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The effect of capital wealth on optimal diversification: Evidence from the Survey of Consumer Finances

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ABSTRACT

It is well known that the wealthier the household, the larger tends to be the proportion of its total capital portfolio allocated to publicly traded stock, and the larger tends to be the number of individual stock issues included in its portfolio. Using the "homogeneous securities" case of a mean-variance model originally proposed by Michael Brennan, explicit functional forms are obtained for both the optimal proportion of the portfolio allocated to stocks and the optimal number of individual stock issues in the portfolio. An empirical evaluation of these theoretical results, using a dataset derived from the 2004 Survey of Consumer Finances, lends substantial support to the model.

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1. Introduction

Relative to such fixed-return assets as corporate bonds, government bonds, Treasury notes and the like, publicly traded common stock instruments combine high expected rate of return with high variance of return. From the point of view of the private investor, the upside of common stock is high expected return, while the downside is high risk, as reflected in the high variance. According to the "gospel of diversification" preached by the large majority of investment counselors, an investor interested in common stock should hold a substantial number of different stocks as an offset to the high variance of individual stock returns. As expressed in the ancient wisdom of not putting all one's eggs in one basket, this strategy takes advantage of the so-called "law of averages," otherwise known as the "law of large numbers." From such classic studies as Markowitz (1952, 1959), Baumol (1963), Sharpe (1964), Lintner (1965) and Samuelson (1967), down to the practitioner literature of today, the diversification prescription is central.

It is generally believed that wealthier investors tend to hold a larger proportion of their assets in common stocks than do less wealthy investors, and that they diversify their stock portfolios to a greater extent. For a comprehensive survey of recognized empirical regularities on the issue, see Carroll (2000). Since the law of averages suggests that every investor in common stock, whatever his or her total wealth level, should hold a large number of different stocks, the fact that smaller investors tend to hold a relatively limited number of stocks suggests that they are influenced, to a larger extent than wealthier investors, by the transactions costs involved in purchasing different stocks. In a word, wealthier investors may be able to better afford the higher transactions costs involved in holding highly diversified portfolios.

The intention of this research is to develop a theoretical model of optimal diversification that generates hypotheses capable of being tested using existing, reliable data. Although a number of studies in the large diversification literature examine relationships between wealth and portfolio choice issues, to the authors' knowledge no prior study has developed mathematically explicit relationships, based on a relatively simple mean-variance model,

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between total capital wealth and both the proportion of total capital wealth devoted to stock and the number of individual stocks held by the investor, that are capable of being empirically tested using well-known survey data. We utilize the "homogeneous securities" case of a mean-variance model originally proposed by Brennan (1975). Although Brennan did not himself develop explicit mathematical forms for the optimal proportion of the total portfolio to be invested in stocks, and the optimal number of stock issues to hold in the portfolio, it is straightforward to derive these formulae from the first-order maximization conditions of the model. These explicit theoretical predictions are tested using data from the 2004 Survey of Consumer Finances. The empirical analysis does in fact lend considerable support to the predictions.

The remainder of this article is organized as follows. Section 2 contains a brief survey of related literature. Section 3 sets forth the model. Section 4 describes the 2004 Survey of Consumer Finances and enumerates the variables utilized in this research. Section 5 presents the empirical results. Section 6 briefly reviews some of the more important caveats and qualifications. Section 7 concludes.

2. Related literature

The cumulative literature on diversification and related issues has become very large. As of 2008, the EconLit database contained over 8000 records with "diversification" as a keyword, about 3000 records with "diversification" in the abstract, and over 1600 records with "diversification" in the title. Contributions range over the spectrum from sophisticated mathematical exercises, exemplified by Carlos-Hatchondo (2008) and Bera and Park (2008), to commonsensical prescriptions from the practitioner literature, exemplified by Sparling (2008), Jaworski (2008), and Domian, Louton, and Racine (2007). A substantial subset of the overall literature concerns factors that influence household investment patterns. Some illustrative examples follow.

Using Italian household portfolio data and times series data on financial assets and housing stock returns, Pelizzon and Weber (2008) determine that housing wealth plays a key role in determining whether or not portfolios chosen by households are efficient. Using Finnish data, Saarimaa (2008) shows that mortgage-encumbered investors hold a smaller share of stocks in a mean-variance efficient portfolio. Also using Finnish data, Kaustia and Knupfer (2008) find a strong positive link at the individual investor level between past IPO returns and future subscriptions, which is consistent with reinforcement learning, wherein personally experienced outcomes are over-weighted compared to rational Bayesian learning. Goetzmann and Kumar (2008) present evidence that U.S. individual investors hold under-diversified portfolios, with the degree of under-diversification greater among younger, low-income, less-educated and less-sophisticated investors. Berkowitz and Qiu (2006) investigate how health status affects portfolio choice, and find that the diagnosis of a new disease causes a larger decrease in financial wealth than in non-financial wealth. Using data from Bank of Italy Surveys of Household Income and Wealth, Guiso and Jappelli (2005) document inadequate information about investment opportunities among investors, and find that the probability of information is positively correlated with education, household resources, long-term bank relations, and proxies for social interaction. Jianakoplos and Bernasek (2006) decompose the effects of chronological age, birth cohort, and calendar year on the age profile of household financial risk-taking, and find that the results support the conventional wisdom that risk-taking decreases with age.

Lundtofke (2006) shows that while investors without inside information will consistently invest less in stocks with higher variance, the relationship between stock variance and amount invested is ambiguous for investors with inside information. Massa and Simonov (2006), using a Swedish dataset, show that investors tend to over-invest in stocks issued by companies that are sources of their personal wage and salary income. Garlappi and Huang (2006) show how the "pecking order" location rule emphasized in the retirement planning literature may become invalid when the household faces certain portfolio constraints. Pachamanova (2006) applies a recent mathematical technique known as "robust optimization" to determine the optimal portfolio under uncertainty regarding the means and variances of returns. Kole, Koedijk, and Verbeek (2006) propose a novel approach incorporating the possibility of systemic crises to determine the optimal portfolio of investors in international equity markets. Cocco (2005) demonstrates a "crowding out" effect of housing investment: households owning a home tend to hold less stock, other things being equal. Berkelaar, Kouwenberg, and Post (2004) show that it is not possible to empirically disentangle the effects of loss aversion from those of theoretically distinct risk aversion in the determination of the household's optimal portfolio. Gomes and Michaelides (2003) show that the introduction of internal habit formation preferences into a life-cycle model of consumption and portfolio choice is not able to simultaneously explain two important stylized facts: a low stock market participation rate, and moderate equity holdings for those households that do invest in stocks.

Information on household wealth and portfolio choice has been used to estimate measures of household risk aversion, as in Vissing-Jorgensen and Attanasio (2003), and Brunnermeier and Nagel (2008). The effect of taxation on household portfolio choice has been investigated by King and Leape (1998), and Poterba and Samwick (2003). Using a bivariate binary-choice model and data from the Dutch Savings Survey 1993 to 1998, Alessie, Hochguertel, and van Soest (2004) examine the ownership dynamics of stocks and mutual funds, and find that the negative relation between ownership of one type in one period and the other type in the next period is explained by correlated unobserved heterogeneity. Carroll (2000) documents that portfolios of wealthy investors are heavily skewed toward risky assets, particularly investments in their own privately held businesses.

Several researchers have applied the same data source utilized here, the Survey of Consumer Finances, to investigate issues in portfolio choice. Kelly (1995) adduces evidence suggesting that most U.S. household portfolios are inadequately diversified in terms of mean-variance efficiency. Poterba and Samwick (2003) find that the portfolio share invested in corporate stock, which is taxed less heavily than interest bearing assets, is increasing in the household's ordinary income tax rate. Hu (2004) finds evidence that homeowners facing more non-diversified and levered risks in housing invest their liquid assets more conservatively than those who have relatively less housing commitments. Bergstresser and Poterba (2004) examine household allocation patterns between taxable and tax-deferred accounts. Polkovnichenko (2005) shows that portfolio choice models with rank-dependent preferences are capable of explaining certain stylized facts inconsistent with expected utility maximization. Gutter and Saleem (2005) find that financial vulnerability, defined by the extent to which income and wealth are derived from the same source, is prevalent among small business owners, especially farmers.

The extent and complexity of the published research on portfolio choice and diversification suggests the impracticality of a major literature survey that exhaustively documents similarities

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