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Optimal portfolio choice for investors with industry-specific labor income risks

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ABSTRACT

We study optimal investment decisions for long-horizon investors with industry-specific labor income risks. We find that in addition to the volatility of labor income growth, the correlation between labor income and risky asset returns is another important factor that affects the optimal portfolio decisions and may provide a plausible explanation for the mixed empirical evidence of the relationship between labor income risk and portfolio holdings. Depending on its relative covariance with stock and bond returns, labor income may help resolve or deepen the asset allocation puzzle.

1. Introduction

Numerous studies have shown that nontradable labor income risk can significantly affect investors' optimal portfolio decisions and thus have important implications for asset pricing (e.g., Bodie et al., 1992; Jagannathan and Wang, 1996; Koo, 1999; Viceira, 2001; Palacios-Huerta, 2003; Santos and Veronesi, 2006; Parlour and Walden, 2011). However, empirical evidence about the relationship between labor income risk and portfolio decisions is mixed. For instance, Guiso et al. (1996) and Palia et al. (2013) find that U.S. investors with a higher expected level of wage volatilities tend to invest less in risky assets or even choose not to participate in the stock market. Similarly, using Swedish data, Betermier et al. (2012) find that investors adjust their portfolios when they switch jobs

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across industries with different wage volatilities. By contrast, Heaton and Lucas (2000) do not find a significant effect of labor income risk on individual portfolio holdings.

This paper studies optimal portfolio decisions of investors who work in different industries with different degrees of labor income risk. Campbell et al. (2001) and Betermier et al. (2012) report large variations in labor income risks across industries. Eiling (2013) further indicates that industry-related human capital matters in determining the cross-section of expected stock returns. Using data from Campbell et al. (2001), we find that the correlations between labor income and risky asset returns crucially affect the optimal investment decisions for investors especially for more risk-averse investors. Our findings are consistent with Bagliano et al. (2013), and Davis and Willen (2014), who show that the correlation between labor income and stock return can affect investors' portfolio decision in a life-cycle model. However, unlike these studies, we focus on investigating the portfolio choice for investors with non-tradable industry-specific labor income risk. Our analysis demonstrates that investors working in such industries as Construction and Public Administration that have a higher correlation between labor income and stock should optimally invest less in stock, while those working in such industries as Agriculture and Professional Service that have a higher correlation between labor income and bond should invest less in bonds.

Betermier et al. (2012) argue that in cross-section data it is possible to find investors who seemingly do not consider labor income risk in their portfolio decisions even though they do in fact hedge their labor income risk in making investment, and the authors attribute this to differential tastes across investors. We show that the heterogeneous correlations between labor income and asset returns across industries can also provide a plausible explanation for the mixed evidence about the relationship between labor income risk and portfolio decisions.

We further show that the covariance between labor income and stock per unit of stock risk premium relative to the covariance between labor income and bond per unit of bond risk premium critically determines the relationship between investors' degree of risk aversion and the bond/stock ratio in the optimal risky portfolio. When the premium-adjusted covariance between labor income and stock is higher than that between labor income and bond, investors with a higher degree of risk aversion will increase the hedging demand for stock more than for bond, and should optimally increase their bond/stock ratio in the risky portfolio. Otherwise, more risk-averse investors should optimally decrease their bond/stock ratio in their risky portfolio. Therefore, the introduction of nontradable labor income may help resolve or deepen the asset allocation puzzle.

Section 2 specifies the model. Section 3 compares the optimal portfolio decisions for investors working in different industries. Section 4 conducts some robustness checks. Concluding remarks are provided in Section 5.

2. Model specification

We follow Viceira (2001) and extend his framework with one risky asset to multiple risky assets. Assume an individual investor facing two states of labor income, namely, the employment state and the retirement state, occurring with probabilities, π^e and $\pi^r = 1 - \pi^e$, respectively. The investor receives labor income each period in the employment state but has no labor income once she jumps to the retirement state and must live off her wealth. Furthermore, in the retirement state, the investor faces a probability of death, π^d. The process is irreversible. Labor income, Y_t, follows the process $Y_t = Y_{t-1}\exp(g + \zeta_t)$, where g is the expected growth rate of labor income, and $\zeta_t \sim N(0, \sigma_\zeta^2)$ is a random shock.

Assume that the market has n assets with the first asset risk-free. The portfolio gross return can be written as $R_{p,t} = \sum_{i=2}^{n} \alpha_{i,t-1}(R_{i,t} - R_f) + R_f$, where R_f is the constant gross risk-free interest rate, $R_{i,t}$ is the gross return on asset i at time t, and $\alpha_{i,t}$ denotes the portfolio weight of asset i at time t. The investment opportunity set is constant and is described as

$$\begin{bmatrix} r_{2,t} - r_f \\ r_{3,t} - r_f \\ \vdots \\ r_{n,t} - r_f \end{bmatrix} = \boldsymbol{\mu} + \mathbf{v}_t, \text{ where } \mathbf{v}_t \sim N(0, \boldsymbol{\Sigma}_\mathbf{v}), \; r_f = \ln(R_f), \text{ and } r_{i,t} = \ln(R_{i,t}), \quad i = 2, \ldots, n.$$