What Moves Money Managers' Portfolios? An Investigation of Preferences and Beliefs *

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Abstract

Asset allocation is widely recognized as the most fundamental decision in the investment process. Surprisingly little work has been done on examining what drives the asset allocation recommendations of professional investment advisors. To address this issue, we propose a general framework to identify and estimate the parameters characterizing the preferences and beliefs of money managers. In a mean-variance framework, we provide joint estimates of the preference parameters and the beliefs conditioned on observable information that most closely reproduce the dynamics of the observed portfolio recommendations made by a panel of international money managers for *The Economist*. Our findings suggest that money managers behave as low risk-averse investors and that heterogeneity in their conditional beliefs is key to explaining differences in their recommended portfolio allocations. The source of heterogeneity lies in the diverse interpretation of publicly available information. Using our general framework, we cannot reject the hypothesis that, in general, money managers use information efficiently.

JEL Classification: G11; G14; G23.

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I. Introduction

For the majority of investors the most fundamental portfolio decision is how to allocate money among equities, bonds, and cash. With the exception of Canner, Mankiw, and Weil (1997), and Elton and Gruber (2000), little attention has been paid to examining professional advice on this issue. This is surprising, since asset allocation is recognized as a major determinant of risk and return and is one of the primary services provided by most brokerage firms and investment advisors. *'Asset allocation is the area in which you can exert the most influence over your returns'*, says David Darst, chief investment strategist for Morgan Stanley's Individual Investor Group.[1] Therefore, understanding the circumstances under which asset allocation choices are made is of great interest to policymakers and market participants alike.

In particular, it is of extreme importance to uncover how economic conditions and individual characteristics affect the investment strategies of money managers at leading investment houses. Investors should understand how money managers implement their investment policies over time. How, for example, does an investment bank recommended allocation to equities or bonds change in a time of high interest rates or market exuberance? These questions are particularly important for investors who choose to implement a portion of their portfolio strategy using professional advisors' recommendations.

The differences in portfolio recommendations across investment banks can be due to differences in beliefs and/or differences in preferences. The contribution of this paper is to document how the recommendations change in response to new information and to disentangle the two components of money managers' recommended portfolios. To identify the key factors moving money managers' portfolios, we need to reverse engineer their portfolio recommendations. The design of our analysis is straightforward. Rather than treating the recommended portfolio weights as observable state variables, we focus on the dependence of the portfolio weights on a (possibly misspecified) quantitative investment strategy. Specifically, we parameterize the portfolio weights in each asset class as a function of a common set of macro and financial variables. The money manager chooses the coefficients of the investment strategy by maximizing the utility that

[1] *Business Week*, 27 June 2005, Investment Guide, p.86.

would have been obtained by implementing the portfolio policy over time. This step allows us to characterize the mapping from money managers' preferences and beliefs to the recommended portfolio weights. Finally, we establish conditions under which both the preference parameters and conditional beliefs about the future state of the market can be recovered from the observed portfolio weights in the class of linear investment strategies. Our estimates and inferences are robust to model misspecification. In other words, we can identify the parameters driving the preferences and beliefs of money managers, even if we typically do not know the full portfolio policy model used to create the investment strategy.

Our paper is related to two strands of the literature - the literature on performance evaluation and the literature on the recoverability problem. Researchers investigating the performance of institutional investors (Carhart (1997), Chevalier and Ellison (1997), Blake, Lehmann, and Timmermann (1999)) or published portfolio recommendations (Barber and Loeffler (1993), Canner, Mankiw, and Weil (1997), Graham and Harvey (1996), Jaffe and Mahoney (1999)) examine whether these experts possess superior market timing ability, yet they never address the issue of what drives their asset allocation choices. The second group of related studies is concerned with recovering an investor's preferences by observing his consumption or investment decisions. The relevance and apparent difficulty of the task is summarized by Kraus and Sick (1980) : *'Since individual agent optimality conditions involve the product of probability and marginal utility, it may be that any set of equilibrium prices that are consistent with some combination of beliefs and preferences could also have resulted from different beliefs combined with different preferences'.* Furthermore, in the presence of delegated portfolio management, the portfolio choice that optimally trades off risk and return for investors may differ from the choice that maximizes money managers' utility. [2]

To the best of our knowledge, there is no previous research that reverse-engineers the problem of portfolio choice. Wolf and Pohlman (1983) consider the problem of a bond dealer who chooses the optimal composition and size of the bid. They attempt to recover the dealer's risk aversion by using his actual demand for bills and the distribution of bond returns calculated from the forecasts made by the dealer in weekly auctions. In a mean-variance framework, French and Poterba (1991) ask

[2] It is likely that career concerns and herding behavior play a crucial role in determining the optimal portfolio composition. In this respect, our work is related to the literature studying the optimal design of compensation schemes of fund managers and delegated portfolio management. See for example Basak, Pavlova, and Shapiro (2004), Goetzmann, Ingersoll, and Ross (2003), Huddart (1999).

what set of expected returns would explain the observed pattern of international portfolio holdings given an in-sample estimate of the covariance matrix, but they ignore the joint determination of parameters characterizing beliefs and preferences. Dybvig and Polemarchakis (1981), Dybvig and Rogers (1997), Wang (1993), and Cuoco and Zapatero (2000) examine from a theoretical standpoint the extent to which a given consumption or investment plan can be rationalized by the simultaneous choice of an agent's preferences and beliefs. Hansen and Singleton (1982) study a representative investor with power utility and develop methods for estimating preferences from the investor's Euler equations.

The above-mentioned papers reduce the complexity of the recoverability problem and avoid the identification issues by focusing on one of the two determinants of portfolio weights (preferences or beliefs) or by approaching the recoverability problem from a theoretical point of view. In contrast, our approach allows for the joint identification and estimation of both the preferences and conditional beliefs implied in an observable sequence of portfolio recommendations or holdings. Furthermore, by framing the asset allocation problem as a statistical estimation problem with an expected utility objective function, we can easily test the rationality of the portfolio recommendations.

Our empirical analysis focuses on the asset allocation strategies provided by a panel of large global institutional investors from around the world between 1981 and 2004. These portfolios are regularly published in *The Economist's* Quarterly Portfolio Poll. In these surveys money managers are asked to provide asset allocations among equities, bonds, and cash for a hypothetical investor *'with no existing investments, no overriding currency considerations, and an objective of long term capital growth'*. The data set provides us with a unique opportunity to study what are the key factors behind the recommended portfolios at the asset allocation level and thus allows us to characterize and quantify the investment strategy of a key group of institutional investors.

In a mean-variance framework we provide sensible estimates of money managers' risk aversion and shed light on the state variables used by different investment houses to form their expectations on the evolution of markets. Our estimates suggest that money managers behave as low risk-averse investors with an average risk aversion coefficient of two, while money managers at Swiss investment banks display an above-average risk aversion. Looking at the cross-section of money managers, we find that macro (inflation, growth in industrial production) and financial (short term risk-free rate, default spread) variables are included in the majority of their portfolio policy functions. We also find evidence of a momentum effect in the recommended investment strategies. In addition, we find that heterogeneity in market beliefs is key to explaining differences in the recommended portfolio allocations. Indeed, the center of their disagreement is the diverse interpretations of publicly available information. For some of the investment houses participating in the survey, none of the macro or financial variables used to track time-varying risk premia is found to be significant.

Finally, we ask if money managers are rational when they construct the recommended portfolios, that is, do money managers incorporate public information efficiently into their portfolio recommendations? Overall, we can reject rationality in 10%-25% of the cases depending on the variable entering the portfolio policy function and the instruments set.

The paper is organized as follows. In the next section, we provide details of the nature and content of the *The Economist* Portfolio Poll. Section III introduces the asset allocation problem and some notations. Section IV outlines the econometric approach and provides details on the identification conditions and the estimation strategy. Section V describes the money manager's problem in a mean-variance framework and sets up the basis for the estimation. Section VI summarizes the empirical findings and Section VII concludes the paper.

II. Data

A. *The Economist* Portfolio Poll

The data on recommended portfolio weights are collected from surveys published every six weeks beginning in 1981 in a confidential newsletter, *Financial Report*, purchased by *The Economist* in 1989. *The Economist* continued to conduct the survey until 2005 but, starting on March 25, 1989, published it every 12 weeks. The nature of the poll is as follows:

> Taking over the portfolio poll that run regularly in Financial Report for eight years, The Economist asked nine money managers for their opinion on the best mix of investments over the next 12 months. They were asked to design a portfolio for

an investor with no existing investments, no overriding currency considerations and an objective of long term capital growth. (*The Economist*, 3/25/1989)

Although the published advice does not necessarily relate to actual managed portfolios, we assume that given the widely-respected and read publication outlet, the investment bankers do not take the portfolio poll light-heartedly.[3]

Each poll comprises three parts. In the first part, *The Economist* ask portfolio managers about the recommended asset allocation among equities, bonds, and cash.[4] In the second part each institution provides a suggested equity portfolio diversification, while in the third part each money manager constructs a portfolio of sovereign bonds denominated in six different currencies. In this paper, we focus on the first part of the poll.

Our sample runs from 1981 to 2004 and includes portfolio allocations provided by twenty four firms. The initial set of recommendations was made by eight Houses. In 1987, a ninth participant joined the group. The set of nine Houses remained unchanged through February 1989. Then, the set of Houses changed periodically through the end of the sample.[5] We excluded eleven firms from the sample due to insufficient number of observations on each firm or because they could not be identified.[6] The final sample consists of four North American firms (Brown Brothers Harriman, Lehman Brothers, Merrill Lynch and Scudder Stevens Clark), two Asian firms (Daiwa Europe, Nikko Securities), and seven European firms (Commerz International, Bank Julius Baer, Capital House, Credit Agricole, Credit Suisse, Robeco Group, and UBS Phillips & Drew). There are a number of advantages in analyzing this sample. First, the participants examined are clearly well known and have established reputation. Second, this dataset is ideal for the purpose of the paper since there are not transaction costs which could induce frictions in the dynamics of portfolio weights. Finally, the Portfolio Poll provides us with a unique opportunity to study the

[3]It is well understood that the survey has a worldwide audience. Indeed, in the cover letter of the survey is written *'Our poll reaches a readership of over 800,000 subscribers'*.

[4]In some instances, the surveys also provided recommended allocations to other assets such as real estate, gold, and fine art. The recommended percentage allocation to these other assets averaged less than 1% throughout the sample. Therefore, we simply added this other allocation to the percentage allocation to cash.

[5]According to the staff of *The Economist* the contributors who have left the poll have chosen to leave or left their positions without designating a substitute.

[6]The institutions not included in the sample are Anonymous One; Anonymous Two; Global Asset Management; Deutschebank; US Trust; Capital Management; Citicorp; Rabobank International; Standard Life and Wardley Investor Group. There were two mergers over the period, and we have treated the merged firms (Phillips and Drew, and UBS; Credit Agricole and Indocam) as a single firm for the purposes of our analysis.

recommended portfolios of individual money managers at the asset allocation level and thus allows us to characterize and quantify the investment strategy of a key group of institutional investors.

The survey is currently conducted via e-mail. Research analysts at each House complete the survey on the Wednesday before the Friday publication date of *The Economist*. In the early days of the sample, however, data-gathering and printing technology might not have allowed for such a quick turn-around. In addition, it is not known exactly when each House sets its recommendations. After 1989 the poll was published quarterly but not always before the start of the quarter to which the recommendations apply. The poll was not published between Q3 1997 and Q3 1998. The publication date of the recommendations varies from two weeks before to three weeks after the start of the applicable quarter. We account for this problem by computing quarterly returns starting from the recommendation date. We compute quarterly gross returns from the perspective of a US investor assuming no rebalancing during the quarter and we disregard management fees and related costs.

Following common practice, we use the Morgan Stanley Capital International (MSCI) value-weighted world index for total returns (capital gains plus dividends) in US dollars as a proxy for the world market portfolio. For bond returns, we use the Merrill Lynch Global Government Bond return index in US dollars, obtained from Global Financial Data. To represent public information in our empirical application, we use a collection of variables that previous international finance studies have found to be useful for predicting time-varying risk premia and volatility.[7,8] The variables are: (1) the quarterly G-7 inflation, (2) the quarterly growth rate of G-7 industrial production, (3) the level of the one-month Treasury bill yield, (4) the slope of the US Treasury yield curve, measured as the difference between ten-year and three months fixed maturity bond yields from the CRSP Fama-Bliss files (5) the default premium, computed as the yield spread between Moody's Baa and Aaa rated bonds.[9]

We do not confine our analysis to a study of the cross section of recommended portfolio weights. For this purpose we also compute and analyze "the consensus broker". For each broad

[7] See for example Campbell (1987), Fama and French (1989), Ferson and Harvey (1991), Pesaran and Timmermann (1995).

[8] For the conditioning variables we use monthly data and match the realization with the month in which the recommendations are issued.

[9] The macro variables are obtained from Global Financial Data, while the interest rates series are from CRSP.

asset class we compute every quarter an average recommended portfolio weight over all reporting investment firms.

B. Allocation to Equity, Bonds, and Cash

Table 1 reports descriptive statistics on the asset allocation recommendations of the investment houses participating in the poll over the sample 1981-2004. Six Houses made at least 60 recommendations, with Daiwa Europe, Bank Julius Baer, and UBS Phillips and Drew making the most with 106, 91, and 86 recommendations, respectively. On average across the sample period the consensus bank recommended that investors allocate 59% to equities, 33% to bonds, and 8% to cash. The lowest average equity recommendation, 37%, is made by Credit Suisse, the highest, 85%, is issued by Scudder Stevens. Table 2 reports the relative composition of the portfolio of the risky assets (Bonds/Equity), and the optimal mix of risky portfolio and the risk-free asset (Cash/(Equity+Bonds)). Credit Suisse, Brown Brothers Harriman, and Capital House display on average the highest holdings in the risk-free asset, but also the highest standard deviation in the optimal mix of risky portfolio and risk-free asset. Turning to the optimal mix of risky assets Credit Suisse, Robeco Group, Merrill Lynch, Commerz International, and UBS/Phillips Drew display a strong preference for bonds versus equities.

Figures 1 and 2 illustrate the time-variation in the asset allocation recommendations for each investment house and for the consensus, respectively. Figure 2 provides a snapshot of the cross sectional distribution in the recommendations, by computing the average, minimum and maximum recommendation across the Houses participating in the poll at each point in time. Two stylized facts emerge from Figures 1 and 2. First, individual bank asset allocation recommendations are volatile over time, matching the fact that investment opportunities change. Next, there is a high cross-sectional variation in the recommendations, together with a stable and consistent average recommended portfolio around the 60/30/10 recommendation. Nevertheless, the average allocation shows the presence of regimes (bull and bear periods); banks were on average more bullish than the static 60/30/10 benchmark between 1982 and 1990. Furthermore, the Houses under-invested in equities and over-invested in bonds for a significant time after the Crash of October 1987. There are three spikes in the average allocation to cash: in 1984 following the uncertainty regarding the interest rates and the dollar; in late 1987 following to the decrease in equity holdings after the Crash of October 1987; between September 1990 and April 1991 when the Houses *'were wrong-footed by events in the Gulf'* (*The Financial Report*, September 29, 1990).

We assume that the portfolio recommendations are made independently. However, it is possible that different Houses provide similar portfolio recommendations if the Houses share common information and process the information in a similar way. It also might be that a manger's relative performance or reputation matters and are therefore incorporated into the portfolio recommendations, generating a herding behavior among managers.[10]

III. The Asset Allocation Problem

In this section we study money managers' objectives and establish conditions under which we can jointly identify the parameters describing their utility functions and conditional beliefs on future investment opportunities from a sequence of observed portfolio recommendations. As expected, identification is a key issue if we want to extract information from the portfolio weights.

A. The Setup

Consider the problem of a money manager designated with the task to recommend a portfolio strategy for a buy and hold investor with investment horizon h. Suppose the investor can allocate wealth W_t among N risky assets with random return vector R_{t+h}, and one risk-free asset with known return R_t^f. Let $r_{t+h} = \left(R_{1,t+h} - R_t^f, ..., R_{N,t+h} - R_t^f\right)'$ be the $N \times 1$ vector of excess returns on the risky securities from t to $t+h$. Let $\Omega_t^{(j)}$ be the information set of the j-th money manager, with $j = 1, ..., J$. Let $X_t \in \Omega_t^{(j)}$ denote the $K \times 1$ vector of observed state variables that the j-th money manager considers when making the asset allocation recommendation. Denote the $N \times 1$ vector of portfolio weights on the risky assets recommended by the j-th money manager at time

[10]There is a huge literature both theoretical and empirical regarding the effects of performance-based compensation schemes (see for example Kapur and Timmermann (2005), Admati and Pfeiderer (1997), Cuoco and Kaniel (2000), and Brennan (1993)) and more in general herding generated by career/reputation concerns (see for example Chevalier and Ellison (1997), Goetzmann, Ingersoll, and Ross (2003), Graham and Harvey (1996), Graham (1999), and Jaffe and Mahoney (1999)) on money managers' portfolio holdings.

t by $\omega_t^{(j)} = \left(\omega_{1,t}^{(j)}, ..., \omega_{N,t}^{(j)}\right)'$. By formulating the problem in terms of excess returns, we implicitly assume that the remainder of the portfolio's value $\left(1 - \sum_{i=1}^{N} \omega_{i,t}^{(j)}\right)$ is invested in the risk-free asset with return R_t^f. We assume that short sales are not allowed and we use A to denote the set of admissible portfolio weights.[11]

Money managers have preferences over terminal wealth $W_{t+h} = W\left(\omega_t^{(j)\prime} r_{t+h} + R_t^f\right)$ described by a differentiable and concave utility function $U\left(W_{t+h}, \gamma^{(j)}\right)$. The vector $\gamma^{(j)}$ captures the parameters characterizing the preferences of the j-th money manager (e.g. the risk aversion). The generic money manager uses a model $p(r_{t+h}|X_t, \phi^{(j)})$ of the conditional distribution of the returns given the state variables, where $\phi^{(j)}$ is the vector of parameters driving the evolution of his beliefs about the returns' distribution. We collect the parameters which characterize preferences and beliefs of the j-th money manager into the vector $\psi^{(j)} = \left(\gamma^{(j)\prime}, \phi^{(j)\prime}\right)'$, where $\psi^{(j)} \in \mathbb{R}^p$ is known to the money manager but unknown to the researcher.

Within this framework, it remains to identify the link between the investment strategy proposed by the money manager, and his preferences and beliefs. A natural way to proceed is to define a portfolio policy function. Formally, we define a portfolio policy function to be:

Definition III..1 ***Portfolio Policy Function (or Investment Strategy).*** *A portfolio policy is a function* $\omega_t \equiv \omega(X_t, \psi) : \mathcal{X} \times \mathcal{G} \rightarrow A$ *where* $\mathcal{X} \subseteq \mathbb{R}^K$ *is the range of values of* X_t*,* $\mathcal{G} \subseteq \mathbb{R}^p$ *is the range of values of* ψ*, and* $A \subseteq \mathbb{R}^N$ *is the set of admissible portfolio weights.*

Our paper is related to a recent literature on drawing inference on optimal portfolio weights without explicitly modeling the underlying return distribution. Brandt (1999) first introduced the idea of directly modeling the optimal allocations to stocks, bonds, and cash as nonparametric functions of variables that predict returns. Ait-Sahalia and Brandt (2001), and Brandt and Santa-Clara (2006) further developed this approach by modeling the optimal portfolio weights as functions of a common set of macroeconomic variables. Specifically, they estimate the coefficients of the portfolio policy by maximizing the utility that would have been obtained by implementing the policy over the sample period. The objective of this paper is to study preferences and beliefs of

[11] This assumption is reasonable since the investment advisors are concerned with the allocation across a stock portfolio, a bond portfolio, and a money market portfolio. For Merrill Lynch, for example, the portfolios can be mutual funds or bond or stock accounts managed directly by Merrill Lynch.

money managers using the observed recommended portfolios. In order to translate these preferences and beliefs into an investment strategy, we introduce a parametric portfolio policy function. A parametric model for the optimal investment strategy is defined as follows.

Definition III..2 ***Parametric Portfolio Policy Function.*** *A parametric model of the portfolio policy ω_t is a collection of portfolio policies $\{\omega(X_t, \theta_\psi), \theta_\psi \in \Theta\}$ where Θ is a compact set and $\theta_\psi \equiv \theta(\psi)$.*

The parameter θ_ψ dictates how preferences and beliefs of the money manager affect the recommended portfolio strategy. By optimally choosing θ_ψ, the money manager maps his preferences and beliefs into the recommended portfolio weights. Examples of a parametric model are the constant allocation strategy, $\omega_t = \overline{\omega}$, the linear allocation policy, $\omega_t = \theta_\psi X_t$, and the non linear allocation policy, $\omega_t = \omega(X_t, \theta_\psi)$. In the case of a portfolio of N risky assets, ω_t is the $N \times 1$ vector of investment strategies, and $\theta_\psi = [\theta'_{\psi,1}, \ldots, \theta'_{\psi,N}]$ is $N \times K$ matrix of coefficients where $\theta_{\psi,i}$ for $i = 1, ..., N$ is the $K \times 1$ vector of parameters mapping the state variables into the portfolio policy for the i-th risky asset.

Given a parametric model for the investment strategy, suppose there exists a parameter value, $\theta_\psi \in \Theta$, that maximizes the expected utility of the money manager within the parametric family $\omega(X_t, \theta_\psi)$. The optimal problem of the j-th money manager can be reformulated as:

$$\begin{aligned} \theta^*_{\psi^{(j)}} &= \arg\max_\theta E_t\left[U\left(W_{t+h}, \gamma^{(j)}\right)\right] \\ &= \arg\max_\theta \int U\left(W_{t+h}, \gamma^{(j)}\right) p(r_{t+h}|X_t, \phi^{(j)}) dr_{t+h} \end{aligned} \tag{1}$$

where the wealth dynamics is given by $W_{t+h} = W\left(\omega_t^{(j)\prime} r_{t+h} + R_t^f\right)$.

The optimal portfolio allocation, $\omega_t^{(j)^*} = \omega\left(X_t, \theta^*_{\psi^{(j)}}\right)$, chosen by the j-th money manager depends upon X_t and $\psi^{(j)}$, and could differ across money managers due to:

1. differences in the conditioning state variables, $X_t \in \Omega_t^{(j)}$ (information disparity),
2. differences in the model of the conditional probability distribution of the excess returns on the risky securities $p(r_{t+h}|X_t, \phi^{(j)})$ (belief disparity), and

3. differences in the parameters $\gamma^{(j)}$ characterizing the utility function (preference disparity).

The superscript j is henceforth suppressed and we refer only to the generic money manager.

IV. The Econometric Framework

Our integrated approach to reverse engineer the portfolio weights differs from those adopted by earlier studies on the recoverability problem in several ways. First, we focus on the portfolio weights, and not on the portfolio's return. Besides the obvious fact that the optimal portfolio weights are the ultimate object of interest, there is another benefit from focusing on the portfolio weights. We exploit the information on the composition of the managed portfolio which is often ignored by the literature on the recoverability problem. Second, our approach allows for the joint identification and estimation of both the preferences and conditional beliefs implied in an observable sequence of portfolio recommendations or holdings. Previous studies tried to reduce the complexity of the problem in order to avoid the identification issues by focusing on only one of the two determinants of portfolio weights (preferences or beliefs).[12] Third, contrary to the literature which treats portfolio weights as observable state variables, in our case, we treat the portfolio weights as the outcome of a possibly misspecified econometric model, given by the parametric investment strategy.[13] Building on the econometric framework developed by Elliott, Komunjer, and Timmermann (2005), we then establish conditions on the money managers' portfolio policy function under which we can identify and estimate the parameters describing preferences and beliefs.

A. Optimal Portfolio Weights

The relevant optimality condition for the money manager's decision problem in (1) is given in the following Proposition. Appendix A lists the assumptions necessary to complete the proofs outlined in Appendix B.

[12] Lehmann (2007) asks what we can learn about beliefs from probability statements about sample moment conditions in rational expectations models, under the maintained hypothesis that the moment conditions are true and the actions of the decision maker cannot affect the random evolution of the state vector.

[13] The mispecification we have in mind concerns the functional form and the variables included in the portfolio policy function. We provide further details below.

Proposition 1 (Optimality) *Under assumptions [A1]-[A6] and for given $\psi \in \mathbb{R}^p$ the policy function is optimal if and only if*

$$E_t\left[\nabla_\theta U\left(W_{t+h}\left(\omega^*\left(X_t,\theta_\psi^*\right),r_{t+h}\right)\right)\right]=0 \tag{2}$$

where $\nabla_\theta U(\theta) = [J_\theta \omega_t \nabla_\omega W_{t+h} \frac{\partial U(W_{t+h},\psi)}{\partial W_{t+h}}]$ and $J_\theta \omega_t$ is the jacobian of the portfolio weights with respect to θ. Moreover, given ψ the solution ω_t^* to the $(N \times 1)$ system of orthogonality conditions in (2) is unique, and the implicit function $\omega_t^* = \omega\left(X_t, \theta_\psi^*\right)$ is a continuously differentiable one-to-one mapping from $\mathcal{G} \subseteq \mathbb{R}^p$ to $A \subseteq \mathbb{R}^N$.

Proposition 1 shows that under fairly weak assumptions on θ, $U(\cdot)$, and the joint distribution of r_{t+h} and X_t, the sequence of optimal investment strategies, ω_t^* satisfies the moment conditions in (2). Given ψ, if the money manager uses (2) to determine the optimal investment strategy, ω_t^*, then for a given ω_t^* we can uncover ψ by using the same condition. However this approach is valid only if knowing a solution to (2) allows us to identify ψ. When the portfolio policy is optimal any information must be correctly included in ω_t^* and the quantity inside the square brackets in (2) is a martingale difference sequence. The second part of Proposition 1 proves the existence of a unique solution $\omega\left(X_t, \theta_\psi^*\right)$ to the asset allocation problem that, in turn, knowing ω_t^* yields a unique value of ψ. Without this relationship we would not be able to identify ψ. Proposition 1 is very general and allows for non-linear policy rules, $\omega_t \equiv \omega\left(X_t, \theta_\psi\right)$, provided that the policy rule is identifiable for each realization of the forecasting variable X_t (i.e. [A5] holds). If in addition $\omega\left(X_t, \theta_\psi\right)$ is twice continuously differentiable and convex in the parameter θ, then ω_t^* is an optimal investment strategy.

B. Identification

The researcher observing the recommended investment strategies does not know exactly which state variables enter the information set of the money manager. In particular we would expect that money managers have access not only to publicly available information but also to private information which is not available to the researcher. For example, money managers may have private information coming from their networks of relationships with companies' managers and financial analysts. For identification we need to impose some restrictions on the functional form of the portfolio policy function. We focus on $J_\theta \omega_t$, the jacobian of the portfolio policy functions with respect to the parameter vector, θ. In the linear case the generic element of the jacobian is simply X_t, but for non-linear policy rules it could depend on both X_t and the vector of parameter values θ^*, not observable to the researcher. In order to identify the parameters, we need to know the functional form of the portfolio policy function, the true values of the parameters, as well as all the values of the variables in the information set of the money managers.

We now consider some examples to clarify the identification restrictions on the portfolio policy function. Suppose that X_t, the vector of state variables considered by the money manager when making his asset allocation recommendations is given by $X_t = \{Y_t, Z_t\}$, where Y_t is private information available only to the money manager and Z_t is public information.

Example 1 *If the optimal portfolio policy function is a linear function of the elements in X_t or it is separable in Z_t, then the jacobian is exactly X_t and knowledge of Z_t is sufficient to guarantee identification. The portfolio policy $\omega_t^* = \theta_{\psi,1}^* Y_t + \theta_{\psi,2}^* Z_t$ is admissible since knowledge of public information, Z_t, is sufficient to guarantee identification of ψ.*

Example 2 *If the optimal portfolio policy has the form $\omega_t^* = \theta_{\psi,12}^* Y_t Z_t$, then the jacobian is given by $Y_t Z_t$ and knowledge of both Y_t, and Z_t is necessary to achieve identification. Since Y_t is private information available only to the money manager, the vector of parameters of interest cannot be identified.*

In general, under separability of the portfolio policy function in the parameters and in the state variables, moment conditions based on a sub-vector $Z_t \in X_t$ are sufficient to identify ψ. Given this practical concern, in the remainder of the paper we focus on linear portfolio policy functions $\omega_t = \theta_\psi X_t$. The assumption that the optimal portfolio weights are linear functions of the state variables is innocuous because one can think of the linear policy function as a more general portfolio policy that is spanned by a polynomial expansion in a more basic set of state variables.[14] Indeed X_t can include non-linear transformations of a set of more basic state variables $\widetilde{X}_t$. In other words, our

[14]See Brandt (2005), Brandt and Santa-Clara (2006), Brandt, Santa-Clara, and Valkanov (2007) for a detailed discussion on this point.

approach can, in principle, accommodate very general dependence of the optimal portfolio weights on the state variables.

The next proposition formalizes the intuition of the previous examples and shows that moment conditions based on an observed subvector Z_t of X_t are sufficient to identify ψ, provided that the investment strategy and the wealth dynamics are linear.

Proposition 2 *Under assumptions [A1]-[A7], linearity of the portfolio policy function, and given a solution $\omega_t^* = \theta_\psi^* X_t$ to (2), the true value ψ is the unique minimum of a quadratic form*

$$Q_0(\psi) = E_t\left[Z_t r_{t+h} \frac{\partial U(W_{t+h}, \psi)}{\partial W_{t+h}}\right]' S^{-1} E_t\left[Z_t r_{t+h} \frac{\partial U(W_{t+h}, \psi)}{\partial W_{t+h}}\right] \tag{3}$$

where Z_t is a subset of X_t and S is any positive definite weighting matrix.

An important implication of the previous proposition is that in order to back out ψ the econometrician does not need to use the full vector of variables, X_t, available to the money manager. Moment conditions based on a sub vector of these variables, Z_t, are sufficient to identify ψ. Since $Q_0(\psi)$ is a quadratic form, the minimum is unique and using Z_t instead of X_t will affect only the curvature of the function and thus the precision of the estimates. This result is rather strong and implies that by using only public information we can identify the parameters driving the preferences and beliefs of money managers, even if we may not know the full portfolio policy model used to create the investment strategy. In our application the result in Proposition 2 is crucial since it allows for misspecification in terms of functional form and variables included in the investment strategies recommended by the investment banks. The next section deals with some econometric issues arising in our approach.

C. Implementation

In practice we only observe the sequence of portfolio weights $\{\widehat{\omega}_t\}$ recommended by a money manager, where $\widehat{\omega}_t \equiv \widehat{\theta}_t X_t$ and $\widehat{\theta}_t$ is an estimate of θ^* obtained by using the data up to time t. Let T be the total number of periods available and assume that the first τ observations are used to produce the first set of portfolio weights $\widehat{\omega}_\tau$. There are $T - \tau + 1$ set of portfolio weights available, starting at $t = \tau$, and ending at $t = T$. The portfolio weights are assumed to be constructed recursively so that the parameter estimates use all information prior to the period for which the weights are chosen. In particular, the investment strategy $\widehat{\omega}_{\tau+i}$ is constructed using data up to $\tau + i$ to compute an estimate $\widehat{\theta}_{\tau+i}$ of θ^*. This approach allows for the possibility that the money manager is recursively learning the parameters of the portfolio policy function.

Having observed the sequence of portfolio weights $\{\widehat{\omega}_t\}_{\tau \leq t < T}$, we now construct an estimate of ψ. In practice we need to invert the mapping implied by the optimality condition in (2). To do so we need to know the functional form of the portfolio policy functions implied by a particular utility function. However, closed form solutions in discrete time are available only in very special cases. Given this consideration, we stay inside the classical mean-variance framework. The main motivation is to take advantage of the analytical tractability. Specifically, it allows us to exploit the affine closed form solution for the portfolio policy functions which otherwise could be highly non linear functions of the preferences and beliefs. This feature is particularly attractive in our specification because it allows us to estimate the parameters by minimizing the errors of the portfolio policy.

The next section describes a mean-variance framework with N risky assets, setting the basis for our estimation strategy.

V. Mean Variance Framework

In this section, we provide analytical expressions for the optimal weights in a portfolio of N risky assets. Consider a generic fund manager with CARA utility

$$U[W_t] = -\frac{1}{\gamma^{(j)}} \exp\left[-\gamma^{(j)} W_t\right], \tag{4}$$

where $\gamma^{(j)}$ is the parameter characterizing the level of risk aversion. Assume that the j-th manager chooses the optimal allocation among N risky assets and a risk-free asset.[15] The return on the

[15] $\gamma^{(j)}$ might be interpreted as the coefficient of risk aversion for the typical client of the j-th money manager.

portfolio recommended by the manager is given by

$$r_{t+1}^{P}=\omega_t^{(j)\prime}r_{t+1}+R_t^f$$

where $\omega_t=(\omega_{1,t},...,\omega_{N,t})'$ is the $(N\times 1)$ vector of portfolio weights and $r_{t+1}=(r_{1,t+1},...,r_{N,t+1})'$ is the $(N\times1)$ vector of gross excess returns of the two risky assets over the risk-free asset. Furthermore, suppose that the subjective conditional distribution of excess return for the j-th manager is given by

$$r_{t+1}|\Omega_t^{(j)}\sim N\left(\mu_{t+1}^{(j)},\Sigma_{t+1}^{(j)}\right) \tag{5}$$

where $\mu_{t+1}^{(j)}$ is the $N\times 1$ vector of expected excess returns and $\Sigma_{t+1}^{(j)}$ is the $N\times N$ covariance matrix of the returns on the risky assets. The superscript j is henceforth suppressed and we refer only to the generic money manager.

Money managers are in general remunerated on the basis of their absolute performance and their performance relative to a benchmark.[16] There is an open debate about the impact of relative performance considerations and how they are incorporated in the portfolio weights. Although, in this case there is not explicit contract between the money manager and the potential investor, relative performance could arguably affect indirectly the reputation of investment houses.[17] We model the managers' payoffs in terms of absolute returns on the recommended portfolio, $W_{t+1}=r_{t+1}^{P}$, arguing that the best way for the money managers to maximize their reputation is to maximize the return on the recommended portfolio.

The money manager solves the following problem:

$$\max_{\omega_t}E_t\left[-\frac{1}{\gamma}\exp\left[-\gamma W_{t+1}\right]\right]=-\frac{1}{\gamma}\exp\left\{-\gamma E_t\left[W_{t+1}\right]+\frac{\gamma^2}{2}Var\left[W_{t+1}\right]\right\}. \tag{6}$$

Using log-normality the solution to this problem is equivalent to

$$\min_{\omega_t}\log\left[-\gamma E_t\left[U\left(W_{t+1}\right)\right]\right]=-\gamma E_t\left[W_{t+1}\right]+\frac{\gamma^2}{2}Var\left[W_{t+1}\right], \tag{7}$$

[16] In a survey about the compensation structure of portfolio managers, Farnsworth and Taylor (2004) find that most managers bonuses are impacted by their investment performance relative to a benchmark and/or peer group.

[17] Once a firm is established, it is recognized by its name, which is uniquely associated with its characteristics and past performance.

which can be reformulated in the usual mean-variance framework:

$$\max_{\omega_t} \left[rf + \omega_t' \mu_{t+1} - \frac{\gamma}{2} \omega_t' \Sigma_{t+1} \omega_t \right]. \tag{8}$$

The first order conditions are given by:

$$\mu_{t+1} - \gamma \Sigma_{t+1} \omega_t = 0 \tag{9}$$

and the optimal weights are given by:

$$\omega_t^{MV} = \frac{1}{\gamma} (\Sigma_{t+1})^{-1} \mu_{t+1}. \tag{10}$$

In the specific case with two risky assets we can specialize the solution as:

$$\begin{aligned} \omega_{1,t}^{MV} &= \frac{1}{\gamma} s_{1,t+1} \\ \omega_{2,t}^{MV} &= \frac{1}{\gamma} s_{2,t+1} \\ \omega_{3,t}^{MV} &= 1 - \omega_{1,t}^{MV} - \omega_{3,t}^{MV} \end{aligned} \tag{11}$$

where

$$\begin{aligned} s_{1,t+1} &= \left[\frac{\sigma_{2,t+1}^2 \mu_{1,t+1} - \mu_{2,t+1} \sigma_{12,t+1}}{\sigma_{1,t+1}^2 \sigma_{2,t+1}^2 - \sigma_{12,t+1}^2} \right], \\ s_{2,t+1} &= \left[\frac{\sigma_{1,t+1}^2 \mu_{2,t+1} - \mu_{1,t+1} \sigma_{21,t+1}}{\sigma_{1,t+1}^2 \sigma_{2,t+1}^2 - \sigma_{12,t+1}^2} \right]. \end{aligned} \tag{12}$$

$s_{1,t+1}$ and $s_{2,t+1}$ are conditional information ratios or beliefs describing the expected evolution of the investment opportunity set for the two risky assets. To gain economic intuition, we consider $s_{1,t+1}$ ($s_{2,t+1}$) as an indicator of the relative attractiveness of stocks versus bonds (bonds versus stocks). These beliefs are not observable, so we need to build a proxy for the evolution of the investment opportunity set.

Suppose that the money managers use an affine specification for the beliefs

$$s_{i,t+1} = \lambda_{i1} + \lambda_{i2} Z_t + \varepsilon_{i,t}, \qquad i = 1, 2 \tag{13}$$

where Z_t is public information at time t, when recommendations are made. This specification for the dynamics of the beliefs guarantees that the policy function is linear in the state variables. Therefore, we can identify the parameters of interest given only a subset, Z_t, of the X_t variables entering the information set of the money manager. Furthermore, we can focus on the linear representation in (13) as a first-order Taylor expansion of a more general non-linear process. The interpretation of λ_{12} (λ_{22}) is straightforward. An increase of one unit in Z_t gives us a measure of how much more (less) attractive asset 1 becomes with respect to asset 2. In general we would expect λ_{12} and λ_{22} to have the same magnitude and opposite sign: if stocks become more attractive than bonds it is natural that bonds are less attractive than stocks. In practice since covariance terms enter the expression this is not necessarily true. The suggested timing here is as follows: (1) the money managers form their beliefs on the evolution of the stock and bond market and choose the optimal mix accordingly; (2) given their level of risk aversion they choose the optimal asset allocation between the risk-free asset and the portfolio of risky assets. The composition of the portfolio of risky assets does not help us in understanding the preferences of the money manager. The only way of learning about the risk appetite is to consider the ratio of the proportion invested in the risky assets and the proportion invested in the risk-free rate ($\frac{\omega_{3,t}^{MV}}{\omega_{1,t}^{MV}+\omega_{2,t}^{MV}}$). The classical separation theorem applies: highly risk averse investors should hold more of their portfolio in the risk-free asset, but the composition of risky assets should be the same for all the investors. The two-fund theorem in principle still allows for a good deal of customized portfolio formation if managers have different information or beliefs. Indeed, the knowledge of the composition of the portfolio of risky assets gives us information about the money managers' beliefs summarized by $s_{1,t+1}$, and $s_{2,t+1}$ and their evolution through time.

A. Estimation

In the mean-variance framework outlined above it is possible to invert the optimal portfolio weights by exploiting the closed form solution in order to proceed to the joint estimation of preferences and beliefs. We treat the recommended portfolio weights as the outcome of a possibly misspecified econometric model by assuming a linear portfolio policy function and minimize the portfolio policy errors. The accuracy of a candidate set of preferences and beliefs can be judged by how well it reproduces the observed portfolio weights. To this end, let us denote by $e_t(\psi)$ the N dimensional vector of portfolio policy errors where $\psi = (\gamma, \lambda_{11}, \lambda_{12}, \lambda_{21}, \lambda_{22})'$ is the $p \times 1$ vector of parameters of interest. The idea of our approach is to select parameters that make the sample averages of the portfolio policy errors as close to zero as possible so that

$$\widehat{\psi} = \left\{ \psi : \frac{1}{T} \sum_{t=1}^{T} e_t(\psi) = 0 \right\}. \tag{14}$$

Here the vector of portfolio policy errors is given by the difference between the observed portfolio weights and the optimal portfolio weights coming from the mean variance optimization problem denoted by $\omega_{1,t}^{MV}$ and $\omega_{2,t}^{MV}$:

$$e_t(\psi) = \begin{bmatrix} \widehat{\omega}_{1,t} - \omega_{1,t}^{MV}(Z_t, \psi) \\ \widehat{\omega}_{2,t} - \omega_{2,t}^{MV}(Z_t, \psi) \end{bmatrix} = \begin{bmatrix} \widehat{\omega}_{1,t} - \frac{1}{\gamma}\left(\lambda_{11} + \lambda_{12} Z_t + \varepsilon_{1,t}\right) \\ \widehat{\omega}_{2,t} - \frac{1}{\gamma}\left(\lambda_{21} + \lambda_{22} Z_t + \varepsilon_{2,t}\right) \end{bmatrix} \tag{15}$$

The Generalized Method of Moments (GMM) developed by Hansen and Singleton (1982) provides the econometric framework for the estimation. The GMM estimator of ψ is given by

$$\widehat{\psi} = arg \min_{\psi} \left[g_T(\psi)' S_T g_T(\psi) \right], \tag{16}$$

where $g_T(\psi) = \frac{1}{T} \sum_{t=1}^{T} e_t(\psi)$ and S_T is a positive definite weighting matrix which may be a function of the data. To identify the parameters we need at least as many moment conditions as there are parameters. In this case, there are only two moment conditions implied by the economic theory so we need to include instruments to achieve identification. Let v_t be $h \times 1$ vector of instruments. Then the sample counterpart of the orthogonality conditions can be expressed as the $N \times h$ vector $g_T(\psi) = \frac{1}{T} \sum_{t=1}^{T} e_t(\psi) \otimes v_t$. The GMM estimator is the value that minimizes the scalar $Q_T = [g_T(\psi)' S_T g_T(\psi)]$. If the number of instruments is greater than the number required to identify the parameters of interest, the remaining variables can be used to test if the orthogonality conditions hold, conditioning on the estimated values of the parameters. In a GMM framework, we test for rationality using Hansen's test (or J-test) of over-identifying restrictions. Hansen's J-test is TQ_T and it converges to a chi-squared distribution with $(N \times h) - p$ degrees of freedom. The interpretation is straightforward: the J-test tells us if money managers are efficiently using all the information contained in the instruments when providing their portfolio recommendations. We discuss in detail our choice for the instruments in Section VI when we present the empirical results. For all the estimates presented in the paper the inverse of the estimate of the asymptotic variance of the sample mean of $e_t \otimes v_t$ is used as the weighting matrix.[18]

VI. Empirical Results

In this section we discuss the results using the asset allocation recommendations from *The Economist* Portfolio Poll when applied to the mean-variance framework outlined in Section 4. Table 3 reports the results of iterated GMM estimates of the level of risk aversion of the money managers, while Tables 4-5 report the estimates of the parameters driving their conditional beliefs about the market.[19] We normalize $\lambda_{11} = 1$ and demean and standardize all the state variables to ease the interpretation of the coefficients of the portfolio policy function. The moment conditions used for the estimation are

$$E\left[\begin{pmatrix} \widehat{\omega}_{1,t} - \frac{1}{\gamma}\left(1 + \lambda_{12} Z_t\right) \\ \widehat{\omega}_{2,t} - \frac{1}{\gamma}\left(\lambda_{21} + \lambda_{22} Z_t\right) \end{pmatrix} \otimes \begin{pmatrix} 1 \\ Z_{t-1} \end{pmatrix}\right]. \tag{17}$$

We have two equations and four parameters so we need two instruments to achieve identification. Our instrument set includes a constant and the lagged value of the state variable entering the portfolio policy function, z_{t-1}. We report estimates of the parameters of the portfolio policy function based on different state variables. Consistent with the literature, we use the G-7 Inflation rate, growth in G-7 Industrial Production, stochastically de-trended risk-free rate, default premium, term spread, and the return differential between equities and bonds (momentum) as our state variables.

At first glance a very interesting result emerges: the estimates of the risk aversion parameter are always significant and sensible with values ranging from 1.12 to 2.74 across different banks and state variables.[20] Becker, Ferson, Myers, and Schill (1999) use mutual funds' returns from the

[18]Since we are working with possibly overlapping quarterly data, the Newey-West kernel lag length is selected as the $min\left[T^{-\frac{1}{3}}, 3\right]$.

[19]The use of multiple starting values provided results nearly identical to the ones reported.

[20]For a summary of the risk aversion estimates found in previous studies see Bliss and Panigirtzoglou (2004).

CRSP database to simultaneously estimate the risk aversion of a fund manager with CARA utility and the precision of the fund's market-timing signal. For the asset allocation category of funds the mean value of the fund-specific risk aversion is 93.6 with a negative median, -13.4. For this to be true, more than half the fund managers must have a negative risk aversion resulting in a strictly convex utility. With the same data, and focusing on portfolio returns, Foster and Stutzer (2003) find more reasonable estimates with a mean value of about 8 compared to our mean value of about 2.

Our estimates are robust (in terms of ranking and magnitude) to the inclusion of different state variables in the portfolio policy function. Independent of the conditioning variables, Scudder Stevens, Brown Brothers Harriman, and Capital House are the least risk averse while Credit Suisse, Bank Julius Baer, and UBS Phillips are the more risk averse among the Houses in our sample. Interestingly, the investment Houses displaying an above-average risk aversion are Swiss banks, *'perhaps partly reflecting traditional Swiss preference for fixed interest paper'*, as noted in *Financial Report*, March 17, 1983.

When we consider the estimates of the parameters driving $s_{1,t+1}$ and $s_{2,t+1}$, the beliefs concerning the relative attractiveness of equities and bonds, several interesting results emerge. If we normalize λ_{11} to 1, the value of λ_{21} becomes informative on the money managers' prior on the relative attractiveness of bonds versus stocks. Values of λ_{21} between zero and one suggest that money managers perceive bonds as a less attractive investment compared to stocks. Interestingly, the more risk averse banks display values of λ_{21} close to one and in some cases (Bank Julius Baer and Credit Suisse) greater than one. Daiwa Europe and Bank Julius Baer are the only banks that over the full sample significantly out-perform and under-perform the competitors. If we compare their estimated values of λ_{21}, Bank Julius Baer displays a coefficient twice as big as Daiwa and greater than one.

To answer the question of what moves money managers' portfolios, we need to look at how different Houses implement their investment policies over time. In particular, in the presence of return predictability, the values of λ_{12} and λ_{22} tell us whether the money managers engage in market timing strategies based on the state of the economy and how they incorporate it into the portfolio policy functions. Table 5 summarizes the main findings reporting (whether significant) the sign with which different state variables affect the investment strategies of the money managers. We measure the state of the economy according to macro and financial variables. Inflation and growth in industrial production affect the portfolio policies of different investment houses like Brown Brothers, Scudder Stevens, Capital House, and Daiwa Europe. This finding supports the conclusion of Lamont (2001) who observes that a portfolio tracking the growth rate of industrial production earns positive abnormal returns. Industrial production growth enters with the expected sign: an increase in industrial production growth makes equities more attractive than bonds. High inflation is usually bad news for stocks and long-term bonds. However, since our specification for the beliefs is in terms of relative attractiveness, we can infer from the estimates that, conditional on high inflation, bonds are perceived as a better investment than stocks for the majority of banks with the exception of UBS. Among the variables tracking the state of financial markets the stochastically de-trended short term interest rate and the default spread seem to be particularly important, while the term spread is not incorporated in the portfolio policies in our sample. High levels of short term interest rates usually imply low stock returns and high and volatile short term bond returns with a gradual transition as we move from shorter maturity to riskier and longer term bonds. This mixed effect of the short term rate is captured by our estimates displaying a degree of heterogeneity among the Houses' responses. It seems that the Houses active before the nineties increase their exposure to stocks and lower their positions in bonds in presence of high interest rates, while the opposite is true for Lehman Brothers or UBS. High credit spreads make stocks more attractive than bonds with again Lehman Brothers and UBS being the only managers going against the consensus. The return differential between equities and bonds turns out to be significant and with the expected sign for Brown Brothers Harriman, Capital House, and Daiwa. This evidence supports the hypothesis of *momentum* strategies in which the Houses move their portfolios based on past return performance of the constituent assets.[21] Finally, we notice that none of the listed state variables seem to be incorporated, if marginally, in the policy functions of Commerz International, Credit Suisse, Credit Agricole, and Robeco Group which are also among the most risk averse investment houses. Interestingly, those banks participated in the poll only after the nineties. This evidence supports the findings of the predictability literature which documented instability in the

[21] Bange, Khang, and Miller (2004) use the same data and find evidence of momentum trading for asset allocation to equities and cash.

relationship between returns and forecasting variables.[22] Table 6 reports the pseudo-R^2 -computed as the squared correlation coefficient between the recommended and fitted portfolio weights-for the equities and bonds allocation based on the model in (17). On average, investment strategies based on default spread, and risk-free rate provide the best fit (with a pseudo-R^2 between 11 and 17%). The portfolio policy functions of the banks participating in the poll after the nineties are well described by the risk-free rate and the term spread (with a pseudo-R^2 of about 8 and 15%), while the portfolio weights of the banks active during the eighties are better characterized in terms of industrial production and default spread (with a pseudo-R^2 between 18 and 32%).

In general, heterogeneity in the conditional beliefs is more important than heterogeneity in the risk aversion to explain differences in the recommended portfolio allocations. Moreover, the source of heterogeneity seems to be in the diverse interpretation of the available information.

To support this finding, Figure 3 plots the average fitted values of $s_{1,t+1}$ computed across policy functions based on different state variables for selected investment banks. As outlined above, UBS usually provides a different interpretation of the signals on the state of economy compared with the other participants in the poll. Interesting findings emerge. At the end of 1999, Daiwa Europe is the only investment house preferring bonds to stocks while Julius Baer usually characterized for a strong preference for bonds behaves exactly in the opposite way.

A. Testing Homogeneity of Preferences and Beliefs

The estimates presented in the previous section are based on a single equation framework. Another possibility is to use the portfolio policy errors from all investment houses in a system. This strategy has two advantages. First, it exploits possible correlations in the portfolio weights recommended by different money managers, giving a more efficient estimation. Second, we can test the restrictions that the risk aversion coefficients or the parameters driving the beliefs are the same across investment houses. To clarify the estimation process, let $e_t^{(j)}(\psi^{(j)})$ be the $N \times 1$ vector of portfolio policy errors defined in (15) for the j-th money manager, and let $\mathbf{e}_t(\Psi) = \left[e_t^{(1)}(\psi^{(1)})', ..., e_t^{(J)}(\psi^{(J)})'\right]'$ be the $((N \times J) \times 1)$ vector containing the portfolio policy errors for the J investment banks

[22]See for example the literature regarding model uncertainty: Avramov (2002), Pettenuzzo and Timmermann (2005).

participating to the poll and $\Psi = \left[\psi^{(1)}, ..., \psi^{(J)}\right]$ be the vector of parameters of interest. The GMM estimator of Ψ is given by

$$\widehat{\Psi} = arg \min_{\Psi} \left[g_T(\Psi)' W_T g_T(\Psi)\right], \tag{18}$$

where $g_T(\Psi) = \frac{1}{T}\sum_{t=1}^{T} \mathbf{e}_t(\Psi)$. The estimation is done using all the available data, so we need to deal with an unbalanced panel of observations. We focus on testing the restrictions of homogeneity in preferences and conditional beliefs across different money managers. The Wald test of the restrictions and their p-values are reported in Table 7. The upper panel reports the results when the homogeneity restrictions are imposed across all banks, while the bottom panel displays the results for the subset of Swiss banks (Credit Suisse, Bank Julius Baer, UBS). We can always reject the restrictions of homogeneity of preferences and beliefs across all money managers. When we use the state variable proxing for the momentum effect in the portfolio policy functions, we cannot reject the null of λ_{22} being the same across banks. This implies that there is agreement among the money managers on the fact that momentum effect does not affect the beliefs on the bond market. We find heterogeneity in the risk aversion coefficient for the subset of Swiss banks, but we cannot reject the restrictions of homogenous beliefs' parameters conditioning on different state variables. This result imply that the parameters driving the beliefs' dynamics of the Swiss banks can be considered to be the same for the available sample.

B. Rationality of Asset Allocation Recommendations

Recent articles on asset allocation by Canner, Mankiw, and Weil (1997) and Elton and Gruber (2000) try to develop test of investor rationality and to examine the rationality of the advice of a set of well-known advisors. The Canner, Mankiw, and Weil (1997) test of rationality for asset allocation advice is: the ratio of bonds to stocks should decrease as an investor is willing to take more risk. Elton and Gruber (2000) show that the bond-stock mix can either increase or decrease as risk increases over low risk levels, but the bond-stock mix must decrease as risk increases over high risk levels. As explained in Section 4.3, in our framework the rationality test is a by-product of the GMM estimation. Indeed Hansen's J-test tells us if the investment houses are using the information contained in the instruments efficiently when providing their portfolio recommendations. We estimate the same model as in the previous section with additional instruments.[23] We test two instruments sets: (1) a constant, a lagged value of the state variable included in the policy function, and lagged excess returns on stocks and bonds; (2) a constant, and lagged values of three factors summarizing the state of the economy. To reduce the dimensionality of the system, we apply the methodology of dynamic factor models to a group of variables including real activity measures (inflation and industrial production), interest rates measures (risk-free, default spread, term spread), financial markets measures (excess returns on equities and bonds).[24] This leaves us with three variables that summarize the state of the economy. More precisely, we first normalize each series separately to have zero mean and unit variance. We then stack the seven variables into a vector Z_t which can be represented as:

$$Z_t = Cf_t + u_t, \tag{19}$$

where C is the factor loading matrix, f_t is the vector of factors. The error term u_t satisfies $E(u_t) = 0$ and $var(u_t) = \Gamma$, where Γ is diagonal. The extracted macro factors f_t inherit the zero mean from Z_t, ($E(f_t) = 0$) and have unit variance as any principal component ($var(f_t) = 1$). Over 60% (75%) of the variance of variables in Z_t is explained by the first two (three) principal components. We include the first three factors as the gain from the additional factor is limited.[25]

The results are reported in Table 8. We do not report the estimated values of the parameters since they are in general robust to different instruments sets. The J-test shows that we reject rationality of the money managers in 10% and 26% of the cases at the 5% level for the two sets of instruments.[26] This result is interesting because we are able to explain the investment strategies recommended by the majority of investment banks within a simple rational model based on a mean-variance framework. [27]

[23] A possible concern is that of weak instruments and weak identification. According to Stock et al. (2004) if identification is weak then GMM estimates can be sensitive to the addition of instruments, so if this occurs in an empirical application it can be indicative of weak identification.

[24] This is a common practice in the literature on term structure modeling. See for example Ang and Piazzesi (2003).

[25] The marginal contribution of the fourth factor to the explanation of the variance of the panel is below 10%.

[26] The percentages reported are computed across investment houses and policy functions based on different state variables.

[27] Nevertheless, some caveats are necessary because the average number of observations is 59 and the power of the test could be undermined.

VII. Conclusion

In this paper, we develop a general framework to examine the factors driving money managers' investment strategies. We treat the recommended portfolio weights as the outcome of a possibly misspecified econometric model and link it to the decision problem of the money manager. We establish conditions under which, if the money manager acts optimally, the parameters describing the preferences and conditional beliefs about the future state of the market can be recovered from the observed portfolio weights. Under the mean-variance framework we provide joint estimates of the preference parameters and the conditional market beliefs that most closely reproduce the dynamics of the observed portfolio recommendations made by a panel of international money managers for *The Economist*.

We find heterogeneity in both the preferences and beliefs of our money managers. The parameter estimates are economically reasonable and suggest that (1) money managers behave as low-risk averse investors; (2) heterogeneity in the beliefs is what really drives the portfolio recommendations; and (3) the key source of disagreement is the diverse interpretation of the signals concerning the state of the economy. In particular, the banks that joined the *Portfolio Poll* after the nineties make little use of variables tracking the state of the economy when setting their investment strategies whereas we confirm the importance of standard macro (inflation and growth rate of industrial production) and financial (short term interest rate, default spread, momentum) variables as the key drivers of the asset allocation dynamics. We also find that in a mean-variance framework only a few banks do not process the information on the state of the economy efficiently when recommending asset allocations recommendations, i.e. their investment strategies are in general rational.

These empirical findings carry practical implications for investors. An understanding of the patterns of professional advisors' investment policies is important for investors who may choose to implement a portion of their portfolio strategy using published recommendations. An attractive feature of our framework is its generality. It could be used in future research to revisit the empirical results on mutual or pension funds' performance, in trying to understand what drives their asset allocation.

There are two interesting areas of research that could be further explored. First, according to the literature on delegated portfolio management it would be nice to explicitly allow for relative performance concerns in the utility function of the money managers. Second, it might be interesting to use this framework to examine what drives sector rotations in the portfolios of equity mutual funds.

Appendix

A Assumptions on the Data

Assumption 1 (A1) *The parameter space, Θ, is a compact subset of $\mathbb{R}^K$ and θ^* is interior to Θ.*

Assumption 2 (A2) *$U(\cdot)$ is globally concave.*

Assumption 3 (A3) *$U'(\cdot)$ is a continuous and twice differentiable function with respect to θ in a neighborhood of θ^*.*

Assumption 4 (A4) *Excess returns, r_{t+h}, and forecasting variables, X_t, are realizations from a strictly stationary $\mathbb{R}^N \times \mathbb{R}^K$ -valued process;*

Assumption 5 (A5) *For each realization of the forecasting variable, X_t, there is an identifiable portfolio policy $\omega^*\left(X_t, \theta^*_\psi\right)$ (i.e. $\omega^*\left(X_t, \theta^*_{\psi,2}\right) = \omega^*\left(X_t, \theta^*_{\psi,1}\right)$ for each realization of X_t implies $\theta^*_{\psi,1} = \theta^*_{\psi,2}$) which is a unique zero of $E\left[U'(\cdot,\cdot)\right]$.*

Assumption 6 (A6) *For every t, $E\left[J_\theta\omega\nabla_{\omega_t}W_{t+h}(\nabla_{\omega_t}W_{t+h}J_\theta\omega)'\right]$ exists, and is positive definite. If the portfolio policy function is linear, $E[r'_{t+h}X_tX'_tr_{t+h}]$ exists, and is positive definite.*

Assumption 7 (A7) *$W_{t+h} = W(\omega_t(X_t,\theta_\psi)), r_{t+h})$ is linear in ω_t, so that $\nabla_\omega W_{t+h}$ is independent of ω.*

B Proofs

Proof of Proposition 1. The proof follows proof of Proposition 1 in Elliott, Komunjer, and Timmermann (2005) as this case is a multivariate extension of their problem. From assumption [A1] we know that θ^* interior to Θ is a solution to $\max_{\theta\in\Theta} EU(\theta)$ where $EU(\theta) = E[U(\theta)]$ and $U(\theta) = [U(W(\omega(X_t,\theta_\psi), r_{t+h}), \psi)]$. Moreover, the function $U(\theta)$ is continuously differentiable on Θ. Let $\nabla_\theta EU$ be the gradient of $EU(\theta)$ on Θ. For given ψ, if $\theta^* \in \Theta$ is the max of $EU(\theta)$, then θ^* is a solution to $\nabla_\theta EU(\theta) = 0$ where $\nabla_\theta EU(\theta) = E[J_\theta \omega_t \nabla_\omega W_{t+h} \frac{\partial U(W_{t+h},\psi)}{\partial W_{t+h}}]$, $\nabla_{\omega_t} W_{t+h} = [r_{1,t+h}, \ldots, r_{N,t+h}]' = r'_{t+h}$ and $J_\theta \omega_t = \begin{pmatrix} \frac{\partial \omega_{1,t}}{\partial \theta_1} & \cdots & \frac{\partial \omega_{1t}}{\partial \theta_N} \\ \vdots & \ddots & \vdots \\ \frac{\partial \omega_{N,t}}{\partial \theta_1} & \cdots & \frac{\partial \omega_{N,t}}{\partial \theta_N} \end{pmatrix}$, and if the portfolio policy is linear $J_\theta \omega_t = \begin{pmatrix} X_t & \ldots & \ldots \\ \vdots & \ddots & \vdots \\ \ldots & \ldots & X_t \end{pmatrix}$. We show that (2) holds which completes the necessary part of the proof. Let $H(\theta)$ be the hessian matrix of $EU(\theta)$ with respect to θ. We know that θ^* is a local maxima of θ if $\nabla_\theta EU(\theta^*) = 0$ and $H(\theta^*)$ is negative definite. The first order condition $\nabla_\theta EU(\theta^*) = 0$ is implied by (2). We show that $H(\theta^*)$ is negative definite. Under assumptions [A6-A7] we have that

$$H(\theta) = E \begin{bmatrix} U(\cdot)'' J_\theta \omega_t \nabla_\omega W_{t+h} (\nabla_\omega W_{t+h} J_\theta \omega_t)' & 0 \\ 0 & U(\cdot)'' J_\theta \omega_t \nabla_\omega W_{t+h} (\nabla_\omega W_{t+h} J_\theta \omega_t)' \end{bmatrix} \quad (20)$$

and if the portfolio policy is linear, we have that

$$H(\theta) = E \begin{bmatrix} U(\cdot)'' r'_{t+h} X_t X'_t r_{t+h} & 0 \\ 0 & U(\cdot)'' r'_{t+h} X_t X'_t r_{t+h} \end{bmatrix}$$

Assumption [A2] guarantees that $U(\cdot)'' < 0$ and assumption [A6] guarantees that $E\left[J_\theta \omega \nabla_{\omega_t} W_{t+h} (\nabla_{\omega_t} W_{t+h} J_\theta \omega)'\right]$ exists and is positive definite. Thus the elements of the main diagonal are negative. The matrix $H(\theta)$ is negative definite if all the eigenvalues are negatives. Since $H(\theta)$ is diagonal, the eigenvalues are the elements on the main diagonal which we have shown to be negative. So for every $\theta \in \Theta$ the matrix $H(\theta)$ is negative definite, then so must be for θ^*. Thus any $\omega_t = \omega(X_t, \theta_\psi)$ which satisfies the moment condition (2) is a solution to the asset allocation problem.

We now use the implicit function theorem to show that for any realization of X_t, the function $\omega_t^* = \omega(X_t, \theta_\psi^*)$ defined implicitly by (2) is a one-to-one mapping from the set of parameters ψ to the set of portfolio weights, ω_t. Define $\xi(\psi, \theta) \equiv \nabla_\theta EU(\theta^*)$, so that $\xi(\psi, \theta^*) = 0$, by (2).

Furthermore, the function is continuously differentiable and we have that $\frac{\partial \xi(\psi,\theta)}{\partial \theta} = H(\theta)$, and $\frac{\partial \xi(\psi,\theta)}{\partial \psi} = U(\cdot)'' \frac{\partial W(\cdot)}{\partial \psi}$. Finally, we have that the matrix $\frac{\partial \xi(\psi,\theta^*)}{\partial \theta}$ is non-singular given that $H(\theta)$ is negative definite. We can now apply the implicit function theorem to show that for every ψ there exists a neighborhood D of ψ and a neighborhood V of θ^* such that the system of equations $\xi(\psi,\theta) = 0$ has a unique solution θ^* in V, and the function $\theta_\psi = \theta(\psi)$ defined implicitly by $\xi(\psi,\theta) = 0$ is continuously differentiable from D to V. In particular we have that, for any realization of X_t, the function $\omega_t^* = \theta_\psi^* X_t$ is continuously differentiable from $\mathcal{G} \subseteq \mathbb{R}^p$ to $A \subseteq \mathbb{R}^N$. We need to show that $\theta_\psi^* X_t$ is a one-to-one mapping from $\mathcal{G}$ to A. It is surjective by construction, so we need to show that it is injective on $\mathcal{G}$, i.e. $\theta_{\psi_1}^* = \theta_{\psi_2}^*$ implies $\psi_1 = \psi_2$. Using identifiability of a linear portfolio policy implied by [A5], we know that for each realization of X_t there is a unique $\theta^* \in \Theta$ such that $\omega^* = \theta^* X_t$ so by using the previous result there is a unique ψ such that $\omega^* = \theta_\psi^* X_t$.■

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Table 1: Recommended Asset Allocation: Summary Statistics

The table reports the number of recommendations (#) made by each investment house, the minimum, average and maximum percentage allocations into equities, bonds, and cash, and the standard deviation and autocorrelation coefficient of the recommended portfolio allocations.

		Equity					Bond					Cash				
	# Obs	Min	Mean	Max	Std	AR(1)	Min	Mean	Max	Std	AR(1)	Min	Mean	Max	Std	AR(1)
Commerz Intern.	45	0.35	0.55	0.94	0.09	0.95	0.06	0.42	0.50	0.07	0.98	0.00	0.03	0.25	0.06	0.67
Credit Suisse	48	0.25	0.37	0.50	0.06	0.97	0.31	0.45	0.64	0.08	0.98	0.03	0.18	0.34	0.10	0.94
Credit Agricole	24	0.40	0.57	0.70	0.08	0.95	0.25	0.35	0.50	0.06	0.96	0.00	0.08	0.20	0.06	0.85
Bank Julius Baer	91	0.32	0.43	0.55	0.06	0.98	0.37	0.47	0.62	0.06	0.99	0.00	0.10	0.21	0.05	0.92
Robeco Group	47	0.40	0.51	0.60	0.05	0.98	0.40	0.48	0.60	0.05	0.98	-0.03	0.02	0.10	0.03	0.53
Merrill Lynch	26	0.38	0.49	0.60	0.08	0.97	0.30	0.42	0.55	0.08	0.94	0.00	0.09	0.15	0.05	0.85
Lehman Brothers	46	0.47	0.62	0.86	0.10	0.97	0.11	0.32	0.45	0.08	0.96	0.00	0.05	0.21	0.07	0.80
Brown Brothers Harriman	66	0.45	0.78	0.91	0.16	0.99	0.00	0.08	0.48	0.14	0.77	0.06	0.14	0.30	0.06	0.96
Scudder Stevens	66	0.59	0.85	1.00	0.10	0.99	0.00	0.09	0.21	0.06	0.95	0.00	0.07	0.20	0.05	0.87
Capital House	66	0.20	0.66	0.90	0.16	0.98	0.09	0.20	0.50	0.10	0.95	0.00	0.14	0.50	0.11	0.86
UBS Phillips Drew	89	0.35	0.52	0.70	0.11	0.99	0.23	0.42	0.57	0.09	0.98	0.00	0.06	0.20	0.06	0.97
Daiwa Europe	106	0.20	0.64	0.90	0.15	0.99	0.10	0.30	0.70	0.14	0.95	0.00	0.06	0.45	0.08	0.76
Nikko Securities	22	0.55	0.66	0.80	0.08	0.95	0.15	0.27	0.35	0.06	0.96	0.00	0.07	0.15	0.04	0.82
Average	57	0.38	0.59	0.77	0.10	0.97	0.18	0.33	0.51	0.08	0.95	0.00	0.08	0.25	0.06	0.83

Table 2: Portfolio Composition

The table reports the optimal mix of the risk-free asset and the optimal risky portfolio (Cash/(Equity+Bonds)) and the optimal mix of the risky portfolio (Bonds/Equity).

	Cash/(Equity+Bonds)				**Bonds/Equity**			
	Min	Mean	Max	Std	Min	Mean	Max	Std
Commerz Internat.	0.00	0.04	0.32	0.07	0.07	0.80	1.24	0.19
Credit Suisse	0.03	0.24	0.52	0.15	0.80	1.28	2.29	0.35
Credit Agricole	0.00	0.09	0.25	0.07	0.36	0.63	1.25	0.20
Bank Julius Baer	0.00	0.11	0.27	0.06	0.70	1.11	1.86	0.27
Robeco Group	-0.03	0.02	0.11	0.03	0.67	0.95	1.50	0.18
Merrill Lynch	0.00	0.10	0.18	0.05	0.50	0.90	1.38	0.30
Lehman Brothers	0.00	0.06	0.27	0.08	0.13	0.55	0.90	0.20
Brown Brothers Harriman	0.06	0.17	0.43	0.09	0.00	0.16	1.04	0.30
Scudders Stevens	0.00	0.07	0.26	0.06	0.00	0.11	0.36	0.09
Capital House	0.00	0.18	1.00	0.19	0.10	0.37	1.50	0.32
UBS/Phillips Drew	0.00	0.07	0.25	0.07	0.34	0.87	1.51	0.37
Daiwa Europe	0.00	0.08	0.82	0.12	0.11	0.57	2.33	0.51
Nikko Securities	0.00	0.08	0.18	0.05	0.19	0.42	0.58	0.12

Table 3: Risk Aversion Estimates

The table reports iterated GMM estimates with 2 equations and 2 instruments (constant and lagged state variable). The 2 equations are derived from the expression of $\omega^*_{1,t}$ and $\omega^*_{2,t}$. The dynamics of the beliefs in the Equity and Bond Markets are given by $s_{i,t+1} = \lambda_{i1} + \lambda_{i2} Z_t + \varepsilon_{i,t}, \quad i = 1, 2$. We report results for policy functions based on different Z_t. The value of λ_{11} has been normalized to 1. We standardize the conditioning variables to ease the interpretation and comparison of the portfolio policy functions. ** and * denote significance at 5% and 10% level respectively. Standard errors in parentheses.

	G7 Infl.	**G7 Ind. Prod.**	**Risk-free Rate**	**Default Spread**	**Term Spread**	**Momentum**
Commerz Intern.	1.70**	1.87**	1.86**	1.88**	1.85**	1.85**
	(0.14)	(0.06)	(0.06)	(0.10)	(0.05)	(0.05)
Credit Suisse	2.63**	2.73**	2.71**	2.74**	2.70**	2.72**
	(0.15)	(0.11)	(0.11)	(0.16)	(0.11)	(0.13)
Credit Agricole/Indocam	1.70**	1.77**	1.86**	2.56**	1.77**	1.62**
	(0.14)	(0.07)	(0.08)	(0.90)	(0.09)	(0.26)
Bank Julius Baer	2.40**	2.31**	2.31**	2.38**	2.31**	2.32**
	(0.07)	(0.06)	(0.06)	(0.05)	(0.07)	(0.06)
Robeco Group	1.92**	1.96**	1.97**	1.96**	1.97**	1.96**
	(0.07)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)
Merrill Lynch	2.22**	1.99**	1.94**	1.84**	2.03**	2.06**
	(0.41)	(0.09)	(0.11)	(0.34)	(0.08)	(0.21)
Lehman Brothers	1.51**	1.62**	1.59**	1.47**	1.63**	1.63**
	(0.12)	(0.07)	(0.06)	(0.04)	(0.07)	(0.08)
Brown Brothers Harriman	1.20**	1.28**	1.26**	1.21**	1.28**	1.29**
	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)
Scudder Stevens	1.12**	1.18**	1.17**	1.13**	1.17**	1.18**
	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Capital House	1.40**	1.52**	1.49**	1.40**	1.52**	1.53**
	(0.07)	(0.06)	(0.06)	(0.05)	(0.08)	(0.07)
UBS/Phillips Drew	1.97**	1.91**	1.91**	1.96**	1.92**	1.91**
	(0.09)	(0.08)	(0.08)	(0.06)	(0.08)	(0.08)
Daiwa Europe	1.54**	1.55**	1.55**	1.55**	1.55**	1.55**
	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
Nikko Securities	1.42**	1.53**	1.51**	2.56*	1.46**	1.34**
	(0.11)	(0.04)	(0.09)	(1.32)	(0.05)	(0.32)

Table 4: Conditional Beliefs' Dynamics

The table reports iterated GMM estimates with 2 equations and 2 instruments (constant and lagged state variable). The 2 equations are derived from the expression of $\omega^*_{1,t}$ and $\omega^*_{2,t}$. The dynamics of the beliefs in the Equity and Bond Markets are given by $s_{i,t+1} = \lambda_{i1} + \lambda_{i2} Z_t + \varepsilon_{i,t}, \qquad i = 1, 2$. We report results for policy functions based on different Z_t. The value of λ_{11} has been normalized to 1. We standardize the conditioning variables to ease the interpretation and comparison of the portfolio policy functions. ** and * denote significance at 5% and 10% level respectively. Standard errors in parentheses.

	G7 Infl.			G7 Ind. Prod.			Risk-free Rate		
	λ_{12}	λ_{21}	λ_{22}	λ_{12}	λ_{21}	λ_{22}	λ_{12}	λ_{21}	λ_{22}
Commerz Intern.	0.17	0.73**	0.00	-0.03	0.80**	0.05*	-0.01	0.80**	0.03**
	(0.18)	(0.08)	(0.03)	(0.03)	(0.04)	(0.03)	(0.05)	(0.03)	(0.01)
Credit Suisse	0.06	1.09**	-0.19	0.04	1.24**	-0.03	-0.04	1.22**	0.06
	(0.05)	(0.11)	(0.13)	(0.04)	(0.08)	(0.08)	(0.04)	(0.08)	(0.06)
Credit Agricole/Indocam	0.06	0.64**	0.09	0.06	0.61**	0.07*	0.18**	0.65**	0.02
	(0.11)	(0.11)	(0.15)	(0.07)	(0.06)	(0.04)	(0.04)	(0.07)	(0.04)
Bank Julius Baer	-0.20**	1.16**	0.17**	-0.02	1.08**	0.00	-0.02	1.09**	-0.04
	(0.10)	(0.05)	(0.07)	(0.03)	(0.05)	(0.03)	(0.03)	(0.05)	(0.03)
Robeco Group	0.04	0.92**	0.02	-0.02	0.93**	-0.00	0.04	0.94**	-0.04
	(0.05)	(0.06)	(0.03)	(0.03)	(0.04)	(0.02)	(0.04)	(0.04)	(0.03)
Merrill Lynch	-0.37	0.97**	0.14	-0.08	0.83**	0.03	-0.08	0.83**	-0.04
	(0.59)	(0.26)	(0.35)	(0.07)	(0.09)	(0.09)	(0.08)	(0.10)	(0.06)
Lehman Brothers	0.12	0.50**	0.01	-0.06	0.53**	0.05	-0.10**	0.51**	0.07**
	(0.11)	(0.07)	(0.05)	(0.05)	(0.06)	(0.04)	(0.04)	(0.05)	(0.03)
Brown Brothers Harriman	-0.14**	0.06	0.08**	0.13**	0.10**	-0.11**	0.07**	0.09**	-0.06**
	(0.04)	(0.04)	(0.02)	(0.05)	(0.04)	(0.04)	(0.03)	(0.04)	(0.02)
Scudder Stevens	-0.10**	0.07**	0.05**	0.09**	0.10**	-0.06**	0.06**	0.09**	-0.04**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Capital House	-0.18**	0.26**	0.05*	0.15**	0.31**	-0.08**	0.11**	0.29**	-0.08**
	(0.05)	(0.05)	(0.03)	(0.05)	(0.04)	(0.02)	(0.04)	(0.03)	(0.03)
UBS/Phillips Drew	0.13**	0.83**	-0.08	-0.04	0.79**	0.02	-0.09**	0.79**	0.04
	(0.06)	(0.07)	(0.06)	(0.06)	(0.07)	(0.04)	(0.04)	(0.06)	(0.03)
Daiwa Europe	-0.08	0.45**	0.09	0.12**	0.45**	-0.14**	0.05	0.45**	-0.10**
	(0.07)	(0.05)	(0.08)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)
Nikko Securities	0.11	0.38**	0.01	0.10	0.42**	-0.05	0.02	0.39**	0.04
	(0.13)	(0.08)	(0.06)	(0.07)	(0.03)	(0.06)	(0.08)	(0.06)	(0.05)

	Default Spread			**Term Spread**			**Momentum**		
	λ_{12}	λ_{21}	λ_{22}	λ_{12}	λ_{21}	λ_{22}	λ_{12}	λ_{21}	λ_{22}
Commerz Intern.	0.02	0.78**	0.04	-0.02	0.80**	-0.03**	0.07	0.79**	-0.02
	(0.06)	(0.05)	(0.03)	(0.03)	(0.03)	(0.01)	(0.10)	(0.03)	(0.05)
Credit Suisse	0.01	1.03**	0.32**	-0.07**	1.23**	-0.04	0.22	1.24**	0.14
	(0.09)	(0.08)	(0.07)	(0.03)	(0.08)	(0.06)	(0.17)	(0.09)	(0.16)
Credit Agricole/Indocam	0.49	0.41	0.52**	0.05	0.64**	-0.08**	-0.38	0.53**	0.22
	(0.55)	(0.38)	(0.20)	(0.06)	(0.06)	(0.03)	(0.79)	(0.15)	(0.22)
Bank Julius Baer	0.12**	1.14**	-0.09**	-0.03	1.08**	0.02	0.04	1.09**	-0.02
	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.03)	(0.04)	(0.05)	(0.04)
Robeco Group	0.00	0.96**	-0.05	0.02	0.94**	-0.03	-0.07	0.93**	0.02
	(0.05)	(0.06)	(0.05)	(0.02)	(0.04)	(0.02)	(0.06)	(0.04)	(0.06)
Merrill Lynch	-0.09	0.73**	0.04	0.10**	0.86**	-0.07*	0.23	0.87**	-0.11
	(0.19)	(0.25)	(0.17)	(0.03)	(0.08)	(0.04)	(0.61)	(0.19)	(0.51)
Lehman Brothers	-0.14**	0.47**	0.02	0.02	0.54**	-0.04	-0.10	0.54**	0.12
	(0.06)	(0.03)	(0.05)	(0.04)	(0.06)	(0.03)	(0.10)	(0.07)	(0.10)
Brown Brothers Harriman	0.10**	0.06	-0.05**	0.01	0.10**	0.00	0.19**	0.11**	-0.11**
	(0.03)	(0.05)	(0.03)	(0.05)	(0.04)	(0.04)	(0.06)	(0.04)	(0.05)
Scudder Stevens	0.08**	0.07**	-0.05**	0.00	0.10**	0.00	0.08*	0.10**	-0.05*
	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)	(0.05)	(0.02)	(0.03)
Capital House	0.14**	0.25**	-0.06**	-0.07	0.31**	0.07*	0.22**	0.31**	-0.07**
	(0.03)	(0.04)	(0.01)	(0.05)	(0.05)	(0.04)	(0.07)	(0.05)	(0.04)
UBS/Phillips Drew	-0.15**	0.82**	0.08**	0.05	0.79**	0.01	-0.04	0.79**	0.01
	(0.03)	(0.05)	(0.03)	(0.05)	(0.07)	(0.04)	(0.05)	(0.07)	(0.04)
Daiwa Europe	-0.01	0.45**	-0.04	0.05	0.45**	0.00	0.19**	0.45**	-0.16**
	(0.06)	(0.05)	(0.05)	(0.04)	(0.06)	(0.04)	(0.05)	(0.05)	(0.07)
Nikko Securities	0.74	0.85	-0.18	-0.09**	0.38**	0.04	-0.54	0.28	0.38
	(0.95)	(0.76)	(0.48)	(0.03)	(0.05)	(0.03)	(1.17)	(0.23)	(0.75)

Table continued from previous page.

Table 5: Summary

The table reports the sign (+ or −) of λ_{i2} if significant in the policy function at 10% level. If the state variable is not significant we report ∘. The specification of the beliefs' dynamics is given by $s_{i,t+1} = \lambda_{i1} + \lambda_{i2} Z_t + \varepsilon_{i,t}, \quad i = 1, 2$

	G7 Infl.		**G7 Ind. Prod.**		**Risk-free Rate**		**Default Spread**		**Term Spread**		**Momentum**	
	Equity	Bond	Equity	Bond	Equity	Bond	Equity	Bond	Equity	Bond	Equity	Bond
Commerz Intern.	∘	∘	∘	+	∘	+	∘	∘	∘	−	∘	∘
Credit Suisse	∘	∘	∘	∘	∘	∘	∘	+	−	∘	∘	∘
Credit Agricole/Indocam	∘	∘	∘	+	+	∘	∘	+	∘	−	∘	∘
Bank Julius Baer	−	+	∘	∘	∘	∘	+	−	∘	∘	∘	∘
Robeco Group	∘	∘	∘	∘	∘	∘	∘	∘	∘	∘	∘	∘
Merrill Lynch	∘	∘	∘	∘	∘	∘	∘	∘	+	−	∘	∘
Lehman Brothers	∘	∘	∘	∘	−	+	−	∘	∘	∘	∘	∘
Brown Brothers Harriman	−	+	+	−	+	−	+	−	∘	∘	+	−
Scudder Stevens	−	+	+	−	+	−	+	−	∘	∘	+	−
Capital House	−	+	+	−	+	−	+	−	∘	+	+	−
UBS/Phillips Drew	+	∘	∘	∘	−	∘	−	+	∘	∘	∘	∘
Daiwa Europe	∘	∘	+	−	∘	−	∘	∘	∘	∘	+	−
Nikko Securities	∘	∘	∘	∘	∘	∘	∘	∘	−	∘	∘	∘

Table 6: In Sample Fit

The table reports the pseudo-R^2 for the level of equities and bonds allocation based on the MV framework conditioning on different state variables. The pseudo-R^2 is computed as the squared correlation coefficient between the recommended and fitted $\left(\widehat{\omega}_{i,t} = \frac{1}{\gamma}\left(\widehat{\lambda}_{i1} + \widehat{\lambda}_{i2} Z_t\right)\right)$ portfolio weights. Average, Average 80's, Average 90's denote the average pseudo-R^2 computed across all banks, banks participating in the poll during the eighties and the nineties respectively.

	G7 Infl.		G7 Ind. Prod.		Risk-free Rate		Default Spread		Term Spread		Momentum	
	Equity	Bond	Equity	Bond	Equity	Bond	Equity	Bond	Equity	Bond	Equity	Bond
Commerz Intern.	0.08	0.00	0.00	0.00	0.00	0.05	0.00	0.01	0.05	0.13	0.02	0.01
Credit Suisse	0.01	0.02	0.03	0.00	0.01	0.01	0.00	0.27	0.09	0.03	0.01	0.04
Credit Agricole	0.00	0.01	0.04	0.04	0.42	0.00	0.08	0.06	0.03	0.30	0.05	0.10
Bank Julius Baer	0.12	0.12	0.01	0.00	0.01	0.04	0.23	0.14	0.02	0.02	0.00	0.01
Robeco Group	0.00	0.00	0.02	0.00	0.03	0.09	0.01	0.01	0.03	0.07	0.02	0.00
Merrill Lynch	0.00	0.00	0.01	0.00	0.02	0.07	0.01	0.01	0.45	0.16	0.01	0.01
Lehman Brothers	0.01	0.00	0.02	0.02	0.18	0.12	0.14	0.01	0.06	0.15	0.00	0.00
Brown Brothers Harriman	0.08	0.03	0.24	0.18	0.23	0.18	0.27	0.09	0.02	0.03	0.14	0.07
Scudder Stevens	0.21	0.11	0.43	0.48	0.35	0.37	0.53	0.52	0.00	0.00	0.10	0.06
Capital House	0.12	0.00	0.29	0.20	0.35	0.27	0.42	0.18	0.06	0.07	0.19	0.02
UBS/Phillips Drew	0.09	0.08	0.01	0.01	0.10	0.02	0.45	0.22	0.04	0.00	0.00	0.00
Daiwa Europe	0.03	0.04	0.16	0.20	0.08	0.21	0.00	0.05	0.01	0.01	0.15	0.10
Nikko Securities	0.02	0.01	0.18	0.11	0.00	0.03	0.12	0.00	0.40	0.12	0.23	0.10
Avg.	0.06	0.03	0.11	0.10	0.14	0.11	0.17	0.12	0.10	0.08	0.07	0.04
Avg 80s	0.11	0.06	0.19	0.18	0.19	0.18	0.32	0.20	0.03	0.02	0.10	0.04
Avg 90s	0.02	0.01	0.04	0.03	0.09	0.05	0.05	0.06	0.16	0.14	0.05	0.04

Table 7: Testing Preferences and Beliefs Homogeneity across Money Managers

The table reports the Wald test based on estimates obtained by iterated multiple equations GMM. The system consists of 52 equations: 2 moment conditions for 13 money managers and 2 instruments (constant and lagged state variable). γ is the risk aversion coefficient. The dynamics of the beliefs in the Equity and Bond Markets are given by $s_{i,t+1} = \lambda_{i1} + \lambda_{i2} Z_t + \varepsilon_{i,t}, \quad i = 1, 2$. We report results for policy functions based on different Z_t. p-values are in parentheses.

All Banks

H_0	**G7 Inflation**	**G7 Ind. Prod.**	**Risk-free Rate**	**Default Spread**	**Term Spread**	**Momentum**
$\gamma^{(1)} = ... = \gamma^{(j)}$	1327 (0.00)	3027 (0.00)	2972 (0.00)	2824 (0.00)	2891 (0.00)	2409 (0.00)
$\lambda_{12}^{(1)} = ... = \lambda_{12}^{(j)}$	37.40 (0.00)	58.25 (0.00)	84.41 (0.00)	199.70 (0.00)	75.77 (0.00)	24.73 (0.00)
$\lambda_{21}^{(1)} = ... = \lambda_{21}^{(j)}$	1857 (0.00)	4663 (0.00)	3858 (0.00)	3413 (0.00)	5040 (0.00)	3787 (0.00)
$\lambda_{22}^{(1)} = ... = \lambda_{22}^{(j)}$	30.47 (0.00)	58.29 (0.00)	59.61 (0.00)	158.63 (0.00)	41.94 (0.00)	11.50 (0.40)

Swiss Banks: Credit Suisse, Bank Julius Baer, UBS Philips and Drew

H_0	**G7 Inflation**	**G7 Ind. Prod.**	**Risk-free Rate**	**Default Spread**	**Term Spread**	**Momentum**
$\gamma^{(1)} = ... = \gamma^{(j)}$	8.36 (0.01)	8.36 (0.01)	72.39 (0.00)	116.30 (0.00)	55.09 (0.00)	44.22 (0.00)
$\lambda_{12}^{(1)} = ... = \lambda_{12}^{(j)}$	2.03 (0.36)	2.03 (0.36)	3.92 (0.14)	118.60 (0.00)	6.80 (0.03)	3.95 (0.14)
$\lambda_{21}^{(1)} = ... = \lambda_{21}^{(j)}$	3.16 (0.21)	3.16 (0.20)	35.03 (0.00)	70.62 (0.00)	35.32 (0.00)	30.30 (0.00)
$\lambda_{22}^{(1)} = ... = \lambda_{22}^{(j)}$	3.50 (0.17)	3.50 (0.17)	4.47 (0.10)	60.32 (0.00)	2.89 (0.24)	0.62 (0.73)

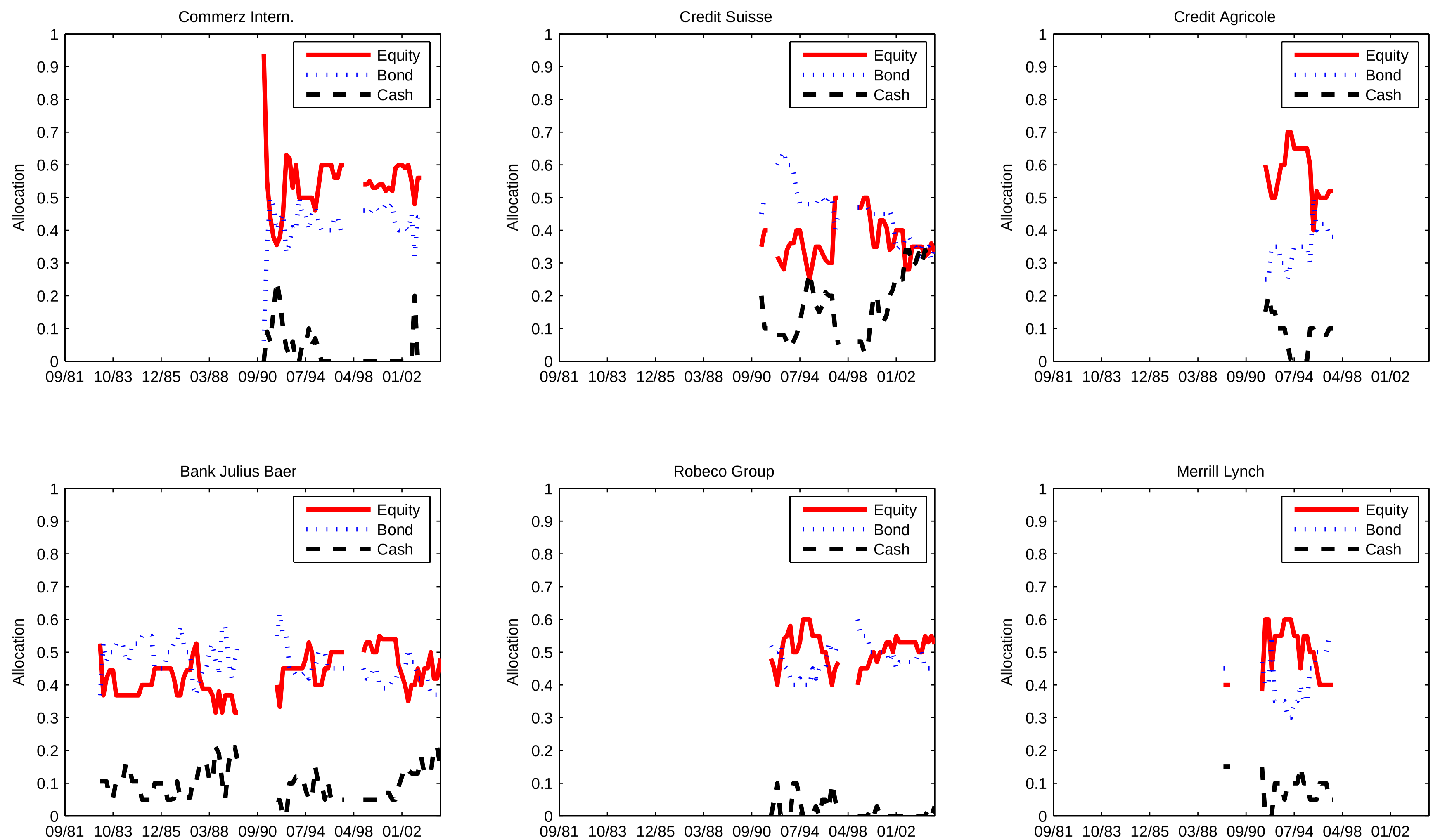
Table 8: Rationality Test of the Money Managers' Investment Strategies

The table reports the J-test values obtained by iterated GMM estimates with over-identifying restrictions given by different sets of instruments. The first instruments' set (1) comprises a constant, a lagged value of the state variable used in the policy function, and the lagged values of excess returns on the stock and bond market. The second instruments' set (2) comprises a constant, one lagged value of three factors extracted from a group of real activity measures, interest rates measures, financial markets measures. ** and * denote significance at 5% and 10% level respectively. The p-values are computed by using a χ^2 distribution with 4 degrees of freedom.

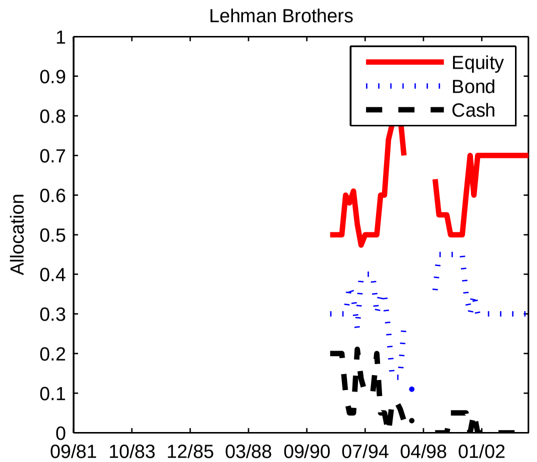
	G7 Inflation		G7 Ind. Prod.		Risk-free Rate		Default Spread		Term Spread		Momentum	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Commerz Intern.	1.82	10.38**	7.77	7.84*	4.81	6.97	2.43	4.83	3.12	6.67	3.12	8.80*
Credit Suisse	6.59	4.32	7.64	7.09	5.69	7.78	6.33	6.03	4.51	1.22	4.51	3.85
Credit Agricole	1.78	NaN	2.94	4.47	3.51	9.77**	2.83	8.88*	1.86	7.40	1.86	9.42*
Bank Julius Baer	21.84**	14.14**	7.30	16.15**	3.59	15.65**	5.37	3.88	6.28	12.64**	6.28	3.13
Robeco Group	2.83	4.06	1.28	4.50	8.28*	4.82	1.45	13.94**	2.82	6.76	2.82	4.48
Merrill Lynch	2.10	12.29**	1.26	6.89	1.41	6.43	1.53	7.01	1.06	2.80	1.06	11.33**
Lehman Brothers	2.14	3.60	0.66	5.36	2.59	4.26	5.69	4.04	2.19	5.53	2.19	2.94
Brown Brothers Harriman	8.38*	4.98	3.88	3.51	8.57*	6.06	8.11*	6.93	6.06	7.12	6.06	5.09
Scudder Stevens	21.04**	9.29*	6.88	15.30**	3.14	6.33	5.75	11.30**	6.05	16.53**	6.05	6.36
Capital House	9.56**	9.15*	16.01**	7.35	12.20**	6.55	13.59**	7.90*	13.01**	11.96**	13.01**	6.86
UBS/Phillips Drew	4.86	10.11**	6.20	10.83**	0.19	10.04**	3.38	9.41*	3.50	13.99**	3.50	8.59*
Daiwa Europe	7.09	8.76*	6.67	8.39*	6.85	8.43*	9.14*	15.84**	9.39*	9.50**	9.39*	10.01**
Nikko Securities	4.40	7.91*	4.49	13.98**	4.21	5.83	5.61	111.39**	2.45	5.17	2.45	5.93

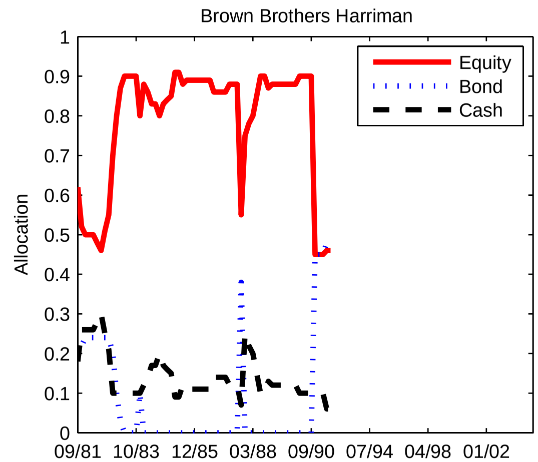
Figure 1: Recommended Asset Allocation

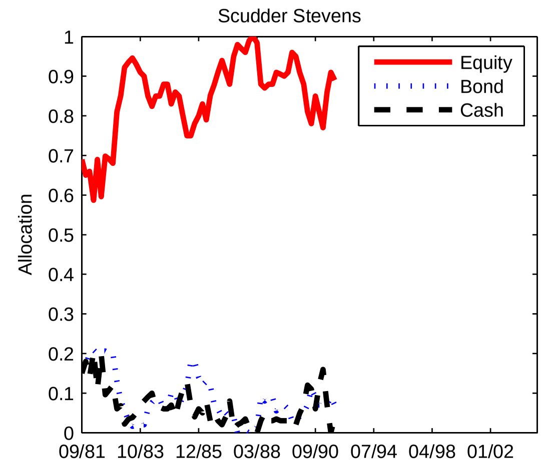
Each panel reports the time series of the allocation to equities, bonds, and cash recommended by each investment house participating to *The Economist Portfolio Poll*. The first recommendation is issued on 09/03/1981 and the last one is issued on 10/14/2004. The *Financial Report*, a confidential newsletter purchased by *The Economist*, published its survey every 6 weeks. *The Economist* continued the survey, but beginning on March 25, 1989, published it approximately every 3 months. The *Portfolio Poll* was not published between Q3 1997 and Q3 1998.

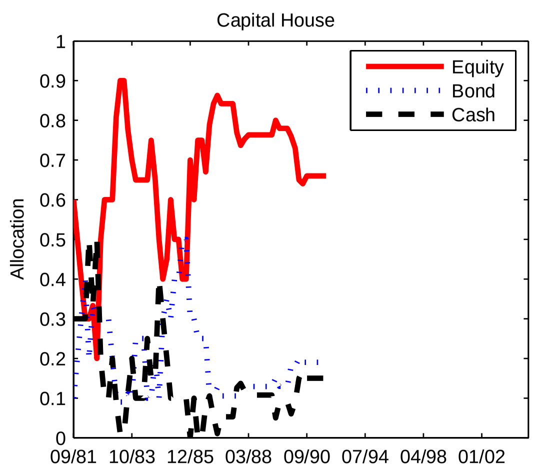


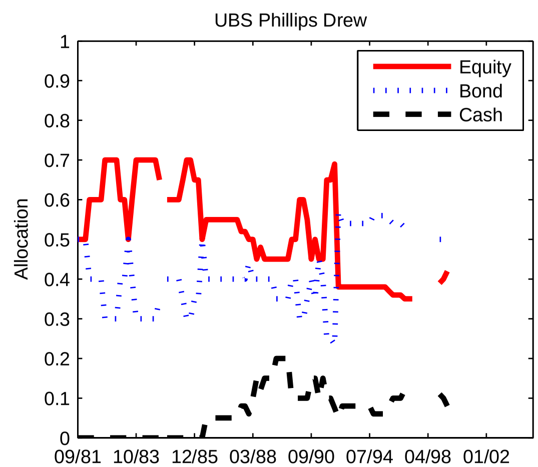
Recommended Asset Allocation Cont'd











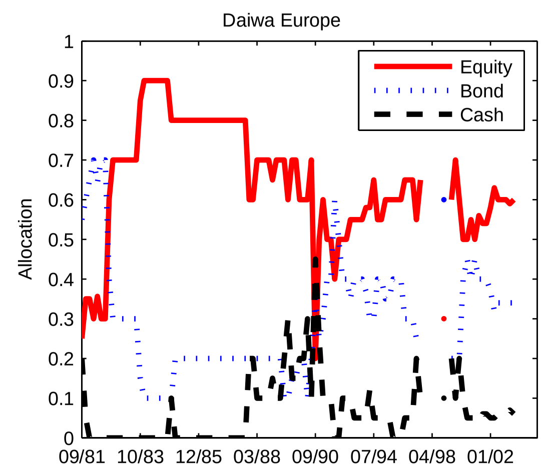


Figure 2: Consensus Asset Allocation

Each panel reports the time series of the minimum, average, and maximum recommended portfolio weights in equities, bonds, and cash - computed across investment houses. The first recommendation is issued on 09/03/1981 and the last one is issued on 10/14/2004. The *Financial Report*, a confidential newsletter purchased by *The Economist*, published its survey every 6 weeks. *The Economist* continued the survey, but beginning on March 25, 1989, published it approximately every 3 months. The *Portfolio Poll* was not published between Q3 1997 and Q3 1998.

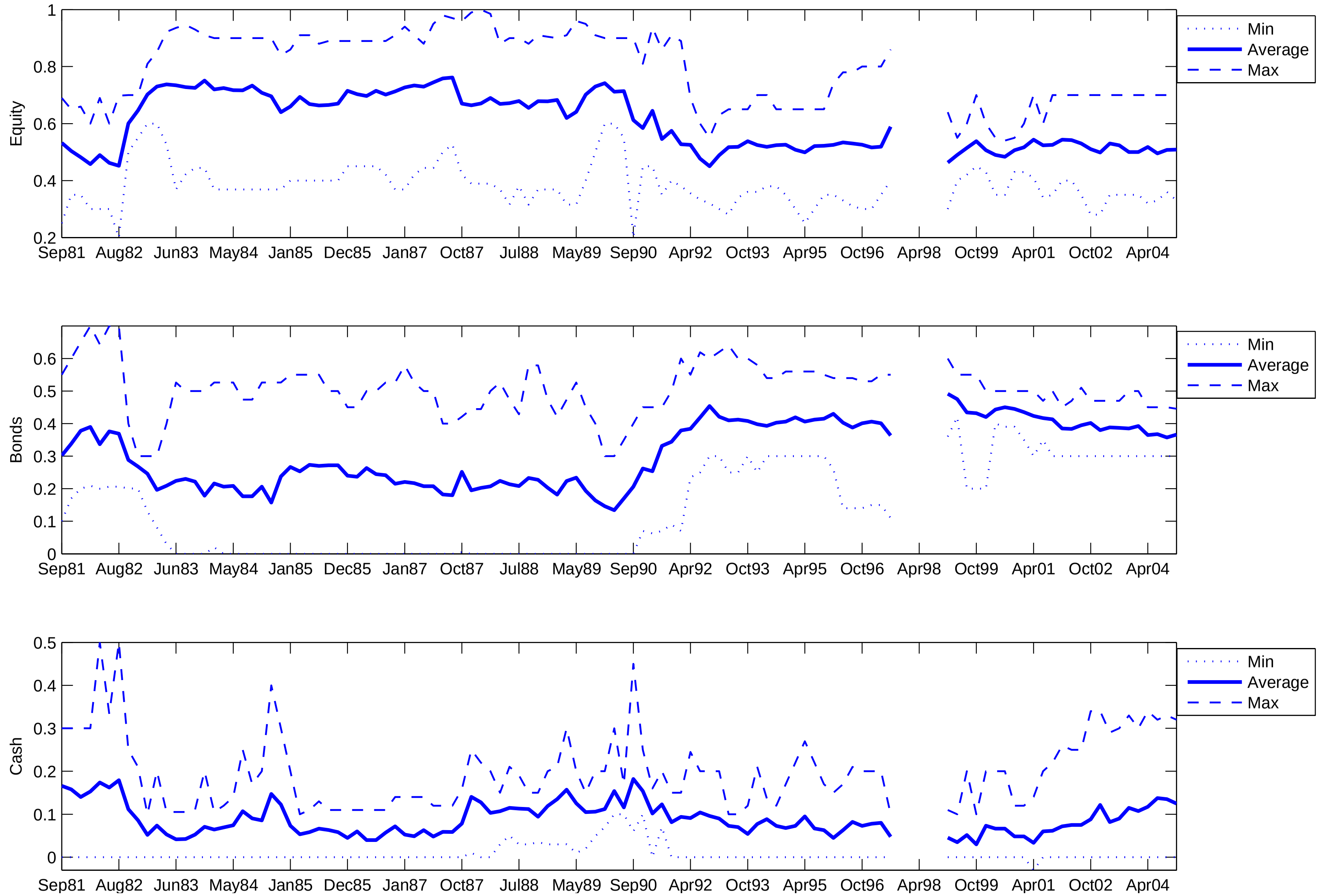


Figure 3: Average Beliefs about the Relative Attractiveness of Equity and Bond Markets for selected Investment Banks

The figure plots the average fitted values of s_{1t+1} computed across different policy functions for selected banks. Values above 1 suggest that the equity market is more attractive compared to the bond market.