Macroeconomic Implications of Top Income Tax Cuts: 1960 - 2010*

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Abstract

Over the last 50 years the US tax system went through a striking transformation that considerably reduced the effective tax rates for top income groups. This paper investigates the macroeconomic repercussions of this change in tax policy, particularly for the distributions of income, wealth and consumption. The results suggest that top income tax cuts explain a modest part of the rise in wealth dispersion since 1960. By contrast, the impact of tax cuts on income and consumption inequality has been negligible due to changes in equilibrium prices.

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1 Introduction

The progressivity of the U.S. federal tax system hit a record high during the mid-twentieth century and has declined considerably ever since following a secular reduction in the tax liabilities of top income groups. The decline in the progressivity of the tax system was mainly driven by major reductions in taxes levied on corporations and estates. Over the years, more generous allowances and exemptions, combined with a decline in the marginal tax rates, especially those at the top, led to a significant drop in the share of tax revenue collected from corporations and estates. Since the ownership of wealth and financial assets in the US is highly concentrated, these policies were disproportionately in favor of top wealth and income groups. The redistributive effects of lower corporate and estate taxes were further intensified by a secular decline in the federal income tax rates applied to highest income groups. In their survey of tax records, Piketty and Saez (2007) report that the average effective tax rate decreased from 47% in 1970 to 33% in 2004 for the top 1% of the income distribution and from 64% to 34% for the top 0.1%. Meanwhile, the average rate for all taxpayers remained stable around 23%, implying an increase in the tax rates applied to other income groups.

The transformation of the tax system was concurrent with a rise in wage and income inequality (Katz and Murphy, 1992; Piketty and Saez, 2003; Heathcote, Storesletten, and Violante, 2014a), wealth inequality (Wolff, 1998; Saez and Zucman, 2014) and consumption inequality (Aguiar and Bils, 2011). These patterns are most evident in concentration ratios. In 1960, the wealthiest 1% held 28% of all wealth in the US, while in 2010 they owned 40%. Similarly, the share of the top 1% of the income distribution doubled from 10% in 1960 to 20% in 2010. In this paper we ask the following question: to what extent are top income tax cuts responsible for the rising economic inequality in the US?

The prominent view of the upward trends in inequality emphasizes changes in production technologies that favor skilled labor, leading to a greater dispersion in labor productivity, and, hence, earnings. It is plausible that a higher earnings inequality translates into larger consumption and wealth inequality over time. Nonetheless, the progressivity of the tax system, especially in the form of higher tax rates on income from capital, may have played a nontrivial role. By distorting the consumption and savings decisions of households, it determines whether the higher inequality in labor income reflects more on consumption inequality or wealth inequality. Piketty and Saez (2003) suggest that the highly progressive tax system may have been responsible for limited accumulation of pri-

vate wealth by top income groups in the early post-WWII era, and that it was only after the tax cuts allowed for better return on capital investment that the wealth inequality became more severe. Furthermore, a less progressive tax system could encourage labor supply and savings by higher income groups, thereby exacerbating the trends in inequality.

To gauge the implications of top income tax cuts, we employ a dynamic model of consumption and savings with uninsurable idiosyncratic income risk and endogenous labor supply building on Aiyagari (1994), Bewley (1986) and Huggett (1993). The demographic structure in the model closely follows the Castañeda, Díaz-Giménez, and Ríos-Rull (2003) implementation of these models. In particular, we combine dynastic and life-cycle elements of decision-making at the household level. Households in the model go through the life-cycle stages of work, where they face idiosyncratic income risk, and retirement, where they live off their pension income and savings. Upon death, they are replaced by their offspring. Households are altruistic. This setup allows to capture the three basic motives for saving that are crucial for understanding the US wealth distribution: a precautionary motive to insure against life-cycle income risk, a consumption smoothing motive to save for retirement, and a bequest motive to endow estates.

To this setting, we introduce a progressive income tax system, estate taxation, corporate income taxation and a tax-financed pay-as-you-go social security system. The presence of a social security system helps account for the bottom-tail of the wealth distribution. The progressive income tax-system is crucial for translating the pre-tax earnings distribution to consumption and wealth inequality. The estate and corporate income taxes are particularly essential to our purpose as the two tax components account for much of the decline of the progressivity of the tax system in US.

We calibrate the model to generate realistic distributions of income and wealth in the 1960s, while matching the life-cycle and intergenerational transitions in income. We then introduce two changes: a rising cross-sectional dispersion of labor efficiency, and a declining tax progressivity. Combined, these two changes together capture the observed rise in income and wealth inequality well. We then assess the contribution of each component, by simulating counterfactual economies where either the tax system or the technical change is kept constant.

The results suggest that the top income tax cuts alone led to a moderate increase in wealth concentration in US. The Gini coefficient for overall wealth inequality in the model increases from 0.75 to 0.80 in response to tax cuts. Raising the dispersion in labor produc-

tivity further increases the Gini coefficient to 0.87, suggesting that tax cuts explain about 40% of the rise in wealth inequality by this measure. They explain about a third of the increase in the top 10% wealth share, and a sixth of the increase in the top 1% wealth share. The latter arises because compared to the top 1%, households in the 90th to 99th percentiles of the wealth distribution benefit more from changes in estate taxes, and react more to changes in corporate taxes. As a result, their wealth rises substantially, preventing the top 1% wealth share from increasing. The rise in the share of the wealthiest 1% is instead attributable to lower marginal tax rate for the top income tax bracket.

In contrast to their moderate effect on wealth inequality, the top income tax cuts contribute little to income inequality. The difference comes in part from equilibrium adjustments in prices that work in opposing directions when income and wealth inequality are concerned. Accumulation of additional wealth in response to tax cuts leads to a decline in the interest rate and an increase in the wage rate. The fall in the equilibrium interest rate discourages savings by lower wealth groups and exacerbates the direct effect of tax cuts. In terms of income, the lower interest rate mitigates the rise in top incomes, while a higher wage rate benefits lower income groups as they live mainly off income from labor.

The change in wage inequality and tax cuts have opposing effects on the distribution of the tax burden. While tax cuts reduce the share of taxes paid by top income groups, the rise in the relative income of top groups leads to additional tax revenue from top groups, resulting in an overall increase in the contribution of these groups to total tax revenue.

There is a substantial literature on the effect of tax reforms. We highlight a few closely related studies using macroeconomic models and quantitative methods. Using a similar setup, Castañeda, Díaz-Giménez, and Ríos-Rull (2003) find that reducing a flat estate tax from 17% to zero results in slight increases of top wealth shares (including the top 1%) and in the capital stock. Their analysis of a hypothetical tax cut does not address the non-linearity of the cut that actually occurred, and does not consider its interaction with the contemporaneous increase in wage inequality. Cagetti and de Nardi (2009) also analyze abolition of the estate tax, and focus on its differential effect on the investment decisions of large and small firms. Domeij and Heathcote (2004) study the welfare implications of eliminating the capital income tax all together. They do not focus on matching the top of the wealth distribution, nor do they report how it changes with the tax experiment. A few recent papers focus on the taxation of top income earners more specifically: Badel and Huggett (2014), Brüggemann and Yoo (2014), Guner, Lopez Daneri, and Ventura (2014) and Kindermann and Krueger (2014) all explore what the optimal marginal

tax rate on income of the top 1% income earners should be. Given their focus on income taxes, they consider neither changes in estate or corporate income taxes, nor the role of changing wage inequality. Finally, on the empirical side, Mertens (2013) finds using U.S. time series data that changes in top marginal income tax rates have substantial effects on top income shares. His analysis does not consider corporate income or estate taxes nor wealth inequality, and is therefore complementary to ours.

The literature on increasing wage inequality is similarly large. Here, we only highlight a small number of papers analyzing the effect of increasing wage inequality on other economic outcomes. Notably, Heathcote, Storesletten, and Violante (2014a) analyze the effect of increasing wage inequality on trends in the inequality of hours worked, earnings, consumption, and welfare, but not on wealth inequality. Heathcote, Storesletten, and Violante (2014b) provide results on how optimal progressivity of income taxes responds to changes in the size of uninsurable idiosyncratic productivity shocks, but analyze neither estate and corporate income taxes nor the effect on wealth inequality.

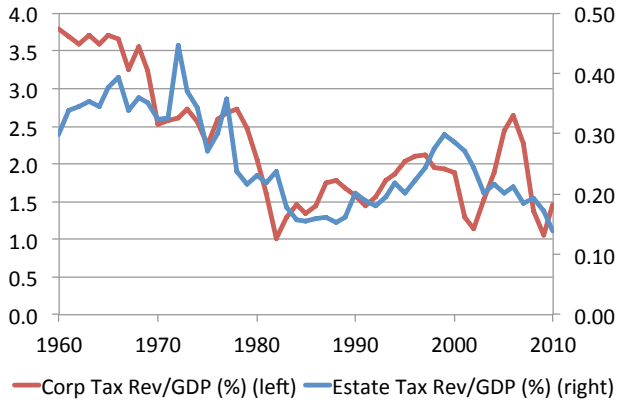
In what follows, we first provide a brief discussion of the major changes in the US tax code in the post-WWI period. Section 3 presents the model and Sections 4 and 5 discuss the calibration of the model parameters. The main findings are reported in Section 6 where we conduct counterfactual simulations to evaluate the impact of top income tax cuts and rising wage inequality on the economy. Section 7 concludes.

2 Changes in the US Tax System: 1960 - 2010

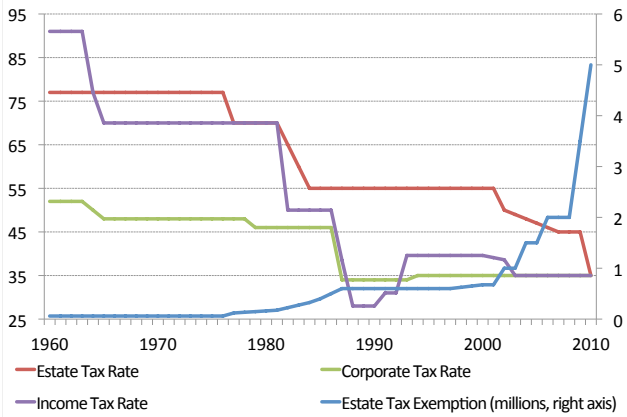
The US tax system went through several changes in the last 50 years that particularly benefited the top income groups. The two major components of this transformation are reductions in taxes imposed on corporations and on the transfer of large estates. Figure 1 shows that from 1960 to 2010, total revenue from each of these taxes expressed as a share of GDP declined by about half. In the case of corporate taxes, the decline resulted both from more generous allowances for depreciation expenses and from lower marginal tax rates. The statutory tax rate on corporate income declined from 52% in 1960 to 35% in 2010. A similar pattern is seen in the effective marginal taxes on corporate income, which take into account tax exemptions and allowances and therefore are usually lower than the statutory rate. Gravelle (2004) and Gravelle (2014) report that a combination of tax exemptions, depreciation allowances and investment incentives reduced the average effective marginal tax rate on corporate profits from 42.0% in 1960 to 23.6% in 2010.

Figure 1: Corporate and Estate Taxes: 1960 - 2010

(a) Tax Revenue / GDP



(b) Top Marginal Tax Rates and Exemption Levels



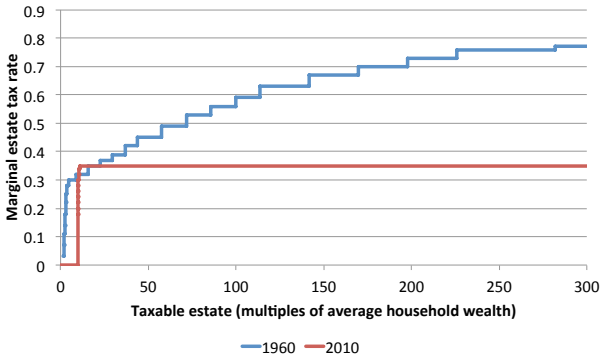
For estate taxes, the decline in revenues stems from a combination of an increase in the exemption level and lower top marginal tax rates. The exemption level in 1960 was 60 thousand dollars, or approximately 1.7 times average wealth then, whereas in 2010, the exemption level was as high as 5 million dollars, or approximately 10 times average wealth. As shown in Figure 2, marginal rates also declined, with the top marginal rate declining from 77% in 1960 to 35% in 2010. As a consequence, marginal estate tax rates dropped by about 30 percentage points for estates corresponding to percentiles 10 to 0.6 of the wealth distribution, and by a variable but large amount at the very top of the distribution. In the analysis below, we will use the estate tax schedules exactly as depicted in Figure 2.

Since ownership of corporate assets and wealth is highly concentrated in the hands of the top income groups, this change benefited them the most. In their survey of tax records, Piketty and Saez (2007) find such distributional effects of corporate and estate tax cuts across different income groups. Figure 3 shows the average effective tax rates by income for 1970 and 2004 as reported in their paper.[1] The average tax rate for all taxpayers was 23.4% in 1970 and 23.3% in 2004. The average tax rate increased slightly for most in the bottom 99% of the income distribution, while it decreased substantially for all groups in the top 1% category. The magnitude of the drop in average tax rates varies between

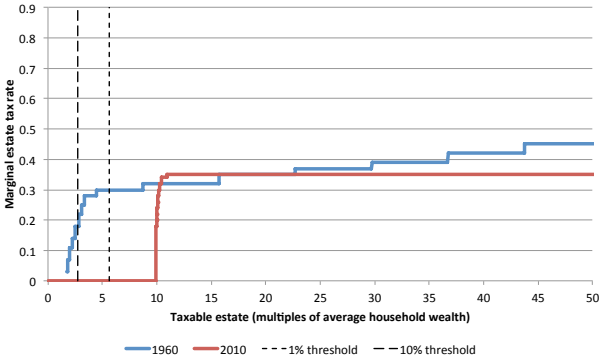
[1]Note that corporate and estate taxes paid do not appear on individual income tax returns. Therefore, Piketty and Saez (2007) impute these taxes to different income groups.

Figure 2: The Estate Tax Schedule, 1960 and 2010

(a) Marginal Estate Tax Rate by Size of Estate



(b) Closeup of Rates for Bottom 99.9% of Wealth



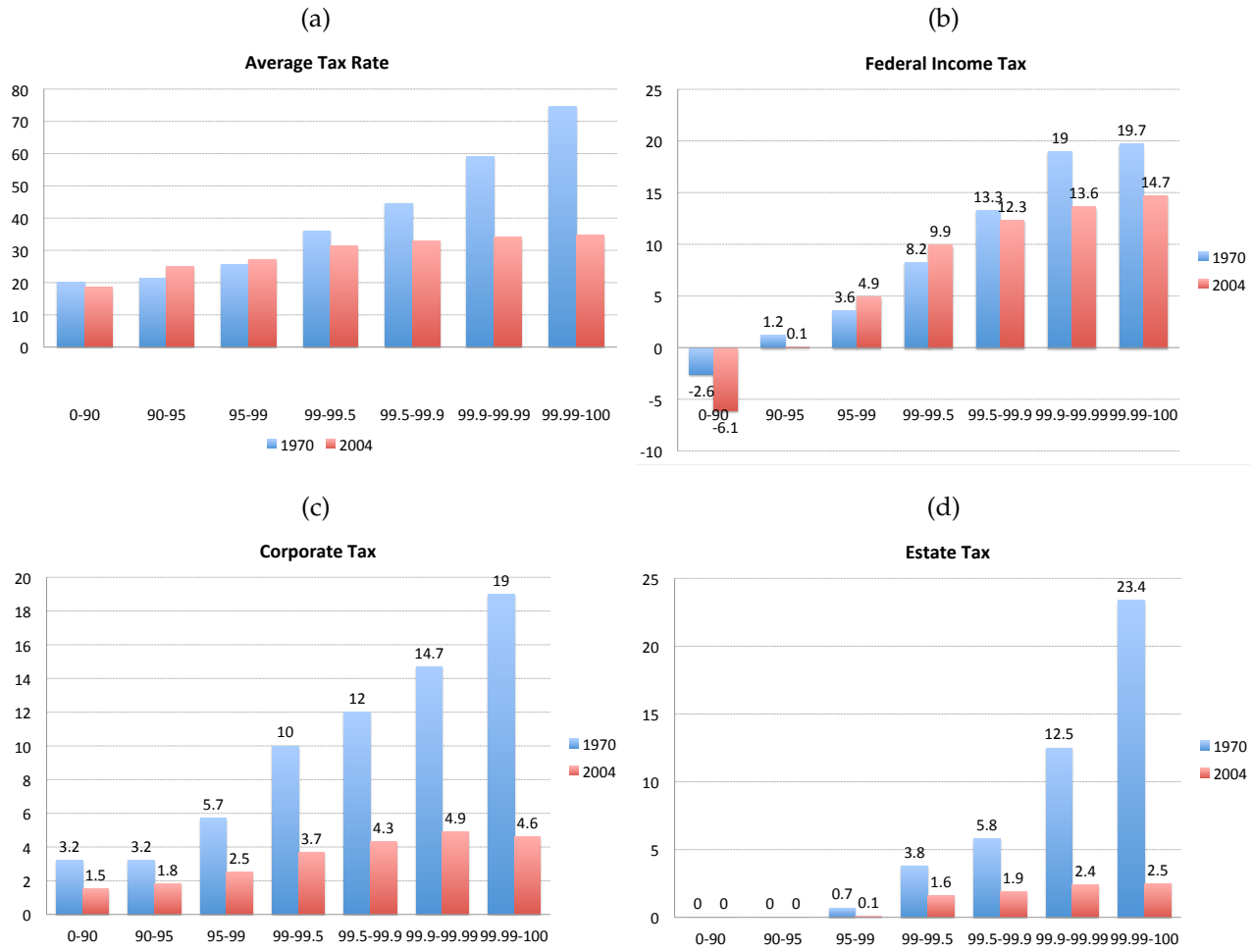
4.8 percentage points for those between 99th and 99.5th percentiles and 39.9 percentage points for the top 0.01 percent.

The main source of the reduction came from lower taxes on corporate income and transfer of estates. The reductions from these two sources add up to a 8.5 percent decline in the average tax rate applied to incomes between 99th and 99.5th percentiles and a 35.3 percent decline for the top 0.01 percent. The federal income tax schedule also went through a dramatic change during this period, where the top marginal tax rate decreased from 92% to 35% (Figure 1). Despite this remarkable decline in the statutory marginal tax rates applied to highest income earners, changes in the personal income tax code contributed little to the decline of the tax progressivity. This is because the very high rates, such as the 92% top statutory marginal tax rate, applied only to a handful of households. Panel (b) in Figure 3 shows that the decline in the federal income tax liabilities of top groups was relatively more modest, and concerned only the top 0.5% of the income distribution.

3 Model

The effects of changes in taxes and the labor productivity distribution are analyzed using a modified version of the neoclassical dynamic stochastic general equilibrium model with uninsurable idiosyncratic income risk (Aiyagari, 1994; Bewley, 1986; Huggett, 1993). In particular, we combine the standard model with a demographic structure that closely

Figure 3: Average Federal Tax Rates by Income Groups



Note: The data for tax rates come from Piketty and Saez (2007).

resembles Castañeda, Díaz-Giménez, and Ríos-Rull (2003), and a detailed, non-linear tax system.

The economy consists of a continuum of heterogeneous households, a representative firm, and a government. Households form dynasties: each one is replaced by a descendant upon death. New entrants to the economy inherit an estate from their parents and start their working life. While working, they face a constant probability of retirement μ_r. Once retired, they still make consumption and savings choices, but cannot work anymore. Retirees die with a constant probability μ_d. Upon death, they are replaced by a descendant who inherits their estate. Let the proportion of retirees in the economy be M_1, and let $\mathcal{R}$ be one for retirees and zero for workers.

At any point in time, a continuum of agents of measure 1 is alive, each endowed with individual-specific capital k and labor skill z. With these endowments, agents can generate a pre-tax income of $y = zwh + rk$, where w is the market wage per skill unit, $h \in [0, 1]$ is hours worked and r is the interest rate net of depreciation. We assume that the labor productivity falls to zero when workers retire. As a result, retirees do not work and receive a fixed social security benefit $\omega(\mathcal{R})$.

Private income from labor and savings, corporate income and estates are subject to a detailed tax system, outlined below. The government uses tax revenue to finance an exogenous stream of expenditures G. Let the disposable income of an agent net of all types of income taxes be y^d. This depends both on total income and on capital holdings, due to the different tax components. Agents can allocate their resources between consumption and investment in capital. This capital stock constitutes savings for an individual, and becomes the estate that is passed on to a descendant in case of death. To rule out negative bequests, agents cannot borrow. Let x denote an agent's end-of-period capital holdings, before potentially paying estate taxes due on inheritance, and k the capital holdings after paying any estate tax. Capital depreciates at a rate δ between periods.

A worker's labor skill z follows a first-order Markov process $F_0(z'|z)$. A descendant enters the economy with her/his own labor skill, which is drawn from a *cdf* $F_1(z'|z)$. The distribution of skill upon labor market entry thus depends on parents' pre-retirement skill.

Agents value consumption, and they dislike work. They care about their welfare as well as about their offspring's, discounting future utility using a constant discount factor $\beta \in (0, 1)$. The problem of an agent then is to choose labor hours, consumption and capital investment to maximize expected discounted utility of the entire dynasty. In doing so,

agents take the wage rate, the interest rate and the aggregate distribution of agents over wealth and productivity, denoted by Γ, as given. Let Γ_0 be the distribution for workers, Γ_1 that for retirees, and let $\Gamma' = H(\Gamma)$ describe the evolution of the distribution over time. The Bellman equation for a consumer's problem then is

$$V(k, z, \mathcal{R}; \Gamma) = \max_{c,x\geq 0,\ h\in[0,1]} \left\{ \frac{c^{1-\sigma}}{1-\sigma} - \theta \frac{h^{1+\epsilon}}{1+\epsilon} + \beta \mathbb{E}[V(k', z', \mathcal{R}'; \Gamma')|z] \right\} \tag{1}$$

subject to

$$\begin{aligned} c + x &= y^d(wzh, rk, \omega(\mathcal{R})) + k, \\ k' &= x - E(x, \mathcal{R}, \mathcal{R}'), \\ \Gamma' &= H(\Gamma), \end{aligned}$$

where the expectation is taken over retirement and survival risk and skill transition risk, for both survivors and the newborn. $E(x, \mathcal{R}, \mathcal{R}')$ denotes the estate tax liability, where x is the estate. The estate tax is zero except for entrants, i.e. unless $\mathcal{R} = 1$ and $\mathcal{R}' = 0$. For retirees, the labor supply choice is fixed at zero. Only retirees receive social security benefits $\omega(z)$.

The representative firm produces output Y using aggregate capital K and effective labor N. Its production technology takes the Cobb-Douglas form $F(K, N) = AK^{\alpha}N^{1-\alpha}$. Factor markets are competitive, and firms are profit maximizers.

A *competitive equilibrium* of the model economy consists of a value function, $V(k, z, \mathcal{R}; \Gamma)$, policy functions for factor supplies, $k'(k, z, \mathcal{R}; \Gamma)$ and $h(k, z, \mathcal{R}; \Gamma)$, a wage rate, $w(\Gamma)$, an interest rate $r(\Gamma)$, and an evolution function $H(\Gamma)$ such that:

1. Given $w(\Gamma)$, $r(\Gamma)$ and $H(\Gamma)$, $V(k, z, \mathcal{R}; \Gamma)$ solves the consumer's problem defined by (1) with the associated factor supplies $k'(k, z, \mathcal{R}; \Gamma)$ and $h(k, z, \mathcal{R}; \Gamma)$.

2. Factor prices are given by the following inverse demand equations:

$$\begin{aligned} r(\Gamma) &= \alpha A(K/N)^{\alpha-1} - \delta \\ w(\Gamma) &= (1-\alpha)A(K/N)^{1-\alpha} \end{aligned}$$

3. Markets clear:

$$K' = (1 - M_1) \int x(k, z, 0; \Gamma) d\Gamma_0(k, z) + M_1 \int [x(k, z, 1; \Gamma) - \mu_d E(x, 1, 0)] d\Gamma_1(k, z)$$
$$N = \int z h(k, z, \mathcal{R}; \Gamma) d\Gamma(k, z).$$

4. $H(\Gamma)$ is consistent with $F_0(z'|z)$, $F_1(z'|z)$, μ_r, μ_d and the savings policy $k'(k, z, \mathcal{R}; \Gamma)$.

5. The government budget is balanced:

$$G + M_1 \int \omega(\mathcal{R}) d\Gamma_1(k, z) = \int [y - y^d(y)] d\Gamma(k, z) + \mu_d M_1 \int E(x, 1, 0) d\Gamma_1(x, z).$$

A *steady-state* of the economy is a competitive equilibrium where the distribution of agents is stationary, i.e. $\Gamma^{ss} = H(\Gamma^{ss})$.

4 Functional Forms and Calibration

The economy is calibrated in two steps. First, we choose a set of parameters based on information that is exogenous to the model. Then, we calibrate the remaining parameters so that the model economy is consistent with a set of relevant aggregate statistics of the U.S. economy and the empirical distributions of income and wealth in 1960. We then introduce changes in the tax system and the distribution of labor productivity observed in the U.S. since 1960 to analyze the relative role of tax cuts in understanding rising economic inequality. In doing so, we treat both 1960 and 2010 as stationary states.

The calibration of the 1960 economy is broadly consistent with the standard for quantitative models with idiosyncratic labor income risk. However, we make two modifications in the spirit of Castañeda, Díaz-Giménez, and Ríos-Rull (2003) so that the model economy features realistic income and wealth distributions with high concentrations at the top. First, we augment the standard stochastic processes for labor productivity estimated from survey data by allowing households a small chance of reaching an extraordinarily high labor productivity level. Second, we introduce a stochastic life cycle, where households retire and die probabilistically, and allow for a correlation in labor productivity across generations.

4.1 Technology

The level of production technology, A, is normalized to 1. Capital's share in income, α, is set to 0.36. Given the calibration target for the annual interest rate of 4.1%, the annual depreciation rate is set to 7.9%, which ensures that the ratio of capital stock to aggregate income in 1960 is 3.

4.2 Demographics and Income Process

The demographics and the income process are jointly governed by the transition matrices described below:

$$\Pi = \left[\begin{array}{c|cc} & z_W & z_R \\ \hline z_W & \Pi_{WW} & \Pi_{WR} \\ z_R & \Pi_{RW} & \Pi_{RR} \end{array}\right]$$

where z_W is a vector of labor productivity levels for a working household. The idiosyncratic labor income risk during employment is governed by the matrix Π_{WW}. The transitions from work to retirement is governed by Π_{WR}. We assume that, each period, workers face a fixed probability of retirement, μ_r, that is independent of their labor productivity. As a result Π_{WR} is a diagonal matrix with μ_r along the diagonal. We set $\mu_R = 1/45$ to obtain an average career length of 45 years. Once retired, households face a constant death probability μ_d. Consequently, Π_{RR} is a diagonal matrix with $1 - \mu_d$ along the diagonal. We set $\mu_d = 1/15$ to obtain an average retirement duration of 15 years. When a household dies, it is replaced by a working age descendant. The intergenerational transition in labor productivity is governed by Π_{RW}.

We assume that the vector $z_W = [z_j]$ contains 6 distinct values in increasing order of which $\{z_1, .., z_4\}$ are ordinary states and $\{z_5, z_6\}$ are extraordinary states reserved for exceptionally high earnings levels that are commonly censored in the survey data. The ordinary levels of productivity consist in combinations of two components: a permanent component, $f \in \{f_H, f_L\}$, that is fixed over a household's lifespan, and a random component, $a \in \{a_L, a_H\}$. Let $F = [F_{ij}]$ and $A = [A_{ij}]$ with $i, j \in \{L, H\}$ be 2-by-2 transition matrices associated with the two components f and a. With this formulation, idiosyncratic fluctuations in labor income risk along the life cycle are captured by A, and those across generations by F. The following matrices summarize the stochastic labor productivity process over the life cycle and across generations.

$$\Pi_{WW} = \left(\begin{array}{c|cccccc} & f_L+a_L & f_L+a_H & f_H+a_L & f_H+a_H & z_5 & z_6 \\ \hline f_L+a_L & A_{11} & A_{12} & 0 & 0 & \lambda_{in} & 0 \\ f_L+a_H & A_{21} & A_{22} & 0 & 0 & \lambda_{in} & 0 \\ f_H+a_L & 0 & 0 & A_{11} & A_{12} & \lambda_{in} & 0 \\ f_H+a_H & 0 & 0 & A_{21} & A_{22} & \lambda_{in} & 0 \\ z_{awe_l} & \lambda_{out} & \lambda_{out} & \lambda_{out} & \lambda_{out} & \lambda_{ll} & \lambda_{lh} \\ z_{awe_h} & 0 & 0 & 0 & 0 & \lambda_{hl} & \lambda_{hh} \end{array}\right)$$

$$\Pi_{RW} = \left(\begin{array}{c|cccccc} & f_L+a_L & f_L+a_H & f_H+a_L & f_H+a_H & z_5 & z_6 \\ \hline f_L+a_L & F_{11} & 0 & F_{12} & 0 & 0 & 0 \\ f_L+a_H & F_{11} & 0 & F_{12} & 0 & 0 & 0 \\ f_H+a_L & F_{21} & 0 & F_{22} & 0 & 0 & 0 \\ f_H+a_H & F_{21} & 0 & F_{22} & 0 & 0 & 0 \\ z_{awe_l} & F_{21} & 0 & F_{22} & 0 & 0 & 0 \\ z_{awe_h} & F_{21} & 0 & F_{22} & 0 & 0 & 0 \end{array}\right)$$

The following additional assumptions are explicit in the formulation of the matrices. The probability of reaching an extraordinary status within lifetime, λ_{in}, is independent of one's current state. Likewise, if a household loses their extraordinary status, then it is equally likely to transition to any ordinary state.[2] The new households start their career at a_L. This helps generate wage growth over the life cycle. It is also consistent with a higher variance of wages for older workers. The probability of having a low or high permanent component for a descendant of a household at the extraordinary state is the same as that of a household with a high permanent productivity component. The chances that the descendant of an extraordinarily productive household will also be as productive is zero. Relaxing these restrictions leads to negligible improvements in the fit of the model.

Our working assumption is that the values for ordinary states and the transitions within are directly observed in the individual-level panel data, such as the PSID, whereas the transitions to, from and within extraordinary states are not due to top-coding. We jointly calibrate the levels of ordinary states, $\{z_1, .., z_4\}$, and the elements of the transition matrices A and F in order to match the average wage growth of 0.305 log-points observed in the data, the annual autocorrelation of 0.985, as estimated by Krueger and Ludwig

[2]The formulation of the transition matrix allows for the possibility of transitioning between different values of the permanent component f by passing through an extraordinary state. However, given the calibrated values for λ_{in} and λ_{out} below, the probability of such an event is extremely small.

(2013), the variance of earnings for working age households, which is reported as 0.52 by Heathcote, Perri, and Violante (2010) and the intergenerational elasticity of wages of 0.30 as reported by Solon (1999). This leaves the transitional probabilities $(\lambda_{in}, \lambda_{out}, \lambda_{ll}, \lambda_{lh}, \lambda_{hl}, \lambda_{hh})$ and the extraordinary productivity levels z_5, z_6. We choose the values for these parameters to replicate the observed distributions of income and wealth in 1960. In particular we target the top 0.5 and 1 percent concentration ratios and the Gini coefficients of inequality for income and wealth.[3]

4.3 Tax System

The tax system consists of personal income taxes levied on capital and labor earnings, corporate taxes, and taxes on estate income. The tax receipts are used to support exogenous government expenditures and transfers to households.

Corporate taxes are modeled as a flat rate, τ_c, levied on a portion of capital earnings before households receive their income.[4] We set $\tau_c = 42\%$, which is the average marginal tax rate on corporate profits in 1960 as reported by Gravelle (2004) based on tax records. To reflect the fact that for most households, positive net worth takes the form of real estate and thus is not subject to corporate income taxes, we assume that corporate taxes only apply to capital income above a threshold d_c.[5] We then choose d_c such that the share of corporate tax revenue in GDP is 3.8% as measured in the data for 1960.

Personal income taxes are applied to earnings, non-corporate capital income and pension income, if any. Taxable income for income tax purposes is given by:

$$y_f = zwh + \min\{rk, d_c\} + \omega(\mathcal{R}). \tag{2}$$

Total disposable income is obtained after applying corporate and personal income taxes and adding lump-sum transfers from the government:

$$y^d = \max\{\lambda y_f^{1-\tau}, (1-\tau_{max})y_f\} + (1-\tau_c)\max(rk - d_c, 0) + Tr. \tag{3}$$

The first term above represents our formulation of the current U.S. income tax system, which can be approximated by a log-linear form for income levels outside the top of the

[3] In addition to the 6 moments we target, there are two constraints on the row-sum of the probabilities in the transition matrix to equal unity.

[4] As a result, corporate income taxes reduce the tax base for personal income tax.

[5] Only about 20% of U.S. households hold stocks or mutual funds directly (Heaton and Lucas 2000, Bover 2010).

income distribution, augmented by a flat rate for the top income tax bracket. The power parameter $\tau \leq 1$ controls the degree of progressivity of the tax system, while λ adjusts to meet the government's budget requirement. $\tau = 0$ implies a proportional (or flat) tax system. When $\tau = 1$, all income is pooled, and redistributed equally among agents. For values of τ between zero and one, the tax system is progressive.[6] See Guner, Kaygusuz, and Ventura (2014), Heathcote, Storesletten, and Violante (2014b) and Bakis, Kaymak, and Poschke (forthcoming) for evidence on the fit of this function.

One advantage of this formulation for the income tax system is that it also allows for negative taxes. Income transfers are, however, non-monotonic in income. When taxes are progressive, transfers are first increasing, and then decreasing in income. This feature allows addressing features of the real tax system like the earned income tax credit and welfare-to-work programs, which imply transfers that vary with income.

When disposable income is log-linear in pre-tax income, the marginal tax rate increases monotonically with income, converging to 100% at the limit. This is undesirable since an increase in top income levels is mechanically accompanied by higher marginal tax rates. The second term in the maximum operator avoids this feature by imposing a cap on the top marginal tax rate, denoted by τ_{max}. The top marginal tax rate in 1960 is set to 92%, as reported by the IRS. The progressivity of the general income tax system, τ is not directly available. Here, we set the progressivity of the personal income tax system in 1960 to 0.08. Using the NBER tax simulator, Bakis, Kaymak, and Poschke (forthcoming) reports an estimate of 0.17 for the period between 1978 and 2009. Heathcote, Storesletten, and Violante (2014b) obtain a similar estimate for more recent years. Using the same data for 1978, the earliest year for which the state income taxes are included the simulator, we estimate τ to be 0.10. We obtained an alternative estimate of 0.05 using the average income tax rates by income deciles in 1960, as reported by Piketty and Saez (2007). Since estimates using federal income tax records exclude transfer income and state level taxes, this is likely a lower bound for the actual value of τ in 1960. Therefore, we find 0.08 to be a reasonable choice.[7]

Finally, estates are subject to tax when they are transferred to the next generation. The estate tax code in the U.S. consists of a deductible and a progressive schedule applied to the remaining portion of the estate. We represent the marginal estate tax schedule by

[6] The average income tax rate is $1 - \lambda y^{-\tau}$, which increases in y if $\tau > 0$.

[7] Unlike the PSID, the estimates of τ using the average tax rates reported in Piketty and Saez (2007) do not indicate any increase in the progressivity over the years. Below, we exclude potential changes in τ from the analysis.

the step function depicted in Figure 2. We do so using statutory estate tax rates and the corresponding brackets reported by the IRS. To obtain comparability across years when changing this function in the following analysis, we normalize the thresholds for estate brackets by average wealth in each year.

The government uses the tax revenue to finance exogenous expenditures and transfers. The expenditures are set at 10.8% of GDP to yield a sum of expenditure and transfers of 17% of GDP, as observed in the data. In addition, the government makes lump-sum transfers to households. In the data, transfers to persons in 1960 represent 4.5% of GDP, of which 2.5% is destined to the elderly in the form of pension payments and 2% is destined to the general public in the form of disability benefits, veterans benefits etc. We set the transfers in the model T_E and T_R accordingly, to match receipts per person. In a last step, we choose λ in the personal income tax function to balance the government's budget.

4.4 Preferences

Preferences are described by a discount rate, β, the elasticity of intertemporal substitution, σ, the Frisch elasticity of labor supply, ϵ, and the disutility of work, θ. We choose β such that the equilibrium interest rate is 4.1%. We set $\epsilon = 1.67$, which implies a Frisch elasticity of 0.6. Blundell, Pistaferri, and Saporta-Eksten (2012) report an estimate of 0.4 for males and 0.8 for females. Thus a value of 0.6 for a model of households seems broadly plausible. We choose θ so that at the equilibrium an average household allocates 34% of their time endowment to work.

The intertemporal elasticity of substitution is an important element of our analysis since a higher elasticity lead to a stronger savings response to tax cuts. We report our results for $\sigma = 1.1$, which implies an EIS of 0.9. As most estimates of the EIS are closer to zero, we consider our choice to be an upper bound. Actual effect of tax cuts on economic inequality is therefore likely to be smaller than our benchmark results.

Table 1 summarizes the calibration of the model for the 1960 economy.

5 Calibration Results for the 1960 economy

We begin by reporting and discussing parameters implied by the calibration, and then examine the fit of the model. The elements of the matrix within ordinary labor productivity states were already calibrated to match panel data on wages. Therefore we focus

Table 1: Calibration of the model parameters for 1960

Parameter	Value	Data Target and Value	
		Preset Parameters	
σ	1.1	Risk Aversion	
α	0.36	Capital Income Share	
δ	0.079	$K/Y = 3.0$	
μ_r	0.022	Average Career Length of 45 yrs.	
μ_d	0.067	Average Retirement Length of 15 yrs.	
		Taxes	
τ_l	0.08	Author's Estimates	
τ_c	0.42	Marginal Corporate Tax Rate, Gravelle (2004)	
τ_e		Actual Estate Tax Schedule	
γ	0.108	$G/Y = 0.17$	
		Productivity Process	
ρ_{lc}	0.985	Kindermann and Krueger (2014)	
ρ_{ig}	0.30	Solon (1992)	
σ_a	0.5×0.38	household earnings variance	0.71
σ_f	0.5×0.62	share of fixed effects	0.62
		Jointly Calibrated Parameters	
β	0.958	Interest Rate	0.041
θ	12	mean hours	0.34
ϵ	1.67	Frisch elasticity	0.6
ψ^*	0.167	(Pension+Medicare)/GDP	2.5%
d_c/r	0.47 $\times K$	Corporate tax revenue/GDP	3.8%

our discussion on the implied transition probabilities for the extraordinary states. The probability of reaching an extraordinary state at any given year is 0.2 percent, and the probability of going back to an ordinary state is 13.6%.[8] These figures imply a considerable degree of persistence of having a high earner status. There is, unfortunately, little information on the transitions to, from and within extraordinary states in the data. Using micro-level data from the Social Security Administration, Kopczuk, Saez, and Song (2010) estimate the probability of staying in the top 1% of earners from one year to the next to be around 75%. The probability is fairly stable over the years fluctuating between 70 to 80%. The corresponding probability implied by our calibration is 74%.

The extraordinary states are essential to the model's ability to generate a realistic wealth distribution. At these states (z_5 and z_6), which represent the most productive 1.3% of the labor force combined, labor productivity is 6 times the average. The top state z_6 alone corresponds to 0.08% of the workforce, with a productivity level that is 57 times the average. When households reach these states, they also work about 20% longer hours than an average household to take advantage of the higher wages and build up a substantial amount of wealth against the risk of losing their highly productive status either by retirement or by returning to an ordinary state. The resulting wealth distribution is highly concentrated as observed in the data.

Table 2 shows the distributions of total income, wealth and labor income for the 1960 economy. The calibration targets are reported in bold. The data on the wealth distribution comes from two different sources. Top 0.5, 1 and 10 percent concentration ratios are taken from Saez and Zucman (2014), who infer the wealth distribution from the reported capital income in tax records and observed returns by asset type in the US economy. They do not report distributional measures for lower wealth levels. The remaining shares and the Gini coefficient are therefore taken from Keister and Moller (2000) and are based on the 1962 Survey of the Financial Characteristics of Consumers (SFCC). The model closely approximates the distributions of income and wealth. While the earnings distribution implied by the model is slightly more concentrated at the top than in the data, the Gini coefficient of earnings in the model is very close to that reported by Heathcote, Perri, and Violante (2010). The main reason for this discrepancy is that the data figures come from Piketty and Saez (2003), who report concentration ratios for wage income shares only. The relevant statistic that corresponds to the model is total labor income, including a portion of entrepreneurial income, which is excluded by Piketty and Saez (2003). Since the

[8]The full set of calibrated values for the transition matrices are reported in the appendix.

Table 2: Distribution of Income and Wealth in 1960

	Top Percentile							
	0.5%	1%	5%	10%	20%	40%	60%	Gini
Wealth Share (Data)	**0.21**	**0.28**	n/a	0.71	0.81	0.95	1.00	**0.80**
Wealth Share (Model)	**0.22**	**0.26**	0.46	0.62	0.79	0.91	0.99	**0.75**
Income Share (Data)	**0.07**	**0.10**	0.23	0.33	0.49	0.73	0.89	**0.34**
Income Share (Model)	**0.09**	**0.11**	0.24	0.41	0.54	0.76	0.87	**0.33**
Earnings Share (Data)	0.05	0.07	0.20	0.33				0.34
Earnings Share (Model)	0.09	0.10	0.22	0.35	0.50	0.67	0.87	0.33

Note.– The data values are taken from Saez and Zucman (2014) and Keister and Moller (2000) for the wealth distribution, and from Piketty and Saez (2003) for the income and earnings shares. Wealth shares are for a wealth ordering of the population, and income and earnings shares for an ordering by income. The income and earnings Ginis are from Heathcote, Perri, and Violante (2010) and refer to 1967, the earliest year for which they report results. The income Gini in both model and data refers to working-age households. See text for details.

share of entrepreneurial income in total income is substantial for the top income/earnings groups, excluding it biases the concentration ratios downward.[9] In line with this, the model slightly overstates the share of labor income in the top 1% incomes, at 71% versus 60% in the data (Piketty and Saez, 2003), but is accurate for the top 10%, at 80%, and below.

A critical element of the analysis is the distribution of the tax burden across income groups. Since our modeling of the corporate and estate tax systems does not explicitly target income groups, the model's ability to shed light on the distributional consequences of changing tax schedules depends on how well it captures the tax liabilities of different income groups in 1960. In their survey of tax records, Piketty and Saez (2007) report the average tax rates for different tax categories for top income groups. In Table 3, we compare the reported values with the model-implied rates for the top 1% and the bottom 99% of the income distribution. The model matches the aggregate revenue from corporate taxes by design. At the same time, it reflects that the top 1% pay much more corporate taxes as a fraction of their income, given their higher capital income share. Aggregate estate tax revenue in the model is also close to that in the data, although this is not a cal-

[9]Income from entrepreunurial activities constitutes 30% of total income for the top 1% of incomes, and 17% of total income for the top 10% in 1960.

Table 3: Average Tax Rates by Income Group in 1960

	Corporate Tax			Estate Tax			Income Tax		
	1%	99%	R/Y	1%	99%	R/Y	1%	99%	R/Y
Data	14.4	5.1	3.8	6.0	0.0	0.3	24.0	13.8	10.6
Model	11.8	3.8	3.8	3.5	0.1	0.4	25.6	14.6	12.8

Note.– R/Y stands for revenue as a fraction of GDP. The data values come from NIPA and from Joulfaian (2013). The data values for the top 1% and 99% are taken from Piketty and Saez (2007).

ibration target. The model matches the fact that the 99% pay essentially no estate taxes, but understates the estate tax paid by the top 1% of the income distribution. We think that the difference might stem from the way estate taxes are imputed to income groups in Piketty and Saez (2007), which likely overshoots the actual figure in the data.[10] The fact that the model does not overstate top estate tax rates and provides a good approximation of aggregate revenue indicates that the use of the statutory tax schedule provides a good representation of the estate tax system, even if it abstracts from certain deductions, deferrals and methods of tax avoidance. Finally, the progressivity of the personal income tax system chosen for the calibration closely reflects the distribution of the income tax burden.

Overall, the calibration of the parameters seems reasonable, as the model does a good job of capturing the salient features of the 1960 economy. In particular, the distributions of income, wealth and the tax burden among households is consistent with the empirical facts of the time. We find this encouraging as it indicates that the model provides an appropriate framework to study the macroeconomic implications of the changes in the tax system, which we turn to next.

6 Tax Cuts and Technical Change

In this section, we analyze the effect of changes in the tax policy and the distribution of labor productivity on economic inequality. In particular, we decrease the corporate tax

[10]Since estate taxes are filed separately, relating them to income tax records is not straightforward. The working assumption in Piketty and Saez (2007) is a perfect rank correlation between the size of the estate and the income of the decedents, which represents an upper bound for the estate tax paid by top income groups.

Table 4: Income and Wealth Inequality in 2010

	Top Percentile							
	0.5%	1%	5%	10%	20%	40%	60%	Gini
Wealth Share (Data)	0.31	0.40	n/a	0.74	0.83	0.95	0.99	0.82
Wealth Share (Model)	0.36	0.43	n/a	0.78	0.92	0.98	1.00	0.87
Income Share (Data)	0.16	0.20	0.35	0.46	0.62	0.82	0.94	0.43
Income Share (Model)	0.15	0.17	0.32	0.49	0.60	0.79	0.89	0.40
Earnings Share (Data)	0.12	0.16	0.33	0.47				0.42
Earnings Share (Model)	0.15	0.16	0.29	0.42	0.57	0.72	0.90	0.39

rate from 42% to 23.6%, which is the average marginal tax rate on corporations reported by Gravelle (2014) for 2010, change the estate tax schedule to represent the 2010 statutory rates and brackets relative to average wealth in 2010, and reduce the top marginal income tax rate to 35%. We capture the technological changes that lead to a higher wage inequality by raising the variance of the labor productivity process to match the rise in the household earnings variance in the data. In doing so, we maintain a constant average labor productivity. Heathcote, Storesletten, and Violante (2014a) report an increase in the earnings variance from 0.50 to 0.75 during this period. This requires a 17% increase in the standard deviation of log-productivity and a 0.144 log-points decline on average.

Table 4 reports the distributions of earnings, income and wealth associated with the steady-state of the new economy. We compare these numbers with the corresponding figures in 2010. The income and earnings distributions implied by the model closely replicate the observed values in 2010. The implied distribution of wealth features slightly higher concentration ratios and a gini coefficient of inequality. Note that the results reflect the long-run equilibrium distributions, assuming that tax policy and the dispersion of labor productivity remain constant at their 2010 values. Since some of the changes in the tax system, especially regarding estate taxes, are fairly recent, it is possible that the wealth distribution in 2010 is along a transition path to a long-run equilibrium with a more severe economic inequality than currently observed.

To gauge the relative roles of tax cuts and rising earnings inequality, we next introduce these changes stepwise. First, we change the estate tax policy, then decrease the marginal corporate tax rate, then decrease the top marginal income tax rate and then raise the wage

inequality.

Table 5 shows the changes in the key macroeconomic aggregates in response to changes in tax policy and rising wage inequality. The first column shows the values for the 1960 benchmark economy. The remaining columns introduce changes and tax policy sequentially and report the percentage changes in the key variables relative to the benchmark economy. The last column, therefore, corresponds to the stationary state associated with the parameters of the 2010 economy. The reduction in taxes raises the net marginal return to savings resulting in a 16% increase in total capital stock. The labor supply does not respond strongly. Output increases by 5.7%, resulting in a slightly higher capital-to-income ratio of 3.29. The increased supply of capital creates a slight downward pressure on the interest rate and an upward pressure on the wage rate due to the complementarity of labor and capital in production. As a result, the pre-tax interest rate decreases by one percentage point and wages rise by 4.8%. Investment increases in line with the capital stock, implying that consumption rises slightly less than output. Average hours worked are not affected significantly by the tax cuts. The last panel of the table shows tax revenue as a share of GDP by source. Not surprisingly, lower estate and corporate taxes lead to a decline in tax revenue, which is compensated by a rise in taxes collected from personal income taxes due to the balanced budget requirement.

The last column in Table 5 shows the changes in aggregate variables when we raise wage inequality in the model. Higher wage inequality represents a technical change in the production process that is biased towards the skilled labor force (Katz and Murphy, 1992). Calibrating the wage dispersion to the observed rise in the household labor earnings inequality raises the average productivity in the two extraordinary states to 10 times the average. Productivity in the top state increases to 120 times the average. Since average labor productivity is maintained at its 1960 level, those below the average experience further declines in productivity. This considerably raises the labor income risk in the model, which encourages higher precautionary savings in response. In addition, shifting disposable income to high-income and high-wealth agents, who have higher saving propensities, strongly promotes capital accumulation. The capital stock thus rises by an additional 13%. Since average productivity is constant, total hours worked do not change much. However, since households with above average productivity generally work longer hours, a higher dispersion leads to an additional 2.9% increase in labor input (See also Table A2 in the appendix.). These changes result in a further 6% increase in output on top of that caused by tax cuts. The capital-to-income ratio reaches 3.47. This is

Table 5: Tax Cuts and Macroeconomic Aggregates

Variable	Benchmark	Estate	+Tax Cuts Corporate	Income	+ Wage Inequality
Capital	30.98	+3.05%	+12.53%	+15.94%	+29.34%
Labor	5.58	+0.22%	+0.12%	+0.36%	+3.21%
Output	10.34	+1.23%	+4.42%	+5.71%	+11.94%
Interest Rate	4.16%	3.87%	3.23%	3.18%	2.60%
Wage Rate	1.18	+1.38%	+4.62%	+4.79%	+8.04%
Consumption	6.15	+0.25%	+0.94%	+1.40%	+4.77%
Hours Worked	0.34	+0.10%	-0.07%	-0.03%	+0.17%
Investment	2.43	+3.05%	+12.53%	+15.94%	+29.34%
Tax Revenue/GDP (%)					
Income Taxes	12.83	13.22	14.99	14.91	14.84
Corporate Taxes	3.81	3.58	1.81	1.84	1.69
Estate Taxes	0.38	0.19	0.20	0.25	0.58

Note.– The first column shows the values for the 1960 benchmark economy. The remaining columns introduce changes in tax policy sequentially and report the percentage changes in the key variables relative to the benchmark economy where appropriate. The last column corresponds to the stationary state associated with the parameters of the 2010 economy.

Table 6: Tax Cuts and Economic Inequality

Variable	Benchmark	Estate	+Tax Cuts Corporate	Income	+ Wage Inequality
Wealth	0.75	0.77	0.79	0.80	0.87
Income	0.50	0.50	0.50	0.50	0.56
Disposable Income	0.44	0.44	0.45	0.45	0.51
Consumption	0.40	0.40	0.41	0.41	0.47

Note.– Table reports the Gini coefficients of inequality for the entire population obtained by model simulations.

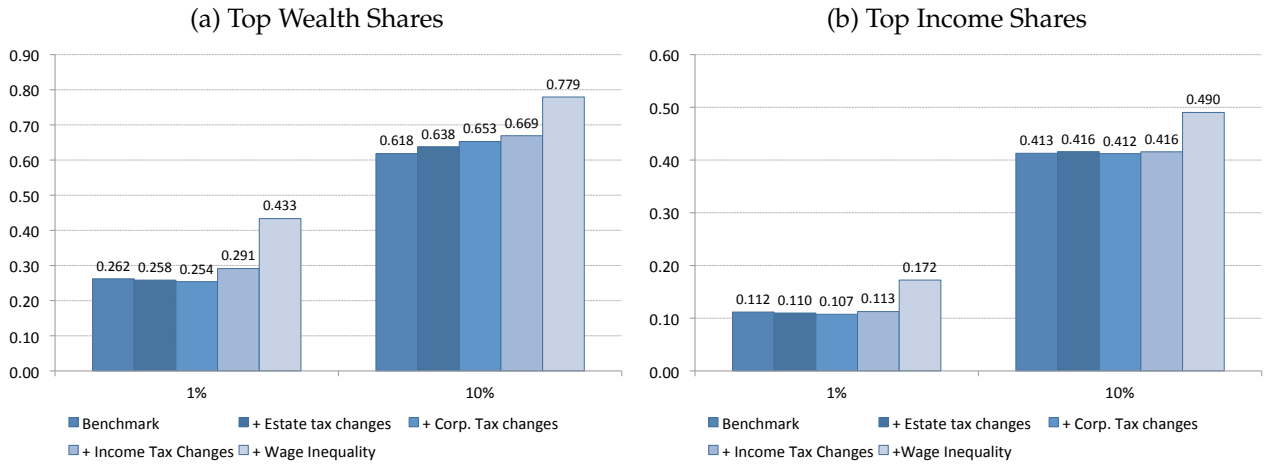
consistent with Saez and Zucman (2014), who report an increase in the wealth-to-income ratio from around 340% in 1970 to 400% in 2010. The larger capital stock pushes the real interest rate further down to 2.6% and raises the equilibrium wage rate per efficiency unit by another 3.4%.

Given the progressive nature of the overall tax system, rising top incomes help generate additional tax revenue. Since capital is more concentrated as a result of higher wage inequality, revenues from corporate and estate taxes increase as share of GDP, and ease up some of the pressure on personal income taxes brought about by cuts in tax rates.

Table 6 shows the Gini coefficients of inequality for wealth, income and consumption. Wealth inequality increases from 0.75 to 0.80 after tax cuts, and further to 0.87 after the rise in wage inequality. By contrast, the impact of tax cuts on income inequality is negligible despite the increase in total output. This is due to general equilibrium effects in factor prices: the lower interest rate combined with a higher wage rate shifts some of the gains experienced by the wealthy over to lower income groups who rely more heavily on labor income. Consequently, the increase in income inequality is almost entirely due to higher wage dispersion. The same pattern is observed in after-tax income and, hence, in consumption.

Figure 4 shows the resulting top income and wealth shares in the economy. The impact of top income tax cuts on wealth inequality is driven mostly by an increase in the share of the top 10% of the wealth distribution. The share of the top 1% slightly declines in response to corporate and estate tax cuts, and rises in response to a lower top marginal income tax rate. While both groups have higher wealth levels after the tax cuts, those in the 90-99% range accumulate disproportionately more wealth, driving up their share of

Figure 4: Decomposing the Rise in Inequality



aggregate wealth, and reducing that of the top 1%.

To better understand the impact of tax cuts on wealth inequality, consider Figure 5, which shows the change in saving propensities in response to tax cuts, where the saving propensity is defined as capital saved for tomorrow divided by disposable income plus wealth: $x'/(y^d + k)$. This is identical to $k'/(y^d + k)$ for households who survive into the next period. Panel (a) shows the saving reaction to estate tax cuts. The changes in the marginal estate tax rate by wealth group is shown with the dashed line. Recall from Figure 2 that the two main components of the estate tax reform were a much higher exemption level and lower marginal rates at the top. This implies that the group experiencing the largest reduction in estate tax rates are high wealth groups just outside the top 1%. The wealthiest still pay estate taxes, albeit at lower rates than they did in 1960. In particular, since the top 77% tax rate in 1960 applied only at very high wealth levels, the reduction in the average marginal rate experienced by the top 0.1% group is modest. As a result, the strongest impact of the tax reform is on behavior of the 90-99% group, which substantially increases its saving propensity, i.e., the substitution effect of a lower tax rate dominates the income effect. This behavioral change combined with the direct effect of lower taxes on estates implies that the wealth level of this group increases most. The wealth level of the top 1% group increases less, so that its share of total wealth declines. Those below the top 20% range are not directly affected by the estate tax cut, as they never pay estate taxes. Nevertheless, they react by saving less because the larger amount of wealth generated by the top groups decreases the equilibrium interest rate,

reducing the return to saving.

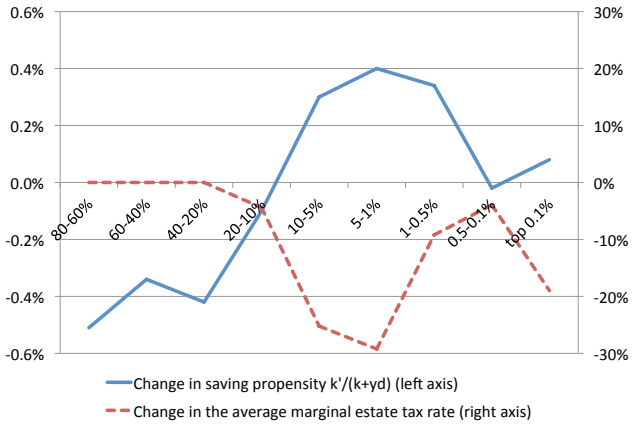
A similar behavior is observed in Panel (b), which shows the savings reaction to the corporate tax cut. Since only the wealthy own corporate assets, only households in the top 40% range are directly affected (dashed line). Again, reactions can be interpreted in terms of substitution and income effects of the tax change, plus general equilibrium effects. Here, too, a stronger substitution effect leads to a higher propensity to save for households that benefit from the tax reduction. The response in the saving propensity declines with wealth due to a stronger income effect for top wealth groups. Those below the top 40% range reduce their saving rate due to the lower equilibrium interest rate.

Panel (c) shows the effects of the lower top marginal income tax rate. The dot-dashed line shows the ensuing change in each wealth group's average marginal income tax rate. Reducing the top rate from 92% to 35% results in a lower average income tax rate for the wealthiest 0.1% by only 4 percentage points, since the top rate applies to only a small portion of their income. To balance the budget, taxes at lower income levels need to increase, raising the average marginal tax rate for all groups outside the top 0.5% of the wealth distribution by about half a percentage point. The top marginal tax rate cut can in principle affect the wealth distribution in two ways: directly, through its effect on the distribution of disposable income, and indirectly, via its effect on saving. The dashed line shows the change in the share of disposable income of different wealth groups. This increases by almost half a percentage point for the top 0.5%, and declines slightly for all other groups. The savings response is very small. As a consequence, the change in the wealth distribution (e.g., the wealth share of the top 1% group increases by almost 0.4 percentage points) essentially reflects the change in the high-wealth groups' share of disposable income. Their relatively high propensity to save implies that their share of wealth increases substantially more than their share of income. The effect of lower top taxes on wealth inequality thus is similar to that of higher wage dispersion in the sense that both work primarily via the distribution of disposable income. In contrast to this, the effect of corporate income and estate taxes, which hit capital, also goes through saving behavior.

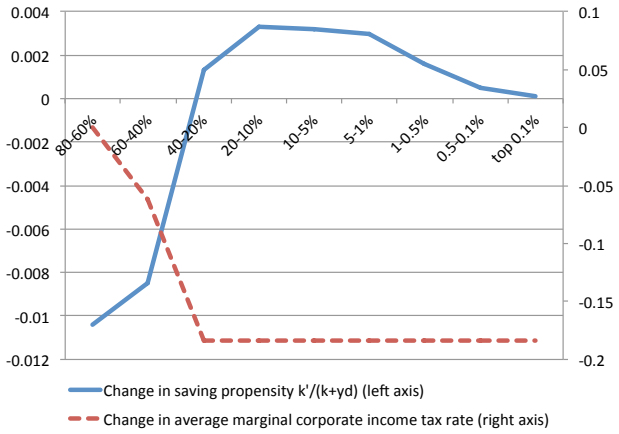
In contrast to the wealth distribution, top *income* shares are hardly affected by any of the three tax cuts. The lower equilibrium interest rate combined with the higher wage rate imply that even as the top 10% share and the Gini coefficient for wealth distribution increase, they remain essentially unchanged for the distribution of both pre-tax and after-tax income. Of course, this occurs because the wealthy derive a much larger proportion

Figure 5: Saving Propensity and Marginal Tax Rates

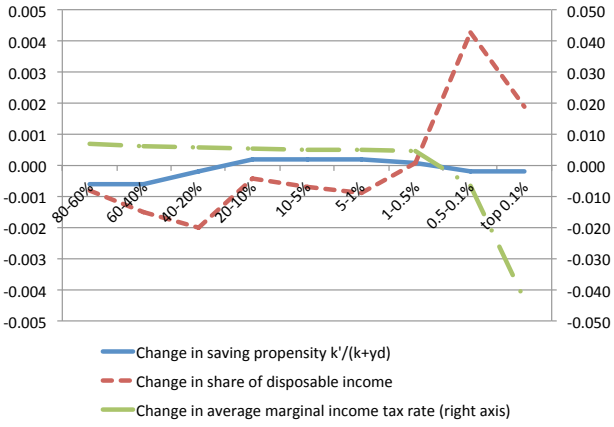
(a) Estate Taxes



(b) Corporate Taxes



(c) Income Taxes



Note.– The figure shows the saving reaction to changes in the tax system for different wealth groups (horizontal axis).

of their income from capital than low-wealth groups. As a result, price changes undo the effect of greater wealth on their relative incomes. General equilibrium effects thus affect income and wealth inequality differently: they dissipate the effects of tax cuts on income inequality, while exacerbating those on wealth inequality.

Finally, tax and wage changes also affect the distributions of consumption, disposable income and taxes. Table A3 in the appendix shows the distributions of consumption and disposable income. In both 1960 and 2010 model economics, disposable income is generally much less dispersed than pre-tax income, and consumption less than disposable income. Decomposition results for consumption and disposable income inequality mirror those for pre-tax income inequality: tax cuts hardly affect them, whereas increasing wage dispersion raises them noticeably. However, its effect on these variables is smaller than that on pre-tax income inequality, given the progressivity of the tax system.

The reduction in taxes paid by top income groups, ceteris paribus, shifts the tax burden onto lower income groups. In the US economy, this is counteracted by the expansion of the tax base due to two reasons. First, the increase in savings and labor supply in response to tax cuts generates additional income, which generates tax revenue. Second, the rise in the dispersion of wage inequality raises earnings for top income groups and lowers it for lower income groups. Since the tax system is generally progressive, the additional tax revenue collected from high income earners more than compensates for lost revenue at the bottom of the income distribution. Table 7 shows the share of taxes paid by various wealth and income groups for each tax category. The first panel shows the distribution of the total tax burden by deciles of the pre-tax income distribution. As expected, introducing tax cuts to the 1960 economy lowers the share of taxes paid by top income groups. Had there not been a change in the distribution of labor productivity, the top 40% of the income distribution would have contributed 1.9% *less*, with larger reductions for those at the top of the distribution. As a result of changes in the wage distribution, however, they contributed 4.2% *more*. A similar pattern appears in the following panels show the distribution of the tax burden for each tax category.

The distribution of the tax burden should, ceteris paribus, shift towards lower income groups following a reduction in taxes paid by top income groups. In our exercise, this is counteracted by the expansion of the tax base due to two reasons. First, the increase in savings and labor supply in response to tax cuts generates additional income, which generates tax revenue. Second, the rise in the dispersion of wage inequality raises earnings for top income groups and lowers them for lower income groups. Since the tax system

is generally progressive, the additional tax revenue collected from high income earners more than compensates for lost revenue at the bottom of the income distribution. Table 7 shows the share of taxes paid by various wealth and income groups for each tax category. The first panel shows the distribution of the total tax burden by deciles of the pre-tax income distribution. As expected, introducing tax cuts to the 1960 economy lowers the share of taxes paid by top income groups. Had there not been a change in the distribution of labor productivity, the top 40% of the income distribution would have contributed 1.9% less, with larger reductions for those at the top of the distribution. As a result of changes in the wage distribution, however, they contributed 4.2% more. A similar pattern appears in the following panels, which show the distribution of the tax burden for each tax category.

7 Conclusion

The changes in the US tax regulations since 1960 has reduced the progressivity of the system by lowering the tax liabilities of high income groups. During the same period, the economy witnessed a widening of income and wealth differences across households. In this paper, we analyzed the potential role of changes in tax policy in explaining these trends. The results indicate a negligible role for tax policy in the rising income inequality. This is partly because the tax cuts generate a very small response in labor supply and savings, and partly because changes in equilibrium prices mitigate the effect of a changing wealth distribution on incomes. Since most of the tax cuts concerned capital income, they increase the supply of savings. Given the complementarity of capital and labor in production, this implies a lower interest rate and a boost to wages. This change in prices raises low incomes, which come almost exclusively from labor, and undoes the effect of higher top wealth shares on high incomes.

By contrast, our analysis ascribes a moderate role for tax cuts in explaining the rise in wealth dispersion. They have been instrumental in raising the share of wealth held by the wealthiest 10%, because they benefit most from changes in the estate tax system (notably the dramatic increase in the exemption level), and because they react strongly to changes in capital income taxes. The wealth gains of the wealthiest 1% is smaller, implying that their wealth share does not increase in response to estate and capital income tax cuts.

Overall, the analysis shows that the dominant factor behind the rising dispersion in income and wealth has been the changes in earnings distribution led by an increase in

Table 7: Distribution of the Tax Burden

	Top Shares					
	0.5%	1%	5%	10%	20%	40%
Total taxes, ordered by pre-tax income:						
Benchmark	20.0%	22.9%	42.6%	63.9%	75.8%	92.3%
+ Estate tax cut	19.4%	22.2%	41.2%	63.7%	75.4%	91.9%
+ Corporate tax cut	17.0%	19.9%	38.4%	60.1%	71.2%	90.3%
+ Top income tax cut	15.1%	17.9%	37.7%	58.7%	70.3%	89.8%
+ Wage inequality	25.0%	28.2%	47.9%	71.1%	80.2%	95.1%
Estate taxes, ordered by wealth (retirees only):						
Benchmark	26.0%	27.9%	47.3%	66.7%	82.2%	84.9%
+ Estate tax cut	24.3%	26.3%	47.6%	66.8%	82.6%	84.7%
+ Corporate tax cut	21.4%	23.8%	40.2%	64.2%	82.2%	84.2%
+ Top income tax cut	26.1%	28.4%	43.9%	66.6%	83.4%	85.5%
+ Wage inequality	39.7%	42.5%	52.5%	75.0%	87.6%	89.8%
Corporate income taxes, ordered by pre-tax income:						
Benchmark	72.6%	81.0%	97.8%	100.0%	100.0%	100.0%
+ Estate tax cut	96.3%	100.0%	100.0%	100.0%	100.0%	100.0%
+ Corporate tax cut	61.1%	71.0%	94.6%	100.0%	100.0%	100.0%
+ Top income tax cut	66.5%	76.8%	96.2%	100.0%	100.0%	100.0%
+ Wage inequality	92.8%	100.0%	100.0%	100.0%	100.0%	100.0%
Income taxes, ordered by pre-tax income:						
Benchmark	22.0%	24.6%	44.0%	64.5%	77.2%	90.5%
+ Estate tax cut	21.0%	23.7%	43.0%	64.5%	77.1%	90.6%
+ Corporate tax cut	18.1%	20.9%	38.8%	60.2%	72.3%	89.1%
+ Estate tax cut	17.9%	20.7%	39.3%	60.1%	72.8%	88.6%
+ Wage inequality	27.9%	31.2%	49.5%	72.0%	81.6%	94.7%

Note.– Table shows the share of taxes paid by various wealth and income groups for each tax category.

the dispersion of wages. This is despite the fact that the parameterization of our model likely exaggerates the impact of taxes. The intertemporal elasticity of substitution used in the analysis is at the higher end of the estimates in the empirical literature. A lower IES would mute the savings response to tax cuts, and is likely to further limit the role of taxes in the analysis.

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A Additional Tables and Figures

Table A1: The Transition Matrix for The Life-cycle Productivity Process

$\mathbf{z_W \backslash z_W}$	**6.7**	**19.2**	**20.5**	**58.4**	**61.4**	**1222**
6.7	0.967	0.009	0	0	0.002	0
19.2	0.006	0.970	0	0	0.002	0
20.5	0	0	0.967	0.009	0.002	0
58.4	0	0	0.006	0.970	0.002	0
61.4	0.034	0.034	0.034	0.034	0.826	0.014
1222	0	0	0	0	0.205	0.773

Note.– Table shows the calibrated transition probabilities for workers over the life-cycle, Π_{ww}.

Table A2: Average hours by productivity group

z	1	2	3	4	5	6
Benchmark	0.338	0.342	0.338	0.339	0.401	0.540
+ Estate tax cut	0.338	0.342	0.338	0.341	0.402	0.541
+ Corporate tax cut	0.338	0.343	0.337	0.340	0.405	0.541
+ Top income tax cut	0.338	0.343	0.338	0.340	0.404	0.559
+ Wage inequality	0.338	0.343	0.338	0.343	0.409	0.559

Note.– Total number of hours available for work is normalized to 1. The changes to the benchmark are introduced sequentially; the last row shows the long-run equilibrium associated with the parameters of the 2010 economy.

Table A3: Top shares and log variance of consumption and disposable income

	Top Shares							Log variance	Gini
	0.5%	1%	5%	10%	20%	40%	60%		
Consumption, ordered by consumption:									
Benchmark	0.055	0.097	0.197	0.321	0.505	0.686	0.848	0.497	0.403
+ Estate tax cut	0.054	0.086	0.193	0.318	0.464	0.685	0.849	0.501	0.403
+ Corporate tax cut	0.056	0.079	0.198	0.320	0.465	0.688	0.852	0.513	0.407
+ Top income tax cut	0.064	0.093	0.204	0.327	0.471	0.691	0.853	0.517	0.413
+ Wage inequality	0.103	0.128	0.258	0.388	0.526	0.726	0.875	0.611	0.470
Consumption, ordered by pre-tax income:									
Benchmark	0.051	0.062	0.181	0.314	0.447	0.674	0.892	0.497	0.403
+ Estate tax cut	0.049	0.060	0.176	0.312	0.445	0.673	0.894	0.501	0.403
+ Corporate tax cut	0.047	0.059	0.168	0.311	0.447	0.672	0.896	0.513	0.407
+ Top income tax cut	0.057	0.069	0.182	0.319	0.456	0.677	0.897	0.517	0.413
+ Wage inequality	0.095	0.109	0.217	0.379	0.507	0.711	0.917	0.611	0.470
Disposable income, ordered by disposable income:									
Benchmark	0.067	0.086	0.218	0.375	0.498	0.719	0.909	0.497	0.443
+ Estate tax cut	0.067	0.085	0.213	0.370	0.500	0.719	0.911	0.501	0.443
+ Corporate tax cut	0.068	0.087	0.223	0.374	0.499	0.720	0.917	0.513	0.448
+ Top income tax cut	0.079	0.098	0.226	0.382	0.505	0.723	0.917	0.517	0.454
+ Wage inequality	0.126	0.147	0.285	0.446	0.564	0.758	0.929	0.611	0.508
Disposable income, ordered by pre-tax income:									
Benchmark	0.067	0.086	0.220	0.369	0.492	0.719	0.910	0.497	0.443
+ Estate tax cut	0.067	0.085	0.213	0.371	0.493	0.719	0.912	0.501	0.443
+ Corporate tax cut	0.068	0.087	0.218	0.376	0.498	0.720	0.917	0.513	0.448
+ Estate tax cut	0.079	0.098	0.234	0.384	0.507	0.724	0.918	0.517	0.454
+ Wage inequality	0.126	0.147	0.284	0.453	0.564	0.758	0.929	0.611	0.508