The Trajectory of Wealth in Retirement

David A. Love
Michael G. Palumbo
Paul A. Smith

March 2010

Our views do not necessarily reflect those of the Federal Reserve Board or its staff.
Our paper focuses on a single empirical question

*How quickly do households spend down their wealth in retirement?*

- We analyze panel data from the Health and Retirement Study from 1998 through 2006.

- We study a comprehensive measure of retirement wealth that includes:
  - Financial assets
  - Nonfinancial wealth (home and business equity)
  - Social Security and private pension benefits (and some other types of income)
Our innovation is to explicitly account for the decrease in life expectancy that occurs during retirement as individuals age and as households shrink.

Specifically, we examine whether household wealth *balances* tend to decline in old age as fast as life expectancy falls.

Our paper’s contribution is more methodological (I think) than analytic.
For each household in the HRS panel, we construct “annualized comprehensive wealth”

- This is essentially a measure of the total amount of resources that is available to finance a constant amount of spending per person per expected year of life

\[ ACW_{i,t} = a_{i,t} \times Wealth_{i,t} \]

where \(a_{i,t}\) is a household annuity factor that converts wealth balances into a measure of expected annual resources

- Note:
  - We’re not suggesting that a retired household’s optimal plan should necessarily involve spending a constant amount each year
  - Nor are we assuming that retirees can actually purchase actuarially fair annuities in the real world
Our objective

Why study annualized comprehensive wealth?

- Our thinking is that if the HRS panel showed a strong tendency for ACW to fall significantly as retirees age, we might wonder why retirees were spending down their assets so fast
  - Why would so many retirees seem to be “running out” of money?

- Alternatively, if the HRS showed that ACW tended to rise substantially, we might wonder why retirees are spending down so slowly
  - What would they seem to be saving so much money for?
The household annuity factor for retirees

For each household in each HRS wave, we compute an “annualizing factor” that depends on each spouse’s age-specific survival rates (taken from SSA life tables).

For simplicity, consider the following crude approximation to the formula for the annualizing factor:

\[
a_j(t, s) \approx \frac{r}{1 + r} \left[ \alpha - \left( \alpha - 1 \right) \frac{1}{(1 + r)T_{tm}} - \frac{1}{(1 + r)T_{sf}} \right]^{-1}
\]

where:

- \( r \) is the real interest rate
- \( T_{tm} \) and \( T_{sf} \) measure age-dependent life expectancies for each spouse
- \( \alpha \) captures economies of scale in home production
  (If no economies, \( \alpha = 2 \))
Intuition behind the “annualizing factor”

Ignoring the discount rate (set $r = 0\%$):

$$\lim_{r \to 0} a_j(t, s) = \frac{1}{(\alpha - 1)T^m_t + T^f_s}$$

- A retired couple, for example, could afford to simply divide their current wealth by the number of years they expected each spouse to be alive and spend that amount each year.

- $\Rightarrow$ For a given wealth balance, couples and younger retirees have smaller annualizing factors than do single and older retirees.
Assuming both spouses expected to live forever:

\[
\lim_{T^m, T^f \to \infty} a = \frac{1}{\alpha} \frac{r}{1 + r}
\]

- The longer a household expects to live, the closer its annualizing factor will be to the real interest rate (their money has to last longer)
Examples of how the “annualizing factors” work

### Table 3: Sample Annualized Factors for Singles and Couples

<table>
<thead>
<tr>
<th>Age of head</th>
<th>Couple</th>
<th>Single female</th>
<th>Single male</th>
<th>Annualized value of $500,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>67</td>
<td>.043</td>
<td>.076</td>
<td>.089</td>
<td>$21,400 $38,000 $44,500</td>
</tr>
<tr>
<td>77</td>
<td>.063</td>
<td>.117</td>
<td>.141</td>
<td>$31,500 $58,500 $70,500</td>
</tr>
<tr>
<td>87</td>
<td>.096</td>
<td>.221</td>
<td>.272</td>
<td>$48,000 $110,500 $136,000</td>
</tr>
</tbody>
</table>

Love/Palumbo/Smith (FRB)
Figure 1: Age Profiles of Annualized Wealth and Optimal of the Life Cycle Model of Spending in Retirement
Trajectory of ACW in the Basic Life-Cycle Model

No Bequests, No Medical Expenses

- Consumption
- Wealth/10
- Annualized Wealth
- Income

Ages:
- 65
- 70
- 75
- 80
- 85
- 90
- 95
- 100

Thousands of dollars

Love/Palumbo/Smith (FRB)
Trajectory of ACW in the LCM with Precautionary Saving Motive and Explicit Bequests

Love/Palumbo/Smith (FRB)
Our HRS panel

- Our “nonparametric” empirical analysis (plotting medians in the raw panel data) is based on a balanced panel of 4,630 retired couples and singles aged 65 years or older in 1998 with complete data through 2006.

- We focus on nonparametric results for a single cohort of retirees, all aged 70 to 75 years in 1998, all of whom survive to 2006.

- Our regression analysis uses data from a larger, unbalanced panel from the HRS, including many households 65 years or older with data in 1998 and later waves who do not survive all the way to 2006.
Components of Comprehensive Wealth:
Cohort Aged 70 to 75 years in 1998 that Survived to 2006

<table>
<thead>
<tr>
<th></th>
<th>Median Comprehensive Wealth (th. 2006 $)</th>
<th>Share of CW (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td>98</td>
<td>82</td>
</tr>
<tr>
<td>Nonfinancial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonfinancial</td>
<td>130</td>
<td>142</td>
</tr>
<tr>
<td>“Pension” wealth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Pension” wealth</td>
<td>264</td>
<td>169</td>
</tr>
<tr>
<td>Social Security</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Security</td>
<td>177</td>
<td>115</td>
</tr>
<tr>
<td>Private DB Pensions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private DB Pensions</td>
<td>72</td>
<td>41</td>
</tr>
<tr>
<td>Comprehensive Wealth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehensive Wealth</td>
<td>493</td>
<td>393</td>
</tr>
</tbody>
</table>
Table 2: Components of Comprehensive Wealth: Surviving Households Aged 70-75 in 1998*

<table>
<thead>
<tr>
<th></th>
<th>Wealth (th. 2006 $)</th>
<th>Share of CW (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stocks(^1)</td>
<td>43</td>
<td>40</td>
</tr>
<tr>
<td>Other(^2)</td>
<td>55</td>
<td>52</td>
</tr>
<tr>
<td>Nonfinancial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td>97</td>
<td>106</td>
</tr>
<tr>
<td>Other(^3)</td>
<td>34</td>
<td>28</td>
</tr>
<tr>
<td>Annuity-like benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Security</td>
<td>177</td>
<td>139</td>
</tr>
<tr>
<td>DB Pensions</td>
<td>72</td>
<td>55</td>
</tr>
<tr>
<td>Other(^4)</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>

*For each year, the rows report means from a trimmed sample selected so that the trimmed mean comprehensive wealth (CW) is equal to the untrimmed median; thus, the components sum to median CW. Calculations use HRS sample weights. Sample size is 1,360 in 2006.

1 Shares held directly and through mutual funds, trusts, and retirement accounts.
2 Liquid assets, bonds, and non-stock assets held in trusts and retirement accounts.
3 Vehicles and businesses.
4 Life annuities and government transfers.
Nonparametric Age Profiles of Comprehensive Wealth Balances

(a) Financial Wealth

(b) Nonfinancial Wealth

(c) Annuity Wealth

(d) Comprehensive Wealth
Nonparametric Age Profiles of Comprehensive Wealth Balances

Median Comprehensive Wealth

Thousands of 2006 $

Age

65 67 69 71 73 75 77 79 81 83 85 87 89 91

Love/Palumbo/Smith (FRB)

Trajectory of Wealth/HRS

March 2010
Evolution of Median Wealth:
Households Aged 70-75 in 1998 Who Survived to 2006

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp. Wealth (th. 2006 $)</td>
<td>493</td>
<td>434</td>
<td>393</td>
<td>-3.7</td>
</tr>
<tr>
<td>Annualizing Factor (%)</td>
<td>6.0</td>
<td>8.0</td>
<td>12.3</td>
<td>12.9</td>
</tr>
<tr>
<td>Ann. Wealth (th. 2006 $)</td>
<td>32.8</td>
<td>35.4</td>
<td>42.2</td>
<td>4.3</td>
</tr>
</tbody>
</table>
Age Profiles of Comprehensive Wealth Balances

(e) Financial Wealth

(f) Nonfinancial Wealth

(g) Annuity Wealth

(h) Comprehensive Wealth
### Distribution of Changes in Annualized Wealth

**Cohort Aged 70-75 in 1998 (Survivors through 2006)**

Percent of Households with a Change in Annualized Wealth that is:

<table>
<thead>
<tr>
<th>Classification</th>
<th>&lt;(-25)%</th>
<th>&gt;(25)%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Sample</td>
<td>12</td>
<td>45</td>
</tr>
<tr>
<td>Single in 1998</td>
<td>15</td>
<td>43</td>
</tr>
<tr>
<td>Married in 1998</td>
<td>11</td>
<td>46</td>
</tr>
<tr>
<td>Bottom 20% of Income in 1998</td>
<td>13</td>
<td>41</td>
</tr>
<tr>
<td>Top 20% of Income in 1998</td>
<td>15</td>
<td>46</td>
</tr>
</tbody>
</table>
Table 5: Distribution of Changes in Annualized Wealth from 1998 to 2006: Surviving Households Aged 70-75 in 1998

<table>
<thead>
<tr>
<th>Classification</th>
<th>&lt;-25%</th>
<th>-25% to -10%</th>
<th>-10% to 10%</th>
<th>10% to 25%</th>
<th>&gt;25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Sample</td>
<td>12</td>
<td>10</td>
<td>19</td>
<td>14</td>
<td>45</td>
</tr>
<tr>
<td>Single in 1998</td>
<td>15</td>
<td>11</td>
<td>20</td>
<td>12</td>
<td>43</td>
</tr>
<tr>
<td>Married in 1998</td>
<td>11</td>
<td>9</td>
<td>19</td>
<td>15</td>
<td>46</td>
</tr>
<tr>
<td>Bottom 20% of Income in 1998</td>
<td>13</td>
<td>9</td>
<td>22</td>
<td>15</td>
<td>41</td>
</tr>
<tr>
<td>Top 20% of Income in 1998</td>
<td>15</td>
<td>9</td>
<td>14</td>
<td>15</td>
<td>46</td>
</tr>
</tbody>
</table>

*Sample size is 1,360 in 2006. Income categories are defined conditional on age and marital status in 1998.
(i) by Marital Status

(ii) by Education

(iii) by Income

(iv) by Health Status
Table 6: Empirical and Simulated Growth Rates of Annualized Comprehensive Wealth*

<table>
<thead>
<tr>
<th>Age category</th>
<th>HRS Data</th>
<th>Baseline</th>
<th>Baseline + Bequests</th>
<th>Baseline + Med Costs</th>
<th>Med Costs + Bequests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 70</td>
<td>1.00</td>
<td>0.03</td>
<td>0.95</td>
<td>1.98</td>
<td>2.23</td>
</tr>
<tr>
<td>71-80</td>
<td>2.37</td>
<td>-0.42</td>
<td>1.31</td>
<td>1.74</td>
<td>2.25</td>
</tr>
<tr>
<td>81+</td>
<td>2.75</td>
<td>-1.65</td>
<td>1.98</td>
<td>-0.49</td>
<td>1.69</td>
</tr>
<tr>
<td>All</td>
<td>2.05</td>
<td>-0.69</td>
<td>1.48</td>
<td>1.44</td>
<td>2.21</td>
</tr>
<tr>
<td>Married couples</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 70</td>
<td>0.64</td>
<td>-0.55</td>
<td>0.05</td>
<td>1.26</td>
<td>1.42</td>
</tr>
<tr>
<td>71-80</td>
<td>1.97</td>
<td>-1.04</td>
<td>0.03</td>
<td>0.65</td>
<td>1.00</td>
</tr>
<tr>
<td>81+</td>
<td>2.11</td>
<td>-1.64</td>
<td>0.31</td>
<td>-1.23</td>
<td>0.04</td>
</tr>
<tr>
<td>All</td>
<td>1.54</td>
<td>-1.25</td>
<td>0.06</td>
<td>0.37</td>
<td>0.85</td>
</tr>
<tr>
<td>Singles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 70</td>
<td>1.48</td>
<td>0.71</td>
<td>2.10</td>
<td>2.92</td>
<td>3.28</td>
</tr>
<tr>
<td>71-80</td>
<td>2.84</td>
<td>-0.07</td>
<td>2.03</td>
<td>2.34</td>
<td>3.03</td>
</tr>
<tr>
<td>81+</td>
<td>3.16</td>
<td>-1.64</td>
<td>2.15</td>
<td>-0.41</td>
<td>1.87</td>
</tr>
<tr>
<td>All</td>
<td>2.58</td>
<td>-0.46</td>
<td>2.10</td>
<td>1.86</td>
<td>2.81</td>
</tr>
</tbody>
</table>

*The table shows the median percentage growth rates of annualized wealth for the HRS data and each of four different model specifications. Each specification is solved for a CRRA parameter $\rho = 3$, a discount factor $\beta = 0.98$, survival probabilities according to the SSA life tables, and an initial simulated distribution of cash-on-hand, income, demographics, and education that is sampled 20,000 times from the HRS distribution of respondents aged 65-70. The second column, the “baseline” specification, includes no bequest motive and no medical costs. The third column adds to the baseline a bequest motive with parameter $b = 3$. The fourth column adds to the baseline the uncertain medical costs described in the text. The last column includes both the bequest motive and the uncertain medical costs.
When measured comprehensively and in terms of dollars per expected year of life, the HRS panel data show a fairly broad tendency for wealth to rise during retirement.

Over the period from 1998 through 2006, the typical increase in annualized comprehensive wealth are nontrivial—from $33,000 to $42,000 per person per expected year of life over 8 years, on net.

The largest increases are seen for retired couples and retirees with more education, higher income, and in better health.

That said, about 1-in-7 retirees in our HRS panel experiences more than a 25 percent decline in annualized comprehensive wealth between 1998 and 2006.
In work that I have not had time to discuss here, we have simulated age-profiles for annualized comprehensive wealth using a fairly standard life-cycle model of consumption during retirement that includes:

- Uncertain longevity
- Random (exogenous) out-of-pocket medical expenditures
- An explicit bequest motive

This type of life-cycle model generally predicts an upward-sloping age-profile for annualized comprehensive wealth.

However, the calibrated models we have looked at generally imply flatter age-profiles for annualized wealth than those evident in the HRS panel data.
Some Ideas for Follow-Up Research: And you thought that was rough!

**Understanding the Distribution of Wealth at Retirement: Is It What Folks Earned or What They Did with It?**

- As you know, the distribution of wealth is incredibly wide.
- Lots of us would like to know why it’s so wide.
- And, the HRS has some restricted-access data that should be helpful, in this regard.
Measuring Lifetime Earnings in the HRS

- Annual earnings records from the Social Security Administration from as far back as the 1950s and as recent as the early 2000s

- Annual wage and salary records from the Internal Revenue Service from the 1980s through the early 2000s

- About a year ago, Paul and I obtained access to these restricted earnings data and I began to construct annual earnings histories for everyone in our HRS dataset (and their spouses, where I could)

- Then, I set about asking whether variation in lifetime earnings could explain/account for (nonparametrically) the variation in wealth near retirement
Restrict HRS sample to a cross-section of households headed by a person in their “mid-60s” between 1998 and 2006

(Sample size ≈ 5,435)

Compute 2 measures of lifetime earnings for every head of household and recorded spouse using SSA and IRS records

1. Straight sum of annual earnings
2. “Future value” concept of annual earnings

Nonparametrically summarize each household’s position in the lifetime earnings distribution (2 ways)

1. Record each household’s decile of the lifetime earnings distribution
   (10 binary indicators)
2. Decile of the earnings distribution in each “age-decade”
   (45 binary indicators)
Results from these Nonparametric Regressions

- Not surprisingly, lifetime earnings is *highly predictive* of wealth near retirement:
  - F-statistics for the OLS regressions are enormous (p-values near 0.0000)
  - T-statistics on individual dummy variables are highly significant

- Somewhat surprisingly, there is *an awful lot* of residual variation in wealth near retirement:
  - $R^2 \approx 0.03$ using levels of wealth as the dependent variable (comprehensive wealth or conventional net worth)
  - $R^2 \approx 0.25$ using the natural log of wealth as the dependent variable

- And, this is true even for “trimmed” samples and even when I condition on the detailed indicators of lifetime earnings histories (40 dummies)
Scatterplot of Comprehensive Wealth and Lifetime Earnings

Scatterplot of $\ln(CW)$ vs. $\ln(\text{Lifetime Earnings})$

Middle of the Lifetime Earnings Distribution Only

$\ln(\text{Comprehensive Wealth})$

$\ln(\text{Lifetime Earnings})$ −−− Decile 3 through Decile 7
Distribution of Comprehensive Wealth across Lifetime Earnings Deciles

**Box Plots of Ln(CW) by Lifetime Earnings Decile**

Graphs by 10 quantiles of a2565_imp_hh

Decile of the Lifetime Earnings Distribution
Scatterplots of Comprehensive Wealth across Lifetime Earnings Deciles

Graphs by 10 quantiles of a2565_imp_hh
Decile of the Lifetime Earnings Distribution
Sadly (for me), this pretty interesting result is not new!

- In the 1998 *AER* *P&J*, Gustman and Steinmeier asked the same question with an earlier (and more limited) vintage of HRS data.
- I took a less parametric regression approach than they did, but (10 years later!) I got the same answer they did.
Why is this an interesting result?

As you may know, in a 2006 *JPE* paper, Scholz, Seshadri, and Khitatrakun say:

We solve each household’s optimal saving decisions using a life cycle model that incorporates uncertain lifetimes, uninsurable earnings and medical expenses, progressive taxation, government transfers, and pension and social security benefits. With optimal decision rules, we compare, household by household, wealth predictions from the life cycle model using a nationally representative sample. We find, making use of household-specific earnings histories, that the model accounts for more than 80 percent of the 1992 cross-sectional variation in wealth. Fewer than 20 percent of households have less wealth than their optimal targets, and the wealth deficit of those who are undersaving is generally small.
So, I thought I would use my nonparametric regression to control for “what folks earned” (ex post heterogeneity in LT earnings) and that would account for a sizable portion of the variation in household wealth near retirement.

I thought the residual variation would be moderate and would plausibly capture ex ante heterogeneity plausibly labelled “what folks did with it.”

Instead, I found incredibly low $R^2$ from the nonparametric regression, suggesting to me (initially, at least) that in spending/saving behavior is at least as important as heterogeneity in lifetime earnings.

Now I don’t know what to think.