

# Saving Rate Heterogeneity under Wealth Rank Mobility

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## Abstract

Under wealth rank mobility, each wealth decile has three saving rates. In the Panel Study of Income Dynamics, the saving-wealth gradient is negative ranked on start wealth, near zero among immobile households and positive ranked on end wealth. The top wealth decile saves 2.6% of lagged wealth a year ranked on start wealth, 7.9% among immobile households and 15.4% ranked on end wealth. Distributional national accounts measure saving from wealth ranked on end wealth and lagged wealth ranked on start wealth. The synthetic rate is 5.7% of lagged wealth and understates the saving rate ranked on end wealth by 63%.

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# 1 Introduction

Models of wealth inequality take the saving-wealth gradient as an input. A steeper saving-wealth gradient compounds top wealth faster and raises the top wealth shares (Benhabib, Bisin and Zhu, 2011; Gabaix et al., 2016; Achdou et al., 2022; Jones, 2015). The saving-wealth gradient also determines how much of wealth concentration is due to saving rates that rise with wealth rather than to bequests, entrepreneurship or returns (De Nardi, 2004; Cagetti and De Nardi, 2006; Hubmer, Krusell and Smith, 2021).

Under wealth rank mobility, each wealth decile has three saving rates.<sup>1</sup> The immobile households are in the wealth decile at both the start and the end of a period. The start group is the households in the wealth decile at the start. The end group is the households in it at the end. Which of the three saving rates a study measures determines the sign of the saving-wealth gradient. I obtain two results in the Panel Study of Income Dynamics (PSID), 2001 to 2023.

First, the saving-wealth gradient is negative when households are ranked on start wealth, close to zero among the immobile households and positive when they are ranked on end wealth. The saving-wealth gradient from the 61 to 70 wealth decile to the top is  $-19.0$  percentage points ranked on start wealth,  $1.8$  among the immobile households and  $9.8$  ranked on end wealth. The households that entered each wealth decile account for  $8.0$  of the  $9.8$  points ranked on end wealth. The entrants into the top wealth decile save  $72.0\%$  of their lagged wealth a year and its immobile households  $7.9\%$ .

Second, the synthetic method of distributional national accounts understates the saving rate of the top wealth decile's end group by  $63\%$  of that saving rate. Repeated cross-sections cannot follow a household over time, so distributional national accounts take the end group's end wealth minus the start group's lagged wealth as the wealth decile's saving (Saez and Zucman, 2016; Garbinti, Goupille-Lebret and Piketty, 2021). Their published saving rate nets out capital gains and divides that saving by income. The synthetic rate divides that saving by the start group's lagged wealth. The top wealth decile's end group saved  $15.4\%$  of its lagged wealth a year and the synthetic rate reports  $5.7\%$ . The households that exited the top wealth decile held more lagged wealth than those that entered it. The ratio of the end group's to the start group's mean lagged wealth corrects the synthetic rate exactly.

**Related literature** The first strand measures saving rates by wealth group on Nordic administrative panels (Bach, Calvet and Sodini, 2018; Fagereng et al., 2025) and by permanent-income

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<sup>1</sup>A saving rate is total saving, capital gains included, over lagged wealth. The understatement and the sign of the end-group gradient hold net of capital gains.

group on US surveys (Dynan, Skinner and Zeldes, 2004; Straub, 2019; Llanes, Thompson and Volz, 2025). A group saving rate from repeated cross-sections is valid only if the group holds the same households at both dates (Deaton, 1985; Verbeek and Nijman, 1993; Moffitt, 1993), and the synthetic rate is nonetheless in wide use (Saez and Zucman, 2016; Kuhn, Schularick and Steins, 2020; Blanchet and Martínez-Toledano, 2023). I measure all three saving rates on one panel and find that the synthetic rate understates the top wealth decile’s end-group saving rate by 63%.

The second strand measures how wealth rank mobility drives the growth of top wealth shares. Gomez (2023) captures it as a composition term in the growth of a top wealth share. Blanchet (2022) fits a model of individual wealth to repeated cross-sections to separate saving, returns and wealth rank mobility at the top, and finds higher saving at the top the largest driver of the rise in the US top 1% share. Halvorsen et al. (2026) find a Norwegian counterpart of the entrants into the top wealth decile: a quarter of the top 0.1%, grouped on end wealth, started with negative wealth on average and saved at exceptionally high saving rates. I show that the same wealth rank mobility decides the sign of the saving-wealth gradient and the size of the synthetic bias.

**Roadmap** Section 2 defines the three saving rates and the synthetic rate and derives the sign of the synthetic bias. Section 3 reports the two results on the PSID sample. Section 4 concludes.

## 2 Four saving rates and the synthetic bias

Wealth rank mobility changes which households are in a wealth decile between the start and the end of a period. The wealth decile therefore has three saving rates: of the households in it at the start, of those in it at the end, and of those in it at both. Without wealth rank mobility the three coincide. A repeated cross-section cannot follow a household from one period to the next. The one saving flow it can form is the end group’s wealth minus the start group’s wealth. The synthetic rate divides that flow by the start group’s lagged wealth and is the saving rate of neither group.

### 2.1 Two rankings and their group means

Each household has start wealth  $W_{t-1}$ , end wealth  $W_t$ , and a saving flow  $N$  for the period. For the saving rate out of wealth,  $N = W_t - T$  is end wealth net of  $T$ , the wealth of members who joined the household during the period less the wealth of members who left it. The denominator is lagged wealth  $B = W_{t-1}$ . A group’s saving rate is its expected numerator over

its expected denominator, less one:  $s = \psi(R) = R - 1$ , with  $R = \mathbb{E}[N]/\mathbb{E}[B]$  the group's gross ratio.

**Assumption 1** (Regularity). (a) *The wealth distributions of  $W_{t-1}$  and  $W_t$  are atomless, with distribution functions continuous and strictly increasing on their supports.* (b)  $\mathbb{E}[N] < \infty$  and  $\mathbb{E}[B] < \infty$ , with  $B > 0$  almost surely. (c) *Aligned denominator:  $B$  is a strictly increasing transform of lagged wealth  $W_{t-1}$ , so grouping by  $B$  is the same as grouping by lagged wealth, as in the leading case  $B = W_{t-1}$ .*

Sort households into  $D$  equal-sized groups by start wealth and again by end wealth, and let  $P_t^d$  and  $P_{t-1}^d$  be the  $d$ th group at the end and the start. Their intersection  $I^d = P_t^d \cap P_{t-1}^d$  is the group's immobile households. Four group means enter the saving rates. They are the mean flow and the mean lagged wealth of the end group and of the start group:

$$\nu_E^d = \mathbb{E}[N \mid P_t^d], \quad \nu_S^d = \mathbb{E}[N \mid P_{t-1}^d], \quad \beta_E^d = \mathbb{E}[B \mid P_t^d], \quad \beta_S^d = \mathbb{E}[B \mid P_{t-1}^d], \quad (1)$$

with  $\nu_I^d$  and  $\beta_I^d$  the same two means over the immobile households  $I^d$ . The subscript  $E$  marks the end group  $P_t^d$  and  $S$  the start group  $P_{t-1}^d$ .

## 2.2 The four saving rates

**Definition 1** (The four saving rates). *Four saving rates are defined for group  $d$ .*

- (i) *The **end-group** rate  $R_E^d = \nu_E^d / \beta_E^d$ , the flow of the households who end in  $d$  over their own lagged wealth.*
- (ii) *The **start-group** rate  $R_S^d = \nu_S^d / \beta_S^d$ , the flow of the households who start in  $d$  over their own lagged wealth.*
- (iii) *The **immobile-group** rate  $R_I^d = \nu_I^d / \beta_I^d$ , the flow of the immobile households of  $d$  over their own lagged wealth.*
- (iv) *The **synthetic** rate  $R_{\text{syn}}^d = \nu_E^d / \beta_S^d$ , the end group's flow over the start group's lagged wealth. Its numerator and denominator come from different cross-sections.*

Each gross ratio gives a saving rate  $s^d = \psi(R^d) = R^d - 1$ , so  $s_E^d = R_E^d - 1$  and likewise for the other three.

Saving rates (i) to (iii) of Definition 1 are the saving rates of three actual sets of households, since each divides the flow of one group by the lagged wealth of that same group. The three group saving rates divide a group's mean flow by its own mean lagged wealth, which on equal-sized groups is the ratio of the group totals. An average of household ratios  $N/B$  would instead be dominated by households with near-zero lagged wealth, whose ratios are unbounded.

The synthetic saving rate  $s_{\text{syn}}^d = (v_E^d - \beta_S^d) / \beta_S^d$  divides the end group's end wealth net of  $T$  minus the start group's lagged wealth by the start group's lagged wealth. Net of capital gains, that numerator is the synthetic saving flow of Saez and Zucman (2016).

### 2.3 Wealth rank mobility and the saving rates

The benchmark is the case without wealth rank mobility, where every household is immobile,  $P_t^d = P_{t-1}^d$ , and the four saving rates coincide.

**Corollary 2.1** (Benchmark without wealth rank mobility). *Suppose Assumption 1 holds, the groups are equal-sized, and  $v_E^d \neq 0$  for every  $d$ . The end-group and synthetic rates coincide at every group if and only if  $P_t^d = P_{t-1}^d$  up to probability zero for every  $d$ , the absence of wealth rank mobility, and then all four saving rates equal the immobile-group rate.*

With wealth rank mobility the end group and the start group share only their immobile households. The end group is  $P_t^d = I^d \sqcup U^d \sqcup F^d$ , where  $\sqcup$  denotes a disjoint union. The upward entrants  $U^d$  were below wealth decile  $d$  at the start, and the downward entrants  $F^d$  were above it. The start group is  $P_{t-1}^d = I^d \sqcup \tilde{U}^d \sqcup \tilde{F}^d$ , with  $\tilde{U}^d$  the households that exit  $d$  upward and  $\tilde{F}^d$  those that exit it downward. The tilde marks exit rather than entry.

Proposition 2.2 splits the end-group rate into the immobile households' saving rate and the contribution of the upward and downward entrants, weighted by the share of the end group's lagged wealth they hold.

**Proposition 2.2** (Saving rate split by flow). *Let  $\pi_g^d$  be the share of  $P_t^d$  of type  $g \in \{I, U, F\}$ , with  $I$  indexing the immobile households  $I^d$ . Let  $\beta_g^d$  and  $s_g^d$  be that type's mean lagged wealth and saving rate. Let  $w_g^d = \pi_g^d \beta_g^d / \beta_E^d$  be the share of the end group's lagged wealth that type  $g$  holds, so  $\sum_g w_g^d = 1$ . Suppose  $I^d$  has positive mass, and  $\beta_E^d$  and each occupied type's  $\beta_g^d$  are nonzero, so every saving rate entering the identity is defined. Then*

$$s_E^d = s_I^d + \sum_{g \neq I} w_g^d (s_g^d - s_I^d), \quad (2)$$

*an identity at the realized group aggregates. Proposition S1.3 in Supplement S1 gives the matching identity for  $\beta_E^d - \beta_S^d$ .*

Each contribution can take either sign. In the PSID the upward entrants into the top wealth decile had low lagged wealth and fast wealth growth, so they raise the top end-group rate above the immobile-group rate. The exiters from the top wealth decile saved less than its immobile households, so they lower the top start-group rate below the immobile-group rate.

At the bottom the directions reverse: the end group includes households whose wealth fell, and the start group households whose wealth rose. Wealth rank mobility therefore raises the saving-wealth gradient on end wealth and lowers it on start wealth (Section 3).

## 2.4 Sign of the synthetic bias

The synthetic rate differs from the end-group rate only in its denominator.

**Proposition 2.3** (Exact denominator channel). *For any numerator  $N$ , whenever  $\beta_E^d, \beta_S^d > 0$  and  $v_E^d \neq 0$ ,*

$$\frac{R_{\text{syn}}^d}{R_E^d} = \frac{\beta_E^d}{\beta_S^d}, \quad (3)$$

For the saving rate,  $\psi(R) = R - 1$ , so whenever  $s_E^d \neq 0$  the relative bias is

$$\frac{s_{\text{syn}}^d - s_E^d}{s_E^d} = \frac{R_E^d}{R_E^d - 1} \left( \frac{\beta_E^d}{\beta_S^d} - 1 \right). \quad (4)$$

The start top group is ranked on lagged wealth, so among all groups of its size it has the highest mean lagged wealth. The end top group includes households that rose from below, so its mean lagged wealth is lower.

**Proposition 2.4** (Mean-preserving spread of the denominators). *On equal-sized groups, and under Assumption 1(c), the cumulative denominator profiles satisfy*

$$\sum_{d=1}^k \beta_S^d \leq \sum_{d=1}^k \beta_E^d, \quad k = 1, \dots, D, \quad \text{with equality at } k = D, \quad (5)$$

*so the synthetic denominators are a mean-preserving spread of the end-group denominators (Rothschild and Stiglitz, 1970). The inequality at  $k$  is strict unless the lowest  $k$  end-groups and the lowest  $k$  start groups coincide up to probability zero.*

Equation (5) says the start groups hold less lagged wealth than the end groups at the bottom of the wealth distribution and more at the top, with the two totals equal. The denominator gap therefore redistributes lagged wealth between the groups and leaves their total unchanged. The proof is a rearrangement inequality over the cumulative sums (Hardy, Littlewood and Pólya, 1952).

**Corollary 2.5** (Endpoint signs and a smaller synthetic gradient). *Suppose  $v_E^1, v_E^D > 0$ , and take the grouping of Proposition 2.4. Then  $R_{\text{syn}}^1 \geq R_E^1$  and  $R_{\text{syn}}^D \leq R_E^D$ , so the synthetic rate overstates*

*the bottom and understates the top, and its saving-wealth gradient is smaller than the end group's,*  
 $R_{\text{syn}}^D - R_{\text{syn}}^1 \leq R_E^D - R_E^1.$

The synthetic method therefore reports neither the end-group nor the start-group saving-wealth gradient. From the bottom to the top wealth decile, its saving-wealth gradient falls short of the end group's and can have the opposite sign. Proposition 2.3 is an identity at the realized group aggregates, so the bias is exact in any finite sample. Supplement S2 proves the propositions, and Supplement S3.1 gives the size of the bias under a Gaussian wealth process.

### 3 The four saving rates in the PSID

#### 3.1 PSID sample

The PSID measures household net worth every two years from 1999 to 2023 (Institute for Social Research, 2023). Net worth sums housing, equity, private business, pension and fixed-income assets net of debt. I restrict the sample to reference persons aged 20 to 65, sort households into ten wealth deciles on each wave's cross-section, trim the top and bottom one percent of each wave's end and lagged wealth, and leave the estimates unweighted. The Survey Research Center core is the PSID's original national probability sample. The matched panel keeps its households observed at both ends of a transition (Cooper, Dynan and Rhodenhiser, 2019). The matched panel holds 33,676 household-wave observations.

A group's saving rate is its saving over its lagged wealth per year. I halve the two-year saving rate of each transition to report it per year. Saving is the change in net worth, capital gains included and net of the wealth that moved with members who joined or left the household. I compute the group aggregates of Definition 1 wave by wave and average them across waves (Supplement S4). I report the six wealth deciles above the 40th wealth percentile, where every group's mean lagged wealth is positive, and define the saving-wealth gradient as the top wealth decile's saving rate minus the 61 to 70 wealth decile's. The wealth deciles are cut on each wave's cross-section before the panel is matched and trimmed, so the start and end groups in the matched panel are not equal in size.

The 61 to 70 wealth decile is the lowest displayed wealth decile in which few households have nonpositive lagged wealth. Households with nonpositive lagged wealth are 19.2% of the 41 to 50 wealth decile's end group, 9.1% of the 51 to 60 wealth decile's and 5.1% of the 61 to 70 wealth decile's. The end-group gradient stays positive and the start-group gradient negative from every other base wealth decile and under a slope across all displayed wealth deciles, and the immobile-group gradient stays small (Supplement S5.2).

**Table 1: Three saving rates and the synthetic rate, by wealth decile**

| Wealth decile             | Start-group<br>$s_S^d$ (%) | Immobile-group<br>$s_I^d$ (%) | End-group<br>$s_E^d$ (%) | Synthetic<br>$s_{\text{syn}}^d$ (%) |
|---------------------------|----------------------------|-------------------------------|--------------------------|-------------------------------------|
| 41-50                     | 55.5                       | 7.1                           | 1.8                      | 5.0                                 |
| 51-60                     | 29.1                       | 7.2                           | 2.8                      | 4.5                                 |
| 61-70                     | 21.6                       | 6.1                           | 5.6                      | 4.3                                 |
| 71-80                     | 15.2                       | 5.9                           | 7.8                      | 4.0                                 |
| 81-90                     | 11.9                       | 7.1                           | 9.4                      | 4.6                                 |
| 91-100                    | 2.6                        | 7.9                           | 15.4                     | 5.7                                 |
| Gradient, top minus 61-70 | -19.0                      | 1.8                           | 9.8                      | 1.4                                 |

**Notes:** Columns report the start-group rate  $s_S^d$ , the immobile-group rate  $s_I^d$ , the end-group rate  $s_E^d$  and the synthetic rate  $s_{\text{syn}}^d$  of Definition 1, annualized and in percent. The synthetic rate is the end group's flow minus the start group's lagged wealth, over the start group's lagged wealth. The last row is the saving-wealth gradient, the top wealth decile minus the 61 to 70 wealth decile. Wealth deciles are cross-section ranks within each wave, and the four lowest are not displayed. PSID 2001 to 2023, matched panel, 33,676 household-wave observations, reference persons aged 20 to 65.

The results are robust to the sample and the definitions. They hold with the Survey of Economic Opportunity oversample included, without the trim, without households whose size or marital status changes, net of gift and bequest receipts, with another anchor wealth decile, and ranked within age bands (Supplement S5).

### 3.2 The three saving rates

The saving-wealth gradient is negative on start wealth, close to zero among the immobile households and positive on end wealth (Table 1). From the 41 to 50 wealth decile to the top, the start-group rate falls from 55.5% to 2.6%, the immobile-group rate stays between 5.9 and 7.9%, and the end-group rate rises 13.6 percentage points to 15.4%.

The upward entrants raise the top end-group rate above its immobile-group rate. The top wealth decile has no downward entrants. Its upward entrants save 72.0% of their lagged wealth, hold 12% of the group's lagged wealth and add 7.6 points to its saving rate. The exiters from the top wealth decile saved less than its immobile households and lower the top start group's saving rate to 2.6%.

The upward and downward entrants move the end-group rate away from the immobile households' saving rate in every wealth decile (Table 2). Their contribution is  $-5.7$  points in the 41 to 50 wealth decile and 7.6 points in the top wealth decile. From the 61 to 70 wealth decile to the top, they account for 8.0 of the 9.8 points and the immobile households for 1.8.

The end group is selected on recorded end wealth, which also enters its numerator. On the 23,957 household-waves observed in three consecutive waves, ranking the end group on the

**Table 2: Decomposition of the end-group rate, by wealth decile**

| Wealth decile | End-group   | Immobile households |            | Upward and downward entrants |
|---------------|-------------|---------------------|------------|------------------------------|
|               | $s_E^d$ (%) | $s_I^{d*}$ (%)      | weight (%) | contribution (pp)            |
| 41-50         | 1.8         | 7.6                 | 31.9       | -5.7                         |
| 51-60         | 2.8         | 7.5                 | 33.1       | -4.7                         |
| 61-70         | 5.6         | 6.1                 | 37.5       | -0.4                         |
| 71-80         | 7.8         | 5.8                 | 42.5       | 2.0                          |
| 81-90         | 9.4         | 7.1                 | 54.3       | 2.3                          |
| 91-100        | 15.4        | 7.9                 | 88.2       | 7.6                          |

**Notes:** Columns report the end-group rate  $s_E^d$ , the immobile households' saving rate  $s_I^{d*}$ , the share  $w_I^d$  of the wealth decile's lagged wealth they hold, and the upward and downward entrants' contribution in percentage points. The first column is the second plus the fourth up to rounding, by Equation (2). In  $s_I^{d*}$  each wave's immobile households are weighted by their share of that wave's wealth decile. This weighting differs from the equal weighting of the immobile-group rate  $s_I^d$  in Table 1. Saving rates are annualized and in percent. Sample as in Table 1.

following wave's wealth instead puts the top end-group rate at 12.6% against 15.9% and takes the end-group gradient from 8.8 to 0.4 points (Supplement S3.2). The forward-ranked gradient is not distinguishable from zero. Households also change wealth decile between the two waves, so the fall overstates the noise in the gradient.

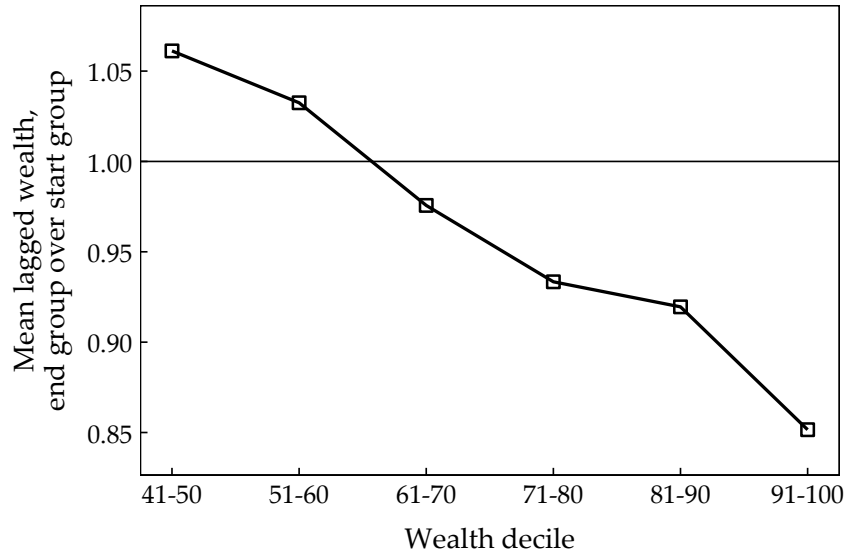
### 3.3 The synthetic bias

The synthetic rate understates the top end group's saving rate by 63% of that saving rate (Table 1). The synthetic rate is 5.7% and the end-group rate 15.4%. The gap is entirely the denominator: the end group's mean lagged wealth is 14.8% below the start group's (Proposition 2.3, Figure 1). On two separate cross-sections instead of the matched panel, the understatement is 67% (Supplement S6).

Against the start group, the synthetic rate overstates the saving rate. The top start group saved 2.6% and the synthetic rate reports 5.7%. Gomez (2023) decomposes the growth of a top wealth share into the wealth growth of its start group and a composition term from wealth rank mobility, and the composition term is positive. Bach, Calvet and Sodini (2018) separate the same composition term from the saving of the households in a net worth bracket. Saez and Zucman (2016) interpret the synthetic saving as the saving of the households in the fractile. The synthetic saving and the saving of those households are equal only without wealth rank mobility. The synthetic rate shares its numerator with the end-group rate, so the end group is their benchmark and against it the synthetic rate understates.

On the cross-section wealth deciles the synthetic method compresses the saving-wealth gradient. From the 61 to 70 wealth decile to the top, the synthetic gradient is 1.4 points against 9.8 for

**Figure 1: Ratio of end-group to start-group mean lagged wealth, by wealth decile**



**Notes:** Each point is  $\beta_E^d / \beta_S^d$ , the ratio of the end group's to the start group's mean lagged wealth in wealth decile  $d$ , the discrepancy of Proposition 2.3. Below one, the households that end in the wealth decile had less lagged wealth than those that started in it. Sample as in Table 1.

the end group (Table 1). Proposition 2.4 holds on equal-sized groups. Re-ranked into equal-sized wealth deciles within the matched panel, the understatement of the top end group's saving rate is 44%. On those wealth deciles the synthetic method also reverses the sign of the saving-wealth gradient. From the 61 to 70 wealth decile to the top, the end-group gradient is 9.9 percentage points and the synthetic gradient  $-5.7$  (Supplement S5.2).

The synthetic method reverses the sign of the top-fractile active saving rate on the PSID counterpart of the published series of Saez and Zucman (2016). Their saving rate is synthetic and its numerator is active saving, net of capital gains. On that numerator the synthetic rate is  $-4.4\%$  at the top wealth percentile and the end-group rate  $3.2\%$ , and the same reversal holds at the top five percent (Supplement S7). Their published saving rate is denominated in income. As a share of the after-tax income of the top wealth decile's end group, that group's flow is  $63.6\%$  against a synthetic  $28.8\%$ . Their series divides by the start fractile's pre-tax income instead (Supplement S7.3).

The understatement keeps its sign under every check. Under a Gaussian benchmark for the wealth process, netting the transitory noise out of recorded wealth leaves the understatement at  $36\%$  (Supplement S3.2). Capital gains are observed for  $94.0\%$  of the matched panel. Net of them the top end group saves  $5.1\%$  and the synthetic rate reports  $-3.0\%$ , so the understatement is  $159\%$  (Supplement S5.6). The understatement stays between 33 and 71% across 12

perturbations of the grouping, age window, wealth floor, trim and numerator, and it is 61% under the PSID family weight and 61% under inverse retention weights (Supplement S5).

## 4 Conclusion

The saving-wealth gradient from the 61 to 70 wealth decile to the top is  $-19.0$  percentage points ranked on start wealth,  $1.8$  among the immobile households and  $9.8$  ranked on end wealth. The upward and downward entrants account for  $8.0$  of the  $9.8$  points ranked on end wealth. Their contribution to the end-group rate is  $-5.7$  points in the 41 to 50 wealth decile and  $7.6$  in the top wealth decile. The upward entrants into the top wealth decile save  $72.0\%$  of their lagged wealth a year and the immobile households  $7.9\%$ .

The three saving rates answer different questions. The end-group rate is the saving rate of the currently wealthy. The saving glut of the rich is the saving of the currently wealthy (Mian, Straub and Sufi, 2020). A random-growth model of the wealth distribution takes the start-group rate as its input (Benhabib, Bisin and Zhu, 2011; Benhabib and Bisin, 2018). Substituting one for the other reverses the sign of the saving-wealth gradient.

Distributional national accounts form synthetic saving from the end group's wealth and the start group's wealth (Saez and Zucman, 2016). The synthetic rate is the saving rate of no group of households. On the PSID cross-section wealth deciles it understates the top end group's saving rate by  $63\%$  of that saving rate. A larger sample does not reduce the bias, because it is a denominator gap. The ratio of the end group's to the start group's mean lagged wealth corrects it exactly.

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