



Institute of Actuaries of Australia

**4th Financial Services Forum**

*Innovation in Financial Markets*

19 and 20 May 2008 – Melbourne

# **The Role of Capital Guaranteed Products in Financial Plans**

**Chris Condon**

**Richard Cornwell**



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# Agenda

1. The Financial Planning Challenge
2. The Personal Balance Sheet
3. Definition of Risk
4. Possible Strategies
5. Simulation results
6. Conclusions



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# The Financial Planning Challenge

- How do we ensure that we enough assets to meet living expenses at the desired level for life?



# Personal Balance Sheet - Liabilities

|  | Physical or Contingent? | Market Sensitivity | Interest Rate Sensitive? | Time     | Inflation? | Longevity Risk? | Discretionary? |
|--|-------------------------|--------------------|--------------------------|----------|------------|-----------------|----------------|
| <b><i>Liabilities</i></b>                    |                         |                    |                          |          |            |                 |                |
| <b>Home Mortgage</b>                         | Physical                | None               | Yes                      | No       | No         | No              | No             |
| <b>Investment Loans</b>                      | Physical                | None               | Yes                      | No       | No         | No              | Yes            |
| <b>Credit Cards etc.</b>                     | Physical                | None               | Yes                      | No       | No         | No              | Yes            |
| <b>Living Expenses (self and dependants)</b> | Physical                | None               | No                       | Reduces  | Yes        | Yes             | No             |
| <b>Holidays/Travel etc.</b>                  | Physical                | None               | No                       | Reduces  | Yes        | Yes             | Yes            |
| <b>Health Expenses</b>                       | Contingent              | None               | No                       | Increase | Yes        | Yes             | No             |
| <b>Bequeathment</b>                          | Contingent              | None               | No                       | No       | Yes        | Yes             | Yes            |



# Personal Balance Sheet - Assets

|                                | Physical or Contingent? | Market Sensitivity | Interest Rate Sensitivity? | Time    | Inflation? | Longevity Risk? | Discretionary? |
|--------------------------------|-------------------------|--------------------|----------------------------|---------|------------|-----------------|----------------|
| <i>Assets</i>                  |                         |                    |                            |         |            |                 |                |
| <b>Home</b>                    | Physical                | Positive           | Indirect                   | No      | Yes        | No              | n/a            |
| <b>Superannuation</b>          | Physical                | Positive           | ?                          | No      | ?          | No              | n/a            |
| <b>Financial Assets</b>        | Physical                | Positive           | ?                          | No      | ?          | No              | n/a            |
| <b>Future Earning Capacity</b> | Contingent              | None               | No                         | Reduces | Yes        | No              | n/a            |
| <b>Social Security</b>         | Contingent              | Negative           | No                         | Reduces | Yes        | Yes             | n/a            |



## Personal Balance Sheet

- Retirees are faced with a classic asset-liability mismatch
- Liabilities are exposed to longevity and inflation risk
- Financial assets don't perfectly match these risks.



## Current Solutions

- As there are no readily available investments that perfectly match this risk the typical financial plan uses a large proportion of risky assets to improve the probability of not running out of money.
- Even with a large lump sum some combinations of investment returns and longevity can mean that a person outlives his or her money.



## Some possible other tools

- Some new products providing guarantees that are popular in US offer characteristics that can mitigate these risks.
- We tested whether they are, in fact, useful for this purpose from a consumer point of view.





## Definition of Risk

- The probability of the invested funds running out while the investor is still alive (“*ProbUnfunded*”). The definition of this metric is:

$$ProbUnfunded \equiv \sum_s Pr(s) {}_n p_x$$

$Pr(s)$   $\equiv$  probability of scenario  $s$

${}_n p_x$   $\equiv$  probability of a person age  $x$  surviving  $n$  years

$n$   $\equiv$  the number of years when the person's assets run out

- Severity of Shortfall

$$ShortfallSeverity_{x,y} \equiv \frac{\sum_s Pr(s) \frac{PV(Shortfall, y)SO_y}{PV(RetInc, y)}}{ProbShortfall_{x,y}}$$



## Possible Strategies

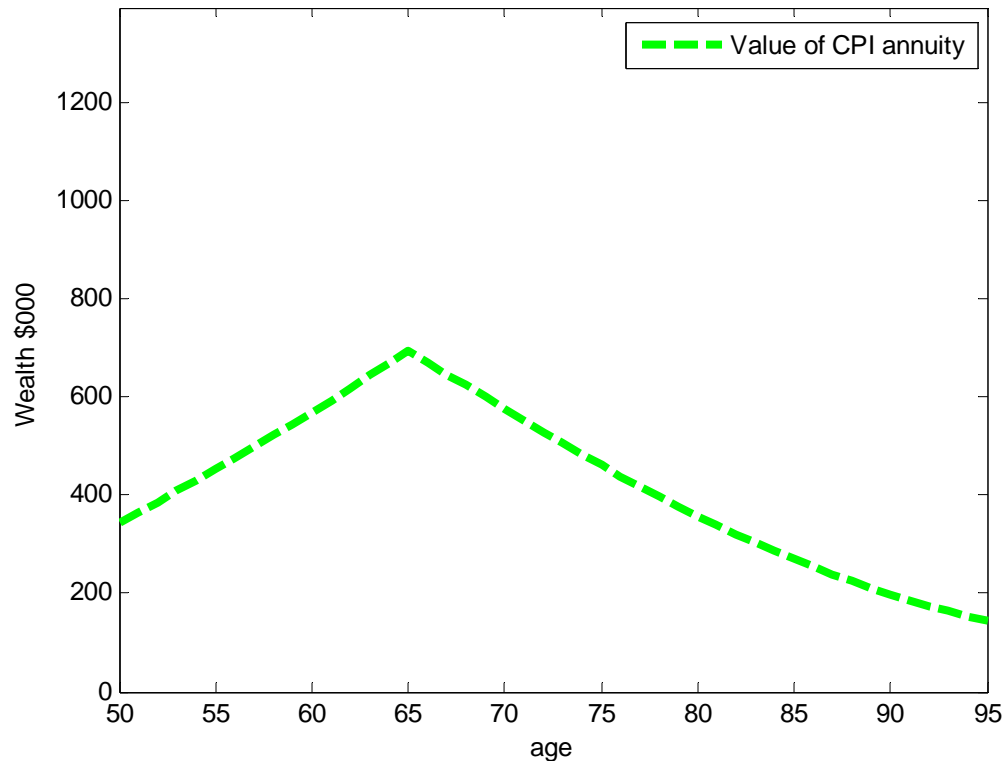
Four strategies evaluated:

1. “Matching”
2. “Long term investment strategy”
3. “Using insurance with embedded guarantees”
4. “Using deferred withdrawal guarantees for life, with uplift”



# Strategy 1: Matched Strategy Wealth (age 50)

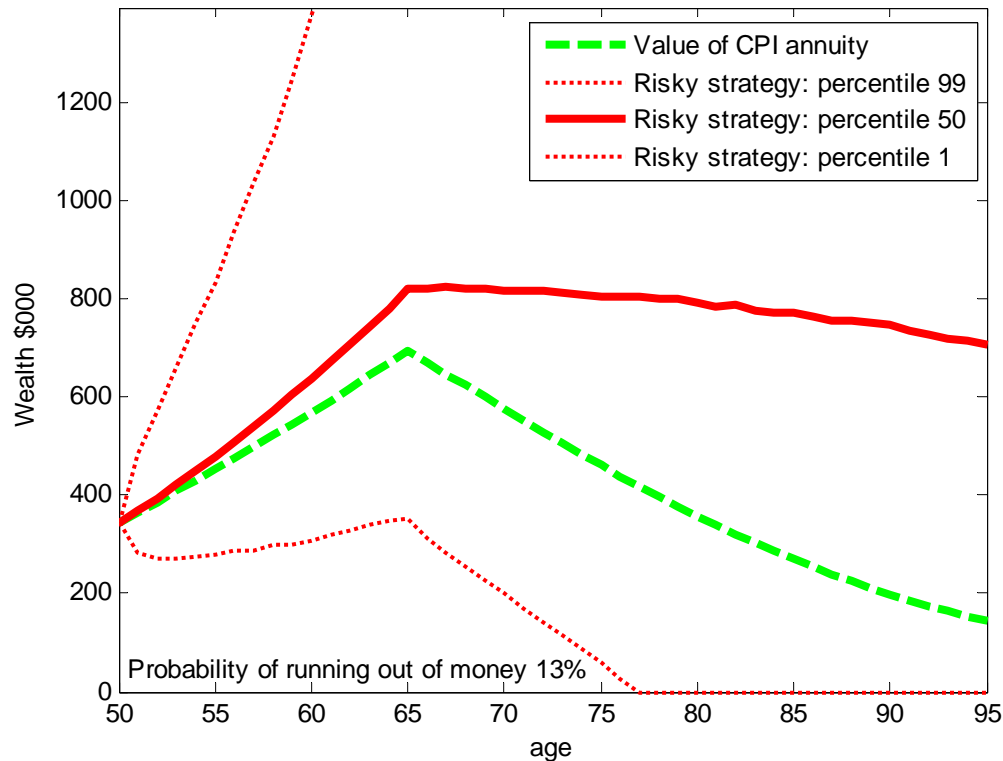
Matched strategy; Commencing at age 50





## Strategy 2: Risky Strategy Wealth (age 50)

Risky investment strategy with no guarantees; Commencing at age 50

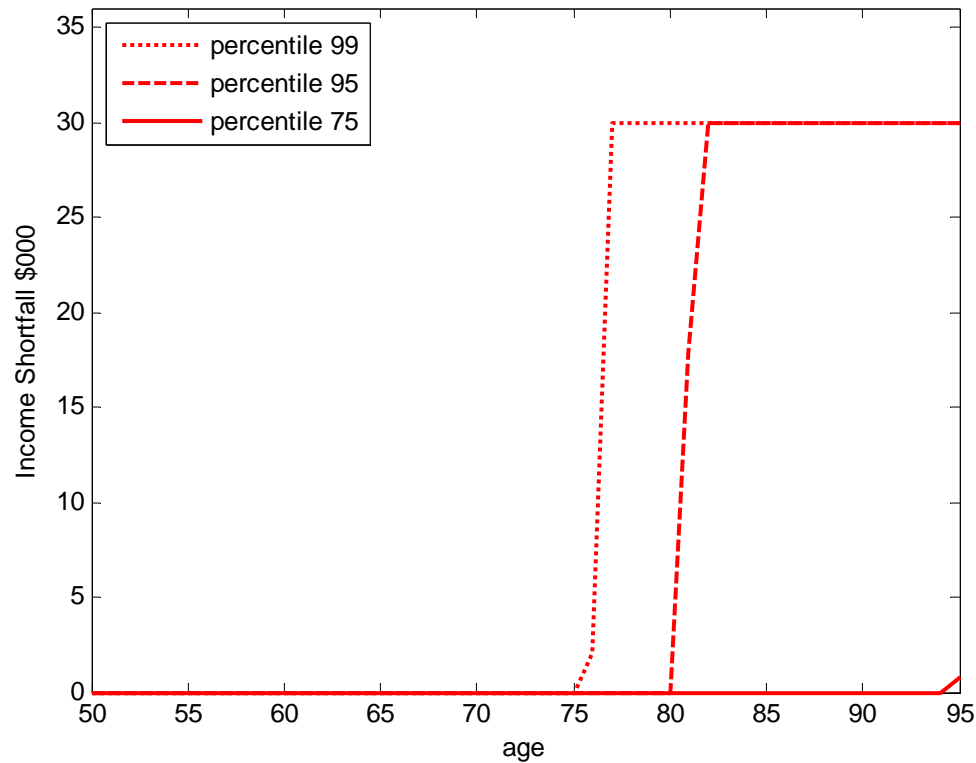




# Strategy 2: Risky Strategy

## Income shortfall (age 50)

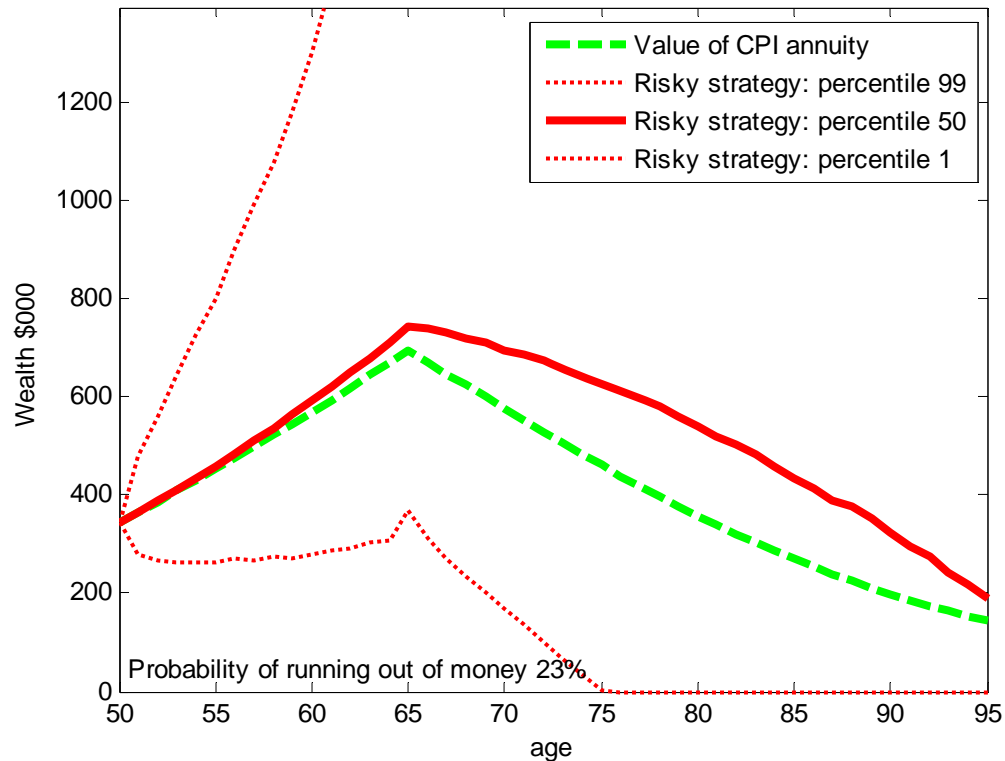
Risky investment strategy with no guarantees; Commencing at age 50





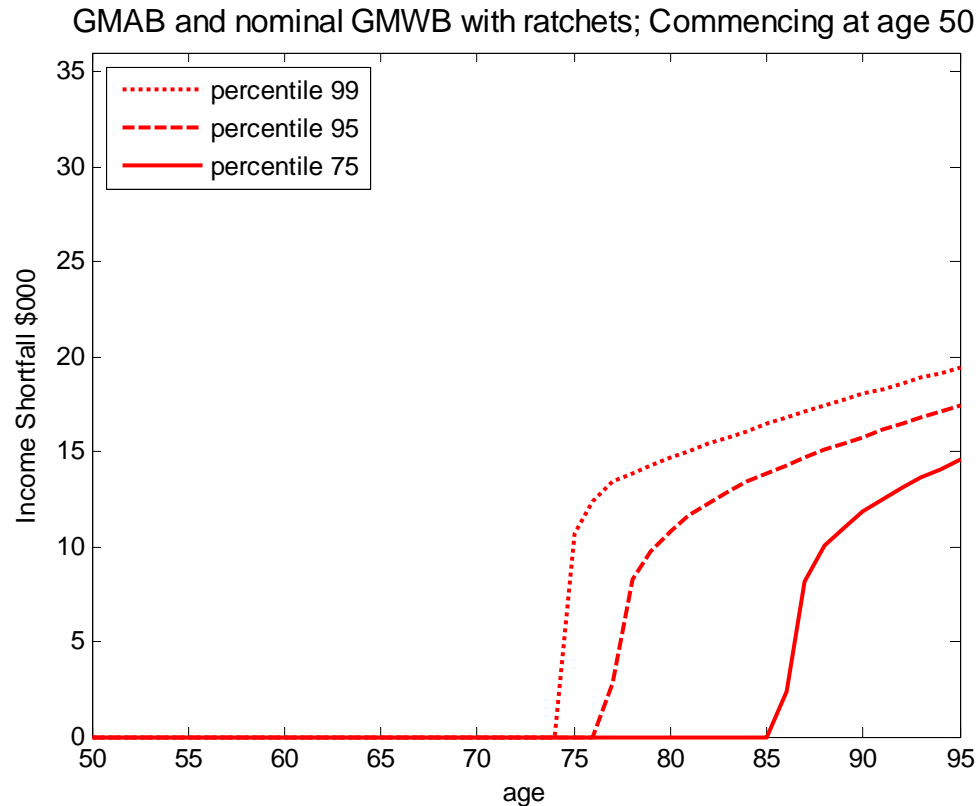
# Strategy 3: With Guarantees (no uplift) Wealth (age 50)

GMAB and nominal GMWB with ratchets; Commencing at age 50



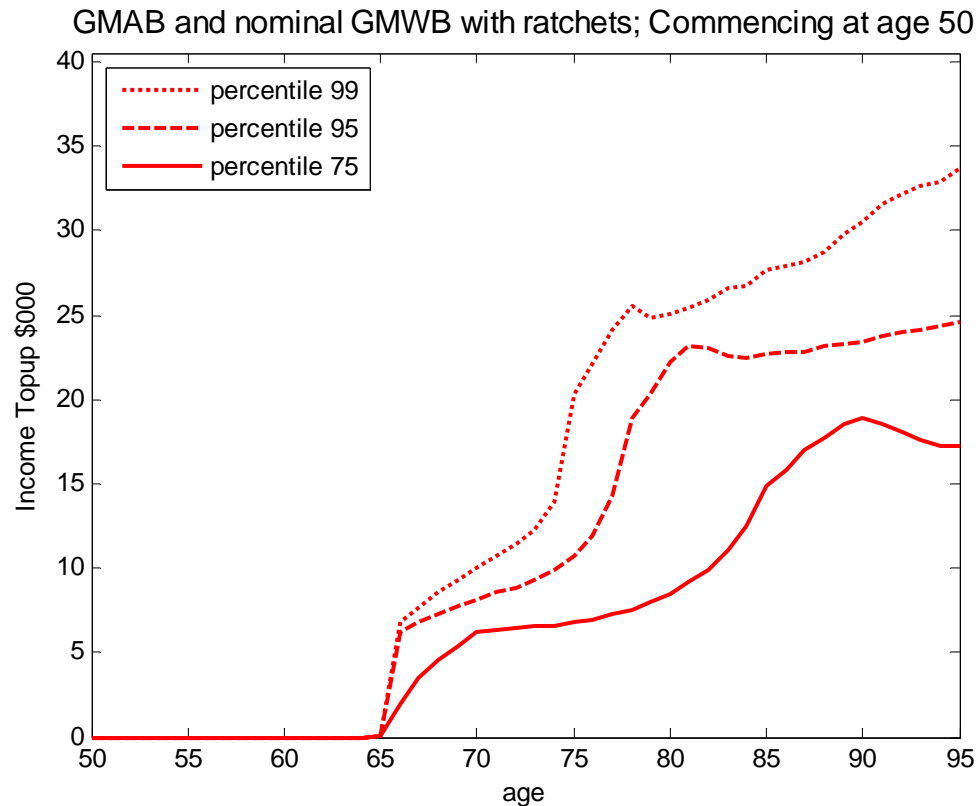


# Strategy 3: With Guarantees (no uplift) Income shortfall (age 50)





# Strategy 3: With Guarantees (no uplift) Income topups (age 50)

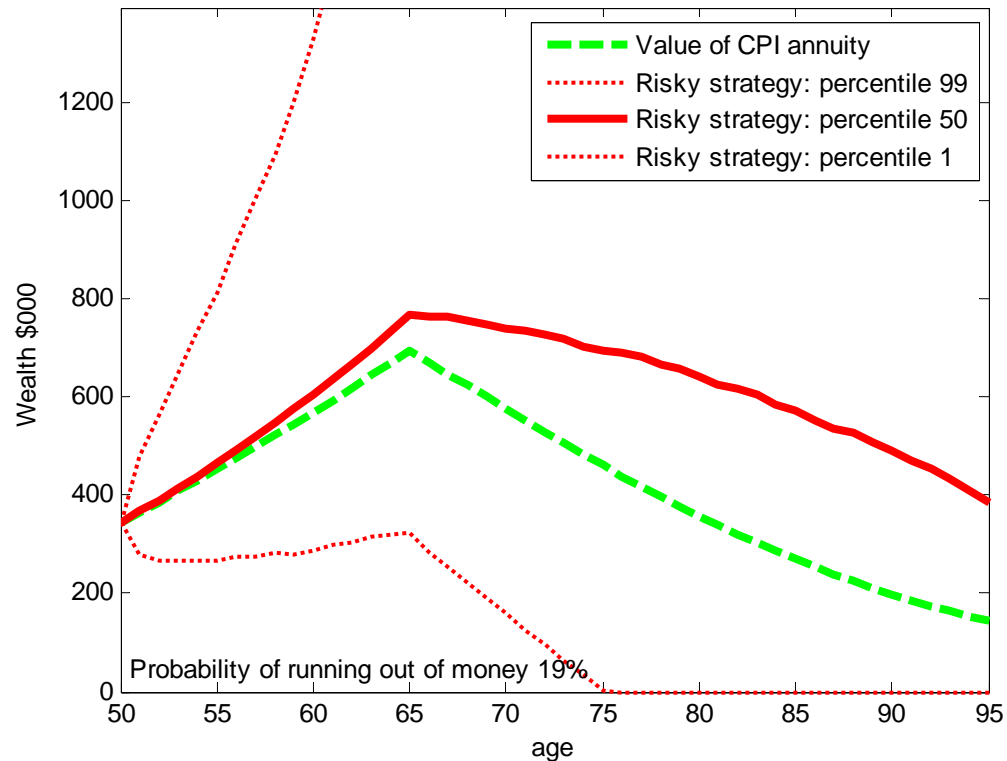






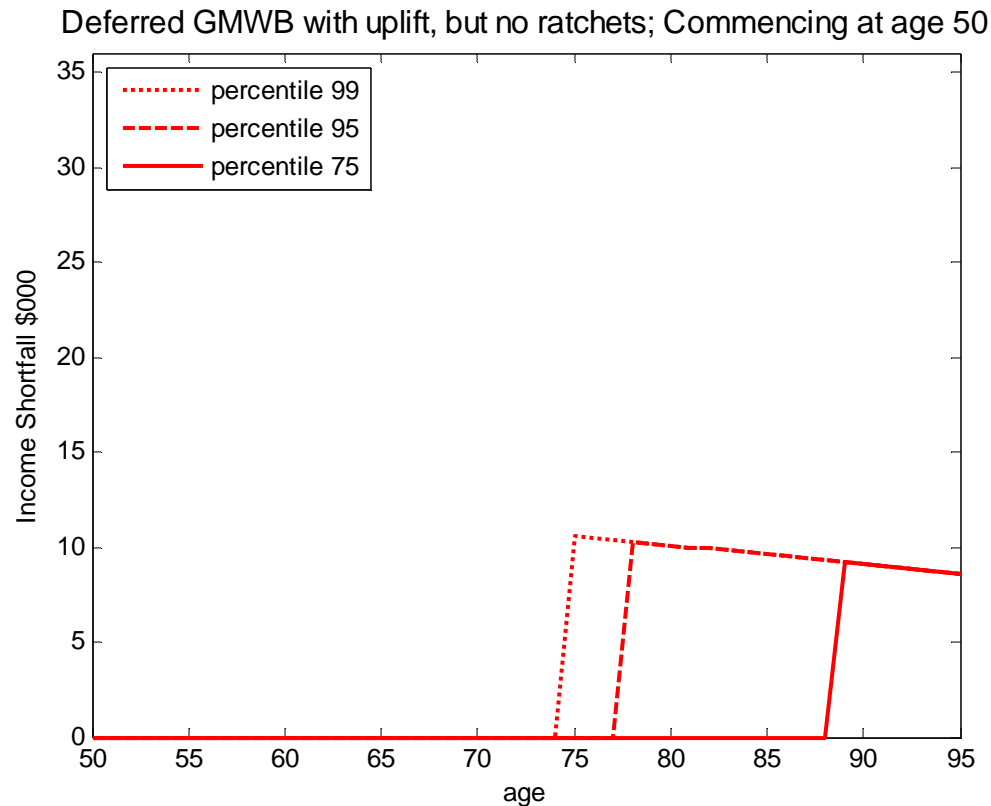
# Strategy 4: Guarantees with uplifts Wealth (age 50)

Deferred GMWB with uplift, but no ratchets; Commencing at age 50





# Strategy 4: Guarantees with uplifts Income Shortfall (age 50)

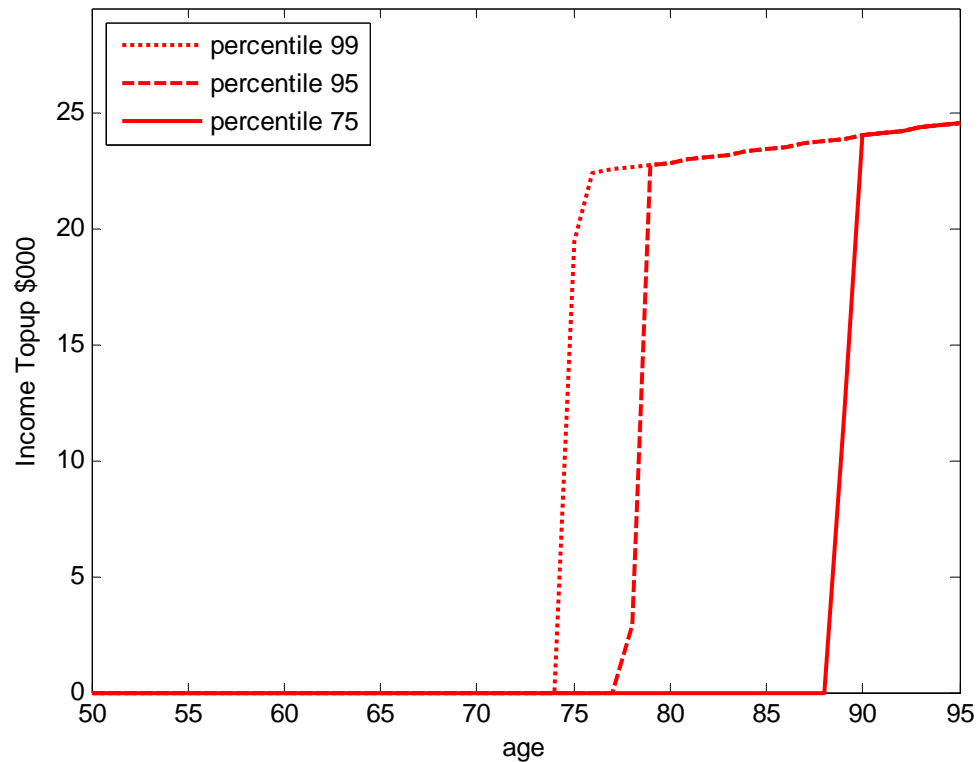




# Strategy 4: Guarantees with uplifts

## Income topups (age 50)

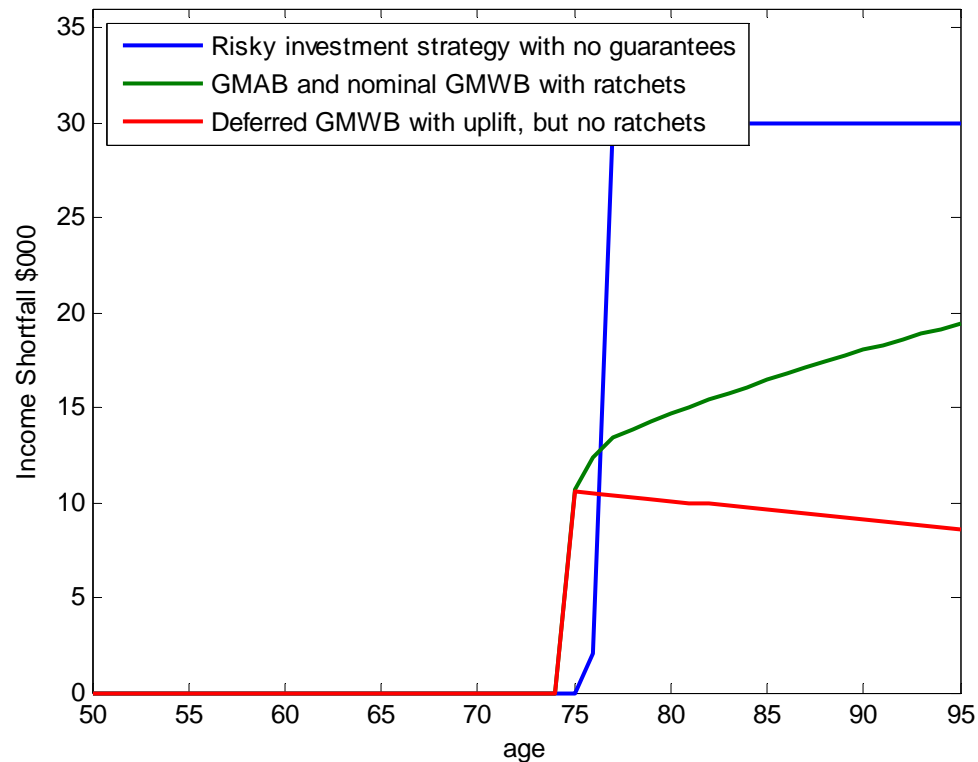
Deferred GMWB with uplift, but no ratchets; Commencing at age 50





# Income Shortfall (99<sup>th</sup> Percentile) Comparison (age 50)

Comparison of income shortfall at percentile 99; Commencing at age 50





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- Severity of Shortfall

$$ShortfallSeverity_{x,y} \equiv \frac{\sum_s \Pr(s) \frac{PV(Shortfall, y) SO_y}{PV(RetInc, y)}}{ProbShortfall_{x,y}}$$



# Shortfall probability and Severity Age 75

For a male now aged 75

|   | at age: | 75   | 85   | 95    |
|---|---------|------|------|-------|
| <b>Risky investment strategy with no guarantees</b> |         |      |      |       |
| Probability of shortfall                            |         | 0.0% | 3.5% | 59.2% |
| Shortfall severity                                  |         | 0.0% | 3.3% | 58.6% |
| <b>GMAB and nominal GMWB with ratchets</b>          |         |      |      |       |
| Probability of shortfall                            |         | 0.0% | 8.6% | 74.0% |
| Shortfall severity                                  |         | 0.0% | 3.3% | 34.4% |
| <b>Deferred GMWB with uplift, but no ratchets</b>   |         |      |      |       |
| Probability of shortfall                            |         | 0.0% | 8.5% | 73.1% |
| Shortfall severity                                  |         | 0.0% | 2.0% | 15.3% |



## Conclusions

Capital guarantees and the withdrawal benefit style products help to:

- remove the risk of outliving one's money
- mitigate the risk of severe investment misfortune

end





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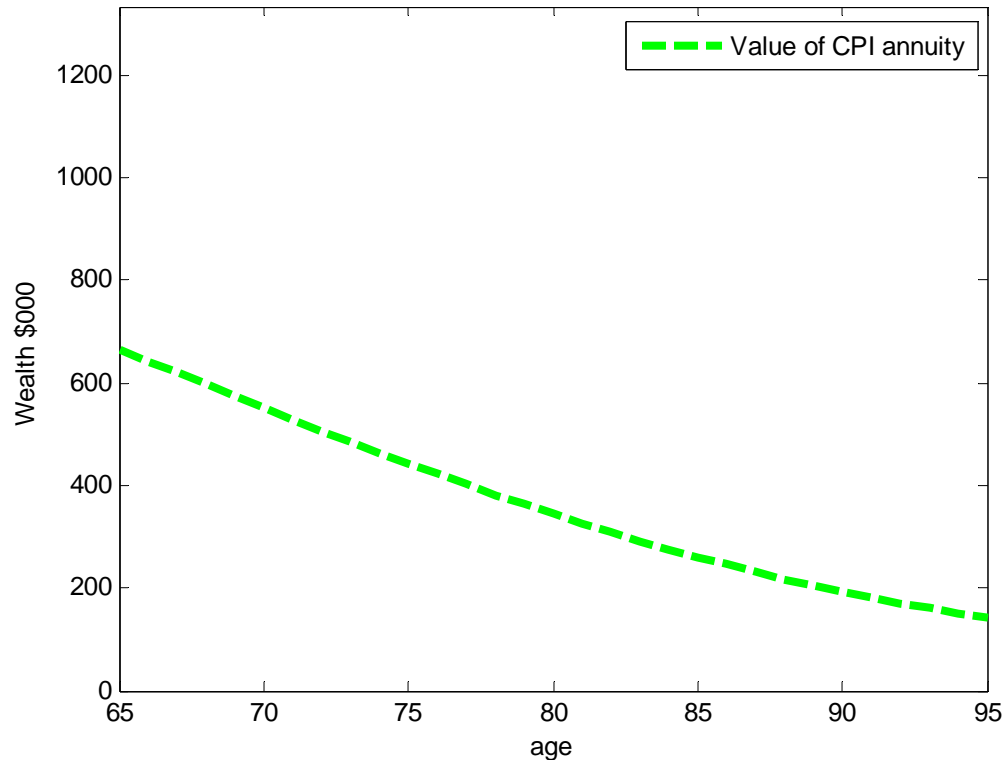
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**Results for a 65 year old at commencement**



# Strategy 1: Matched Strategy Wealth (age 65)

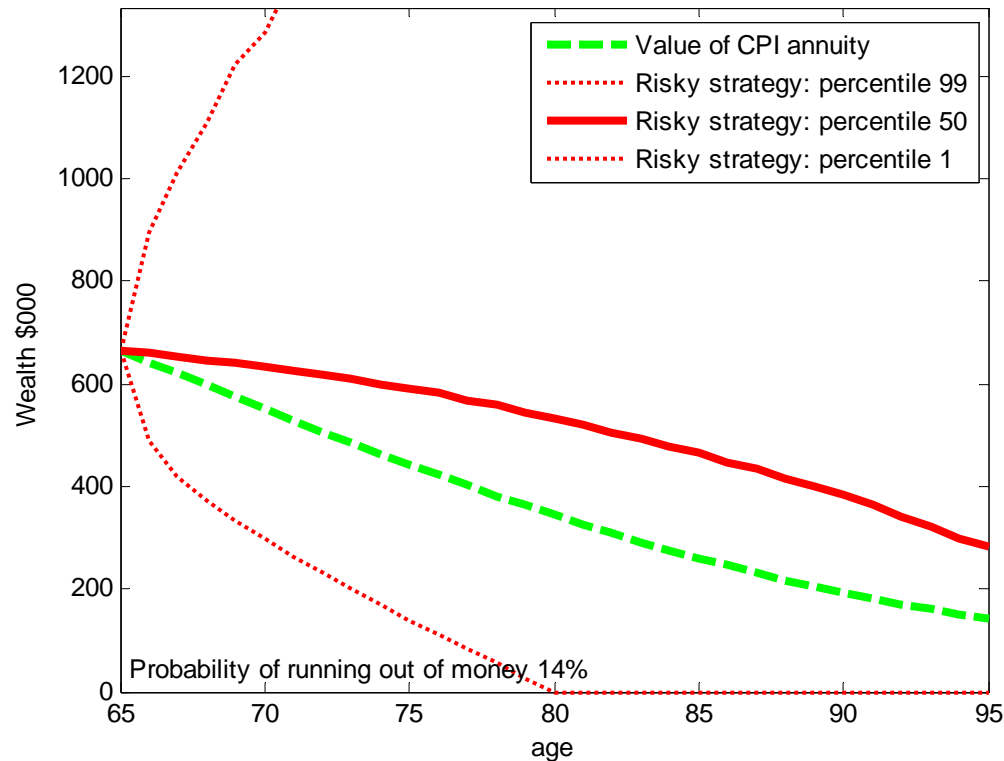
Matched strategy; Commencing at age 65





## Strategy 2: Risky Strategy Wealth (age 65)

Risky investment strategy with no guarantees; Commencing at age 65

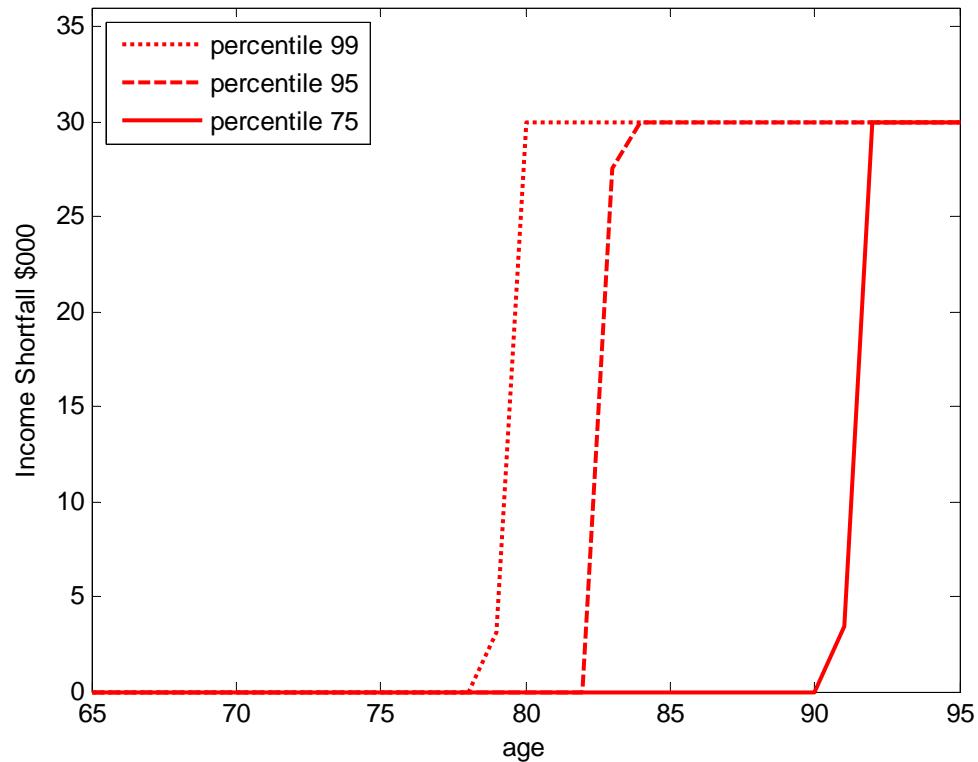




# Strategy 2: Risky Strategy

## Income shortfall (age 65)

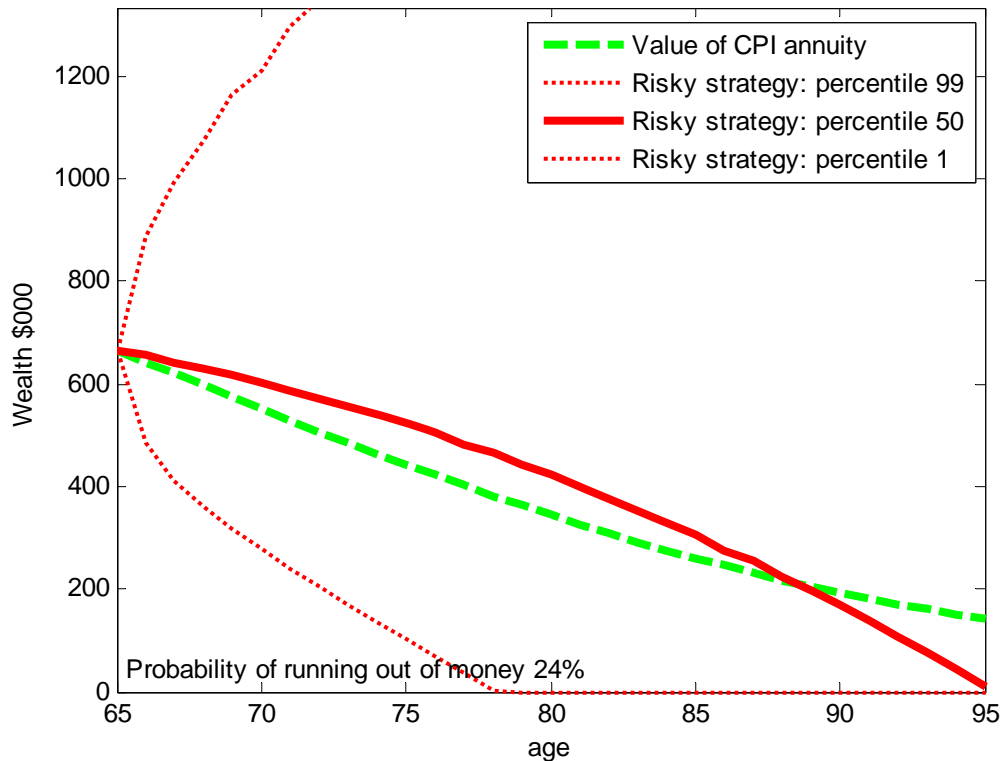
Risky investment strategy with no guarantees; Commencing at age 65





# Strategy 3: With Guarantees (no uplift) Wealth (age 65)

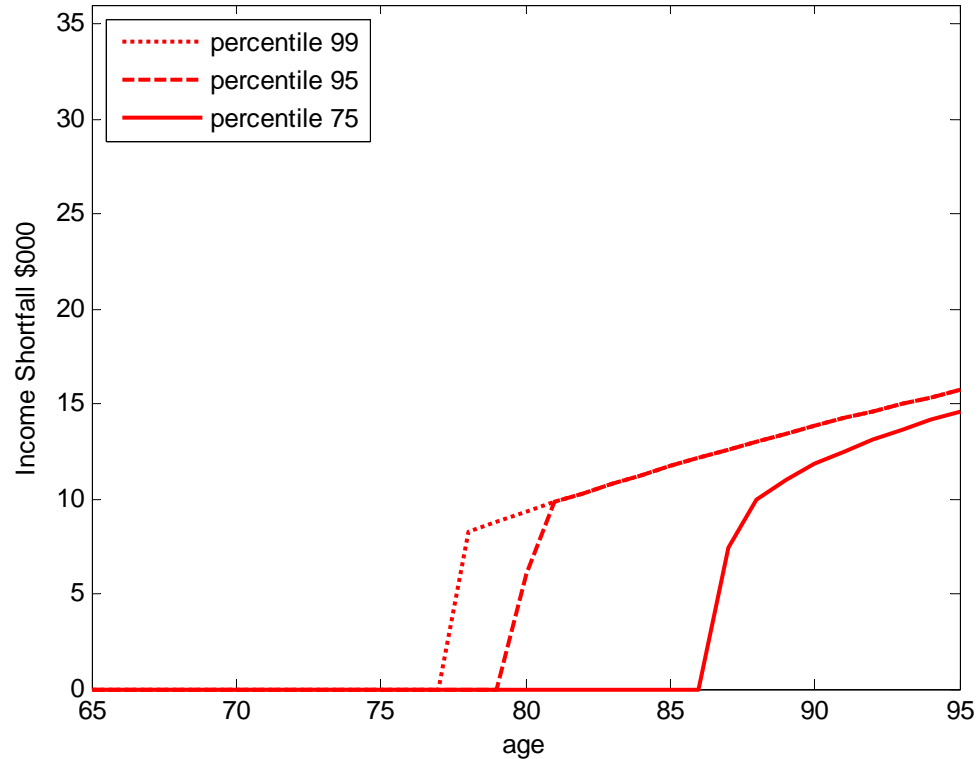
GMAB and nominal GMWB with ratchets; Commencing at age 65





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GMAB and nominal GMWB with ratchets; Commencing at age 65

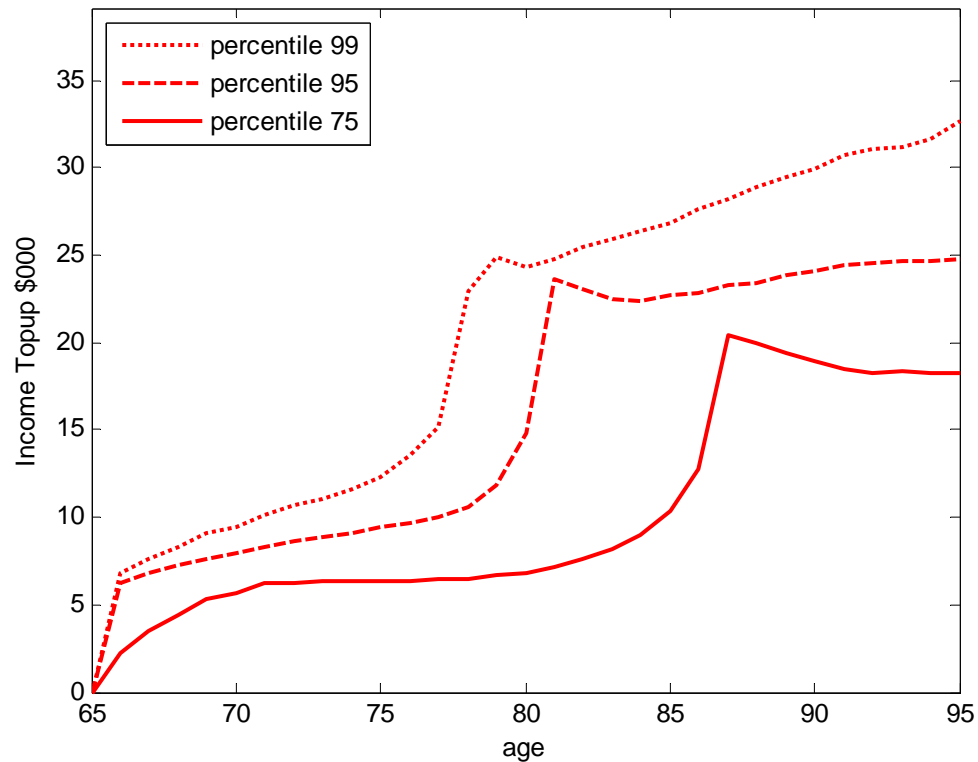




# Strategy 3: With Guarantees (no uplift)

## Income topups (age 65)

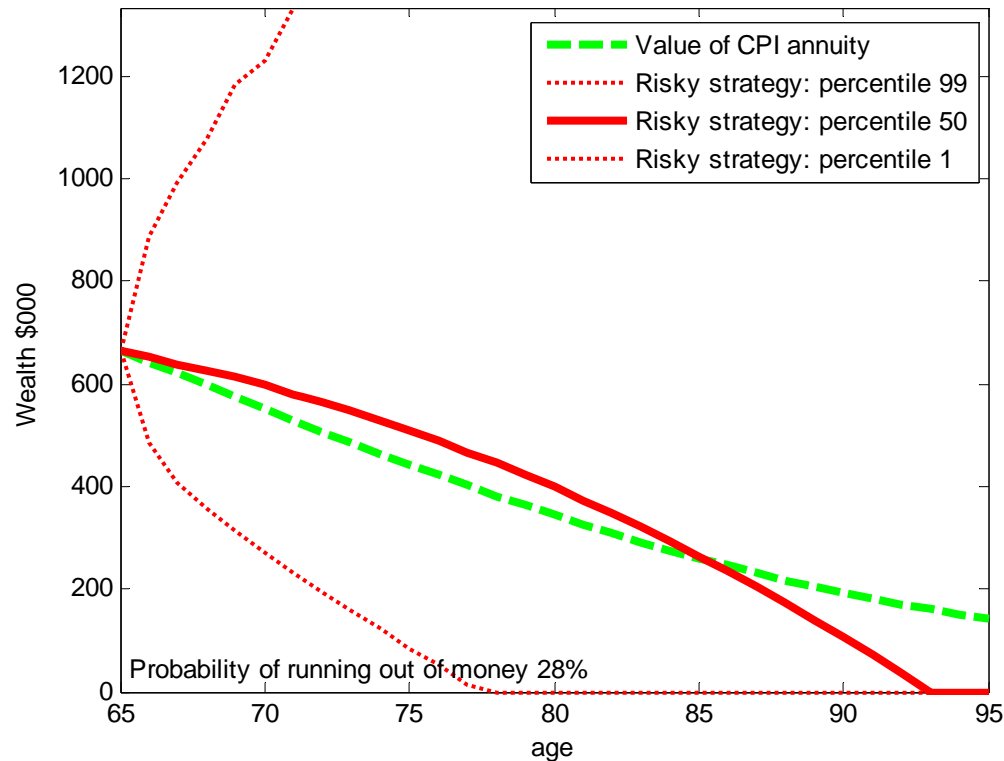
GMAB and nominal GMWB with ratchets; Commencing at age 65





# Strategy 4: Guarantees with uplifts Wealth (age 65)

Deferred GMWB with uplift, but no ratchets; Commencing at age 65

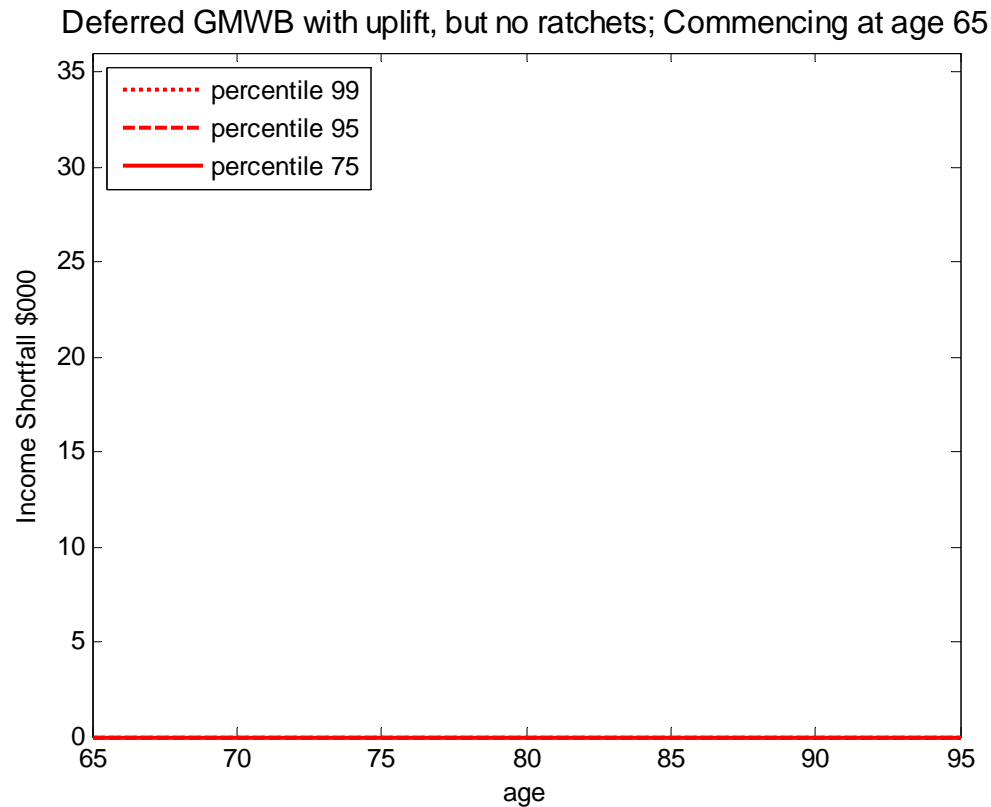






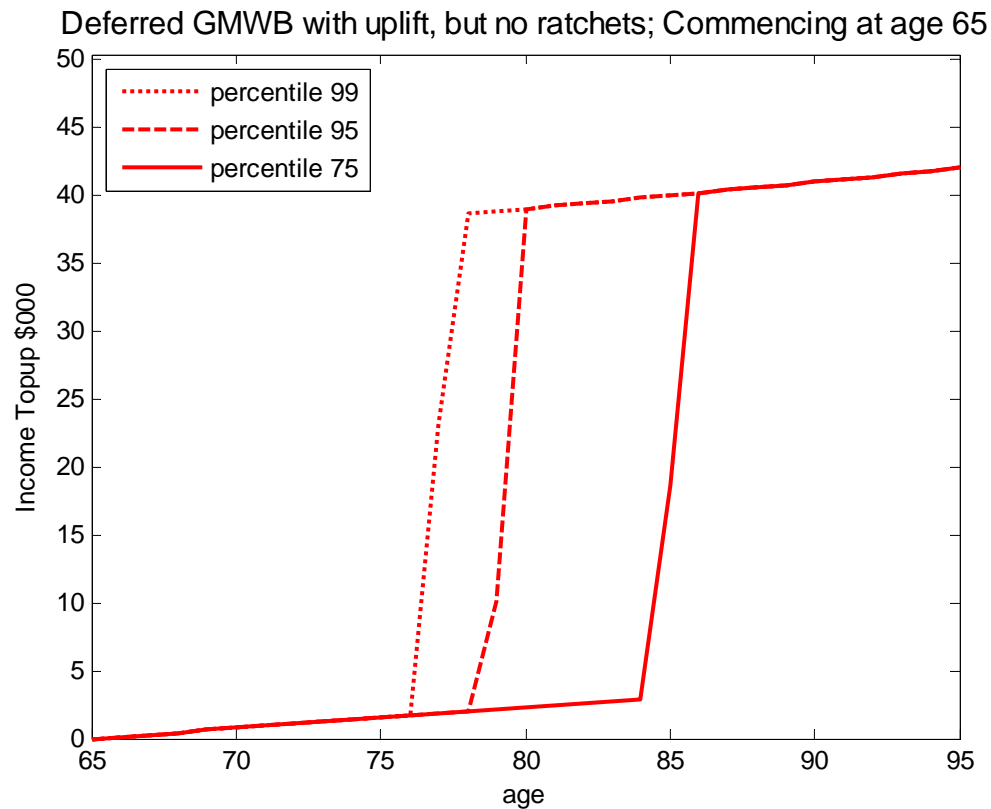
# Strategy 4: Guarantees with uplifts

## Income shortfall (age 65)





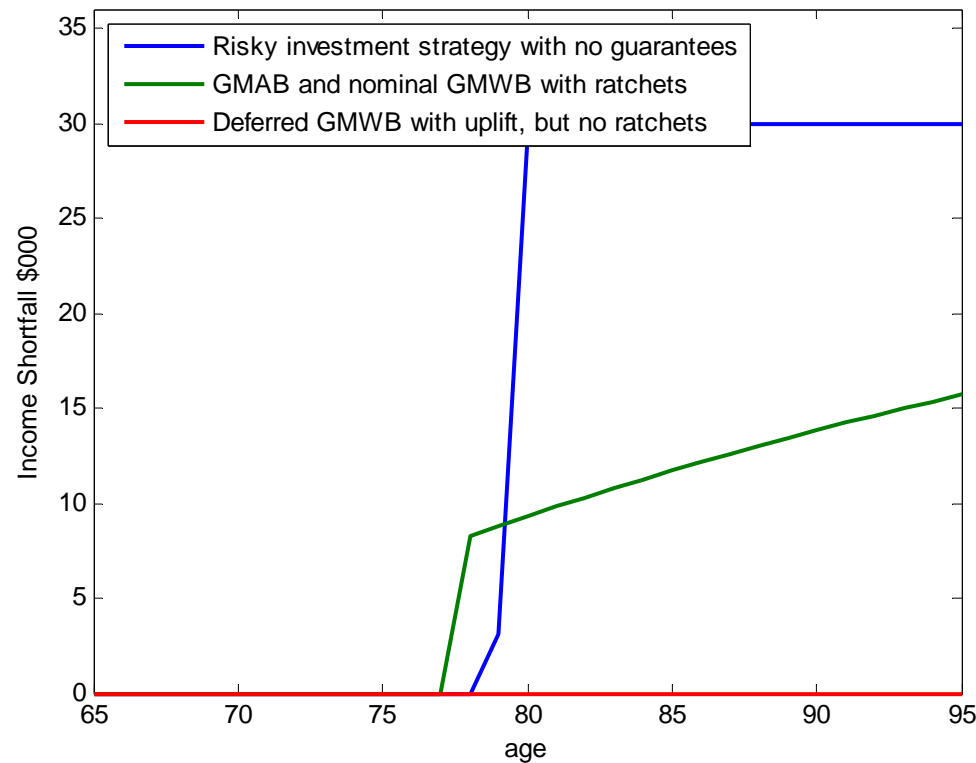
## Strategy 4: Guarantees with uplifts Income topups (age 65)





# Income Shortfall (99<sup>th</sup> Percentile) Comparison (age 65)

Comparison of income shortfall at percentile 99; Commencing at age 65





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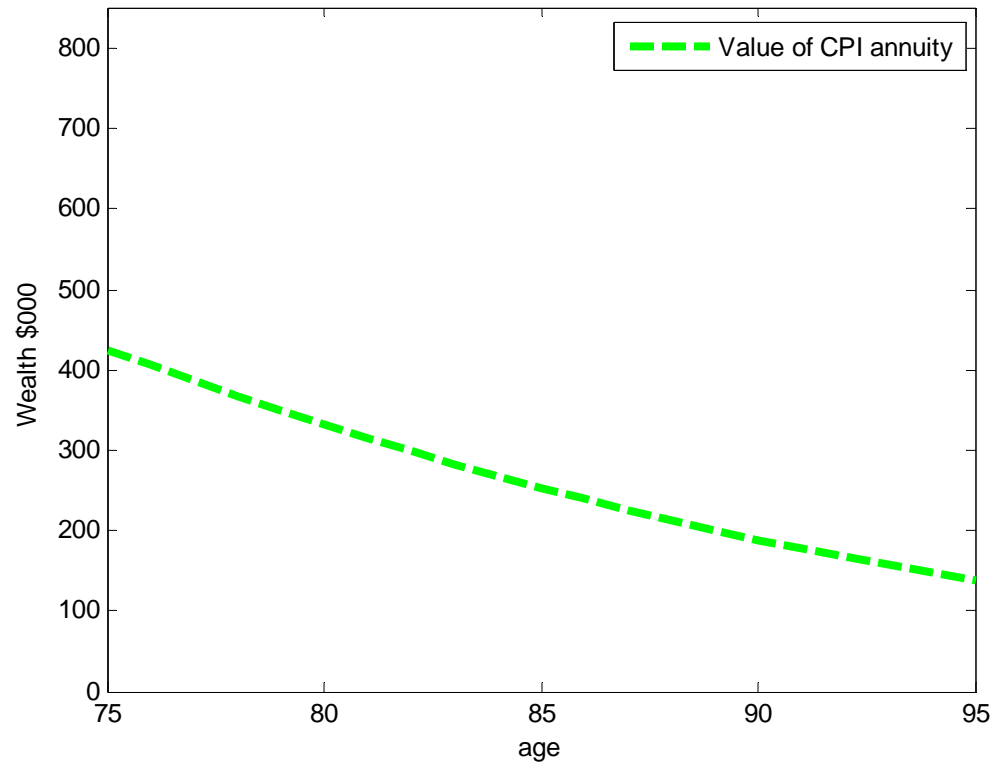
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**Results for a 75 year old at commencement**



# Strategy 1: Matched Strategy Wealth (age 75)

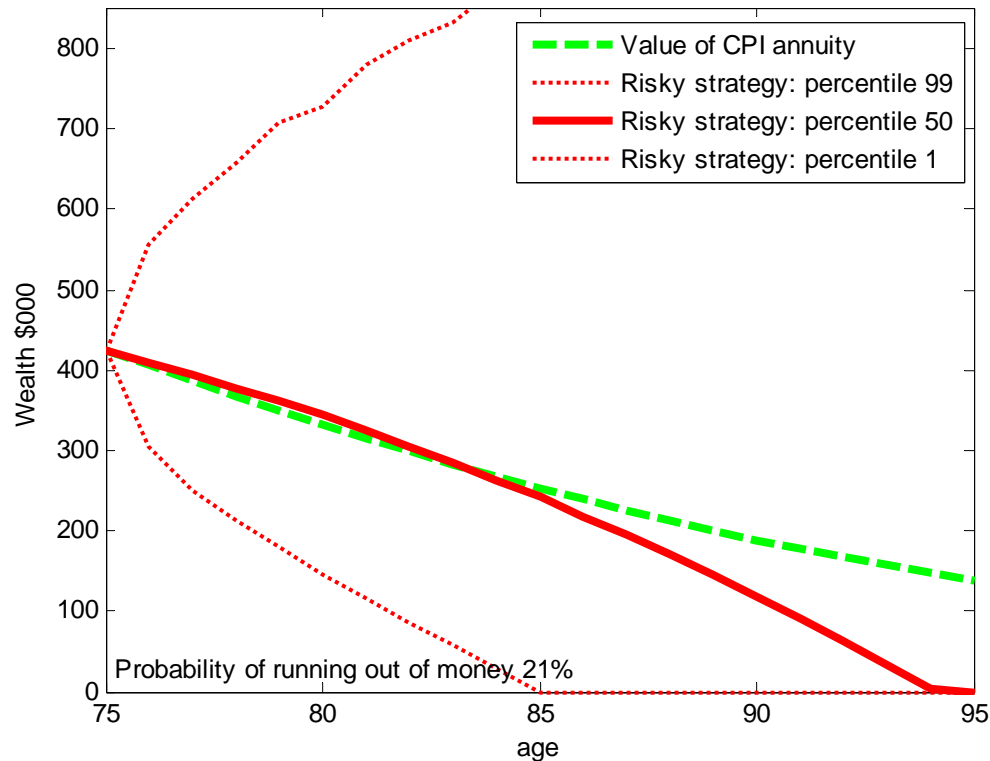
Matched strategy; Commencing at age 75





## Strategy 2: Risky Strategy Wealth (age 75)

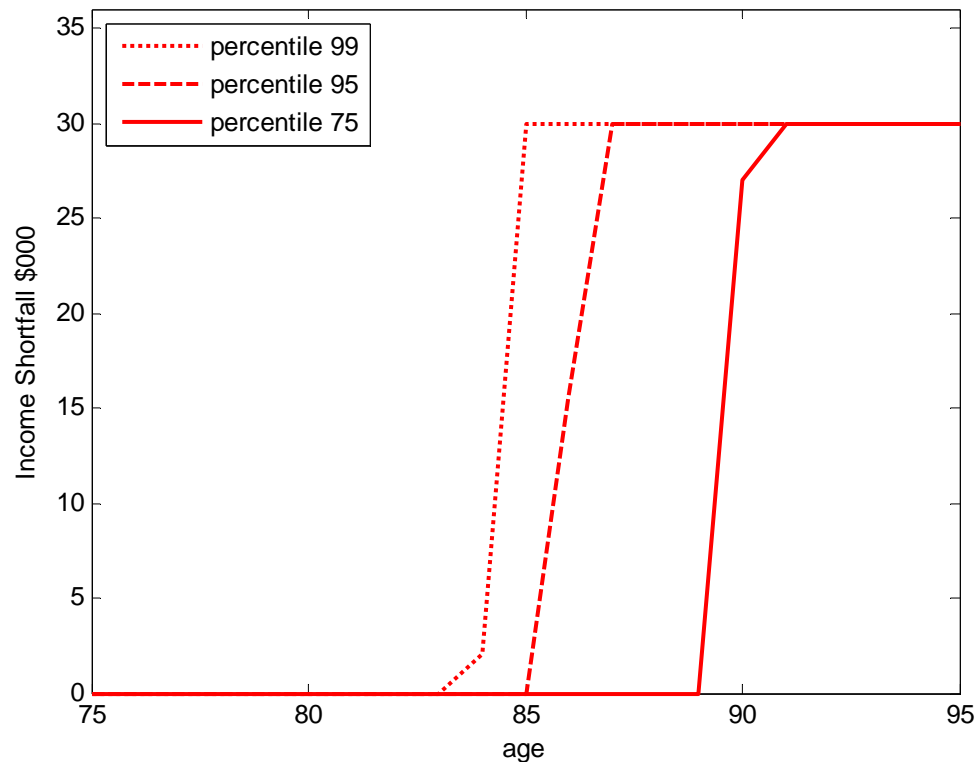
Risky investment strategy with no guarantees; Commencing at age 75





## Strategy 2: Risky Strategy Income shortfall (age 75)

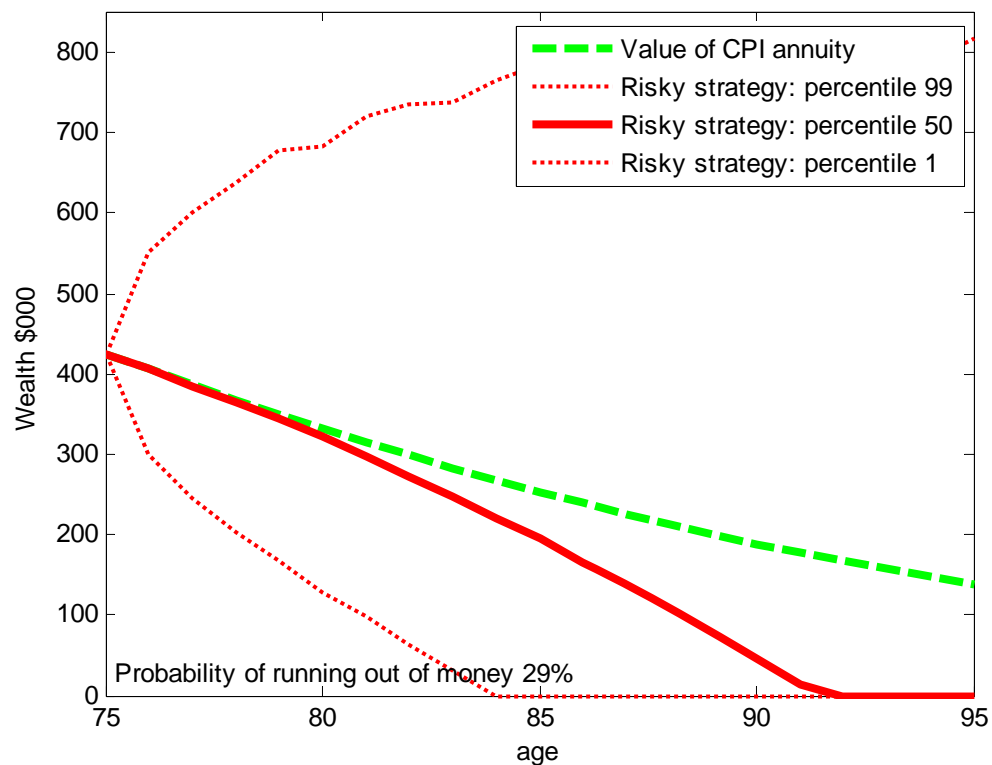
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# Strategy 3: With Guarantees (no uplift) Wealth (age 75)

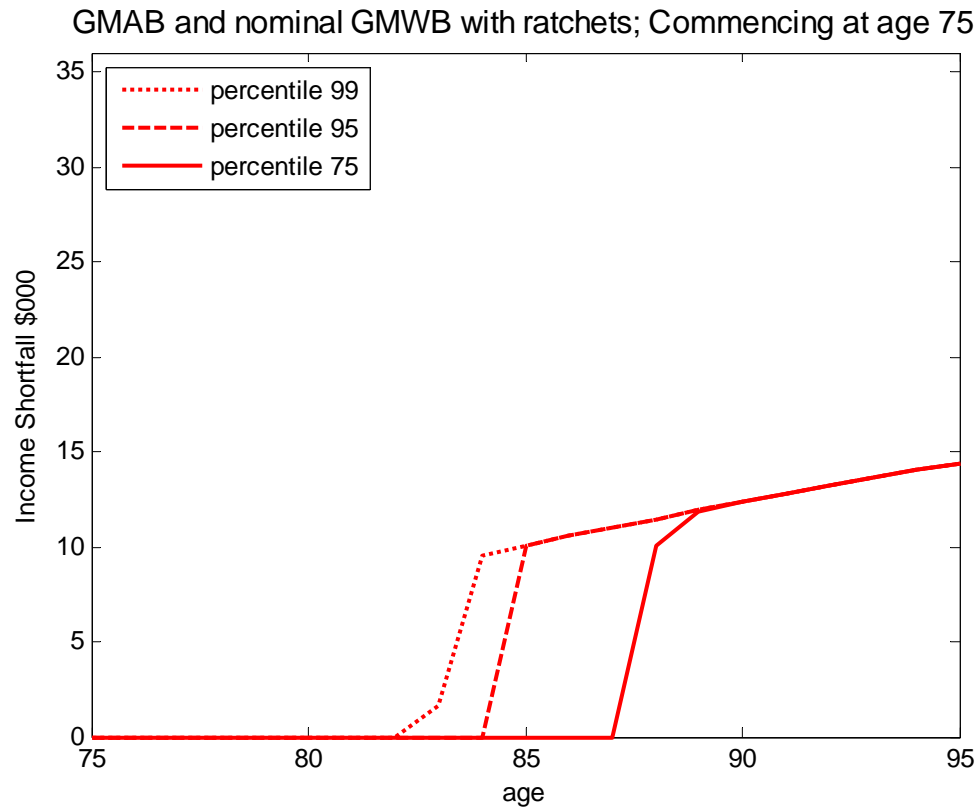
GMAB and nominal GMWB with ratchets; Commencing at age 75







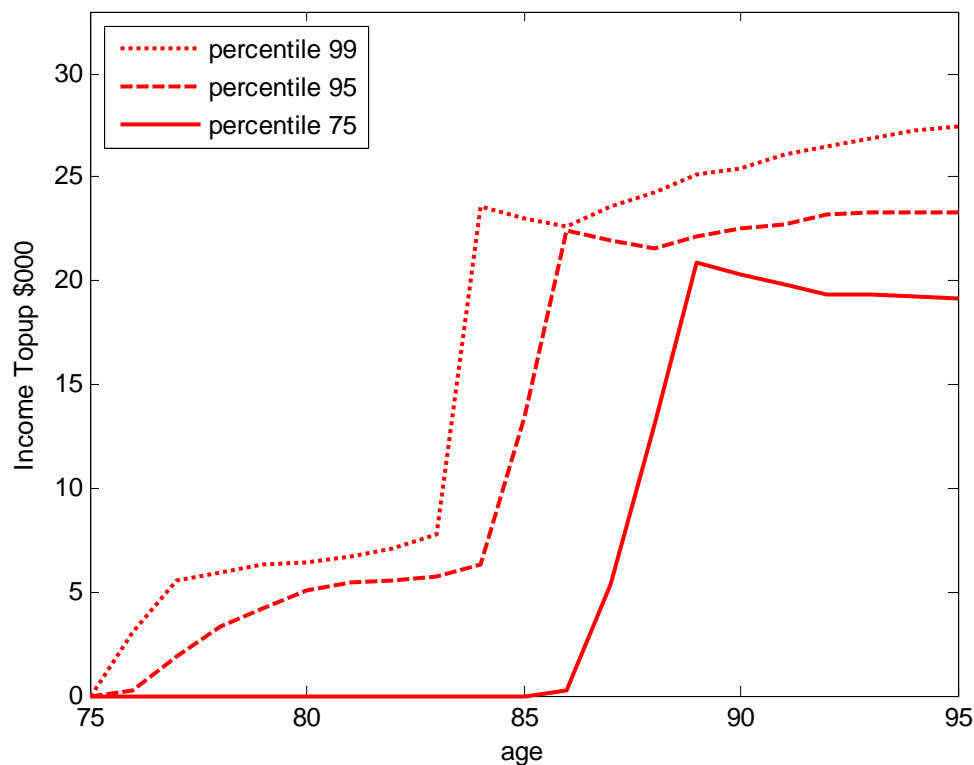
# Strategy 3: With Guarantees (no uplift) Income shortfall (age 75)





# Strategy 3: With Guarantees (no uplift) Income topups (age 75)

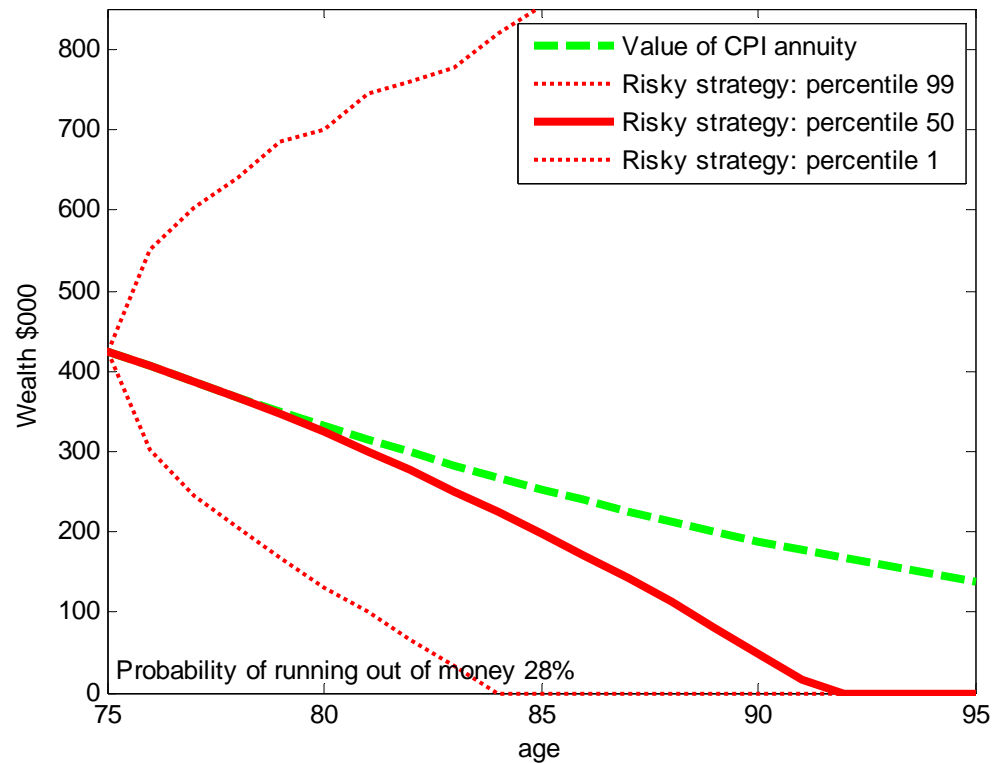
GMAB and nominal GMWB with ratchets; Commencing at age 75





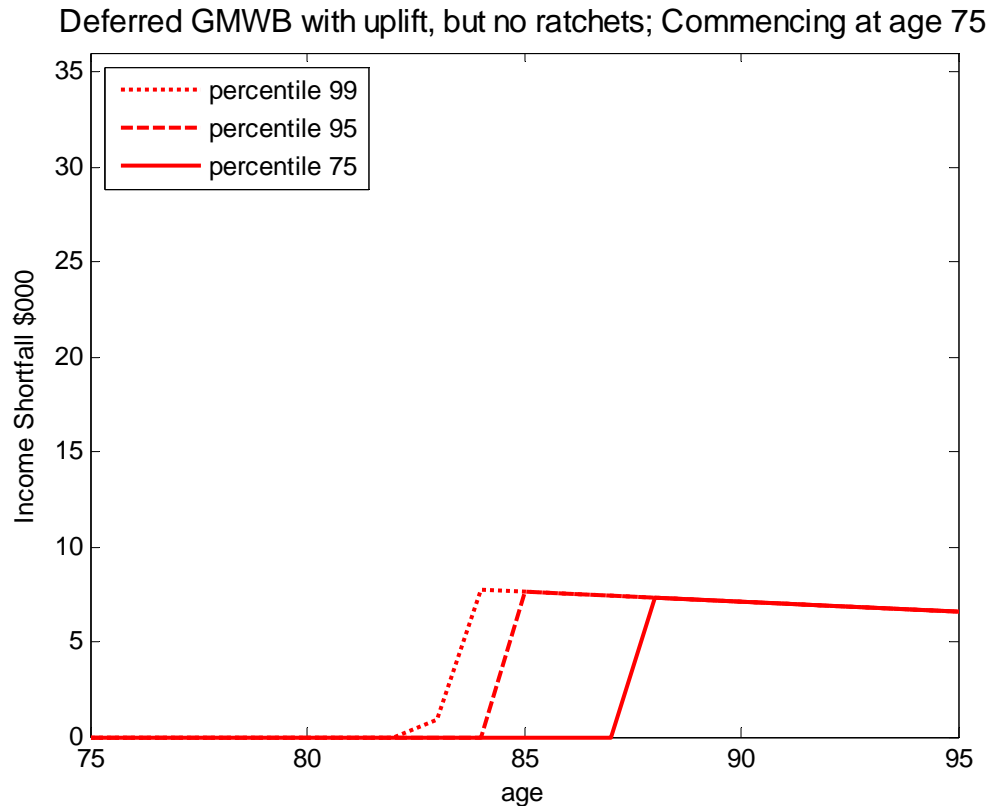
# Strategy 4: Guarantees with uplifts Wealth (age 75)

Deferred GMWB with uplift, but no ratchets; Commencing at age 75





# Strategy 4: Guarantees with uplifts Income Shortfalls (age 75)

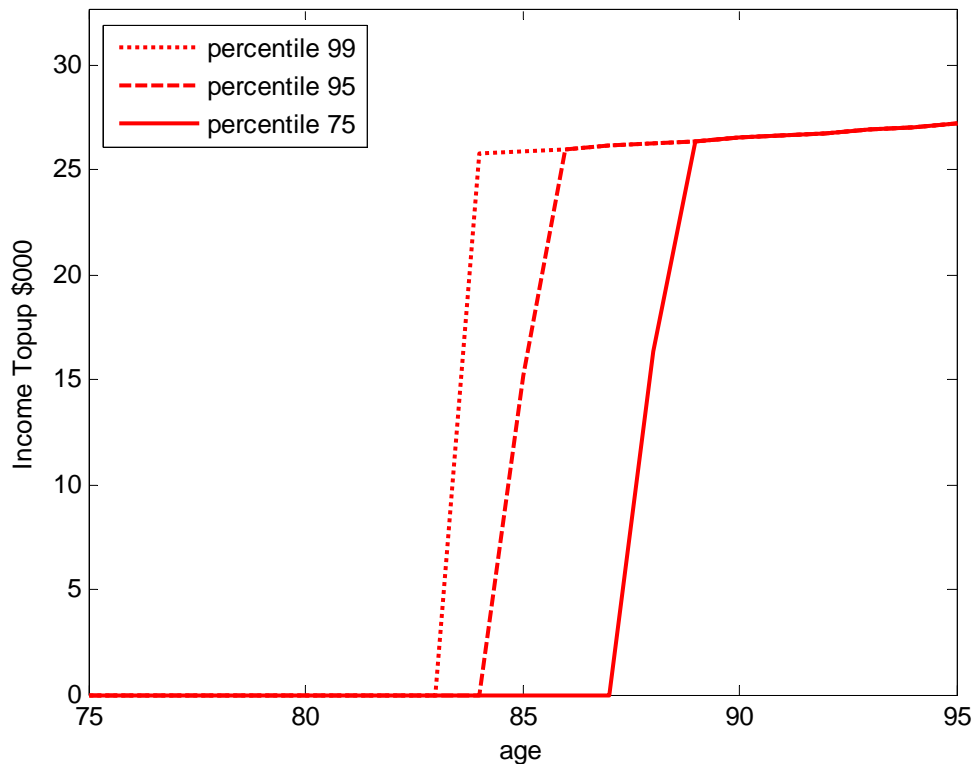




# Strategy 4: Guarantees with uplifts

## Income topups (age 75)

Deferred GMWB with uplift, but no ratchets; Commencing at age 75





# Income Shortfall (99<sup>th</sup> Percentile) Comparison (age 75)

Comparison of income shortfall at percentile 99; Commencing at age 75

