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# Ambiguity aversion and optimal derivative-based pension investment with stochastic income and volatility

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## Abstract

This paper provides a derivative-based optimal investment strategy for an ambiguity-averse pension investor who faces not only risks from time-varying income and market return volatility but also uncertain economic conditions over a long time horizon. We derive a robust dynamic derivative strategy and show that the optimal strategy under ambiguity aversion reduces the exposures to market return risk and volatility risk and that the investor holds opposite positions for the two risk exposures. In the presence of a derivative, ambiguity has distinct effects on the optimal investment strategy. More important, we demonstrate the utility improvement when considering ambiguity and exploiting derivatives and show that ambiguity aversion and derivative trading significantly improve utility when return volatility increases. This improvement becomes more significant under ambiguity aversion over a long investment horizon.

*JEL classification:* C61; G11; G22

*Key words:* Robust portfolio choice; DC pension plan; Ambiguity; Derivative; Stochastic volatility; Stochastic salary

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## 1. Introduction

Pension funds hold a significant share of the global market portfolio. Global institutional pension fund assets in 22 major markets are approximately \$36.4 trillion and increased 4.3% in 2016, and the total pension assets in these countries amount to 62% of their GDP<sup>1</sup>.

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<sup>1</sup>The data are from Willis Towers Watson's Global Pension Assets Study 2017: <https://www.willistowerswatson.com/en/insights/2017/01/global-pensions-asset-study-2017>.

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