Inheritance, Wealth Distribution, and Estate Taxation

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July 1, 2023

Abstract

The estate tax has been considered by its supporters as a natural way to reduce wealth inequality because it targets the affluent directly. This paper documents that the relative importance of inheritance is less significant for wealthy heirs, as they inherit less relative to their wealth. Notably, over half of the richest one percent report receiving no inheritance at all. Then, in a quantitative model that accounts for these novel facts on inheritance received by the rich, this paper finds that the impact of estate taxation on wealth redistribution and overall welfare is small. Even with a hypothetical 100% estate tax rate, the wealth share of the top one percent would only decrease by 3.5 percentage points. The estate tax rate that maximizes welfare achieves a gain of only 0.24%, as measured by the consumption equivalent variation. Furthermore, the analysis indicates that estate taxation, compared to other major tax reforms, such as the top income taxation, incurs a greater loss in aggregate output for an equivalent amount of wealth redistribution, suggesting that despite its direct targeting of the affluent, estate taxation may not be an effective tool for wealth redistribution.

Keywords: inheritance, household wealth, inequality, estate taxation
JEL Codes: D14, D31, D64, E21, H21

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Acknowledgments: I thank Lutz Hendricks, Oksana Leukhina, Matthias Kehrig, Can Tian, Stanislav Rabinovich, Gary Biglaiser, Cheng Chen, Roozbeh Hosseini, Fei Li, Roberto Samaniego, and Andrew Yates for their valuable comments. I also thank all participants at UNC Macro Workshop, UNC Micro Theory Workshop, I-85 Macroeconomics Workshop, SEA, and The University of Melbourne Macro Seminar for their questions, comments, and insights.

1 Introduction

In the United States, the concentration of household wealth presents a significant economic disparity, with the richest one percent of households holding over 40% of the nation's total wealth (Saez and Zucman (2016)). This degree of wealth inequality surpasses other forms of economic disparity, such as earnings and income inequality. The roots of this pronounced wealth inequality lie in whether fortunes are inherited or self-made. Understanding the role of inheritance in shaping wealth inequality has important policy implications as it directly influences the level of policy support for estate taxation versus income taxation among policymakers.

This paper makes two main contributions. Firstly, it documents new facts about the inheritance patterns of wealthy households. Secondly, using a quantitative model governed by these new empirical observations, we explore the policy implications of varying estate tax rates and find the optimal tax rate that maximizes welfare. The key finding is that estate taxation's effect on wealth redistribution and overall welfare is limited. Furthermore, the estate tax is a less effective method of redistributing wealth than other major tax reforms, such as the progressive income tax. For a given amount of wealth redistribution, taxing the incomes of the top one percent earners has lower output loss but higher welfare gains.

Previous empirical studies have mainly focused on the overall value of inheritances, documenting that affluent households receive a significant share of wealth transfers (see, for example, Feiveson and Sabelhaus (2018)). Instead, this paper focuses on the inheritance patterns among the top wealth holders. We find that even though richer heirs inherit larger amounts, the relative importance of inheritance is less significant for them, as wealthy heirs inherit less relative to their own wealth. Specifically, using the Survey of Consumer Finances data (SCF), we document that inheritances account for, on average, just 13% of the net worth of the richest one percent.[1] Moreover, over half of the wealthiest one percent have not received any wealth transfer during their lifetime. This finding is important because it generates new implications for revising estate taxation policies.

To quantify the redistribution and welfare impacts of estate taxation, we employ a heterogeneous agent, general equilibrium, life-cycle model in which households derive utility from consumption and leisure. We further incorporate *imperfect altruism* and *het-*

[1] Intergenerational wealth transfer includes both inter vivos gifts and bequests. However, throughout this paper, we will interchangeably use the two terms: inheritance and intergenerational wealth transfer. From the Survey of Consumer Finances data, around 85% of intergenerational transfers are in the form of inheritances. Therefore, in this paper, the term *inheritance* is used to refer to the total intergenerational wealth transfers a household receives.

erogeneity in returns to wealth into the model. The strength of altruism is then calibrated to allow the model to match new inheritance evidence. The introduction of the rate of return heterogeneity is due to two reasons. Empirically, a growing number of studies document the existence of large and persistent differences in individual returns (e.g., Bach et al. (2020), Fagereng et al. (2020), Hubmer et al. (2020)). Theoretically, the previous literature shows that the rate of return heterogeneity is a powerful modeling tool to replicate the highly skewed wealth distribution observed in the U.S. economy—a phenomenon that has been challenging to explain through other mechanisms (e.g. Benhabib et al. (2019)).

Our calibrated model is consistent with key features of the U.S. data, including the earnings and wealth distributions, the proportion of estates subject to estate taxes, the ratio of estate tax revenues to the overall output, and the new empirical evidence on inheritance documented from the data, among other features. The calibrated model is, thus, a good laboratory to study the effects of estate taxation.

Our policy counterfactual analysis includes three experiments conducted in the long-run steady state. Additional tax revenues are redistributed among all households by a lump-sum transfer. The first experiment investigates the equity versus efficiency trade-off of the estate tax. Increasing estate tax rates would reduce the wealth concentration at the top at the expense of reducing total output. Compared with the benchmark steady state, a 100% estate tax rate reduces the top one percent wealth holding from 32.0% to 28.5%, with a cost of a 0.86% decrease in output. The limited equalizing effect is due to the low inheritance-to-wealth ratio of the richest one percent, which is 0.13. On average, the wealth of the richest one percent is seven times as high as their inheritance. Given the empirically estimated idiosyncratic returns, inheritance alone is insufficient to account for their substantial wealth accumulation. As a result, changes in estate tax rates would not significantly affect their wealth.

The second experiment calculates the optimal estate tax rate that maximizes welfare as measured by consumption equivalent variation in the new steady state. The resulting tax rate is 78%. Comparing between the benchmark economy and the new steady state with tax rate being 78%, we find that there is only a mild welfare gain–by 0.24% of consumption-equivalent per year for newborn people in our benchmark calibration. Implementing the welfare-maximizing estate tax rate has disparate effects on households in different wealth groups. Wealthy households suffer from a large welfare loss because a significant portion of their wealth will be taken away when they die. The rest of the economy, on the other hand, enjoys a small welfare gain.

In our last policy experiment, we evaluate the effectiveness of estate tax policy by comparing it with the top income taxation. Specifically, we investigate the effects of introducing an additional top marginal income tax rate of 25%. Under this scenario, the wealth share of the richest one percent decreases to 28.5%, mirroring the most equitable outcome achieved by the 100% estate tax rate. However, this income tax change results in a smaller decrease in total output of 0.73% and a more substantial welfare gain of 7.04%.

This superior performance of the income tax policy change is due to its broader impact on different wealth and demographic groups. When estates are fully taxed, the wealthy old households bear the brunt, leading to a reduction in their savings and, consequently, a decline in aggregate capital. This decline, in turn, negatively affects total output. In contrast, an increase in the top marginal income tax rate affects both young and old wealthy households. While their savings decrease, leading to a reduction in aggregate capital, young high-productivity households respond by increasing their labor supply. This response offsets some of the negative impacts of reduced capital by raising the total efficient labor units in the economy, thereby leading to a smaller reduction in aggregate output. Moreover, a higher top marginal income tax rate generates large tax revenue. Poor households enjoy an increase in consumption due to the high lump-sum transfer, leading to a significant welfare gain.

The rest of the paper is organized as follows. Section 2 frames our contribution in the context of the previous literature. Section 3 presents motivating facts on inheritances received by the rich. Section 4 lays out the quantitative model and defines the equilibrium. Section 5 discusses the calibration procedure and evaluates the fit of the model against a number of important features of the data. The core of our analysis, the policy experiments, is presented in Section 6. Section 7 concludes.

2 Related Literature

In this paper, we first document facts on inheritances received by the rich. Then, we develop a heterogeneous agent general equilibrium life-cycle model with imperfect altruism and rate of return heterogeneity to study the effects of estate taxation. This paper contributes to the macroeconomics literature in several different ways.

This paper adds to the empirical work on intergenerational wealth transfers. The previous studies focus on the aggregate evidence either by studying intergenerational transfers as an essential determinant of household wealth in the overall economy (e.g., Kotlikoff and Summers (1981), Gale and Scholz (1994), Davies and Shorrocks (2000), Brown and Weisbenner (2004)) or by looking at the aggregate value of inheritance received by the rich (e.g., Feiveson and Sabelhaus (2018)). Previous research highlights that intergenerational transfers, particularly bequests, are substantial and predominantly received by affluent households. The literature finds that around 40% of the U.S. capital stock is attributable to intergenerational transfers.[2] As for the concentration of bequests, the intergenerational transfers reported by the richest ten percent are seven times as high as those reported by the bottom half of the wealth distribution (e.g., Feiveson and Sabelhaus (2018)). Our study delves deeper, focusing on the inheritances received by the very rich. We show that even though richer heirs inherit larger amounts, the relative importance of inheritance is larger for less wealthy heirs, who inherit more relative to their wealth. A closely related work is Hurd and Mundaca (1989), which studies the importance of inheritances in individual wealth holdings. However, they look at the income-rich households. Another paper closely related to ours is Wolff and Gittleman (2014), which discusses inheritances as a proportion of current net worth. But they focus on the aggregate economy and investigate how inheritances as a share of household wealth change over time. Our paper completes the literature by characterizing the features of wealth transfers received by the richest few.

Our research contributes to the body of literature examining the effects of estate taxation within quantitatively calibrated models with incomplete markets and heterogeneous agents. This includes studies by Nishiyama (2002), Castañeda et al. (2003), Cagetti and De Nardi (2009), De Nardi and Yang (2016). What sets our approach apart is that, unlike these quantitative studies, which primarily calibrate their models to match moments on inheritance for the overall economy, our model is further governed by new moments on inheritance received by the rich. While Nishiyama (2002), Castañeda et al. (2003), Cagetti and De Nardi (2009) focus on scenarios involving the complete elimination of the estate tax, De Nardi and Yang (2016) examines a wider range of estate tax rates, including 0, 40%, and 60%. Our study conducts a comprehensive search across estate tax rates ranging from 0 to 100%. We aim to identify the optimal tax rate that maximizes welfare. More importantly, as our model is governed by the new facts on inheritance received by the rich, most of the wealthy households in our model are self-made, which is consistent with the data. This aspect leads to an even smaller impact of estate taxation than previously suggested in the literature. To better posit our study in the literature, we recalibrate the model

[2] Kotlikoff and Summers (1981) estimate that around 80% of the U.S. capital stock is attributable to intergenerational transfers. Even though Modigliani (1988) reaches a different conclusion, claiming that less than 20% of wealth can be attributed to transfers, this discrepancy is mainly due to methodological issues. After summarizing the findings of the literature, Davies and Shorrocks (2000) conclude that inheritances are responsible for approximately 35% – 45% of aggregate wealth.

without targeting the new inheritance moments. In this recalibrated model, the welfare at its maximized rate is 2.14%—nearly tenfold the maximized welfare gains observed in our benchmark model.[3] Additionally, our paper offers a comparative analysis between changes in estate tax policy and other major tax reforms, providing a clear evaluation of the effectiveness of estate taxation.

Finally, this paper is related to the growing literature on macroeconomic models of inequality. Many recent studies of wealth inequality focus on the relatively difficult task of replicating the thick upper tail of wealth distribution. An extensive literature in the context of Aiyagari-Hugget-Bewley framework incorporates a skewed and persistent distribution of stochastic earnings, namely the temporary 'superstar' high earnings state(s), to create the thick right tail and concentration found in the data. The seminal work taking this route is by Castañeda et al. (2003). Later this framework has been widely applied to the study of several problems for which inequality is a key determinant (see, for example, Kaymak and Poschke (2016), Díaz-Giménez and Pijoan-Mas (2019), Kindermann and Krueger (2022)). Our paper has a detailed discussion on the implications of this classic model framework regarding inheritance, and shows that in the existing models used in the literature wealthy households tend to receive more in bequests than what is suggested by data.[4]

3 Motivating Facts

This section characterizes the features of wealth transfers received by rich households that will serve as inputs for the calibration of the quantitative model. We present a series of empirical findings following a brief overview of our primary data source and methodology. Discussions regarding the robustness of these findings are included in the final part of this section.

3.1 Data and Methodology

The primary data source is the Survey of Consumer Finances (SCF) 1989-2019, a cross-sectional survey conducted every three years. We compute the statistics by pooling across

[3] A detailed description of the re-calibrated model, the calibration results, and its policy counterfactuals can be found in Appendix C.

[4] In the data, only less than 10% of the richest one percent have wealth transfers that account for at least half of their current net worth. However, in the model used in the literature, this share is as high as 50%. A more detailed discussion is in Section 5.3 Figure 4.

all years.[5] SCF asks interviewees to provide details for up to three inheritances, gifts, or trusts they have received: the year in which the transfer was received, the value of the transfer when received, and the type of the transfer.[6] Given that more than 85% of transfers are in the form of inheritances, we use the term *inheritance* in this paper to refer to the total wealth transfers (bequests and inter vivos) received by a household.

Adopting the standard approach in the literature (e.g., Brown and Weisbenner (2004), Wolff and Gittleman (2014)), we apply a 3% real interest rate to calculate the present value of each transfer. This calculation is based on both the reported value and the date of receipt. We then aggregate the value of all past transfers received by each household. Finally, we directly estimate the fraction of wealth attributable to transfers by taking the ratio of these two. The wealth concept used here is net worth, defined as the current value of all marketable assets less the current value of debts. Both the value of wealth and the value of inheritances are in 2019 dollars. As Brown and Weisbenner (2004) discusses, this direct estimation method computes the maximum possible portion of current household wealth that could be derived from past transfers, assuming that all received transfers, along with their accumulated interest, have been saved until the present.

On average, from 1989 to 2019, 21% of households in the U.S. received a wealth transfer at some point in the past, contributing to approximately 43% of their net worth. To investigate the total wealth transfers received over a lifetime, the facts presented next focus on households who are at least 60 years old and do not expect to receive a substantial inheritance or transfer of assets in the future. Over the lifetime, about 30% of households could expect to receive a wealth transfer, and these transfers constitute nearly 49% of their net worth.

3.2 Facts

Fact 1. The distribution of wealth transfers received over a lifetime is highly skewed.

Most households do not receive any wealth transfers, as evidenced by more than 70% of households report having zero transfers. At the other end of the size distribution, 10% of households receive wealth transfers that account for almost 90.6% of total dollars transferred. The top one percentile in the wealth transfer distribution accounts for a staggering 54.3% of the total dollars transferred. On average, 2.9% of wealth transfers, by

[5] The group of interviewees changes in each survey year. However, similar results are obtained using the data from every survey year.

[6] The type of transfers in the SCF is defined as bequest or inter vivos.

count, exceed the top decile cutoff value in a given year's wealth distribution, representing 68.8% of the total dollars transferred.

Fact 2. The majority of intergenerational transfers predominantly flow to wealthy households.

Figure 1 displays the share of total transfers held by households in different wealth groups. Households in the top decile of the wealth distribution receive a substantial 61% of the total dollars transferred. Furthermore, the wealthiest one percent alone holds 22.1% of these transfers. In stark contrast, households in the bottom half of the wealth distribution receive less than 5% of the total amount transferred.

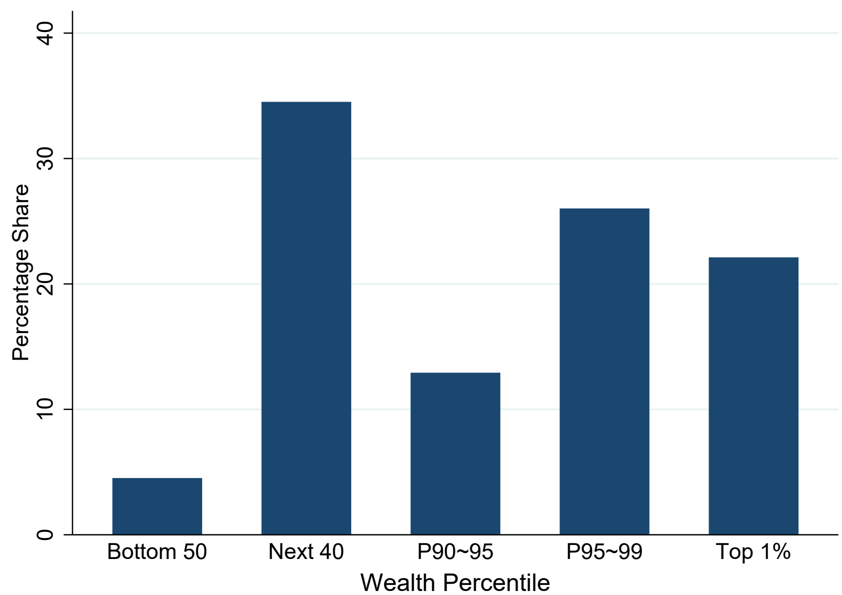

Figure 1: Concentration of Intergenerational Transfers Received by Wealth

Notes: This figure illustrates the percentage of aggregate wealth transfers received by different household groups, categorized according to percentiles of the wealth distribution. Specifically, it focuses on households within each wealth group who are at least 60 years old and do not anticipate receiving a substantial inheritance or asset transfer in the future.

Fact 3. Wealth transfers received by rich households account for a small fraction of their wealth holding.

The fraction of wealth directly accounted for by wealth transfers is calculated as the ratio of the present value of wealth transfers to the current net worth. We compute this statistic using households in the top decile wealth group who are at least 60 years old and do not expect to receive a substantial inheritance or transfer of assets in the future. As shown in Table 1, less than 20% of the wealth of the richest ten percent can be directly attributed to transfers. Among households in the top one percentile, this fraction is even smaller, at approximately 13%.

Table 1: Ratio of Wealth Transfers to Current Net Worth

Wealth top decile	Sub-groups in top decile		
	$90 \sim 95$	$95 \sim 99$	Top 1%
0.18	0.24	0.22	0.13

Notes: 1989 – 2019 SCF data. This table presents the ratio of wealth transfers to the current net worth for households in each top wealth group. The focus is on households that are at least 60 years old and do not expect any substantial future inheritance or asset transfer. Wealth transfers are calculated as their present value, applying a 3% real interest rate, and based on both the reported value and the date of receipt. Since the net worth values are expressed in 2019 dollars, the value of the inheritance is also converted to 2019 dollars for consistency.

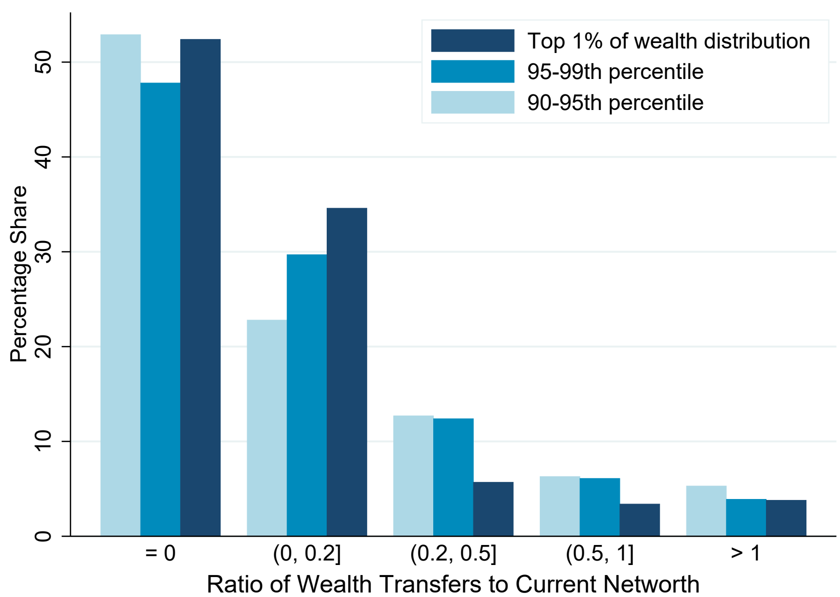

Figure 2: Share of Households in Each Inheritance-to-Wealth Ratio Category

Notes: This figure shows the number of households within each inheritance-to-wealth ratio bin, reported as a fraction of the total number of households in different wealth groups. More precisely, there are three subgroups of households within the top decile of wealth distribution: $90 \sim 95$ percentile, $95 \sim 99$ percentile, and the top 1%. In each wealth group, households, who are at least 60 years old and do not expect to receive a substantial inheritance or transfer of assets in the future, are divided into five categories according to the ratio of wealth transfers they received to their current net worth. The y-axis shows the share of households that belong to each category.

Fact 4. Half of the rich households do not receive any wealth transfers over their lifetime.

Figure 2 shows the number of households within each inheritance-to-wealth ratio bin, reported as a fraction of the total number of households in each wealth group. Notably, 52% of households in the top one percent by wealth do not receive any wealth transfers throughout their lifetime. Additionally, approximately 35% of the wealthiest one percent receive transfers that account for less than one-fifth of their wealth. Less than 10% of the top one percent fall into the category where wealth transfers account for at least half of their current net worth. Similar patterns are also observed in households within the wealth $90 \sim 95^{th}$ and $95 \sim 99^{th}$ percentile groups.

The primary insight derived from SCF data is that wealthier heirs tend to receive larger wealth transfers, but the relative importance of wealth transfers is less significant for them, as they inherit less relative to their own net worth. In fact, nearly 90% of the wealthiest one percent either received no wealth transfers or only a minor amount relative to their current net worth. This finding aligns with the facts documented by Korom et al. (2017). Using data from the annual American Forbes 400 ranking (1982-2013), Korom et al. (2017) observed that 55% of the fortunes on this list are self-made, defined as fortunes built entirely from scratch. Additionally, their finding indicates that about $60-70\%$ of multimillionaires come from backgrounds where their parents were blue-collar workers or from lower-middle or middle-class families, rather than wealthy ones.

3.3 Discussions

The concerns regarding the empirical findings of this paper are as follows. First, the results are derived using a 3% real interest rate to compute the present value of inheritances. There is a concern that wealthier households may have access to better investment portfolios yielding higher returns, which could elevate the role of inheritance in their wealth accumulation. Hubmer et al. (2020) estimates that the expected excess return on net worth for households in the top decile of wealth distribution ranges from 3% to 6%. As a robustness check, we recalculated all statistics using a 6% real interest rate to compute the present value of inheritances.[7]

When using the higher interest rate, all figures in Table 1 increase. This increase is expected, as the denominator (households' current net worth) remains constant while the numerator (present value of wealth transfers) grows due to the higher interest rate.

[7] According to the estimates by Hubmer et al. (2020), the mean excess returns for households in the 90^{th} to 99^{th} percentile are lower than 6%, but we use the 6% rate for all households, treating this as an upper bound analysis.

However, as Figure 3 indicates, the inheritances of most wealthy individuals remain small relative to their wealth holdings. Firstly, regardless of the interest rate used, half of the wealthy received no wealth transfers, making the interest rate irrelevant for them. Secondly, when applying a 6% real interest rate, the proportion of the richest one percent with an inheritance-to-wealth ratio below 0.2 decreases only slightly, from 34.6% to 30.5%. This suggests that most wealthy households received only small inheritances relative to their wealth. Our conclusion, that the relative importance of inheritance is less significant for the wealthy, is robust. It stems from the fact that half of this group inherited nothing and a third received only small inheritances compared with their wealth. This finding holds true even when a higher real interest rate is used for the present value calculations of inheritances.

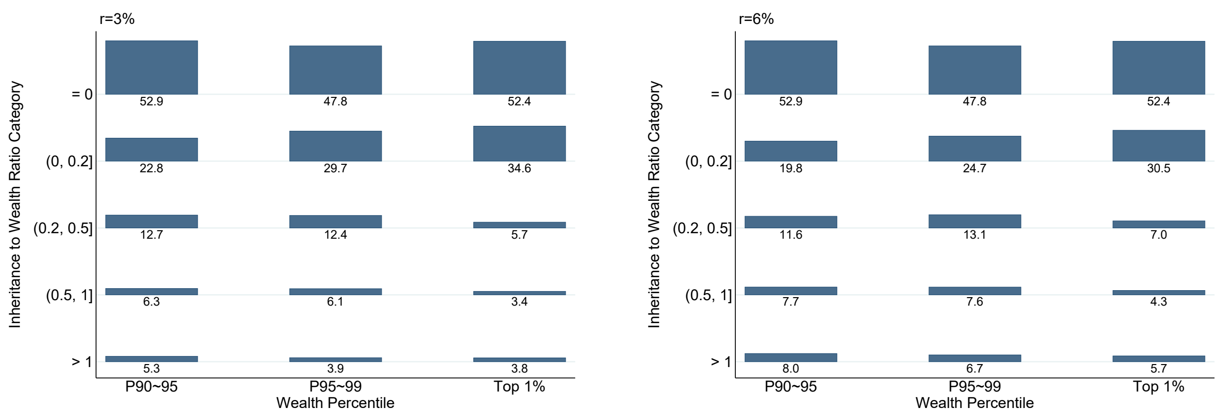

Figure 3: Share of Households in Each Inheritance-to-Wealth Ratio Category

Notes: This figure shows the number of households within each inheritance-to-wealth ratio bin, reported as a fraction of total number of households in different wealth groups. The x-axis categorizes households into three subgroups within the top decile of the wealth distribution: the $90^{th}-95^{th}$ percentile, the $95^{th}-99^{th}$ percentile, and the top 1%. On the y-axis, households in each of these wealth groups are classified into five categories based on the ratio of wealth transfers received to their current net worth. For example, the number 52.9 in the first column indicates that 52.9% of households in the $90^{th}-95^{th}$ wealth percentile have an inheritance-to-wealth ratio of 0. The sum of the percentages in each column equals 100. Present value of inheritance in the left panel of the figure is computed using a 3% real interest rate. This panel contains the same information as Figure 2. The right panel, on the other hand, calculates the present value of inheritance using a 6% real interest rate.

Another potential issue with the data is underreporting of received wealth transfers. Recall error is a possible cause of this. The SCF collects information on bequests and gifts received by individual households in a retrospective way, which can lead to underreporting, particularly for small inheritances received long ago. However, the likelihood of recall error decreases for larger inheritances. de Nicola and Giné (2014) investigates the accuracy of recall data by comparing administrative records with retrospective, self-reported survey responses. Their findings suggest that higher-value variables are more accurately recalled.[8] Our paper, which focuses on inheritances received by the richest one percent, deals primarily with significant-value transfers, thereby suffering less from recall error. The second factor that might lead to underreporting is tax avoidance. Nevertheless, the SCF, being a cross-sectional household survey, does not delve into detailed questions about household tax filings or liabilities. As a result, respondents have less motivation to misreport their inheritance in this survey context.

4 The Model

We study a modified version of the discrete-time, incomplete-markets, life-cycle model with a temporary superstar working productivity state that closely resembles Castañeda et al. (2003). In particular, we combine the standard model with *imperfect altruism* and *heterogeneity in returns to wealth*.

4.1 Demographics and Endowments

The economy consists of a continuum of heterogeneous households, a representative firm, and a government. Households go through two demographic states: working life (young) and retirement (old), with N^Y phases in the working life state and N^O phases in retirement.[9] In each period, households face a constant probability of moving to the next phase. Once retired, they still make consumption and savings choices but cannot work anymore. Retirees in the last phase die with a constant probability. Upon death, they are replaced by a working-age young descendant.

Households are endowed with a fixed amount of disposable time ι, which can be allocated between working time and leisure. A worker's labor productivity is captured in a one-dimensional state variable $s \in \mathcal{S}$ that follows a finite-state Markov chain with transition probabilities $\Gamma(s'|s) = Pr(s_{t+1} = s'|s_t = s)$. Upon retirement, households' productivity

[8] The data they use are on earnings. They find that monthly earnings higher than the median are better recalled.

[9] The introduction of phases is essential to prevent counterfactual demographic implications. Without phases, the probability of retiring is just the inverse of the expected duration of working life, 1/45, and the probability of dying is the inverse of the expected duration of retirement, 1/15. In an earlier version without phases, we found that in the model economy, most households in the $95^{th} \sim 99^{th}$ percentile of the wealth distribution build their wealth by living an incredibly long life. The introduction of life phases rectifies this, increasing the probability of transitioning to the subsequent demographic state.

becomes zero. Hence, they stop working and receive uniform retirement benefits denoted as $\overline{\tau}$, irrespective of their labor productivity during their working years. In the event of an old household's demise, it is replaced by a working-age descendant who not only inherits the estate but also some of the earning abilities of the deceased household. The initial productivity draw for descendants is correlated with the labor productivity realized by their parents during the last period of their working life.

4.2 Preferences

Preferences are time separable with a constant discount factor, $0 < \beta < 1$. The household's period utility is a function of both consumption and leisure:

$$u(c_t, l_t) = \frac{c_t^{1-\sigma_1}}{1-\sigma_1} + \chi \frac{(\iota - l_t)^{1-\sigma_2}}{1-\sigma_2} \tag{1}$$

where l_t is the working time. Importantly, the presence of imperfect altruism means that households aim to maximize the expected discounted sum of period utilities over their lifetime, plus part of the value of their descendants.

4.3 Returns to Capital

In this model, households make endogenous decisions regarding labor supply and savings. Capital income is subject to rate of return heterogeneity. Following Hubmer et al. (2020), the return on savings is specified as

$$\underline{r} + r^X(k_t) + \sigma^X(k_t)\eta_t \tag{2}$$

Here, $\underline{r}$ represents an aggregate return component common to all households, $r^X(\cdot)$ denotes the mean excess returns which depend on wealth k_t, $\sigma^X(\cdot)$ captures the standard deviation of excess returns, which increases with a household's wealth holding, and η_t represents an *i.i.d* standard normal idiosyncratic shock affecting the household in each period.

Register data from Norway (Fagereng et al. (2020)) and Sweden (Bach et al. (2020)) have revealed an average return that increases with household wealth and an idiosyncratic return component whose variance also increases in wealth. Equation (2) mimics these observed data features. Moreover, cross-sectionally, there is also a limited amount of return persistence under this specification due to wealth's persistence.[10] This formulation

[10] Conditional on wealth, returns are uncorrelated over time.

aligns with the findings of Fagereng et al. (2020) and Bach et al. (2020), supporting the presence of both heterogeneity and persistence in idiosyncratic asset returns.

4.4 Government

The government levies taxes on households' income and estates to fund exogenous public expenditure G and provide retirement benefits $\overline{\tau}$ to old households.

Household income comprises two components. The ordinary gross income y_t is the sum of labor income and the deterministic part of capital income, $y_t = w_t s_t l_t + (\underline{r} + r^X)k_t$. The second part is the stochastic capital income, $\tilde{y}_t = \sigma^X \eta_t k_t$. Households at the top end of the wealth distribution have a high standard deviation of excess returns, as $\sigma^X(\cdot)$ is a function increasing in household's wealth. Therefore, they face substantial return risk and experience significant fluctuations in capital income from period to period. Following Hubmer et al. (2020), we assume a flat capital gains tax, $\tau_k(\tilde{y}_t) = \tau_0 \tilde{y}_t$, for this highly volatile part of capital income.

Household's ordinary gross income is subject to a progressive income tax $\tau_y(y_t)$:

$$\tau_y(y_t) = \tau_1[y_t - (y_t^{-\tau_2} + \tau_3)^{(-1/\tau_2)}] \tag{3}$$

This income tax function, first proposed by Gouveia and Strauss (1994), captures the progressivity of U.S. effective household income taxes. It has been widely employed in the quantitative public finance literature (see, for example, Conesa and Krueger (2006), and Díaz-Giménez and Pijoan-Mas (2019)). τ_1 controls the level of average tax rate, while τ_2 captures the curvature of the tax function, reflecting the progressivity of the tax code.[11]

The U.S. federal estate tax is a very progressive tax on the total value of net worth at the time of a household's death. In line with the literature, we assume a constant marginal tax rate (see, for example, Castañeda et al. (2003), Cagetti and De Nardi (2009), De Nardi and Yang (2016)). In particular, the tax is summarized by two parameters: an exemption level $\underline{z}$ and a constant marginal tax rate τ_4 for estates above the exemption level.

$$\tau_e(k) = \begin{cases} 0 & \text{for } k \leq \underline{z} \\ \tau_4(k - \underline{z}) & \text{for } k > \underline{z} \end{cases} \tag{4}$$

[11] $\tau_2 = 0$ implies a proportional tax system.

4.5 Firm and Market Arrangements

In this model economy, asset markets are incomplete, preventing households from fully insuring against idiosyncratic shocks. There is one representative firm producing goods according to a constant returns to scale production function $F(K, L)$, where K is the aggregate capital stock, and L is the aggregate labor input. Capital depreciates geometrically at a constant rate δ.

$$Y_t = F(K_t, L_t) = K_t^{\theta} L_t^{1-\theta} \tag{5}$$

The firm rents factors of production from households in competitive spot markets at a wage rate w_t and an average market return on capital r_t.

4.6 The Household's Decision Problem

Households have four state variables: the phase of the demographic state (n), asset holdings (k), the realization of labor productivity (s), and the capital return shock (η). The dynamic program of a household is expressed as

$$\begin{aligned} V(n,k,s,\eta) = \max\ & u(c, \iota - l) + \beta \cdot (1-\Omega) \cdot \mathbb{E}\Big[V(n,k',s',\eta') \mid s\Big] \\ & + \beta \cdot \Omega \cdot (1 - \mathbf{1}_{\{n=N^Y+N^O\}}) \cdot \mathbb{E}\Big[V(n',k',s',\eta') \mid s\Big] \\ & + \beta \cdot \Omega \cdot b \cdot \mathbf{1}_{\{n=N^Y+N^O\}} \cdot \mathbb{E}\Big[V(1,a',s',\eta') \mid s\Big] \\ s.t. \quad & k' + c = k + y - \tau_y(y) + \tilde{y} - \tau_k(\tilde{y}) \\ & y = (\underline{r} + r^X)k + wsl + \overline{\tau} \cdot \mathbf{1}_{\{s=0\}} \\ & \tilde{y} = \sigma^X \eta k \\ & a' = k' - \tau_e(k') \\ & k' \geq 0 \end{aligned} \tag{6}$$

Here, Ω denotes the probability of transitioning to the next phase, and $n = N^Y + N^O$ indicates that the household is currently in the last phase of retirement. With probability Ω, this retiree moves to the next phase, signifying death and succession by its descendant. $V(1,a',s',\eta')$ is the value function of the descendant, and $n = 1$ indicates that the descendant is in the first phase of working-age. The descendant inherits its predecessor's estate after paying estate taxes. The initial draw of its labor productivity s' depends on its parent's last realization of productivity during working life, s. The parameter b governs the bequest motive, reflecting the degree to which parents care about the value of their offspring.

4.7 Stationary Equilibrium

Define $x = (n, k, s, \eta)$ as the state vector. Given excess return schedule $r^X(\cdot)$ and $\sigma^X(\cdot)$, a stationary equilibrium is defined by the household value function $V(x)$, their decision rules $c(x)$, $l(x)$, $k'(x)$, public policies $\{\tau_y, \tau_k, \tau_e, \overline{\tau}\}$, factor prices $\{r, w\}$, aggregate return component $\underline{r}$, and a distribution over households $\Lambda(x)$, such that, given prices and government tax and transfer schedules:

i. policy functions $c(x)$, $l(x)$, and $k'(x)$ maximize household's value function;

ii. the firm maximizes profit

$$w = (1-\theta)\Big(\frac{K}{L}\Big)^{\theta}$$
$$r = \theta\Big(\frac{K}{L}\Big)^{(\theta-1)} - \delta \tag{7}$$

iii. the government budget is balanced

$$G + \int \overline{\tau} \cdot \mathbf{1}_{\{n>N^Y\}}(x) d\Lambda(x) = \int \Big[\tau_y(y(x)) + \tau_k(\tilde{y}(x))\Big] d\Lambda(x) + \int \tau_e(k(x)) \cdot \mathbf{1}_{\{n=1\}}(x)\Lambda(x) \tag{8}$$

iv. the goods market clears

$$Y = \int c(x) d\Lambda(x) + K' - (1-\delta)K + G \tag{9}$$

v. the labor market clears

$$L = \int l(x)s(x)\Lambda(x) \tag{10}$$

vi. the capital market clears

$$K = \int k(x)\Lambda(x) \tag{11}$$

Due to the non-trivial excess return schedule $r^X(\cdot)$, household capital income is no longer proportional to their asset. Hence, in addition to the standard capital market-clearing condition, there is a second condition

$$rK = \int (\underline{r} + r^X + \sigma^X \eta) k(x) d\Lambda(x) \tag{12}$$

vii. the distribution of household over the state variables, $\Lambda(x)$, is stationary.

5 Quantitative Analysis

This section sets out to discuss the calibration procedure and present the characteristics of the benchmark equilibrium. Additionally, we examine an alternative model in Section 5.3. In this case, the calibration relies solely on moments on inheritance for the overall economy. Notably, this alternative model is not governed by our new empirical evidence on inheritance received by the rich, emphasizing the significance of our empirical findings.

5.1 Model Parameterization

The model is calibrated through a two-step process using the simulated method of moments. In the initial step, a subset of the parameters is externally calibrated, drawing on estimates independent of the model or commonly used values in the literature. The parameters determined in this first step are presented in Table 2 & 3. In the second step, the remaining parameters are endogenously determined within the model to match the features of the US economy during the late 1990s and early 2000s, a period during which the estate tax was relatively stable. Parameters calibrated to match model-generated moments with those observed in the data are listed in Table 4.

5.1.1 Demographics and Preference

Households enter the model economy at age 20, experiencing three phases each in working life and retirement. The probability of moving to the next phase in working life is calibrated to to yield an expected duration of working life of 45 years. Similarly, the probability of transitioning to the next phase in retirement is calibrated to achieve an average retirement duration of 15 years.

We set the coefficient of risk aversion in the utility function, σ_1, to be 1.5, which is in the middle of the range typically used in the literature. Consistent with existing studies, we choose the value of σ_2 to yield a corresponding Frisch elasticity of labor equal to one.[12] The weight of disutility of labor, χ, is determined by targeting the average share of time allocated to working, set at 0.3 based on McGrattan and Rogerson (2004). The endowment of disposable time, ι, is set to be 3.3, ensuring that the aggregate working time approximates one. The discount factor, β, is calibrated to target a capital-to-output ratio of 3. Lastly, the parameter governing the bequest motive, b, is calibrated to match the new evidence on inheritance – the share of the wealthiest one percent with an inheritance-to-wealth ratio below 0.2. This targeted moment is 87%, as shown in Figure 2 and the left panel of Figure 3.

5.1.2 Labor Productivity Process

Following the approach of Castañeda et al. (2003), we adopt a parsimonious strategy for modeling the labor productivity process, s. Specifically, we choose four different realizations of labor productivity, $s \in [s_1, s_2, s_3, s_4]$, and normalize the lowest labor state to one. The labor productivity process is calibrated such that it generates distributions for wealth and earnings that match their empirical counterparts. Moreover, as productivity process and inheritance both affect wealth accumulation, the model is further constrained by targeting the wealth transfers to wealth ratio, as presented in Table 1 in Section 3.2.

The initial draw of productivity for descendants is assumed to be correlated with the labor productivity their deceased parents encountered during their last working period. This transition of earnings ability between generations captures both the life-cycle pattern of earnings and the intergenerational transmission of earnings ability. These two goals are achieved parsimoniously through the introduction of two additional parameters, ϕ_1 and ϕ_2. Specifically, ϕ_1 governs the intergenerational persistence of earnings, while ϕ_2 captures the life-cycle profile of earnings.[13] Calibration of these parameters is guided by two targeted moments: the ratio of average earnings of senior workers (aged 41 to 60) to those of new junior workers (aged 21 to 40), 1.3, and the cross-sectional correlation between average lifetime earnings of one generation of households and that of the subsequent generation, 0.4.

5.1.3 Returns to Capital and Technology

The aggregate return component $\underline{r}$ is calibrated to ensure that the aggregate capital income rK equals the aggregate individual capital income. The *i.i.d* idiosyncratic shock η is drawn

[12] For example, Conesa et al. (2009) obtain a Frisch labor elasticity around 1.

[13] Details of the formula used to compute the transition of earnings ability between parents and offspring from ϕ_1 and ϕ_2 can be found in Appendix B. We borrow it directly from Castañeda et al. (2003).

from a standard normal distribution in each period. Hubmer et al. (2020) estimate the schedule of excess returns for each wealth percentile group using the US data. Hence, for the mean excess returns $r^X(\cdot)$ and return dispersion $\sigma^X(\cdot)$, we rely on estimates from Hubmer et al. (2020), which are presented in Table 3.

The production function is of the Cobb-Douglas form: $F(K,L) = K^\theta L^{1-\theta}$. The capital share parameter θ is set to the conventional value of 0.36, as in Cooley and Prescott (1995). The discount rate δ is fixed at 0.06, following Stokey and Rebelo (1995).

5.1.4 Government Policy

The stochastic part of capital income, $\tilde{y}$, is subject to the capital gains tax. In the U.S. economy, the capital gains tax schedule is progressive, though less so than the one applied to ordinary income. Therefore, we opt for a flat tax with a rate of $\tau_0 = 0.147$, which is the average effective capital gains tax rate reported in 2004 by the U.S. Department of the Treasury (2016).

Household's ordinary gross income y, calculated as the sum of labor income and the deterministic part of capital income, is subject to a progressive income tax. Household income taxes are described by the function:

$$\tau_y(y) = \tau_1[y - (y^{-\tau_2} + \tau_3)^{(-1/\tau_2)}]$$

Given that τ_1 and τ_2 are unit-independent, we use values reported by Gouveia and Strauss (1994) for these parameters, namely, $\tau_1 = 0.258$ and $\tau_2 = 0.768$. The last parameter in the income tax function, τ_3, is calibrated to achieve an average effective federal income tax rate of 0.11, defined as total income tax raised divided by total taxable income (IRS, 2000-2004).

Estate taxation serves as another source of government income. Estates exceeding a specified value $\underline{z}$ are taxed at rate τ_4 on the amount exceeding $\underline{z}$. We choose the tax parameters $\underline{z}$ and τ_4 to match the fraction of estates subject to estate taxes (0.02, Gale and Slemrod (2001)) and the fraction of estate tax revenue as a percentage of output (0.33%, Gale and Slemrod (2001)).

The retirement benefits $\overline{\tau}$ provided by the government to retirees are calibrated to achieve a transfers-to-output ratio of 0.05. This ratio is computed as the share of GDP represented by Medicare and two-thirds of Social Security transfers, utilizing data reported by the Congressional Budget Office (2000-2004). While Social Security transfers in the

U.S. are progressive, our model considers only a lump-sum transfer, for which we take two-thirds of Social Security transfers as the lump-sum components.

Table 2: Parameters Calibrated Outside of the Model

Parameter		Source	Value
Demographics			
N^Y	Phases in working life	-	3
N^O	Phases in retirement	-	3
Preferences			
ι	Endowment of disposable time	-	3.3
σ_1	Risk aversion	Attanasio et al. (1999)	1.5
σ_2	Frisch labor supply elasticity	Conesa et al. (2009)	2.33
Earning Process			
s_1	Lowest labor state	Normalization	1
Returns to Capital			
$r^X(\cdot)$	Mean excess return	Hubmer et al. (2020)	Table 3
$\sigma^X(\cdot)$	Idiosyncratic return dispersion	Hubmer et al. (2020)	Table 3
Technology			
θ	Elasticity of the capital stock	Cooley and Prescott (1995)	0.36
δ	Depreciation rate	Stokey and Rebelo (1995)	0.06
Government			
τ_0	Flat capital gains tax	U.S. Department of the Treasury	0.147
τ_1	Income tax parameter	Gouveia and Strauss (1994)	0.258
τ_2	Income tax parameter	Gouveia and Strauss (1994)	0.768

Table 3: Excess Return Schedule

	Wealth Percentile								
	Bottom 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 95	95 – 99	Top 1%
r^X	0.000	0.011	0.017	0.020	0.022	0.026	0.031	0.036	0.055
σ^X	0.023	0.056	0.081	0.093	0.095	0.095	0.094	0.094	0.167

Notes: Hubmer et al. (2020) provides a comprehensive breakdown up to the top 0.01% in the wealth distribution. To derive the excess return schedule for the entire top percentile in our model economy, we aggregate their detailed estimates. This aggregation is necessitated by jumps in the cumulative distribution of wealth in our model, preventing a clear separation among wealth groups smaller than a percentile.

Table 4: Parameters Calibrated (Jointly) Inside the Model

	Parameter	Value
Preferences		
Weight of disutility of labor	χ	1.59
Discount factor	β	0.94
Bequest motive parameter	b	0.20
Earning Process		
Labor efficiency	$[s_2, \quad s_3, \quad s_4]$	[2.57, 7.90, 974.14]
Transition probabilities	$[p_{12}, p_{13}, p_{14}$	[0.024, 0.005, 0.000
	p_{21}, p_{23}, p_{24}	0.029, 0.006, 0.000
	p_{31}, p_{32}, p_{34}	0.038, 0.007, 0.002
	$p_{41}, p_{42}, p_{43}]$	0.106, 0.000, 0.085]
Earnings life-cycle controller	ϕ_1	0.97
Intergenerational earnings persistence controller	ϕ_2	0.53
Government		
Income tax parameter	τ_3	0.20
Estate tax exemption level	$\underline{z}$	45.93
Estate tax rate	τ_4	0.39
Lump-sum transfer to retiree	$\overline{\tau}$	0.72

5.2 Model Performance

This section provides an overview of the model fit. We further assess the performance of the benchmark model for some important untargeted data moments and features, including the inheritance distribution and the wealth mobility of the richest one percent.

5.2.1 Targeted Moments

Table 5 summarizes the relevant macroeconomic ratios. These aggregate moments are also used in previous literature to help pin down parameter values. Overall the model demonstrates good match to its calibration targets, especially the two moments that are crucial for identifying estate tax parameters – the fraction of estates subject to tax and the share of estate tax revenue in total output.

Table 5: Values of the Targeted Ratios and Aggregates in the U.S. and in the Model

Target	Source	Data	Model
Average hours worked	McGrattan and Rogerson (2004)	0.3	0.32
Ratio of capital to annual output	BEA	3	3.21
The ratio of average earnings of senior workers to those of new junior workers	Castañeda et al. (2003)	1.3	1.15
The cross-sectional correlation between average lifetime earnings of father and son	Castañeda et al. (2003)	0.4	0.31
Average effective federal income tax rate	IRS (2000-2004)	0.11	0.12
Aggregate transfers to output ratio	Congressional Budget Office (2000-2004)	0.05	0.04
Ratio of estate tax revenues to GDP	Gale and Slemrod (2001)	0.33%	0.32%
Fraction of estates that pay estate taxes	Gale and Slemrod (2001)	0.02	0.02

Tables 6 and 7 present the earnings and wealth distributions generated by the model alongside their empirical counterparts from the 2004 SCF data. Notably, the earnings and wealth distributions in the benchmark economy closely mirror the targeted empirical distributions. Given that this model is developed to study the impacts of tax policies that depend on wealth inequality, it is crucial for the benchmark model to accurately capture the upper tail of the wealth distribution. The model successfully replicates the top end of the wealth distribution, where it deviates from the data by only 1.2 percentage points.

One contribution of this paper is that it enriches a standard general equilibrium dynamic framework to account for the new evidence on inheritance. Table 8 presents the inheritance-to-wealth ratio, comparing empirical data with model-generated results. The model successfully captures the observed phenomenon where wealthy heirs inherit a smaller proportion relative to their overall wealth. Moreover, the vast majority, nearly 90%, of the wealthiest one percent only inherit minimally, with an inheritance-to-wealth ratio below 0.2.

Table 6: Earnings Distribution (%)

		Quintile				Top Groups (Percentile)		
	Gini	$1^{st}+2^{nd}$	3^{rd}	4^{th}	5^{th}	$90-95^{th}$	$95-99^{th}$	$99-100^{th}$
Data	0.62	4.3	12.1	21.7	61.8	12.2	15.7	16.5
Model	0.59	7.0	13.1	20.6	59.3	9.8	17.2	16.9

Table 7: Wealth Distribution (%)

		Quintile				Top Groups (Percentile)		
	Gini	$1^{st}+2^{nd}$	3^{rd}	4^{th}	5^{th}	$90-95^{th}$	$95-99^{th}$	$99-100^{th}$
Data	0.81	0.9	4.4	11.8	82.9	12.0	24.1	33.2
Model	0.81	0.5	3.9	12.5	83.2	14.9	21.8	32.0

Table 8: Present Value of Wealth Transfers to Wealth Ratio

	Wealth Top Decile	Sub-groups in Wealth Top Decile		Fraction of the Richest 1%
		$95 \sim 99$	Top 1%	with Ratio ≤ 0.2
Data	0.18	0.22	0.13	0.87
Model	0.21	0.22	0.14	0.85

5.2.2 Untargeted Moments

Table 9 presents the distribution of transferred wealth received by households over their lifetimes. The model effectively captures a highly skewed inheritance distribution, with over half of the households not receiving any wealth transfers during their lifetimes. Simultaneously, a concentrated 10% of households holds approximately 80 – 90% of the total wealth transfers. It's noteworthy, however, that inheritances appear to be less unequally distributed in the model economy compared to empirical data. Despite this observed disparity, it is important to emphasize the primary focus of this model: specifically, the accurate representation of the low inheritance-to-wealth ratio among households in the top wealth brackets. This objective is successfully achieved, as demonstrated in Table 8.

Table 9: Wealth Transfers Distribution (%)

	Bottom 50	Next 40	Top 10
Data	0	9.4	90.6
Model	0	19.8	80.2

Notes: 1989 – 2019 SCF data.

Given that the entire top percentile wealth group is subject to estate tax, any changes in estate tax policy would directly impact this group. Therefore, it is crucial to ensure a good representation of this wealth group in the model before conducting policy counterfactuals. In this context, we examine the wealth mobility of the richest one percent. To provide a sense of realistic wealth mobility, we compare our results with the transition probabilities provided by Bach et al. (2020). Leveraging an administrative panel containing the full balance sheet of every Swedish resident between 2000 and 2007, Bach et al. (2020) calculate transition probabilities between a household's net wealth rank in 2000 and its rank in 2007, conditional on the survival of the household. The first row in Table 10 presents the transition probabilities for the richest one percent as per Bach et al. (2020). The second row reports wealth mobility in the model economy, which is very close to its empirical counterparts. Importantly, none of these statistics were targeted in our calibration exercise. Consequently, we interpret our mobility results as an additional indicator of the model's success.

Table 10: Wealth Mobility of the Richest One Percent

	Wealth Percentiles			
	Bottom 90	$P90-95$	$P95-99$	Top 1%
Data	3.1	3.4	30.1	63.3
Model	0	3.6	29.1	67.3

Notes: The first row in the table presents the transition probabilities of the richest one percent provided by Bach et al. (2020) using the Swedish administrative data between 2000 and 2007. These figures can be interpreted as follows: among households that belonged to the top one percent of the wealth distribution in 2000 and were still in existence in 2007, 3.1% were situated in the bottom 90% of the distribution in 2007. The second row shows the transition probabilities of the richest one percent over an eight-year span in our model economy.

5.3 Model Implication

This section explores an alternative model to highlight the importance of the new empirical evidence on inheritance. Unlike the benchmark model, this alternative model is calibrated to match only the aggregate moments and the earnings and wealth distributions, as presented in Tables 5, 6, and 7, consistent with previous literature. However, it is not governed by the new inheritance moments presented in Table 8. Specifically, while this model has the same basic setup as the benchmark model, it diverges in a key aspect: it assumes perfect altruism, characterized by a bequest motive parameter of $b = 1$, following Castañeda et al. (2003) and Cagetti and De Nardi (2009). In contrast, the benchmark model posits imperfect altruism, where b is identified by the new inheritance moment on the fraction of the wealthiest one percent with little inheritance. Detailed specifications and calibration results of this alternative model are available in Appendix C. Both the benchmark and the alternative models are capable of generating the highly skewed wealth distribution observed in the data, yet they yield different model implications.

Inheritance-to-Wealth Ratio Table 11 presents the proportion of wealth among the rich that can be attributed directly to wealth transfers. In the data, approximately 13% of the wealth of the richest one percent is accounted for by wealth transfers directly, whereas in the alternative model, this fraction is more than 70%. Additionaly, Figure 4 shows the number of wealth top percentile households within each inheritance-to-wealth bin, reported as a fraction of total number of wealth top one percent households. In the alternative model economy, rich households predominantly rely on inheritance, with half of the wealth top percentile receiving inheritances greater than their current wealth.

However, only about 4% of the wealth top percentile households in the data have an inheritance-to-wealth ratio greater than one, and half of the richest one percent receive no transfers over their lifetime. These observations suggest that the standard model, not governed by the new evidence on inheritance, overstates the role of inheritance in wealth accumulation among the rich.

Table 11: Present Value of Wealth Transfers to Wealth Ratio

	Wealth Top Decile	Sub-groups in Top Decile		Frac. of the Richest 1%
		$95 \sim 99$	Top 1%	with Ratio ≤ 0.2
Data	0.18	0.22	0.13	0.87
Benchmark Model	0.21	0.22	0.14	0.85
Alternative Model	0.69	0.57	0.71	0.50

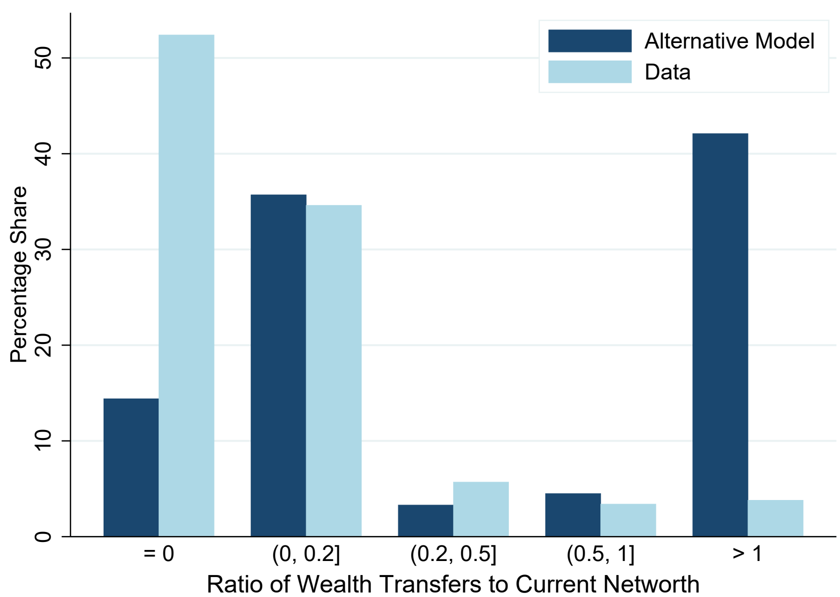

Figure 4: Share of Households in Each Inheritance-to-Wealth Ratio Category

Notes: This figure shows the number of wealth top percentile households within each inheritance-to-wealth ratio bin, reported as a fraction of total number of households in different ratio categories. Dark blue bars represent the alternative model, and light blue bars correspond to actual data. Households are categorized into five groups based on the ratio of wealth transfers received to their current net worth. The y-axis indicates the proportion of households in each category.

Source of Wealth Table 12 investigates the source among the richest one percent. In the model economy, households generally accumulate substantial wealth through two primary avenues: inheriting large wealth transfers, thus being born into the richest percentile, or achieving the highest levels of labor productivity. In the benchmark model, only around 20% of wealth top percenters inherit their status, indicating that the majority are self-made, having ascended from lower wealth ranks to the top percentile. Conversely, the alternative model demonstrates reduced wealth mobility, with nearly 45% of the wealthiest one percent originating from top-tier wealth households.

Table 12: Source of Wealth

<table>
<tr><td colspan="2" rowspan="2">Share of the Richest One Percent</td><td colspan="2">Born in a richest 1% household</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td rowspan="2">Have had the top labor state</td><td>Yes</td><td>2.4</td><td>38.0</td></tr>
<tr><td>No</td><td>20.3</td><td>39.3</td></tr>
</table>

(a) Benchmark Model

<table>
<tr><td colspan="2" rowspan="2">Share of the Richest One Percent</td><td colspan="2">Born in a richest 1% household</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td rowspan="2">Have had the top labor state</td><td>Yes</td><td>2.3</td><td>39.7</td></tr>
<tr><td>No</td><td>40.6</td><td>17.4</td></tr>
</table>

(b) Alternative Model

6 Policy Counterfactuals

In this section, we examine the effects of changing the estate tax rate. Due to the tax exemption threshold, most households are exempt from estate tax, while the entire wealth top percentile is subject to it. It is noteworthy that the top one percent hold a significant portion of total wealth. Therefore, any changes in the estate tax rate directly impact this group, affecting their saving behaviors. Such changes, in turn, could potentially generate effects on the aggregate economy and wealth inequality.

In the benchmark model, the estate tax rate is calibrated at 0.39, which is in line with the effective estate tax rate estimates reported in other studies, such as 0.35 according to Luo (2016). In our policy experiments, the tax rate is varied between 0 and 1, while the tax exemption threshold is kept at its calibrated level. The level of government expenditure is maintained as in the benchmark model. Any additional tax revenue generated is redistributed to all households through a lump-sum transfer, denoted as T, thereby maintaining the balance of the government's budget. It is noteworthy that a negative value of T effectively acts as a lump-sum tax, serving to compensate for the decrease in tax revenue.

All policy counterfactuals are conducted in a general equilibrium context, and we focus only on the steady-state comparison. The rates of return for households consist of two components: the aggregate return component, $\underline{r}$, and the excess return schedule. The aggregate return component is uniform across all households, representing the return on risk-free assets. The level of the excess return schedule is irrelevant, as the aggregate return component $\underline{r}$ adjusts for market clearing. Therefore, when changing the tax rate, we recalibrate the aggregate return component $\underline{r}$ to clear the capital market, while the excess return schedule remains unchanged from the benchmark economy.

The excess return schedule is a function of wealth groups, as presented in Table 3. In our policy counterfactuals, we maintain this schedule at the same level as in the benchmark model economy, including the use of specific threshold values for each wealth group. This means that, despite the thresholds for each wealth group shifting across various experiments due to changes in the overall wealth distribution, we consistently apply the benchmark economy threshold values for the excess return schedule. Our rationale stems from the key observation from Hubmer et al. (2020): the excess return schedule varies among households because individuals with different levels of wealth have different asset portfolios. The composition of these portfolios is directly related to the household's wealth level. Consequently, although the excess return schedule corresponds to wealth percentiles, it essentially represents a mapping from wealth levels and their corresponding asset portfolio composition. Our underlying assumption is that the wealth level determining each asset portfolio remains stable across steady states in policy experiments. Hence, we maintain the threshold values from the benchmark economy in the excess return schedule to accurately reflect the correlation between wealth levels and asset portfolio diversity.

6.1 Results

Figure 5 presents the the lump-sum transfer necessary to balance the government budget when adjusting the estate tax rate. It has a Laffer curve feature. The abolition of the estate tax necessitates the collection of a lump-sum tax from households to compensate for the loss in revenue. However, as the tax rate increases, this lump-sum tax requirement diminishes due to the decreasing deficit in estate tax revenue. Once the tax rate surpasses 0.39, the government has additional revenue from estate taxation, allowing it to provide lump-sum transfers to households. Yet, excessively high tax rates dampen the incentive for wealthy households to save, leading to a reduction in income tax revenue for the government. Consequently, the government must once again levy a lump-sum tax to maintain budget balance. The curve of lump-sum transfers reaches its apex at a tax rate of 0.7, suggesting that the optimal revenue-maximizing estate tax rate is 0.7.

The magnitude of these lump-sum transfers ranges from −0.007 to 0.003, translating to an annual value of approximately −110 to 30 dollars per year. This modest range is a consequence of the relatively minor role of estate taxes in the government's total income, contributing just 0.33% of GDP. Consequently, alterations in the estate tax rate have a limited impact on the overall balance of the government's budget.

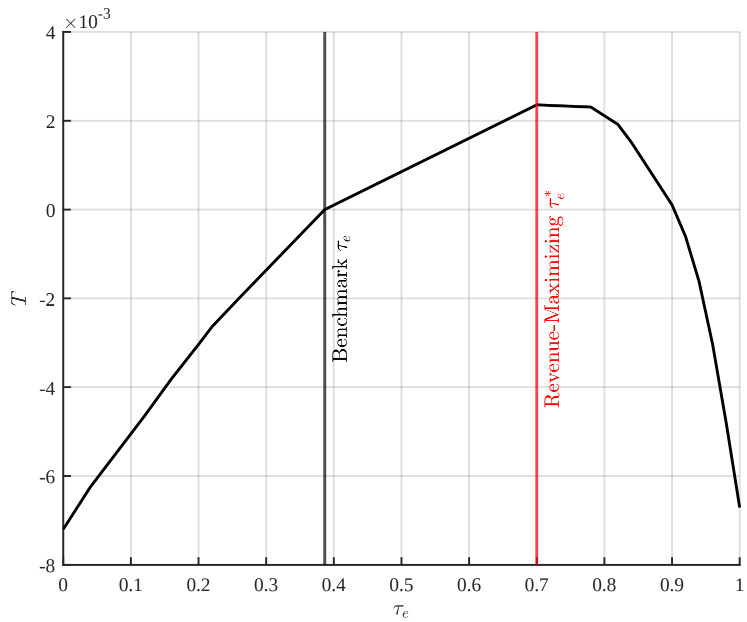

Figure 5: Lump-sum Transfers to Re-balance the Government Budget

Notes: This figure shows the lump-sum transfers required to balance the government budget in response to changes in the estate tax. In the model, these transfers fluctuate between −0.007 and 0.003 in model units. This range translates to approximately −110 to 30 USD.

Figure 6 reports the impact on aggregate economic variables as the estate tax rate varies from 0 to 1. Abolishing the estate tax increases the return to leaving inheritances for the wealthy households. This policy change results in a significant increase in the savings of the wealthy, which is sufficient to counterbalance the decline in savings by other groups due to lower interest rates. As a result, the abolition of the estate tax leads to a 2.03% increase in the aggregate capital stock (K), which in turn derives a 0.77% rise in aggregate output. Conversely, higher estate tax rates lead to lower savings among affluent households. This shift in savings behavior reduces the overall aggregate capital. In scenarios where the estate tax rate is particularly high, reaching confiscatory levels, aggregate capital experiences a decrease of 2.36%, which corresponds to a reduction in aggregate output of 0.86%.

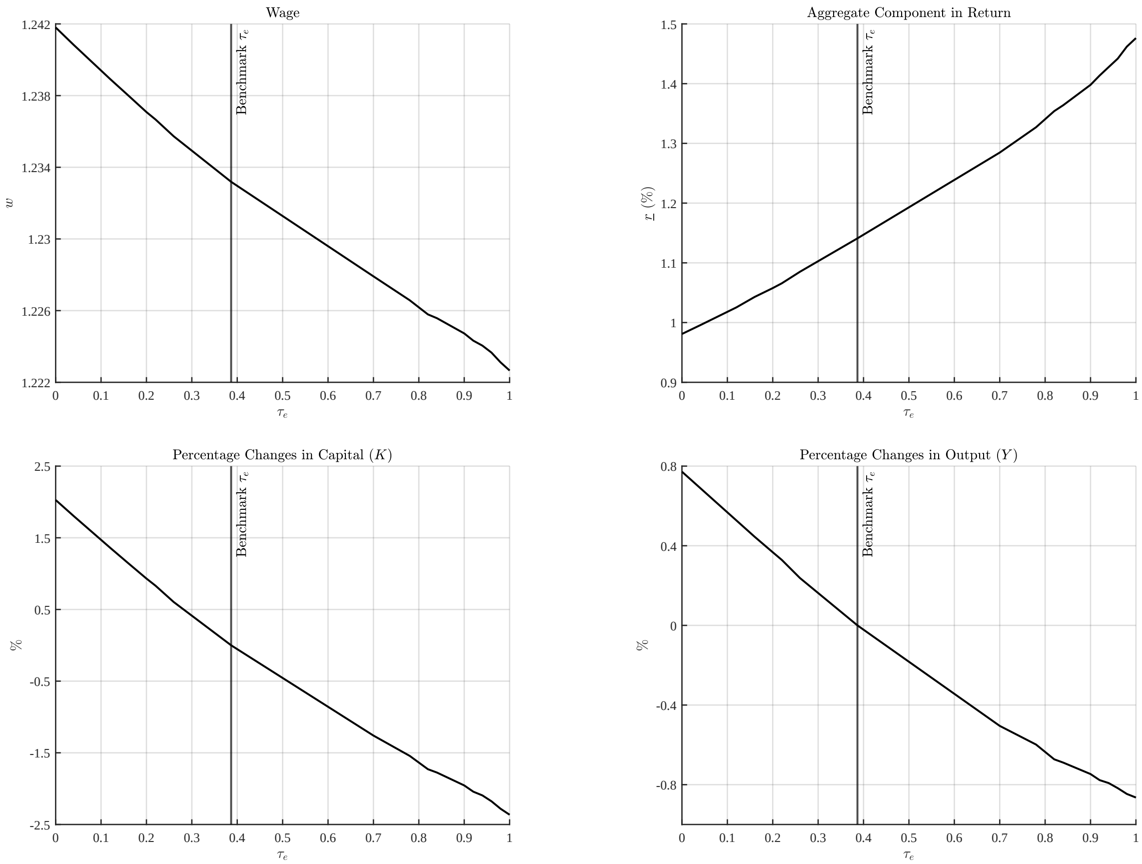

Figure 6: Aggregate Effects of Changing the Estate Tax Rate

Notes - This figure shows the aggregate effects of changing the estate tax rate while keeping the exemption value fixed at its calibrated benchmark level. The upper left panel shows the wage rate. The upper right panel is the aggregate return component, $\underline{r}$, in individual idiosyncratic asset returns schedule. It is calibrated to be 1.14% in the benchmark economy. The mean excess returns $r^X(\cdot)$ and the standard deviation of returns $\sigma^X(\cdot)$ are kept at their original level as in the benchmark economy. The two panels at the bottom are percentage changes in aggregate capital and aggregate output compared with their benchmark economy counterparts.

Turning to distributional outcomes, Figure 7 displays the Gini coefficient and the proportion of wealth held by the richest one percent as the estate tax rate varies from 0 to 1. Notably, the wealth share of the top one percent is monotonically decreasing in tax rates. In the benchmark economy, the richest one percent possesses 32.0% of total wealth. However, the abolition of the estate tax would elevate this figure, raising the top percentile's wealth share to 33.5%. Conversely, increasing the tax rate to its maximum of 1 results in a reduction of the richest one percent's wealth share to 28.5%. A similar trend is evident in the Wealth Gini coefficients, which also exhibit a decrease as the tax rate increases.

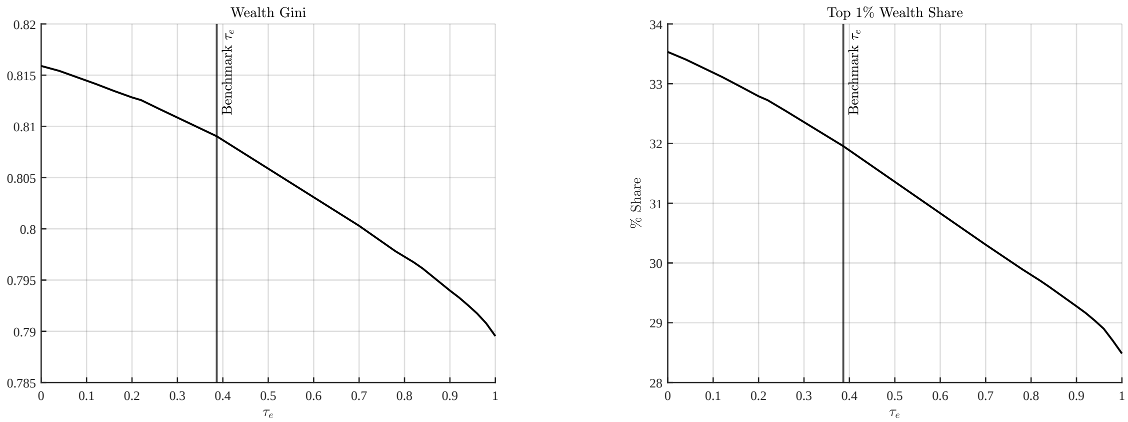

Figure 7: Distributional Effects of Changing the Estate Tax Rate

Notes - The left panned presents the wealth Gini coefficients when the estate tax rate varies from 0 to 1. The right panel shows the share of wealth held by the richest one percent. A lump-sum transfer to all households is used to re-balance the government budget when changing the tax rate.

Combining the aggregate and distributional consequences of altering estate tax rates, we find that repealing the estate tax increases both aggregate output and capital, yet it simultaneously exacerbates wealth inequality. In contrast, raising the estate tax rate yields the reverse effect. This observation aligns with the widely acknowledged perspective on the estate tax, emphasizing an inherent trade-off between equity and efficiency. A tax rate set at 1 represents the most equitable scenario achievable through estate taxation reform, resulting in a 3.4 percentage point decrease in the wealth share of the top one percent. However, this equitable adjustment incurs economic costs, including a 2.36% reduction in total capital and a 0.86% decrease in GDP.

Notably, these effects are smaller than those predicted by a model that is not calibrated to match the new evidence on inheritance. In the alternative model discussed in Section 5.3, changing the estate tax rate leads to a lump-sum transfer ranging from −400 to 510 dollars per year. A tax rate set at 1 in this alternative framework results in a substantial 7.4 percentage point decrease in the wealth share of the top one percent—more than twice the impact observed in our benchmark model. Additionally, the alternative model forecasts a more substantial decline in total capital, amounting to 6.02%, accompanied by a reduction of 2.16% in total output. A comprehensive exploration of policy counterfactual results for the alternative model is available in Appendix C.

6.2 Welfare Analysis

We compute the welfare of each new steady state using consumption equivalent variation (CEV). Following McGrattan (1994), CEV is defined as the percentage by which every newborn household's initial steady-state per-period consumption would need to be permanently increased to make them indifferent between the initial and the new steady state, with all other factors held constant. Positive values of CEV indicate a welfare gain in the new steady state, suggesting that households would not be willing to stay in the benchmark steady state unless they were compensated with additional consumption.

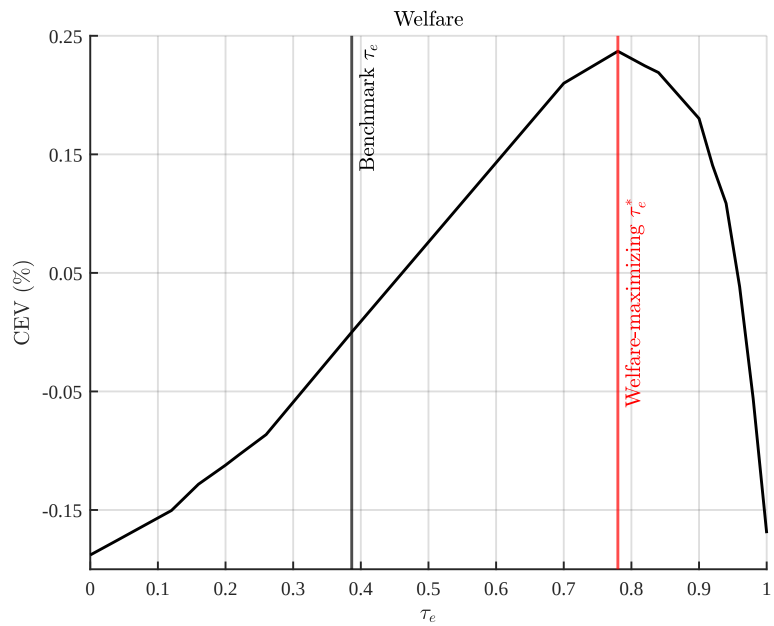

Figure 8: Welfare Effects of Changing the Estate Tax Rate

Notes: Welfare is calculated using consumption equivalent variation (CEV), which is defined as the percentage by which every newborn's initial steady-state per-period consumption would have to be permanently increased to be indifferent between the initial and the new steady state, keeping everything else constant. Positive values of CEV indicate a welfare gain in the new steady state, while negative values imply welfare loss.

Figure 8 illustrates the CEV for estate tax rates ranging from 0 to 1. The welfare changes resulting from the tax reforms are small. Even in the best-case scenario, where the CEV reaches its peak, newborns in the benchmark would only need to increase their consumption by 0.24% to be indifferent to the new steady state. However, the welfare impact of estate tax reforms is more pronounced in the alternative model, which is not governed by the new moments on inheritance. The CEV in the alternative model spans from −1.13% to 2.14%, indicating that the maximized welfare in the alternative model is nearly tenfold the maximized welfare gains observed in our benchmark model. The complete welfare analysis for the alternative model is provided in Appendix C.

The estate tax rate that maximizes welfare is 0.78. Raising the estate tax rate to its welfare-maximizing level leads to reductions in total capital, labor supply, and output. This response is shaped by two crucial channels: the direct effects of the tax increase on incentives to work and save, and the indirect effects through adjustments in general equilibrium prices. Table 13 details the changes in aggregate variables when the estate tax rate is set at its welfare-maximizing level for both the general equilibrium and partial equilibrium cases.

Table 13: Aggregate Effects Under the Welfare-Maximizing Estate Tax Rate

	T	K	N	L	Y
Partial Equilibrium	−0.004	−4.04%	+0.28%	+0.23%	−1.37%
General Equilibrium	+0.002	−1.54%	−0.13%	−0.06%	−0.60%

Notes: This table presents the lump-sum transfer T and percentage changes of various macro aggregates when increasing the estate tax rate to 0.78. K is the aggregate capital stock. N is the hours worked, and L is the efficient labor supply, which is the working hour multiplied by labor productivity. Y is the total output produced by K and L.

The first row in Table 13 shows the changes in aggregate variables when the tax rate is increased to 0.78, with prices held constant at their benchmark level. The second row presents the general equilibrium case, where prices adjust to clear capital and labor markets. At a tax rate of 0.78, wealthy households bear a substantial cost in leaving bequests. In the partial equilibrium case, the rich are exclusively impacted by the high tax rate as there is no accompanying price adjustment. Consequently, the affluent, particularly the elderly with significant wealth, reduce their savings, leading to a 4.04% reduction in the aggregate capital stock. This reduction in capital results in lower income tax revenue for the government. Therefore, despite the elevated estate tax rate, the government still necessitates a lump-sum tax to maintain a balanced budget. As labor supply is decreasing in wealth in this model, a lower saving rate among the rich makes them relatively poorer, prompting them to supply more labor. Additionally, in the partial equilibrium case, lower-income households also increase their labor supply to offset the loss from the lump-sum tax. Given that lower-income households typically exhibit lower working productivity, the increase in efficient labor units (L) is less than that in working hours (N).

In the general equilibrium case, prices begin to adjust, leading to a higher rate of return and lower wages. The elevated interest rate partially mitigates the drop in capital. However, the lower wage prompts a decrease in labor supply from the poor, who constitute a larger share of the economy. Consequently, the additional working time supplied by the wealthy fails to compensate for the overall reduction in the total working time of the poor, resulting in a 0.13% decrease in aggregate labor (N). Nevertheless, due to the higher productivity of the rich, the decline in efficient labor units (L) is relatively modest, amounting to only 0.06%.

Underlying these aggregate movements are the responses of households in the economy to the tax changes and the subsequent adjustments in general equilibrium prices. Households' reactions vary by productivity and wealth holding, resulting in a substantial degree of heterogeneity in welfare gains. How are the welfare gains distributed across the entire population? Figure 9 illustrates the average welfare change for each demographic and productivity group when the estate tax rate is set at the welfare-maximizing level, 0.78. Each demographic state has three phases, and there are four productivity states in the benchmark economy. s_4 is the highest productivity state, which is more than 100 times as high as s_3. Once a household reaches s_4, it becomes the wealthiest one percent in the model economy and is subject to the estate tax.

When the estate tax rate is set at the welfare-maximizing level, 0.78, the interest rate increases, and wages decrease compared to the benchmark steady state. Additionally, the higher estate tax rate is accompanied by a lump-sum transfer to every household. In this scenario, most households experience a welfare gain. The upper panel of Figure 9 shows the CEV for young households, revealing that, in general, they benefit from the high estate tax rate. Notably, young households in the first phase with the lowest productivity (s_1) enjoy a small welfare gain of 0.04%. These young households, having spent a relatively short time in the model economy, have not yet accumulated sufficient wealth to take advantage of the high interest rate. Households with the top labor state represent the highest wealth holders in the model economy. Consequently, they experience a welfare loss due to the high estate tax rate. However, this loss is minimal, nearly negligible (−0.003%), for the first-phase high-productivity young households, as they are still far from leaving a bequest.

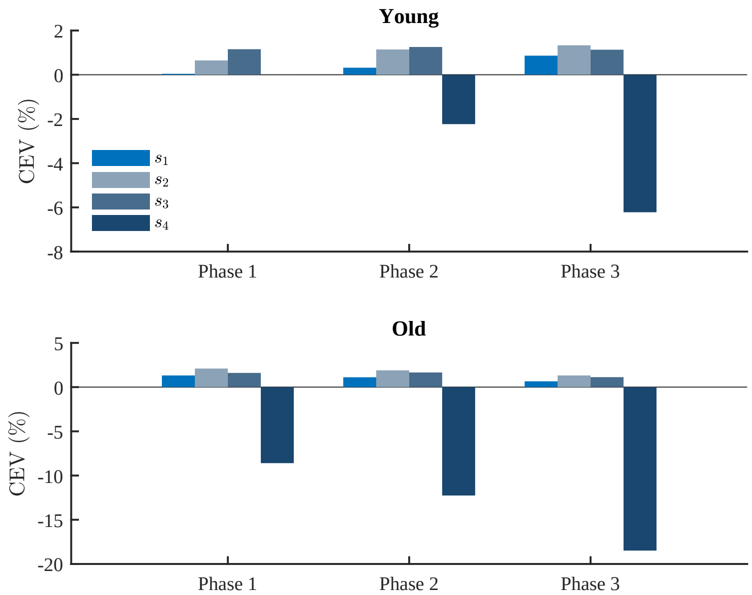

Figure 9: Welfare Gain/Loss by Demographic and Productivity

Notes: This figure shows welfare gains and losses for each demographic and productivity group when the estate tax rate is set at the welfare-maximizing level, 0.78. The welfare costs and benefits are expressed in terms of consumption equivalent variation (CEV). There are three phases in each demographic state. s_1 is the lowest labor productivity state, whereas s_4 is the highest labor state.

The bottom panel of Figure 9 displays the CEV for old households. Although all old households are retirees and do not work in our model, we keep track of their labor productivity in their last working period. Hence, the s_1 old household in Figure 9 denotes that the last productivity realization of this household is s_1. Given that old households do not supply labor, and their pensions remain fixed at the benchmark level by design, they are not affected by changes in wages. All the s_1, s_2, and s_3 old households are better off due to the high interest rate and the lump-sum transfer. Conversely, s_4 households suffer from a significant welfare loss as they are the ones subject to the tax upon their demise. Wealthy old households in phase 3 experience the largest welfare loss, which is around −20%, primarily because they are on the verge of being affected by the high estate tax rate.

6.3 Comparison with Top Income Taxation

The above discussion shows the equity-efficiency trade-off as well as the welfare effect of the estate tax. To provide a more comprehensive understanding of the efficacy of estate taxation as a policy tool for reducing wealth inequality, this section aims to explore whether there exists a more effective method of wealth redistribution than the estate tax.

In pursuit of this objective, in this section, we adjust the top marginal income tax rate to a level that can yield a comparable wealth share for the top one percent as when estates are fully taxed. Then, we quantify the impact of the change in the income tax and compare it with the effect of setting the estate tax rate at 1. It is important to clarify that the goal of this section is not to identify the most effective tax with the most favorable equity-efficiency trade-off. Rather, the objective of this section is to demonstrate that, compared with other major tax reforms, such as the progressive income tax, estate taxation proves to be a less effective method for wealth redistribution. The same level of equity can be achieved with a lower output loss and a higher welfare gain using tax policies other than the estate tax.

The progressive income tax system in the benchmark economy is given by $\tau_y(y) = \tau_1[y-(y^{-\tau_2}+\tau_3)^{(-1/\tau_2)}]$. Here, y is the pre-tax ordinary gross income, and (τ_1, τ_2, τ_3) are tax parameters. In the policy experiment, we modify the tax code according to the following formulation:

$$\tau_y(y) = \begin{cases} \tau_1[y-(y^{-\tau_2}+\tau_3)^{(-1/\tau_2)}] & \text{if } y < y_H \\ \tau_1[y-(y^{-\tau_2}+\tau_3)^{(-1/\tau_2)}] + \tilde{\tau}(y-y_H) & \text{if } y \geq y_H \end{cases} \tag{13}$$

where y_H is the cutoff value for the top 1% income. Consequently, the marginal tax rate for top incomes is given by:

$$\tau_y'(y) = \frac{\partial \tau_y(y)}{\partial y} = \tau_1(1-(1+\tau_3 y^{\tau_2})^{-1/\tau_2-1}) + \tilde{\tau} \tag{14}$$

We fix (τ_1, τ_2, τ_3) at their benchmark level and determine the value of $\tilde{\tau}$ that generates an equivalent level of wealth inequality as observed with a confiscatory estate tax rate. A lump-sum transfer is used to re-balance the government budget.

Setting $\tilde{\tau}$ at 0.25 results in a decline in the wealth share of the top one percent to 28.5%, mirroring the reduction achieved by fully taxing estates. However, as presented in Table 14, the effects on the aggregate economy from the two tax policy changes are quite different. With an estate tax rate set at 1, the most significant impact is felt by wealthy old households. Consequently, the reduction in total capital primarily originates from the older demographic. On the other hand, the young experience only a mild tax effect, resulting in a limited increase in efficient labor supply denoted as L. The 2.36% decrease in capital, coupled with a modest increase in efficient labor units, contributes to an overall reduction of 0.86% in total output. Additionally, this estate tax reform results in a welfare loss of −0.17%.

Table 14: Comparison Between the Estate Taxation and the Top Income Taxation

	T	K	N	L	Y	CEV	Top Wealth Share
$\tau_e = 1$	−0.007	−2.36%	−0.02%	−0.01%	−0.86%	−0.17%	28.5%
$\tilde{\tau} = 0.25$	0.155	−4.48%	−3.50%	+1.44%	−0.73%	+7.03%	28.5%

Notes: This table presents the lump-sum transfer T and percentage changes of various macro aggregates when increasing the estate tax rate to 1 and when having an additional top marginal income tax rate of 25%. N is the hours worked, and L is the efficient labor units. Thus, L is the working hours multiplied by working productivity.

In the scenario of increasing the top marginal income tax rate, both wealthy young and old households are impacted. They reduce their savings, causing a more substantial decline in aggregate capital. While all other young households work less due to the lower wage, the most productive young individuals (workers with s_4) increase their labor supply. Consequently, the resulting efficient labor units denoted as L experience a 1.44% increase, despite the overall decrease in total working time N. Moreover, the increased efficient labor supply mitigates the reduction in capital, resulting in a decrease in total output of 0.73%. From a welfare perspective, a higher top marginal income tax rate generates a substantial welfare gain of 7.03%.

In Table 14, the comparison between estate tax and income tax makes it evident that for similar distributional impacts, the estate tax incurs a higher output cost and yields a lower welfare gain compared to the income tax. Despite directly targeting the wealthy, the estate tax proves less efficient in wealth redistribution than other major tax policies, such as top income taxation. This finding highlights the limited efficacy of the estate tax in achieving wealth equity.

7 Conclusion

In this paper, we study the efficiency and distributional implications of estate taxation within a quantitative framework. The model employed is capable of generating the highly skewed wealth distribution. Furthermore, the role of intergenerational wealth transfers in wealth accumulation for the rich in this model is disciplined by the new empirical findings from the data.

Two key findings emerge. First, on the empirical front, the paper documents new evidence on inheritances, indicating that while intergenerational wealth transfers are concentrated in affluent households, their relative importance is less significant for wealthy heirs, as they inherit less compared to their wealth. Second, from a policy standpoint, several experiments are conducted within the calibrated model framework. Estate taxation introduces a trade-off between equity and efficiency: an increase in the estate tax rate reduces wealth concentration at the top but is accompanied by a decline in total output. The optimal welfare-maximizing estate tax rate is found to be 0.78, with a limited welfare gain reaching a maximum of 0.24%. In comparison with other major tax reforms, such as top income taxation, changing the top marginal income tax rate can achieve similar distributional effects with lower costs and substantial welfare gains. This suggests that not only in terms of the equity-efficiency trade-off but also from a welfare perspective, the estate tax proves to be an ineffective policy tool for reducing wealth inequality.

The main focus of this paper is on the value of wealth transfers received by the rich, and our findings indicate that this value tends to be small relative to the overall wealth of the rich. While there are other possibilities that could be important in shaping wealth inequality but make inheritance appear small in value, these aspects are not addressed in this paper. An example is wealth transfers taking the form of human capital investment, such as college tuition payments. Although not reflected in the traditional value of inheritance received by descendants, these investments may contribute to the children's affluence, potentially leading to greater wealth dispersion in the future. Exploring these indirect links is an interesting avenue for future research, but it falls beyond the scope of this paper. The primary goal here is to develop a model calibrated to match these new moments on the direct link between inheritance and wealth and to study the implications of estate taxation in this model.

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Appendices

A SCF Data

We obtained data for earnings and wealth distributions, as well as intergenerational wealth transmission statistics, from the Survey of Consumer Finances (SCF). The regular SCF cross-sectional surveys are conducted every three years to provide detailed information on the finances of U.S. families.

Household wealth is defined as the net worth of a household, calculated by deducting the current value of all marketable assets from the current value of debts. Assets include both financial and nonfinancial assets. Financial assets consist of liquid assets, certificates of deposit, directly held pooled investment funds, bonds, stocks, quasi-liquid retirement assets, whole life insurance, other managed assets, and additional financial instruments. Nonfinancial assets include vehicles, houses, businesses, and other tangible assets. Total liabilities constitute the sum of mortgage debt, consumer debt, and any other outstanding debts.

The SCF additionally provides details on bequests and gifts received by individual households, with the data collected retrospectively. Households are asked to record the amount of the transfer they received, the year when it was received, and the nature of the transfer (bequest or inter vivos). The survey also queries interviewees about their expectations regarding substantial transfers in the future. To analyze the cumulative inheritance a household might receive over a lifetime, we concentrate on households that are at least 60 years old and indicate that they do not expect to receive substantial wealth transfers in the future.

In the main text, we argue that many of the rich received relatively small transfers. To have a notion of *small*, additional statistics are computed and presented in Table 15. Using 2019 SCF, Kuhn and Rios-Rull (2020) report that the average earnings for the entire economy amount to $\$77,800$. Using this average earnings figure as a benchmark, we find that only 44% of the top one percent by wealth received transfers surpassing this amount. This suggests that over half of the top one percent either inherited nothing or received an inheritance smaller than the average earnings of the overall economy.

Guvenen et al. (2022) estimate the threshold value for the 99^{th} percentile of the lifetime earnings distribution to be $\$9,335,650$. Taking the lifetime earnings of the top one percent earners as a proxy for earnings of the top one percent by wealth, we find that less than

25% of the super-rich inherited more than 10% of the lifetime earnings of a typical top one percent by lifetime earnings. This indicates that a substantial portion of the top one percent by wealth inherited only a relatively small fraction of their lifetime resources. Moreover, using the cutoff value for the top one percentile of the wealth distribution as a criterion for what is considered *small*, only 27% of the top one percent by wealth received wealth transfers greater than one-tenth of the cutoff value for the 99^{th} percentile of the wealth distribution.

Table 15: Fraction of the Richest One Percent

Wealth transfer > average earnings of the whole economy	44%
Wealth transfer > 0.1×cutoff for the 99^{th} percentile of lifetime earnings distribution	24%
Wealth transfer > 0.1× wealth top percentile cutoff value	27%

Notes: 1989 ∼ 2019 SCF data. This table shows the percentage share of households in the top one percent of wealth distribution who are at least 60 years old and do not expect to receive a substantial inheritance or transfer of assets in the future and with wealth transfers that satisfy the requirement.

B Transition of Earning Ability between Old and Young

Let p_{ij} denote the probability of a descendant's first draw of productivity being s_j when the realization of efficiency labor units that their deceased parent faced during the last working period is s_i. $p*$ is the stationary distribution of labor efficiency endowments. Following Castañeda et al. (2003), p_{ij} is computed in two steps.

Step 1:

$$
\begin{aligned}
p_{11} &= p_1 * + \phi_1 p_2 * + \phi_1^2 p_3 * + \phi_1^3 p_4 * \\
p_{12} &= (1-\phi_1)(p_2 * + \phi_1 p_3 * + \phi_1^2 p_4 *) \\
p_{13} &= (1-\phi_1)(p_3 * + \phi_1 p_4 *) \\
p_{14} &= (1-\phi_1) p_4 * \\
p_{21} &= (1-\phi_1) p_1 * \\
p_{22} &= \phi_1 p_1 * + p_2 * + \phi_1 p_3 * + \phi_1^2 p_4 * \\
p_{23} &= (1-\phi_1)(p_3 * + \phi_1 p_4 *) \\
p_{24} &= (1-\phi_1) p_4 *
\end{aligned}
$$

$$
\begin{aligned}
p_{31} &= (1-\phi_1)p_1* \\
p_{32} &= (1-\phi_1)(\phi_1 p_1 * + p_2*) \\
p_{33} &= \phi_1^2 p_1 * + \phi_1 p_2 * + p_3 * + \phi_1 p_4* \\
p_{34} &= (1-\phi_1)p_4* \\
p_{41} &= (1-\phi_1)p_1* \\
p_{42} &= (1-\phi_1)(\phi_1 p_1 * + p_2*) \\
p_{43} &= (1-\phi_1)(\phi_1^2 p_1 * + \phi_1 p_2 * + p_3*) \\
p_{44} &= \phi_1^3 p_1 * + \phi_1^2 p_2 * + \phi_1 p_3 * + p_4*
\end{aligned}
$$

Step 2: For $i = 1, 2, 3, 4$

$$
\begin{aligned}
p_{i1} &= p_{i1} + \phi_2 p_{i2} + \phi_2^2 p_{i3} + \phi_2^3 p_{i4} \\
p_{i2} &= (1-\phi_2)(p_{i2} + \phi_2 p_{i3} + \phi_2^2 p_{i4}) \\
p_{i3} &= (1-\phi_2)(p_{i3} + \phi_2 p_{i4}) \\
p_{i4} &= (1-\phi_2)p_{i4}
\end{aligned}
$$

C Alternative Model

This section presents the alternative model, which closely resembles the benchmark model in its basic setup. The primary distinction lies in the fact that the alternative model is characterized by *perfect altruism* ($b = 1$). The alternative model is calibrated solely to replicate the aggregate moments, as well as the earnings and wealth distributions.

Unlike the benchmark model, where the bequest motive parameter is determined by one of the new empirical moments on inheritance, the alternative model is not calibrated with these specific moments. If we were to adhere to the imperfect altruism assumption in the alternative model, the bequest motive parameter would remain unidentified. Therefore, we opt for the assumption of perfect altruism, following Castañeda et al. (2003) and Cagetti and De Nardi (2009).

C.1 Calibration

The alternative model has the same set of exogenously imposed parameters as the benchmark model. The identification strategy for the jointly calibrated parameters follows the methodology employed in the benchmark model. Table 16 presents the parameters that are jointly calibrated in the equilibrium. Calibration results are detailed in Tables 17, 18, and 19. This model framework can generate the key features of the US economy and effectively produce realistically skewed distributions for both wealth and earnings.

Table 16: Parameters Calibrated (Jointly) Inside the Alternative Model

	Parameter	Value
Preferences		
Weight of disutility of labor	χ	1.999
Discount factor	β	0.925
Earning Process		
Labor efficiency	$[s_2, \quad s_3, \quad s_4]$	[3.07, 10.15, 1033.1]
Transition probabilities	$[p_{12}, p_{13}, p_{14}$	[0.022, 0.003, 0.000
	p_{21}, p_{23}, p_{24}	0.025, 0.004, 0.000
	p_{31}, p_{32}, p_{34}	0.017, 0.002, 0.001
	$p_{41}, p_{42}, p_{43}]$	0.124, 0.003, 0.088]
Earnings life-cycle controller	ϕ_1	0.969
Intergenerational earnings persistence controller	ϕ_2	0.525
Government		
Income tax parameter	τ_3	0.226
Estate tax exemption level	$\underline{z}$	52.543
Estate tax rate	τ_4	0.286
Lump-sum transfer to retiree	$\overline{\tau}$	0.680

Table 17: Values of the Targeted Ratios and Aggregates in the U.S. and in the Alternative Model

Target	Source	Data	Model
Average hours worked	McGrattan and Rogerson (2004)	0.3	0.30
Ratio of capital to annual output	BEA	3	3.00
The ratio of average earnings of senior workers to those of new junior workers	Castañeda et al. (2003)	1.3	1.20
The cross-sectional correlation between average lifetime earnings of father and son	Castañeda et al. (2003)	0.4	0.36
Average effective federal income tax rate	IRS (2000-2004)	0.11	0.11
Aggregate transfers to output ratio	Congressional Budget Office (2000-2004)	0.05	0.04
Ratio of estate tax revenues to GDP	Gale and Slemrod (2001)	0.33%	0.33%
Fraction of estates that pay estate taxes	Gale and Slemrod (2001)	0.02	0.02

Table 18: Earnings Distribution (%) in the Alternative Model

		Quintile				Top Groups (Percentile)		
	Gini	$1^{st}+2^{nd}$	3^{rd}	4^{th}	5^{th}	$90-95^{th}$	$95-99^{th}$	$99-100^{th}$
Data	0.62	4.3	12.1	21.7	61.8	12.2	15.7	16.5
Model	0.61	6.2	12.1	21.7	60.7	11.9	17.0	15.5

Table 19: Wealth Distribution (%) in the Alternative Model

		Quintile				Top Groups (Percentile)		
	Gini	$1^{st}+2^{nd}$	3^{rd}	4^{th}	5^{th}	$90-95^{th}$	$95-99^{th}$	$99-100^{th}$
Data	0.81	0.9	4.4	11.8	82.9	12.0	24.1	33.2
Model	0.79	0.8	4.7	13.6	80.9	14.2	18.8	33.5

C.2 Policy Experiment

In this section, we perform a policy experiment within the alternative model framework, similar to the one conducted in the benchmark model: we change the estate tax rate while maintaining the exemption level at its calibrated value. Additionally, the extra tax revenue is redistributed through a lump-sum transfer to all households (T) to restore government budget balance. The policy experiment is conducted in general equilibrium.

Figure 10 illustrates the aggregate effects on the economy, while Figure 11 presents the distributional effects. Additionally, Figure 12 depicts the welfare changes when altering the estate tax rate from 0 to 1 within the calibrated alternative framework. In the alternative model economy, a higher estate tax rate contributes to improved equality, with the share of wealth held by the wealthiest one percent decreasing from 34.5% to 26.1% as the estate tax rate goes from 0 to 1. This reduction is more substantial than observed in the benchmark economy. The estate tax rate that maximizes welfare is 0.8. Notably, the maximized welfare in the comparison model economy exceeds 2%, a significantly larger welfare gain compared to the benchmark model, which is only 0.24%.

Changes in estate tax policy within the alternative model yield more pronounced effects on the overall economy. The disparity in the impact of estate taxation reform between the alternative framework and the benchmark model can be attributed to the following rationale. The benchmark model is calibrated to align with the distributions of earnings, wealth, and empirical findings on inheritances received by the rich. In this economy, inheritance is not the primary mechanism driving wealth concentration. Only about 20% of the top one percent of wealth holders are born into affluent households, as shown in Table 12. Additionally, households in the benchmark model have a weak incentive to leave a bequest (bequest motive parameter $b = 0.2$). Consequently, changes in the estate tax do not significantly influence the wealth holdings of the majority of the rich. In contrast, in the alternative model, the role of inheritances in wealth accumulation is important. Given that wealth accumulation for the rich in this model depends on inheritances, their behavior is more affected by alterations in the estate tax rate than in the benchmark model.

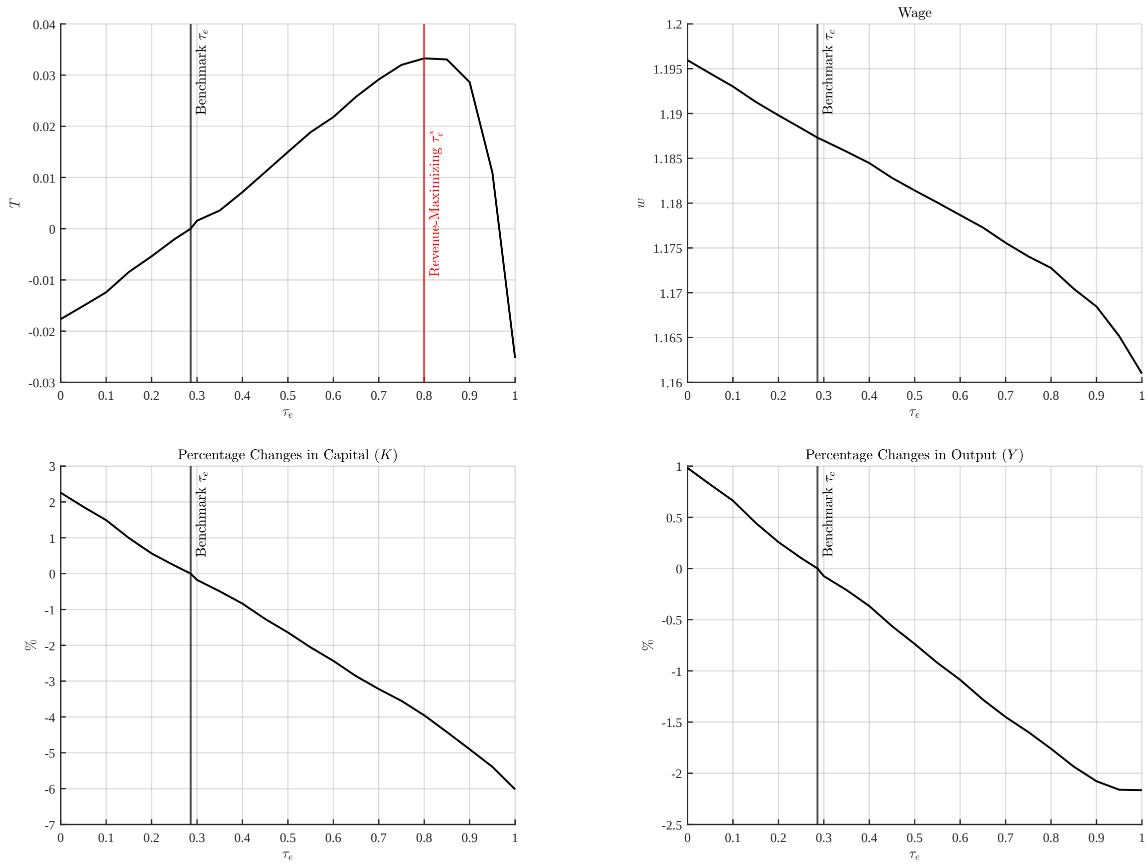

Figure 10: Aggregate Effects of Changing the Estate Tax Rate in the Alternative Model

Notes - This figure shows the aggregate effects of changing the estate tax rate while keeping the exemption value fixed at its calibrated benchmark level. The upper left panel shows the lump-sum transfer that is used to re-balance the government budget. The upper right panel is the wage rate. The two panels at the bottom are percentage changes in aggregate capital and aggregate output compared with their benchmark economy counterparts.

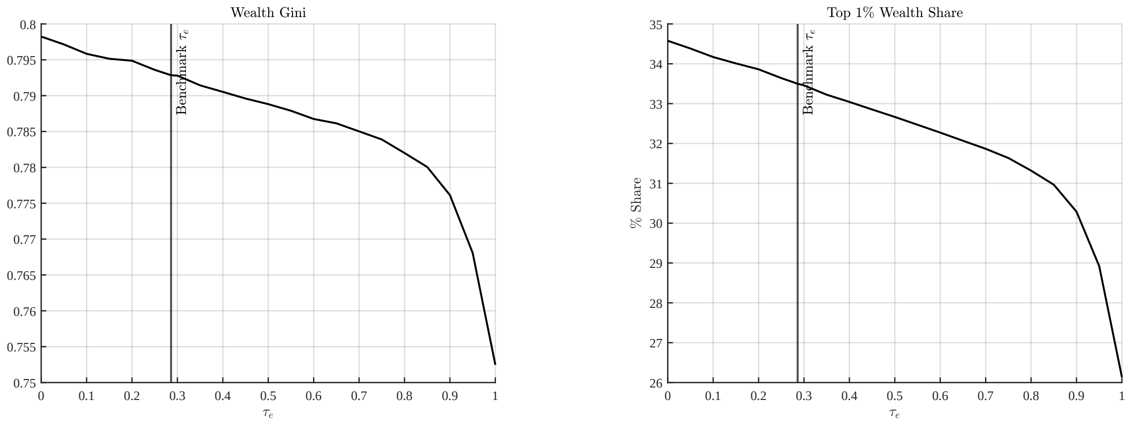

Figure 11: Distributional Effects of Changing the Estate Tax Rate in the Alternative Model

Notes - The left panned presents the wealth Gini coefficients when the estate tax rate varies from 0 to 1. The right panel shows the share of wealth held by the richest one percent. A lump-sum transfer to all households is used to re-balance the government budget when changing the tax rate.

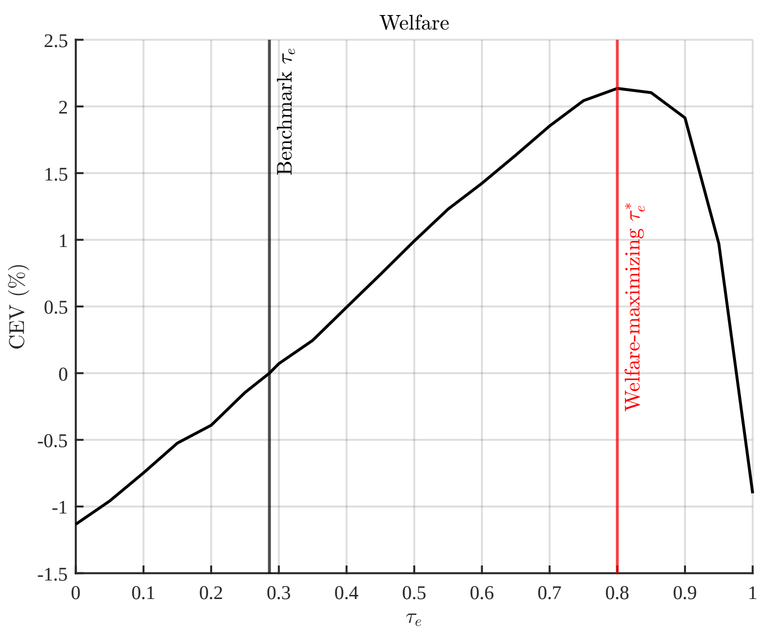

Figure 12: Welfare Effects of Changing the Estate Tax Rate in the Alternative Model

Notes: Welfare is calculated using consumption equivalent variation (CEV), which is defined as the percentage by which every newborn's initial steady-state per-period consumption would have to be permanently increased to be indifferent between the initial and the new steady state, keeping everything else constant. Positive values of CEV indicate a welfare gain in the new steady state, while negative values imply welfare loss.

D Welfare

D.1 Consumption Equivalent Variation (CEV)

Following Heer and Trede (2003), aggregate welfare W is defined as the aggregate lifetime utility:

$$
\begin{aligned}
W &= \int V(x) d\Lambda^*(x) \\
&= \int \mathbb{E}_0 \Big[\sum_{t=0}^{\infty} \beta_i^t u(c_t, \iota - l_t) \Big] d\Lambda^*(x) \\
&= \int \mathbb{E}_0 \Big[\sum_{t=0}^{\infty} \beta_i^t \Big(\frac{(c_t^*)^{1-\sigma_1}}{1-\sigma_1} + \chi \frac{(\iota - l_t^*)^{1-\sigma_2}}{1-\sigma_2} \Big) \Big] d\Lambda^*(x)
\end{aligned} \tag{15}
$$

Policy functions in steady state of the benchmark economy are marked with an asterisk. x is the state vector for a newborn household. Λ^* is the stationary distribution over newborn household types in the benchmark economy.

Welfare in the new steady state is denoted by $\tilde{W}$. The CEV is defined as the percentage (Δ^{CEV}) by which benchmark consumption c^* has to be increased to make a newborn household indifferent between the two steady states. Therefore,

$$
\begin{aligned}
\tilde{W} &= W(\Delta^{CEV}) \\
&= \int \mathbb{E}_0 \Big[\sum_{t=0}^{\infty} \beta_i^t \Big(\frac{((1+\Delta^{CEV}) c_t^*)^{1-\sigma_1}}{1-\sigma_1} + \chi \frac{(\iota - l_t^*)^{1-\sigma_2}}{1-\sigma_2} \Big) \Big] d\Lambda^*(x)
\end{aligned} \tag{16}
$$

The expression for the CEV can be obtained by rearranging the equation above.

$$
\Delta^{CEV} = \Bigg[\frac{\tilde{W} - W}{\int \mathbb{E}_0 \Big[\sum_{t=0}^{\infty} \beta_i^t \frac{(c_t^*)^{1-\sigma_1}}{1-\sigma_1} \Big] d\Lambda^*(x)} + 1 \Bigg]^{\frac{1}{1-\sigma_1}} - 1 \tag{17}
$$