

---

## LITERATURE APPENDIX

---

**Christopher Carroll<sup>1</sup>**  
Johns Hopkins University  
Econ-ARK

**Alan Lujan**  
Johns Hopkins University  
Econ-ARK

**Matthew N. White**  
Econ-ARK

Monday 29<sup>th</sup> September, 2025

*Keywords*

---

<sup>1</sup>Correspondence to: ccarroll@llorracc.org

Citation	Summary
Samuelson [1975]	Reviews optimal consumption-investment decisions for investors with constant relative risk aversion utility functions. Shows that optimal portfolio decisions are independent of time, wealth, and consumption. Demonstrates that investing over multiple periods does not increase risk tolerance.
Merton [1969]	Examines optimal portfolio selection and consumption rules in a continuous-time model with stochastic asset returns. Develops optimality equations for multi-asset problems with Wiener processes, with detailed analysis of two-asset cases under constant relative and absolute risk aversion.
Samuelson [1989]	Challenges conventional wisdom that young investors should take more risk than older investors. Shows that when retirement requires minimum wealth levels, investors become less risk-tolerant in youth - the Merton paradox. However, declining human capital with age can reverse this effect.
Epstein and Zin [1989]	Develops recursive utility preferences that separate risk attitudes from intertemporal substitution. Shows how these preferences lead to an asset pricing model combining both CAPM and consumption CAPM, where systematic risk depends on both market portfolio returns and consumption growth.
Deaton [1991]	Analyzes saving behavior under borrowing constraints. Shows that with impatient consumers and i.i.d. income, assets act as buffer stock against income shocks. Model can explain microeconomic saving patterns but struggles to match aggregate data unless accounting for heterogeneous income processes.
Bodie et al. [1992]	Examines how labor-leisure choice affects portfolio and consumption decisions over the lifecycle. Shows that labor flexibility allows greater risk-taking in investment portfolios since labor supply can adjust to offset investment losses.
Kimball [1991]	Introduces “standard risk aversion” concept where risks that make wealth reductions more painful also make independent risks more painful. Shows this requires both decreasing absolute risk aversion and decreasing absolute prudence.
Jagannathan and Kocherlakota [1996]	Evaluates common financial planning advice to reduce stock allocation with age. Finds only the human capital argument valid - younger investors should hold more stocks only if their labor income is uncorrelated with stock returns.
Carroll [1997]	Argues that household saving is better explained by “buffer-stock” model than traditional lifecycle hypothesis. Shows how income uncertainty and impatience lead consumers to maintain target wealth-to-income ratios, explaining several empirical puzzles.
Viceira [2001]	Shows that employed investors should optimally invest more in stocks than retirees when labor income is uncorrelated with stock returns. Increased labor income risk reduces willingness to hold stocks, with savings being more responsive than portfolio allocation.
Campbell and Viceira [1999]	Presents analytical solution for portfolio choice with time-varying equity premium. Shows hedging motives can double stock demand for risk-averse investors. Market timing and hedging provide significant welfare benefits.
Barberis [2000]	Examines how return predictability affects long-horizon portfolio choice, accounting for parameter

---

## References

- Paul A. Samuelson. *LIFETIME PORTFOLIO SELECTION BY DYNAMIC STOCHASTIC PROGRAMMING*, pages 517–524. Elsevier, 1975. ISBN 9780127808505. doi:[10.1016/b978-0-12-780850-5.50044-7](https://doi.org/10.1016/b978-0-12-780850-5.50044-7). URL <http://dx.doi.org/10.1016/B978-0-12-780850-5.50044-7>.
- Robert C. Merton. Lifetime Portfolio Selection under Uncertainty: The Continuous-Time Case. *The Review of Economics and Statistics*, 51(3):247, 8 1969. ISSN 0034-6535. doi:[10.2307/1926560](https://doi.org/10.2307/1926560). URL <http://dx.doi.org/10.2307/1926560>.
- P A Samuelson. A case at last for age-phased reduction in equity. *Proceedings of the National Academy of Sciences*, 86(22):9048–9051, 11 1989. ISSN 1091-6490. doi:[10.1073/pnas.86.22.9048](https://doi.org/10.1073/pnas.86.22.9048). URL <http://dx.doi.org/10.1073/PNAS.86.22.9048>.
- Larry G. Epstein and Stanley E. Zin. Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework. *Econometrica*, 57(4):937, 7 1989. ISSN 0012-9682. doi:[10.2307/1913778](https://doi.org/10.2307/1913778). URL <http://dx.doi.org/10.2307/1913778>.
- Angus Deaton. Saving and Liquidity Constraints. *Econometrica*, 59(5):1221, 9 1991. ISSN 0012-9682. doi:[10.2307/2938366](https://doi.org/10.2307/2938366). URL <http://dx.doi.org/10.2307/2938366>.
- Zvi Bodie, Robert C. Merton, and William F. Samuelson. Labor supply flexibility and portfolio choice in a life cycle model. *Journal of Economic Dynamics and Control*, 16(3–4):427–449, 7 1992. ISSN 0165-1889. doi:[10.1016/0165-1889\(92\)90044-f](https://doi.org/10.1016/0165-1889(92)90044-f). URL [http://dx.doi.org/10.1016/0165-1889\(92\)90044-F](http://dx.doi.org/10.1016/0165-1889(92)90044-F).
- Miles Kimball. *Standard Risk Aversion*. National Bureau of Economic Research, 3 1991. doi:[10.3386/t0099](https://doi.org/10.3386/t0099). URL <http://dx.doi.org/10.3386/T0099>.
- Ravi Jagannathan and Narayana Kocherlakota. Why Should Older People Invest Less in Stocks Than Younger People? *Quarterly Review*, 20(3), 6 1996. ISSN 0271-5287. doi:[10.21034/qr.2032](https://doi.org/10.21034/qr.2032). URL <http://dx.doi.org/10.21034/QR.2032>.
- C. D. Carroll. Buffer-Stock Saving and the Life Cycle/Permanent Income Hypothesis. *The Quarterly Journal of Economics*, 112(1):1–55, 2 1997. ISSN 1531-4650. doi:[10.1162/003355397555109](https://doi.org/10.1162/003355397555109). URL <http://dx.doi.org/10.1162/003355397555109>.
- Luis M. Viceira. Optimal Portfolio Choice for LongHorizon Investors with Nontradable Labor Income. *The Journal of Finance*, 56(2):433–470, 4 2001. ISSN 1540-6261. doi:[10.1111/0022-1082.00333](https://doi.org/10.1111/0022-1082.00333). URL <http://dx.doi.org/10.1111/0022-1082.00333>.
- J. Y. Campbell and L. M. Viceira. Consumption and Portfolio Decisions when Expected Returns are Time Varying. *The Quarterly Journal of Economics*, 114(2):433–495, 5 1999. ISSN 1531-4650. doi:[10.1162/003355399556043](https://doi.org/10.1162/003355399556043). URL <http://dx.doi.org/10.1162/003355399556043>.
- Nicholas Barberis. Investing for the Long Run when Returns Are Predictable. *The Journal of Finance*, 55(1):225–264, 2 2000. ISSN 1540-6261. doi:[10.1111/0022-1082.00205](https://doi.org/10.1111/0022-1082.00205). URL <http://dx.doi.org/10.1111/0022-1082.00205>.
- B. C. Madrian and D. F. Shea. The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior. *The Quarterly Journal of Economics*, 116(4):1149–1187, 11 2001. ISSN 1531-4650. doi:[10.1162/003355301753265543](https://doi.org/10.1162/003355301753265543). URL <http://dx.doi.org/10.1162/003355301753265543>.
- Francisco J. Gomes and Alexander Michaelides. Life-Cycle Asset Allocation: A Model with Borrowing Constraints, Uninsurable Labor Income Risk and Stock-Market Participation Costs. *SSRN Electronic Journal*, 2002. ISSN 1556-5068. doi:[10.2139/ssrn.299388](https://doi.org/10.2139/ssrn.299388). URL <http://dx.doi.org/10.2139/SSRN.299388>.
- Stephanie Curcuru, John Heaton, Deborah Lucas, and Damien Moore. *Heterogeneity and Portfolio Choice: Theory and Evidence*, pages 337–382. Elsevier, 2010. ISBN 9780444508973. doi:[10.1016/b978-0-444-50897-3.50009-2](https://doi.org/10.1016/b978-0-444-50897-3.50009-2). URL <http://dx.doi.org/10.1016/B978-0-444-50897-3.50009-2>.
- FRANCISCO GOMES and ALEXANDER MICHAELIDES. Optimal LifeCycle Asset Allocation: Understanding the Empirical Evidence. *The Journal of Finance*, 60(2):869–904, 3 2005. ISSN 1540-6261. doi:[10.1111/j.1540-6261.2005.00749.x](https://doi.org/10.1111/j.1540-6261.2005.00749.x). URL <http://dx.doi.org/10.1111/J.1540-6261.2005.00749.X>.
- João F. Cocco, Francisco J. Gomes, and Pascal J. Maenhout. Consumption and Portfolio Choice over the Life Cycle. *Review of Financial Studies*, 18(2):491–533, 2005. ISSN 1465-7368. doi:[10.1093/rfs/hhi017](https://doi.org/10.1093/rfs/hhi017). URL <http://dx.doi.org/10.1093/RFS/HHI017>.
- James Poterba, Joshua Rauh, Steven Venti, and David Wise. *Lifecycle Asset Allocation Strategies and the Distribution of 401(k) Retirement Wealth*. National Bureau of Economic Research, 1 2006. doi:[10.3386/w11974](https://doi.org/10.3386/w11974). URL <http://dx.doi.org/10.3386/W11974>.

- 
- Luis M. Viceira. Life-Cycle Funds. *SSRN Electronic Journal*, 2007. ISSN 1556-5068. doi:[10.2139/ssrn.988362](https://doi.org/10.2139/ssrn.988362). URL <http://dx.doi.org/10.2139/SSRN.988362>.
- Zvi Bodie and Jonathan Treussard. Making Investment Choices as Simple as Possible, but Not Simpler. *Financial Analysts Journal*, 63(3):42–47, 5 2007. ISSN 1938-3312. doi:[10.2469/faj.v63.n3.4689](https://doi.org/10.2469/faj.v63.n3.4689). URL <http://dx.doi.org/10.2469/FAJ.V63.N3.4689>.
- Francisco J Gomes, Laurence J Kotlikoff, and Luis M Viceira. Optimal Life-Cycle Investing with Flexible Labor Supply: A Welfare Analysis of Life-Cycle Funds. *American Economic Review*, 98(2):297–303, 4 2008. ISSN 0002-8282. doi:[10.1257/aer.98.2.297](https://doi.org/10.1257/aer.98.2.297). URL <http://dx.doi.org/10.1257/AER.98.2.297>.
- Ryan D Edwards. Health Risk and Portfolio Choice. *Journal of Business and Economic Statistics*, 26(4):472–485, 10 2008. ISSN 1537-2707. doi:[10.1198/073500107000000287](https://doi.org/10.1198/073500107000000287). URL <http://dx.doi.org/10.1198/073500107000000287>.
- Gokul Bhandari and Richard Deaves. Misinformed and informed asset allocation decisions of self-directed retirement plan members. *Journal of Economic Psychology*, 29(4):473–490, 8 2008. ISSN 0167-4870. doi:[10.1016/j.joep.2007.12.003](https://doi.org/10.1016/j.joep.2007.12.003). URL <http://dx.doi.org/10.1016/J.JOEP.2007.12.003>.
- John Beshears, James J. Choi, David Laibson, and Brigitte C. Madrian. *The Importance of Default Options for Retirement Saving Outcomes*, pages 167–195. University of Chicago Press, 2009. ISBN 9780226076508. doi:[10.7208/chicago/9780226076508.003.0006](https://doi.org/10.7208/chicago/9780226076508.003.0006). URL <http://dx.doi.org/10.7208/CHICAGO/9780226076508.003.0006>.
- Kent A. Smetters and Ying Chen. Optimal Portfolio Choice Over the Life Cycle with Social Security. *SSRN Electronic Journal*, 2010. ISSN 1556-5068. doi:[10.2139/ssrn.1706245](https://doi.org/10.2139/ssrn.1706245). URL <http://dx.doi.org/10.2139/SSRN.1706245>.
- Olivia Mitchell and Stephen Utkus. *Target-Date Funds in 401(k) Retirement Plans*. National Bureau of Economic Research, 3 2012. doi:[10.3386/w17911](https://doi.org/10.3386/w17911). URL <http://dx.doi.org/10.3386/W17911>.
- Luigi Guiso and Paolo Sodini. *Household Finance: An Emerging Field*, pages 1397–1532. Elsevier, 2013. doi:[10.1016/b978-0-44-459406-8.00021-4](https://doi.org/10.1016/b978-0-44-459406-8.00021-4). URL <http://dx.doi.org/10.1016/B978-0-44-459406-8.00021-4>.
- Zvi Bodie. Thoughts on the Future: Life-Cycle Investing in Theory and Practice. *Financial Analysts Journal*, 71(1):43–48, 1 2015. ISSN 1938-3312. doi:[10.2469/faj.v71.n1.6](https://doi.org/10.2469/faj.v71.n1.6). URL <http://dx.doi.org/10.2469/FAJ.V71.N1.6>.
- Jason C. Hsu, Jonathan Treussard, Vivek Viswanathan, and Lillian Wu. Two Determinants of Lifecycle Investment Success. *The Journal of Retirement*, 2(4):14–21, 4 2015. ISSN 2326-6902. doi:[10.3905/jor.2015.2.4.014](https://doi.org/10.3905/jor.2015.2.4.014). URL <http://dx.doi.org/10.3905/JOR.2015.2.4.014>.
- Matthew O’Hara and Ted Daverman. Reexamining “To vs. Through”: What New Research Tells Us about an Old Debate. *The Journal of Retirement*, 2(4):30–37, 4 2015. ISSN 2326-6902. doi:[10.3905/jor.2015.2.4.030](https://doi.org/10.3905/jor.2015.2.4.030). URL <http://dx.doi.org/10.3905/JOR.2015.2.4.030>.
- Ning Tang and Yen-Ting Lin. The efficiency of target-date funds. *Journal of Asset Management*, 16(2):131–148, 3 2015. ISSN 1479-179X. doi:[10.1057/jam.2015.8](https://doi.org/10.1057/jam.2015.8). URL <http://dx.doi.org/10.1057/JAM.2015.8>.
- Sandeep Singh. The evidence on target-date mutual funds. *Financial Services Review*, 25(3):235–262, 10 2023. ISSN 1873-5673. doi:[10.61190/fsr.v25i3.3223](https://doi.org/10.61190/fsr.v25i3.3223). URL <http://dx.doi.org/10.61190/FSR.V25I3.3223>.
- ANDREAS FAGERENG, CHARLES GOTTLIEB, and LUIGI GUISO. Asset Market Participation and Portfolio Choice over the LifeCycle. *The Journal of Finance*, 72(2):705–750, 3 2017. ISSN 1540-6261. doi:[10.1111/jofi.12484](https://doi.org/10.1111/jofi.12484). URL <http://dx.doi.org/10.1111/JOF1.12484>.
- Alexander Michaelides and Yuxin Zhang. Stock Market Mean Reversion and Portfolio Choice over the Life Cycle. *Journal of Financial and Quantitative Analysis*, 52(3):1183–1209, 6 2017. ISSN 1756-6916. doi:[10.1017/s0022109017000357](https://doi.org/10.1017/s0022109017000357). URL <http://dx.doi.org/10.1017/S0022109017000357>.
- David Blanchett and Paul D. Kaplan. Beyond the Glide Path: The Drivers of Target-Date Fund Returns. *The Journal of Retirement*, 5(4):25–39, 4 2018. ISSN 2326-6902. doi:[10.3905/jor.2018.1.038](https://doi.org/10.3905/jor.2018.1.038). URL <http://dx.doi.org/10.3905/JOR.2018.1.038>.
- John M. Mulvey and Han Hao. Setting Realistic Goals for Personal Retirement Planning via Micro–Macro Analyses. *The Journal of Retirement*, 8(2):23–38, 9 2020. ISSN 2326-6902. doi:[10.3905/jor.2020.1.076](https://doi.org/10.3905/jor.2020.1.076). URL <http://dx.doi.org/10.3905/JOR.2020.1.076>.
- Javier Estrada. Target-Date Funds, Glidepaths, and Risk Aversion. *The Journal of Wealth Management*, 23(3):50–60, 8 2020. ISSN 2374-1368. doi:[10.3905/jwm.2020.1.118](https://doi.org/10.3905/jwm.2020.1.118). URL <http://dx.doi.org/10.3905/JWM.2020.1.118>.

- 
- Wenliang Hou. How Accurate Are Retirees' Assessments of Their Retirement Risk? *SSRN Electronic Journal*, 2020. ISSN 1556-5068. doi:[10.2139/ssrn.3653456](https://doi.org/10.2139/ssrn.3653456). URL <http://dx.doi.org/10.2139/SSRN.3653456>.
- Household finance*, pages 112–126. The World Bank, 12 2014. ISBN 9781464803437. doi:[10.1596/978-1-4648-0342-0\\_CH6](https://doi.org/10.1596/978-1-4648-0342-0_ch6). URL [http://dx.doi.org/10.1596/978-1-4648-0342-0\\_CH6](http://dx.doi.org/10.1596/978-1-4648-0342-0_CH6).
- Francisco Gomes. Portfolio Choice Over the Life Cycle: A Survey. *Annual Review of Financial Economics*, 12(1):277–304, 11 2020. ISSN 1941-1375. doi:[10.1146/annurev-financial-012820-113815](https://doi.org/10.1146/annurev-financial-012820-113815). URL <http://dx.doi.org/10.1146/ANNUREV-FINANCIAL-012820-113815>.
- John B. Shoven and Daniel B. Walton. An Analysis of the Performance of Target Date Funds. *The Journal of Retirement*, 8(4):43–65, 3 2021. ISSN 2326-6902. doi:[10.3905/jor.2021.1.084](https://doi.org/10.3905/jor.2021.1.084). URL <http://dx.doi.org/10.3905/JOR.2021.1.084>.
- Francisco Gomes, Alexander Michaelides, and Yuxin Zhang. Tactical Target Date Funds. *Management Science*, 68(4):3047–3070, 4 2022. ISSN 1526-5501. doi:[10.1287/mnsc.2021.3981](https://doi.org/10.1287/mnsc.2021.3981). URL <http://dx.doi.org/10.1287/MNSC.2021.3981>.
- Victor Duarte, Julia Fonseca, Aaron Goodman, and Jonathan A. Parker. Simple Allocation Rules and Optimal Portfolio Choice Over the Lifecycle. *SSRN Electronic Journal*, 2021. ISSN 1556-5068. doi:[10.2139/ssrn.3983913](https://doi.org/10.2139/ssrn.3983913). URL <http://dx.doi.org/10.2139/SSRN.3983913>.
- Olivia S. Mitchell and Stephen P. Utkus. Target-date funds and portfolio choice in 401(k) plans. *Journal of Pension Economics and Finance*, 21(4):519–536, 6 2021. ISSN 1475-3022. doi:[10.1017/s1474747221000263](https://doi.org/10.1017/s1474747221000263). URL <http://dx.doi.org/10.1017/S1474747221000263>.
- Francisco Gomes, Michael Haliassos, and Tarun Ramadorai. Household Finance. *Journal of Economic Literature*, 59(3):919–1000, 9 2021. ISSN 0022-0515. doi:[10.1257/jel.20201461](https://doi.org/10.1257/jel.20201461). URL <http://dx.doi.org/10.1257/JEL.20201461>.
- Jonathan A. Parker, Antoinette Schoar, Allison Cole, and Duncan Simester. Household Portfolios and Retirement Saving Over the Life Cycle. *SSRN Electronic Journal*, 2022. ISSN 1556-5068. doi:[10.2139/ssrn.4068063](https://doi.org/10.2139/ssrn.4068063). URL <http://dx.doi.org/10.2139/SSRN.4068063>.
- David Altig, Laurence J. Kotlikoff, and Victor Yifan Ye. How Much Lifetime Social Security Benefits Are Americans Leaving on the Table? *Tax Policy and the Economy*, 37:135–173, 7 2023. ISSN 1537-2650. doi:[10.1086/724355](https://doi.org/10.1086/724355). URL <http://dx.doi.org/10.1086/724355>.
- Ankul Daga, Timothy Smart, and David C. Pakula. The Multi-Goal Framework: Why Practitioners Have Not Adopted the Lifecycle Model—Yet. *The Journal of Retirement*, 10(3):71–94, 1 2023. ISSN 2326-6902. doi:[10.3905/jor.2023.10.3.071](https://doi.org/10.3905/jor.2023.10.3.071). URL <http://dx.doi.org/10.3905/JOR.2023.10.3.071>.
- JONATHAN A. PARKER, ANTOINETTE SCHOAR, and YANG SUN. Retail Financial Innovation and Stock Market Dynamics: The Case of Target Date Funds. *The Journal of Finance*, 78(5):2673–2723, 6 2023. ISSN 1540-6261. doi:[10.1111/jofi.13258](https://doi.org/10.1111/jofi.13258). URL <http://dx.doi.org/10.1111/JOFI.13258>.