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ABSTRACT

We ask: what are the most efficient means of redistribution in an unequal society? 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 taxing wealth and allowing for increasing marginal income tax schedules raises utilitarian welfare, the incremental gains from doing so are small. 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 across financially constrained entrepreneurs.

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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 revisits this classic question by characterizing the optimal shape of non-linear income and wealth tax schedules. We do so using a dynamic general equilibrium model with uninsurable 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 universal lump-sum transfers to households.

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

To make our results as transparent as possible we start our analysis from 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 is highly concentrated in the hands of private business owners, we also extend our analysis to allow for entrepreneurial activity and find once again that a uniform flat tax on labor and capital income is nearly optimal.

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. To facilitate comparison with our model with entrepreneurs we assume that corporate firms operate a decreasing returns technology and that the mass of producers is pinned down by a free entry condition.

The government redistributes by taxing income and wealth and 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 taxes of the Benabou (2000) and Heathcote et al. (2017) type, as well as a flexible two-parameter functional form for wealth taxes.

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. Nevertheless, as we show, maximizing this criterion leads to more redistribution because pure economic efficiency is increased by policies which improve risk sharing. On the other end, we consider objectives that place increasingly higher weights on the welfare of the poor, such as utilitarian welfare.

We begin our analysis by providing some intuition about the relative benefits and costs of income and wealth taxes. To that end, we first change the parameters of the income and wealth tax schedules in isolation and trace out the implications for the welfare of households in various parts of the distribution. Not surprisingly, we find 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 lump-sum transfers, thus increasing the welfare of the poor. We find, however, that redistributing solely by increasing top marginal income taxes or wealth taxes is inefficient compared to raising marginal income taxes on all households. In particular, the efficiency cost of increasing the welfare of poor households by a given amount is much higher if redistribution is financed by only increasing top marginal income tax rates or wealth taxes.

We then turn to the optimal tax experiments. We begin by studying the problem of a planner that seeks to maximize utilitarian welfare using once-and-for-all tax reforms. We assume that government debt is constant throughout the transitions 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 persistent 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 gradually augmenting the set of instruments with non-linear income taxes, as well as linear and non-linear 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. Specifically, a utilitarian planner that can only use a flat income tax sets it equal to 56%, which increases consumption-equivalent welfare by 7.8%, a sizable amount. A planner that can use non-linear income taxes chooses an increasing marginal income tax schedule, but the incremental gains from doing so are relatively small: utilitarian welfare only increases by 0.7 percentage points relative to the optimally chosen flat income tax. A planner that can also use a linear wealth tax, in addition to non-linear income taxes, would set it equal to 0.6%. The incremental welfare gains from this additional instrument are, however, only 0.2 percentage points. Finally, a planner that can also tax wealth non-linearly would disproportionately tax wealthier households but once again achieve relatively small additional gains. Overall, we find that an optimally chosen flat income tax delivers the bulk (80%) of the welfare gains that can be achieved with more complex income and wealth taxes.

The intuition for this result is that increasing taxes on wealth or the incomes of top earners depresses the capital stock and output, reducing the tax base and therefore the amount of lump-sum transfers. Since the welfare of the poor households is primarily determined by the size of these transfers, a utilitarian planner chooses to avoid distorting the savings and labor supply choices of high-ability households too much. Introducing more complex instruments allows the planner to reduce marginal income taxes faced by the median household, at the cost of lower lump-sum transfers, which implies that the poor gain less relative to the case of a flat income tax. The gains from more complex instruments thus accrue mostly to households in the middle of the distribution. Since a utilitarian planner places a high weight on the consumption-equivalent welfare of the poor, the incremental welfare gains from increasing top marginal income taxes or from taxing wealth are relatively small.

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 allow the planner to tax labor and capital income at different rates. We find that if the planner can only tax labor income, it achieves much smaller welfare gains of 2.9% compared to the 7.8% attainable using a a flat tax applied to both labor and capital income. This suggests that taxing capital income is important for efficient redistribution. Indeed, the planner would find it optimal to tax capital income at a rate slightly higher than labor income. However, the welfare gains from non-uniform taxation of capital and labor income are small. 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.

As is well known, optimal tax policy is critically shaped by household preferences, the underlying distribution of ability, as well as the planner's desire to redistribute. 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, the distribution of labor ability and the planner's taste for redistribution, our result that a flat income tax is nearly optimal stands. In all the experiments we considered, an optimally chosen flat income tax achieves between 80% and 90% of the welfare gains attainable with more complex tax instruments.

We next extend our analysis to allow for 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 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, generates an important distinction between capital income and wealth taxation. Taxing private business income distorts entrepreneurs incentives to accumulate wealth, amplifying the production inefficiencies induced by collateral constraints.

We revisit the question of efficient redistribution 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 wealth and top incomes, the welfare gains achieved with more complex instruments are only 10.6%, 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. In fact, we find that the optimal tax on wealth in this economy is equal to zero, provided the planner can tax capital income at a rate higher than labor income. 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 income tax is nearly optimal, even when the planner can use complex 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, a challenging task. 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.

A related complementary paper that studies optimal capital and labor income taxation and explicitly takes transition dynamics into account is Dyrda and Pedroni (2018). In contrast to our work, which allows for non-linear income and wealth tax schedules, they restrict attention to linear but time-varying taxes and finds that the incremental welfare gain from allowing tax instruments to vary over time is relatively small. In contrast to the papers mentioned above, we also study a model of entrepreneurship in which there is a meaningful distinction between wealth and capital income taxation.

Our results also corroborate the observation in a number of recent papers which find that redistributive policies such as wealth, capital or progressive labor income taxes can, in isolation, increase utilitarian welfare. 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), 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 tax reforms that jointly change all of 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 are subject to idiosyncratic shocks to their labor market ability. Household supply labor elastically to firms which produce a homogenous good. We abstract from aggregate uncertainty, and study the steady state of the model and transition dynamics after policy reforms.

2.1 Households

Households seek to maximize life-time utility given by

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

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 wage rate W_t and the idiosyncratic ability e_t, which follows a Markov process with transition probability $F_e(e_{t+1}|e_t)$. Asset income $r_{t-1}a_t$ depends on household wealth a_t and the return to savings r_{t-1}. As we discuss below, a_t is the sum of holdings of government bonds, stocks in firms and physical capital. Because there is no aggregate uncertainty, the rates of return on all 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 households' behalf. We assume that households cannot borrow so $a_{t+1} \geq 0$.

The budget constraint is

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

where τ_s is a consumption tax. We assume, in line with the tax code in the United States, 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 $T^i(i_t)$. We assume a modified HSV[1] tax function $T(i_t) = i_t - (1-\tau) \frac{i_t^{1-\xi}}{1-\xi} - \iota_t$ where ι_t is a lump-sum transfer. Here τ determines the average level of the marginal income tax and

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

ξ determines the slope of the marginal income tax schedule. As we show below, a lump-sum transfer is necessary to capture means-tested and other transfers to poorer households 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, which we parameterize as

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

Here τ_a determines the average level of the wealth tax and ξ_a determines how fast the marginal wealth tax increases with wealth.

2.2 Technology

We assume that all firms produce a homogeneous good with identical technology

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

where k_t and l_t are the amounts of capital and labor used in production. We assume that the production technology is decreasing returns to scale, with span of control parameter η. Assuming decreasing returns to scale is inconsequential for our results, but facilitates comparison with the model with entrepreneurs which we study in a latter section. We normalize the price of output to 1.

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

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

where $Y_t = N_t y_t$ is total output produced by the mass N_t of firms in the economy, G is the exogenously-given government spending, X_t is investment in physical capital and in creating a mass ν_t of new firms

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

and F_t is the cost of creating a new firm in period t. Firms exit with exogenous probability φ, so their number evolves endogenously according to

$$N_{t+1} = (1-\varphi)(N_t + \nu_t).$$

These firms are subject to a corporate profit tax τ_c. There is free entry, so the mass of new firms ν_t is pinned down by the free-entry condition

$$F_t \geq Q_t,$$

where Q_t is the price of a claim to a firm and is given by

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

and π_{t+1} are the profits of the representative firm.

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.

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 an exogenous amount of government 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, consumption taxes and corporate income taxes.

2.4 Financial Intermediaries

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

The budget constraint of the financial intermediary is

$$K_{t+1}+B_{t+1}-A_{t+1}+Q_tS_{t+1} = (R_t+1-\delta)\,K_t+(1+r_{t-1})\,(B_t-A_t)+[Q_t+(1-\tau_c)\,\pi_t]\,(1-\varphi)\,S_t,$$

where S_t denotes the number of shares in firms held by the intermediary and Q_t is the price of such shares. In equilibrium

$$S_{t+1} = N_t + \nu_t$$

and

$$N_t = (1 - \varphi) S_t.$$

Here A_t is the total assets of the households, K_{t+1} is the capital stock in the economy and B_{t+1} is the amount the debt issued by the government in period t. Since financial intermediaries can choose K_{t+1} freely, it must be that

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

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, *(iv)* measures of households over their idiosyncratic states $n_t(a,e)$, *(v)* mass of entrants ν_t and incumbents N_t, and *(v)* stock price Q_t such that

1. Given prices, households and firms solve their optimization problems.
2. Total output is equal to
$$Y_t = N_t y_t.$$
3. Markets clear. The labor market clearing condition is
$$N_t l_t = \int e h_t(a,e)\, dn_t(a,e).$$
   The asset market clearing condition is
$$K_{t+1} + B_{t+1} + Q_t(N_t + \nu_t) = \int a_{t+1}(a,e)\, dn_t(a,e),$$
   where $K_t = N_t k_t$.

   The goods market clears by Walras' Law.
4. The mass of new entrants is pinned down by the free-entry condition.
5. The budget constraint of the government is satisfied period by period.
6. 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.

2.6 Tax Distortions

Redistributive policies have production consequences because they distort household saving and labor supply choices. We briefly discuss the two distortions introduced by redistributive 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

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

For aggregation purposes, which we turn to next, it is 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) yields the optimality condition for aggregate labor supply

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

where the aggregate labor wedge $\bar{\vartheta}_t$ is

$$\bar{\vartheta}_t = \left(\int \vartheta_{it}^{-\frac{1}{\gamma}} \hat{c}_{it}^{-\frac{\theta}{\gamma}} e_{it}^{1+\frac{1}{\gamma}} \mathrm{d}i\right)^{-\gamma} \tag{3}$$

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

Consider next the households savings choice and let

$$\tilde{\tau}_{it}^{a} = \tau_a a_{it}^{\xi_a}$$

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

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

where χ_{it} is the multiplier on the no-borrowing constraint. For notational convenience, we can collapse the distortions into a single savings wedge ζ_{it} that satisfies

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

As above, aggregating across households yields the aggregate Euler equation

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

where the aggregate savings wedge $\bar{\zeta}_t$ is

$$\bar{\zeta}_t = \left(\int \mathbb{E}_t \left(\frac{\hat{c}_{it+1}}{\hat{c}_{it}} \right)^{-\theta} \zeta_{it+1}^{-1} \mathrm{d}i \right)^{-1} \tag{4}$$

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

As we show below, the production consequences of redistribution via various tax instruments are entirely captured by their impact on the two aggregate wedges.

3 Quantifying the Model

In this section we outline our calibration strategy, and then evaluate the model's ability to account for data features not targeted in the calibration. We assume the economy is in a steady-state in 2013 and target statistics for this year. We then calculate a measure of inequality in consumption-equivalent welfare and use this to define the measures of social welfare used throughout the rest of the paper.

3.1 Calibration Strategy

We next describe how we choose parameters for our quantitative analysis.

3.1.1 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 span-of-control parameter $\eta = 0.85$, 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 exit rate of corporate firms $\varphi = 0.04$, to match that exiting firms account for approximately 4% of employment.[2]

[2] https://www.census.gov/data/tables/2013/econ/susb/2013-susb-employment.html

We set the elasticity of entry rates equal to $\varepsilon = 1.5$, the estimate of Gutierrez et al. (2019) who exploit the comovement between industry-level entry rates and stock prices to pin down this parameter.

We set the wealth tax parameters τ_a and ξ_a to zero in the initial steady state. We follow Bhandari and McGrattan (2018) and set $\tau_c = 0.36$ and $\tau_s = 0.065$, 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.

3.1.2 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 81st to 90th percentile, the 91st to 95th percentile, the 96th to 99th 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. Clearly, 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 amount redistributed to 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 $\xi = 0.049$, $\iota = 0.216$ of the mean household income (or approximately \$18,000) and $\tau = 0.280$. 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% and the marginal tax rate paid by the richest 5% of households is equal to 34%. We note that 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 a standard incomplete markets economy like ours requires departures from a Gaussian distribution of ability. Since the distribution of ability is critical in shaping optimal tax policy (Saez, 2001), we follow Castaneda et al. (2003) in allowing for a super-star state that allows the model to match the top income and wealth shares. Specifically, an agent can be in either a normal state or a super-star state. In the normal state labor market ability 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 shocks u_t which are drawn from a standard normal distribution. In the super-star state, labor market ability is relatively high, $\bar{e}$ 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 with these parameters 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 aspects of the wealth and income distribution. It matches the wealth Gini coefficient (0.85 in the data vs. 0.84 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 vs. 0.23) and top 1% (0.35 in both the data and the model), the share of income held by the top 0.1% and top 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 $\beta = 0.966$. The process for labor market ability in the normal state has persistence $\rho_e = 0.986$ and standard deviation $\sigma_e = 0.171$. The level of ability in the super-star state is $\bar{e} = 15.1$ times greater than the average. Households enter this state with probability $p = 0.02\%$ and remain there with probability $q = 0.975$. These numbers imply that 0.02% of households are in the super-star state at any point in time.

Finally, without loss of generality, we normalize the fixed entry cost $\bar{F}$ to ensure that the mass of firms is equal to one in the steady state. Total entry costs amount to 4.8% of GDP.

3.1.3 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 the data and and 72% in the model. Similarly, the richest 10% of households earn 51% of income in both the data and the model. The model also reproduces well the wealth and income shares at the bottom of the distribution. For example, households in the bottom half of the wealth distribution hold only 1% of the wealth in the data and nearly no wealth in the model, while households in the bottom half of the income distribution earn 10% of income in the data and 6% the model.

In summary, our model does a good job at reproducing the high degree of inequality in wealth and income in the United States, including the very low wealth and income shares of the median household.

3.2 The Distribution of Household Welfare

We next evaluate the extent to which incomplete risk-sharing translates into welfare inequality. Clearly, measures of wealth or income inequality do not entirely capture the distribution of household welfare. For example, as we show below, an increase in lump-sum transfers may reduce poor households' incentives to save and work, increasing wealth and income inequality. However, such policies would 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). Specifically, 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. Formally, 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 us to make 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 smaller compared to wealth and income inequality. For example, the share of wealth held by the top 1% is 35% and their share of pre-tax income is 22%. Since the existing tax and transfer system entails some degree of 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 twice more than the bottom 25% combined (12% vs. 6%, respectively). We thus conclude that our economy is characterized by substantial inequality in welfare, motivating our analysis of redistributive policies.

In our optimal policy exercise below 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):

$$\text{average welfare} = \int \omega_i \mathrm{d}i. \tag{5}$$

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. Nevertheless, maximizing this criterion leads to more redistribution because policies that improve risk-sharing, thus reducing consumption fluctuations, increase efficiency.

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

$$\text{utilitarian welfare} = \left(\int \omega_i^{1-\theta} \mathrm{d}i\right)^{\frac{1}{1-\theta}}. \tag{6}$$

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 results are robust to the planner's preference for redistribution.

4 Inspecting the Mechanism

We begin our analysis by providing some intuition about the relative benefits and costs of income and wealth taxes. To that end, we first change the parameters of the income and wealth tax schedules in isolation and trace out the implications for welfare in various parts of the distribution. We then gauge the relative cost of each instrument by examining the macroeconomic implications of financing a given amount of redistribution using each of them in isolation.

Specifically, we consider one-time, unanticipated and permanent changes in the three parameters that determine the level of marginal income taxes τ, the slope of the marginal income tax schedule ξ and the wealth tax τ_a. 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, including the amount of government debt, unchanged at their initial steady-state values. We calculate the transition dynamics following these reforms and report their implications for welfare taking into account the long-lived nature of these transitions.

4.1 Welfare Implications

Consider first the welfare implications of varying the average level of the marginal income tax schedule τ. The top row of Figure 2 reports the change in the welfare of the poorest and richest 20% of households. Since households differ along two dimensions, wealth and ability, we rank them by their welfare ω_i in the initial steady state. Because the value of $\tau$is not interpretable on its own, the horizontal axis reports the implied median marginal income tax rate. As income taxes increase, the welfare of the poorest 20% of households increases because of the larger lump-sum transfers. For example, raising marginal income taxes from 25% to 55% increases the welfare of these households by 40% on average. Recall that we measure welfare in consumption-equivalent units, so these households experience an increase in welfare equivalent to that resulting from a 40% permanent increase in consumption, a sizable amount. Wealthy households, in contrast, lose from higher income taxes. For example, raising marginal income taxes from 25% to 55% reduces their welfare by 15% on average.

We also report, in the bottom row of the figure, the impact of higher income taxes on average and utilitarian welfare, defined in equations (5) and (6). Small increases in marginal income tax rates allow the planner to raise lump-sum transfers and increase average welfare, as the insurance value of the transfers outweighs the distortions induced by higher taxes. For a larger increase in marginal income taxes the distortions dominate and average welfare decreases. For example, an increase in marginal income taxes from 25% to 55% reduces average welfare by 2%. In contrast, utilitarian welfare increases for a much wider range of marginal tax increases, owing to the utilitarian planner's explicit preference for redistribution. Utilitarian welfare increases by approximately 8% when the median marginal income tax increases to 55%.

Consider next the welfare implications of varying the slope of the marginal income tax schedule ξ, reported in Figure 3. Since the slope parameter is not easily interpretable on its own, the horizontal axis in the figure reports the marginal tax rate paid by households at the 95^{th} percentile of the income distribution. We note that the median income tax is approximately constant at 26%, as in the initial steady state. Qualitatively, the patterns documented in the figure are similar to those resulting from changing the average level of income taxes. Notably, the welfare of the poor increases, while that of the rich falls. The utilitarian welfare increases and then falls. Quantitatively, however, increasing marginal tax rates only at the top leads to substantially smaller gains for poor households. Intuitively, high marginal income taxes at the top discourage labor supply by high-ability households and greatly reduce aggregate labor supply, lowering output and the tax base and resulting in much lower lump-sum transfers. Since the welfare of the poorest households is mostly determined by the size of the lump-sum transfers, they gain much less if the tax burden only falls on high-ability earners.

Lastly, Figure 4 shows the implications of increasing wealth taxes from 0 to 5%. Once again, the qualitative patterns we obtain are similar to those resulting from higher marginal income taxes. Higher wealth taxes allow the planner to finance larger lump-sum transfers, increasing the welfare of the poor at the expense of the wealthier households. Notice, however, that the welfare losses at the top are larger than in the case of income taxes. For example, increasing the welfare of the poorest households by 20% comes at the expense of a 10% drop in the welfare of the richest households if redistribution is achieved through higher income taxes. In contrast, increasing the welfare of the poor by the same amount requires a 15% drop in the welfare of the richest households if redistribution is achieved through wealth taxes.

The results above show that increasing either wealth or income taxes allows the planner to increase the welfare of the poor, thus achieving redistribution. Previous work used this observation to argue in favor of a particular tax reform as means to increase utilitarian welfare. However, most of this work allows the planner to change 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 progressive income taxation. In contrast to this research, the goal of our paper is to consider tax reforms that jointly change all of these instruments in order to identify the most efficient means of redistribution.

We provide a preliminary account of the relative costs of these instruments by characterizing the equity-efficiency trade-off they imply. We do this by tracing out in Figure 5 the change in the average welfare, our measure of efficiency, against the change in the welfare of the poorest 20% of the households, implied by varying each of the three instruments in isolation. As the figure shows, for small amounts of redistribution average welfare increases for all tax instruments, indicating the absence of an equity-efficiency tradeoff. Large amounts of redistribution eventually decrease average welfare, because the distortions induced by taxes dominate the insurance gains from lump-sum transfers. The key difference between the instruments is the amount of redistribution they can achieve before distortions become too costly and reduce average welfare. Clearly, increasing the slope of the marginal income tax schedule ξ is the most costly and can only achieve a very limited amount of redistribution. Increasing average income taxes τ allows the most redistribution and is least costly. The wealth tax τ_a is in between. For example, consider a planner that would like to increase the welfare of the poor households by 20% and can only use a single instrument. Clearly, the planner can only achieve this goal by either increasing wealth taxes or the average level of income taxes. For efficiency considerations, the planner would prefer redistribution via income taxes because this would generate a nearly 1% increase in average welfare. In contrast, a wealth tax that delivers the same amount of redistribution comes at the cost of a nearly 2% decline in average welfare.

4.2 Macroeconomic and Distributional Implications

To better understand why a wealth tax is more costly than increasing the average level of income taxes, we next zoom in on the transition dynamics induced by two policy reforms, each of which increases the welfare of the bottom 20% of households by the same amount, namely 20%. The first reform delivers this amount of redistribution by increasing the median marginal income tax from 26% to 37%. The second reform achieves this by increasing the wealth tax from 0 to 2.5%.

Figure 6 illustrates the costs and the benefits of the two tax reforms. On the benefit side, the left panel of the figure shows that lump-sum transfers increase after both reforms. The wealth tax front-loads these transfers, which increase sharply initially but then quickly decline as households decumulate wealth and the tax base shrinks. On the cost side, the next two panels show the response of the aggregate labor and savings wedges, calculated as in equations (3) and (4). In response to an increase in income taxes both the labor and the savings wedge increase, as this tax distorts both the hours and the savings choice of households. The wealth tax, in contrast, reduces the labor wedge by lowering the consumption share of wealthier, higher ability households. Because of wealth effects on the labor supply, these households reduce hours worked less than lower ability households, resulting in a decline of the labor wedge. As shown in the right panel of the figure, the wealth tax distorts the savings choice by much more.

Figure 7 shows that output and the capital stock fall much more if redistribution is financed with wealth taxes. In contrast, the supply of efficiency units of labor falls by less under a wealth tax, because of the reallocation of hours worked towards high ability households. Consumption increases sharply after an increase in wealth taxes, owing to the increase in lump-sum transfers as well as wealth decumulation by richer households, but eventually drops to more than 10% below its initial steady-state value. In contrast, the decline in consumption is smaller and more gradual if redistribution is financed with income taxes. Finally, notice that interest rates increase sharply in response to an increase in wealth taxes, owing to the decline in the supply of assets by households. Because the wealth tax depresses the capital stock by more, it reduces the marginal product of labor and therefore lowers the equilibrium wage. To summarize, a wealth that redistributes as much as an income tax does comes at the cost of much larger production distortions.

In Figure 8 we zoom in on the distributional implications of the two tax reforms. The wealth tax leads to a sharper increase and then decrease in the consumption of the bottom 20% of households, mirroring its impact on the lump-sum transfers. Richer households initially increase their consumption in response to higher wealth taxes to shield their assets from taxation, but eventually experience a large drop in consumption as they become poorer. The poorest households sharply reduce hours worked due to wealth effects on labor supply stemming from larger lump-sum transfers. Though general equilibrium effects depress hours worked by wealthy households as well, this effect is offset by the decline in their consumption and the ensuing wealth effects.

Of course, the results above only offer a partial characterization of the relative costs and benefits of the tax instruments we considered, because we only varied them in isolation. In the next section, we characterize a more comprehensive tax reform in which we allow the planner to vary all instruments jointly. We will also allow for the possibility that the planner taxes separately labor and capital, in order to understand the role of taxing each margin in isolation.

5 Optimal Policy

We ask: what is the most efficient means of redistribution? We answer this question by considering alternative once-and-for-all tax reforms and computing the resulting household welfare taking the long-lived transition dynamics into account. The tax reforms we consider involve a one-time, unanticipated, permanent change in the parameters $\boldsymbol{\pi} = (\tau, \xi, \tau_a, \xi_a)$ that describe 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.

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 transfers 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 in Aiyagari and McGrattan (1998), that the marginal gains from allowing the government to change its debt are small and therefore do not report these results for brevity. We also considered allowing the government to change consumption taxes. As is well known, a time-invariant consumption tax is equivalent to a tax on labor and an initial capital levy. Not surprisingly, we found that an optimally chosen consumption tax can generate large welfare gains, provided it is sufficiently large, in excess of 200%. 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 and to Boar and Midrigan (2019) for an analysis of the effects of corporate profit tax reforms. 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) and note that Dyrda and Pedroni (2018) allow for time-varying linear taxes but find relatively small welfare gains relative to time-invariant instruments, provided one restricts the planner's ability to tax initial wealth.

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 $\boldsymbol{\pi}$. As earlier, 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. Throughout most of our analysis we assume that the objective of the planner is to maximize utilitarian welfare ($\Delta = \theta = 1$), but we show that our conclusion is robust to alternative preferences for redistribution.

5.1 Maximizing Utilitarian Welfare

We proceed incrementally, by first allowing the planner to only use a flat income tax τ combined with a lump-sum transfer and then gradually augmenting the set of instruments with non-linear income taxes, linear wealth taxes as well as non-linear wealth taxes. We find that an optimally chosen flat income tax delivers most of the welfare gains that the planner can possibly achieve. Specifically, the incremental welfare gains from non-linear income and wealth taxes are small.

Flat Income Tax. The first column in Table 4 reports the effects of replacing the current tax and transfer system with an optimally chosen flat income tax. Panel A of the table reports the change in the tax schedule. We find that a flat tax of 56% on all earners is optimal in this restricted class of instruments. Increasing the median marginal tax rate from 26% in the initial steady state to 56% allows the planner to increase lump-sum transfers across steady states from 17% to 28% of the per-capita GDP in the initial steady state. Panel B of the table shows that the welfare of the poorest 20% of households increases substantially, by 42%. Households in the middle of the welfare distribution experience a welfare gain of 6% while the richest 20% of households lose the equivalent of 14% of life-time consumption. Recall that we sort households by their welfare in the initial steady state when doing these calculations. Overall, utilitarian welfare increases by 7.8%. That is, this reform is equivalent to permanently increasing all households' consumption by 7.8%.

Panels C and D report the macroeconomic and distributional consequences of implementing the optimal flat income tax. All macroeconomic aggregates fall in the new steady state, owing to the fact that the income tax depresses capital accumulation and labor supply. For example, output falls by 19%, the capital stock falls by 36% and employment falls by 10%. Interestingly, wealth and income inequality greatly increase across steady states, as poor households no longer save for precautionary reasons and cut hours worked in response to the higher lump-sum transfers. In contrast, the Gini coefficient of welfare ω_i falls from 0.38 in the initial steady state to 0.30, reflecting the redistributive nature of the policy reform.

Non-linear Income Tax. In the second column of Table 4 we report results from allowing the planner to optimally choose a non-linear income tax schedule. As Panel A shows, the planner chooses marginal income taxes that increase with income, more so than in the status-quo ($\xi = 0.078$ vs. 0.049). Because the value of τ is not interpretable on its own, the table reports the implied marginal income tax rate for earners at the 50^{th} and 95^{th} percentile of the income distribution. We note that the median marginal income tax increases from 26% to 50%, while the marginal income tax rate at the 95^{th} percentile increases from 34% to 58%. Notice that the increase in the lump-sum transfer is smaller than that obtained under an optimally chosen flat income tax. Consequently, as Panel B shows, the poorest 20% of households experience somewhat smaller welfare gains (38%). In contrast, households in the middle of the distribution experience larger welfare gains (7%), owing to the lower marginal income tax. Overall, the utilitarian social welfare increases by 8.5%, a modest gain relative to the one achieved with the flat income tax, mostly reflecting gains in the middle of the distribution. As earlier, macroeconomic aggregates fall sharply and slightly more than under a flat income tax. A non-linear income tax reduces the savings of wealthy households, reducing wealth inequality as well as inequality in welfare.

Non-linear Income Tax and A Flat Wealth Tax. We next allow the planner to use a linear wealth tax, in addition to a non-linear income tax schedule, and report the results in the third column of Table 4. The planner finds it optimal to set the wealth tax to 0.6%, which allows for a reduction in marginal income tax rates to 47% at the 50^{th} percentile of the income distribution and to 55% at the 95^{th}. Though allowing for a wealth tax does not change the welfare of the poor relative to an optimally chosen non-linear income tax schedule, it increases the welfare of those in the middle of the welfare distribution from 7% to 8% and decreases the welfare of those at the top from 14% to 15%. This results in a very modest increase in utilitarian welfare, from 8.5% to 8.7%. The wealth tax further depresses the capital stock and output, but has a modest impact on wealth, income and welfare inequality.

Non-linear Income and Wealth Tax. The last column of Table 4 reports the implications of allowing the planner to use both non-linear income and wealth taxes. The optimal wealth tax is progressive, with the median household paying a 0.2% marginal wealth tax and households at the 95^{th} percentile of the wealth distribution facing a 0.7% marginal wealth tax. Once again, enlarging the set of instruments that the planner can use mostly benefits households in the middle of the distribution, at the expense of wealthy households. Even though a non-linear wealth tax greatly reduces wealth and income inequality, it comes at the expense of larger declines in the capital stock and output. Overall, the planner is able to increase utilitarian welfare by 9.5%. Since the planner is able to increase welfare by 7.8% using flat income taxes alone, we conclude that a flat income tax can achieve 82% of the overall gains from redistribution attainable using non-linear wealth and income taxes. In this precise sense, a flat income tax is nearly optimal, a result reminiscent of the static Mirrleesian literature summarized by Mankiw et al. (2009).

Role of Taxing Capital. We emphasize that our result that the incremental gains from taxing wealth are small does not imply that the gains from taxing capital income are low. Rather, the gains from taxing capital income at a different rate than labor income are low. To see this point, we next allow the planner to tax labor and capital income at different rates. Specifically, we allow the planner to optimally choose among a mix of potentially non-linear taxes levied on labor income $W_t e_t h_t$ and on wealth a_t. We note that in this economy taxing wealth and asset income is nearly equivalent,[3] and therefore do not allow for separate capital income taxes.

Table 5 reports the results from this experiment. As before, we proceed incrementally, starting from a flat labor income tax and then enlarging the set of instruments to allow for non-linear labor income and wealth taxes. The first column of the table shows that an optimally chosen flat labor income tax only increases utilitarian welfare by 2.9%, much less than the 7.8% attainable using a flat tax applied to both labor and asset income. This suggests that taxing capital income is important for efficient redistribution. We then note that the marginal gains from non-linear labor income taxes are small, in that the planner can only increase welfare by 3.3%. Interestingly, despite the fact that labor income taxes alone lead to relatively modest utilitarian welfare gains, note that poor households gain quite a bit. An optimally chosen flat labor income tax of 63% increases the welfare of the poorest 20% of households by 30%, a sizable amount.

The last two columns of Table 5 show that if the planner can also tax wealth in addition to labor income, it chooses to tax wealth at a rate of approximately 4%, allowing it to increase welfare to 9.3% or 10.7%, depending on whether wealth taxes are non-linear or not. These gains are similar to those achieved using the set of instruments considered earlier. To see

[3] They are not exactly equivalent because we calculate optimal policy including transition dynamics and the return to savings varies over time. Therefore, one-time permanent changes in capital or wealth taxes yield different paths for government revenue during the transitions.

why this is the case, consider for example the optimal flat income tax of 56% in Table 4. Since this tax applies to both labor and capital income, and given the equilibrium interest of 6.6% implied by this policy, it amounts to a 3.7% (0.56×0.066) tax on wealth, only slightly lower than that reported in Table 5.

That taxing capital in this economy is welfare improving stems from several considerations. 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. Overall, we note that in all the experiments we considered the long-run savings wedge is greater than one, suggesting that the planner wants to tax capital at a rate that is higher than that prescribed by the golden rule.

5.2 Maximizing Alternative Social Welfare Functions

We next show that our conclusion that flat income taxes are nearly optimal does not depend on the planner's preference for redistribution. To that end, in Table 6 we report optimal policy for two alternative social welfare functions. The top of the table reports results for a social welfare function with $\Delta = 0$. With such an objective the planner seeks to maximize average welfare, that is, pure economic efficiency. The bottom of the table reports results for setting $\Delta = 2$ so the planner desires more redistribution than the utilitarian planner considered above. As earlier, we gradually enlarge the set of tax instruments that the planner can use, starting from a flat income tax and concluding with non-linear income and wealth taxes.

As the top part of the table shows, a planner that is only concerned with efficiency and can only use flat income taxes sets the marginal income tax rate equal to 43%, lower that that chosen by a utilitarian planner. Nevertheless, such an income tax greatly increases the size of the lump-sum transfers and the welfare of the poor households, by 24%. Notice that average welfare increases by only 0.6%, suggesting that the status quo is nearly optimal for a planner that desires to maximize pure economic efficiency. As before, the planner prefers marginal income taxes that increase with income, but the additional gains from these are small. Finally, the planner would find it optimal to subsidize wealth accumulation by setting the linear wealth tax to -0.7%, which would increase social welfare to 1%, once again a small amount. A non-linear wealth tax provides virtually no additional welfare gains.

To summarize, even if the planner has no explicit concern for redistribution, it chooses a policy that greatly increases the welfare of the poor. Average welfare, our measure of efficiency, increases due to additional insurance. We conclude that measures of macroeconomic activity, such as output, which falls here, are poor indicators of how efficient a particular redistributive 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. Nevertheless, the additional gains from departing from flat income taxes are small.

The bottom panel of Table 6 reports the optimal policy chosen by a planner with strong preference for redistribution. Not surprisingly, such a planner finds it optimal to set higher income and wealth taxes which increases the welfare of poor households even more, at the expense of larger welfare losses at the top. For example, the optimal flat income tax is equal to 60%, 4 percentage points larger than that chosen by a utilitarian planner. The optimal flat wealth tax is equal to 0.9%, also larger than that chosen by a utilitarian planner. Once again, allowing for a richer set of instruments mostly benefits households in the middle of the distribution rather than households at the bottom. Importantly, the incremental gains from non-linear wealth and income taxes are small. For example, an optimally chosen flat income tax delivers 92% (0.151/0.164) of the maximum welfare gains that the planner can attain using non-linear wealth and income taxes.

5.3 Sensitivity Analysis

It is well known in the public finance literature that optimal tax policy is critically shaped by household preferences and the distribution of household ability. We next show that though the size of optimal taxes indeed depends on these details of the model, our conclusion that a flat income tax is nearly optimal 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 that the planner maximizes utilitarian social welfare.

Parameterization. Table 7 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 three panels of Table 8 report the optimal policy chosen by the planner in each of these alternative economies. As earlier, we gradually increase the set of instruments that the planner can use. For brevity, we only report results from allowing the planner to use a flat income tax, a non-linear income tax and a flat wealth tax. 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 72%, larger than the 56% in our benchmark model. As the second column shows, the planner prefers positively-sloped marginal income taxes, reducing the median marginal income tax to 67% and raising marginal income taxes at the 95^{th} percentile to 75%. However, the incremental welfare gains from doing so are small (29.8% vs. 28.9%). The third column shows that when the planner can also use a wealth tax to redistribute, it chooses a large wealth tax of 4.4%, much larger than the 0.6% in the benchmark model. Nevertheless, the marginal welfare gains are, once again, small. Overall, an optimally chosen flat income tax achieves 85% of the welfare gains that the planner can attain by using all tax instruments.

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 51%. Once again, the planner prefers positively-sloped marginal income taxes, but the gains from this flexibility are very small. Finally, the planner chooses to tax wealth at a rate of 1.4%, allowing it to further reduce income taxes. Once again, however, a flat income tax achieves most (80%) 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 79% at the median to 63% at the 95^{th} percentile. Once again, the incremental welfare gains of departing from a flat income tax are very small. Similarly, even though the planner finds it optimal to set a 0.5% wealth tax, the incremental gains from wealth taxation are minuscule because there is not much wealth concentration at the top.

6 Optimal Policy in an Economy with Entrepreneurs

Our motivation for studying an economy with entrepreneurs is that in the U.S. data 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.[4] This group of households is especially prevalent 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).[5] 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.

6.1 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. 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

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

[4] We use a broad definition of entrepreneurs that encompasses all private business owners, not only those actively engaged in managing their business.

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

Entrepreneurs produce the same homogenous good as corporate firms using the same technology

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

Their entrepreneurial efficiency z_t 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

$$\pi_t\left(a_t, z_t\right) = y_t - W_t l_t - R_t k_t.$$

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

$$k_t \leq \lambda a_t.$$

Notice that 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.

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

$$\int_{\text{entr}} y_{it}^{e} \mathrm{d}i + N_t y_t \equiv Y_t = Z_t\left(K_t^{\alpha} L_t^{1-\alpha}\right)^{\eta},$$

where y_{it}^{e} denotes the output of entrepreneur i, N_t is the mass of corporate firms, and y_t is the output produced by an individual corporate firm, while K_t and L_t denote aggregate capital and labor. Aggregate productivity Z_t is endogenously determined and 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 $\phi_{it} = 1 + \mu_{it}/R_t$ and z is the productivity of corporate firms. Absent collateral constraints, $\phi_{it} = 1$, and aggregate productivity increases to

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

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

6.2 Parameterization

Table 9 reports the parameter values and moments we targeted to calibrate this version of the model. The externally-set 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 volatility 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 9 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. 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%.

6.3 Optimal Policy

Table 10 reports optimal policies chosen by a utilitarian planner. As earlier, we gradually increase the number of tax instruments that the planner has at its disposal. The first column of the table shows that the flat optimal tax chosen by the planner is 58%, very similar to the 56% chosen in the benchmark economy. The welfare of the poorest 20% of households increases by 42%, that of households in the middle of the distribution increases by 7%, while wealthy households experience welfare losses of 13% on average. These numbers are similar to those in the benchmark model. Overall, utilitarian welfare increases by 9.1%. Notice also that the drop in macroeconomic aggregates and the change in inequality across steady states are also quantitatively similar to those induced by implementing the optimal flat income tax in the economy without entrepreneurs.

Consider next a planner who can use non-linear income taxes. As the second column of the table shows, the planner reduces the median marginal income tax to 51% and increases the marginal income tax at the 95^{th} percentile to 60%, numbers once again very similar to those in the benchmark model. Non-linear income taxes allow the planner to increase the utilitarian welfare gains from 9.1% to 9.8%. A planner who can also use wealth taxes, sets the flat wealth tax equal to 0.6%, but the marginal welfare gains from this additional instrument are negligible. Finally, a planner that can also use non-linear wealth taxes chooses to tax wealth only at the top, setting the median marginal wealth tax equal to zero and taxing the wealth of households at the 95^{th} percentile of the wealth distribution at a rate of 0.5%, increasing utilitarian welfare gains to 10.6%. As in the benchmark model, the beneficiaries of a richer set of tax instruments are households in the middle of the distribution, and a flat income tax achieves the vast majority (86%) of the maximum attainable welfare gains.

Because wealth and 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 11. 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% and it allows the planner to increase lump-sum transfers relative to the status quo, increasing the welfare of the poorest 20% of households by 19%. However, utilitarian welfare falls relative to the status quo, since the planner no longer taxes capital. This benefits entrepreneurs, whose average welfare increases by 10%, and hurts workers who now pay higher taxes on their labor income. Overall, their welfare falls on average by 6%. 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 $r_{t-1}a_t + \pi_t(a_t, z_t)$ 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 marginal welfare gains from being able to tax capital and labor income at different rates are small. In particular, 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 the first column of Table 10. By taxing capital the planner is able to redistribute from the relatively wealthy entrepreneurs, whose welfare falls by 14%, towards workers, who experience welfare gains of 5% on average.

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, a tax on wealth is unable to achieve as much redistribution as a tax on capital income. Consequently, utilitarian welfare only increases by 5.6%. Notice that the average welfare of both workers and entrepreneurs falls in this experiment, suggesting that the wealth tax is too blunt a tool of redistribution. 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. To see this, Figure 9 displays the transition dynamics induced by moving from the status quo to the optimally chosen capital income and wealth taxes reported in the last two columns of Table 11. Notice that the capital income tax increases misallocation and significantly depresses the capital stock of entrepreneurs, increasing the implicit tax on capital in the economy. In contrast, misallocation falls in the wealth tax reform and the capital stock of entrepreneurs falls much less, resulting in a decline in the capital wedge. Consequently, aggregate productivity falls more under the capital income tax reform. 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. Indeed, we found that when the planner can tax both capital income and wealth in addition to labor income, it chooses to set the wealth tax equal to zero and reproduces the allocations reported in the second column of Table 11.

Notice that this result differs from Guvenen et al. (2019), who argue that a wealth tax is preferable to taxing capital income. Our analyses deviate 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 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 subtleties, our main point stands: a flat income tax is nearly optimal and the marginal gains from either non-linear income, wealth or differential taxation of capital and labor income are small.

7 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 society? 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.

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, increasing taxes on wealth and the income of top earners depresses the capital stock and output, reducing the tax base and therefore the amount of lump-sum transfers. Since the welfare of the poor is primarily determined by the size of these transfers, a utilitarian planner avoids distorting the savings and labor supply choices of high-ability households. Though households in the middle of the distribution benefit from more progressive income and wealth taxes, utilitarian welfare, which disproportionately weighs the consumption-equivalent welfare of the poor, increases little when the planner is able to use more complex tax instruments. This 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	0.84
Gini income	0.64	0.65
Wealth share top 0.1%	0.22	0.23
Wealth share top 1%	0.35	0.35
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	0.966	discount factor
γ	2	inverse Frisch elasticity	ρ_e	0.986	autocorrelation e
α	1/3	capital elasticity	σ_e	0.171	std. dev. e shocks
δ	0.06	depreciation rate	p	0.0002	prob. enter super-star state
τ_a, ξ_a	0	wealth tax	q	0.975	prob. stay super-star state
τ_s	0.065	consumption tax	$\bar{e}$	15.1	ability super-star state, rel. to mean
τ_c	0.36	corporate profits tax	ι	0.166	lump-sum transfer, rel. per-capita GDP
τ_k	0.20	capital gains tax	τ	0.280	income tax schedule
φ	0.04	exit rate, corporations	ξ	0.049	income tax schedule
ε	1.5	elasticity of entry rate			
η	0.85	span of control			
$\bar{B}$	1	government debt to GDP			

Table 2: Non-Targeted Moments

	Data	Model		Data	Model
A. Wealth Distribution			**B. Income Distribution**		
Share top 5%	0.63	0.57	Share top 5%	0.39	0.39
Share top 10%	0.75	0.72	Share top 10%	0.51	0.51
Share bottom 75%	0.09	0.08	Share bottom 75%	0.29	0.27
Share bottom 50%	0.01	0.00	Share bottom 50%	0.10	0.06
Share bottom 25%	-0.01	0.00	Share bottom 25%	0.02	0.01

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%	0.12	0.15	0.22	0.35
Share top 5%	0.23	0.28	0.39	0.57
Share top 10%	0.33	0.39	0.51	0.72
Share bottom 75%	0.47	0.40	0.27	0.08
Share bottom 50%	0.26	0.14	0.06	0.00
Share bottom 25%	0.06	0.05	0.01	0.00

Table 4: Optimal Tax Policy. Maximize Utilitarian Welfare ($\Delta = 1$)

	Flat income tax	Non-linear income tax	+ Flat wealth tax	+ Non-linear wealth tax
A. Tax Schedule				
marg income tax, 50^{th} pct	0.56	0.50	0.47	0.49
marg income tax, 95^{th} pct	0.56	0.58	0.55	0.55
marg wealth tax, 50^{th} pct	0	0	0.006	0.002
marg wealth tax, 95^{th} pct	0	0	0.006	0.007
lump-sum transfer	0.28	0.25	0.24	0.24
B. Welfare Change				
bottom 20%	0.42	0.38	0.38	0.40
middle 20%	0.06	0.07	0.08	0.09
top 20%	-0.14	-0.14	-0.15	-0.21
planner's objective	0.078	0.085	0.087	0.095
C. Change in Macro Aggregates				
output	-0.19	-0.21	-0.23	-0.23
tfp	-0.03	-0.03	-0.04	-0.04
capital	-0.36	-0.38	-0.43	-0.42
employment	-0.10	-0.11	-0.10	-0.11
wage	-0.11	-0.11	-0.14	-0.13
interest rate (level, %)	6.58	6.84	7.56	7.40
D. Inequality				
Gini wealth	0.94	0.77	0.76	0.50
Gini income	0.73	0.64	0.64	0.57
Gini welfare	0.30	0.26	0.25	0.21

Notes: Panels A, C and D report values of variables in the new steady state. The lump-sum transfer is expressed relative to initial per-capita GDP. Panel B reports welfare changes taking transitions into account. For reference, the interest rate in the initial steady state is equal to 3.98%.

Table 5: Optimal Tax Policy. Role of Taxing Capital

	Flat labor tax	Non-linear labor tax	+ Flat wealth tax	+ Non-linear wealth tax
A. Tax Schedule				
marg labor tax, 50^{th} pct	0.63	0.59	0.50	0.51
marg labor tax, 95^{th} pct	0.63	0.64	0.57	0.57
marg wealth tax, 50^{th} pct	0	0	0.042	0.035
marg wealth tax, 95^{th} pct	0	0	0.042	0.043
lump-sum transfer	0.28	0.26	0.26	0.24
B. Welfare Change				
bottom 20%	0.30	0.27	0.44	0.46
middle 20%	0	0.01	0.08	0.10
top 20%	-0.06	-0.06	-0.17	-0.23
planner's objective	0.029	0.033	0.093	0.107

Notes: Panel A reports values of variables in the new steady state. The lump-sum transfer is expressed relative to initial per-capita GDP. Panel B reports welfare changes taking transitions into account.

Table 6: Optimal Tax Policy. Alternative Preferences for Redistribution

	Flat income tax	Non-linear income tax	+ Flat wealth tax	+ Non-linear wealth tax
I. Maximize Average Welfare, $\Delta = 0$				
A. Tax Schedule				
marg income tax, 50^{th} pct	0.43	0.38	0.42	0.42
marg income tax, 95^{th} pct	0.43	0.43	0.48	0.48
marg wealth tax, 50^{th} pct	0	0	-0.007	0
marg wealth tax, 95^{th} pct	0	0	-0.007	-0.007
lump-sum transfer	0.24	0.22	0.23	0.23
B. Welfare Change				
bottom 20%	0.24	0.20	0.20	0.19
middle 20%	0.03	0.04	0.03	0.03
top 20%	-0.05	-0.05	-0.04	-0.03
planner's objective	0.006	0.008	0.010	0.010
II. Maximize Social Welfare for $\Delta = 2$				
A. Tax Schedule				
marg income tax, 50^{th} pct	0.60	0.55	0.52	0.53
marg income tax, 95^{th} pct	0.60	0.61	0.58	0.57
marg wealth tax, 50^{th} pct	0	0	0.009	0.007
marg wealth tax, 95^{th} pct	0	0	0.009	0.011
lump-sum transfer	0.29	0.27	0.25	0.25
B. Welfare Change				
bottom 20%	0.46	0.43	0.43	0.44
middle 20%	0.06	0.07	0.07	0.08
top 20%	-0.16	-0.17	-0.19	-0.22
planner's objective	0.151	0.154	0.157	0.164

Notes: Panels A report policy variables in the new steady state. The lump-sum transfer is expressed relative to initial per-capita GDP. Panels B report welfare changes taking transitions into account.

Table 7: Sensitivity: Parameterization

	Data	Lower IES $\theta = 2$	Higher Frisch $\gamma = 1$	Gaussian ability
A. Parameter Values				
β, discount factor		0.953	0.965	0.961
ρ_e, autocorrelation e		0.986	0.987	0.990
σ_e, std. dev. e shocks		0.214	0.156	0.236
p, prob. enter super-star state		0.0003	0.0003	–
q, prob. stay super-star state		0.981	0.978	–
$\bar{e}$, ability super-star state		16.4	14.5	–
B. Moments				
Wealth to income ratio	6.6	6.6	6.6	6.6
Gini wealth	0.85	0.84	0.85	0.87
Gini income	0.64	0.65	0.64	0.78
Wealth share top 0.1%	0.22	0.22	0.22	0.06
Wealth share top 1%	0.35	0.35	0.35	0.25
Income share top 0.1%	0.14	0.14	0.14	0.06
Income share top 1%	0.22	0.22	0.22	0.23

Table 8: Sensitivity: Optimal Policy

	Flat income tax	Non-linear income tax	+ Flat wealth tax
A. Lower IES, $\theta = 2$			
marg income tax, 50^{th} pct	0.72	0.67	0.52
marg income tax, 95^{th} pct	0.72	0.75	0.66
wealth tax	0	0	0.044
social welfare gains	0.289	0.298	0.339
B. Higher Frisch, $\gamma = 1$			
marg income tax, 50^{th} pct	0.51	0.46	0.39
marg income tax, 95^{th} pct	0.51	0.52	0.46
wealth tax	0	0	0.014
social welfare gains	0.049	0.05	0.061
C. Gaussian Ability			
marg income tax, 50^{th} pct	0.65	0.79	0.78
marg income tax, 95^{th} pct	0.65	0.63	0.61
wealth tax	0	0	0.005
social welfare gains	0.246	0.256	0.257

Table 9: Economy with Entrepreneurs: Parameterization

A. Moments Used in Calibration

	Data	Model
Wealth to income ratio	6.6	6.5
Percentage entrepreneurs	6.6	6.6
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	0.0001	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	$\bar{e}$	18.3	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 10: Optimal Policy: Economy with Entrepreneurs, $\Delta = 1$

	Flat income tax	Non-linear income tax	+ Flat wealth tax	+ Non-linear wealth tax
A. Tax Schedule				
marg income tax, 50^{th} pct	0.58	0.51	0.47	0.50
marg income tax, 95^{th} pct	0.58	0.60	0.57	0.57
marg wealth tax, 50^{th} pct	0	0	0.006	0
marg wealth tax, 95^{th} pct	0	0	0.006	0.005
lump-sum transfer	0.29	0.26	0.26	0.25
B. Welfare Change				
bottom 20%	0.42	0.38	0.38	0.40
middle 20%	0.07	0.08	0.09	0.09
top 20%	-0.13	-0.13	-0.14	-0.17
planner's objective	0.091	0.098	0.100	0.106
C. Change in Macro Aggregates				
output	-0.20	-0.22	-0.23	-0.23
tfp	-0.03	-0.03	-0.04	-0.04
capital	-0.38	-0.41	-0.46	-0.45
employment	-0.12	-0.13	-0.11	-0.12
wage	-0.09	-0.10	-0.13	-0.12
interest rate (level, %)	5.31	5.54	6.44	6.15
D. Inequality				
Gini wealth	0.93	0.85	0.85	0.73
Gini income	0.72	0.68	0.69	0.65
Gini welfare	0.26	0.25	0.25	0.23

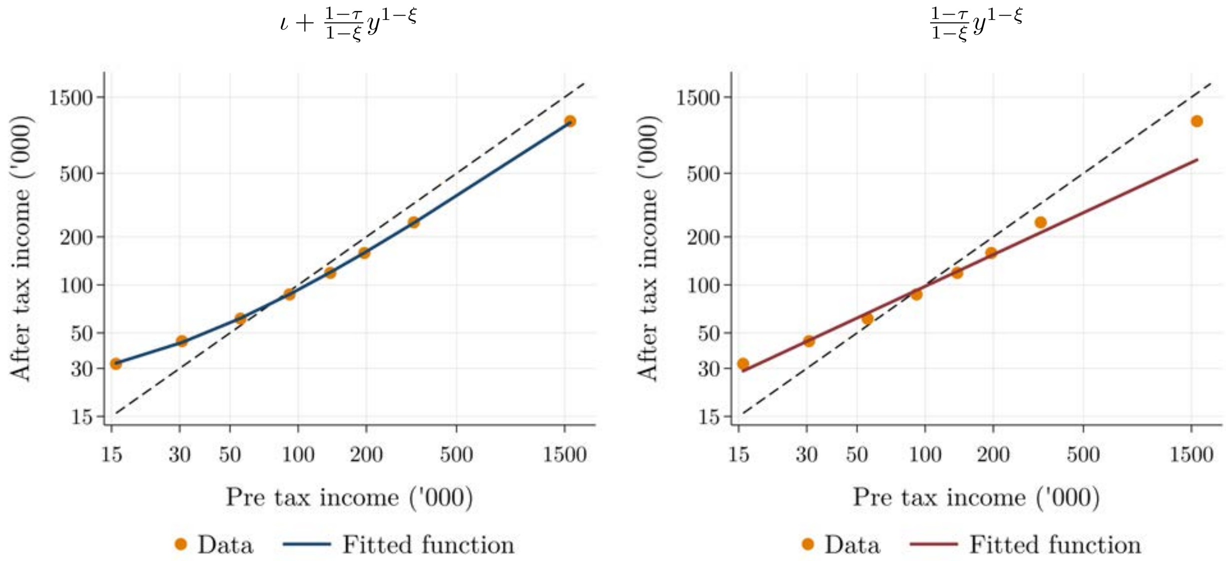
Notes: Panels A, C and D report values of variables in the new steady state. The lump-sum transfer is expressed relative to initial per-capita GDP. Panel B reports welfare changes taking transitions into account. For reference, the interest rate in the initial steady state is equal to 2.86%.

Table 11: Wealth vs. Capital Income Taxes in Economy with Entrepreneurs

	Flat labor income tax	+ Flat capital income tax	+ Flat wealth tax
A. Tax Schedule			
labor income tax	0.63	0.53	0.56
capital income tax	0	0.66	0
wealth tax	0	0	0.043
lump-sum transfer	0.26	0.26	0.26
B. Welfare Change			
bottom 20%	0.19	0.41	0.35
middle 20%	-0.05	0.08	0.04
top 20%	-0.02	-0.14	-0.15
average welfare workers	-0.06	0.05	-0.02
average welfare entrepreneurs	0.10	-0.14	-0.04
planner's objective	-0.011	0.095	0.056

Notes: Panel A reports values of variables in the new steady state. The lump-sum transfer is expressed relative to initial per-capita GDP. Panel B reports welfare changes taking transitions into account.

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 Effect of Changing τ

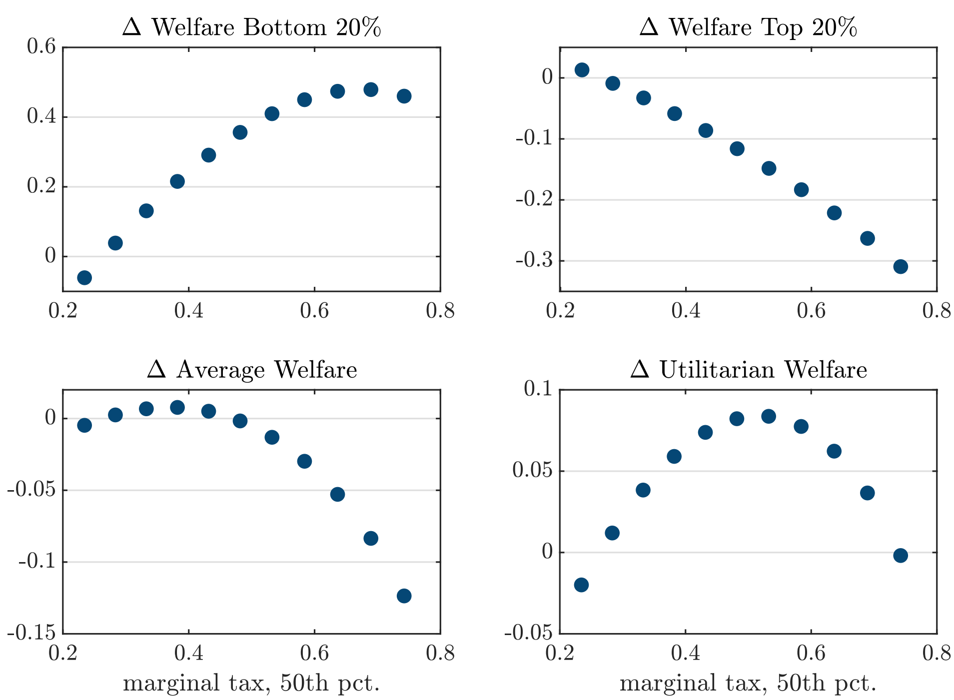


Figure 3: Welfare Effect of Changing ξ

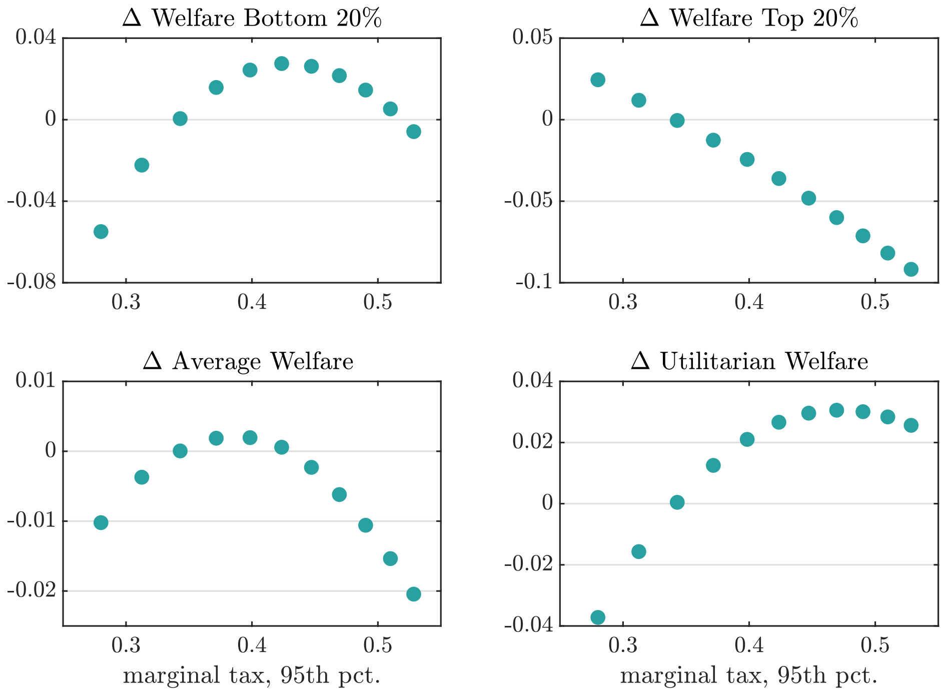


Figure 4: Welfare Effect of Changing τ_a

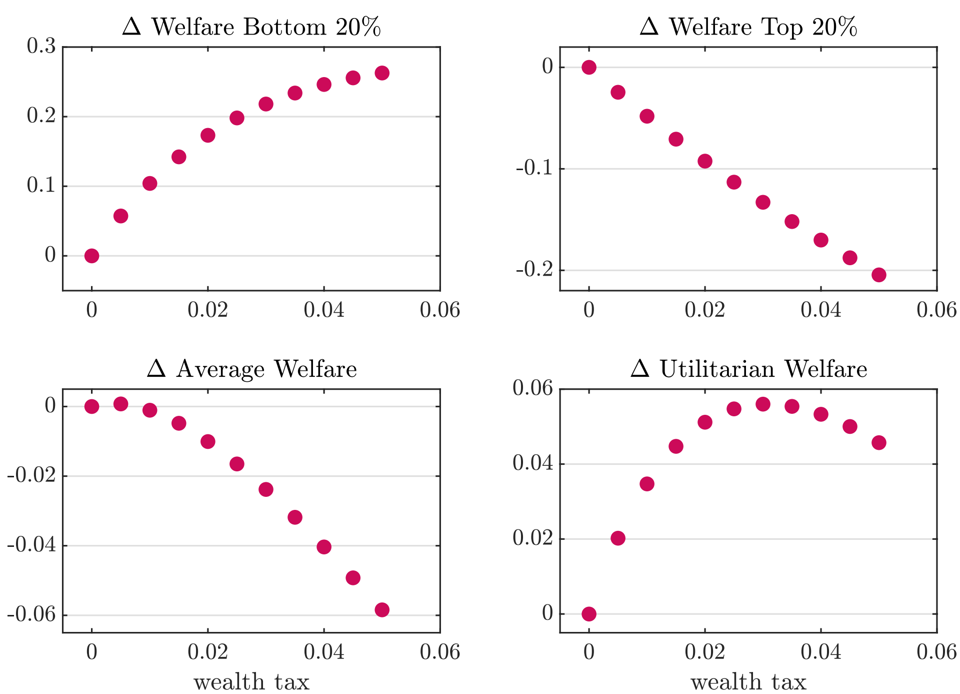


Figure 5: The Cost of Redistribution

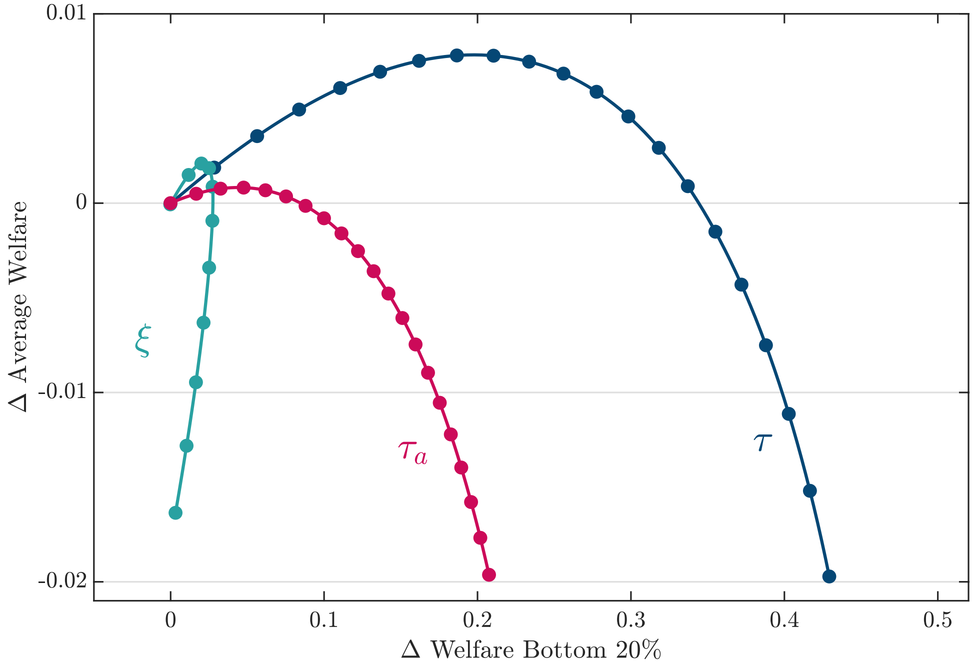


Figure 6: Effect of Tax Reforms on Lump-sum Transfers and Wedges

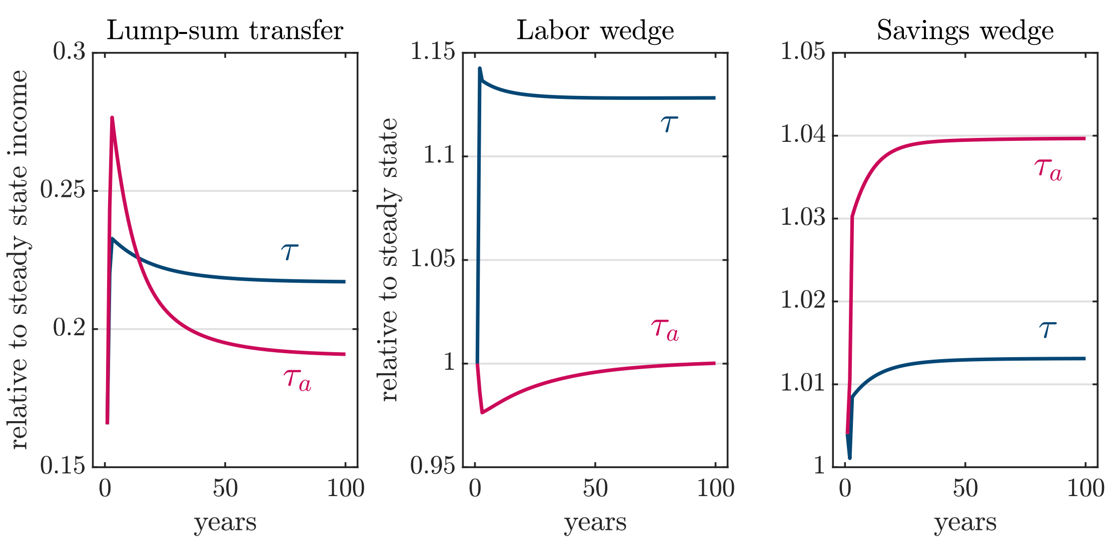


Figure 7: Effect of Tax Reforms on Macro Aggregates

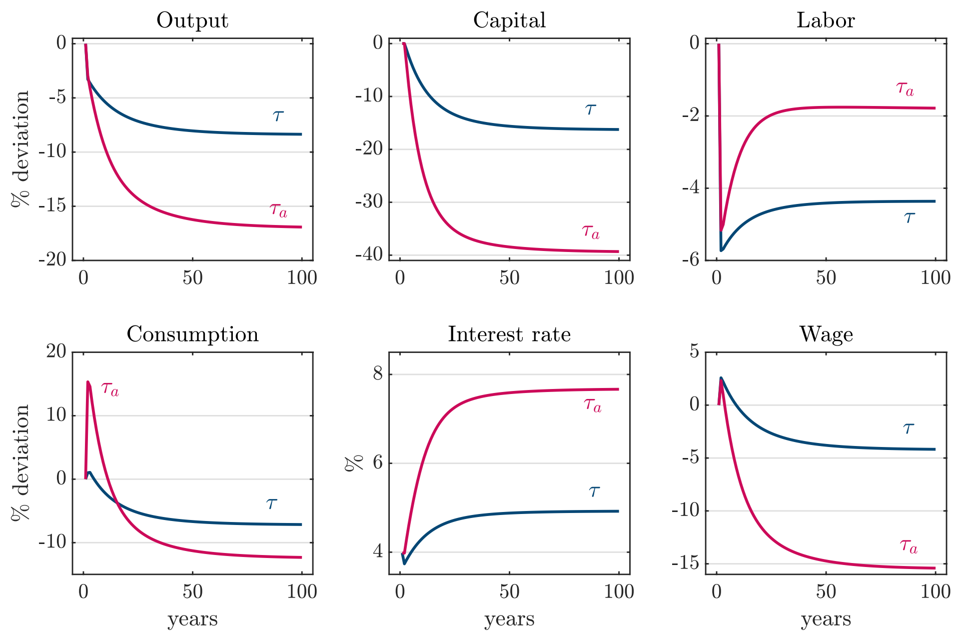


Figure 8: Distributional Effect of Tax Reforms

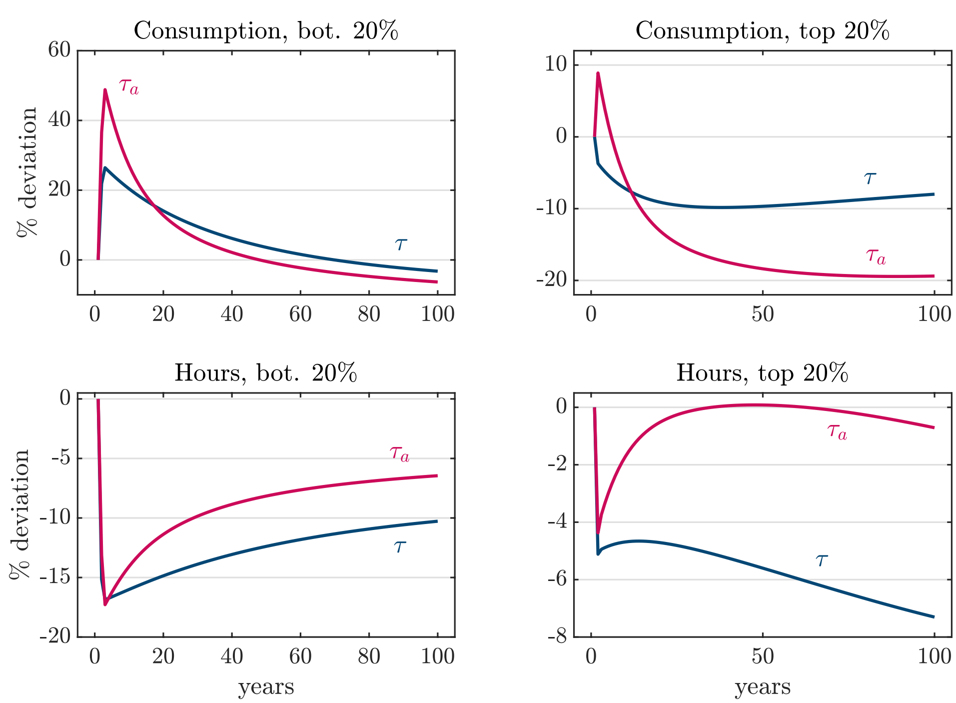


Figure 9: Effect of Capital and Wealth Taxes on Financial Distortions