Unintended Effects of Estate Taxation on Wealth Inequality

Mi Luo*

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Abstract: Intergenerational wealth transmission occurs not only at the end of life (bequests) but also throughout the life cycle (inter-vivos transfers). This paper documents that bequests are largely accidental, and inter-vivos transfers are intentional and negatively correlated with the recipient’s current income. This paper builds and estimates a general-equilibrium life-cycle model of intergenerational wealth transfers, where parents potentially value inter-vivos transfers differently from bequests. The model renders a response in inter-vivos transfers to estate tax changes close to the data. Under the current U.S. tax codes, increasing the estate tax does not necessarily reduce top wealth inequality. Instead, it could potentially increase inequality with a sufficiently strong response in inter-vivos transfers. Such a response is partly caused by differential tax treatment between inter-vivos transfers and bequests, and partly amplified by the wealthier people responding more due to the preference curvature for both transfers.

Key words: bequests, inter-vivos transfers, estate tax, wealth inequality

JEL codes: D14, E21, E24, H31

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1 Introduction

Estate taxation policy in the United States has experienced various changes historically, reflecting the public’s concern about increasing wealth inequality, and the policy debate around the equity versus efficiency trade-off. In the theoretical literature, various models reach inconclusive implications for optimal estate taxation (Farhi and Werning, 2010; Piketty and Saez, 2013). To understand the effects of estate taxes on (top) wealth inequality requires starting with tackling the underlying motives for people to transfer wealth across generations. This paper fills this gap by zooming in on intergenerational wealth transmission throughout the life cycle.

There are two main objectives. The first is to characterize the salient features of intergenerational wealth transmission at different points in life. I categorize these transfers into two groups: inter-vivos transfers scattered throughout the life cycle between a living parent and a living child, and bequests that happen at the very end of a parent’s life. These features guide my modeling assumptions for the underlying preferences motivating transfers. I then build and estimate a general-equilibrium dynamic model that explicitly allows for inter-vivos transfers and bequests from parent to child, thus producing features that are consistent with the data. The second objective of the paper is to quantify the effects of alternative estate taxation policies under the estimated framework.

I first present two empirical facts that suggest there are different preferences for inter-vivos transfers and bequests. On the one hand, inter-vivos transfers are intentional and driven by the underlying financial needs of the recipients. I show evidence from new data from a sample of wealthy Vanguard clients and traditional sources representative of the U.S. elderly population, such as the Health and Retirement Study (HRS). Parents are consistently making more transfers to recipients they expect to do worse, in other words, recipients with lower current income. On the other hand, bequests are largely accidental, and the bequest saving motive is dominated by other precautionary saving motives during old age. This finding is supported by revealed-preference evidence with people stating that saving for
long-term care (as an example) has a higher priority than bequests.

I use these facts to motivate a general-equilibrium life-cycle consumption-savings model with an overlapping generation structure. The model features warm-glow utility from not only bequests, but also inter-vivos transfers, and the warm glow can be potentially “directed” toward lower-income recipients. Parents with such utility make optimal choices regarding wealth transfers to their children each period. The advantage of the warm-glow utility in both cases allows me to solve both parents’ and children’s saving decisions easily, without entering a strategic game between the two. There are three saving motives for the parent, corresponding to the realistic old-age risks featured in the model: a precautionary saving motive for uncertain but lumpy long-term care expenses, a precautionary saving motive for helping with financial need in the family through inter-vivos transfers, and a bequest saving motive. I estimate the model through the Method of Simulated Moments (MSM) by matching wealth distribution moments, wealth mobility moments, and informative bequest and inter-vivos transfer moments. Counterfactual exercises show that the bequest motive is indeed relatively weaker compared with the precautionary transfer saving motive, consistent with the motivating facts.

I use the model to quantify the effects of estate taxation on wealth inequality, the second objective of this paper. There are two steps. The first step is to use the plausibly exogenous variation in the estate tax exemption level changes in U.S. history to calculate the response of inter-vivos transfers for the marginal group of households relative to their counterparts. The marginal group refers to those with net worth higher than the old exemption level but lower than the new one; in other words, the marginal group is those who previously paid estate taxes but no longer do so. I analyze this response by comparing the empirical data with the results of the simulated model, and find that the likelihood of making transfers decreases by about 9 percent in the data and 5 percent in the model.

Then I conduct two larger-scale estate tax policy experiments that are absent from the real world, and examine the effects on top wealth inequality. In the baseline experiment
where I vary the marginal estate tax rate with the estimated baseline model, the top 1 percent
wealth share before any redistribution displays a U-shaped curve against the increasing tax
rate. When the tax rate is low, increasing it mechanically reduces the wealth accumulation
of the wealthiest. When the tax rate is high enough, inter-vivos transfers kick in with
the increasing tax, for two reasons. One reason is the tax advantage of the inter-vivos
transfers with an effective lower rate, and this tax differential is multiplied by the curvature
in the warm-glow utility from both bequests and inter-vivos transfers as the second reason.
Wealthier people respond more as the difference between their marginal utility from bequests
versus inter-vivos transfers is larger with the increasing tax rate. However, the rebound in
the top wealth share is not large, as inter-vivos transfers are “re-distributing” in the sense
that they are targeted toward lower-income recipients.

In the counterfactual experiment where I vary the marginal tax rate in a model without
the inter-vivos transfer channel, the share of the wealthiest 1 percent decreases monotonically
with the increasing tax rate. This sharp contrast highlights the importance of taking into
account the possibility of inter-vivos transfers when studying the effects of estate taxation
on wealth inequality.

**Related literature** I make contributions to three strands of related literature. The
uniqueness of the paper is to knit together the pursuit of deeper understanding of old-age risks
with the traditional macroeconomic models studying the importance of intergenerational
wealth transmission for aggregate capital accumulation. First, I introduce a new risk during
old age, hence a new motive for retirement savings. There is a growing literature documenting
why retirees continue to retain a significant amount of wealth late in life (Poterba et al.,
2011), which contrasts with the prediction that retirees decumulate according to the standard
life-cycle model. However, there is no consensus on why retirees retain so much wealth.
Important saving motives studied in the literature include a precautionary saving motive for
mortality risks (Kaymak and Poschke, 2016), uncertain medical expenses (De Nardi, French
and Jones, 2010), and long-term care risks (Ameriks et al., 2015). This paper expands this
literature by introducing another realistic old-age risk that retirees are facing, that is, to help with the uncertain financial needs of their children.

Second, I zoom in on the preferences of intergenerational altruism and analyze the features that distinguish between inter-vivos transfers and bequests. There is a long literature referring to altruism as an important motive for savings and capital accumulation in a macroeconomic model. Starting with Abel and Warshawsky (1987) and Barro and Becker (1988), researchers have argued for the importance of altruism and its representation of the warm-glow bequest motive accounting for aggregate capital accumulation. Followers have largely focused on bequests and the bequest motive (De Nardi, 2004; Cagetti and De Nardi, 2009; Kopczuk and Lupton, 2007; Lockwood, 2016), and there are a few exceptions that distinguish inter-vivos transfers from bequests (McGarry, 1999, 2001; Nishiyama, 2002; Barczyk and Kredler, 2014, forthcoming). I contribute to this literature by pointing out the different preferences for inter-vivos transfers and bequests from the perspective of different implications for savings as well as tax policies.

Echoing the last point, the third contribution sheds new light on the effects of estate taxation on individual saving behavior and aggregate wealth inequality in the United States. The literature on this topic has largely concentrated on theoretical studies that seek to understand what should be the optimal design of estate taxation (Farhi and Werning, 2010, 2013; Piketty and Saez, 2013; Kopczuk, 2001, 2013). In these studies, agents typically only live for one or two model periods, and inter-vivos transfers and bequests are (and have to be) lumped together and treated the same. I find that the distinctive features of the two forms of transfers would lead to unintended consequences of estate taxes that the theoretical literature has largely ignored. The elasticities calculated in this paper help to explain the real-life responses to changes in estate taxation policies. Moreover, estate taxation is closely related to the more general capital income tax or even wealth tax, dating back to the famous Chamley-Judd zero capital income tax result (Chamley, 1986; Judd, 1985). However, followers have identified constraints that relax this result. This paper
provides another example in the context of intergenerational wealth transmission.

Outline The rest of the paper is organized as follows. In the next section, I describe two motivating facts concerning inter-vivos transfers and bequests, using novel data as well as representative surveys of the U.S. population. Section 3 provides details of important features of the U.S. estate taxation policies and historical changes. Section 4 lays out the overlapping-generation life-cycle model of consumption, savings, inter-vivos transfers, and bequests at different stages of life. The data and estimation procedure are in Section 5, and Section 6 reports the results of the estimation. Section 7 discusses elasticities in transfers in response to historical changes in estate taxation policies, as well as the results of the counterfactual policy experiments. Section 8 concludes.

2 Motivating facts

There are two important facts on inter-vivos transfers and bequests, respectively, that motivate and guide my model. One of them is that inter-vivos transfers are intentional and need driven. The other suggests that bequests are largely accidental and the bequest motive to save is dominated by other saving motives during retirement.

2.1 Intentional inter-vivos transfers

I start by documenting that inter-vivos transfers are substantial throughout the life cycle. Table 1 tabulates the mean and median of inter-vivos transfers from different major surveys of the U.S. population. The specific questions asked in each survey are slightly different, and I calculate the annual equivalent amount of transfers for each. The three surveys are, in the order of the wealthiness of the sample: 1) the Vanguard Research Initiative (VRI), which surveys Vanguard clients over age 55;\(^1\) 2) the Survey of Consumer Finances (SCF),

\(^1\)For documentation of the VRI, including a dynamic link to the survey instrument, see Ameriks et al., 2014 and http://ebp-projects.isr.umich.edu/VRI/.
which is representative of the U.S. adult population; and 3) the HRS, which surveys the representative U.S. population over age 55 and over-samples from the bottom of the wealth distribution.

The amount of transfers increases with wealth, so depending on how wealthy the sample is, average transfers would vary as well. In the wealthiest sample, the VRI, average annual transfers amount to $11,106, and the median is $2,667. The mean transfers from the SCF and the HRS, respectively, are lower at $7,307 and $3,665, and the medians are both zero. Transfers are highly skewed to the right, as the median is much lower than the mean.

Table 1: Inter-vivos transfers in different surveys

<table>
<thead>
<tr>
<th>Survey</th>
<th>Annual transfers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean $</td>
<td>Median $</td>
</tr>
<tr>
<td>Vanguard Research Initiative</td>
<td>11,106</td>
<td>2,667</td>
</tr>
<tr>
<td>In which: education</td>
<td>3,031</td>
<td>0</td>
</tr>
<tr>
<td>Survey of Consumer Finance</td>
<td>7,307</td>
<td>0</td>
</tr>
<tr>
<td>Health and Retirement Study</td>
<td>3,665</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 1 plots the average values for four categories of inter-vivos transfers against respondents’ age in the VRI. The four categories are transfers for 1) education expenses (the green dashed line); 2) health expenses (the orange long-dashed line); 3) specific expenses, including payment for vacation, wedding, home purchase/repair or rent, car purchase/repair, childcare, etc. (the blue short-dashed line); and 4) remaining monetary gifts (the brown dotted line). Except for the very start and the very end of old age, where the pattern needs to be read with caution because of the relatively smaller samples, all four categories stay relatively flat against parental age.
Figures 2 and 3 explain why inter-vivos transfers are intentional. Figure 2 employs a specific question from the VRI, asking the respondents to give a subjective evaluation of the expected socioeconomic status of their children relative to themselves. This score ranges from 1 (much worse) to 5 (much better), and is taken average across all children of the respondents. All four categories monotonically decrease with children’s economic status score.

Figure 2: Categories of inter-vivos transfers against children’s average economic status
The score plotted in Figure 2 renders a subjective expectation from parents towards their children, and I provide additional evidence from the HRS showing that transfers respond to the actual current income of the recipients. Figure 3 plots average annual transfers against categories of the recipients’ income over different waves of the HRS: those with income less than $10,000, income between $10,000 and $35,000, income between $35,000 and $70,000, and income greater than $70,000. Transfers to those in the lowest income group are consistently higher throughout all the waves.

Figure 3: Inter-vivos transfers and recipient’s income

The pattern in Figure 3 could be confounded by observables such as parental wealth, so I replicate the figure with a regression according to equation 1:

\[
\text{transfer}_{ij} = \alpha + \beta_1 X_{\text{parent} i} + \beta_2 X_{\text{child} j} + \beta_3 \text{Income}_{\text{child} j} + \epsilon_{ij}
\]  

(1)

where the parental controls \(X_{\text{parent} i}\) include the basic demographics and net worth of parent \(i\), and child controls \(X_{\text{child} j}\) include the basic demographics, co-residence status, and work status (not working, part-time, full-time) of child \(j\), and \(\text{Income}_{\text{child} j}\) is a categorical variable corresponding to the four income groups in Figure 3. The coefficients of these group dummies, \(\beta_3\), are the focus of Table 2. Since the base group in the regressions is the lowest income group,
the negative coefficients for all the waves renders a consistent pattern that corresponds to Figure 3, meaning that parents are transferring more to children with lower current income. In fact, the coefficient on the highest income group is the largest in absolute value in most waves.

Table 2: Inter-vivos transfers and recipient’s income in the HRS

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Income group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10k (base)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-35k</td>
<td>-0.83***</td>
<td>-0.47</td>
<td>-1.5***</td>
<td>-0.83***</td>
<td>-0.79***</td>
<td>-1.32***</td>
</tr>
<tr>
<td></td>
<td>(0.20)</td>
<td>(0.35)</td>
<td>(1.8)</td>
<td>(1.5)</td>
<td>(1.3)</td>
<td>(2.9)</td>
</tr>
<tr>
<td>35-70k</td>
<td>-0.55**</td>
<td>-1.1***</td>
<td>-1.7***</td>
<td>-0.87***</td>
<td>-0.81***</td>
<td>-1.8***</td>
</tr>
<tr>
<td></td>
<td>(0.24)</td>
<td>(0.33)</td>
<td>(0.18)</td>
<td>(0.15)</td>
<td>(0.14)</td>
<td>(0.21)</td>
</tr>
<tr>
<td>&gt;70k</td>
<td>-1.1***</td>
<td>-1.2***</td>
<td>-1.8***</td>
<td>-0.42*</td>
<td>-0.60***</td>
<td>-1.9***</td>
</tr>
<tr>
<td></td>
<td>(0.26)</td>
<td>(0.32)</td>
<td>(0.23)</td>
<td>(0.25)</td>
<td>(0.18)</td>
<td>(0.25)</td>
</tr>
<tr>
<td>Parent controls</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Child controls</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

2.2 Accidental bequests

The second motivational fact concerns bequests at the end of life. I argue that bequests are largely accidental, in the sense that the saving motive for bequests is dominated by other saving motives, such as precautionary saving motives for mortality risks (Kaymak and Poschke, 2016), medical expense risks (De Nardi, French, and Jones, 2010), and long-term care (LTC) risks (Ameriks et al., 2015), for example. I present supporting evidence from two perspectives, both using the sample from the VRI.

First, I provide direct evidence from the VRI through a revealed-preference approach, in which retirees reveal that the bequest motive is dominated by the precautionary motive to save for LTC. Figure 4 shows histograms for a set of Strategic Survey Questions in the VRI, i.e., hypothetical scenario questions where the respondents are shown a given scenario and asked to make allocation decisions between two plans. The scenario in this question
(more details are provided in the Appendix) supposes that the respondent is 80 years old, has one year to live, and will need long-term care in the next year. Respondents are asked to allocate $W$ into two plans, one reserved for LTC expenses and the other as a bequest. The only difference between the three plots is the varying $W$, increasing from $100,000$ in panel (a), to $150,000$ in panel (b), and $200,000$ in panel (c). In panel (a) with the lowest wealth ($W = 100,000$), more than 40 percent of the respondents report that they would allocate all the money to LTC. This is a drastic result. Moreover, the histograms clearly shift to the left monotonically with increasing $W$, indicating that respondents allocate more money to LTC expenses when they have lower wealth. I read from comparing these histograms that people’s saving motive for LTC dominates the saving motive for bequests.

Figure 4: Strategic survey question response histograms: LTC vs. bequests

Second, I resort to results from previous work using the VRI sample to show that the bequest motive is dominated by other saving motives. In Ameriks et al. (2015, 2016) carry out decomposition exercises after estimating the structural model, to compare the importance of each saving motive. The idea is to shut down each motive one by one, and calculate the resulting life-cycle profile for wealth accumulation. In Ameriks et al. (2015) for example, the bequest motive is shown to be clearly dominated by the LTC saving motive.
3 Institutional background

Before jumping into the model, I lay out the institutional backgrounds necessary for studying estate taxation in the United States.

First, the U.S. federal estate tax is a very progressive tax on the total value of net worth when a person dies. The tax can be summarized by two parameters: (1) an exemption level $e$ and (2) a constant\footnote{In the real world, there is a staggered schedule with increasing marginal tax rates above the exemption level. Here I assume a constant rate for simplicity.} marginal tax rate $\tau^b$ for estates above the exemption level. There is a lot of historical variation in these two numbers. Figure 5 plots the exemption level (green line) and the top marginal rate (orange line) in the past 15 years. There is a decreasing trend in the estate taxation burden - noticeably, the tax was repealed in 2010 under the Economic Growth and Tax Relief Reconciliation Act of 2001, and it was reinstated under the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010. Later in the analysis I shall assume that these changes are exogenous to the problem I study and calculate the transfer elasticity to the estate tax changes.

Figure 5: Historical evolution of the U.S. estate taxation

Second, the federal gift tax, which is a tax on inter-vivos transfers made during the life cycle, was unified with the estate tax in 1976, with two important differential treatments.
There is a high annual exclusion level per recipient/donor pair, which was $11,000 in 2001, for example. The effective tax rates on taxable gifts (above the exclusion level) are also different, as the gift tax is *tax exclusive* while the estate tax is *tax inclusive*. This means that the effective tax rate for the gift tax is \( \frac{\tau_g}{1+\tau_b} \) if the estate tax rate is \( \tau_b \). For instance, if \( \tau_b \) equals 35 percent, the gift tax rate would be 26 percent. My baseline estimation incorporates these differential treatments in the two taxes.

4 Model

I build a general-equilibrium overlapping-generation life-cycle model of consumption and savings. The model features two stages of life: young and old, where one old parent has one young child. The old can make inter-vivos transfers to the young each period before death, and can leave a bequest at the end of life. The model is further complemented by realistic risks that people may face and save precautionarily for, in particular for the elderly.

4.1 Environment

**Demographics** The model has an overlapping-generation demographic structure. One generation lives seven model periods (where each period lasts 10 years), and periods 1, 2, and 3 are the young stage, and periods 4, 5, 6, and 7 are the old stage of the life cycle. Each agent retires (thus enters the old stage) and has one and only one child at period 4. The parent can potentially make non-negative inter-vivos transfers in periods 4, 5, and 6, and potentially a non-negative bequest in period 7. The following figure lays out the demographic structure of the model.
Preferences Here I introduce the preferences of the young and the old. The young child has a constant relative risk aversion (CRRA) flow utility over their own consumption, 

\[ u(c) = \frac{c^{1-\sigma}}{1-\sigma}, \]

where \( c \) denotes own consumption, and \( \sigma \) is the CRRA elasticity parameter.

The old parent values own consumption as well as any transfers to the child, no matter whether the transfers are inter-vivos transfers or bequests. When leaving a bequest, the parent’s utility over bequests takes the warm-glow utility (Abel and Warshawsky, 1987; Andreoni, 1990; De Nardi, 2004),

\[ \phi(a) = \theta \frac{(a + k)^{1-\nu}}{1-\nu}, \]

where \( a \) is the post-estate-tax bequest, \( \theta \) is the intensity parameter governing the relative marginal utility from bequests relative to own consumption, and \( \nu \) is the curvature parameter governing the degree to which bequests are a luxury good (lower \( \nu \) indicates richer people leaving more bequests if \( \nu < \sigma \)). \( k \) is potentially a function of the child’s income, \( y_k \),

\[ k = b_q \times y_k, \]
to test whether bequests are directed to lower-income children. In the baseline, I restrict $b_q$ (hence $k$) to be zero.$^3$

When making inter-vivos transfers, the parent’s utility over transfers follows a similar warm-glow functional form as in bequests. To be specific, the parent’s own consumption $c$ and $c_k$ enter the CRRA utility through a Cobb-Douglas aggregator,

$$u(c, c_k; \kappa) = \left[\frac{c^\psi \cdot (c_k + \kappa)^{1-\psi}}{1-\sigma}\right]^{1-\sigma},$$

where $\sigma$ is the same CRRA elasticity parameter as in the child’s utility, and $\psi$ is the utility weight on the parent’s own consumption. Moreover, $\kappa$ is similar to $k$ in the bequest function and controls the degree to which transfers are a luxury good. It also potentially depends on the child’s income, in the sense that utility from inter-vivos transfers is directed warm-glow. However, to capture the underlying need process in the child’s life cycle, $\kappa$ has a stochastic component,

$$\kappa = \kappa_0 + b \times y_k,$$

where $\kappa_0$ is an i.i.d. process over periods and across people. In the baseline, I also restrict $b$ to be zero.

The preference functional forms demand some discussion. First, to model the response of inter-vivos transfers to changes in estate taxation, it is crucial to have a non-cooperative framework with parents and children saving separately. However, it is well known that even a very simple dynamic model with one-sided altruism has stark predictions over transfer behavior that are inconsistent with the empirical data (known as the “Samaritan’s dilemma”, see Appendix C in Mommaerts (2015), for a good discussion). That is, parents will withhold most transfers until all uncertainty is revealed in the last period, to prevent children from over-consumption.

$^3$If $k$ is a constant parameter, it serves the same purpose as $\nu$, in the sense that a higher positive $k$ indicates that bequests are more of a luxury good. Hence in the baseline the parameter is indeed redundant.
Studies with two-sided altruism in a dynamic model have to impose restrictions on dynamic behavior, such as saving. The only exceptions, to my knowledge, are works by Barczyk and Kredler (2014, forthcoming), which allow each party to save, but characterize a “dynamic Samaritan’s dilemma,” in which both parties over-consume.

The one-sided altruism through the warm-glow functional form on inter-vivos transfers and bequests circumvents the Samaritan’s dilemma and induces a transfer pattern that is consistent with the data. The child’s policies do depend on the parent’s, but not vice versa. The technical reason is that the parent’s problem only depends on the child’s exogenous state variables, but not endogenous ones. Doing so prevents the household problem from evolving into a strategic game, which induces the Samaritan’s dilemma.

The reason why I include the child’s current income in the utility function is exactly to reflect the empirical fact that inter-vivos transfers are negatively correlated with the child’s income. Of course, one could consider other state variables in the utility function and, test whether they are important, as long as these variables are exogenous.

**Income** Life-cycle income profile \( \{y_t\} \) is exogenous and stochastic only across generations.

That is, each generation draws an income draw at the beginning of their life and once drawn, the whole profile is stochastic. The child’s draw is positively correlated with the parent’s.

**Credit** Both agents can only save at a risk-free rate \( r \). The model is in general equilibrium, mainly through the return \( r \) responding to changes in the aggregate stock of capital.

**Health** During old age, the parent faces an i.i.d. stochastic health expenditure shock \( m \) each period, which is essentially a negative wealth shock and captures the risk of needing lumpy health expenditures and giving old people an additional precautionary saving motive.

**Firms** There is a representative firm aggregating capital through constant return to scale production technology, which pins down the rate of return \( r \). There is no labor choice
decision on the household side, so aggregate labor stock is normalized to the mass of the young generation.

**Government** The government does three things in this economy: 1) It levies two taxes, on total income through a progressive tax function $T(Y)$, and on transfers - bequests through the estate tax $T_b(a)$, and inter-vivos transfers through the gift tax $T_g(c_k)$. Both taxes on the transfers can be summarized by two parameters, the exemption level $e$ and the marginal tax rate $\tau_b$. The estate tax and the gift tax are integrated as in the U.S. laws; however, they have different effective rates. Since the tax rate on estates is $\tau_b$, the one on inter-vivos transfers would be $\frac{\tau_b}{1+\tau_b}$. 2) The government pays a pension $p$ to the old generation, although, with some abuse of notation, I subsume the notation for the pension with the earnings profile $\{y_t\}$. 3) The government provides a consumption floor $c$ for everyone through welfare transfer $b$.

### 4.2 Bellman equations

I describe the Bellman equations backward along the life cycle. There are four optimization problems corresponding to different periods of the life cycle.

**Last period with parent bequeathing**

In the last period $t = 7$, parents are dying and potentially leaving a non-negative bequest. Denote $V_t(a; z)$ as the value of the parent at the beginning of period 7 with an endogenous state vector $a$ (saving $a$) and an exogenous state vector $z$ (including realized income profile and medical expenses shock $m$). The problem goes as follows:

$$V_t(a; z) = \max_{c \geq z} \ u(c) + \phi(T_b(a'))$$

* s.t. 

$$c + a' = (1 + r)a + b + y - m - T(y + ra)$$
where $a = \{a\}, z = \{y, m\}$. The parent cannot make inter-vivos transfers in the last period, but values own consumption and bequests in the form of warm-glow utility.

Parent making inter-vivos transfers

In periods 5 and 6, the parent may potentially make non-negative inter-vivos transfers and derive utility from doing so. The problem goes as follows:

\[
V_t(a; z) = \max_{c \geq c_k \geq 0} u(c, c_k; \kappa) + \beta \mathbb{E}V_{t+1}(a'; z')
\]

\[
s.t.
\]

\[
c + c_k + a' = (1 + r)a + b + y - m - T(y + ra)
\]

\[
a' \geq 0
\]

where $a = \{a\}, z = \{y, m, \kappa\}$. The expectation is taken over all the idiosyncratic shocks.

Parent receiving bequests

Period 4 differs from the previous two periods only in that the parent is also receiving potential bequests from her or his own parent (or grandparent, for easier narrative). Therefore, we need to track the grandparent’s state variables in this problem. The problem now goes as follows:

\[
V_t(a; z) = \max_{c \geq c_k \geq 0} u(c, c_k; \kappa) + \beta \mathbb{E}V_{t+1}(a' + Tb(a'_p), a'_p; z')
\]

\[
s.t.
\]

\[
\]

\[
4\text{Note that } y \text{ indicates the relative position in the earnings profile draw. Once drawn, the life-cycle earnings profile is deterministic. Therefore, I use } y \text{ instead of } y_t \text{ for simplicity. I will also stick to this notation for the value function and endogenous and exogenous state variable vectors, but will be clear about which variables the vectors contain at each period.}
\]

\[
5\text{This is an assumption for simplicity only.}
\]
\[ c + c_k + a' = (1 + r)a + b + y - m - T(y + ra) \]
\[ a' \geq 0 \]

where \( a = \{a, a_p\}, z = \{y, y_p, m, m_p, \kappa\} \). All the variables with subscript \( p \) are those of the parent.

**Child with parents transferring**

In periods 1, 2, and 3, the child receives potential transfers and needs to predict the parent’s policy functions to make their own consumption and saving decisions. Therefore, the endogenous state variable vector contains not only the parent’s saving \( a_p \), but also the grandparent’s saving \( a_{gp} \) (needed only for period 1). The problem goes as follows:

\[
V_t(a; z) = \max_{c \geq \xi} \ u(c) + \beta \mathbb{E} V_{t+1}(a'; z')
\]
\[ s.t. \]
\[ c + a' = (1 + r)a + b + y + T_g(c_k) - T(y + ra) \]
\[ a' \geq 0 \]
\[ a'_p = a'_{t+3}(a; z) \]
\[ c_k = c'_{t+3}(a; z) \]

where \( a = \{a, a_p, a_{gp}\}, z = \{y, y_p, m, m_p, \kappa, \kappa_p\} \). The subscript \( gp \) indicates the state variable of the grandparent.

**4.3 The Equilibrium**

Denote the relevant state vector as \( s \). Here I define the equilibrium concept in this problem. The only general equilibrium force in the model is through the rate of return \( r \) responding to changes in aggregate capital.

A recursive equilibrium in this economy is a set of a) policy and value functions
\{c(s), c_k(s), a'(s), V_t(s)\}_{s \in \mathcal{S}, t \in \{1, \ldots, 7\}}, \text{ b) measure over states } \lambda(s), \text{ and c) price } r, \text{ such that 1) policy functions are consistent with agent optimization, 2) measure } \lambda(s) \text{ is stationary and consistent with the policy functions as well as processes for exogenous state variables, and 3) price is consistent with measure.}

To summarize, there are three main saving motives for retirees (i.e., the parents) in the model. First, they want to save precautionarily for uncertain medical expenses. Second, they want to save precautionarily to help with the financial need of their children, that is, to save for their children’s consumption. Third, they want to save to leave a bequest. An important goal of the quantitative exercise below is to run a horse race between the three forces and tease out the relative importance of each.

5 Estimation

I estimate the model through the MSM in two steps. In the first step, I externally calibrate a subset of the parameters with estimates independent of the model, or commonly used values in the literature; then, in the second step, I solve the model and estimate the remaining preference parameters through matching key moments.

5.1 First step

Table 3 summarizes the subset of parameters that I externally calibrate and fix throughout the estimation in the second step.
### Table 3: Externally calibrated parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model period</td>
<td></td>
<td>10 years</td>
</tr>
<tr>
<td>CRRA elasticity</td>
<td>(\sigma)</td>
<td>2</td>
</tr>
<tr>
<td>Discount factor</td>
<td>(\beta)</td>
<td>0.96</td>
</tr>
<tr>
<td>Capital input share</td>
<td>(\alpha)</td>
<td>1/3</td>
</tr>
<tr>
<td>Consumption floor</td>
<td>(c)</td>
<td>$733$ monthly</td>
</tr>
<tr>
<td>Labor income levels</td>
<td>({y_t})</td>
<td>Heathcote et al. (2010): PSID</td>
</tr>
<tr>
<td>Labor income transitions</td>
<td>(P_y)</td>
<td>Chetty et al. (2014): tax data</td>
</tr>
<tr>
<td>Income tax</td>
<td>(T(Y) = \lambda Y^\tau)</td>
<td>Heathcote et al. (2016)</td>
</tr>
<tr>
<td>Estate tax</td>
<td>(T_b(a) = \tau^b \max{0, a - e})</td>
<td>De Nardi and Yang (2016): federal tax 2000</td>
</tr>
<tr>
<td>Gift tax</td>
<td>(T_g(c_k) = \frac{\tau^b}{1+\tau^b} \max{0, c_k - e_g})</td>
<td>Federal tax 2000</td>
</tr>
</tbody>
</table>

First, each model period is set to be 10 years.

Second, I set the CRRA elasticity \(\sigma\) to the standard value of 2, the annual discount factor \(\beta\) to 0.96 (converted to a 10-year value in the estimation), the capital input share in the firm’s production function \(\alpha\) to 1/3, and the consumption floor to $733 monthly to reflect the annual poverty threshold of $8,794 for an individual living alone in 2008.\footnote{https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html}

Third, I calibrate the labor income process across generations \(\{y_t\}\) through two sources. The process is discretized as a Markov chain with three states: top, middle, and bottom income profiles. The income values for each process are from the cleaned version of the Panel Study of Income Dynamics (PSID) in Heathcote et al. (2010). Figure 6 lays out the three actual profiles throughout the life cycle. Of course, the actual values fed into the estimation shall be aggregated according to the age brackets.
For the transition matrix capturing the connection between parent’s and child’s draw for the relative position in the labor income profile distribution, I resort to the big transition matrix estimated by Chetty et al. (2014). The original matrix is 100 by 100, and I collapse it into a 3 by 3 matrix as follows:

\[
\begin{bmatrix}
0.489 & 0.304 & 0.207 \\
0.335 & 0.371 & 0.295 \\
0.176 & 0.325 & 0.499
\end{bmatrix}
\]

Finally, I adopt the simple formula in Heathcote et al. (2016) to approximate for the income tax function:

\[ T(Y) = \lambda Y^\tau \]

where \( \tau = 0.161 \) and \( \lambda \) is such that the implied income-weighted average marginal tax rate is 0.32. For the two taxes on bequests and inter-vivos transfers, I assume that they follow the same functional form (as the two taxes are in fact integrated in reality) with two key
parameters:

\[ T_b(a) = \tau^b \max\{0, a - e\} \]
\[ T_g(c_k) = \frac{\tau^b}{1 + \tau^b} \max\{0, c_k - e_g\}. \]

where the exemption level \( e = \$675,000 \) (\( e_g = \$10,000 \) for the gift tax) and the marginal tax rate \( \tau^b = 0.35 \) (\( \frac{\tau^b}{1 + \tau^b} \) is the effective marginal rate for the gift tax). All the numbers come from the federal tax laws in 2000.

5.2 Second step

Table 4 lays out the internally estimated parameters in the second step and the targeted moments. I go over the data source for each moment first, and then discuss the identification mapping parameters to moments.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Targeted moments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bequests: ( \nu, \theta )</td>
<td>Wealth shares: SCF 2007</td>
</tr>
<tr>
<td>Mean need: ( E(\kappa_0) )</td>
<td>Mobility diagonals: SCF 2007-2009</td>
</tr>
<tr>
<td>Std. need: ( \sigma(\kappa_0) )</td>
<td>% of bequests paying tax</td>
</tr>
<tr>
<td>Transfer weight: ( \psi )</td>
<td>% of positive transfers</td>
</tr>
<tr>
<td>Dependence parameter: ( b )</td>
<td>Transfer income differentials</td>
</tr>
</tbody>
</table>

The first two sets of moments are wealth distribution shares and the diagonal of the mobility transition matrix of wealth across generations. The wealth shares are those for the following brackets: 0-20, 20-40, 40-60, 60-80, 80-90, 90-95, 95-99, and 99-100 percent. It is important to capture the top wealth inequality (i.e., the top 1, 1-5, and 5-10 percent) as the wealth distribution in the United States is very skewed to the right. The transition mobility matrix shares similar states, that is, the shares for those brackets are 0-25, 25-50, 50-75, 75-90, 90-95, 95-99, and 99-100 percent. It is also important to capture the mobility toward the top end of the wealth distribution.
The wealth shares are from the official tables produced with the SCF for the 2007 wave. The mobility transition matrix is estimated from the SCF panel from 2007 to 2009.\footnote{The SCF is indeed a repeated cross-section survey. However, at two times in history, it developed a smaller-scale panel that tracked people across waves. The two times are the panel from 1983 to 1989, and the one from 2007 to 2009. I use the latter one, as it is more recent, for estimating the mobility matrix.} The detailed estimation procedure for the mobility matrix is delegated to Appendix.

Both sets of moments are scale-free, and I need some other moments to pin down the level parameters. To serve this end, I include two moments: the percentage of bequests paying estate taxes, and the percentage of strictly positive transfers in the cross section. The last moment of interest is the transfer income differentials reported in Table 3, which will not be utilized in the baseline setup, but will be used to identify and test whether the dependence parameter governing whether the warm glow for inter-vivos transfers is directed. To be exact, the moment is the difference in average transfers for the highest income group (more than $70,000) and the lowest income group (lower than $10,000). I construct the simulated counterpart according to the same criterion as in the empirical regression.

The estimation procedure is described in the next section in two steps, adapted from Guvenen (2016). The global stage is a multi-start algorithm where candidate parameter vectors are uniform Sobol (quasi-random) points. I typically take about 10,000 initial Sobol points for pre-testing and select the best 200 points (i.e., ranked by objective value) for the multiple restart procedure. The local minimization stage is performed with the Nelder-Mead’s downhill simplex algorithm (which is slow but performs well on nonlinear objectives). Within one evaluation, I draw 100,000 individuals randomly and simulate their entire wealth process, initiated with zero wealth and the lowest earnings profile.

6 Results

All the results are categorized into two specifications in terms of the underlying need process: 1) the baseline specification, where the need process is independent of the child’s income, and 2) the other allowing for potential dependence on child’s income in the need process,
and testing whether the warm glow (for inter-vivos transfers and bequests) is directed or not. I dub the baseline the “independence” specification, and the latter the “dependence” specification throughout this section. The results are presented in three subsections: 1) I discuss the parameter values pertaining to the utility from inter-vivos transfers and bequests, respectively; 2) I discuss the model fit regarding targeted moments, and 3) I run counterfactual exercises to tease out the relative importance of the two saving motives for accounting for wealth inequality, in particular at the top of the wealth distribution.

6.1 Parameter values

Table 5 reports the estimates for the internally estimated parameters. I discuss the parameters pertaining the bequest utility, and the inter-vivos transfer utility in order.

Under both specifications, the two parameters in the bequest warm-glow utility are remarkably similar. The curvature parameter, $\nu$, is 1.30 under the independence specification and 1.29 under the dependence specification. Both values are different from 2, the value for the curvature parameter of the CRRA consumption utility. The large difference indicates that bequests are a luxury good, and wealthier people leave a larger bequest. The intensity parameter, $\theta$, by contrast, turns out to be small under both specifications (0.011 in the independence case and 0.012 under the dependence case). The marginal utility from bequests is relatively lower than that from consumption, indicating that the bequest motive is relatively weak.

Table 5: Parameter estimates

<table>
<thead>
<tr>
<th>Need spec.</th>
<th>Bequests</th>
<th>Transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\nu$</td>
<td>$\theta$</td>
<td>$\psi$</td>
</tr>
<tr>
<td>Independence</td>
<td>1.30</td>
<td>0.011</td>
</tr>
<tr>
<td>Dependence</td>
<td>1.29</td>
<td>0.012</td>
</tr>
</tbody>
</table>

There are three main parameters governing the warm-glow utility from inter-vivos transfers. The utility weight parameter, $\psi$, governs the weight on the parent’s own consumption,
and turns out to be more than half in both specifications. Its value ranges from 0.56 (independence case) to 0.78 (dependence case), which means that parents still value their own consumption more.

Recall the need process as follows:

\[ \kappa = \kappa_0 + b \times y_k \]

The mean for the stochastic component of the underlying need process, \( \kappa_0 \) is positive but not large, indicating that transfers are still slightly a luxury good. \( \mathbb{E}(\kappa_0) \) is 5.45 under the independence case, and slightly lower at 2.07 in the dependence case. However, the mean of the realized \( \kappa \) needs to be elevated to account for the income component through \( b \), which is positive at 0.09 under the dependence case. A positive dependence parameter indicates that the warm-glow utility from inter-vivos transfers is directed toward lower-income recipients. The standard deviation of the stochastic component is large relative to the mean. \( \sigma(\kappa_0) \) is 2.91 under the independence case, and 1.52 under the dependence one. The large variation captures the lumpy nature of inter-vivos transfers, so under some occasions these transfers are a necessity good.

### 6.2 Model fit

After going through the parameter estimates, I check the model’s fit for targeted moments. There are two sets of main targeted moments: the wealth distribution in percentile shares and the diagonal elements of the wealth transition matrix across generations. Table 6 lays out the moments for the wealth distribution, and Table 7 for the mobility moments.
Table 6: Targeted moments: Wealth distribution

<table>
<thead>
<tr>
<th>Moments</th>
<th>Share of wealth</th>
<th>0-20</th>
<th>20-40</th>
<th>40-60</th>
<th>60-80</th>
<th>80-90</th>
<th>90-95</th>
<th>95-99</th>
<th>99-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data (SCF 2007)</td>
<td>-0.002</td>
<td>0.001</td>
<td>0.045</td>
<td>0.112</td>
<td>0.120</td>
<td>0.111</td>
<td>0.267</td>
<td>0.336</td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>0.000</td>
<td>0.006</td>
<td>0.069</td>
<td>0.122</td>
<td>0.161</td>
<td>0.132</td>
<td>0.247</td>
<td>0.263</td>
<td></td>
</tr>
<tr>
<td>Dependence</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.116</td>
<td>0.155</td>
<td>0.196</td>
<td>0.267</td>
<td>0.265</td>
<td></td>
</tr>
<tr>
<td>Decomposition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No bequest</td>
<td>0.000</td>
<td>0.026</td>
<td>0.091</td>
<td>0.119</td>
<td>0.159</td>
<td>0.132</td>
<td>0.254</td>
<td>0.220</td>
<td></td>
</tr>
<tr>
<td>No transfer</td>
<td>0.002</td>
<td>0.030</td>
<td>0.154</td>
<td>0.166</td>
<td>0.136</td>
<td>0.120</td>
<td>0.236</td>
<td>0.158</td>
<td></td>
</tr>
</tbody>
</table>

Both the independence and dependence specifications match the wealth distribution shares reasonably well, except for the top 1 percent share. In addition, across the two specifications, the model fit regarding wealth distribution is relatively similar.

Table 7: Targeted moments: Diagonal of transition matrix

<table>
<thead>
<tr>
<th>Moments</th>
<th>Share of wealth</th>
<th>0-24</th>
<th>25-49</th>
<th>50-74</th>
<th>75-89</th>
<th>90-94</th>
<th>95-99</th>
<th>99-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>0.278</td>
<td>0.261</td>
<td>0.247</td>
<td>0.164</td>
<td>0.062</td>
<td>0.091</td>
<td>0.027</td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>0.356</td>
<td>0.212</td>
<td>0.280</td>
<td>0.100</td>
<td>0</td>
<td>0.125</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Dependence</td>
<td>0.303</td>
<td>0.345</td>
<td>0.339</td>
<td>0.276</td>
<td>0.074</td>
<td>0.094</td>
<td>0.142</td>
<td></td>
</tr>
<tr>
<td>Decomposition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No bequests</td>
<td>0.292</td>
<td>0.224</td>
<td>0.352</td>
<td>0.100</td>
<td>0</td>
<td>0.300</td>
<td>0.020</td>
<td></td>
</tr>
<tr>
<td>No transfer</td>
<td>0.376</td>
<td>0.364</td>
<td>0.188</td>
<td>0.106</td>
<td>0</td>
<td>0.275</td>
<td>0.300</td>
<td></td>
</tr>
</tbody>
</table>

Table 7 highlights the importance of matching mobility in any question studying wealth inequality. It is relatively more difficult to match the mobility moments than the inequality ones. The model fit if better under the dependence specification, except for the staying probability of the top 1 percent.

---

8There are several other reasons that account for the inequality at the top of the wealth distribution, among which stochastic (or heterogeneous) returns is an indispensable force. Please see Benhabib et al. (2016) for a lengthy discussion.
Lastly, I look at the remaining three targeted moments concerning bequests and inter-vivos transfers, in the upper panel of Table 8. These moments include the percentage of bequests paying estate taxes, the percentage of positive transfers in the cross section, and the transfer income differentials. The last moment is defined as the average (unconditional) inter-vivos transfers among people with income greater than $70,000 and those with income less than $10,000, and the differential is reported in thousands of dollars.

The proportion of bequests paying tax is 2 percent in the data, and about 3 percent in the simulated model. The percentage of positive transfers is about 18.5 percent in the SCF, and 24.5 percent in the simulated model. Moreover, the transfer income differential is roughly $1,100 more for the lower-income group compared with the higher-income one, while the number for the simulated model is around $1,400. All three moments from the simulation are within reasonable ranges of the empirical counterparts.

It is also helpful to check for a few non-targeted moments, for instance the mean (unconditional) inter-vivos transfers, which turns out to be $7,307 in the SCF, and is over-estimated to be around $12,259 in the simulated model. There is another non-targeted moment I shall discuss in Section 7 with policy experiments.
6.3 A horse race

Reading the parameter values one by one might hide useful information about the overall motives for saving. I conduct two counterfactual exercises in this subsection to do a horse race between the two saving motives: the bequeast motive and the precautionary transfer saving motive. The decomposition results are demonstrated in the lower panels of Tables 6 and 7.

To conduct the counterfactuals, I shut down one saving motive at a time and re-solve the model to calculate the moments without re-estimating the other parameters. Both counterfactuals are under the dependence specification in terms of the need process.

As for the wealth distribution moments in Table 6, I focus on the top 1 percent wealth share, as this is the most informative moment and the most difficult one to target. The top wealth inequality decreases by 4.5 percentage points (17 percent) in the “no bequest” counterpart, and decreases a lot by 10.7 percentage points (40 percent) in the “no transfer” counterpart. These findings are in line with the fact that the intensity parameter in the bequest utility function is estimated to be small. By contrast, shutting down the transfer saving motive significantly reduces top wealth inequality, suggesting that this saving motive is more active and accounts for a large proportion of top wealth inequality.

The comparison along the mobility moments tells a consistent story. As shown in Table 7, shutting down the bequest motive does not change the diagonal of the mobility transition matrix much, but shutting down the transfer motive changes the diagonal by a lot, in particular the staying probability of the wealth share of the top 1 percent.

Taking stock, I claim from both parameter estimates and the counterfactual horse race, that the bequest motive is relatively weak compared with the precautionary saving motive for smoothing out the financial need of children through inter-vivos transfers.
7 Policy experiments

This section conducts policy experiments in terms of changes in the estate taxation rules. I first look at the actual historical changes in the estate tax policies in the United States and how inter-vivos transfers respond to these regulatory changes. I then run counterfactual experiments with larger-scale policy changes.

7.1 Historical changes in estate taxation

As discussed in Section 3 and in particular Figure 5, the estate tax policies in the United States have experienced gradual changes at the federal level, not only in the marginal tax rate, but also the exemption level in the past few decades. Following Bernheim et al. (2004), I take advantage of these exogenous variations in the exemption level of estate taxes, and test whether inter-vivos transfers respond to those changes.

I run the following Probit regression with repeated cross-sectional cohorts from 1989 to 2013 in the SCF: 9

\[
Pr(transfer_{it} > 0) = \Phi(X_i \cdot \beta + group_i + year_t + group_i \times year_t)
\]

where the dependent variable is a binary variable indicating positive inter-vivos transfers, \(X\) is a vector of demographic variables (net worth in thousands, net worth in thousands squared, income in thousands, income in thousands squared, age, age squared, marital status, education level, race dummies, number of children, and gender of household head). The “group” dummies of household \(i\) are defined as follows:

1. The dummy equals 1 if the current household net worth is below the estate tax exemption level in the current year and the following year.

2. The dummy equals 2 if the current household net worth is above the current (old)

---

exemption level but below the new one in the following year.

3. The dummy equals 3 if the current household net worth is above both exemption levels.

The exemption level for these years only increases over time, so there is no fourth group. Apparently the second group is the marginal group, and the key coefficients of interest are those for the interaction between the second group dummy and the year dummies, which I report in Table 9.

Table 9: Probit estimation results: Average marginal effects

<table>
<thead>
<tr>
<th>Variables</th>
<th>Probit (AME)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 2 ×</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>-0.1979***</td>
</tr>
<tr>
<td></td>
<td>(0.04605)</td>
</tr>
<tr>
<td>1998</td>
<td>-0.06845***</td>
</tr>
<tr>
<td></td>
<td>(0.02459)</td>
</tr>
<tr>
<td>2001</td>
<td>-0.08680***</td>
</tr>
<tr>
<td></td>
<td>(0.01063)</td>
</tr>
<tr>
<td>2004</td>
<td>-0.1315***</td>
</tr>
<tr>
<td></td>
<td>(0.01670)</td>
</tr>
<tr>
<td>2007</td>
<td>-0.03555***</td>
</tr>
<tr>
<td></td>
<td>(0.007653)</td>
</tr>
<tr>
<td>Obs.</td>
<td>177,565</td>
</tr>
</tbody>
</table>

Notes: For years not reported, there is no second group, as the exemption level did not change between those years and the following wave. Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

The coefficients of the interaction between the second group and the year dummies indicate, relative to other groups, whether the group 2 households transfer more or less to their children in that year. In Table 9, all the coefficients are negative, indicating that the marginal group of households transfers less on the extensive margin in response to increases in the exemption level of the estate taxes. An increase in the exemption level means paying potentially less estate tax, so people feel less eager to transfer inter-vivos. In particular, the coefficient for 2001 (closest to 2000) is -0.087, meaning there is an 8.7 percent decrease in
the probability of making any transfers.

I replicate the same experiment in the regression around 2000, that is, an increase in the exemption level from $675,000 to $1.5 million, in the simulated model. However, there is one caution before comparing the model with the data: in any counterfactual I run with the model, I always simulate the model to a new steady state and compare across steady states. Therefore, the difference in the probability of making positive inter-vivos transfers in the model is a long-run effect, while that in the data is likely to be a short-run effect.

With that caveat in mind, I compare the results across the model and the data in the last row of Table 8. Again, in the data, the decrease on the extensive margin of transfers is around 8.7 percent, while the decrease in the simulation is around 4.5 percent. They are of the same sign and similar economic magnitude.

### 7.2 Counterfactual experiments

I then take the policy experiment to another level, by conducting counterfactuals that have not happened in U.S. history, and hence lack a data counterpart. It is of academic and policy interests to study the actual effects of larger-scale estate taxation reforms.

I conduct two sets of experiments: one that I dub the “baseline” experiment, and the other the “counterfactual” experiment. In the baseline experiment, I change the marginal estate tax rate (for bequests above the exemption level) one at a time, resolve the model, and calculate the pre-redistribution steady-state wealth inequality and report the top 1 percent wealth share in the left panel of Figure 7. In the counterfactual experiment, I re-estimate the model, shutting down the inter-vivos transfer channel, that is, not allowing parents to make any transfers before the end of life and assuming they no longer value those transfers. I then repeat the tax experiment as in the baseline case. The results are reported in the right panel of Figure 7.

To be exact, the horizontal axis in Figure 7 (both panels) is the marginal tax rate for estate taxes, and the vertical axis is the top 1 percent wealth share of the pre-redistribution
wealth distribution. I calculate the resulting wealth inequality pre-redistribution, as I would like to abstract away from any mechanical effect on inequality from pure redistribution. Hence, I assume that the government simply throws away the collected tax revenue.

Figure 7: Varying marginal tax rate

The dashed red line marks the steady-state top 1 percent wealth share with the tax rate of 35 percent and the original parameter estimates. In the baseline experiment (left panel of Figure 7), the top 1 percent wealth share displays a U-shaped curve against increases in the tax rate from 0 to 100 percent. Yet the change in the share of wealth of the top 1 percent is economically small, ranging within 2 percentage points (from a bit more than 26 percent to about 28 percent). There are three main observations from this panel.

First, the effects of estate taxes on top wealth inequality are relatively small. This is consistent with the general-equilibrium response story in Cagetti and De Nardi (2009). The rate of return \( r \) decreases with increasing aggregate capital, which partially counteracts to any changes in savings induced by changes in estate taxes.

Second, the non-monotonicity in the U-shape comes from response in inter-vivos transfers to changes in the estate tax rate. When the tax rate remains low, the mechanical negative effect of increasing the marginal tax rate on top wealth inequality dominates: when bequests
are taxed more, wealthier people save relatively less, and top wealth inequality is reduced. When the tax rate is high enough, people who want to transfer wealth would substitute more into inter-vivos transfers for two reasons. One reason is the tax advantage of inter-vivos transfers. This effect is compounded by the second reason, the difference in preferences: the marginal utility from leaving bequests decreases faster as the tax increases, because of the curvature in preference, and becomes dominated by the marginal utility from making inter-vivos transfers more quickly. The decrease in the marginal utility from bequests is faster for wealthier households relative to the less wealthy, and the former end up transferring more inter-vivos transfers, hence increasing top wealth inequality.

Third, the rebound in top wealth inequality is not large. The share of wealth of the top 1 percent ranges within 2 percentage points as the marginal estate tax rate moves. This is because inter-vivos transfers effectively “re-distribute” within the cross-section of living parents and children. Parents transfer more to children with lower current income (hence likely with a lower asset position as well), so inter-vivos transfers reduce wealth inequality across households of different wealth levels in this sense.

Finally, I ran a counterfactual experiment, with the inter-vivos transfer channel completely shut down. The results are reported in the right panel of Figure 7. There are again two observations.

The first observation is that, consistent with the decomposition exercise in the last row of Table 6, without inter-vivos transfers the model performs worse in matching the share of wealth of the top 1 percent. This is shown by comparing the two dashed red lines in the left and right panels of Figure 7.
The second observation comes from normalizing the changes in the share of wealth of the top 1 percent due to different tax rates in percentage deviation from the estimated baseline as in Figure 8. Such normalization helps in comparing the actual changes relative to the original estimates. An apparent feature is that in the right panel of the figure, the top wealth share decreases monotonically with the increasing tax rate. This is exactly because inter-vivos transfers are not allowed, so people cannot substitute into this alternative channel of wealth transmission, and the top wealth share is mechanically reduced with higher estate taxes. The contrast between the baseline experiment and the counterfactual one highlights the importance of accounting for inter-vivos transfers when studying the effects of estate taxes on wealth inequality.

8 Conclusion

This paper argues that accounting for inter-vivos transfers separately from bequests is important for understanding the effects of estate taxation on top wealth inequality. I build and estimate a dynamic model of intergenerational wealth transmission at different stages
of the life cycle to examine (1) whether different preferences for inter-vivos transfers versus bequests explain top wealth inequality differently, and (2) whether modeling inter-vivos transfers changes the understanding of the effects of varying estate tax policies on wealth inequality.

I find that inter-vivos transfers are intentional and are directed toward recipients with lower current income. By contrast, bequests are accidental, and the bequest saving motive is dominated by other precautionary saving motives during old age. In the estimated model accommodating these distinctive features, shutting down the bequest channel only reduces the share of wealth of the top 1 percent by 17 percent, compared with a 40 percent decrease from shutting down the inter-vivos transfer channel. I calculate the response in inter-vivos transfers to changes in the exemption level of estate taxes, and obtain similar results across the data and the model. In the counterfactual policy experiments, increasing the marginal estate tax rate from 0 to 100 percent induces a U-shaped curve in the top 1 percent wealth share before any redistribution. The decreasing part of the curve for lower tax rates comes from the mechanical effect of the tax reducing the savings of the wealthiest. The increasing part comes from a too high tax, which drives the wealthy to substitute into more inter-vivos transfers. In contrast, in a model without inter-vivos transfers, varying the estate tax rate only induces a monotonically declining curve of the top wealth share. The comparison highlights the importance of accounting for inter-vivos transfers differently from bequests in studying the effects of estate taxation.

More generally, the prevalence of inter-vivos transfers has potentially important implications for other policies in the United States. First, the insurance role of such transfers at the right time would have different implications for the design of Social Security, for instance (Kotlikoff, 1988). Second, the positive study in this paper opens the route to normative questions, such as what should be the optimal estate taxation design under this broader framework of intergenerational wealth transmission.
Appendix

A. Input Data Sources

A.1 Labor income levels

The labor income data we use is adapted from the PSID data cleaned by Heathcote et al. (2010), specifically Sample C in their labeling. We only keep those aged between 25-60 inclusively. Then we construct the age-dependent decile values in the following order: this order corresponds to several implicit assumptions, the most important of which is that we allow people to move across bins during their life cycle.

1. for each age calculate the decile values of earnings;

2. for each age bin of six years, calculate the average decile earnings across these six years.

The above order maintains the distributional ranking of model agents across the life cycle.

A.2 Intergenerational labor income transitions

Chetty et al. (2014) provide a 100 by 100 transition matrix linking parental family income and child’s income in their online data and tables, with each cell corresponding to share of each percentile of the income distribution. The main sample they use is the Statistics of Income (SOI) annual cross-sections from 1980 to 1982 cohorts for children, and the authors link children to their parents using population tax records spanning 1996-2012 for parent family income. We collapse this big matrix into a 10 by 10 transition matrix, with each cell corresponding to share of each decile of the income distribution. Note that this matrix captures intergenerational transition in income.

Online table 2 of Chetty et al. (2014) also provide the average income levels for both parent and child. However, they are an average income around a particular age (29-30) for

\footnote{See \url{http://equality-of-opportunity.org/images/online_data_tables.xls}, online table 1.}
both parent and child rather than an average life cycle income. We would like our income profiles to capture the hump-shaped life cycle feature, thus calculate our own as explained in the last sub-section.

B. Output Data Sources

B.1 Wealth distributional moments

The wealth distributional moments are taken from Díaz-Giménez et al. (2011). Their calculations are more cleaned and serve as an official report. Many papers have used their numbers, e.g. in Kindermann and Krueger (2015). Other estimates are very close.

B.2 Intergenerational wealth mobility moments

I follow Benhabib et al. (2016) in calculating the intergenerational wealth mobility moments. The idea is to use the most recent SCF panel (2007-2009) that track people and to calculate the two-year mobility transition sub-matrices for each two-year age group from 30 to 66. Then I construct a synthetic intergenerational wealth mobility matrix by multiplying these sub-matrices together.

Apparently there are two ways to select the neighboring ages for defining the age group. For example, for the age group around 30, I can include either ages 29 and 30, or ages 30 and 31. I call the matrix calculated in the former way the left matrix, and the latter way as the right matrix. I then sum the two matrices up and divide them by two cell-wise to obtain the final sub-matrices. Here I report all the three matrices.

If I take only the right age and the left neighboring age, i.e. 29 and 30, for the age group
30, I have the following matrix

\[
\begin{bmatrix}
0.275 & 0.264 & 0.243 & 0.137 & 0.042 & 0.032 & 0.007 \\
0.268 & 0.258 & 0.244 & 0.142 & 0.046 & 0.035 & 0.008 \\
0.259 & 0.251 & 0.247 & 0.148 & 0.049 & 0.038 & 0.009 \\
0.232 & 0.229 & 0.252 & 0.166 & 0.061 & 0.050 & 0.011 \\
0.226 & 0.224 & 0.252 & 0.170 & 0.064 & 0.052 & 0.012 \\
0.195 & 0.197 & 0.253 & 0.192 & 0.080 & 0.068 & 0.016 \\
0.113 & 0.125 & 0.258 & 0.250 & 0.121 & 0.107 & 0.026 \\
\end{bmatrix}
\]

\(T_{36,\text{left}}^{2009}\)

If I take only the right age and the right neighboring age, i.e. 30 and 31, for the age group 30, I have the following matrix

\[
\begin{bmatrix}
0.280 & 0.272 & 0.245 & 0.130 & 0.039 & 0.028 & 0.006 \\
0.269 & 0.264 & 0.246 & 0.137 & 0.045 & 0.033 & 0.007 \\
0.260 & 0.257 & 0.248 & 0.142 & 0.049 & 0.037 & 0.008 \\
0.226 & 0.232 & 0.251 & 0.161 & 0.068 & 0.052 & 0.011 \\
0.239 & 0.241 & 0.249 & 0.154 & 0.061 & 0.047 & 0.010 \\
0.131 & 0.143 & 0.236 & 0.211 & 0.141 & 0.114 & 0.024 \\
0.111 & 0.124 & 0.233 & 0.221 & 0.156 & 0.127 & 0.027 \\
\end{bmatrix}
\]

\(T_{36,\text{right}}^{2009}\)

I note that the two matrices are relatively similar. Taking average, the final mobility matrix
is

\[
T_{36,\text{avg}}^{2009} = \begin{bmatrix}
0.278 & 0.268 & 0.244 & 0.134 & 0.041 & 0.030 & 0.006 \\
0.268 & 0.261 & 0.245 & 0.139 & 0.045 & 0.034 & 0.007 \\
0.260 & 0.254 & 0.247 & 0.145 & 0.049 & 0.037 & 0.008 \\
0.229 & 0.230 & 0.251 & 0.164 & 0.064 & 0.051 & 0.011 \\
0.232 & 0.232 & 0.251 & 0.162 & 0.062 & 0.049 & 0.011 \\
0.163 & 0.170 & 0.245 & 0.201 & 0.110 & 0.091 & 0.020 \\
0.112 & 0.125 & 0.245 & 0.235 & 0.139 & 0.117 & 0.027
\end{bmatrix}
\]
References


