

# Zeta Estimates of Wealth Volatility and Financial Planning Horizon

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## ⟨Abstract⟩

The intention of this study was to document how closely households follow normative descriptions of financial behavior in relation to their financial planning horizon. Modern Portfolio Theory predicts that households, in general, exhibit risk aversion. Aversion to wealth volatility should correspondingly be highest among those households with the shortest planning horizons. This study estimated percentage changes in wealth and wealth volatility over time categorized by financial planning horizon using data from the 2002 through 2010 waves of Health and Retirement Study. Modigliani ratios were computed for the entire population and by planning horizon. Zeta estimates were made by calculating the difference between the Modigliani ratios for each planning horizon and the ratio for the short-term horizon. Contrary to the conceptualized relationship between planning horizon and financial wealth volatility, results from this study show that respondents with the shortest financial planning horizons experienced lower risk-adjusted returns and greater wealth volatility. The findings of this study underscore an unmet and perhaps unrealized need for professionally provided financial planning.

**Key Words:** Volatility, Zeta, Modigliani Ratio, Sharpe Ratio, Wealth<sup>1)</sup>

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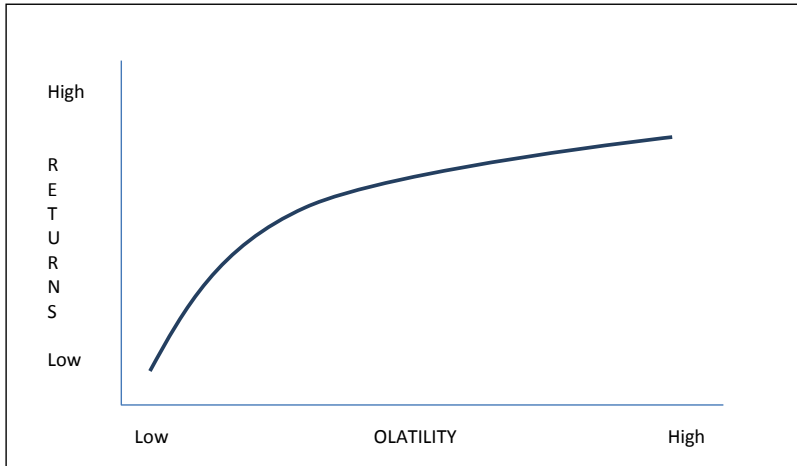
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## I . Introduction

Traditional economic theory is based, in part, on the assumption that individuals and households are rationally risk averse. The life cycle hypothesis (Modigliani & Ando, 1957) indicates, for example, that households with different planning horizons ought to select combinations of assets that are different. Those with a short planning horizon should exhibit relative risk aversion by selecting assets that limit variability in wealth. Consider also the development of modern portfolio theory (MPT) (Markowitz, 1959) within economics. MPT was conceptualized to help investors optimize their choice selection when presented with a wide assortment of investment assets and portfolios. As shown in Figure 1, the efficient frontier (an important outcome of MPT) consists of portfolios that balance risks and returns in a way that maximizes returns while minimizing volatility (i.e., risk). As illustrated, the frontier's lower left section combines assets that offer minimal returns and low risks. The upper right section of the frontier includes portfolios that maximize returns with correspondingly higher levels of risk (i.e., volatility).



<Figure 1> Efficient Frontier within a Modern Portfolio Theory Framework

The choice of a portfolio along the frontier is shaped by a household's risk tolerance and preferences. A key proposition within MPT is that investors are risk averse; that is, households prefer less risk and higher returns. It is assumed within the framework that an investor's planning horizon acts as a limiting factor in actual portfolio selection. For instance, regardless of an investor's age or risk capacity—defined as an investor's financial ability to withstand financial losses (Cordell, 2001)—those with a very short planning horizon should limit their selection of assets and portfolios to those that generate low volatility, and thus, low returns. It is reasonable, for example, to hypothesize that an investor with, say, a 9-month planning horizon ought to be risk-averse and invest in guaranteed short duration investments, such as government insured bank accounts, time matched certificates of deposit, or high quality fixed-income securities that provide a liquidation date that

corresponds to the investor's asset need. The level of wealth volatility for households with a short planning horizon should theoretically be constrained. Alternatively, an investor with a long planning horizon (e.g., 10 years or longer) should be more willing to take risks with their wealth. As such, it is reasonable to hypothesize that the wealth volatility of those with a long planning horizon ought to be higher. Stated another way, the relationship between acceptable wealth volatility and a household's planning horizon should be positive.

Typically, MPT has been used as a framework for the development of investment portfolios. It is possible, however, to extend MPT to be more encompassing. For example, Black, Ciccotello, and Skipper (2002) argued that MPT could be expanded to include a broad basket of assets, including household possessions, homes, and use assets. Using this approach, MPT could be used to describe and predict consumer behavior beyond security and portfolio selection. Grable and McGill (2009) followed Black et al.'s recommendation and incorporated occupational income—as a proxy for human capital—into a MPT framework to show that the source and volatility of household income can influence the efficient frontier. Earlier, Chandra and Shadel (2007) used MPT to test models of self-concept in social psychology by determining when the portfolio of individual self attributes is well diversified, variability in self concepts is minimized. This paper extends the assumptions and propositions underlying MPT to include a household's entire wealth situation. Specifically, this study attempts to document how closely households follow normative descriptions

of behavior in relation to planning horizon and volatility of wealth. As noted above, MPT predicts that households should exhibit general risk aversion. Aversion to wealth volatility should be highest among those households with the shortest planning horizons. This proposition is tested in this study.

## II. Conceptual Framework

A significant advancement in MPT was made in the mid-1960s. Sharpe (1966) published his now seminal work on a mathematical approach to comparing the risk-adjusted performance of two or more assets. What has since become known as the Sharpe ratio was measured in this study as follows:

$$S = \frac{E[R_a - R_b]}{\sigma_a}$$

where,  $S$  is the Sharpe Ratio,  $R_a$  is the asset return,  $R_b$  is the risk-free rate,  $E[R_a - R_b]$  is the expected value of the excess return over the risk-free rate, and  $\sigma_a$  is the standard deviation of the excess return. The primary purpose of the Sharpe ratio within the investment and financial planning community is to rank securities and portfolios on a risk-adjusted basis. The primary disadvantage associated with the Sharpe ratio is that the ratio itself is not easily interpreted. If an investor's goal is to simply compare

the risk-adjusted performance of two or more assets or portfolios, the ratio works well; however, in cases where it would be useful to compare calculated risk-adjusted returns, rather than a ratio, the Sharpe ratio comes up short.

A solution was introduced by Modigliani and Modigliani (1997). They refined the Sharpe ratio so that the excess return is adjusted for an asset's or portfolio's risk compared to a benchmark. For example, assume an investment's volatility was twice that of a reasonable benchmark. The investment's return ought to be twice as high as the benchmark on a risk-adjusted basis. The Modigliani and Modigliani ( $M^2$ ) measure allows a direct comparison of risk-adjusted returns by showing the magnitude of an investment's performance compared to a benchmark. It is possible, for instance, to use the  $M^2$  measure to evaluate the risk-adjusted wealth volatility of two households and determine which household did a better job of controlling risk. In effect, the  $M^2$  measure makes two or more households equally risky for evaluation purposes. Once the risk is held constant, the household with the highest mean wealth return would be defined as outperforming the other.

The following formula can be used to calculate  $M^2$ . This formula was used to derive risk-adjusted measures of wealth growth in this study:

$$M^2 = R_i + (\sigma_{BW} \left[ \frac{(R_W - R_i)}{\sigma_W} \right])$$

where,  $M^2$  is the Modigliani measure,  $R_W$  is the mean change in wealth during the period categorized by planning horizon,  $R_i$  is the inflation rate during the period,<sup>2)</sup>  $\sigma_W$  is the standard deviation of the mean change in wealth based on planning horizon, and  $\sigma_{BW}$  is the benchmark standard deviation of the change in wealth. As will be described later in the paper, the benchmark was the wealth change over the entire period inclusive of all planning horizons.

Recall that the purpose of this study was to document how accurately households follow predictions related to planning horizons and wealth volatility. The actual process of comparing changes in risk-adjusted wealth at the household level was made using a technique introduced by Grable and Chatterjee (2014). They were interested in comparing changes in household wealth over time to determine whether financial advisers help reduce wealth volatility for clients. After adjusting household wealth for risk, using the  $M^2$  measure, Grable and Chatterjee subtracted  $M^2$  estimates for those who managed their own wealth from  $M^2$  estimates for those who worked with a financial adviser. The difference score was termed zeta. They reported that the risk-adjusted wealth volatility for adviser led households was significantly lower than wealth volatility for other households.

This paper uses the concept of zeta, with the primary difference being the wealth volatility comparisons were made based on

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2) The risk-free rate of return is most often used in the formula; however, the risk-free rate is appropriate only in cases when investment or portfolio returns are being evaluated. Wealth, as measured in this study, encompasses all household assets and liabilities, and as such, the annual inflation rate is a more appropriate baseline return measure.

planning horizons rather than the source of wealth advice. Zeta was defined in this study as:

$$\zeta = M_{SPH} - M_{OPH}$$

where,

$$\zeta = \text{Zeta}$$

$M_{SPH}$  =  $M^2$  estimate for those with a short planning horizon

$M_{OPH}$  =  $M^2$  estimate for those with a longer planning horizon

Essentially, zeta estimates reported in this paper represent the relative risk-adjusted change in wealth for households with differing planning horizons compared to those households with a short planning horizon. Based on MPT assumptions, those with a short planning horizon ought to exhibit smaller gains and losses in wealth compared to those with longer planning horizons. Shorter planning horizons should also be associated with reduced volatility. As such, the zeta estimates for households with shorter planning horizons should be equal or superior to other households.

### III. Methodology

#### Data

The 2002 through 2010 waves of Health and Retirement Study (HRS) dataset were utilized for the empirical analyses conducted in



this study. The HRS is a national U.S. representative longitudinal dataset sponsored by the Social Security Administration and the National Institute of Aging. The survey includes more approximately 22,000 respondents who are surveyed once every two years. The HRS contains detailed data on financial asset holdings, wealth, and retirement planning horizons of participating older Americans. The dataset also includes information on income and health, as well as demographic distributions of these participants.

In this study, we tracked the financial wealth and financial planning horizons of the same set of respondents across five waves of the HRS data. However, in the 2006 wave, the question on financial planning horizon was asked only to non-retired respondents below the age of 65. As a result we included only those respondents who were not retired and were below the age of 65 in this study. The variables of interest in this study—financial wealth and financial planning horizon—were obtained from participant responses to the following two questions included in the HRS:

***Financial wealth.*** The HRS provides the computed “*net value of non-housing financial wealth*” of the participants. Non-housing financial wealth amounts, as reported in the dataset, are based on the sum of cash and cash equivalents, bonds, stocks, and other financial assets of the participants minus debt. The non-housing financial wealth variable, however, excludes money held in Individual Retirement Accounts (IRAs) and Keogh plans. The computation for financial wealth also excludes values of real estate, vehicles, and business assets of the participants.

**Financial Planning Horizon.** The financial planning horizon variable is a self-reported measure where the HRS participants are asked if their financial planning horizon falls under one of the following planning horizons: (a) less than 1 year, (b) 1 year, (c) 1 to 5 years, (d) 5 to 10 years, or (e) 10 or more years.

## Analyses

The first part of the empirical analyses for this study compared the mean, standard deviation, and coefficient of variation of financial wealth for respondents with financial planning horizons ranging from a few months to longer than 10 years. The coefficient of variation was defined as the ratio of standard deviation of wealth (volatility) divided by the mean of financial wealth (Hendriks & Robey, 1936):

$$\text{Coefficient of Variation} = SD_{\text{financialwealth}} / M_{\text{financialwealth}}$$

where,  $M$  = average financial wealth and  $SD$  = standard deviation of financial wealth.

The second part of this study was used to compute the percentage change in wealth and its volatility by financial planning horizon. In the final part of this study,  $M^2$  ratios were computed for the entire population and by planning horizon. Zeta was measured as the difference between the  $M^2$  ratios of each planning horizon with the reference period being the short-term horizon.

## IV. Results

Estimates from several calculations were used to determine whether households with shorter planning horizons exhibited wealth volatility that was similar to or less than households with longer planning horizons during three periods: (a) 2002–2010, (b) 2006–2010, and (c) 2002–2006. Table 1 shows baseline mean and standard deviation data for the three periods broken out by financial planning horizon. Also shown is the estimated coefficient of variation for each planning horizon. The coefficient of variation was calculated as the standard deviation divided by the mean. For interpretation purposes, the coefficient of variation can be used to indicate the magnitude of standard deviation in comparison to a mean value. When more than one coefficient of variation is compared, the higher coefficient is indicative of relatively higher volatility.

Two things stand out in Table 1. First, households with shorter planning horizons reported holding less financial wealth. Over the entire period from 2002 to 2010, for example, those with less than a one year planning horizon controlled nearly three times less wealth than those with a planning horizon greater than 10 years. Second, the volatility in change in wealth over each period was larger for those with a shorter planning horizon. The coefficient of variation estimates indicate that that the magnitude of volatility increased as planning horizons declined. This surprising finding runs counter to what is predicted by MPT.

&lt;Table 1&gt; Descriptive Data for Each Period and Planning Horizon

	Financial Planning Horizon				
	<1 year	1 year	1 to 5 years	5 to 10 years	10+years
Mean Fin. Wealth 2002-2010	\$147,945	\$252,006	\$305,210	\$423,397	\$561,100
Volatility (SD)	\$504,249	\$702,435	\$681,411	\$960,254	\$1,152,826
Coefficient of Variation	3.41	2.79	2.23	2.27	2.05
Mean Fin. Wealth 2006-2010	\$141,206	\$259,140	\$310,941	\$411,441	\$519,193
Volatility (SD)	\$554,507	\$843,825	\$751,155	\$921,066	\$1,169,680
Coefficient of Variation	3.93	3.26	2.42	2.24	2.25
Mean Fin. Wealth 2002-2006	\$128,834	\$227,011	\$298,125	\$419,885	\$521,183
Volatility (SD)	\$402,699	\$566,520	\$778,833	\$1,202,329	\$1,216,925
Coefficient of Variation	3.13	2.50	2.61	2.86	2.33

Data from Table 1 were converted to percentages in order to estimate  $M^2$  coefficients. These converted data are shown in Table 2. The second column in Table 2 provides the benchmark change in financial wealth and standard deviation figures needed for the  $M^2$  formula. As illustrated, households with the shortest planning horizons fared far worse than other households in terms of wealth growth and volatility. For example, over the three periods, households with a planning horizon less than one year lost 3.52%,

9.07%, and 3.02% between 2002 and 2010, 2006 and 2010, and 2002 and 2006, respectively. Conceptually, it is reasonable to have presupposed that these households would have had the lowest growth in wealth; however, it is perplexing that, on average, those with the shortest planning horizons would actually incur wealth losses. On the other hand, households with longer planning horizons all saw an increase, on average, in wealth over the three periods.

<Table 2> Percentage Change in Wealth and Volatility for each Period and Planning Horizon

	All horizons	Financial Planning Horizon				
		<1 year	1 year	1 to 5 years	5 to 10 years	10+ years
$\Delta$ in Fin. Wealth 2002-2010	2.57%	-3.52%	0.72%	1.39%	4.71%	5.98%
Volatility ( <i>SD</i> )	106%	194%	83%	153%	93%	81%
Inflation Rate	2.33%					
$\Delta$ in Fin. Wealth 2006-2010	1.43%	-9.07%	0.43%	0.94%	1.91%	3.51%
Volatility ( <i>SD</i> )	142%	566%	116%	80%	121%	123%
Inflation Rate	2.19%					
$\Delta$ in Fin. Wealth 2002-2006	2.88%	-3.02%	0.60%	1.49%	1.90%	3.68%
Volatility ( <i>SD</i> )	88.66%	138%	139%	85%	105%	35%
Inflation Rate	2.64%					

Data from Table 2 were combined to estimate  $M^2$  coefficients and zeta estimates across periods and planning horizons. Results are shown in Table 3. The  $M^2$  coefficient indicates the mean change in wealth that would have occurred had households

taken the same risk with their wealth as the benchmark. Over each of the periods, households with a planning horizon less than one year performed worse than the benchmark. Had these households taken the same risk as the overall benchmark, they would have underperformed the benchmark by 0.87%. On the other hand, those households that had a financial planning horizon of more than 10 years outperformed the benchmark over the three periods. In general, as the planning horizon increased, so did the risk-adjusted outperformance of wealth.

<Table 3>  $M^2$  Coefficient and Zeta Estimates

Planning Horizon	$M^2$	Zeta
2002 to 2010		
Less than 1 Year	-0.87%	0.00%
1 Year	0.26%	1.13%
1 to 5 Years	1.68%	2.55%
5 to 10 Years	5.04%	5.91%
More than 10 Years	7.12%	7.99%
2006 to 2010		
Less than 1 Year	-0.64%	0.00%
1 Year	0.04%	0.68%
1 to 5 Years	-0.03%	0.61%
5 to 10 Years	1.87%	2.51%
More than 10 Years	3.72%	4.36%
2002-2006		
Less than 1 Year	-0.90%	0.00%
1 Year	1.33%	2.23%
1 to 5 Years	1.44%	2.34%
5 to 10 Years	2.01%	2.91%
More than 10 Years	5.25%	6.15%

Table 3 also reports zeta estimates for households. Each of the zeta estimates was based on a comparison to the period's shortest planning horizon (i.e., less than one year). For example, between 2002 and 2010, those with a financial planning horizon of 10 years or more did nearly 8% better, on a risk-adjusted basis, than households with a planning horizon less than one year. One would expect, based on MPT as a guideline, that zeta estimates should have been close to zero across planning horizons. The fact that zeta was large for those households with a longer planning horizon suggests that those with very short planning horizons not only experienced weak growth in wealth, but also high volatility in relation to their wealth.

The zeta estimates were quite stable across periods. Consider the period bookmarked by the beginning and end of the Great Recession in the United States (2006 to 2010). During this time period, the average maximum wealth growth was approximately 3.50% (Table 2). It is important to note, however, that the level of volatility was quite large (142%). This means that some households likely experienced large windfalls that increased wealth, whereas other households experienced dramatic losses in wealth. On average, however, the average wealth gain during this period was less than 1.50%. Even so, households with very short planning horizons did comparatively worse than others. As noted above, the zeta estimate for those with a very short planning horizon should have been close to zero when compared to households holding other planning horizons. This was not the case.

The story was very much the same for the period building up to

the Great Recession (2002 to 2006). Wealth increased nearly 3%, whereas wealth volatility was close to 90% (Table 2). On a risk-adjusted basis, those with a very short planning horizon did worse than the benchmark and worse than households with longer financial planning horizons.

## V. Discussion

Most seminal theories that are applied in both scholarly research and the professional practice of financial planning, such as the life cycle hypotheses (Modigliani & Ando, 1957) and MPT (Markowitz, 1959), suggest that rational individuals with the shortest planning horizons are better off selecting combinations of assets with lower volatility; conversely, these frameworks suggest it is more rewarding to have longer planning horizon portfolios with higher volatility. This is true because over longer periods, risky portfolios have a better opportunity to generate greater returns and recover from the sporadic losses that might occur over certain periods. Other scholars have argued that holding portfolios over long periods of time reduces overall volatility since portfolio returns become less correlated to each other across time (Bodie, Kane, & Marcus, 2010). However, contrary to the conceptualized relationship between planning horizon and financial wealth volatility, results from this study show that respondents with shortest financial planning horizons experienced lower risk-adjusted returns, as suggested by the Modigliani ratios, when compared to the overall



market. Surprisingly, this relationship held true before, during, and after the Great Recession. This indicates that the allocation of assets held by households is often not compatible with their financial planning horizon. More specifically, the management of wealth volatility appears to run counter to theory at the household level.

The findings from this study underscore an unmet and perhaps unrealized need for financial planning. Although many households may yet be unaware of, or may not be able to access, the services of a financial planning professional, the results of this study indicate an opportunity that is present in the market for advice that is needed to make the asset allocation decisions of households more realistic with the constraints of financial planning horizons.

According to survey data collected and reported by the Certified Financial Planner Board of Standards, Inc. and the Consumer Federation of America (CFP Board, 2013), 9 out of 10 Americans are currently engaged in some type of informal financial planning activity. Among the general population, however, less than one-third of all Americans engage the services of a professional financial planner or adviser. Two striking features stand out among those who do work with a professional adviser. First, their financial preparedness tends to be higher than for others. Second, the use of professional services tends to be skewed towards higher income and net worth households. Grable and Chatterjee (2014) noted that households who work with a financial service adviser exhibit superior risk-adjusted wealth growth rates compared to those households that do not take advice from the a professional. Similar

to the CFP Board of Standards, Inc. and Consumer Federation of American survey, Grable and Chatterjee also documented that lower wealth holding households are less likely to work with a financial planner.

It is possible that the discrepancies in wealth volatility noted in this study are an artifact of financial help seeking and household financial numeracy. Within the dataset, households with longer planning horizons were, on average, wealthier. The level of volatility associated with this wealth was lower than those whose planning horizon was shortest. Although there is no direct evidence to support this notion, it may be possible to hypothesize that wealthier households with longer planning horizons were also obtaining asset and liability allocation advice from professional advisers. It may be this direct advice that is providing value to those households with longer planning horizons. At least this is what Grable and Chatterjee (2014) found in their study of non-retired U.S. households. If true, the combined evidence from this and other studies indicates a real need for financial planning advice for lower wealth households. In many ways, the lowest wealth household can least afford dramatic shifts in wealth. This is especially true for those with low wealth and short planning horizons. Access to allocation advice could be a key factor in helping the most disadvantaged households reach a higher degree of financial stability. At a minimum, this possibility is worth further study.

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