Target Date Funds Revisited

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- More recently, fintech (robo advisors): http://www.investmentzen.com/best-robo-advisors

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- All approaches are useful
- Computing power affects all approaches (data-driven or methods of solving models)

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- Recent work on this issue: Michaelides and Zhang (2017) and ongoing work with Francisco Gomes (LBS) and Yuxin Zhang (Renmin)

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- γ is relative risk aversion coefficient
- CRRA utility is special case of this model, can accommodate long run risk.

Financial advisors

- Constant share of wealth in stocks is not right: the rule of thumb is

$$\alpha = 100 - age$$

- Popular lifestyle funds (Target Date Funds)
- Focus on Vanguard recommendations today (nice video interview with John Ameriks and main graph to use): https://retirementplans.vanguard.com/ekit/pmed/trf/index.html?ajdejc&

How does one recover popular advice?

- Solve realistic life cycle model with undiversifiable labor income risk (eg Carroll (1997))

$$Y_{it} = Y_{it}^{p} U_{it}, \quad (1)$$
$$Y_{it}^{p} = \exp(g(t, Z_{it})) Y_{it-1}^{p} N_{it}, \quad (2)$$

- How should household view labor income? Key is the correlation between stock returns and permanent labor income shocks (Heaton and Lucas (EJ 2000), Haliassos and Michaelides (IER, 2003), Cocco, Gomes and Maenhout (CGM, RFS, 2005))
- Idiosyncratic risk an order of magnitude greater than aggregate shocks in labor income regressions (Abowd and Card (1989), Deaton (1991), Pischke (1995))
- Therefore, correlation between idiosyncratic labor income shocks and aggregate stock market weak

How does one recover popular advice?

- To the extent that households are invested through mutual funds/diversified investments, (Polkovnichenko (2005) for cases when they are not), then pensions/labor income act as an implicit risk free asset and therefore "stocks are for the young" (Jagganathan and Kocherlakota, 1996)
- CGM show effect and illustrate how popular advice should be made conditional on household characteristics: risk aversion, labor income uncertainty (Guiso, Jappelli and Terlizzese, AER 1996), pensions (Bagliano, Fugazza and Nicodano (2014))
- Cocco (2005) emphasizes housing, while Chetty and Szeidl (QJE, 2007) the role of consumption commitments
- Key insight: wealth determines portfolio rule. Therefore, saving and portfolio choice are inextricably linked

Stock Market Predictability

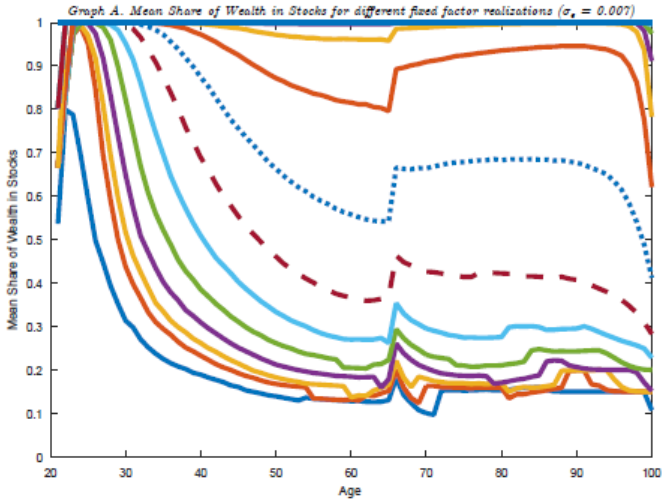
- Large literature on how prevalent stock market predictability exists in the data and whether that arises from rational models
- Stock market predictability with a persistent factor
- Popular predictors: dividend yield, cay, variance risk premium
- Campbell and Viceira (1999), Pastor and Stambaugh (2012):

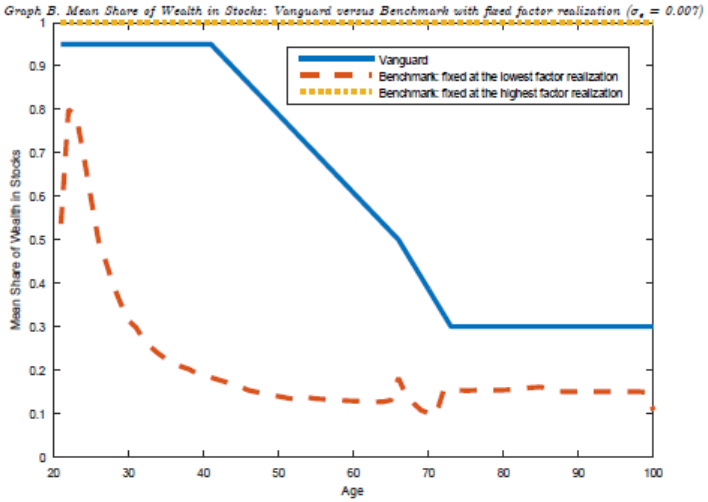
$$r_{t+1} - r_f = f_t + z_{t+1}, \tag{3}$$

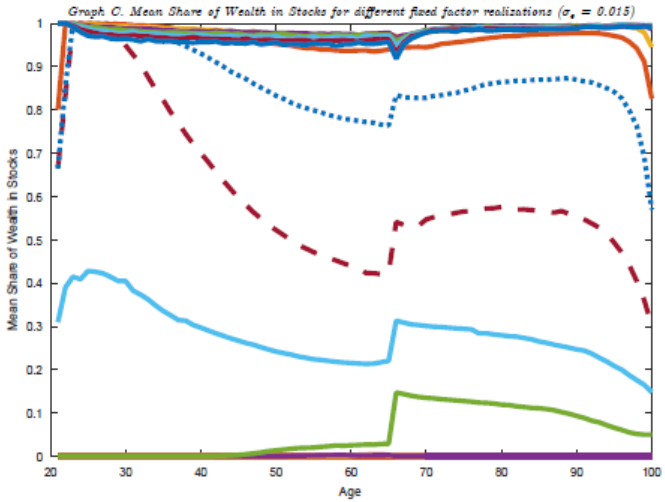
$$f_{t+1} = \mu + \phi(f_t - \mu) + \varepsilon_{t+1}, \tag{4}$$

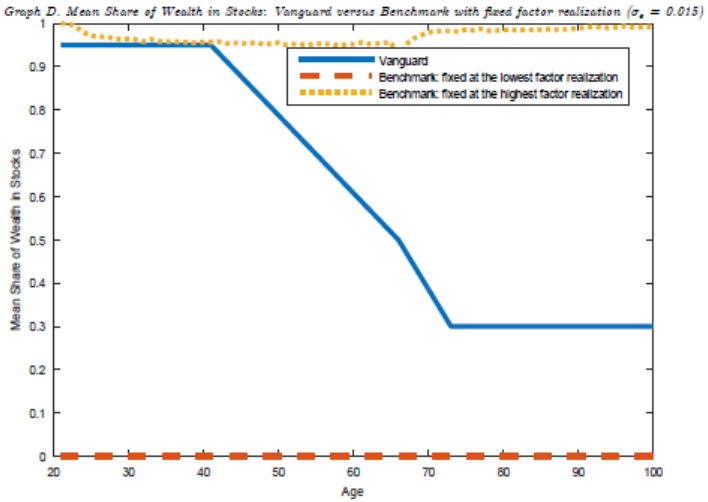
- Next graph is from Michaelides and Zhang (2017)

Role of stock market predictability









Current Work

- Above graph from a general dividend yield predictor, annual frequency
- How about quarterly frequency?
- How about another factor?
- Variance risk premium
- Bollerslev, Tim, George Tauchen and Hao Zhou, 2009, "Expected Stock Returns and Variance Risk Premia," *Review of Financial Studies*, 22, 4463–4492.
- Bollerslev, Tim, James Marrone, Lai Xu, and Hao Zhou, 2014, "Stock Return Predictability and Variance Risk Premia: Statistical Inference and International Evidence, *Journal of Financial and Quantitative Analysis*, 49 (3), 633-661.

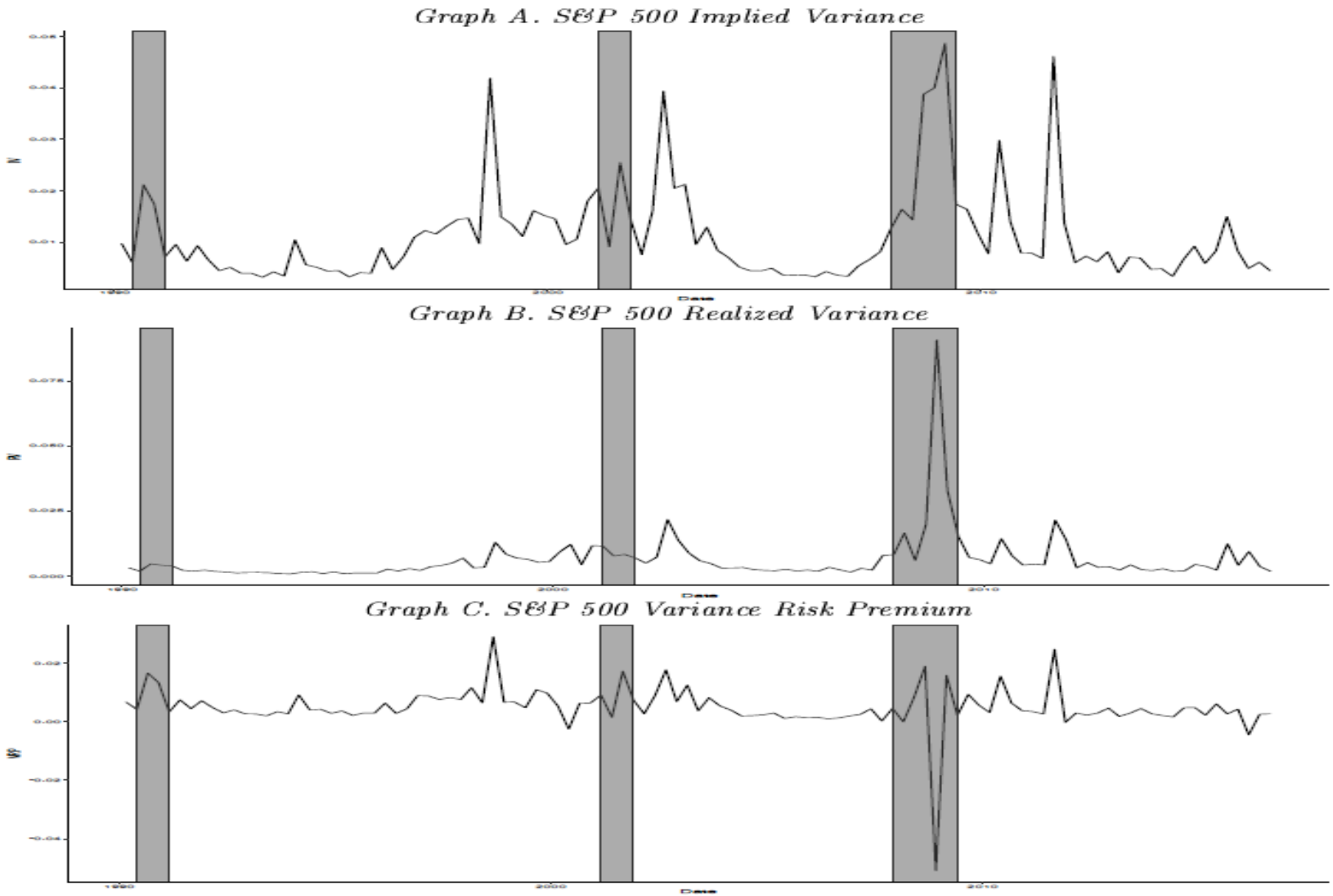
VRP: variance risk premium

- Generate measure of historical volatility and subtract option-based measure of volatility (eg VIX)
- Historical

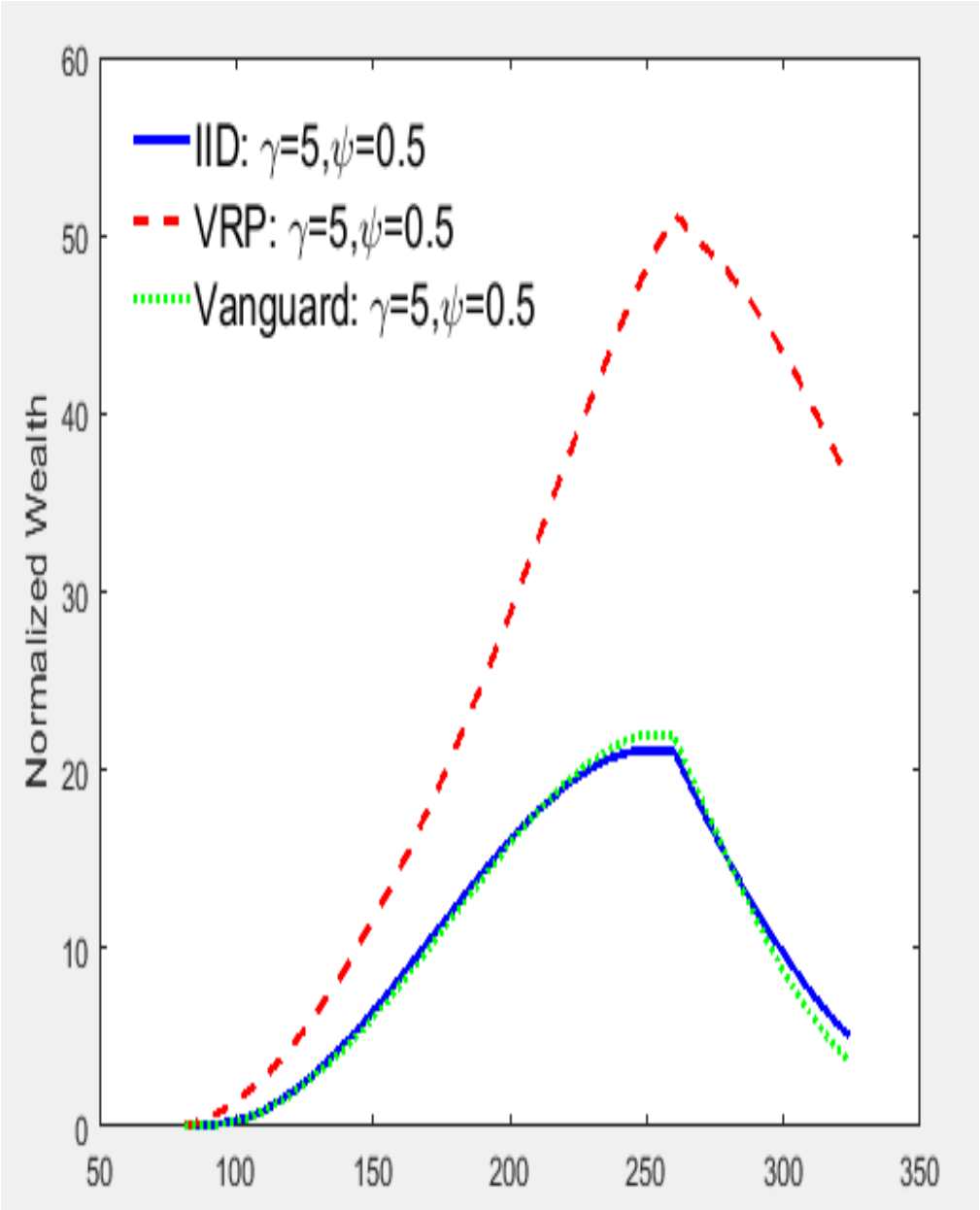
$$RV_t \equiv \sum_{j=1}^{n} \left[p_{t-1+\frac{j}{n}} - p_{t-1+\frac{j-1}{n}}(\Delta) \right]^2$$

- Implied variance from VIX, quarterly frequency

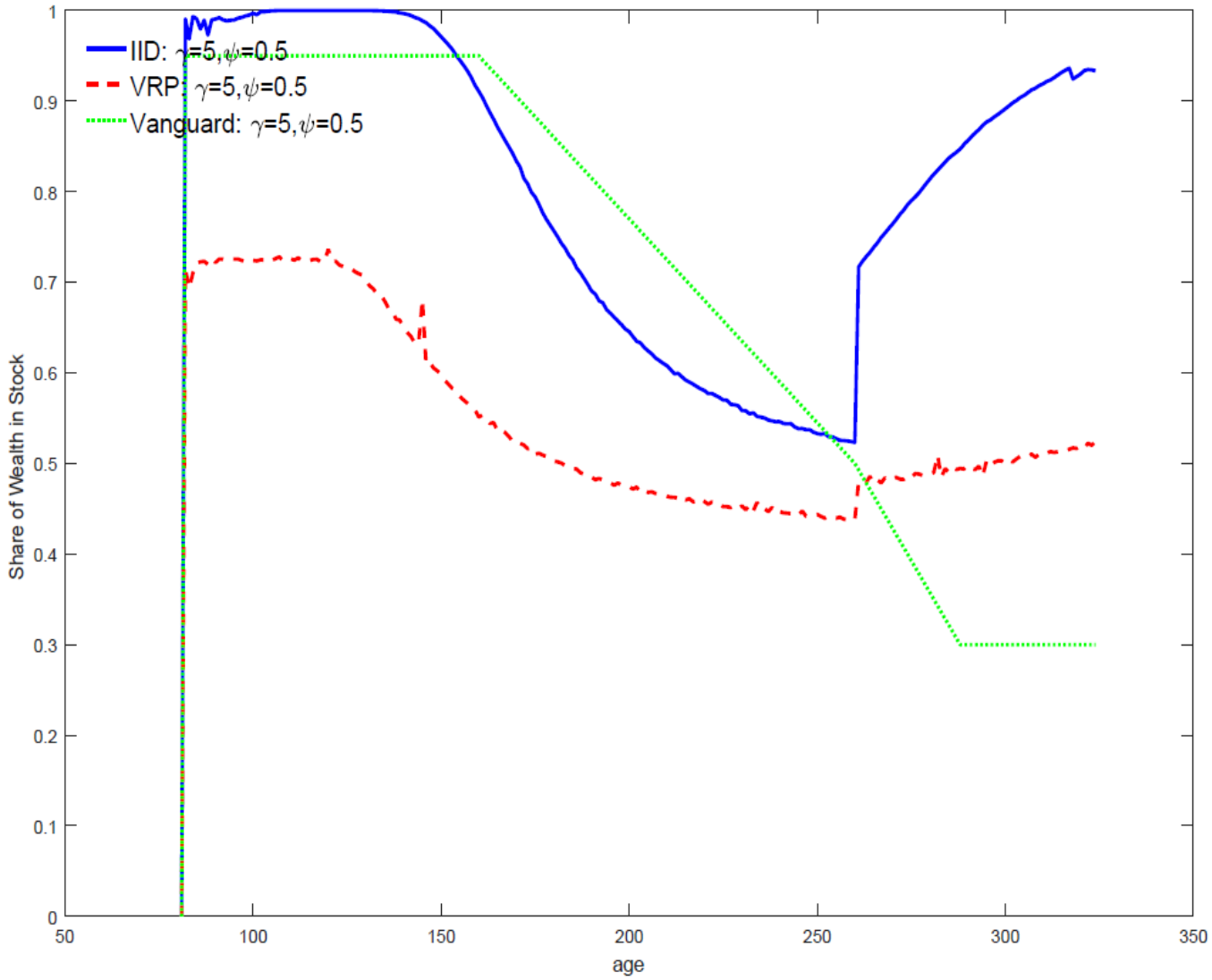
VRP: variance risk premium



Wealth accumulation



TDF Rules


IID: γ=5,ψ=0.5
VRP: γ=5,ψ=0.5
Vanguard: γ=5,ψ=0.5
Share of Wealth in Stock
age
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
50
100
150
200
250
300
350

Welfare evaluation

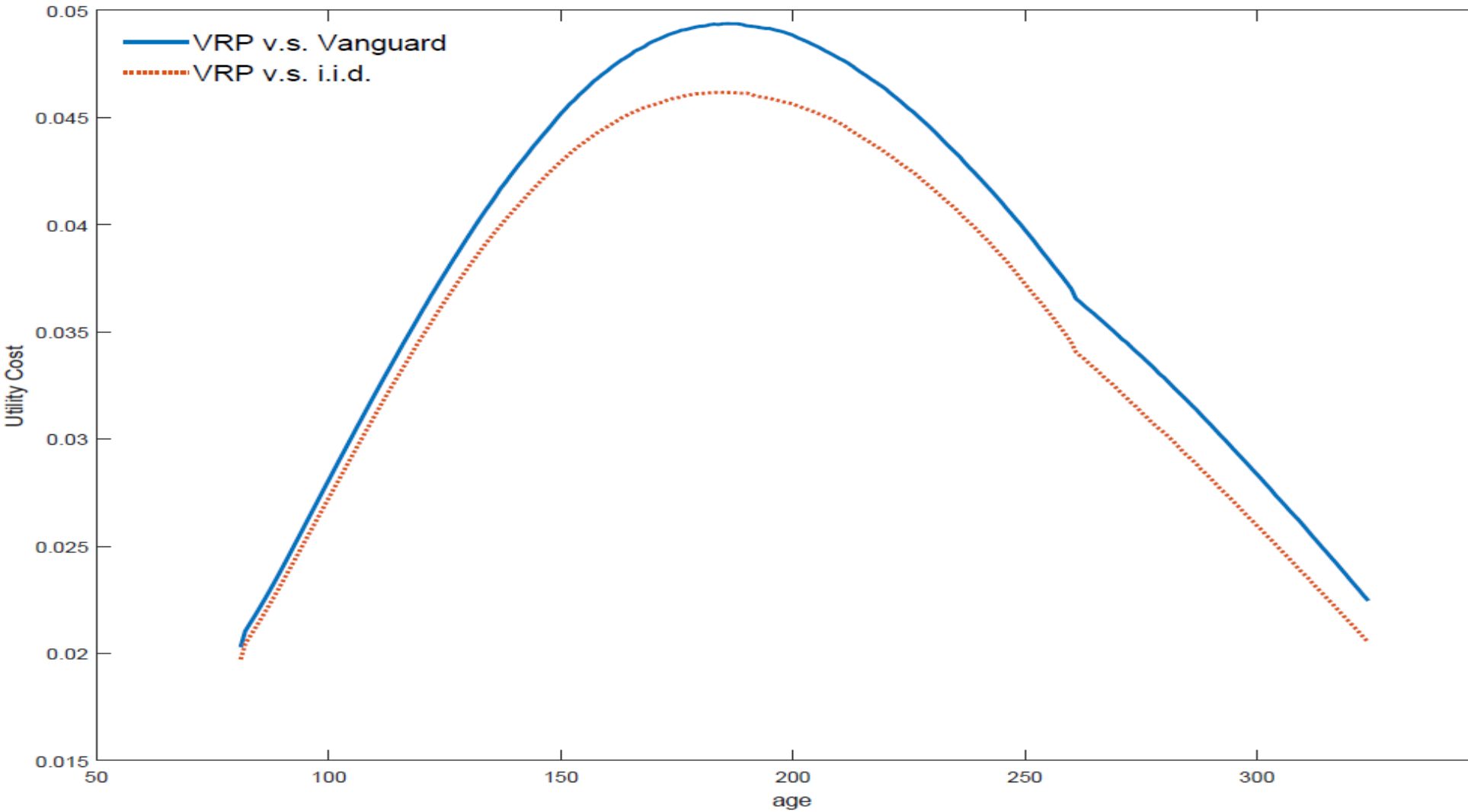
- Assume returns generates according to a predictability model, but investor makes decisions based on i.i.d. or Vanguard recommendation
- How can welfare be evaluated from different rules?
- Static welfare loss

$$\overline{\mu}_{\text{age}} = \text{average of } \left[\left(\frac{v_n(x_{it}, f_t)}{v_0(x_{it}, f_t)} \right)^{\frac{1}{1-\gamma}} - 1 \right] \text{ for all } i \in I_{\text{age}} \text{ and all factor}$$

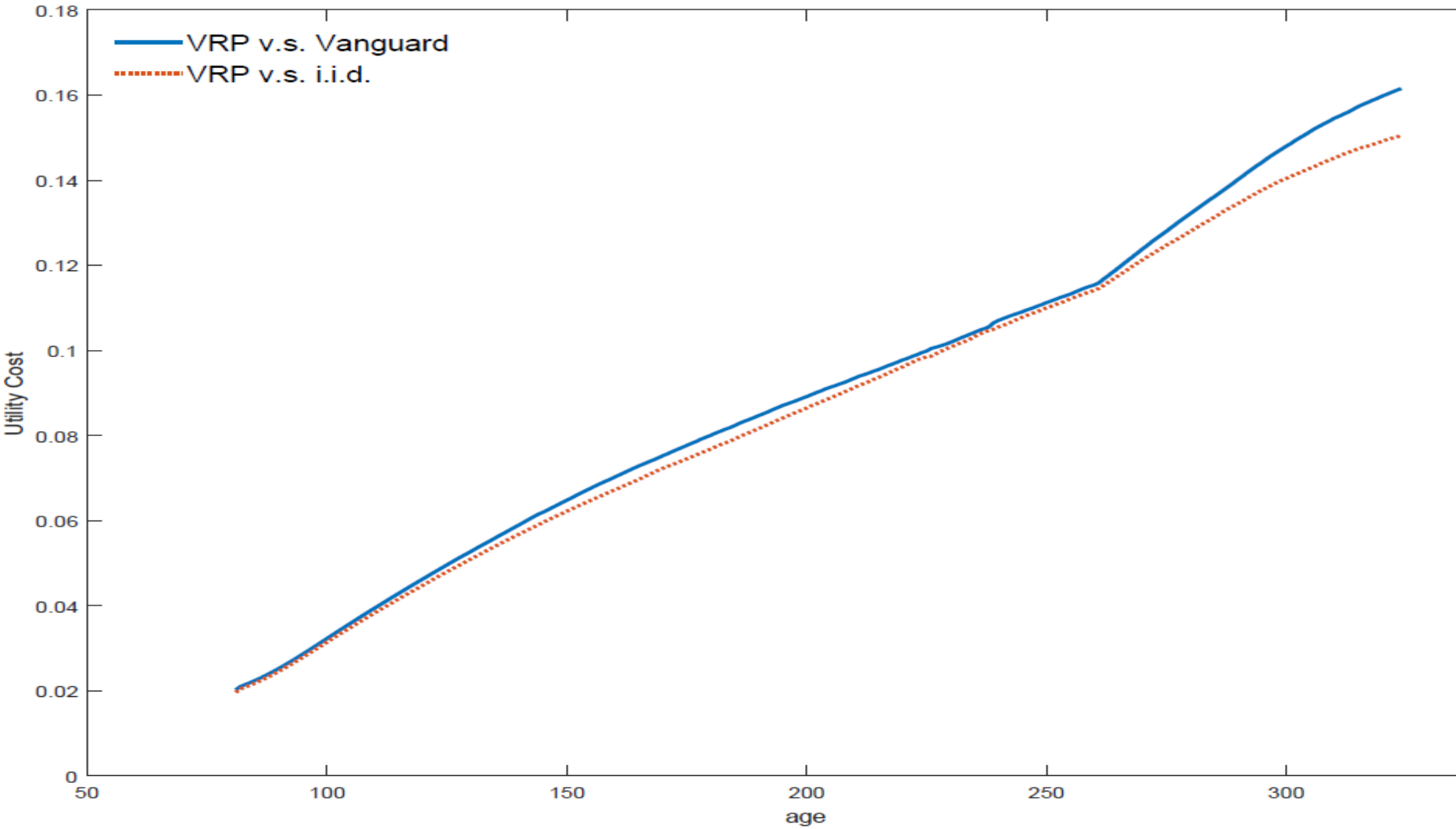
- Cumulative welfare loss

$$\overline{\mu}_{\text{age}} = \text{average of } \left[\left(\frac{v_n(x_{it}, f_t)}{v_0(\widetilde{x}_{it}, f_t)} \right)^{\frac{1}{1-\gamma}} - 1 \right] \text{ for all } i \in I_{\text{age}} \text{ and all factor}$$

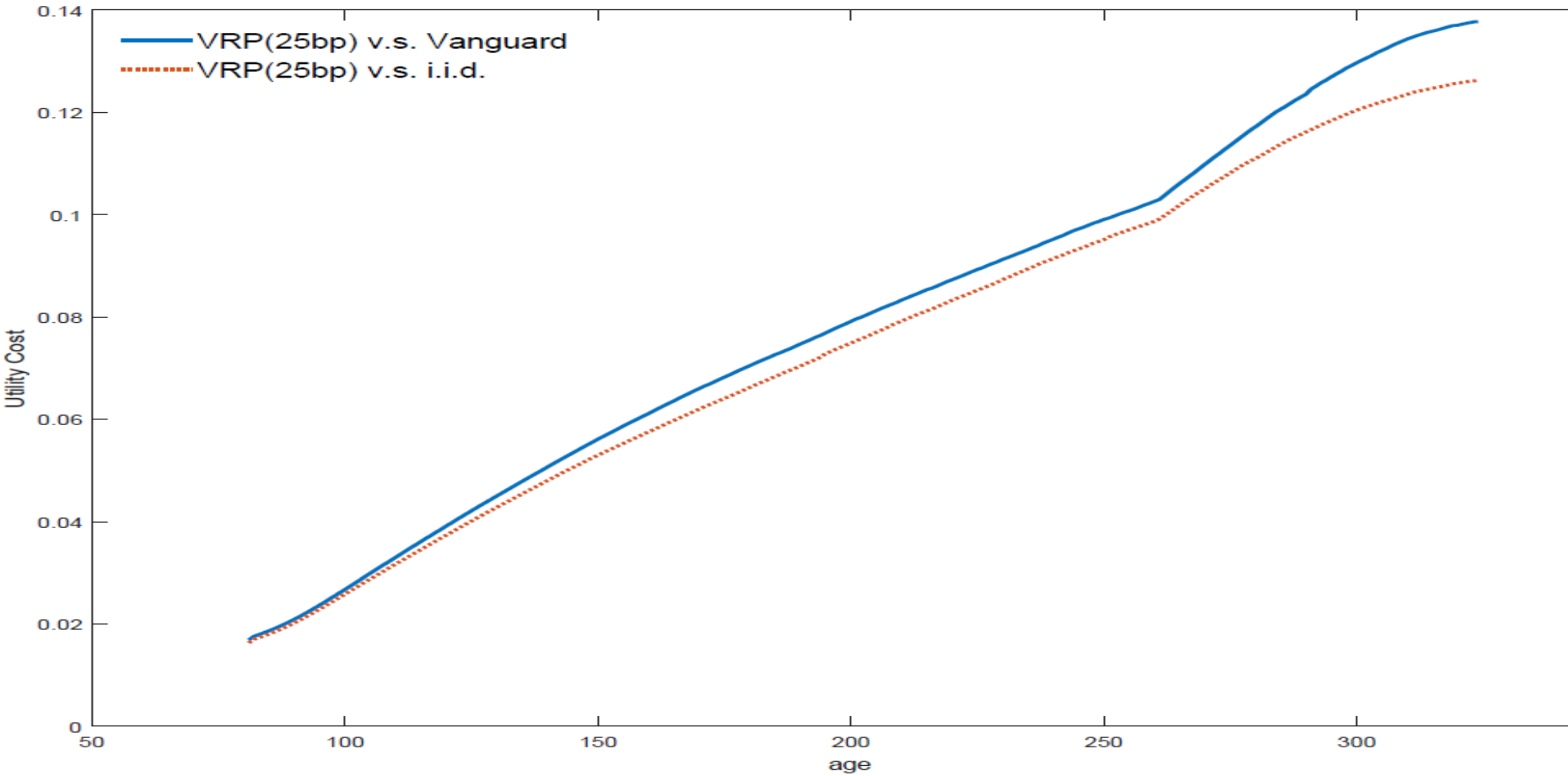
Static Welfare Loss



Cumulative Welfare Loss



Cumulative Welfare Loss with 25 bp cost

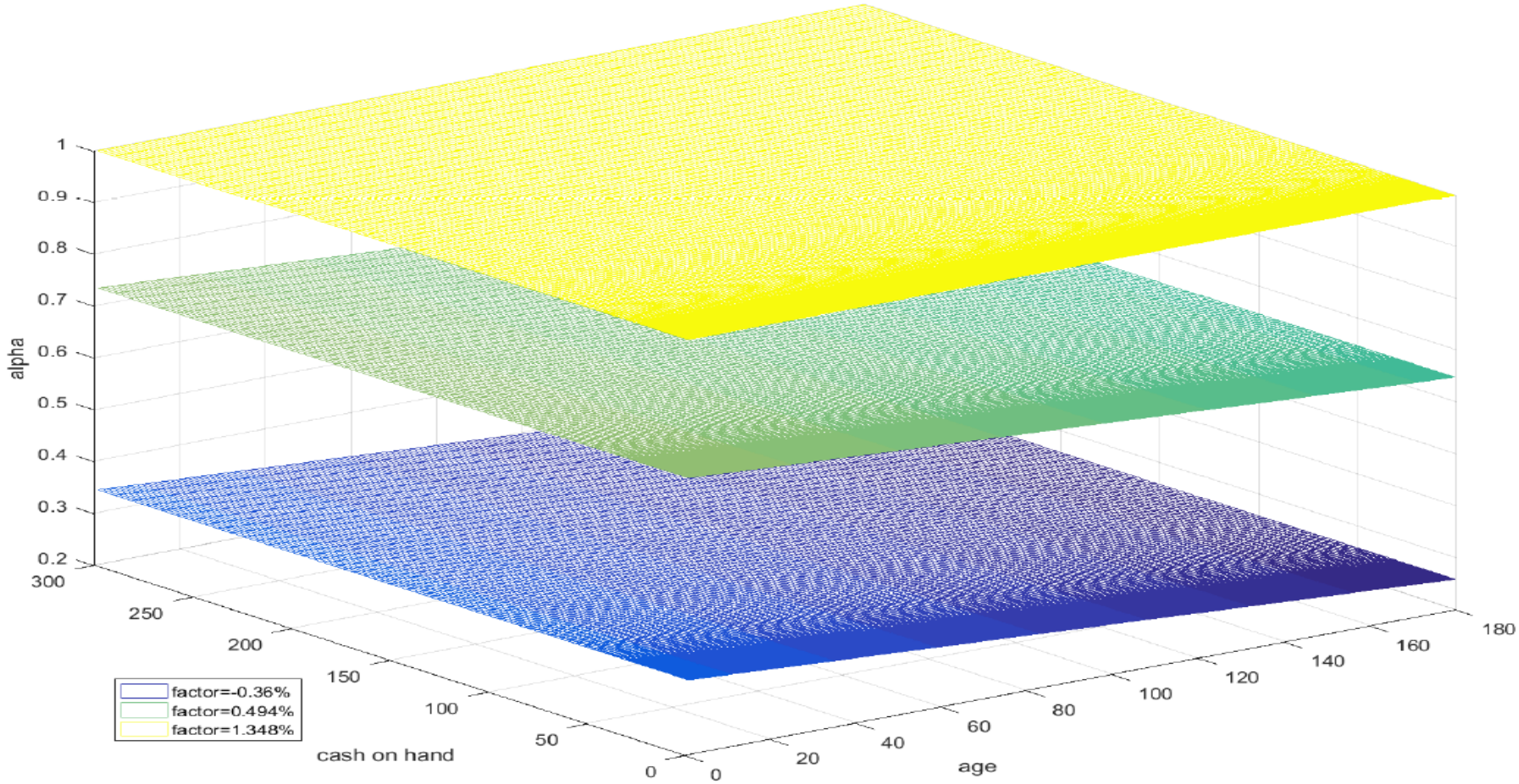


Regression rules (working life)

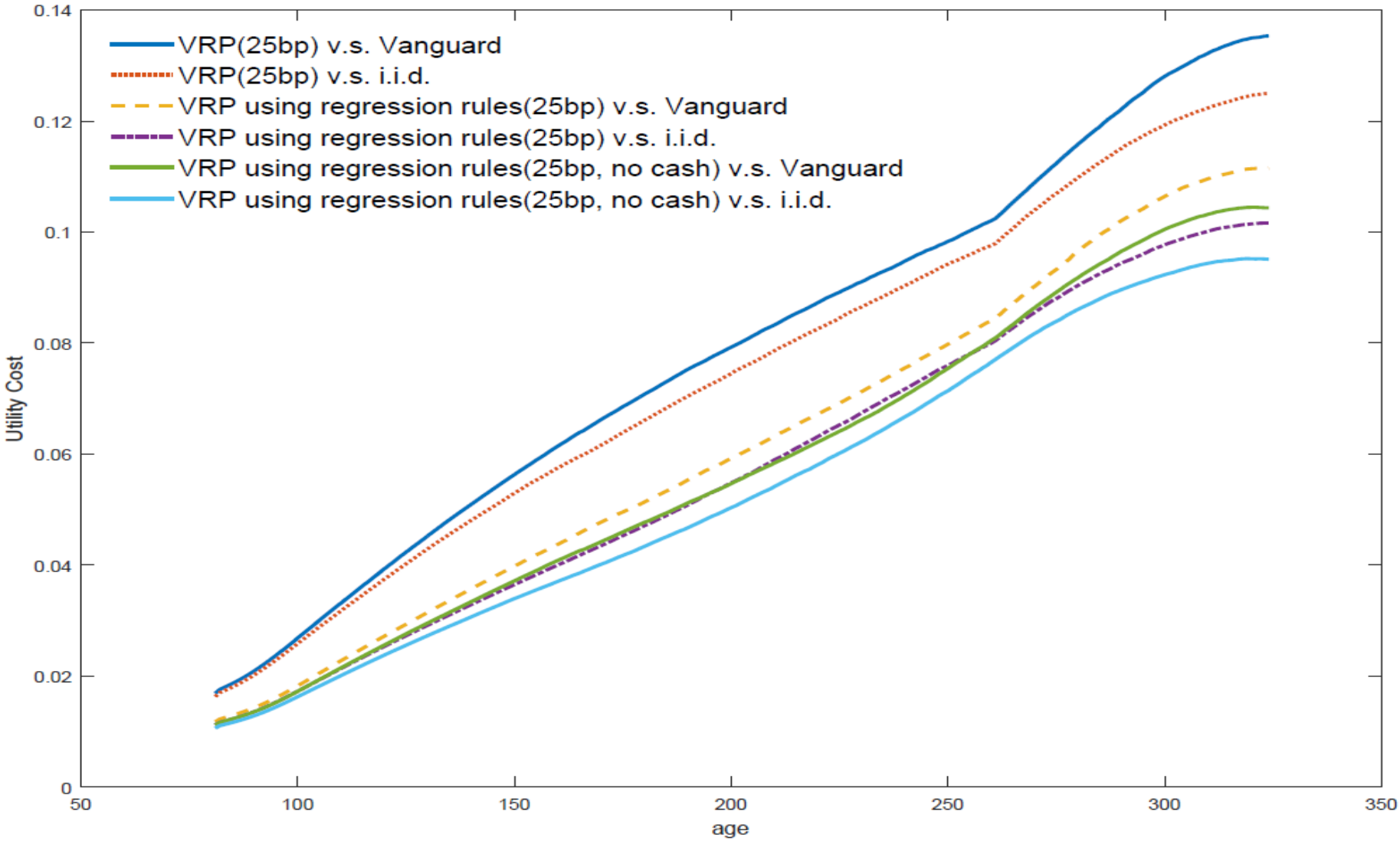
Parameter	Value	t-stat	Value	t-stat
Intercept	0.51	1521.4	0.5006	1467
Factor	45.56	2182	45.54	2192
Age	-0.00191	-625.0	-0.00146	-321
Wealth	–	–	-0.00144	-135
R^2	0.741		0.744	

- Importance of Age and Factor relative to Wealth

Policy functions from regressions



Cumulative Welfare comparisons from regression rules



Punchline

- To the extent predictability exists, factor can have a profound effect on stock market asset allocation
- Vanguard TDF holds on average but level can shift up and down depending on volatility of factor
- Effects can be well approximated by regression rules
- Welfare loss substantial to the extent stock market predictability model captures well stock market return dynamics

Conclusion

- Better data and better computing power can be used to better understand household financial decisions
- Current generation of robo-advisors relies on Markowitz or Vanguard type models
- Future generation could include some of ideas capturing effect of stock market predictability on asset allocation
- Role of Imperfect factor predictability and robustness in presence of possible model misspecification (Pastor and Stambaugh (2012))