distortions from depressing the long-run capital stock.

Our paper is also related to the dynamic public finance literature (Farhi and Werning, 2013, Golosov et al., 2016, Stantcheva, 2017) which uses a mechanism design approach to optimal taxation and often finds that age-dependent linear taxes achieve the bulk of the welfare gains. In contrast to this research, which is usually set in a partial equilibrium setting,[1] we explicitly study the general equilibrium consequences of tax reforms. Optimal policy would call for much steeper marginal wealth taxes in partial equilibrium, where the planner would not face the production consequences of depressed wealth accumulation.

Our work also relates to a number of recent papers which study partial reforms, such as changing wealth, capital or progressive labor income taxes in isolation. For example, Guvenen et al. (2019), Rotberg and Steinberg (2020) and Kaymak and Poschke (2019) allow the planner to use wealth taxes and find large gains from taxing wealth. Similarly, Kindermann and Krueger (2014), Bakis et al. (2015), Heathcote et al. (2017), Imrohoroglu et al. (2018),

[1]See Farhi and Werning (2012) who explicitly incorporate general equilibrium considerations.

Brüggemann (2019) and Ferriere et al. (2020) allow the planner to only use income taxes and also find welfare gains from non-linear income taxation. In contrast to these papers, we consider joint tax reforms that simultaneously change all these instruments in order to identify the most efficient means of redistribution.

2 Model

The economy is inhabited by a unit mass of households who face idiosyncratic shocks to their labor market ability. Households supply labor elastically to firms. We abstract from aggregate uncertainty and study the steady state of the model and transition dynamics after unanticipated optimal policy reforms.

2.1 Households

Households seek to maximize life-time utility given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{c_t^{1-\theta}}{1-\theta} - \frac{h_t^{1+\gamma}}{1+\gamma} \right), \tag{1}$$

where c_t is consumption and h_t is hours worked. Their income is derived from two sources. Labor income $W_t e_t h_t$ depends on the equilibrium wage rate W_t and the idiosyncratic ability e_t, which follows a Markov process with transition probability $F_e\left(e_{t+1}|e_t\right)$. Asset income $r_{t-1}a_t$ depends on household wealth a_t and the equilibrium return to savings r_{t-1}. As we discuss below, a_t is the sum of government bonds and physical capital holdings. Because there is no aggregate uncertainty, the rates of return on these assets are equalized, so we only need to record the total wealth of a given household. For notational convenience, we assume that households deposit their wealth with financial intermediaries who invest on their behalf. Households cannot borrow, so $a_{t+1} \geq 0$.

The budget constraint is

$$\left(1+\tau_s\right) c_t + a_{t+1} = i_t - T^i\left(i_t\right) + a_t - T^a\left(a_t\right), \tag{2}$$

where τ_s is a consumption tax. Consistent with the tax code in the United States, we assume that all household income $i_t = W_t e_t h_t + r_{t-1} a_t$ is subject to a non-linear personal income tax schedule $T^i\left(i_t\right)$. We assume a modified HSV[2] tax function $T\left(i_t\right) = i_t - (1-\tau)\frac{i_t^{1-\xi}}{1-\xi} - \iota_t$, where ι_t is a lump-sum transfer. The parameter τ determines the average level of the marginal

[2] Benabou (2002), Heathcote et al. (2017).

income tax and ξ determines the slope of the marginal income tax schedule. The lump-sum transfer allows us to match the extent of redistribution in the United States.

In our baseline calibration we assume that the wealth tax $T^a(a_t)$ is zero, as currently in the United States. However, in computing optimal taxes, we allow for the possibility of non-linear wealth taxes, also of the HSV functional form

$$T^a(a_t) = a_t - \frac{1-\tau_a}{1-\xi_a} a_t^{1-\xi_a}.$$

Here τ_a determines the average level of the wealth tax and ξ_a determines the extent to which the marginal wealth tax increases with wealth. We note that in this environment wealth and capital income taxes are equivalent because all agents face the same rate of return on assets. Thus a non-zero wealth tax simply allows for differential taxation of labor and capital income. Below we study an extension with heterogeneity in rates of return in which there is a meaningful distinction between capital income and wealth taxes. We show that our results are robust and contrast the relative merits of capital income and wealth taxation.

2.2 Technology

Firms produce a homogeneous good with technology

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

where K_t and L_t are the amounts of capital and labor used in production. We normalize the price of output to 1. Firms rent capital at a rental rate R_t and hire labor at a wage rate W_t.

Output is used for consumption, investment and government spending, so the aggregate resource constraint is

$$Y_t = C_t + X_t + G,$$

where G is government spending and X_t is investment in physical capital

$$X_t = K_{t+1} - (1-\delta) K_t,$$

and where δ is the depreciation rate. Given this structure, the capital-labor ratio is pinned down by the equilibrium rental rate

$$\frac{K_t}{L_t} = \left(\frac{\alpha}{R_t}\right)^{\frac{1}{1-\alpha}}, \tag{3}$$

which, in turn, pins down the equilibrium wage

$$W_t = (1-\alpha)\left(\frac{K_t}{L_t}\right)^\alpha. \tag{4}$$

2.3 Government

The government has an outstanding stock of debt B_t on which it pays the equilibrium interest rate r_{t-1}. It finances exogenous spending G and collects taxes T_t. The budget constraint is

$$(1 + r_{t-1}) B_t + G = B_{t+1} + T_t,$$

where taxes derive from personal income taxes, net of lump-sum transfers, wealth taxes and consumption taxes.

2.4 Financial Intermediaries

For notational convenience, we assume that households deposit their savings with competitive financial intermediaries who use these resources to purchase capital and government bonds. Since this is a closed economy, these must add up to the savings of the households.

The budget constraint of a financial intermediary is

$$K_{t+1} + B_{t+1} - A_{t+1} = (R_t + 1 - \delta) K_t + (1 + r_{t-1}) (B_t - A_t),$$

where A_t are the deposits from the households. No-arbitrage implies that

$$R_{t+1} = r_t + \delta. \tag{5}$$

2.5 Equilibrium

A competitive equilibrium consists of: *(i)* aggregate prices W_t, R_t, r_t, *(ii)* consumption, saving and labor supply decisions of households $c_t(a, e)$, $a_{t+1}(a, e)$, $h_t(a, e)$, *(iii)* employment, capital and output choices of firms L_t, K_t, Y_t, and *(iv)* measures of households over their idiosyncratic states $n_t(a, e)$, such that

1. Given prices, households and firms solve their optimization problems.
2. The measure $n_t(a, e)$ evolves according to an equilibrium mapping dictated by the households' optimal choices and the stochastic process for labor market ability.
3. The budget constraint of the government is satisfied period by period.
4. Markets clear. The labor market clearing condition is

$$L_t = \int e h_t(a, e) \, dn_t(a, e).$$

The asset market clearing condition is

$$K_{t+1} + B_{t+1} = \int a_{t+1}(a, e)\, dn_t(a, e).$$

The goods market clears by Walras' Law.

2.6 Tax Distortions

We next discuss the two distortions in the household saving and labor supply choices introduced by tax policies.

Consider first the labor supply choice of households and let

$$\tilde{\tau}_{it} = 1 - (1-\tau)\left[r_{t-1}a_{it} + W_t e_{it} h_{it}\right]^{-\xi}$$

denote the marginal income tax rate faced by household i. The income tax and the consumption tax distort household labor supply by reducing the marginal return to working. In particular, the labor supply choice is given by

$$h_{it}^{\gamma} = \frac{1-\tilde{\tau}_{it}}{1+\tau_s} c_{it}^{-\theta} W_t e_{it}.$$

We find it convenient to rewrite this optimality condition in terms of a labor wedge ϑ_{it}, which implicitly satisfies

$$h_{it}^{\gamma} = \frac{1}{\vartheta_{it}} c_{it}^{-\theta} W_t e_{it}.$$

Letting $\hat{c}_{it} = \frac{c_{it}}{C_t}$ denote the consumption share of household i and aggregating across households (see Berger et al., 2019 for details) gives the aggregate labor supply

$$L_t^{\gamma} = \frac{1}{\bar{\vartheta}_t} W_t C_t^{-\theta},$$

where the aggregate labor wedge

$$\bar{\vartheta}_t = \left(\int \vartheta_{it}^{-\frac{1}{\gamma}} \hat{c}_{it}^{-\frac{\theta}{\gamma}} e_{it}^{1+\frac{1}{\gamma}} \mathrm{d}i\right)^{-\gamma} \tag{6}$$

depends on individual labor wedges and the covariance between consumption shares and labor market ability.

Consider next the household's savings choice and let

$$\tilde{\tau}_{it}^{a} = 1 - (1-\tau_a)\, a_{it}^{-\xi_a}$$

denote the marginal wealth tax faced by household i. The marginal income and wealth taxes distort the savings choice by lowering the marginal benefit of saving. In particular, the savings choice is given by

$$c_{it}^{-\theta} = \beta \mathbb{E}_t c_{it+1}^{-\theta} \left[1 - \tilde{\tau}_{it+1}^{a} + \left(1 - \tilde{\tau}_{it+1}\right) r_t + \chi_{it}\right], \tag{7}$$

where χ_{it} is the multiplier on the no-borrowing constraint. We can collapse the distortions into a single savings wedge ζ_{it}, which implicitly satisfies

$$c_{it}^{-\theta} = \beta \mathbb{E}_t c_{it+1}^{-\theta} \frac{1 + r_t}{\zeta_{it+1}}. \tag{8}$$

Aggregating across households yields the aggregate Euler equation

$$C_t^{-\theta} = \frac{1}{\bar{\zeta}_t} \beta C_{t+1}^{-\theta} \left(1 + r_t\right), \tag{9}$$

where the aggregate savings wedge

$$\bar{\zeta}_t = \left(\int \mathbb{E}_t \left(\frac{\hat{c}_{it+1}}{\hat{c}_{it}} \right)^{-\theta} \frac{1}{\zeta_{it+1}} \mathrm{d}i \right)^{-1} \tag{10}$$

depends on individual savings wedges and the growth rates of consumption shares.

The production consequences of redistribution via various tax instruments are entirely captured by their impact on the two aggregate wedges. For example, a wealth tax increases the savings wedge $\bar{\zeta}_t$ and therefore the equilibrium interest rate, reducing the capital-labor ratio and the equilibrium wage. This effect is partly countered by a decline in the labor wedge stemming from wealth effects which encourage the labor supply of more productive households. A higher income tax worsens both the savings and labor wedge, and reduces the amount of labor supplied by households, as well as the capital-labor ratio. Optimal policy balances the costs of these distortions against the benefits of insurance and redistribution.

3 Quantifying the Model

In this section we describe our calibration strategy and evaluate the model's ability to account for data features not targeted in the calibration. We then calculate a measure of consumption-equivalent welfare for each household and use it to define measures of social welfare that span a wide range of preferences for redistribution.

3.1 Calibration Strategy

We next describe how we choose parameters for our quantitative analysis. We assume the economy is in a steady-state in 2013 and target statistics for this year.

Assigned Parameters. We assume that a period in the model is one year and set the depreciation rate of capital $\delta = 0.06$. We set the stock of government debt B equal to 100% of GDP, its value in 2013. We set the elasticity of capital in production $\alpha = 1/3$, the relative risk aversion $\theta = 1$, and the inverse of the Frisch elasticity of labor supply $\gamma = 2$, all conventional choices in the literature.

We set the wealth tax equal to zero in the initial steady state. We follow Bhandari and McGrattan (2018) and set the consumption tax $\tau_s = 0.065$, consistent with the United States tax code. We assume that the unexpected capital gains generated upon implementing the tax reforms are taxed at a constant rate $\tau_k = 0.20$, consistent with the capital gains tax in the United States in 2013. We summarize these parameter choices in Panel B of Table 1.

Calibrated Parameters. We parameterize the income tax function to replicate the degree of income redistribution in the United States. Specifically, we estimate the parameters ι, τ and ξ to match the CBO data on the shares of income before and after taxes and transfers for eight income groups: the first four quintiles, the 81^{st} to 90^{th} percentile, the 91^{st} to 95^{th} percentile, the 96^{th} to 99^{th} percentile, as well as the top 1 percent. The advantage of the CBO data is that it combines information from the Current Population Survey and the IRS Statistics of Income to provide detailed information about taxes and transfers. In addition, the CBO adjusts its estimates of means-tested transfers for survey under-reporting and thus provides a more accurate account of the transfers to low-income households.

We use the CBO data on the pre- and post-tax income shares of the various income groups to estimate the parameters of the tax function using non-linear least squares, weighting each group by its population share. The left panel of Figure 1 depicts both the data and the fitted values from our estimates. The fit is almost perfect. The tax function accounts well for the extent of redistribution to the poorest quintiles and the degree of tax progressivity at the top. For comparison, we also estimated the standard HSV tax function without lump-sum transfers. As the right panel of the figure shows, this function overstates the taxes paid by the richest households and understates the post-tax income of the poorest households, a point also made by Daruich and Fernández (2020). Table 1 shows that our estimates of the parameters of the tax function are $\xi = 0.049$, $\iota = 0.167$ of the mean household income (or approximately $14,000) and $\tau = 0.263$. Since the value of τ cannot be easily interpreted on its own, we note that the marginal tax paid by the median household in our model is equal to 26.7% and the marginal tax paid by a household at the 95^{th} percentile of the income distribution is equal to 34.5%. Our estimate of ξ is similar to that of Guner et al. (2014), but, owing to the presence of lump-sum transfers, lower than that of Heathcote et al. (2017).

As is well known, matching the large degree of wealth and income inequality in an incomplete markets economy like ours requires departures from a Gaussian distribution of ability. We follow Castaneda et al. (2003) in assuming a super-star ability state that allows the model to match the top income and wealth shares. Specifically, ability can be either in a normal state or a super-star state. In the normal state it follows an AR(1) process

$$\log e_t = \rho_e \log e_{t-1} + \sigma_e u_t,$$

where ρ_e is the persistence and σ_e is the volatility of the standard normal shocks u_t. In the super-star state, labor market ability is $\bar{e}$ times higher than the average. We assume that agents transit from the normal to the super-star state with a constant probability p and remain in the super-star state with a constant probability q. When agents return to the normal state, they draw a new labor market ability from the ergodic distribution associated with the AR(1) process. In the sensitivity section we derive optimal policies for an alternative calibration with Gaussian ability shocks.

The discount factor and the parameters describing the labor ability process are jointly chosen to minimize the distance between a number of moments in the model and in the data. We report the parameter values in Panel B of Table 1 and the moments we target in Panel A of Table 1. We target the average wealth to average income ratio, the wealth and income Gini coefficients, and the top 0.1% and 1% wealth and income shares. All these statistics are computed using the 2013 SCF.

We next discuss how our model matches these targets. The wealth to income ratio is 6.6 in both the data and the model. The model reproduces well the wealth Gini coefficient (0.85 in the data vs. 0.86 in the model) and the income Gini coefficient (0.64 vs. 0.65), the share of wealth held by the top 0.1% (0.22 in both the data and the model) and top 1% (0.35 vs. 0.34), as well as the share of income held by the top 0.1% and 1% (0.14 and 0.22 in both the data and the model).

Panel B of Table 1 reports the values of the calibrated parameters. The discount factor is $\beta = 0.975$. The process for labor market ability in the normal state has persistence $\rho_e = 0.982$ and standard deviation $\sigma_e = 0.2$. The level of ability in the super-star state is $\bar{e} = 504$ times greater than the average. Households enter this state with a small probability $p = 2.2\text{e-}6$ and remain there with probability $q = 0.99$. These numbers imply that 0.02% of households are in the super-star state at any point in time and that they earn 12% of all income.

Additional Moments Not Targeted in Calibration. In our calibration we only targeted the Gini coefficients of the wealth and income distributions and the shares of wealth and income held by the top 0.1% and 1%. Panels A and B of Table 2 show that the model reproduces these distributions more broadly. For example, the wealthiest 10% of households hold 75% of wealth in both the data and the model. The richest 10% of households earn 51% of income in both the data and the model. The model also reproduces well the bottom of the wealth and income distribution. For example, households in the bottom half of the wealth distribution hold nearly no wealth in both the data and the model, while those in the bottom half of the income distribution earn 10% of income in the data and 8% the model.

In summary, our model reproduces well the high degree of inequality in wealth and income, as well as the extent of redistribution in the United States.

3.2 The Distribution of Household Welfare

Measures of wealth or income inequality do not entirely capture the distribution of household welfare. For example, as we show below, optimal tax reforms may reduce poor households' incentives to save and work, increasing wealth and income inequality. However, such policies make these households better off, reducing welfare inequality. We therefore next report the model's implications for welfare inequality.

To do so, we construct a measure of household welfare using an approach similar to that of Benabou (2002) and Bakis et al. (2015). We convert a household's life-time utility V_i into more interpretable units by calculating the constant consumption stream ω_i a household would need to receive every period in order to achieve life-time utility V_i. Consider a household i who has life-time utility

$$V_i = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{c_{it}^{1-\theta}}{1-\theta} - \frac{h_{it}^{1+\gamma}}{1+\gamma} \right),$$

where the paths for consumption c_{it} and hours h_{it} solve the household's optimization problem. We define household welfare ω_i as the solution to

$$V_i = \sum_{t=0}^{\infty} \beta^t \frac{\omega_i^{1-\theta}}{1-\theta}.$$

That is, ω_i is the amount the household would have to consume each period, without working, to enjoy the same level of life-time utility as under the equilibrium allocations. This measure of welfare adjusts for risk, intertemporal substitution and mean-reversion and, importantly, allows for interpersonal comparisons, a feature that is particularly useful when comparing the degree of redistribution that can be achieved by a particular policy.

Table 3 shows that welfare inequality is substantially lower in our model compared to wealth and income inequality. For example, the share of wealth held by the top 1% is 34% and their share of pre-tax income is 22%. Since the existing tax and transfer system entails some redistribution, post-tax income is less concentrated, with the top 1% earning 15% of all income. Welfare is slightly less concentrated than post-tax income, owing to mean-reversion in labor ability, but is nevertheless unevenly distributed, with the top 1% receiving more than the bottom 25% combined (10% vs. 8%, respectively). We thus conclude that our economy is characterized by substantial inequality in welfare.

In our optimal policy exercise we need to take a stand on the objective of the planner. A parsimonious way of capturing alternative preferences for redistribution is to express the social welfare function as

$$\text{social welfare function} = \left(\int \omega_i^{1-\Delta} \mathrm{d}i \right)^{\frac{1}{1-\Delta}},$$

where Δ is a parameter that captures the desire to redistribute. This specification captures a wide range of social welfare functions commonly used in the literature. For example, if $\Delta = 0$ the objective of the planner is to maximize average welfare, as in Benabou (2002):

$$\text{average welfare} = \int \omega_i \mathrm{d}i. \tag{11}$$

As pointed out by Benabou (2002), who refers to it as risk-adjusted GDP, this objective captures pure economic efficiency and disregards equity considerations in and of themselves.

Alternatively, by setting $\Delta = \theta$, the households' coefficient of relative risk aversion, we recover the preferences of a utilitarian planner:

$$\text{utilitarian welfare} = \left(\int \omega_i^{1-\theta} \mathrm{d}i \right)^{\frac{1}{1-\theta}}. \tag{12}$$

To see that this is indeed the case, notice that the utilitarian social welfare function is

$$\int V_i \mathrm{d}i = \frac{1}{(1-\beta)(1-\theta)} \int \omega_i^{1-\theta} \mathrm{d}i,$$

which follows from our definition of ω_i. To convert this measure into a consumption equivalent, we calculate the constant amount of consumption $\bar{\omega}$ that each household would have to receive so that society achieves the utilitarian level of welfare $\int V_i \mathrm{d}i$:

$$\frac{1}{(1-\beta)(1-\theta)} \bar{\omega}^{1-\theta} = \int V_i \mathrm{d}i,$$

which implies that

$$\bar{\omega} = \left(\int \omega_i^{1-\theta} \mathrm{d}i \right)^{\frac{1}{1-\theta}}.$$

Thus, utilitarian welfare is simply a weighted average of the welfare of individual households, with weights given by each household's marginal utility, $\omega_i^{-\theta}$. More generally, a higher Δ implies a stronger preference for redistribution. In the limit, as $\Delta \to \infty$, this objective reduces to that of a Rawlsian planner. We show below that our main result is robust to the planner's preference for redistribution.

4 Optimal Policy

We next study optimal tax reforms. By way of motivation and to illustrate the role of each tax instrument, we first study partial reforms in which we vary one instrument at a time. We show that higher or steeper marginal income or wealth taxes can, in isolation, increase the welfare of poor households. This observation has been used in the literature to argue in favor of one instrument of redistribution or another. We then characterize optimal policy, allowing the planner to use all instruments simultaneously. We show that flat income taxes are nearly optimal, in that they deliver the bulk of the welfare gains that can be attained with non-linear income and wealth tax schedules, a result robust to the details of the parameterization.

4.1 Welfare Implications of Partial Reforms

We consider one-time, unanticipated and permanent increases in the parameters τ, ξ and τ_a that determine the level of marginal income taxes, the slope of the marginal income tax schedule and the wealth tax, respectively.[3] For each of these changes, the lump-sum transfer ι_t adjusts to ensure that the government budget constraint is satisfied at all dates during the transition. As we vary each instrument, we keep all the other tax parameters, as well as the amount of government debt, unchanged. We calculate the resulting transition dynamics and report implications for welfare, taking into account the long-lived nature of the transitions and the general equilibrium implications of the reforms.

Figure 2 reports the welfare implications of varying each instrument. Since households differ along two dimensions, wealth and ability, we rank them according to their welfare ω_i in the initial steady state. We then report the utilitarian welfare change, as well as the welfare change for households in three groups of the distribution. Each column of the figure depicts

[3] To conserve space, for this exercise we restrict attention to linear wealth taxes only and set $\xi_a = 0$.

the welfare implications of changing a single tax instrument, τ, ξ and τ_a, respectively. Because the values of the parameters are not interpretable on their own, the horizontal axes report the implied median marginal income tax rate, the marginal tax rate at the 95^{th} percentile of the income distribution and the wealth tax, respectively.

We make two observations. First, increasing either wealth or income taxes allows the planner to increase the welfare of the poor at the expense of the rich. Intuitively, all these instruments allow the planner to collect additional revenue from the rich and finance transfers to the poor, either by increasing the lump-sum transfer or by reducing their marginal income tax. This increases utilitarian welfare as the insurance and redistributional value of transfers outweighs the distortions induced by higher taxes. For large enough tax increases the distortions dominate and welfare falls. Second, the instruments differ in how much redistribution they can achieve. For example, the planner can increase the welfare of the poorest third by as much as 30% by increasing the level of marginal income taxes, and by only 15% using wealth taxes.

To understand the consequences of the partial reforms, Figures 3 and 4 illustrate the transition dynamics resulting from setting each of the three tax parameters at the values that maximize utilitarian welfare.[4] Figure 3 shows that each reform increases the tax bill of the rich and reduces that of the poor. The latter reflects an increase in lump-sum transfers arising from a higher average level of income taxes or wealth taxes, and a fall in the marginal income tax at the bottom arising from a steeper slope of the marginal income tax schedule.

Figure 4 reports the consequences of these tax reforms for macro aggregates. An increase in either the level or the slope of marginal income taxes worsens the labor wedge, while an increase in wealth taxes improves the labor wedge by stimulating labor supply by high-ability households due to wealth effects. All reforms worsen the savings wedge and consequently depress the capital stock, labor and output. In turn, the interest rate increases and the wage rate falls. Notice that the savings wedge increases to a level greater than one, implying that the interest rate increases above the rate of time preference, depressing capital relative to the modified golden rule. We finally note that these reforms have very different implications for wealth inequality. While a steeper marginal income tax schedule reduces wealth inequality, as measured by the Gini coefficient, higher average income taxes and wealth taxes increase it. Intuitively, the increase in lump-sum transfers discourages labor supply and the precautionary motive for saving of the poor. Since all of these policies increase the welfare of the poor, this

[4] Specifically, we set $\tau = 0.5$, $\xi = 0.2$ and $\tau_a = 0.02$.

suggests that measures of wealth inequality can provide a misleading account of the welfare consequences of tax reforms.

To summarize, increasing either wealth or income taxes can achieve redistribution. Previous work used this observation to argue in favor of a particular tax reform. However, most of this work allows the planner to use a single instrument at a time. For example, Guvenen et al. (2019), Rotberg and Steinberg (2020) and Kaymak and Poschke (2019) allow the planner to use wealth taxes and find large gains from taxing wealth. Similarly, Kindermann and Krueger (2014), Bakis et al. (2015), Imrohoroglu et al. (2018) and Brüggemann (2019) allow the planner to only use income taxes and also find welfare gains from taxing top incomes more heavily. In contrast to this research, the goal of our paper is to consider tax reforms that jointly change all of these instruments.

4.2 Optimal Tax Reforms

We next study optimal tax reforms. Specifically, we consider one-time, unanticipated, permanent changes in the parameters $\boldsymbol{\pi} = (\tau, \xi, \tau_a, \xi_a)$ that determine the income and wealth tax schedules. We restrict the space of tax instruments to these four parameters for computational reasons: a search over unrestricted income and wealth tax schedules is computationally infeasible. Nevertheless, we conjecture that the tax schedules we consider are flexible enough to capture most of the gains from richer non-linear tax systems and provide useful insight regarding the relative merits of wealth and income taxation. For example, as Heathcote and Tsujiyama (2019) show, the optimal income tax function in the HSV class approximates well the optimal Mirrlees policy in a static economy.[5]

Throughout, we maintain the assumption that government debt and all instruments other than wealth and income taxes are constant and require that the lump-sum transfer ι_t adjusts at every date to ensure that the government budget is balanced. We have experimented with allowing the planner to also choose debt optimally and found that raising government debt has similar implications to increasing the wealth tax. Both policies allow for a temporary increase in lump-sum transfers at the expense of a depressed capital stock. We found, as did Aiyagari and McGrattan (1998), that the marginal gains from allowing the government to borrow more are small and therefore do not report these results for brevity. We also considered allowing the government to change the tax on consumption. As is well known, a consumption tax is equivalent to a tax on labor and a capital levy, an intervention that we

[5]We have also experimented with more flexible functional forms using neural networks and were not able to improve social welfare significantly relative to the HSV parametric functional form.

study below. Given our focus on wealth and income taxation, we do not report these results either and refer the interested reader to Correia (2010) for an analysis of redistribution using consumption taxes. Finally, we follow the large literature that considers once-and-for-all tax reforms (Domeij and Heathcote, 2004, Conesa et al., 2009, Guvenen et al., 2019). The planner therefore needs to balance the desire to tax wealth at date zero against the long-term distortions arising from capital income taxation.

We assume that the planner's objective is

$$\max_{\boldsymbol{\pi}} \left(\int \omega_i(\boldsymbol{\pi})^{1-\Delta} \mathrm{d}i \right)^{\frac{1}{1-\Delta}},$$

where $\omega_i(\boldsymbol{\pi})$ is the welfare of household i resulting from a particular reform $\boldsymbol{\pi}$. We compute this consumption-equivalent measure of welfare taking into account the path of equilibrium prices during the transition. Recall that Δ is a parameter that captures the policymaker's preference for redistribution. We consider three values of Δ, corresponding to average, utilitarian and Rawlsian welfare.

Table 4 summarizes the tax schedules and the implied welfare gains from implementing the optimal tax reforms. Since the parameters of the tax functions are not interpretable on their own, we report the marginal income and wealth taxes evaluated at the 50^{th} and 95^{th} percentiles of the pre-reform income and wealth distributions. We proceed in two steps. First, we assume that the planner can only impose a flat tax on income and is thus restricted to setting $\xi = \tau_a = \xi_a = 0$. We then search for the value of τ that maximizes social welfare. Second, we assume that the planner can use all tax instruments and search for the optimal values of τ, ξ, τ_a and ξ_a. The table reports results for the three measures of social welfare we consider. For concreteness, we focus most of the discussion on a utilitarian objective.

As Panel B of Table 4 shows, a utilitarian planner who is restricted to only use a flat income tax sets it equal to 56%, which increases welfare by 7.4%. Recall that we express welfare in consumption-equivalent units, so these gains are equivalent to increasing everyone's consumption permanently by 7.4%. When the planner can use all instruments, it chooses positively sloped marginal income and wealth tax schedules. The marginal income tax paid by the pre-reform median earner is equal to 50.5%, lower than under the optimal flat income tax, and that paid by an earner at the 95^{th} percentile is 57.8%, higher than under the optimal flat income tax. The planner subsidizes wealth accumulation by the poor (the marginal wealth tax at the 50^{th} percentile is -0.7%) and taxes, albeit at a small rate, the wealth of the rich (the marginal wealth tax at the 95^{th} percentile is 0.04%).

As is well understood, when the planner has access to a rich set of tax instruments, multiple tax policies can generate the same allocations, so wedges in the optimality conditions provide a more useful account of the distortions induced by the tax system.[6] We next ask whether a planner who is able to collect wealth taxes chooses to distort wealth accumulation by more compared to an environment with flat income taxes. To answer this question we note that the steady state interest rate in both the economy with the optimally set flat income tax and in that with optimally set richer tax instruments is equal to 4%, implying that the savings wedge is unchanged, so the planner does not further depress wealth accumulation.

Overall, the richer set of tax instruments allows the planner to increase utilitarian welfare by 8.5%, a modest increase relative to the 7.4% welfare gains achievable with an optimally set flat income tax alone. Thus, the latter delivers 87% of the gains that can be achieved using all tax instruments. Interestingly, the households that benefit from a richer set of tax instruments are those in the middle of the distribution. For example, the welfare gains experienced by households in the middle third of the pre-reform welfare distribution increase from 5.7% to 7% when the planner uses the richer set of tax instruments. In contrast, the welfare gains experienced by households in the bottom third of the welfare distribution fall from 26.7% to 25.2%. Intuitively, with a richer set of tax instruments the planner can reduce the marginal income taxes paid by households in the middle to lower end of the distribution at the expense of lower lump-sum transfers. Since households at the bottom of the distribution have relatively low labor market ability, they prefer redistribution via lump-sum transfers as opposed to lower marginal income taxes.

We reach a similar conclusion when considering alternative welfare objectives. As Panel A of Table 4 shows, a planner who seeks to maximize average welfare and therefore has no explicit concern for redistribution, chooses to tax income at a lower rate compared to a utilitarian planner, and subsidizes wealth accumulation. Nevertheless, such a planner also increases the welfare of the poor and of those in the middle class. For example, the bottom third of households experience welfare gains of 20.2% under an optimally set flat income tax, while the middle third experience welfare gains of 4.8%. Thus, even if the planner has no explicit concern for redistribution, it chooses a policy that greatly increases the welfare of the poor at the expense of the rich. Average welfare, which we interpret as a measure of efficiency, following Benabou (2002), increases due to the additional insurance provided by the lump-sum transfers financed by higher income taxes. We conclude that measures

[6] See Chari et al. (2020) for a recent illustration of this point.

of macroeconomic activity, such as output, which falls by 8% here, are poor indicators of how efficient a particular tax reform is. Our argument is thus distinct from that of Bowles and Gintis (1996) who argue that under certain circumstances more redistributive policies may increase output. In contrast, the policies we consider here reduce output, but increase average welfare. Importantly, as in the case of a utilitarian objective, the marginal gains from non-linear income and wealth taxes are small. An optimally set flat income tax achieves 81% (2.1% relative to 2.6%) of the welfare gains attainable using more complex tax instruments.

Panel C of Table 4 shows that a Rawlsian planner, who only values the welfare of the poorest agent, sets much higher income taxes, subsidizes wealth accumulation by the poor and taxes the wealth of the rich. Moreover, such a planner chooses a negatively sloped marginal income tax schedule in order to increase lump-sum transfers, the main source of income for the poorest agent. Notice that such a planner only increases the welfare of the bottom third of households by 29.4%, an increase only slightly larger than that achieved by a utilitarian planner. These gains to the poor come at cost of very large losses at the top. Importantly, we once again find that an optimally set flat income tax achieves 97% (65% relative to 66.9%) of the welfare gains attainable using all tax instruments.

Taken together, Panels A – C of Table 4 imply that the stronger is the planner's preference for redistribution, the smaller the additional welfare gains from deviating from a uniform flat income tax. Intuitively, a flat income tax allows the planner to raise the maximum amount of revenue, used to finance lump-sum transfers, which benefits the poor the most.

It is important to note that our result that the incremental gains from taxing wealth are small does not imply that the gains from taxing capital income are low. To see this point, we consider an experiment in which we only allow a utilitarian planner to tax labor income. Such a planner achieves smaller welfare gains of 5.9% if restricted to tax labor income at a constant rate and 6.8% with non-linear labor income taxes. This suggests that taxing capital income is important for efficient redistribution, though not as important as taxing labor income. Taxing capital in our economy is optimal for several reasons. First, as pointed out by Aiyagari (1995), our economy features capital over-accumulation relative to an economy with complete markets. Second, taxing capital prevents high ability households from accumulating wealth and leads them to supply more labor. Third, since the stock of wealth is inelastic in the short run, taxing it generates government revenue.

4.3 Inspecting the Mechanism

We next explain why a richer set of tax instruments does not allow the planner to substantially increase welfare relative to an optimally chosen flat income tax. At a first glance, this result appears to contradict the conclusion of the partial reform exercises in Section 4.1, which showed that increasing wealth taxes or the slope of the marginal income tax schedule allows the planner to greatly increase social welfare. We show that there is, in fact, no contradiction. Rather, the result reflects that starting from an optimally chosen flat income tax, the marginal gains from additional instruments are small because steeper marginal income taxes or wealth taxes place the economy on the wrong side of the Laffer curve.

We illustrate this point by first considering the impact of increasing the slope of the marginal income tax schedule and then analyzing the effect of wealth taxes.

Steeper marginal income taxes. Figure 5 shows the consequences of increasing the slope of the marginal income tax schedule ξ starting from two values of the parameter τ which determines the average marginal income tax. The first value is $\tau = 0.26$, that under the status quo, and the second is $\tau = 0.56$, that optimally chosen by a utilitarian planner restricted to use flat income taxes only. For each of these values of τ, we calculate the transition dynamics and welfare consequences of varying ξ, holding $\tau_a = 0$. We report the differential welfare change and the change in the present value of taxes arising from a particular value of ξ relative to setting $\xi = 0$. The figure thus traces out the incremental effect of increasing the slope of the marginal tax schedule, conditional on a given value of τ.

The top three panels of the figure show that increasing ξ leads to small (and even negative) welfare gains for the poor when $\tau = 0.56$, so that marginal income taxes are already high on average. This is in sharp contrast to the large welfare gains that steeper marginal income taxes can achieve starting from an environment in which $\tau = 0.26$, so that marginal income taxes are low to begin with. The bottom panel shows that the reason a higher ξ does not increase the welfare of the poor when τ is high is because a steeper marginal income tax schedule does not increase the tax bill paid by the richest one-third of households.[7] Consequently, the government is not able to increase transfers to the poor.

To understand why the government is unable to collect additional revenue from the rich by increasing the slope of the marginal income tax schedule when τ is high, let $T_t(\tau, \xi)$ denote the income taxes collected from the richest one-third of households in period t when

[7]Here, we consider all taxes paid by households, including those on consumption.

the planner sets the parameters of the income tax schedule equal to τ and ξ. Similarly, let $I_t(\tau, \xi)$ denote the pre-tax income of these households under the same reform. Finally, let

$$\upsilon_t(\tau, \xi) \equiv \frac{T_t(\tau, \xi)}{I_t(\tau, \xi)}$$

denote the implied average tax rate for this group. By definition, the differential change in the taxes paid by the richest third of households in an environment with $\xi > 0$ relative to an environment with $\xi = 0$ is equal to

$$T_t(\tau, \xi) - T_t(\tau, 0) = \upsilon_t(\tau, \xi)\left[I_t(\tau, \xi) - I_t(\tau, 0)\right] + \left[\upsilon_t(\tau, \xi) - \upsilon_t(\tau, 0)\right] I_t(\tau, 0). \qquad (13)$$

Mechanically, the differential response of tax revenue is the sum of two components. The first one captures the behavioral response, the decline in income $I_t(\tau, \xi) - I_t(\tau, 0)$, brought about by steeper marginal income taxes. The second captures the change in average income taxes, $\upsilon_t(\tau, \xi) - \upsilon_t(\tau, 0)$.

We next zoom in on two reforms that increase the slope of the marginal income schedule starting from the two values of τ considered above. When $\tau = 0.56$, we set $\xi = 0.2$, which increases the average income tax paid by the richest one-third by 6.9% across steady states. Since the value of ξ on its own is not interpretable, to ensure comparability across the two reforms, we set $\xi = 0.079$ when $\tau = 0.26$. This leads to an identical stready-state increase in the average income tax paid by the richest one-third of 6.9%.

The top panel of Figure 6 traces out the differential response of income taxes collected from the richest one-third of households, as well as the two components in equation (13). By construction, the second component is similar for high and low values of τ, which allows us to isolate the behavioral response. Notice that the income of the richest one-third of households falls by a much larger amount when increasing ξ starting from $\tau = 0.56$. This drop in income entirely offsets the gains from higher average income taxes, so the tax bill of the richest households changes little. The bottom panel of the figure shows that the equilibrium wage and output falls by a larger amount when increasing ξ starting from a high τ. Thus, increasing the slope of the marginal income tax schedule when τ is high generates little to no additional government revenue, but leads to large declines in output and wages and therefore reduces welfare for all households.

Wealth taxes. Figure 7 shows the consequences of increasing the wealth tax τ_a starting from the same two values of τ as above, holding $\xi = 0$. Once again, the figure traces out the incremental effect of increasing the wealth tax, conditional on a given value of τ.

Notice that the overall tax bill paid by the richest one-third of households increases by a similar amount for the two values of τ. However, the higher revenues collected from the rich lead to much smaller declines in the taxes paid by the poor when τ is high, compared to when τ is low. Thus, even though wealth taxes depress the welfare of the rich by a lot more, they only modestly increase the welfare of the poor when τ is high. To understand why this is the case, Figure 8 traces out the effect of a 2% wealth tax starting from $\tau = 0.26$ and $\tau = 0.56$. The figure shows that the tax bill paid by the top third richest households increases immediately and by similar amounts in the two scenarios. However, the equilibrium interest rate increases by much more when a wealth tax is introduced in an environment with a high τ. Since the government's budget constraint is

$$T_t = r_{t-1}B + G,$$

where we imposed that government debt is constant, a higher interest rate increases the cost of servicing government debt, reducing the amount the planner can transfer to the poor.

To understand why a given wealth tax leads to a larger increase in interest rates when income taxes are high, rearrange equations (7) – (10) to derive an expression for the steady-state equilibrium interest rate

$$\beta \int \mathbb{E}_t \left(\frac{\hat{c}_{it+1}}{\hat{c}_{it}} \right)^{-\theta} \big(1 - \tau^a + (1-\tau)r_t + \chi_{it}\big)\mathrm{d}i = 1, \tag{14}$$

where we implicitly impose that wealth and income taxes are linear. Recall that χ_{it} is the multiplier on the no-borrowing constraint and $\hat{c}_{it}$ is the consumption share of household i. An increase in the wealth tax τ^a reduces the return to wealth and requires a counterveiling increase in the after-tax interest rate $(1-\tau)r_t$ to ensure equation (14) holds. Thus, the higher τ is, the larger the required increase in the interest rate r_t needed to clear the asset market. A given wealth tax is therefore more distortionary and yields much smaller welfare gains in an environment with high income taxes. We once again emphasize that in our economy income taxes apply to both capital and labor income, so the result that the gains from wealth taxation are small implies that the gains from taxing capital and labor income at different rates are low, not that there are no gains from capital income taxation.

4.4 Role of General Equilibrium Effects

We next study the role of general equilibrium effects in shaping optimal tax policy. To do so we consider a small open economy that takes the interest rate r as given and can run a current accout surplus/deficit with the rest of the world. Since firms operate with a constant returns to scale technology, equations (3), (4) and (5) imply that the equilibrium wage is also policy invariant.

Table 5 reports the optimal tax schedule in this environment, as well as the implications for welfare and aggregate outcomes. A utilitarian planner that can only use a flat income tax sets it equal to 60.1%, only slightly higher than in the general equilibrium setting. This generates welfare gains of 7.8%. When the planner can use the richer set of tax instruments, it chooses a steeper marginal income tax schedule, as in the general equilibrium setting, and a significantly steeper wealth tax schedule. Specifically, the marginal wealth tax paid by a household at the 50^{th} percentile of the pre-reform wealth distribution is -25.1%, while that paid by a household at the 95^{th} percentile is 34.9%. In effect, the planner immediately redistributes wealth from the rich to the poor, since it no longer faces the production consequences of depressing wealth accumulation. Notice that output falls by a much smaller amount across steady states in a small open economy, despite the fact that the wealth-to-income ratio falls much more. Also notice that even though the utilitarian welfare gains from using the richer set of tax instruments only increase by an additional 1.8 percentage points, the poor greatly benefit. The welfare gains of the bottom one-third increase from 29.4% to 40.5%, reflecting the initial wealth redistribution. We therefore conclude that general equilibrium forces greatly constrain the planner's ability to use a wealth tax to achieve redistribution.

4.5 Capital Levy

In choosing time-invariant policies the planner balances the desire to tax the initial wealth against the distortions from depressing the capital stock. To see how the former shapes optimal policy, we consider an experiment where the planner levies a 100% wealth tax at date zero, which it redistributes lump-sum to all households, thus keeping aggregate wealth unchanged but entirely eliminating initial wealth inequality. The column labeled 0 in the last panel of Table 5 reports the effect of such a capital levy, taking into account that the economy eventually returns to the initial steady state. The utilitarian welfare gains are nearly 15%, with the poorest one-third of households experiencing a welfare gain of 38.8%. We next allow the planner to also change the tax schedules, in addition to imposing a capital levy. The planner increases income and wealth taxes by less than in the absence of a capital levy. Indeed, the planner subsidizes wealth accumulation, especially at the top, which ensures that the interest rate in the new steady state is equal to 2.2%, very similar to the 2.1% in the initial steady state. Thus, in the presence of a capital levy the planner does not tax capital accumulation at a higher rate than under the status quo. Once again, however, the marginal gains from deviating from uniform labor and capital taxation are small: the optimally set flat income tax achieves 86% of the maximum attainable welfare gains.

4.6 Sensitivity Analysis

It is well known that optimal tax policy is critically shaped by household preferences and the distribution of household ability. We next show that even though the size of optimal taxes indeed depends on these details of the model, our conclusion that a flat income tax achieves a large fraction of the gains attainable with non-linear wealth and income taxes is robust. Specifically, we consider three perturbations of the model. First, we reduce the intertemporal elasticity of substitution to 0.5 by setting $\theta = 2$. Second, we double the Frisch elasticity of labor supply by setting $\gamma = 1$. Lastly, we assume a Gaussian distribution of ability by eliminating the super-star state. We recalibrate each of these models and revisit the optimal tax experiments under the assumption of a utilitarian planner.

Parameterization. Table 6 reports the parameter values under the three perturbations of the model in Panel A and the implied moments in Panel B. The economies with a lower elasticity of intertemporal substitution and a higher Frisch elasticity of labor supply successfully reproduce the wealth to income ratio, the Gini coefficients of wealth and income inequality, the top 0.1% and top 1% wealth and income shares. In contrast, as is well known, the economy in which labor ability is normally distributed cannot reproduce the top wealth and income shares and the fact that wealth is more concentrated than income.

Optimal Policy. The top three panels of Table 7 report the optimal policy chosen by the planner in each of these alternative economies. As earlier, we contrast an optimally chosen flat income tax with a richer set of tax instruments. Consider first Panel A, an economy characterized by a lower elasticity of intertemporal substitution. Since under this parameterization a utilitarian planner desires more redistribution, the optimal flat income tax is 71.6%, larger than the 56% in our benchmark model. As the second column shows, the unrestricted policy calls for positively-sloped marginal income and wealth tax schedules. In particular, it imposes very high wealth taxes at the top: the marginal wealth tax paid by households at the 95^{th} percentile of the pre-reform wealth distribution is 21%. This allows the planner to redistribute from the rich to the poor in the first few periods of the reform, after which the distribution of wealth is much less dispersed. Overall, with an optimally set flat income tax the planner can achieve 72% of the welfare gains attainable with more instruments. Most of these additional gains accrue because of the initial wealth redistribution. If the planner was constrained to set a linear wealth tax, it would set it equal to 3.3% and increase utilitarian welfare by 32%, very close to the 28.7% welfare gain from the optimal flat income tax alone.

Consider next the economy with a higher Frisch elasticity of labor supply, displayed in Panel B. Since labor is more elastic, the optimal flat income tax is smaller than in our benchmark and is equal to 49%. Once again, the planner prefers positively-sloped marginal income and wealth taxes. In contrast to the baseline parameterization, the planner taxes wealth at the top: the marginal wealth tax paid by households at the 95^{th} percentile of the pre-reform wealth distribution is 1%. Since labor is more elastic, the planner effectively taxes capital income at a higher rate than labor income. However, the gains from this flexibility are relatively small: a flat income tax achieves a substantial share (73%) of the welfare gains attainable with a richer set of tax instruments.

Lastly, Panel C reports optimal policies in an economy with normally distributed labor ability. As is well known (Saez, 2001, Mankiw et al., 2009), marginal income taxes decrease with income in such an environment. We confirm this in the second column of the table which shows that the marginal income tax falls from 73.9% at the median to 57.9% at the 95^{th} percentile. In addition, the planner also finds it optimal to tax wealth at a decreasing rate: the marginal wealth tax falls from 0.5% at the median to 0.1% at the 95^{th} percentile. Once again, the incremental welfare gains of departing from a flat income tax are small: the flat income tax achieves 96% of the maximum attainable welfare gains.

5 Optimal Policy in an Economy with Entrepreneurs

We next study optimal tax policy in an economy with entrepreneurs who face heterogeneous rates of return. Our motivation for studying such an economy is that in the U.S. much of wealth and income is concentrated in the hands of private business owners. According to the 2013 SCF, pass-through business owners represent 12% of households, but account for 46% of all wealth and 31% of all income.[8] This group of households is especially prevalent

[8] We use a broad definition of entrepreneurs that encompasses all private business owners, not only those actively engaged in managing their business, but exclude owners of C-corporations. We associate C-corporations with corporate firms in our model because, as in the data, they are taxed at the entity level and their ownership is much more diversfied.

at the top of the income and wealth distribution: they account for 62% of households in the top 1% income bracket and 70% of households in the top 1% wealth bracket. An important characteristic of private businesses (see Dyrda and Pugsley, 2018) is that rigid ownership rules make it difficult for them to issue equity. They therefore rely much more on internal savings and collateralized borrowing, which generates heterogeneity in rates of return across these households, as in Quadrini (2000) and Cagetti and De Nardi (2006).[9] As Guvenen et al. (2019) shows, because of this heterogeneity, in such an environment there is an important distinction between taxing wealth and taxing capital income, a feature absent in our benchmark model. Since pass-through business profits in the United States are taxed as individual income, tax reforms depress entrepreneurs' incentives to accumulate wealth and overcome collateral constraints, thus affecting their production choices. These effects are potentially important because private business owners account for 40% of output in the United States. Motivated by these considerations, we next augment our model to allow for entrepreneurial activity. We revisit the question of efficient redistribution in this richer setting and once again find that a flat income tax is nearly optimal.

5.1 Framework

We extend the standard incomplete markets economy studied above by assuming that an exogenously given fraction ψ of households have the option to run a private business. Entrepreneurs produce a homogeneous good alongside corporate firms. We first discuss the problem of private business owners and then that of corporate firms.

Entrepreneurs. These households supply labor and also earn business income $\pi_t(a, z)$ which depends on their entrepreneurial ability z and their wealth a due to a collateral constraint. Entrepreneurs maximize the same objective and face the same budget constraint as in the benchmark model, listed in equations (1) and (2). The only difference is that their income includes profits and is given by

$$i_t = W_t e_t h_t + r_{t-1} a_t + \pi_t(a_t, z_t).$$

Entrepreneurs produce using the same production technology as corporate firms

$$y_t = z_t^{1-\eta} \left(k_t^{\alpha} l_t^{1-\alpha}\right)^{\eta},$$

[9] See also Meh (2005), Boar and Knowles (2020) and Bhandari et al. (2020a) who study tax policy in economies with private business owners.

where we now allow for decreasing returns to scale determined by the span-of-control parameter η. Their entrepreneurial efficiency z_t is iid across firms and follows a Markov process with transition probability $F_z\left(z_{t+1}|z_t\right)$. We assume that the processes for labor and entrepreneurial ability are independent. Entrepreneurial profits are equal to

$$\pi_t = y_t - W_t l_t - R_t k_t.$$

Unlike corporate firms, private businesses face a collateral constraint which limits the capital used in production to a multiple $\lambda \geq 1$ of their wealth

$$k_t \leq \lambda a_t.$$

The marginal return to wealth for entrepreneurs, net of the equilibrium interest rate, is

$$\frac{\partial \pi_t\left(a_t, z_t\right)}{\partial a_t} = \lambda \mu_t\left(a_t, z_t\right),$$

where $\mu_t\left(a_t, z_t\right)$ is the multiplier on the collateral constraint. Poor but efficient entrepreneurs are more constrained and therefore have a higher return to saving. The entrepreneurs' Euler equation for wealth accumulation is therefore given by

$$c_{it}^{-\theta} = \beta \mathbb{E}_t c_{it+1}^{-\theta}\left[1 - \tau_{it+1}^a + \left(1 - \tilde{\tau}_{it+1}\right)\left(r_t + \lambda \mu_{it+1}\right)\right]$$

so income taxes reduce the shadow return to saving and hinder their ability to overcome collateral constraints.

Corporate firms. We assume, without loss of generality, that all corporate firms have the same productivity z. Because of decreasing returns to scale these firms earn profits, which the government taxes at a rate τ_c. Corporate firms exit with exogenous probability φ. Their mass evolves endogenously according to

$$N_{t+1} = \left(1 - \varphi\right)\left(N_t + \nu_t\right),$$

where ν_t is the mass of new entrants, determined in equilibrium by the free-entry condition

$$F_t \geq Q_t.$$

Here, F_t is the cost of creating a new firm and Q_t is the price of a claim to a firm, given by

$$Q_t = \frac{1 - \varphi}{1 + r_t}\left[Q_{t+1} + \left(1 - \tau_c\right)\pi_{t+1}\right],$$

where π_{t+1} are the profits of the representative firm. Corporate firms are owned by households, who hold shares in corporate firms, in addition to physical capital and government bonds. As in the benchmark model, no-arbitrage implies that the rate of return on all these assets is equalized and the portfolio composition of an individual household is indeterminate.

We follow Gutierrez et al. (2019) in assuming that entry costs increase with the mass of entrants, so that entry responds inelastically to changes in the environment. Specifically, we assume that

$$F_t = \bar{F}\nu_t^{\varepsilon},$$

where ε determines the elasticity of firm entry to changes in firm profitability and $\bar{F}$ determines the average level of the entry costs. The elasticity of firm entry ε has implications for the comovement of stock prices and entry rates. If $\varepsilon = 0$, stock prices are constant, and all adjustment is in the entry margin, as in Hopenhayn (1992). As ε increases, entry rates respond less, and the stock price responds more to a given shock.

Aggregation. Output is used for consumption, investment and government spending, so the aggregate resource constraint is

$$Y_t = C_t + X_t + G,$$

where

$$Y_t \equiv \int_{\text{entr}} y_{it}^e \mathrm{d}i + N_t y_t$$

is total output, y_{it}^e is the output of entrepreneur i, y_t is the output of a corporate firm, G is government spending, and X_t is investment in physical capital and in new firms

$$X_t = K_{t+1} - (1-\delta)\, K_t + F_t \nu_t.$$

Collateral constraints introduce two additional distortions relative to our benchmark model. First, they generate dispersion in the marginal product of capital across producers, generating misallocation and reducing TFP. Second, they depress the capital-output ratio. To see the impact on misallocation, we note that aggregating individual producers' choices allows us to write an aggregate production function

$$Y_t = Z_t \left(K_t^{\alpha} L_t^{1-\alpha}\right)^{\eta},$$

where K_t and L_t denote aggregate capital and labor. Aggregate productivity Z_t is equal to

$$Z_t = \left(\int_{\text{entr}} z_{it}\phi_{it}^{-\frac{\alpha\eta}{1-\eta}} \mathrm{d}i + N_t z\right)^{1-(1-\alpha)\eta} \left(\int_{\text{entr}} z_{it}\phi_{it}^{-\frac{1-(1-\alpha)\eta}{1-\eta}} \mathrm{d}i + N_t z\right)^{-\alpha\eta},$$

where $\phi_{it} = 1 + \mu_{it}/R_t$. Absent collateral constraints, $\phi_{it} = 1$, and aggregate productivity increases to

$$Z_t^* = \left(\int_{\text{entr}} z_{it} \text{d}i + N_t z \right)^{1-\eta}.$$

To see that collateral constraints also depress the capital-output ratio and act as a tax on capital, we note that aggregating individual capital choices across firms gives

$$\alpha\eta \frac{Y_t}{K_t} = R_t \bar{\phi}_t,$$

where $\bar{\phi}_t = \frac{1}{K_t} \left(\int_{\text{entr}} \phi_{it} k_{it} \text{d}i + N_t k_t \right)$ is a weighted average of the individual capital wedges.

5.2 Parameterization

Table 8 reports the parameter values and moments we targeted to calibrate this version of the model. The assigned parameters have the same values as in our benchmark model. We assume that entrepreneurial ability z_t follows an AR(1) process with persistence ρ_z and standard deviation σ_z. We choose the parameters governing the process for labor market and entrepreneurial ability, the fraction of entrepreneurs, the discount factor, the collateral constraint and the span-of-control parameter to match the moments listed in Panel A of the table. In addition to targeting the wealth-to-income ratio and moments characterizing overall wealth and income inequality, we now require that the model also reproduces the fraction of entrepreneurs in the data, their wealth and income shares, the fraction of entrepreneurs in the top 0.1% and 1% wealth bracket and the Gini coefficients of the wealth and income distributions for entrepreneurs and workers separately. All these statistics are computed using the 2013 SCF, a year for which Bhandari et al. (2020b) find that, despite its limitations, the SCF data on aggregate business income aligns well with the IRS data. In addition, we target the sales share of corporations reported by Dyrda and Pugsley (2018) and the size-weighted average debt-to-capital ratio for entrepreneurs reported by Crouzet and Mehrotra (2017) for US firms and Zetlin-Jones and Shourideh (2017) for UK firms. As Panel A of Table 8 shows, the model successfully reproduces all these statistics.

We briefly discuss the model's implications for the severity of financial constraints. We note that the capital-weighted fraction of constrained entrepreneurs is equal to 43%, reflecting the relatively low value of the leverage ratio λ of 2.3 necessary to match the debt-to-capital ratio of entrepreneurs in the data. Nevertheless, our model predicts relatively small overall losses from misallocation, of 1.3%, similar to those in Midrigan and Xu (2014), partly reflecting that corporate firms are unconstrained and partly that entrepreneurial ability is persistent so productive entrepreneurs grow out of their borrowing constraints. The capital wedge $\bar{\phi}$ induced by collateral constraints depresses the capital-output ratio of entrepreneurial firms by 17% and the aggregate capital-output ratio by 6%.

5.3 Optimal Policy

Panel D of Table 7 reports optimal policies chosen by a utilitarian planner. The first column of the table shows that the flat optimal tax chosen by the planner is 58.2%, very similar to the 56% chosen in the benchmark economy. The utilitarian welfare increases by 9.1%. When the planner can use all tax instruments it reduces marginal income taxes, sets a positively sloped marginal income tax schedule, and taxes wealth at the top. Specifically, the marginal wealth tax paid by households at the 95^{th} percentile of the pre-reform wealth distribution is 0.8%, larger than in the baseline model. This wealth tax at the top increases the savings wedge. The equilibrium interest rate increase from 2.9% to 5.3% in the case of flat income taxes, and to 6.1% with the richer set of tax instruments. Thus, in contrast to the benchmark model, the planner exacerbates the savings distortions when it uses a richer set of tax instruments. Nevertheless, a flat income tax once again achieves the vast majority (88%) of the maximum attainable welfare gains.

We also confirm the insight of Guvenen et al. (2019), who point out that a wealth tax may improve allocative efficiency by reducing the relative tax burden of productive entrepreneurs. Specifically, when the planner is constrained to use a flat income tax, the losses from misallocation increase from 1.3% to 1.7%. When the planner uses the richer set of tax instruments, it is able to reduce income taxes and thus encourages savings by entrepreneurs, leading to losses from misallocation of 1.6%, smaller than under a flat income tax. However, since these misallocation losses are relatively small, the additional frictions introduced by collateral constraints do not critically affect optimal policy.

Because wealth and capital income taxes are not equivalent in this model, we next study optimal policy reforms that separately tax labor income, capital income and wealth. We report the results of these experiments in Table 9. For brevity we restrict attention to linear taxes only. The first column reports the optimal policy and its effects on welfare when the planner can only use labor income taxes. The optimal tax on labor income is equal to 63.8% and it increases the welfare of the poorest third of households by 12%. However, utilitarian welfare falls relative to the status quo, by 1.1%, since the planner no longer taxes capital. This benefits entrepreneurs, whose welfare increases by 7%, and hurts workers who now pay higher taxes on their labor income. Overall, their welfare falls by 2.2%. The reason utilitarian welfare falls is that the majority of households in our economy are workers and these agents are poorer on average than entrepreneurs.

In the second column of the table we show that allowing the planner to tax capital income $r_{t-1}a_t + \pi_t$, in addition to labor income, greatly increases utilitarian welfare, by 9.5%. The planner achieves these gains by taxing capital income at a rate slightly higher than labor income (66% vs. 53%). Notice however, that the incremental welfare gains from being able to tax capital and labor income at different rates are small. In particular, the welfare gains are now 9.5%, only slightly higher than the 9.1% achieved with a uniform flat tax levied on both sources of income, reported in Panel D of Table 7. By taxing capital the planner is able to redistribute from the relatively wealthy entrepreneurs, whose welfare falls by 8.7%, towards workers, who experience welfare gains of 12.2%.

In the third column of the table we allow the planner to use labor income and a wealth tax. Since the wealth tax falls on both workers and entrepreneurs, it is unable to achieve as much redistribution as a tax on capital income. Consequently, utilitarian welfare only increases by 5.6%. As pointed out by Guvenen et al. (2019), the advantage of the wealth tax is that it improves allocative efficiency because, unlike a capital income tax, it does not fall exclusively on productive entrepreneurs. When the planner taxes capital income, the steady state losses from misallocation increase to 2%. In contrast, when the planner taxes wealth, they fall to 0.8%. These efficiency considerations are swamped however by the planner's concern for redistribution. Since entrepreneurs in our economy are much wealthier on average, as in the data, the planner desires to redistribute towards workers and thus prefers to tax capital income instead of wealth.

Notice that this result differs from Guvenen et al. (2019), who argue that a wealth tax is preferable to taxing capital income. Our analysis deviates from theirs along a number of dimensions. In contrast to Guvenen et al. (2019), in our framework entrepreneurs co-exist with unconstrained corporate firms and operate a technology that uses both capital and labor. Our losses from misallocation are therefore much smaller than in their setting (1.3% vs. 20%). In addition, we target the large wealth and income concentration in the hands of entrepreneurs, allow for lump-sum transfers, and conduct optimal policy taking transition dynamics into account. That our results are different from those of Guvenen et al. (2019) therefore simply reflects well known results in public finance that the details of the model critically influence the size of optimal taxes. Notwithstanding all these differences, our main point stands: a flat uniform income tax achieves the bulk of welfare gains attainable with non-linear income, wealth or differential taxation of capital and labor income.

6 Conclusions

Motivated by the large increase in wealth and income inequality in the United States, we ask: what are the most efficient means of redistribution in an unequal economy? We answer this question by characterizing the optimal shape of income and wealth tax schedules in a dynamic general equilibrium model that reproduces the observed wealth and income inequality, as well as the extent of redistribution currently in place.

We find that taxing capital and labor income at a uniform flat rate is nearly optimal, in that the incremental gains from introducing more complex non-linear income and wealth tax schedules are relatively small. Intuitively, the optimal flat income tax is high and further increasing the slope of the marginal income tax schedule or taxing wealth places the economy on the wrong side the Laffer curve. While steeper marginal income taxes or wealth taxes can greatly increase government revenue when average marginal income taxes are low to begin with, such policies lead to little or no increase in government revenue when marginal income taxes are already high due to a larger drop in the labor supply of high-ability households and the general equilibrium implications of depressed capital accumulation. Interestingly, the incremental gains from a richer set of tax instruments are smaller, the stronger the planner's concern for redistribution. Our result is robust to a number of perturbations of the model, as well as to explicitly modeling private business ownership and the ensuing heterogeneity in rates of return stemming from financial constraints.

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Table 1: Parameterization

A. Moments Used in Calibration

	Data	Model
Wealth to income ratio	6.6	6.6
Gini wealth	0.85	0.86
Gini income	0.64	0.65
Wealth share top 0.1%	0.22	0.22
Wealth share top 1%	0.35	0.34
Income share top 0.1%	0.14	0.14
Income share top 1%	0.22	0.22

B. Parameter Values

Assigned			*Calibrated*		
θ	1	CRRA	β	0.975	discount factor
γ	2	inverse Frisch elasticity	ρ_e	0.982	autocorrelation e
α	1/3	capital elasticity	σ_e	0.200	std. dev. e shocks
δ	0.06	depreciation rate	p	2.2e-6	prob. enter super-star state
τ_a, ξ_a	0	wealth tax	q	0.990	prob. stay super-star state
τ_s	0.065	consumption tax	$\bar{e}$	504.3	ability super-star state, rel. to mean
τ_k	0.20	capital gains tax	ι	0.167	lump-sum transfer, rel. per-capita GDP
$\bar{B}$	1	government debt to GDP	τ	0.263	income tax schedule
			ξ	0.049	income tax schedule

Table 2: Non-Targeted Moments

	Data	Model		Data	Model
A. Wealth Distribution			**B. Income Distribution**		
Share top 5%	0.63	0.59	Share top 5%	0.39	0.40
Share top 10%	0.75	0.75	Share top 10%	0.51	0.51
Share bottom 75%	0.09	0.06	Share bottom 75%	0.29	0.27
Share bottom 50%	0.01	0.00	Share bottom 50%	0.10	0.08
Share bottom 25%	-0.01	0.00	Share bottom 25%	0.02	0.02

Notes: The data moments are based on the 2013 SCF survey.

Table 3: Dimensions of Inequality

	Welfare	Post-Tax Income	Pre-Tax Income	Wealth
Share top 1%	0.10	0.15	0.22	0.34
Share top 5%	0.20	0.29	0.40	0.59
Share top 10%	0.29	0.39	0.51	0.75
Share bottom 75%	0.52	0.40	0.27	0.06
Share bottom 50%	0.30	0.18	0.08	0.00
Share bottom 25%	0.08	0.06	0.02	0.00

Table 4: Optimal Tax Policy

	Flat income tax	Non-linear income and wealth tax
A. Maximize Average Welfare		
marg income tax, 50^{th} pct	47.8	48.1
marg income tax, 95^{th} pct	47.8	53.2
marg wealth tax, 50^{th} pct	—	−0.6
marg wealth tax, 95^{th} pct	—	−0.7
average welfare gains	2.1	2.6
welfare gains, bottom 1/3	20.2	19.0
welfare gains, middle 1/3	4.8	4.7
welfare gains, top 1/3	−4.6	−3.1
B. Maximize Utilitarian Welfare		
marg income tax, 50^{th} pct	56.0	50.5
marg income tax, 95^{th} pct	56.0	57.8
marg wealth tax, 50^{th} pct	—	−0.7
marg wealth tax, 95^{th} pct	—	0.04
utilitarian welfare gains	7.4	8.5
welfare gains, bottom 1/3	26.7	25.2
welfare gains, middle 1/3	5.7	7.0
welfare gains, top 1/3	−7.5	−4.8
C. Maximize Rawlsian Welfare		
marg income tax, 50^{th} pct	70.4	75.4
marg income tax, 95^{th} pct	70.4	69.0
marg wealth tax, 50^{th} pct	—	−1.0
marg wealth tax, 95^{th} pct	—	0.2
Rawlsian welfare gains	65.0	66.9
welfare gains, bottom 1/3	29.4	29.4
welfare gains, middle 1/3	1.7	0.8
welfare gains, top 1/3	−16.3	−16.7

Notes: The first column restricts $\xi = \tau_a = \xi_a = 0$. The second column is the unrestricted optimum. The x^{th} marginal tax percentile is the marginal tax rate paid by an agent at the x^{th} percentile of the income/wealth distribution in the initial steady state. The welfare gains are computed taking transitions into account. All numbers are expressed in percent.

Table 5: Partial Equilibrium and Capital Levy, Utilitarian Planner

	Baseline		Partial Equilibrium		Capital Levy		
	I	II	I	II	0	I	II
A. Optimal Policy							
marg income tax, 50^{th} pct	56.0	50.5	60.1	58.1	26.7	53.1	47.4
marg income tax, 95^{th} pct	56.0	57.8	60.1	63.0	34.5	53.1	63.0
marg wealth tax, 50^{th} pct	—	−0.7	—	−25.1	—	—	−0.7
marg wealth tax, 95^{th} pct	—	0.04	—	34.9	—	—	−1.1
B. Welfare Change							
utilitarian welfare gains	7.4	8.5	7.8	9.6	14.9	19.2	22.3
welfare gains, bottom 1/3	26.7	25.2	29.4	40.5	38.8	59.9	62.5
welfare gains, middle 1/3	5.7	7.0	6.8	13.8	20.5	25.3	29.3
welfare gains, top 1/3	−7.5	−4.8	−9.3	−17.8	−9.3	−15.4	−12.9
C. Aggregate Implications							
change in wage	−9.7	−9.8	0	0	0	−8.1	−0.5
interest rate	4.0	4.0	2.1	2.1	2.1	3.7	2.2
change in output	−19.1	−19.7	−9.3	−11.0	0	−16.2	−11.7
wealth to income	5.4	5.4	1.9	1.5	6.6	5.6	6.6

Notes: The columns labeled I refer to the optimal flat income tax reform. The columns labeled II refer to the optimal non-linear income and wealth tax reforms. The column labeled 0 reports the result of a one-time 100% wealth tax at date 0 that is rebated lump-sum to all households, with no additional changes in the parameters of the income and wealth tax schedules.

Table 6: Sensitivity: Parameterization

	Data	Lower IES $\theta = 2$	Higher Frisch $\gamma = 1$	Gaussian ability
A. Parameter Values				
β, discount factor		0.958	0.970	0.968
ρ_e, autocorrelation e		0.981	0.963	0.979
σ_e, std. dev. e shocks		0.254	0.271	0.313
p, prob. enter super-star state		3.4e-6	3.0e-6	–
q, prob. stay super-star state		0.990	0.970	–
$\bar{e}$, ability super-star state, rel. mean		1147	790.1	–
B. Moments				
Wealth to income ratio	6.6	6.6	6.6	6.6
Gini wealth	0.85	0.85	0.84	0.87
Gini income	0.64	0.65	0.66	0.75
Wealth share top 0.1%	0.22	0.23	0.23	0.05
Wealth share top 1%	0.35	0.34	0.34	0.24
Income share top 0.1%	0.14	0.14	0.13	0.05
Income share top 1%	0.22	0.22	0.22	0.21

Table 7: Sensitivity: Optimal Policy, Utilitarian Planner

	Flat income tax	Non-linear income and wealth tax
A. Lower IES, $\theta = 2$		
marg income tax, 50^{th} pct	71.6	70.7
marg income tax, 95^{th} pct	71.6	78.2
marg wealth tax, 50^{th} pct	—	−25.3
marg wealth tax, 95^{th} pct	—	21.0
utilitarian welfare gains	28.7	40.1
B. Higher Frisch, $\gamma = 1$		
marg income tax, 50^{th} pct	49.0	41.9
marg income tax, 95^{th} pct	49.0	46.2
marg wealth tax, 50^{th} pct	—	−0.2
marg wealth tax, 95^{th} pct	—	1.0
utilitarian welfare gains	3.7	5.1
C. Gaussian Ability		
marg income tax, 50^{th} pct	61.9	73.9
marg income tax, 95^{th} pct	61.9	57.9
marg wealth tax, 50^{th} pct	—	0.5
marg wealth tax, 95^{th} pct	—	0.1
utilitarian welfare gains	19.4	20.2
D. Economy with Entrepreneurs		
marg income tax, 50^{th} pct	58.2	51.1
marg income tax, 95^{th} pct	58.2	56.8
marg wealth tax, 50^{th} pct	—	−0.7
marg wealth tax, 95^{th} pct	—	0.8
utilitarian welfare gains	9.1	10.3

Notes: The first column restricts $\xi = \tau_a = \xi_a = 0$. The second column is the unrestricted optimum. The x^{th} marginal tax percentile is the marginal tax rate paid by an agent at the x^{th} percentile of the income/wealth distribution in the initial steady state. The welfare gains are computed taking transitions into account. All numbers are expressed in percent.

Table 8: Economy with Entrepreneurs: Parameterization

A. Moments Used in Calibration

	Data	Model
Wealth to income ratio	6.6	6.5
Percentage entrepreneurs	11.7	11.7
Wealth share of entrepreneurs	0.46	0.44
Income share of entrepreneurs	0.31	0.28
Fraction entrepr., top 0.1% wealth	0.66	0.65
Fraction entrepr., top 1% wealth	0.70	0.80
Gini wealth, all hhs	0.85	0.87
Gini income, all hhs	0.64	0.66
Gini wealth, entrepr.	0.78	0.78
Gini income, entrepr.	0.68	0.68
Gini wealth, workers	0.81	0.87
Gini income, workers	0.58	0.62
Wealth share top 0.1%	0.22	0.17
Wealth share top 1%	0.35	0.37
Income share top 0.1%	0.14	0.12
Income share top 1%	0.22	0.22
Average debt to capital ratio	0.35	0.34
Sales share of corporate firms	0.63	0.63

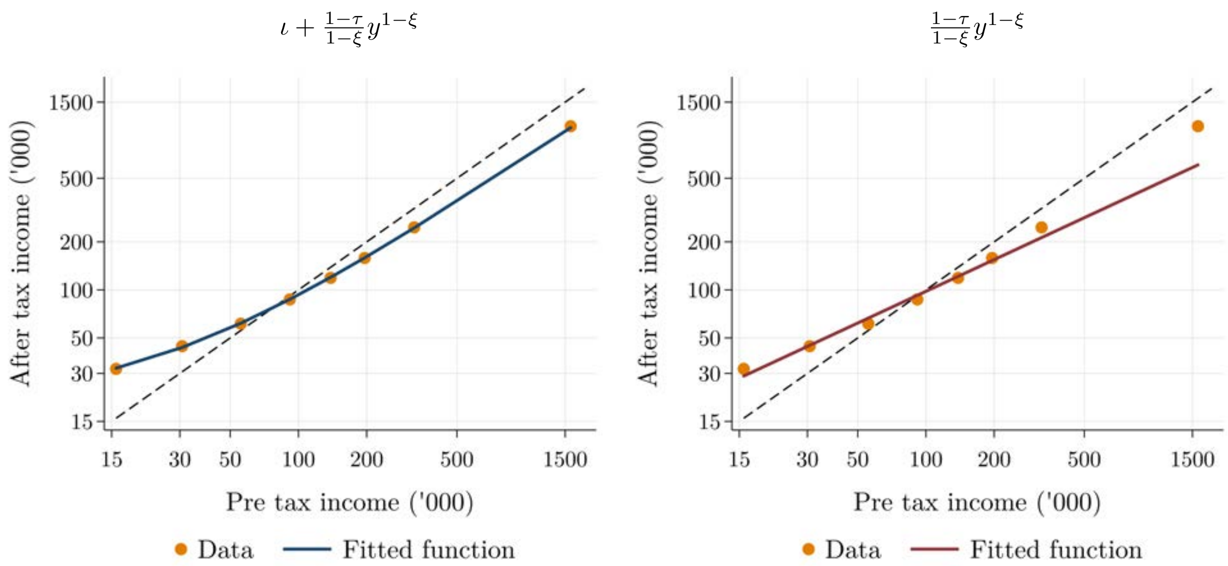
B. Parameter Values

Assigned			*Calibrated*		
θ	1	CRRA	β	0.969	discount factor
γ	2	inverse Frisch elasticity	ψ	0.117	share of entrepreneurs
α	1/3	capital elasticity	ρ_z	0.961	AR(1) z
δ	0.06	depreciation rate	σ_z	0.696	std. dev. z shocks
τ_a, ξ_a	0	wealth tax	ρ_e	0.981	AR(1) e
τ_c	0.36	corporate profits tax	σ_e	0.198	std. dev. e shocks
τ_k	0.20	capital gains tax	p	2.1e-6	prob. enter super-star state
φ	0.04	exit rate, corporations	q	0.985	prob. stay super-star state
ε	1.5	elasticity of entry rate	$\bar{e}$	474.0	ability super-star state, rel. to mean
			λ	2.303	leverage constraint
			η	0.784	span of control
			z	2.63	productivity corporate firms

Table 9: Wealth vs. Capital Income Taxes, Economy with Entrepreneurs

	Flat labor income tax	+ Flat capital income tax	+ Flat wealth tax
A. Tax Schedule			
labor income tax	63.8	53.2	55.6
capital income tax	—	65.6	—
wealth tax	—	—	4.3
B. Welfare Change			
utilitarian welfare gains	−1.1	9.5	5.6
welfare gains, bottom 1/3	11.8	32.2	26.6
welfare gains, middle 1/3	−5.7	8.8	4.2
welfare gains, top 1/3	−8.4	−8.8	−10.8
welfare gains, workers	−2.2	12.2	5.9
welfare gains, entrepreneurs	7.1	−8.7	3.6

Figure 1: Tax Function



Notes: The figure plots the relationship between pre- and post-tax income under the assumption that post-tax income is equal to i) $\iota + \frac{1-\tau}{1-\xi} y^{1-\xi}$ in the left panel and ii) $\frac{1-\tau}{1-\xi} y^{1-\xi}$ in the right panel. The dashed line is the 45 degree line.

Figure 2: Welfare Implications of Partial Reforms

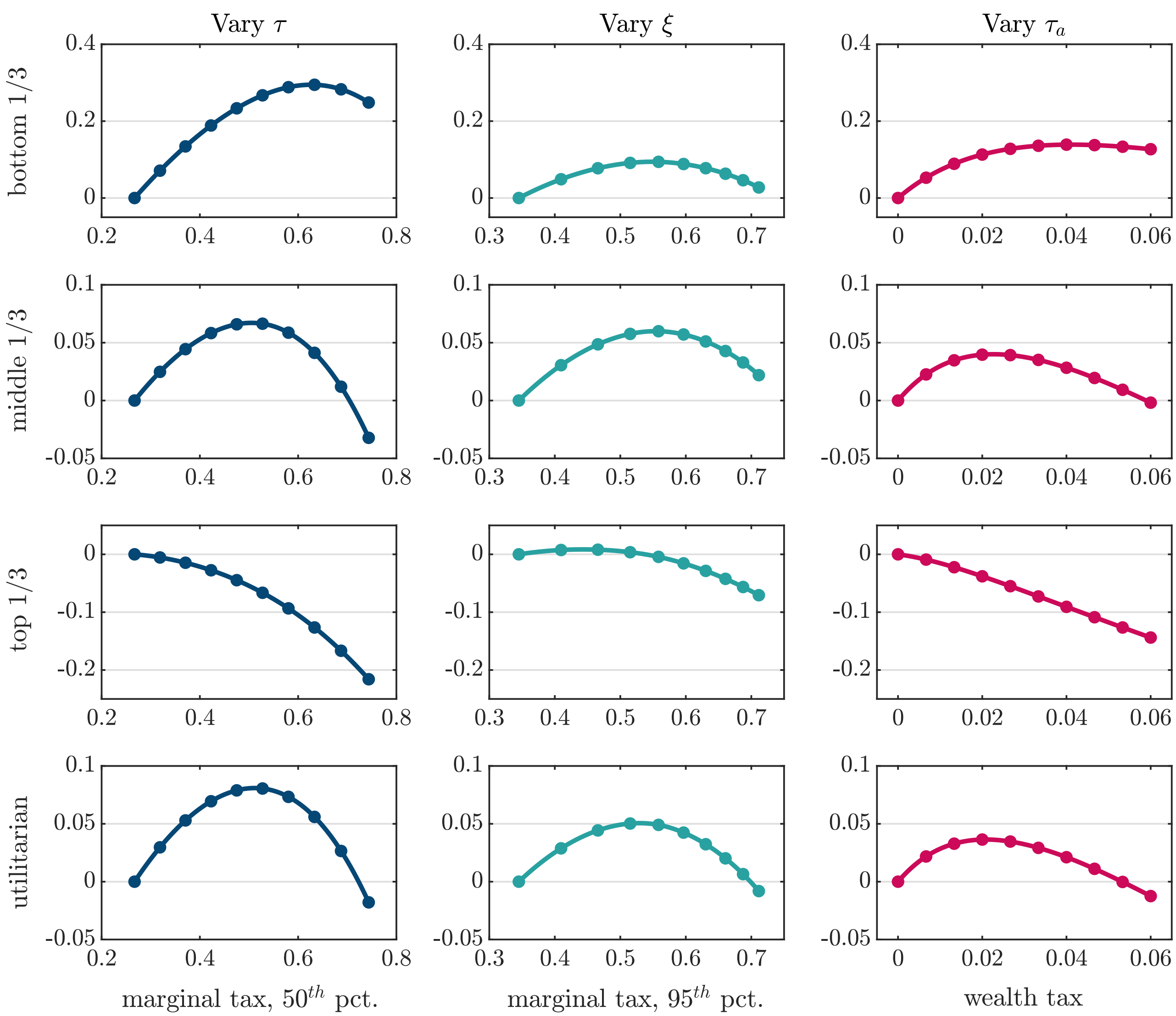
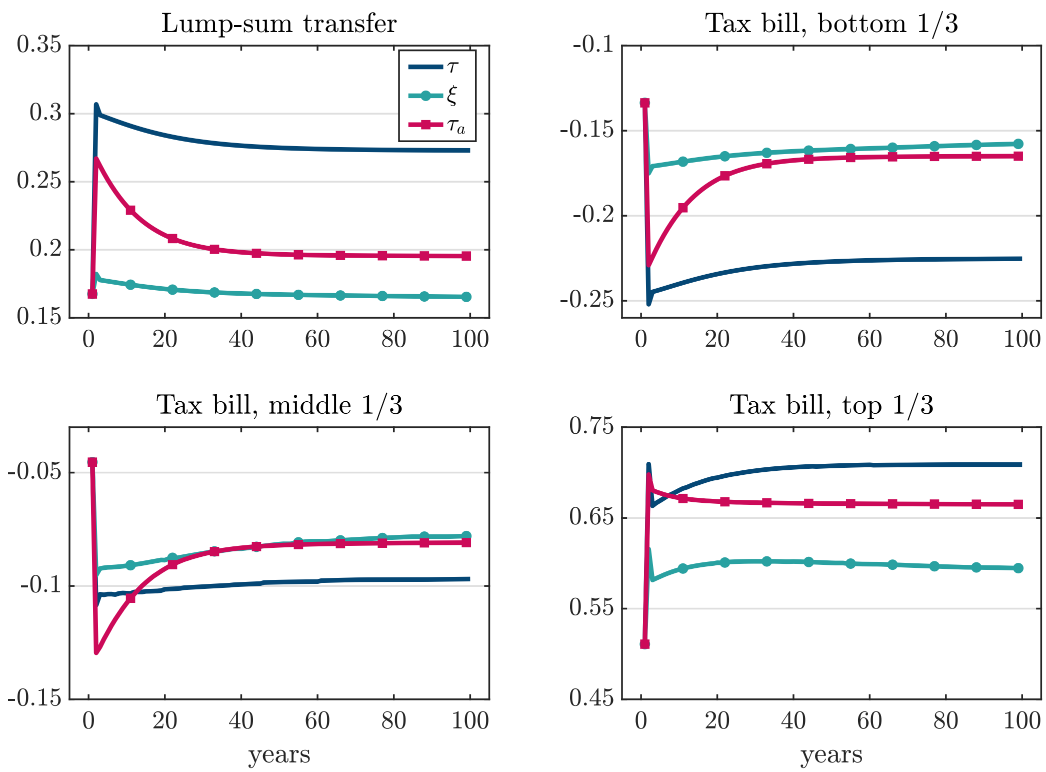
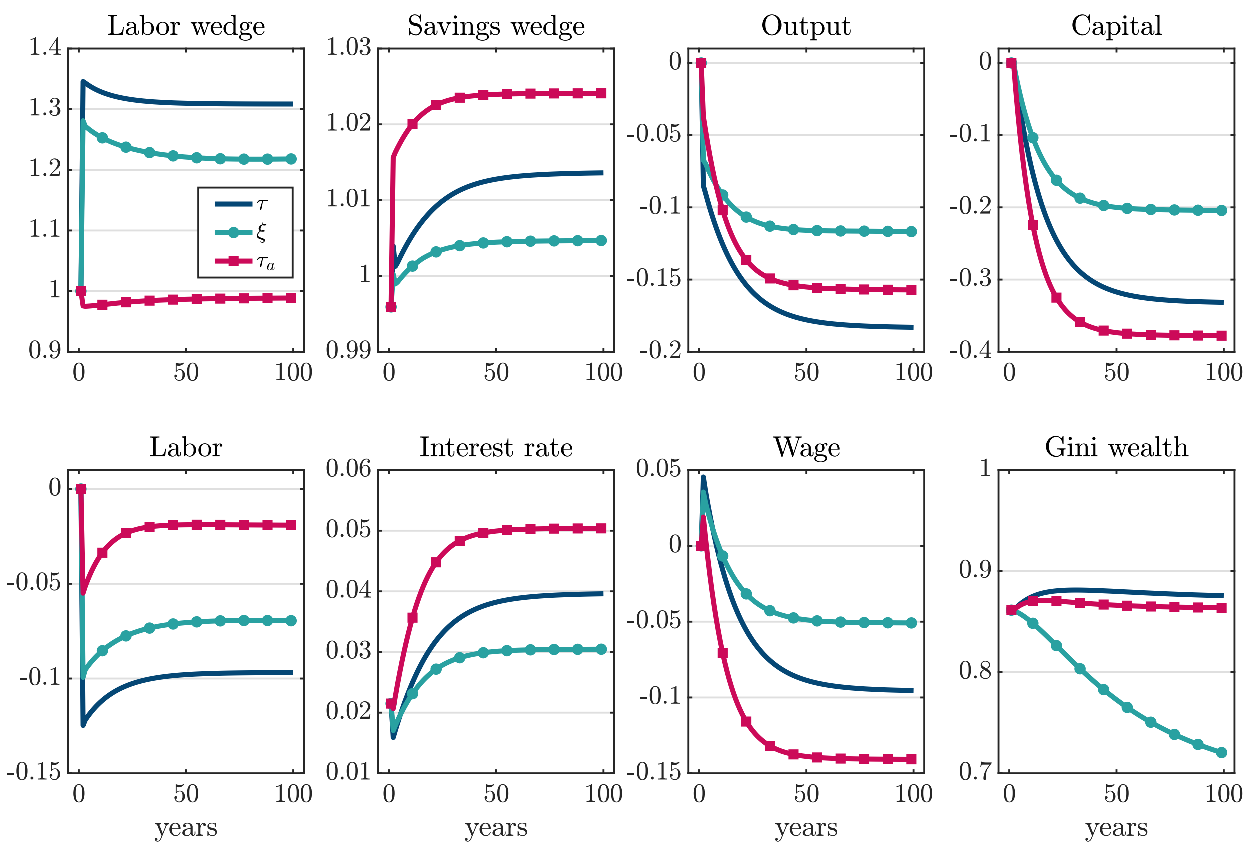


Figure 3: Effect of Partial Reforms on Taxes and Transfers



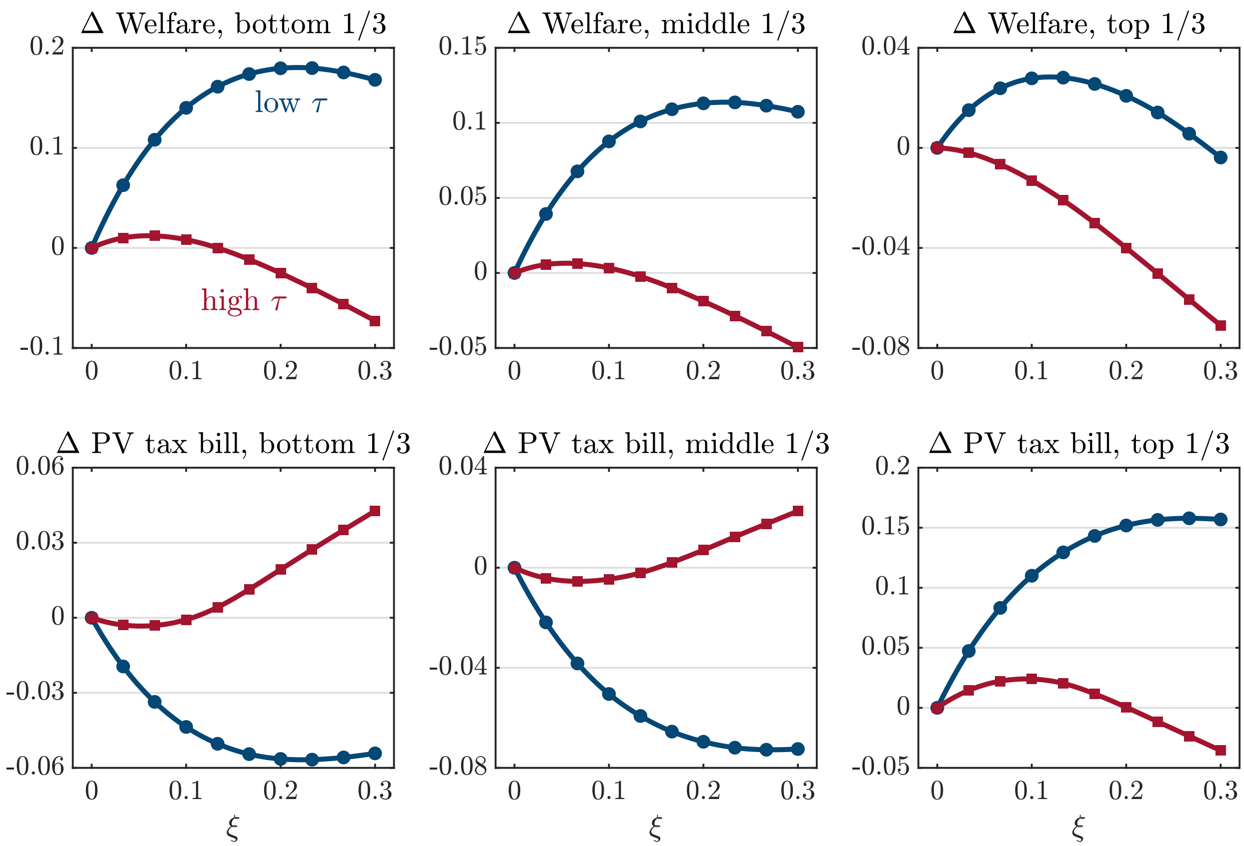
Notes: All variables are expressed relative to pre-reform GDP. The tax liabilities are averages for each group.

Figure 4: Effect of Partial Reforms on Macro Aggregates



Notes: The labor wedge is expressed relative to its pre-reform value. The savings wedge, interest rate and Gini coefficient are expressed in levels. Changes in output, capital, labor and the wage are expressed relative to their pre-reform values.

Figure 5: Differential Response to Varying ξ



Notes: The tax bill is expressed relative to pre-reform GDP. We report the per capita, annuitized present value, discounted at the pre-reform equilibrium interest rate.

Figure 6: Transition Dynamics after Increasing ξ

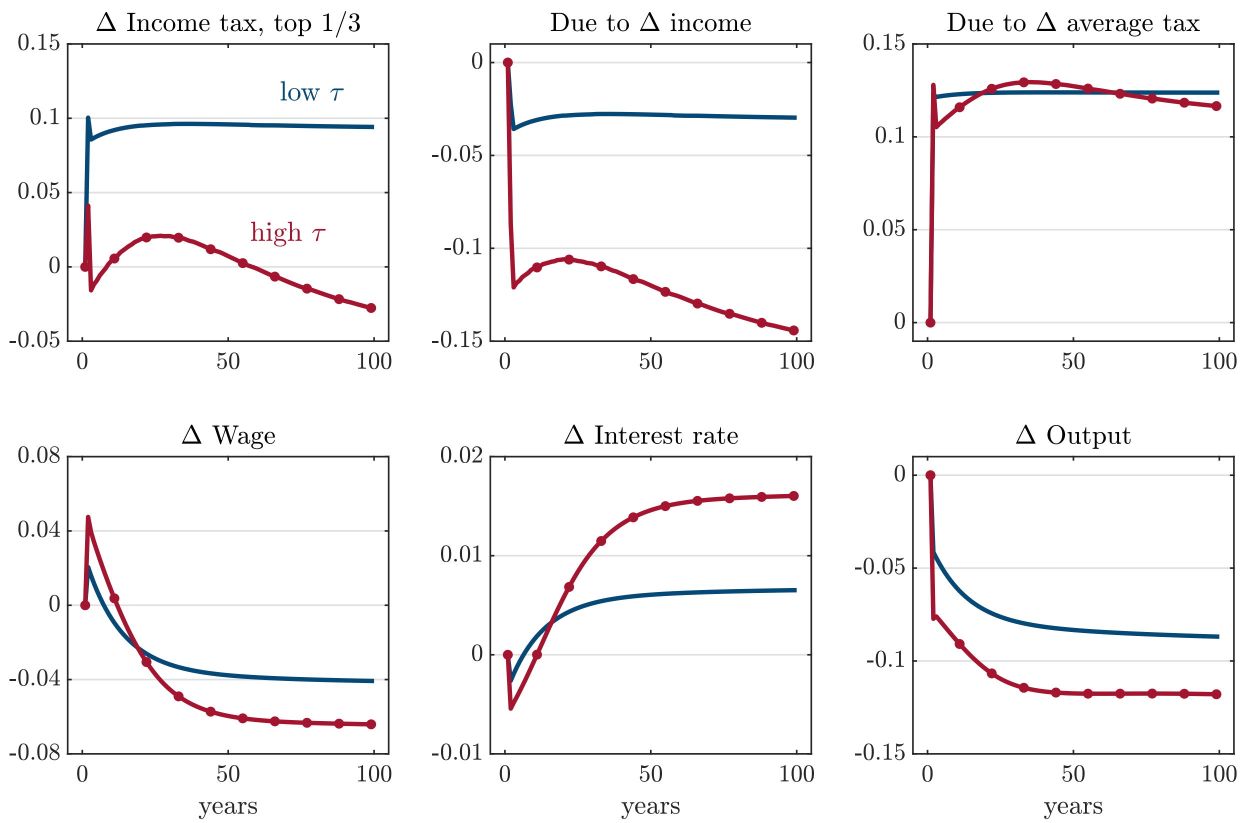
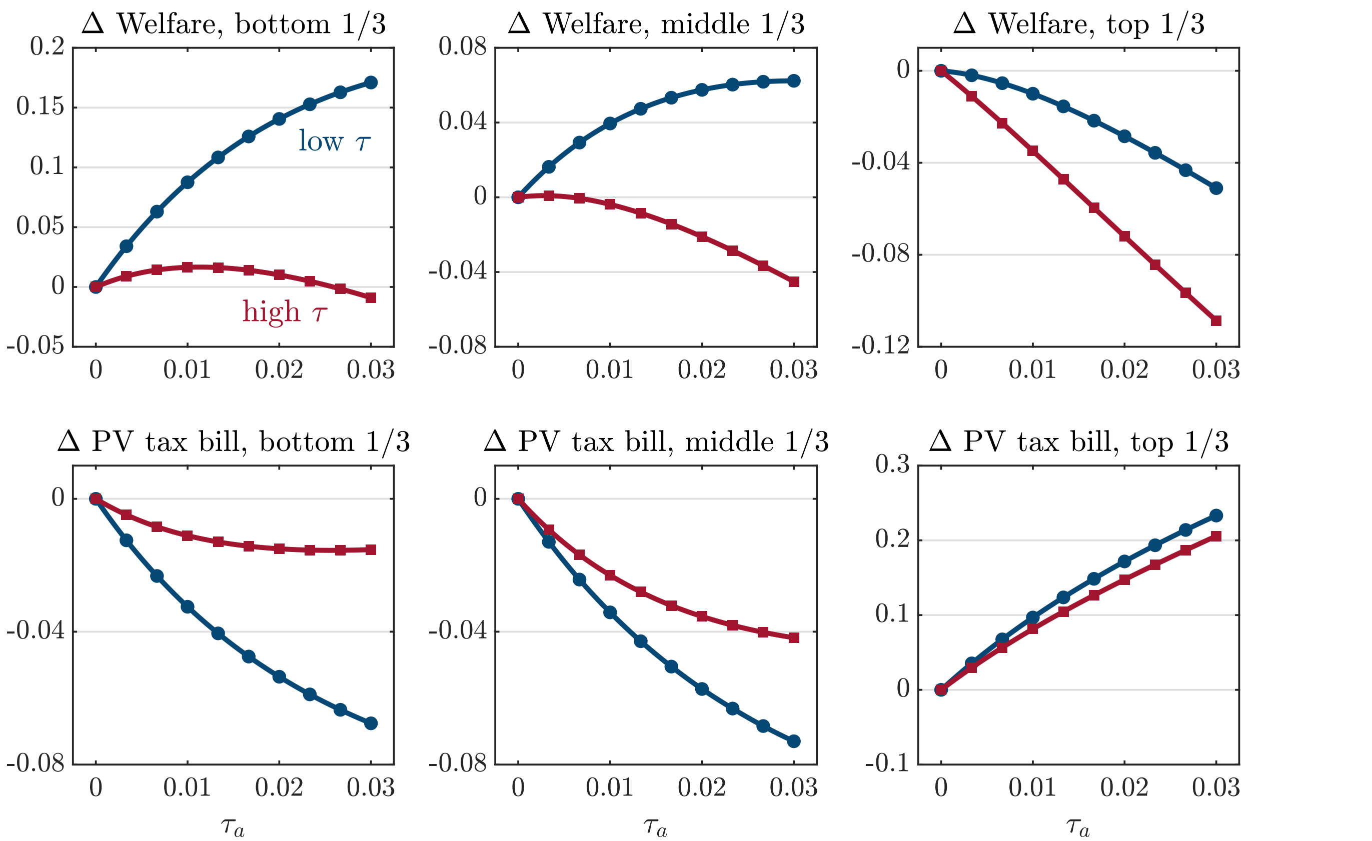


Figure 7: Differential Response to Varying τ_a



Notes: The tax bill is expressed relative to pre-reform GDP. We report the per capita, annuitized present value, discounted at the pre-reform equilibrium interest rate.

Figure 8: Transition Dynamics after Increasing τ_a