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# INDIVIDUAL ASSET ALLOCATION AND INDICATORS OF PERCEIVED CLIENT RISK TOLERANCE

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## INTRODUCTION

Proper asset allocation is dependent upon two inputs: (1) expected capital market returns and (2) the individual client's desire and ability to tolerate risk. Though much has been done to explain capital market returns, little has been added to our understanding of the factors which influence client risk tolerance.

As money managers begin the task of allocating a client's money into various investment vehicles they face two potential problems. First, the money manager may poorly allocate the funds. This can lead to the client either not having the required funds at a desired point in the future or perhaps lead to a loss of client wealth. The second problem stems from the first; the money manager may be held liable for poor performance. This study provides insight into individual client risk tolerance in a manner which addresses both problems mentioned. As will be detailed later in the article, the methodology of the study is designed to provide a quantitative, rather than qualitative, model for measuring client risk tolerance. Thus, the study contributes a methodology which allows clients to achieve their objectives, as well as one which provides the money manager with a technique to determine client risk tolerance in a manner which is prudent and defendable.

Individual asset allocation is a twofold process. First, the expected capital market returns must be estimated and second, the risk tolerance of the client must be determined.

## LITERATURE REVIEW

Since the pioneering work of Markowitz[11] and Sharpe[15], a major tenet of financial theory has been the proper definition of the risk/return relationship that exists in the capital markets. This risk/return relationship extends to the process of individual asset allocation as well. The question evolves into what level of risk is appropriate given an investor's risk/return profile.

The state of research in the risk tolerance area is best described by Harlow and Brown[5]:

> "..it is surprising to find an almost total absence of unanimity about the proper assessment method. In fact, even a cursory inspection of the literature indicates that this area is seldom addressed with the same degree of rigor as is the analysis of the capital market side of the asset allocation equation."

Proper measurement of client risk tolerance is essential for suitable asset allocation. To date, asset allocation studies typically possessed the risk measures related to the market, but not the proportions to be invested in the various assets.

There is an ongoing debate exists between psychologists and economists as to what drives the risk tolerance of individuals. Psychologists tend to believe, "that individuals' choices are primarily determined by factors unique to the particular decision setting, whereas economists assume that there is some individual-specific mechanism playing a common role in all economic decisions."[5]

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From an economics perspective, client risk tolerance tends to concentrate on changes in a client wealth. Examples of this are the Pratt[13] and Arrow[1] measures of risk aversion. Economic studies of this type appear to indicate that the typical investor will have a constant to declining risk premium as wealth increases.[14,10]

Psychological studies have approached the measurement of risk tolerance through the development of techniques which classify individuals into various risk categories. From these category assignments the money manager derives insight into the risk attributes of the person and thus recommends an asset mix for their portfolio. Examples of this type of approach are detailed by Kaiser[7], Lipper and Busby[9], Droms[4], and Lebaron, Farrelly, and Gula[8].

## THEORY

This research as indicated above, advances a quantitative model for asset allocation which incorporates features of psychological and economic paradigms. The model hypothesizes client risk tolerance to be a function of time horizon, salary, expected salary growth, age, gender, marital status, and number of children.

The hypothesized relationship between perceived client risk tolerance and horizon, client salary, and projected salary growth, are all positive. The longer the planning horizon, the greater the client's salary, and/or the higher the projected salary growth, the more risk the client should be able to tolerate.

Time horizon is often thought to be the most important variable in the allocation process[3, 12]. The fundamental logic underlying this hypothesis is the longer the time period between initial investment and need for monies from the portfolio, the greater the probability the client can recoup any temporary loss in wealth. Therefore greater risk (with its promise of greater returns) can be assumed by the portfolio.

Client risk tolerance should also be an increasing function of both the client's salary level and anticipated salary growth. Client's with these characteristics should be capable of tolerating a short term loss of principal,and hence capable of accepting higher risk within the portfolio.

Studies which have addressed gender and client risk tolerance, have concluded that men tend to seek out greater risk than do women[2, 3]. A gender variable is included in this analysis to test this hypothesis.

Additional factors included in the model relate to marital status and number of children. Being married, divorced, widowed, and/or having children are factors hypothesized to reduce the risk tolerance of the client. Thus, as marital status moves from that of being single, and/or as the number of children becomes greater than zero, the risk tolerance of the client should decrease.

## METHODOLOGY

Insight into what drives the perceived risk tolerance of a CFA advisor regarding an individual investor, i.e., the risk tolerance that CFA advisors deem appropriate for a particular client, was derived from a survey of 2000 Chartered Financial Analysts (CFA) across the country. The survey consisted of a hypothetical client scenario containing both demographic and financial information. Given the information in the scenarios, the CFA respondents were asked to provide an allocation of client money into U.S. equities, U.S. bonds and/or cash equivalents. Other data provided by the respondents were their assumptions as to time horizon and assumed periodic savings of the client. Of the 2000 scenarios mailed, 712 were returned. After eliminating 128 scenarios due to insufficient data, the remaining 584 scenarios were used as the basis of this study.

Using the CFA asset allocations from the survey as inputs, an implied perceived risk for each client scenario is calculated. The implied perceived risk measure calculated is a three asset standard deviation, suggested by the work of Harry Markowitz[11]. The formula for the implied risk measure is as follows:

$$\sigma_{p,i} = [\, w_c^2\sigma_c^2 + w_b^2\sigma_b^2 + w_c^2\sigma_c^2 + 2w_c w_b\, cov_{c,b} + 2w_c w_c\, cov_{c,c} + 2w_b w_c\, cov_{b,c}\, ]^{1/2}$$

where:

$\sigma_{p,i}$ = Implied perceived portfolio risk tolerance of hypothetical investor, i.
$w_c$ = CFA response proportion invested in cash.
$w_b$ = CFA response proportion invested in bonds.
$w_e$ = CFA response proportion invested in equities.
$s_c$ = Standard deviation of cash returns.
$s_b$ = Standard deviation of bond returns.
$s_e$ = Standard deviation of equity returns.
$cov_{i,j}$ = Covariance between returns of assets i and j.

The standard deviation and covariance statistics were estimated using five years of monthly returns from the Ibbotson Associates Yearbook[6]. Together with the standard deviation and covariance estimates, allocations provided by the respondents allow for the direct measurement of the implied client risk tolerance, $\sigma_{p,i}$.

The implied risk, i.e., $\sigma_{p,i}$, of each hypothetical client is hypothesized to be a function of the demographic/financial data contained in the client scenarios. The functional specification of implied risk is as follows:

$$\sigma_{p,i} = f(\overset{+}{HOR}, \overset{+}{SAL}, \overset{+}{SALGRO}, \overset{-}{CLIAGE}, \overset{+}{GEN}, \overset{-}{DMSM}, \overset{-}{DMSD}, \overset{-}{DMSW}, \overset{-}{NUMCHLD}$$

where:

$\sigma_{p,i}$ = Implied risk, as measured by the Markowitz type standard deviation for a three asset portfolio.
HOR = Planning horizon for client assumed by financial advisor.
SAL = Scenario client salary.
SALGRO = Scenario projected salary growth
CLIAGE = Scenario client age
GEN = Scenario gender: 0-male 1-female
DMSM = Scenario marital status: 0-single 1-married
DMSD = Scenario marital status: 0-single 1-divorced
DMSW = Scenario marital status: 0-single 1-widowed
NUMCHLD = Scenario number of children

Financial advisors are assumed to be homogeneous in their utility functions for risk tolerance. Each variable is assumed to be exogenous to $\sigma_{p,i}$. Partial derivatives are given above each variable. The equation to be estimated is as follows, where:

Equation 1

$$\sigma_{i,p} = (\alpha + b1 \times HOR^{ehor} + b2 \times SAL + b3 \times CLIAGE + b4 \times SALGROW) \times (1 + b5 \times DMSM + b6 \times DMSD + b7 \times DMSW + b8 \times NUMCHLD + b9 \times GEN)$$

As defined by Equation 1, the implied risk tolerance of an individual investor is driven by two sets of factors. The first set is contained within the first set of parentheses. These factors are a set of structural components which relate risk tolerance to an investor's time horizon, salary, client age, and salary growth. Also included in this first set of factors is a regression coefficient with a hypothesized value of zero. The second set of factors is contained within the second set of parentheses. These are factors which shift the structural component by the parameters which attach to marital status, the number of children in the household and gender. Hence, the structural component is relative to a single male with no children, i.e., single males with no children have shift variables equal to zero, and thus no adjustment made to the first component of the equation. As marital status, number of children and/or gender change, the expected level of risk tolerance changes in proportion to the shift component given by the parameters which attach to marital status, gender and number of children.

While conventional models of strategic risk allocation utilize multiple regression analysis to estimate the effect of independent variables on client risk tolerance, the nature and complexity of the model advanced above precludes estimation with ordinary least squares (OLS), as implied risk is not linear in time horizon, marital status, gender, or number of children. A nonlinear estimation procedure which produces least squares estimates will be used to estimate coefficients for the parameters which define the model.

## RESULTS

Parameter estimates and the analysis of variance for the model are presented in Table 1, below. The results present strong evidence that variation in the independent variables affect the level of perceived risk tolerance.

**TABLE 1**
**Nonlinear Estimation Regression Results**

| Variable | Coefficient | T-RATIO | | |
|---|---|---|---|---|
| **α** | -3.588 | -.750 | R-Square | .894 |
| **HORIZON** | 2.377 | 5.380 | Adj. R-Square | .890 |
| **EHOR** | 1.343 | 30.000 | SSE | 3339 |
| **SALARY** | .044 | 1.340 | | |
| **SALGROW** | -.014 | -3.950 | | |
| **CLIAGE** | -.091 | -.074 | | |
| **NUMCHLD** | -.022 | -1.830 | | |
| **DMSM** | -.099 | -2.590 | | |
| **DMSD** | -.208 | -2.950 | | |
| **DMSW** | -.132 | -1.880 | | |
| **GEN** | .035 | 2.270 | | |

The explanatory power of the model is high with over 89 percent of the variation in the implied perceived risk being explained by or attributed to variation in the independent variables which define the model. The constant term of -3.588 is not significant, as hypothesized.

The statistically significant regression coefficient of 2.377 for time horizon indicates that risk tolerance perceived by CFA respondents increases with client time horizon. The positive and statistically significant parameter exponent of 1.34 for ehor which attaches to time horizon is positive and statistically significant. With a standard error of .003, it is highly likely that the population parameter is not only greater than zero, but greater than one. Taken in concert the two parameters indicate that implied risk tolerance increases with time horizon at an increasing rate. The exponent estimate of 1.34 can be interpreted as an elasticity, with the implication that a one percent increase in time horizon leads to a 1.34 percent increase in client risk tolerance.

The coefficient associated with salary level of the client (SALARY) is positive and weakly significant. As was hypothesized *a priori*, clients should be capable of assuming greater risk as their income increases. Related to the absolute level of income is the expected growth in the client's salary. The coefficient for salary growth (SALGROW), was hypothesized to be positive. The results indicate a negative and statistically significant coefficient for SALGROW. The cause of this anomalous result may be the consequence of SALGROW being highly correlated with some other omitted variable.

The client age (CLIAGE) coefficient is negative, as hypothesized, but not statistically significant. The effect of CLIAGE, however, may be subsumed in horizon, which would have the effect of diminishing the coefficient and thus making it insignificant.

The coefficients for the three dummy variables (DMSM, DMSD, and DMSW) relating to marital status are negative, as hypothesized, and statistically significant at the five percent level. These parameter estimates measure coefficient shifts in the structural portion of Equation 1. The results indicate that a married individual has an expected risk tolerance 9.9 percent less than that of a single person, a divorced person 20.8 percent less than that of a single person, and a widowed person 13.2 percent less than a single person, other things equal. The results relative to a single person square with intuition.

Reason holds that as the number of children a client has increases, they should construct a less risky portfolio. The results above provide evidence in support of this hypothesis. The coefficient shift relative to the client's number of children (NUMCHLD) is both negative and statistically significant. The coefficient shift of .022 indicates that each additional child diminishes risk tolerance by an estimated 2.2 percent.

Another finding has to do with the gender of the client (GENDER). In a normative sense, male and female clients with the same risk parameters should be provided a portfolio with the same risk tolerance. The coefficient shift for GENDER of .035 is positive and statistically significant, and indicates that CFA respondents believe females to have an estimated 3.5 percent greater risk tolerance than males, other things equal.

## CONCLUSIONS

While conventional wisdom holds that increased risk should lead to increased returns, little work has been done which specifically addresses those elements which identify the determinants of individual risk. This study represents an advancement in that regard.

Many of the findings of this study are consistent with mainstream thought. *A priori* beliefs about time horizon, salary level, marital status, and number of children are all borne out by this study. CFA perceived risk tolerance appears to be an increasing function of client time horizon and salary, a decreasing function of the incidence of not being single, and decreasing function of one or more children. This study adds to the conventional wisdom in that it associates females as having a higher level of risk tolerance. A conclusion contrary to Baker and Haslem[2], as well as Blume and Friend[3]. While it was hypothesized that risk tolerance should be positively associated with salary growth and client age, the results indicate no such relationship exists. These results, however, may be the result of collinearity between salary growth and salary, and between client age and time horizon which have the effect of generating unreliable regression coefficients and statistical inferences. Hence, the conclusions regarding salary growth and client age are tentative, under the circumstances, and warrant further investigation.

While the results clearly indicate that the assumed time horizon for a client is an essential element for a proper asset allocation, this may indicate another aspect of this study which warrants further inquiry. While variables such as age, marital status, gender, and number of children are observable, time horizon, which appears to have the greatest explanatory power of risk tolerance, may be a random variable in-and-of-itself, which has its own sets of determinants. Further research might investigate what variables explain the assumed time horizon of the respondent.

Apart from the notion that a few aspects of this study might warrant further research, this research represents a new direction in discovering what variables affect risk tolerance in the individual asset allocation process.

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