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A Note on Life-Cycle Funds

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Agenda

Motivation

Modeling approach

Results

Conclusion

Motivation

Life-cycle funds' assets under management have tremendously increased in recent years and are especially applied within old age provision products.

Life-cycle funds are (planned to be) set as default investment option in many defined contribution plans.

- Life-cycle funds' performance will have a huge impact on retirement wealth and living standard after the active working phase.
- The risk-return profile of life-cycle funds has to be assessed appropriately for sustainable financial planning.

Motivation

Contribution

- Compare the risk-return profile of life-cycle funds to the risk-return profile of simple balanced funds
- Derive balanced funds exactly matching the risk-return profile of life-cycle funds assuming a Black-Scholes model and challenge these approximations using more sophisticated asset models

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Modeling approach

Asset models considered

- Black-Scholes (BS)
 - closed form solutions
- hybrid Cox-Ingersoll-Ross – Heston (CIR-SV)
 - Monte-Carlo approach
- hybrid Cox-Ingersoll-Ross – Heston + jumps (CIR-SVJD)
 - Monte-Carlo approach

Analyze single and regular contributions to the considered funds

Modeling approach

Life-cycle and balanced funds

- Both funds invest in equity (risky asset) and zero-bonds (riskless asset).
- Management fees reduce the funds' performance.

Life-cycle funds

- apply a time-dependant (**not** path-dependant) switch from risky to riskless assets following the so-called glide path.

Balanced funds

- apply a constant mix of risky and riskless assets.

Modeling approach

Life-cycle funds' glide paths under consideration (for numerical analyses)

- classical (A)
 - Starting with 100% investment in equity, the equity exposure is linearly decreased up to 0% equity portion in the last year.
- contrarian (B)
 - Starting with 0% investment in equity, the equity exposure is linearly increased up to 100% equity portion in the last year.
- “alternating” (C)
 - Starting with 100% investment in equity, the equity exposure is alternated on a yearly basis between 0% and 100%.

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Results – single contribution

Black-Scholes model

- For any given life-cycle fund, there exists a balanced fund allowing for exactly the same risk-return profile as the life-cycle fund.
- A balanced fund stochastically dominating the life-cycle fund is constructed using the balanced fund above but setting its management fee equal to the life-cycle fund's management fee.

Results – single contribution*

CIR-SVJD model

Strategy	5%	25%	Median	75%	95%
Balanced A	-3.03%	1.14%	3.89%	6.71%	10.63%
Life-cycle A	-3.17%	1.09%	3.96%	6.75%	10.67%
Balanced B	-3.03%	1.14%	3.89%	6.71%	10.63%
Life-cycle B	-3.15%	1.17%	3.94%	6.63%	10.48%
Balanced C	-4.74%	0.22%	3.52%	6.88%	11.62%
Life-cycle C	-4.88%	0.14%	3.54%	6.84%	11.57%

Statistical tests (Kolmogorov-Smirnov, Anderson-Darling) do not neglect the null hypothesis of above samples being drawn from the same original probability distribution

*12 year single premium investment

Results – regular contribution*

Black-Scholes model

→ For any given life-cycle fund, there exists a balanced fund matching the first two moments of the life-cycle fund investment.

Strategy	5%	25%	Median	75%	95%
Balanced A	1.00%	3.34%	4.97%	6.60%	9.08%
Life-cycle A	1.27%	3.34%	4.92%	6.57%	9.11%
Balanced B	-3.27%	1.53%	4.96%	8.45%	13.83%
Life-cycle B	-3.63%	1.45%	4.96%	8.52%	13.81%
Balanced C	-2.62%	1.64%	4.67%	7.74%	12.45%
Life-cycle C	-2.53%	1.65%	4.64%	7.79%	12.46%

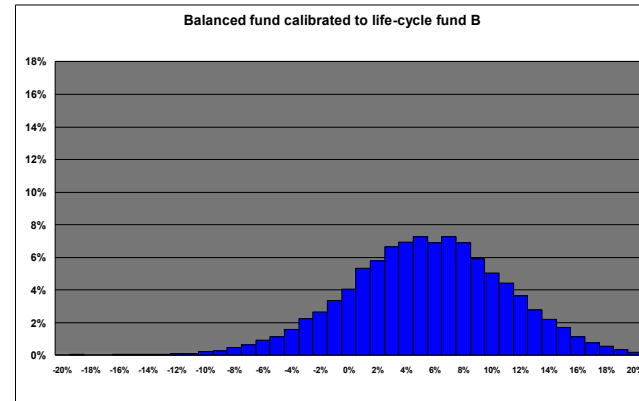
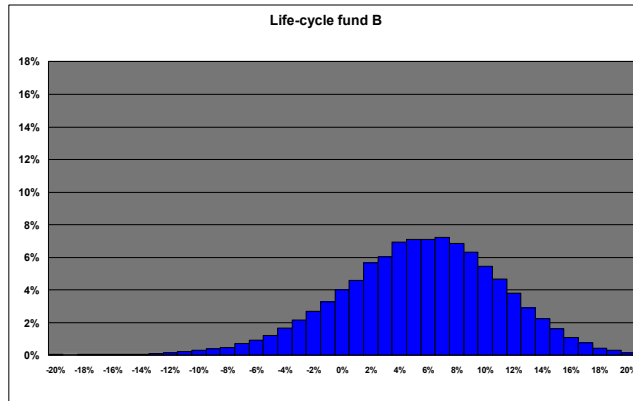
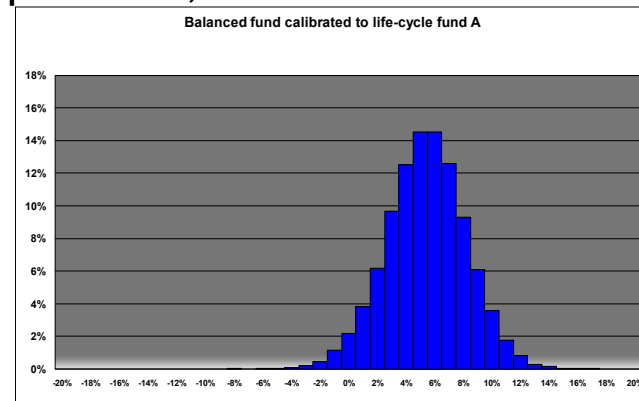
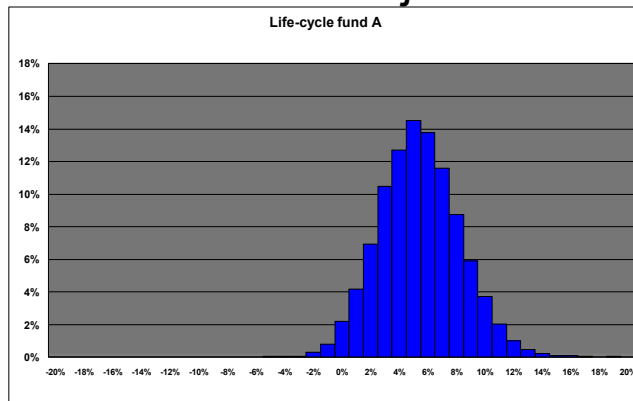
Differences in the lower tail yield to a rejection of the null-hypothesis by the statistical tests considered.

*12 year regular (i.e. annual) premium investment

Results – regular contribution*

CIR-SVJD model

→ statistical tests reject the null-hypothesis, but



*12 year regular (i.e. annual) premium investment

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Conclusion and further research

Conclusion

- Life-cycle funds' risk-return profile can to a major part be appropriately assessed by a corresponding balanced fund
 - Supports financial planning and clients' awareness of the risk they are taking
 - Challenges the very existence of life-cycle funds

Further research

- Extend the analysis using historical data
- Clarify the reason for the very existence of life-cycle funds
- Analyze more sophisticated (e.g. path-dependant) life-cycle strategies

Thanks for your attention

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