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How long does savings last when retirees need more money (or less) than conventional wisdom suggests?

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How Long Does Savings Last When Retirees Need More Money (or Less) than Theory Suggests?

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Retiree Risk

- Volatility of investment risk
  - Standard deviation of returns
  - Statistical measurement, academic

- Longevity risk
  - Hard to quantify
  - Not academic
Longevity Risk and Human/Financial Capital

- Life Cycle and the risk/return trade-off
  - Younger investors
    - Willing to bear more risk for higher returns
  - Older investors
    - Willing to accept lower returns for lower risk
4% Rule Example

• At retirement, you have $1,000,000 in retirement savings

• 1st year of retirement:
  • Withdraw $40,000.00
  • Inflation that year is 2.4%

• 2nd year of retirement:
  • Withdraw $40,000 x 1.024 = $40,960.00
  • Inflation that year is 3.2%

• 3rd year of retirement:
  • Withdraw $40,960 x 1.032 = $42,270.72
  • Continue this procedure indefinitely
The 4% Convention

• Withdraw 4% of retirement funds for the first year of retirement
  • Base withdrawal amount

• Increase the amount annually with inflation

• Savings will normally last for at least 30 years
  • Some exposure to stock is required (40% or more)

• Rule of thumb, very rigid
  • Does not allow for any flexibility
  • Many retirees have unique circumstances

• 4% has been questioned as too high in our low rate environment
More Flexibility

• Withdraw initial amounts varying between 2% and 10%

• Allow for 1 or 2-asset portfolios
  • 10% increments (0-100%)

• Determine how long savings will survive
  • Percentage of portfolios not running out of money

• Check survival rate in 5-year increments
  • 5 years to 40 years

• Use real data from 1934 – 2015
Data

- Small Cap stocks, Midcap stocks, Large cap stocks, T-bonds, T-bills
  - Kenneth French Data Library
  - Federal Reserve Economic Data (FRED)
- Increased withdrawal amount each year using previous year CPI-U
- Data from 1934 – 2015
Methodology

• 1- and 2-asset portfolios of the 5 assets in 10% increments
  • 95 distinct portfolios (e.g. 30% midcaps/70% T-bonds)

• 2 – 10% initial withdrawal amounts
  • Base dollar amount
  • Increased by inflation from previous year

• Rolling 5-, 10-, 15-, 20-, 25-, 30-, 35-, and 40-year periods
  • 78, 73, 68, 63, 58, 53, 48, and 43 rolling periods (1934-2015)

• Determine survival rate
  • Percentage of rolling periods that do not run out of money

• Taxes not considered
## Correlation Matrix

<table>
<thead>
<tr>
<th>Asset</th>
<th>SmCap</th>
<th>MidCap</th>
<th>LgCap</th>
<th>10yTBond</th>
<th>TBill(Cash)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SmCap</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MidCap</td>
<td>0.9309</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LgCap</td>
<td>0.8081</td>
<td>0.9467</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10yTBond</td>
<td>-0.1978</td>
<td>-0.1143</td>
<td>-0.0557</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>TBill(Cash)</td>
<td>-0.1413</td>
<td>-0.0901</td>
<td>-0.0470</td>
<td>0.2864</td>
<td>1.0000</td>
</tr>
</tbody>
</table>
## Descriptive Statistics

<table>
<thead>
<tr>
<th>Asset</th>
<th>E(R)</th>
<th>STD. DEV.</th>
<th>CV</th>
<th>SHARPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SmCap</td>
<td>20.47%</td>
<td>34.99%</td>
<td>1.7091</td>
<td>0.4833</td>
</tr>
<tr>
<td>MidCap</td>
<td>15.46%</td>
<td>24.11%</td>
<td>1.5591</td>
<td>0.4936</td>
</tr>
<tr>
<td>LgCap</td>
<td>13.01%</td>
<td>19.20%</td>
<td>1.4751</td>
<td>0.4923</td>
</tr>
<tr>
<td>10yTBond</td>
<td>5.40%</td>
<td>8.23%</td>
<td>1.5238</td>
<td>0.2233</td>
</tr>
<tr>
<td>TBill(Cash)</td>
<td>3.56%</td>
<td>3.15%</td>
<td>0.8837</td>
<td>0.0000</td>
</tr>
</tbody>
</table>
Best Risk-Return (Highest Sharpe) **Survival**

- 7 (of 95) Portfolios had Sharpe Ratios of >0.5500
- Best was 30% Small Cap, 70% T-bonds (0.5818)
  - $E(r) = 9.92\%$ over the 82-year period
- 2-3% withdrawal rates: nearly 100% survival
- 4% withdrawal rate: Acceptable survival at 40 years (95%)
- 5% withdrawal rate: Acceptable survival at 30 years (89%)
- 6% withdrawal rate: Acceptable survival at 20 years (89%)
- 7-10% withdrawal rates: Acceptable only at $\leq 10$ years
2% Withdrawal Rate **Survival**

- Everything survives for 40 years except combinations of T-bonds and T-bills
- Combinations of T-bonds and T-bills have some probability of failing after 30 years
- Any combination with at least 10% stock survives for the entire period
- No need for a financial advisor for this one
  - If your only goal is to be sure your money survives
3% Withdrawal Rate **Survival**

- 100% chance of 25-year survival with at least 10% invested in stocks (any-cap)
- 89% chance or greater of 30-, 35-, and 40-year survival with at least 10% invested in stocks
- Some portfolio combinations survived for 40 years
- Not likely to run out of money if you only need 2-3% initial withdrawal rate from your retirement savings
4% Withdrawal Rate Survival

• This is the conventionally recommended rate

• 4 portfolio combinations that survive for 30 years 100% of the time
  • 30-40% small cap stocks, 70-60% T-bills
  • 30-40% midcap stocks, 70-60% T-bills

• No 100% guarantees at 35- or 40-year horizons

• Stocks are necessary to include in retirement portfolio if 4% or more initial withdrawal rate is desired and assets expected to last for more than 20 years

• If retirement savings survival of 30 or more years is required, the 4% convention seems to reflect reality
5% Withdrawal Rate Survival

- Survival rates with withdrawal rates $\geq$ 5% get more complex
- Some 100% survival rates at 15-year horizon
- Many >90% survival rates at 20-year horizon
- Some portfolio combinations had >90% survival rates for 25-, 30-, 35-, and 40-year horizons
  - 70% small cap stocks / 30% T-bonds survived for 40 years 95% of the time
- Many all-stock portfolios survive longer than those with bonds, but some portfolios with bonds did well
6% Withdrawal Rate **Survival**

• Stock component is necessary for an acceptable probability of a >20 year survival rate
  • All-bond combinations survived <30% of the time

• Best combinations
  • 20 Years: 60% SmCap/40% T-bonds (97%)
  • 25 Years: 80% SmCap/20% T-bonds, or
    90% SmCap/10% T-bills (95%)
  • 30 Years: 90% SmCap/10% T-bonds or T-bills (93%)
  • 35 Years: 90% SmCap/10% T-bonds (92%)
  • 40 Years: 80-100% SmCap/0-20% T-bonds or T-bills (88%)
    • 5 Combinations
7% Withdrawal Rate **Survival**

- Many 15-year survival rates are good (>90%)
- The best 20-, 25-, 30-, and 35-year survival rates are 80-90%, which is starting to get risky
  - All of the best survival rates had allocations to small cap stocks of at least 50%, but mostly higher
- The best 40-year survival rate was 79%
  - All had a 60-100% allocation to small cap stocks
- Portfolios with large portions of bonds and bills rarely survived 15 years
8% Withdrawal Rate **Survival**

- 10-year survival rates are mostly good (>90%)
- 15 and 20-year survival rates may be acceptable (>85%) for the best portfolio combinations
- Survival rates for portfolio combinations with horizons of 25 years or more are only around 80% (+/- 3%)
  - 25 Years: 80% SmCap/20% Large Caps (83%)
  - 30 Years: 90% SmCap/10% Midcaps or Large caps (77%)
  - 35 Years: 100% SmCap; or 90% SmCap/10% T-bills (79%)
  - 40 Years: 100% SmCap (79%)
9% Withdrawal Rate **Survival**

- No portfolios had 100% survival rates at 10 years
  - Best combinations at 10 years: 30-50% small cap stocks combined with 70-50% T-bills
    - Survived 95% of the time and included a large chunk of T-bills
    - Relatively short time horizon

- Best portfolio combinations at other time horizons:
  - 15 years: 50-80% SmCap/20-50% other stocks or T-bonds (85%)
  - 20 years: 70% SmCap/30% Large Caps (79%)
  - 25 years: 100% Small Cap stocks (71%)
  - 30, 35, and 40 years: 90-100% SmCap/0-10% Midcap or LargeCap (64-65%)
    - 80% small caps and 20% midcaps also tied for best at 35 years

- Consider delaying retirement if horizon >15 years
10% Withdrawal Rate Survival

• Not all 5-year horizons survived (but almost all)

• 10- and 15-year horizons may be acceptable
  • Best survival rates are 89% for 10 years and 79% for 15 years
  • 40-70% SmCap/60-30% T-bonds (best 10-year portfolios)
  • 90% SmCap/10% LargeCap (best 15-year portfolio)

• Survival rates for portfolios of 20 years or more were all lower than 2/3 chance of survival
  • 1 in 3 chance of failure
  • All of the best portfolios had large allocations to small cap stocks

• NOT recommended for horizons longer than 10 years under normal circumstances, or 15 years under extraordinary circumstances
General Recommendations

• If you only need 2-4% withdrawal rate, your unlikely to run out of money as long as you have some allocation to stocks

• For 5-6% withdrawal rates, a significant allocation to stocks is necessary if you time horizon is longer than 15 years

• For 7-10% withdrawal rates, a delayed retirement is a good option if possible. If not, careful allocations and high tolerance to risk (volatility of returns) are necessary for longer time horizons

• Small cap stocks are important in all of the higher withdrawal rates
  • A combination of a small cap ETF and microcap ETF would approximately replicate this portfolio

• Retirees must balance the risk of investment volatility with the risk of running out of money too soon
Caveat & Future Directions

• This study shows past performance and survival rates
  • The future may be different... However...
    • Never underestimate the past

Future Avenues of Research (Things I didn’t do)
1. Increase the potential portfolio choices to include three-, four-, or five-asset portfolios.
2. Include international assets, corporate bonds, and/or high-yield bonds as potential choices for the portfolio.
3. Look at variable withdrawal scenarios, including increasing withdrawal rates and declining withdrawal rates throughout retirement.
Thank you!