The Looming Fiscal Reckoning: Tax Distortions, Top Earners and Revenues.

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Abstract

How should the U.S. confront increasing revenue needs associated to the growth of spending across the board? We investigate the mix of potential tax hikes that minimize welfare costs under several tax options, and evaluate their impact on macroeconomic aggregates. We do so in the context of a life-cycle growth model that captures key aspects of the earnings and wealth distributions and that explicitly considers the non-linear shape of taxes and transfers in place. We evaluate changes in income taxes, the introduction of an economy-wide linear consumption tax, and a wealth tax for top wealth holders that match different revenue targets. Our findings indicate that introducing a linear consumption tax, together with a reduction in income tax progressivity consistently emerges as the best alternative to minimize welfare costs associated to a given need of revenue. A long-run requirement of 30% additional Federal revenue requires a consumption tax rate of 27.8%, a transfer to all of about 12% of benchmark household income and a reduction of top marginal income tax rates of more than 5 percentage points. Output declines by about 7.3% in the long run.

JEL Classifications: E6, H2.

Key Words: Taxation, Progressivity, Tax Revenue.

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1 Introduction

A fiscal winter is coming. We take the stand that non-trivial additional revenues will be needed in the United States given the growth in spending across the board – large expenditures associated to the COVID 19 pandemic, debt payments from past fiscal deficits, additional social spending not matched by tax revenues, and unfunded health care and pension liabilities due to an aging population. According to the Congressional Budget Office, at least 2.6-2.8% of GDP will have to be raised annually in coming years to confront expected expenditures. Even so, additional defense expenditures are likely on the horizon as well. In this paper, we ask: how should the U.S. confront increasing revenue needs in the medium and long term? Assuming that no reductions in spending are available, what should be the mix of tax instruments to generate additional revenue?

Increasing revenues at a macroeconomic scale presents multiple challenges and trade-offs. The magnitude of the tax hikes associated to revenue needs will have an aggregate impact under distortionary taxes, and it is unlikely that it can be financed by taxing income and/or wealth at the very top. Our approach in this paper is to search for a mix of changes in existing taxes, or the magnitude of new ones, in order to minimize the welfare impact upon those alive at the start of a hypothetical transition triggered by tax regime change. We abstract from demographic changes and demographic-induced budget imbalances, and focus with high resolution on the tradeoffs induced by alternative taxes in the context of a macroeconomic model with household heterogeneity.

Model We develop a parsimonious model economy, with a minimally realistic description of the tax and transfer system in the United States. We study a nowadays’ standard life-cycle economy with individual heterogeneity and endogenous labor supply. Individual heterogeneity is driven by differences in individual labor productivity at the start of the life cycle, as well as by stochastic shocks as individuals age. Individuals are also heterogenous in their discount factors, which are in turn potentially correlated with permanent differences

\footnote{See The Budget and Economic Outlook: 2021-2031, Table 1-5. Congressional Budget Office, 2021.}
in labor endowments. Individuals have access to a single, risk-free asset, and face different forms of taxes. They face flat-rate taxes on capital income and total income. They also face a non-linear income tax schedule with increasing marginal and average tax rates. The first two tax rates are aimed at capturing the corporate income tax and income taxes at the state and local level. The non-linear tax schedule aims to capture the salient features of the Federal Income Tax in the U.S. In addition, they also face a tax rate on consumption, that approximates state-level consumption taxes. In terms of transfers, working-age households potentially qualify for transfers that are declining in income. Individuals have also access to a social security transfer upon retirement, that is financed via proportional taxes on labor income.

We parameterize our economy so that is consistent with a host of aggregate and cross-sectional observations, under our representation of the tax and transfer system. Given our parameterization, the model economy is consistent with the observed distributions of household earnings and wealth, including the shares of earnings and wealth accounted by those at the top. As a result, our model economy is broadly consistent with the sharp heterogeneity observed in distribution of tax liabilities by household income. In particular, our economy reproduces quite well the taxes paid by top 1% income earners. Overall, this is reassuring for our subsequent use of the model to assess the role of changes in taxation, and its impact across different households.

**Findings** We first aim at providing a road map of the effects of different alternatives to generate revenue in isolation. We start by investigating the consequences of changing Federal income taxes to generate a given revenue increase in the long run – 30% increase in Federal revenues or about 2.4% of output in the benchmark economy. We consider changes in the curvature, or progressivity, and its level (i.e. changes that leave the progressivity intact but increases taxes for everyone). First, we keep the benchmark progressivity intact and increase taxes for everyone. To generate a 30% increase in revenue, tax rate for households with the mean income in the economy has to increase from 5.1% in the benchmark to 8.3%. The increase in taxes results in a significant, 4.3%, welfare loss. Next, we increase the level of progressivity. As we make taxes more progressive, output shrinks significantly. As a
result, simply increasing progressivity cannot deliver a 30% increase in revenue, and this level of income taxes that has also to increase to generate the required revenue. Our results show quite different responses in hours, labor supply and long-run output as progressivity increases, that are also of a non-trivial magnitude. Long-run output declines range from 2.6% when only the level of the tax function changes, to about 12% at the level of progressivity that maximizes revenues (in the absence of an increase in the level of taxes for everyone).

We subsequently consider a hypothetical linear consumption tax, characterized by a tax rate and a lump-sum transfer, to target the same, 30%, revenue increase in the long run. When the transfer is zero, we have a simple proportional consumption tax, while a lump-sum transfer makes it progressive. As the associated transfer increase, hours, labor supply and output decline. In turn, larger consumption taxes are needed to generate the revenue target as the transfer increases. However, unlike the case of a changes in income tax progressivity, the associated changes in aggregates are more moderate. This reflects the fact that consumption taxes, even when accompanied by a transfer, tend to be less distorting than a non-linear income tax. We find that a transfer of about $5,000 per household (in 2020 dollars), leads to a decline in long-run output of about 4.2%, with a required tax rate of about 9.6%. The associated welfare loss is about 2.8% in consumption terms.

Our findings do not reveal significant long-run increases in revenues from a wealth tax, when applied to the top 1% of wealth holdings. We find that upon impact, revenues sharply rise, but then rapidly decline, becoming even lower than what the government was able to collect in the benchmark without any tax on wealth. This decline in revenues is accompanied by a gradual decline in output. For a 2% wealth tax applied to the richest 1%, revenues decline by 0.3% in the long run, while output non-trivially declines by about 2%. From these findings, it is hard to justify a wealth tax on revenue grounds.

Finally, we search for the optimal mix of tax instruments that delivers alternative levels of revenue increases. Our results consistently find relatively large transfers associated with a high consumption tax rate, and a non-trivial reduction of tax progressivity. Thus, the alternative that minimizes the welfare cost leads to an increase in spending and a reduction in distortions on labor choices and asset formation for top incomes via the income tax.
Increasing Federal revenues by 30% is concomitant with a transfer per household of about $12,000 in 2020 dollars, a consumption tax of 27.8% and a reduction of marginal tax rates at the top by about 5%. The resulting welfare cost is about 1.9%.

Our paper is organized as follows. Section 2 presents a big-picture view of the revenue needs of the United States. Section 3 presents the model we use in our analysis. We discuss the parameterization of the model and its mapping to data in Section 4. Section 5 contains findings related to the use single tax instruments to generate additional revenue in the long run, whereas section 6 contains our main findings regarding the optimal mix of tax instruments. In section 7 we put our findings in perspective. Section 8 presents concluding remarks.

2 The Looming Revenue Requirements

3 Model

We present below a stationary version of our model, leaving a formal definition of equilibrium for an appendix.

**Demographics**  Each period a continuum of agents are born. Agents live a maximum of $N$ periods and face a probability $s_j$ of surviving up to age $j$ conditional upon being alive at age $j-1$. Population grows at a constant rate $n$. The demographic structure is stationary, such that age-$j$ agents always constitute a fraction $\mu_j$ of the population at any point in time. The weights $\mu_j$ are normalized to sum to 1, and are given by the recursion $\mu_{j+1} = (s_{j+1}/(1+n))\mu_j$.

**Preferences**  All agents have preferences over streams of consumption and hours worked, and maximize:
\[
E \left[ \sum_{j=1}^{N} \beta^j (\prod_{i=1}^{j} s_i) u(c_j, l_j) \right].
\]

where \(c_j\) and \(l_j\) denote consumption and labor supplied at age \(j\). The period utility function \(u\) is given by

\[
u(c, l) = \log(c) - \frac{l^{1+\frac{1}{\gamma}}}{1 + \frac{1}{\gamma}}.
\]

The parameter \(\gamma\) in this formulation – central to our analysis – governs the static Frisch elasticity as well as the intertemporal labor supply elasticity. The parameter \(\varphi\) controls the intensity of preferences for labor versus consumption.

**Technology**

There is a constant returns to scale production technology that transforms capital \(K\) and labor \(L\) into output \(Y\). This technology is represented by a Cobb-Douglas production function. The technology improves over time because of labor augmenting technological change, \(X\). The technology level \(X\) grows at a constant rate, \(g\). Therefore,

\[
Y = F(K, LX) = AK^\alpha(LX)^{1-\alpha}.
\]

The capital stock depreciates at the constant rate \(\delta\).

**Heterogeneity**

At birth, individuals differ in two ways in our environment, via a permanent differences in labor endowments and discount factors. In addition, as they age, they experience persistent shocks to their labor endowments.

Let \(\theta\) stand for (the log of) a permanent shock to labor endowments, and \(z\) for (the log of) a persistent shock. Hence, the labor endowment of an individual as a function of shocks and age is given by \(e(\Omega, j), \Omega = \{\theta, z\}\), with \(\Omega \in \Omega, \Omega \subset \mathbb{R}_+^2\). Age-1 individuals receive
permanent shocks according to the probability distribution $Q_\theta(\theta)$. Conditional on a value for the permanent shock, individuals draw a discount factor a distribution $Q_\beta(\beta|\theta)$. Hence, permanent shocks and discount factors are potentially correlated. We refer to these shocks as permanent as they remain constant during the working life cycle.

The persistent shock $z$ follows a Markov process, with age-invariant transition function $Q_z$, so that $\text{Prob}(z_{j+1} = z'|z_j = z) = Q_z(z', z)$. Productivity shocks are independently distributed across agents, and the law of large numbers holds. We describe the parametric structure of shocks in detail in section 4.

**Individual Constraints** The market return per hour of labor supplied of an age-$j$ individual is given by $we(\Omega, j)$, where $w$ is a wage rate common to all agents, and $e(\Omega, j)$ is a function that summarizes the combined productivity effects of age and idiosyncratic productivity shocks.

All individuals are born with no assets, and face mandatory retirement at age $j = R + 1$. This determines that agents are allowed to work only up to age $R$ (inclusive). An age-$j$ individual experiencing shocks $\Omega$ chooses consumption $c_j$, labor hours $l_j$ and next-period asset holdings $a_{j+1}$. The budget constraint for such an agent is then

$$c_j + a_{j+1} \leq a_j(1 + r) + (1 - \tau_p)we(\Omega, j)l_j + TR_j + B_j - T_j,$$

with

$$c_j \geq 0, \quad a_j \geq 0, \quad a_{j+1} = 0 \text{ if } j = N,$$

where $a_j$ are asset holdings at age $j$, $T_j$ are taxes paid, $\tau_p$ is the (flat) payroll social-security tax and $B_j$ is a social security transfer. Asset holdings pay a risk-free return $r$. In addition, if an agent survives up to the terminal period ($j = N$), then next-period asset holdings are zero. $TR_j$ are transfers available to working-age individuals. The social security benefit $B_j$ is zero up to the retirement age $J_R$, and equals a fixed benefit level for an agent after
Taxes, Transfers and Government Consumption The government consumes in every period the amount $G$, which is financed through taxation, and by fully taxing individual’s accidental bequests. In addition to payroll taxes, taxes paid by individuals have three components: a flat-rate income tax, a flat-rate capital income tax and a non-linear income tax scheme. Income for tax purposes ($I$) consists of labor plus capital income. Hence, for an individual with $I = we(\Omega, j)l_j + ra_j$, taxes paid at age $j$ are

$$T_j = T_f(I) + \tau_l I + \tau_k ra_j + \tau_c [we(\Omega, j)l_j + ra_j - (a_{j+1} - a_j) + B_j + \phi TR_j]$$ (5)

where $T_f$ is a strictly increasing and convex function. $\tau_l$ and $\tau_k$ stand for the flat income and capital income tax rates. We later use the function $T_f$ to approximate effective Federal Income taxation in the United States. We will use the rates $\tau_l$ and $\tau_k$ to approximate income taxation at the state level and corporate income taxes, and $\tau_p$ to capture payroll (social security) taxes in the United States. The rate $\tau_c$ captures a consumption at the state level, allowing for a potential deduction of transfers $\phi \in [0, 1]$; i.e. when $\phi = 1$, transfers are not deductible and fully taxable via the (state) consumption tax.

Transfers available to working-age individuals are a function of income $I$ as well. Transfers are declining with income up to a threshold level, and then become zero. We parameterize in detail this function in section 4.

3.1 Decision Problem

We now state the decision problem of an individual in our economy in the recursive language. We first transform variables to remove the effects of secular growth, and indicate transformed variables with the symbol ($\hat{\cdot}$). With these transformations, an agent’s decision problem can be described in standard recursive fashion. We denote the individuals’s state by the triple $x = (\hat{a}, \Omega, \beta)$, $x \in X$, where $\hat{a}$ are current (transformed) asset holdings, $\Omega$ are the
idiosyncratic productivity shocks and $\beta$ stands for the discount factors. The set $X$ is defined as $X \equiv [0, \bar{a}] \times [0, \bar{\beta}] \times \Omega$, where $\bar{a}$ and $\bar{\beta}$ stand for upper bounds on (normalized) asset holdings and discount factors. We denote taxes (other than payroll taxes) at state $(x, j)$ by $T(x, j)$, and total transfers by $TR(x, j)$. Optimal decision rules are functions for consumption $c(x, j)$, labor $l(x, j)$, and next period asset holdings $a(x, j)$ that solve the following dynamic programming problem:

$$V(x, j) = \max_{(c, l)} u(c, l) + \beta s_{j+1} E[V(\hat{a}', \Omega', j+1) | x]$$

subject to

$$\begin{cases}
\hat{c} + \hat{a}'(1 + g) \leq \hat{a}(1 + \hat{r}) + (1 - \tau_p)w e(\Omega, j)l + \hat{B}_j + TR(x, j) - T(x, j) \\
\hat{c} \geq 0, \quad \hat{a}' \geq 0, \quad \hat{a}' = 0 \text{ if } j = N \\
V(x, N + 1) \equiv 0
\end{cases}$$

**Comments** It is worth noting that as an agent’s income subject to taxation includes capital (asset) income; capital income is taxed through the non-linear income tax as well as through the flat-rate tax on income $\tau_l$ and capital income $\tau_k$. In addition, transfers and the consumption tax affect after-tax rates of return. Altogether, our specification implies that for an individual with income $I$, the (gross) after-tax rate of return on savings equals to

$$(1 + r) [1 - \tau_c] - r [T'_f(I) + \tau_l + \tau_k - TR'(I, j)(1 - \tau_c\phi)].$$

Regarding labor income, marginal tax rates are affected by payroll taxes as well as by income taxes and the presence of transfers. Hence, an individual with an income $I$, faces a marginal tax rate on labor income equals to $T'_f(I) + \tau_l + \tau_c - TR'(I, j)(1 - \tau_c\phi) + \tau_p$. 

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It is important to note a couple of points here. First, in an intertemporal first-order condition for asset choice, the term \((1 - \tau_c)\) appears on both sides of the equation. Thus, in the absence of other taxes, consumption taxes do not distort asset choices in the margin as it is well known. Second, note that when transfers are operative, transfers affect the decisions to work and save. Since \(TR'(I,j) < 0\), an additional unit of labor or asset income reduces transfers and thus, affects choices on the margin.

### 3.2 Equilibrium

In our model, individuals are heterogeneous with respect to their idiosyncratic labor productivity shocks, their discount factors, their asset holdings, and their age. To specify the notion of equilibrium, we define a probability measure \(\psi_j\) on subsets of the individual state space that describes heterogeneity in assets and productivity shocks within a particular cohort. Hence, for any set \(B \subset X\), \(\psi_j(B)\) describes the mass of agents of age \(j\) for with state \(x \in B\). We specify this probability measure in more detail in the appendix.

In any equilibrium, factor prices equal their marginal products. Hence, \(\hat{w} = F_2(\hat{K}, \hat{L})\) and \(\hat{r} = F_1(\hat{K}, \hat{L}) - \delta\). Moreover, markets clear. In our context, this implies

\[
\sum_j \mu_j \int_X (c(x,j) + a(x,j)(1 + g))d\psi_j + \hat{G} = F(\hat{K}, \hat{L}) + (1 - \delta)\hat{K}, \tag{8}
\]

\[
\sum_j \mu_j \int_X a(x,j)d\psi_j = (1 + n)\hat{K}, \quad \text{and} \quad \sum_j \mu_j \int_X l(x,j)e(\Omega,j)d\psi_j = \hat{L} \tag{9}
\]

**Budget Balance**  Government budgets are balanced in any equilibrium. This implies that government consumption plus transfers equals tax collections from all sources, and that
social security transfers are consistent with payroll tax collections. This implies

$$\sum_j \mu_j \int_X T(x,j) d\psi_j + \hat{G} = \sum_j \mu_j \int_X T(x,j) d\psi_j + \hat{AB}$$

(10)

$$\tau_p \hat{w} \hat{L} = \sum_{j=J_R+1}^N \mu_j \hat{B}_j$$

(11)

Note that equation (10) includes the aggregate amount of accidental bequests, $\hat{AB}$. This reflects our assumption that the government fully taxes accidental bequests. In the appendix section, we provide a formal notion of equilibria.

4 Parameter Values

We now proceed to assign parameter values to the endowment, preference, and technology parameters of our benchmark economy. To this end, we use aggregate as well as cross-sectional and demographic data from multiple sources. As a first step in this process, we start by defining the length of a period in the model to be 1 year.

Demographics We assume that individuals start life at age 25, retire at age 65 and live up to a maximum possible age of 100. This implies that $J_R = 40$ (age 64), and $N = 75$. We set demographic parameters so as to reflect recent demographic changes. The population growth rate is 0.7% per year ($n = 0.007$), corresponding to the growth rate for the period 2010-2019. We set survival probabilities according to the U.S. Life Tables for the year 2018.\footnote{United States Life Tables, 2018. National Vital Statistics Reports (2020), Volume 69, Number 12}
Heterogeneity and Endowments To parameterize labor endowments, we assume that the log-hourly wage of an agent is given by the sum of a fixed effect or permanent shock (θ), a persistent component (z), and a common, age-dependent productivity profile, $\bar{e}_j$. Specifically, we pose

$$\log(e(\Omega, j)) = \theta + \bar{e}_j + z_j, \quad (12)$$

with

$$z_j = \rho z_{j-1} + \epsilon_j, \quad z_0 = 0 \quad (13)$$

where $\epsilon_j \sim N(0, \sigma^2_\epsilon)$. For the permanent shock (θ), we assume that a fraction π of the population is endowed with $\theta^*$ at the start of their lives, whereas the remaining $(1 - \pi)$ fraction draws θ from $N(0, \sigma^2_\theta)$. The basic idea is that a small fraction of individuals within each cohort has a value of the permanent component of individual productivity that is quite higher than the values drawn from $N(0, \sigma^2_\theta)$. We refer occasionally to these individuals as superstars. Given a value for permanent shocks, we assign a single discount factor for each level of θ. This strategy (detailed below) allows us to reproduce jointly in a parsimonious way a host of targets for the distributions of earnings and wealth.

Our strategy for setting the parameters characterizing heterogeneity consists of two steps. First, we use available estimates and observations on individual wages (hourly earnings) to set the parameters governing the age-productivity profile and the persistence and magnitude of idiosyncratic shocks over the life. We then determine the parameters governing permanent differences – permanent shocks to endowments and discount factors – so in stationary equilibrium our economy is in line with the overall degree of earnings and wealth inequality for households in data. For these purposes, we calculate statistics of earnings and wealth inequality for households in a consistent manner. We use data from the 2013 Survey of Consumer Finances, including households with non-negative income and non-negative wealth. For earnings, we further restrict the sample to households with a head between 25 and 25.
We estimate the age-dependent deterministic component $\bar{e}_j$ by regressing mean-log wages of individuals on a polynomial of age together with time effects. We use for these purposes data from the Current Population Survey (CPS) data for 1980-2005. We consider data from males aged between 25 and 64. We drop observations with individual wages less than half of the federal minimum wage. Moreover, as in Heathcote, Perri and Violante (2010), we impose that individuals must work at least 260 hours per year. We also correct for top-coding following Lemieux (2006). To set values for the parameters governing persistent shocks, we follow Kaplan (2012) and set the autocorrelation coefficient ($\rho$) and the variance of the persistent innovation ($\sigma^2_\epsilon$) to the estimates therein, $\rho = 0.958$ and $\sigma^2_\epsilon = 0.017$.

For the permanent differences in labor endowments and discount factors, we proceed as follows. We set $\pi = 0.01$; i.e. we assume that 1% of each cohort are superstars. Then, we set the variance of permanent shocks for the remaining $1 - \pi$ fraction and the value of the high permanent shock ($\theta^*$) to reproduce two targets: i) the level of household earnings inequality – measured by the Gini coefficient – observed in U.S. data (0.55), and ii) the share of labor income at top 1% (12.9%). This procedure yields $\sigma^2_\theta = 0.45$ and $\theta^* = 2.7$. It implies that superstar individuals that are about 15 times more productive than the median individual in each cohort – $15 \sim \exp(2.7)$.

Since we use six permanent shocks in total, there are six corresponding discount factors to determine. We select their values in order to reproduce the overall capital-output ratio (3.0), the wealth Gini coefficient (0.81), and the shares of wealth held by the bottom 60% and the top 20%, 5% and 1%. These shares amounted to 5.9%, 83%, 59% and 32%, respectively.

**Taxes** Following Benabou (2002) and Heathcote, Storesletten and Violante (2014) and others, we use a convenient tax function to represent Federal Income taxes in the data. Specifically, we set the function $T_f$ to

$$T_f(I) = It(\bar{I}),$$

where
\[ t(\bar{I}) = 1 - (1 - \tau_0)\bar{I}^{-\tau_1}, \]

is an average tax function, and \( \bar{I} \) is income relative to mean income. As we indicated earlier, the parameter \( \tau_0 \) defines the ‘level’ of the tax rate whereas the parameter \( \tau_1 \) governs the curvature or progressivity of the system.

To set values for the curvature parameter \( \tau_1 \), we use the estimates of effective tax rates for this tax function in Guner, Kaygusuz and Ventura (2014). The underlying data is tax-return, micro-data from Internal Revenue Service for the year 2000 (Statistics of Income Public Use Tax File). We use the estimates therein for all households when refunds for the Earned Income Tax Credit are included, resulting in \( \tau_1 = 0.053 \). We set the level parameter \( \tau_0 \) so that our economy reproduces in stationary equilibrium the observed tax collections out of the Federal Income Tax for 2000-2015, which averaged 7.6% of GDP. This determines \( \tau_0 = 0.051 \). Altogether, these estimates imply that a household around mean income faces an average tax rate of 5.1% and marginal tax rate of 10.1%. For high income individuals, average and marginal rates are non-trivially higher. At five times the mean household income, the average and marginal rates for a married household amount to 12.9% and 17.5%, respectively.

We use the tax rate \( \tau_l \) to approximate state and local income taxes. Guner et al. (2014) find that average tax rates on state and local income taxes are essentially flat as a function of household income, ranging from about 4% at the central income quintile to about 5.3% at the top one percent of household income. From these considerations, we set this rate to 5% \( (\tau_l = 0.05) \).

We set \( \tau_k \) so as to proxy the U.S. corporate income tax. We estimate this tax rate as the one that reproduces the observed level of tax collections out of corporate income taxes in stationary equilibrium; about 1.6% of GDP for 2000-2015 period. The resulting value is \( \tau_k = 0.074 \). We set the consumption tax rate so that our economy reproduces the share of consumption tax collections in GDP at the state level – about 2.9% of GDP. Under the assumption of full deductibility of transfers \( (\phi = 1) \), the resulting rate is 4.8%. Finally, we calculate \( \tau_p = 0.162 \), as the (endogenous) value that generates an earnings replacement ratio
Transfers  The final component of fiscal policy in our environment are Federal transfers to working-age households. Following Guner, Rauh and Ventura (2021), we use data from the Survey of Income and Program Participation to estimate an effective transfer schedule that relates transfers received by different household types to their income, excluding medical transfers (Medicaid). We include the Temporary Assistance to Needy Families (TANF), the Supplemental Nutrition Assistance Program (SNAP), the Supplemental Nutrition Program for Women, Infants, and Children (WIC), Supplemental Security Insurance (SSI) and Housing Subsidies. We estimate a transfer (Richter) function of the following form:

\[ TR(\tilde{I}) = \omega_0 \quad \text{if } \tilde{I} > 0, \quad \text{and} \quad TR(\tilde{I}) = \exp(\omega_1) \exp(\omega_2 \tilde{I}) \tilde{I}^{\omega_3} \]

where \( \tilde{I} \) is household income relative to the mean as before. This formulation implies that transfers are positive if household income is zero, and accommodate for a smooth decline as household income increases. Our estimates imply that a household with zero income collects 12.1% of mean household income and that transfers decline rapidly with income, with households at around median income collect about 0.5-0.3% of mean income.

Preferences and Technology  We set the intertemporal elasticity of labor supply (\( \gamma \)) to a value of 1 in our benchmark exercises, and later study its importance by conducting exercises for different, in particular lower, values of it. Our choice is in line with macro estimates of the elasticity of labor supply, that tend to be larger than micro estimates at the intensive margin. We set the value of the parameter \( \varphi \) to reproduce in stationary equilibrium a value of mean hours of 1/3.

We calibrate the capital share and the depreciation rate using a notion of capital that includes fixed private capital, land, inventories and consumer durables. For the period recent period

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3We use the median replacement rate of long-career workers born in the 1960s, taking into account all earnings from age 22 through age 61. Source: Social Security Replacement Rates and Other Benefit Measures: An In-Depth Analysis. CBO, April 2019.
2010-2019, the capital share equals 0.35 and the (annual) depreciation rate amounts to 0.04 under a targeted capital-output ratio of 3.0. This procedure also implies a rate of growth in labor efficiency of about 1.6% per year ($g = 0.016$).

**Summary** Table 1 summarizes our parameter choices. Recall that the parameters ($\{\beta_z\}_{i=1}^6$, $\varphi$, $\theta^*$ and $\sigma^2_\theta$) are set so as to reproduce endogenously several observations in stationary equilibrium: capital-output ratio, the wealth Gini coefficient, the wealth shares of the bottom 60%, the wealth shares of the top 20%, top 5% and 1%, aggregate hours worked, earnings Gini coefficient, and the share of labor income accounted by top 1% of households.

### 4.1 The Benchmark Economy

We now discuss the quantitative properties of the benchmark economy that are of importance for the questions of this paper. We focus on the consistency of the benchmark economy with facts on cross-sectional inequality in earnings and wealth. We also show that the model is in line with the distribution of taxes paid at different percentiles of the distribution of income.

**Earnings and Wealth Heterogeneity** Table 2 shows that the model is in close consistency with facts on the distribution of household earnings. Our economy reproduces the overall inequality in household earnings as measured by the Gini coefficient, which we target alongside the share of earnings accounted for by the top 1%. The model also reproduces quite well the (untargeted) shares accounted by different quintiles, ranging from empirical values of just 0.2% in the bottom quintile to nearly 83.4% in the fifth quintile. The model is also in line with the share of labor earnings accounted by top percentiles, beyond the targeted share of the top 1% earners. As the table summarizes, the share accounted for by the the top 5% earners in the data is of about 58.7% while the model implies 59.3%.

Table 2 also shows that the model is in close agreement with the observed wealth distribution from the SCF data. This includes the wealth share of the top 1%, which is problematic for models with no heterogeneity in discount factors. Altogether, these findings imply that the
Lorenz curves for both labor earnings and wealth holdings generated by the model are in close conformity with data.

We note that our parameterization does not require large discount factors at the top to account for the observed wealth concentration. The mean value for the discount factor is about 0.973, and these values are negatively correlated with permanent types, as Table 1 shows. The discount factor for superstar individuals is 0.994, which is lower or similar to the values at the bottom of the distribution of permanent types. It follows then that in order to account for observed wealth disparities, discount factors must obey a u-shape relationship with permanent types; i.e. discount factors for agents around the middle of the distribution of permanent types tend to be lower.

**The Distribution of Taxes Paid** Figure 1 shows the distribution of income-tax payments at the Federal level for different percentiles of the income distribution, for both model and data. As the figure shows, the distribution of tax payments is quite concentrated – more so than the distributions of labor income and wealth. The first three income quintiles do not account for much in terms of tax liabilities, whereas the top income quintile accounts for nearly 80% of tax payments. All this is the natural consequence of a concentrated distribution of household income and progressive income tax scheme. While the model does not explicitly targets how tax payments increase with income, the model tracks the data in across the entire distribution reasonably well. Note in particular that the model matches quite nicely the share of tax payments accounted for by the top 1%. Overall, this is reassuring in light of our subsequent analysis of tax changes.

5 Increasing Revenues

We now use our model environment to assess the impact of alternative changes in taxation that generate given percentage increases in tax revenues in the long run. For expositional purposes, we focus in this section on the case of a 30% increase in Federal revenues relative
to the benchmark economy. This effectively imply increases in revenues that amount to 2.8% of the benchmark value of output in the new steady state. We later explore higher and lower increases in revenues in our analysis of the optimal mix of tax instruments.

Our approach is to implement at date $t = t_0$, say, in a non-anticipated fashion, the changes in taxes that lead to the targeted revenue increases in the long run. We compute the transitions that ensue between steady states, and report changes over time in different variables, and provide welfare measures for those alive at $t = t_0$. We concentrate in three separate cases. First, we evaluate increase in revenues via variants of changes in income taxes. We then introduce an additional, new linear consumption tax. We finally examine the implications of a wealth tax.

### 5.1 Raising Income Taxes

We present four cases below to increase revenues by 30% in the long run, indexed by the value of the curvature parameter in the tax function, $\tau_1$. We focus on two values higher than the benchmark value, $\tau_1 = 0.053$. We consider $\tau_1 = 0.07$ and $\tau_1 = 0.09$. We also show results for the benchmark value of $\tau_1 = 0.053$, and the value for $\tau_1$ that maximizes revenue from progressivity changes (only) in the long run. In all cases, we adjust the ‘level’ of the tax function via changes in the parameter $\tau_0$ so as to hit the target in the new steady state.

Our results are shown in Table 3 for a host of variables across corresponding steady states. To assess our findings, note that increases in the curvature of the tax function, while increasing tax rates at the top and reducing rates at the bottom, increase marginal rates for everyone. Thus, all the same, individuals face higher marginal rates on labor and asset income, reducing labor supply and asset formation on the margin. The result is higher revenue (up to a point) but lower levels of labor supply and output in the long run. This reasoning and its consequences help understanding the dynamic effects associated to changes in curvature that are concomitant with revenue increases.

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4In our calculation of Federal revenues, we do not take into account payroll taxes. We only impute revenues associated to the Federal income tax and the corporate tax via the capital income tax $\tau_k$. 

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Our results show that the required $\tau_0$ increases from the benchmark value of 5.1%, and declines as the curvature level increases. However, the changes in $\tau_0$ are relatively small as curvature increases. Agents at mean household income levels see increases in average tax rates across the board, which now range from 8.3% to 7.8% for across all levels of curvature in the tax function. This follows as increases in progressivity are associated to non-trivial reductions in output and labor supply in the long run, but relatively minor effects in revenues, as we emphasized earlier in Guner et al. (2016). As a result, only small reductions in $\tau_0$ are needed in order to generate a targeted increase in revenues as curvature increases.

A prominent finding emerging from our exercises is that quite different effects on output and labor supply are consistent with the same level of revenue increases. Table 3 and Figure 2 clearly show this. When revenues are increased via a proportional tax, output drops by only 2.4%. When the curvature of the tax function increases relative to the benchmark case, the decline in output is 5.5% and 8.7%, for $\tau_1 = 0.07$ and $\tau_1 = 0.09$, respectively. At the highest level of curvature consistent with a targeted increase of 30%, $\tau_1 = 0.114$, the decline in output is about 12%. These outcome differences are substantial, and reflect the non-trivial distortionary effects associated with higher levels of progressivity.

Welfare Table 3 also shows that welfare losses decline as curvature increases while achieving the targeted long-run increase in revenues. We measure welfare by the the common, compensation increase in consumption to all individuals alive at $t = t_0$. Our results show that as progressivity increases, the welfare losses become smaller. They range from -4.3% when $\tau_1 = 0$, to -2.7% at the highest sustainable level of progressivity. These effects take place even when the contraction in output and other aggregates become larger as curvature increases. Underlying this finding is the fact that as progressivity increases, taxes do not increase as much for some agents. In addition, a higher level of curvature provides insurance against idiosyncratic risk. Overall, the tradeoffs that are associated to different levels of progressivity in lieu of revenue needs will help determining the optimal mix of tax instruments.

---

5To have a sense of the implied changes in marginal rates at top incomes, the marginal tax rate at five times mean household income increases by about 6, 10 and 14.5 percentage points when the curvature increases to $\tau_1 = 0.07$, $\tau_1 = 0.09$, and $\tau_1 = 0.114$, respectively.
which we analyze in the next section.

**State-level Revenues** Table 3 also shows the changes in revenues at the *state* level that follow the tax changes. As Table 3 and the figure illustrate, different progressivity levels have sharp implications for other (i.e. state and local) sources of tax revenue. Alongside the shrinking in the aggregate economy as shown in Figure 2, state revenues decline as well. State revenues decline by 4.5% when the additional revenue is raised by a proportional tax, while they do by 12.3% at the maximum level of progressivity. These effects are large, and highlight additional tradeoffs associated to *how* revenue increases are generated in an economy with different jurisdictions. Altogether, total revenues (i.e. federal plus state) change non-trivially less than the increases at the Federal level.

### 5.2 Introducing a Consumption Tax

We now introduce consumption taxes as an instrument to increase Federal revenues by 30%. Specifically, we evaluate the merits of a linear consumption tax; i.e. a tax rate $\tau_c^F$, alongside a lump-sum transfer in all dates and states. We assume that the new transfer is taxable via the state-level consumption tax. For expositional purposes, we consider three cases when the target increase in Federal revenues is 30%. We show results below for the case without a transfer, and the cases of transfers equal to 3% and 5% of household income in the benchmark steady state.

Our findings are presented in Table 4 and Figure 3. In understanding these results, it is key to recall that a consumption tax, all the same, does not distort asset choices and creates only a distortion in labor supply. For given prices, it may lead to changes in labor supply depending on the relative strengths of income and substitution effects. When a transfer is in addition present, labor supply falls due to income effects, and leads to a stronger substitution effect associated to the consumption tax. Hence, all the same, as the transfer increases, labor supply falls due to the income effect induced by the transfer. Moreover, larger tax rates are concomitant with larger transfers, which lead to stronger substitution effects away from
market work. Altogether, the net result is further reductions in labor supply as transfers and tax rates increase.

Table 4 shows that as the lump-sum transfer increases, large tax rates on consumption are needed in order to generate a 30% increase in revenues. As a result, larger transfers are associated with larger declines in hours, labor supply, and output in the long run. Figure 3 presents the time path for output for different levels of transfers. These effects are in line with our previous findings, whereby increases in progressivity of the income tax led to differential effects on long-run output for a given increase in revenues.

Two important differences with the results for income taxes are worth pointing out. First, output differences in the long run tend to be larger for changes in income tax progressivity. This property of the results will play a central role in the mix of taxes that minimize welfare costs. Second, when transfers increase, hours drop on average more than labor supply, while the opposite is the case when progressivity raises. This follows as the lump-sum transfer is disproportionately more important for less productive (poorer) agents relative to more productive ones. This determines a decline in hours that is more pronounced for agents with low productivity, which in turn implies changes in average hours that are larger than changes in labor supply (hours weighted by efficiency units). Since what matters in the determination of prices and output is labor supply – not raw hours – the negative effects on output as the transfer increases are less pronounced than under changes in progressivity.

Welfare Table 4 presents the effects on welfare for those alive at $t = t_0$ and the numbers of agents in favor. As transfers and consumption tax rates increase, the welfare cost associated to increasing revenues declines, and the support for the increase in revenues increases as well. This is line with the previous findings regarding the income tax. These findings also show that the reduction in the welfare cost is relatively fast, as relatively small transfers lead to non trivial changes in welfare. This clearly suggest that consumption taxes in conjunction with transfers maybe a critical part of an optimal arrangement of tax increases. We elaborate on this later on.
5.3 Introducing Wealth Taxes

Can wealth taxes generate enough revenue in the long run? We address this question by introducing a wealth tax that applies to all levels wealth above the threshold that defines the top 1%. We consider three potential rates; 1%, 2% and 3%. All other taxes are left unchanged.

Our findings for Federal tax revenue and output in all cases are summarized in Figure 4. As the figure illustrates, the sudden increase enactment of a wealth tax raises revenues immediately in a non trivial fashion. Revenues jump up to about 12%, as all wealth in top 1% is taxed. This discourages wealth formation at the top in a substantial manner, and leads to reductions in asset accumulation at the top. The net result is a reduction in revenues that materializes very quickly.

The wealth tax has also implications for capital, labor supply, and output. Figure 4 shows the gradual reduction in output that ensues after the introduction of the tax on top wealth. Output declines in the long run by about 1.2%, 2% and 2.6%. Overall, this reduction in output over time leads to a decline in other sources of revenue, resulting in a net decline in Federal revenues in the long run. We conclude from these findings that the introduction of a wealth tax can be hardly justified on revenue needs on a steady basis, even when it could be part of an optimal mix of tax instruments. We explore these issues later in the paper in our robustness analyses.

6 Increasing Revenues: Mixing Tax Instruments

We now look for a mix of tax instruments that raise revenue for different targets at the minimum cost in welfare terms. Based on our previous results, we consider three tax instruments, which are adjusted in order to deliver a long-run increase in Federal revenues of 15%, 30% and 45%, respectively. We assume no changes in the ‘level’ of the income tax function ($\tau_0$). We also assume as well that a wealth tax is not available – we later relax this assumption. We consider changes in the curvature of the income tax function and the potential...
use of a linear consumption tax at the Federal level, as explained in the previous section. Specifically, our procedure is to select the (constant over time) tax rate on consumption, the level of lump-sum transfer and a curvature of the tax function in order to maximize welfare of those alive at $t = t_0$ (minimize welfare loss), subject to the generation of target revenues in the long run.

Our findings are summarized in Table 5, where for expositional purposes we present a column for the benchmark case. Values for transfers are expressed in terms of mean household income of the benchmark economy (initial steady state). We now note and discuss several features of our results. First, a prominent finding is that the optimal mix of instruments includes a consumption tax alongside a lump sum transfer. The tax rates that emerge are substantial, ranging from 27.4% to 30.2%, depending on the needs for revenue, bearing therefore the brunt of the additional revenue requirements. These high rates are concomitant with high transfers, of about 13% of mean income of the benchmark economy under a targeted 15% increase in revenues, declining to about 11-12% in the other two cases. Second, the progressivity of the income tax declines across the board, with a reduction in curvature from $\tau_1 = 0.053$ to values around $\tau = 0.03$.

Third, state revenues fall only mildly in all cases, despite the fact that the output loss is up to 8% in the long run. This occurs as the new transfer is taxed at the local level via the state consumption tax. Moreover, the reductions in progressivity and the introduction of a consumption tax minimize losses on the tax base at the state level. We subsequently examine as part of robustness exercises cases in which the state consumption tax taxes partly or fully the new Federal transfer.

These findings imply that the search for additional revenue requires additional spending to minimize welfare costs for all alive at $t = t_0$. The transfer embedded in the linear consumption tax is large, of around $12,000 per household. The rationale for these findings is connected to our previous results, which suggest that linear consumption taxes lead to smaller changes in long-run macroeconomic aggregates as opposed to non-linear income taxes. A consumption tax

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6This implies non-trivial reduction of marginal rates for top incomes. At five times mean income, this implies a drop the marginal tax rate of more than five percentage points.
tax plus a transfer are preferred as a consumption tax distorts little individual choices on the margin, while redistribution to minimize welfare losses is accomplished via lump-sum transfers. In addition, the optimal mix involves a reduction in income tax progressivity. Such a reduction reduces distortions on the margin on labor and asset formation decisions for more productive agents, minimizes output losses and contributes to achieve the revenue targets when mixed with revenue targets. Altogether, this reasoning suggests that as revenue needs increase, the reduction in progressivity becomes stronger. Our findings are in line with this intuition, albeit the reduction is quantitatively mild as target revenues increase.

**Inequality**  A noteworthy feature of our results is that inequality in earnings and wealth increases as part of a mix of tax instruments. Table 5 shows that earnings concentration measured by the Gini coefficient increases non trivially – from 0.55 to 0.60-0.62, while the wealth Gini coefficient increases to about 0.85 from 0.81. This is expected, given the nature of the mix of tax instruments that emerges in our exercises. Large transfers in conjunction with a consumption tax disproportionately reduce the labor supply of labor-poor agents, while reductions in progressivity tend to mitigate the reduction or increase the labor supply of those at the top of the distribution of earnings. The net result is an increase in earnings inequality displayed in Table 5. This process is mirrored in terms of asset accumulation, resulting in the increase in wealth inequality displayed in Table 5.

**Welfare**  Not surprisingly, our findings imply that as revenue needs increase, the welfare cost of raising additional revenue sharply raises, and support among those alive at \( t = t_0 \) declines. The findings show the quantitative importance of considering multiple tax instruments, while allowing for a an unrestricted consumption tax. Consider the case of a 30% increase in Federal revenues, that we analyzed in the previous section. The welfare cost when only the income tax function can be used ranges from 4.3% under the benchmark curvature level, to 2.7% under the maximum curvature. In contrast, the welfare cost in Table 5 amounts to 1.9%. In similar fashion, a linear consumption tax with either no transfer or lower levels of transfers, delivers non-trivially larger welfare costs.
In the next section, we evaluate the quantitative importance of different component of the tax mix.

### 6.1 Wealth Taxation and Government Debt

[TO COMPLETE]

### 7 Findings in Perspective

[TO COMPLETE]

### 8 Conclusion

[TO COMPLETE]
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Growth Rate ($n$)</td>
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<td>U.S. Data</td>
</tr>
<tr>
<td>Labor Efficiency Growth Rate ($g$)</td>
<td>0.016</td>
<td>U.S. Data</td>
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<td>Mean Discount Factor ($\beta$)</td>
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<td>see text</td>
</tr>
<tr>
<td>Correlation (discount factor, $z$)</td>
<td>-0.17</td>
<td>see text</td>
</tr>
<tr>
<td>Intertemporal Elasticity ($\gamma$)</td>
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<td>Literature</td>
</tr>
<tr>
<td>Disutility of Market Work ($\varphi$)</td>
<td>6.55</td>
<td>Calibrated - matches hours worked</td>
</tr>
<tr>
<td>Capital Share ($\alpha$)</td>
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<td>Calibrated</td>
</tr>
<tr>
<td>Depreciation Rate ($\delta_k$)</td>
<td>0.04</td>
<td>Calibrated</td>
</tr>
<tr>
<td>Autocorrelation Permanent Shocks ($\rho$)</td>
<td>0.958</td>
<td>Kaplan (2012)</td>
</tr>
<tr>
<td>Variance Permanent Shocks ($\sigma^2_\theta$)</td>
<td>0.45</td>
<td>Calibrated – matches Earnings Gini</td>
</tr>
<tr>
<td>Variance Persistent Shocks ($\sigma^2_\epsilon$)</td>
<td>0.017</td>
<td>Kaplan (2012)</td>
</tr>
<tr>
<td>Share of Superstars ($\pi$)</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Value of Superstars Productivity ($\theta^*$)</td>
<td>2.9</td>
<td>Calibrated – matches labor income share of top 1%</td>
</tr>
<tr>
<td>Payroll Tax Rate ($\tau_p$)</td>
<td>0.162</td>
<td>Calibrated</td>
</tr>
<tr>
<td>Capital Income Tax Rate ($\tau_k$)</td>
<td>0.065</td>
<td>Calibrated</td>
</tr>
<tr>
<td>Income Tax Rate ($\tau_l$)</td>
<td>0.050</td>
<td>Calibrated</td>
</tr>
<tr>
<td>Consumption Tax Rate ($\tau_c$)</td>
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<td>Calibrated</td>
</tr>
<tr>
<td>Tax Function Level ($\tau_0$)</td>
<td>0.051</td>
<td>Calibrated</td>
</tr>
<tr>
<td>Tax Function Curvature ($\tau_1$)</td>
<td>0.053</td>
<td>Guner et al. (2013)</td>
</tr>
</tbody>
</table>

**Note:** Entries show parameter values together with a brief explanation on how they are selected. See text for details.
Table 2: Shares of Labor Income and Wealth (%) – Model and Data

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Data Labor</th>
<th>Model Labor</th>
<th>Data Wealth</th>
<th>Model Wealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st (bottom 20%)</td>
<td>1.3</td>
<td>2.6</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>2nd (20-40%)</td>
<td>7.3</td>
<td>7.0</td>
<td>1.4</td>
<td>0.2</td>
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<tr>
<td>3rd (40-60%)</td>
<td>13.2</td>
<td>12.1</td>
<td>4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>4th (60-80%)</td>
<td>21.9</td>
<td>20.5</td>
<td>10.7</td>
<td>12.0</td>
</tr>
<tr>
<td>5th (80-100%)</td>
<td>56.3</td>
<td>57.9</td>
<td>83.4</td>
<td>82.8</td>
</tr>
<tr>
<td>Top 10%</td>
<td>39.7</td>
<td>41.6</td>
<td>70.9</td>
<td>70.1</td>
</tr>
<tr>
<td>Top 5%</td>
<td>28.5</td>
<td>29.7</td>
<td>58.7</td>
<td>59.3</td>
</tr>
<tr>
<td>Top 1%</td>
<td>12.9</td>
<td>12.9</td>
<td>32.0</td>
<td>31.8</td>
</tr>
<tr>
<td>Gini Coefficient</td>
<td>0.55</td>
<td>0.55</td>
<td>0.81</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Note: Entries show the distribution of labor income in the data and the implied distribution from our model. Both wealth and labor income data are from the 2013 Survey of Consumer Finances. See text for details.
Table 3: 30% Tax Revenue Increase: Income Taxes

<table>
<thead>
<tr>
<th></th>
<th>( \tau_1 = 0.053 )</th>
<th>( \tau_1 = 0.07 )</th>
<th>( \tau_1 = 0.09 )</th>
<th>( \tau_1 = 0.114 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>97.6</td>
<td>94.5</td>
<td>91.3</td>
<td>88.0</td>
</tr>
<tr>
<td>Hours</td>
<td>98.6</td>
<td>97.7</td>
<td>96.2</td>
<td>94.4</td>
</tr>
<tr>
<td>Labor Supply</td>
<td>99.5</td>
<td>97.7</td>
<td>95.9</td>
<td>90.7</td>
</tr>
<tr>
<td>Tax Function Level (( \tau_0 ))</td>
<td>0.083</td>
<td>0.080</td>
<td>0.078</td>
<td>0.078</td>
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<tr>
<td>Revenues</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Income Tax</td>
<td>130.0</td>
<td>130.0</td>
<td>130.0</td>
<td>130.0</td>
</tr>
<tr>
<td>State and Local Taxes</td>
<td>96.5</td>
<td>93.7</td>
<td>90.7</td>
<td>87.7</td>
</tr>
<tr>
<td>All Taxes</td>
<td>114.7</td>
<td>113.6</td>
<td>112.3</td>
<td>110.7</td>
</tr>
<tr>
<td>Welfare</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welfare (%)</td>
<td>-4.3</td>
<td>-3.9</td>
<td>-3.6</td>
<td>-2.7</td>
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<tr>
<td>% in Favor</td>
<td>0.0</td>
<td>0.5</td>
<td>8.8</td>
<td>13.0</td>
</tr>
</tbody>
</table>

**Note:** The table presents the steady-state effects on a host of variables associated to different levels of income tax curvature, ranging from the benchmark case of curvature (\( \tau_1 = 0.053 \)) to the level that maximizes revenues from progressivity changes only (\( \tau_1 = 0.114 \)). In all cases, the ‘level’ of the tax function is adjusted to achieve the target of 30% increase in Federal revenues. See text for details.
Table 4: 30% Tax Revenue Increase: Linear Consumption Tax

<table>
<thead>
<tr>
<th></th>
<th>No transfer</th>
<th>Transfer 3%</th>
<th>Transfer 5%</th>
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<tr>
<td>Output</td>
<td>99.9</td>
<td>97.5</td>
<td>95.8</td>
</tr>
<tr>
<td>Hours</td>
<td>99.9</td>
<td>94.8</td>
<td>91.3</td>
</tr>
<tr>
<td>Labor Supply</td>
<td>99.9</td>
<td>97.3</td>
<td>95.4</td>
</tr>
<tr>
<td>Consumption Tax Rate ($\tau^F_c$)</td>
<td>0.045</td>
<td>9.6</td>
<td>13.4</td>
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<tr>
<td>Revenues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal</td>
<td>130.0</td>
<td>130.0</td>
<td>130.0</td>
</tr>
<tr>
<td>State and Local</td>
<td>99.9</td>
<td>99.3</td>
<td>98.8</td>
</tr>
<tr>
<td>All Taxes</td>
<td>116.6</td>
<td>115.7</td>
<td>115.6</td>
</tr>
<tr>
<td>Inequality and Welfare</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welfare (%)</td>
<td>-4.7</td>
<td>-3.4</td>
<td>-2.8</td>
</tr>
<tr>
<td>% in Favor</td>
<td>0.0</td>
<td>9.2</td>
<td>18.4</td>
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</table>

Note: The table presents the steady-state effects on a host of variables associated to different levels of transfers associated to the introduction of a linear consumption tax. Values of the transfer are in terms of mean household income in the benchmark economy. The value of the consumption tax rate is chosen so as to achieve the target of 30% increase in Federal revenues (net of the transfer). See text for details.
Table 5: Optimal Mix of Tax Changes

<table>
<thead>
<tr>
<th></th>
<th>Benchmark</th>
<th>15% Revenue Increase</th>
<th>30% Revenue Increase</th>
<th>45% Revenue Increase</th>
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<tr>
<td>Output</td>
<td>100.0</td>
<td>92.0</td>
<td>92.7</td>
<td>92.3</td>
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<tr>
<td>Hours</td>
<td>100.0</td>
<td>77.2</td>
<td>78.5</td>
<td>77.8</td>
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<tr>
<td>Labor Supply</td>
<td>100.0</td>
<td>89.0</td>
<td>89.8</td>
<td>89.4</td>
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<tr>
<td>Consumption Tax Rate ($τ_c^F$)</td>
<td>-</td>
<td>27.4</td>
<td>27.8</td>
<td>30.2</td>
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<td>Transfer (%)</td>
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<td>12.0</td>
<td>12.0</td>
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<td>Tax Function Curvature ($τ_1$)</td>
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<td>0.033</td>
<td>0.030</td>
<td>0.0280</td>
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<td>Tax Function Level ($τ_0$)</td>
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<td>0.051</td>
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<tr>
<td>Revenues</td>
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<td>Federal</td>
<td>100.0</td>
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<td>130.0</td>
<td>145.0</td>
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<td>State and Local</td>
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<tr>
<td>Gini Earnings</td>
<td>0.55</td>
<td>0.62</td>
<td>0.60</td>
<td>0.61</td>
</tr>
<tr>
<td>Gini Wealth</td>
<td>0.81</td>
<td>0.85</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>Welfare (%)</td>
<td>-</td>
<td>0.7</td>
<td>-1.9</td>
<td>-4.5</td>
</tr>
<tr>
<td>% in Favor</td>
<td>-</td>
<td>42.6</td>
<td>33.0</td>
<td>25.6</td>
</tr>
</tbody>
</table>

Note: The table presents results on the steady-state effects on different variables for different targets of Federal revenue increase relative to the benchmark economy. The instruments considered are the curvature of the income tax function, the level of the consumption tax rate and the associated transfer (in terms of mean income of the benchmark economy). The reported mix minimizes the welfare loss at the initial date, subject to achieving the revenue target.
Distribution of Taxes Paid: Model versus Data

Notes: The figure presents the distribution of income taxes paid by household income. Data is from the Internal Revenue Service.

Figure 1: Distribution of Income Taxes Paid
Notes: The figures displays the time path out model output under different levels of curvature of the income tax function, ranging from the benchmark value to the one that maximizes revenue from progressivity changes only. See text for details.

Figure 2: Curvature and Output Effects over Time
Notes: The figure displays the time path out model output under different levels of the transfer in the linear consumption tax. Values of the transfer are given in terms of mean household income of the benchmark economy. See text for details.

Figure 3: Transfer Levels and Output Effects over Time
Notes: The figure shows the time path for revenues from a wealth tax, and the associated output effects. The wealth is imposed at different rates on the top 1% of wealth holders.

Figure 4: Wealth Taxes: Revenues and Output Effects over Time