An Asset Allocation Puzzle

By NIKO CANNER, N. GREGORY MANKIW, AND DAVID N. WEIL*

This paper examines popular advice on portfolio allocation among cash, bonds, and stocks. It documents that this advice is inconsistent with the mutual-fund separation theorem, which states that all investors should hold the same composition of risky assets. In contrast to the theorem, popular advisors recommend that aggressive investors hold a lower ratio of bonds to stocks than conservative investors. The paper explores various possible explanations of this puzzle and finds them unsatisfactory. (*JEL* G11)

How should an investor's attitude toward risk influence the composition of his portfolio? A simple and elegant answer to this question comes from the mutual-fund separation theorem. This theorem, a building block of the most basic Capital Asset Pricing Model (CAPM), is taught regularly to undergraduates and business students. According to the theorem, more risk-averse investors should hold more of their portfolios in the riskless asset. The composition of risky assets, however, should be the same for all investors.

Popular financial advisors appear not to follow the mutual-fund separation theorem. When these advisors are asked to allocate portfolios among stocks, bonds, and cash, they recommend more complicated strategies than indicated by the theorem. Moreover, these strategies differ from the theorem in a systematic way. According to these advisors, more risk-averse investors should hold a higher ratio of bonds to stocks. This advice contradicts the conclusion that all investors should hold risky assets in the same proportion.

The purpose of this paper is to document this popular advice on portfolio allocation and attempt to explain it. We begin in Section I by reviewing the basic mutual-fund separation theorem. We consider the conditions under which all investors should hold stocks and bonds in the same proportion. We also present a numerical example of the optimal mutual fund based on the historical distribution of stock and bond returns.

In Section II we document the nature of popular financial advice regarding portfolio allocation. We show that this advice contrasts starkly with the predictions of the mutual-fund separation theorem. Moreover, the deviations from the theorem are systematic. In the rest of the paper we take this popular advice on portfolio allocation as the "data" to be explained.

In Section III we consider whether such advice might be optimal. We consider various deviations from the assumptions that underlie the basic mutual-fund separation theorem. In particular, we consider the absence of a riskless asset; preferences that depend on more than the mean and variance of returns; portfolio choice in dynamic settings; and the existence of nontraded assets. Although we cannot rule out the possibility that popular advice is consistent with some model of rational behavior, we have so far been unable to find such a model.

The difficulty in explaining popular advice suggests that investors (or investment advisors) are not fully rational. But how far from full rationality are the recommended portfolios? In Section IV we examine the costs of holding nonoptimal portfolios. We show that these portfolios are not far from

* Canner: McKinsey & Company, 55 East 52nd Street, New York, NY 10055; Mankiw: Department of Economics, 223 Littauer Center, Harvard University, Cambridge, MA 02138; Weil: Department of Economics, Box B, Brown University, Providence, RI 02912. The authors are grateful to John Campbell, Tony Lancaster, and the referees for comments, to Michael Rashes for research assistance, and to the National Science Foundation for financial support.

the mean-variance efficient frontier. That is, even though recommended portfolios are quite different from optimal portfolios, the costs of such deviations are small. Popular advice is "near rational."

Section V summarizes our findings and offers concluding comments.

I. Theoretical Background

The textbook Capital Asset Pricing Model is based on the work of William F. Sharpe (1964), John Lintner (1965), and Jan Mossin (1966). This model shows how rational investors should combine risky assets with a given distribution of returns. It rests on the following important assumptions:

(i) All assets can be freely traded.
(ii) Investors operate over a one-period planning horizon.
(iii) Investors can hold long or short positions in all assets.
(iv) Investors are indifferent between any two portfolios with identical means and variances.

The fourth assumption can be replaced with the somewhat more primitive assumption that investors' objective functions are quadratic. Alternatively, it can be replaced with the assumption that asset returns are normal, so that the mean and variance fully characterize the distribution of returns.

These four assumptions yield a powerful conclusion: regardless of the number of assets in the economy, two mutual funds span the set of efficient portfolios. This result becomes even stronger if we add another assumption:

(v) A riskless asset exists.

In this case, the riskless asset and a single mutual fund of risky assets are sufficient to generate all efficient portfolios. Under these conditions, all investors hold risky assets in the same proportions. In particular, every investor holds the same ratio of bonds to stocks. To achieve the desired balance of risk and return, investors simply vary the fraction of their portfolios made up of the riskless asset.

To illustrate this principle, consider a world with three assets: an index fund of stocks, an index fund of bonds, and riskless cash. Suppose the means and variance-covariance matrix of annual real returns for bonds and stocks from 1926 to 1992 represent the distribution of future returns. In addition, suppose that cash offers a riskless real return equal to the mean real return on Treasury bills over the same period. Straightforward calculations show that, under these assumptions, all mean-variance efficient portfolios hold bonds and stocks in a ratio of 0.33 to one. For example, the portfolio composed of 60 percent stocks, 20 percent bonds, and 20 percent cash is mean-variance efficient: there is some quadratic objective function for which this portfolio is optimal. Other investors will hold other portfolios, depending on their preferences toward risk. But all investors will hold portfolios with a 0.33:1 ratio of bonds to stocks.

II. Popular Advice on Portfolio Allocation

It is easy to find advice on portfolio allocation being offered to the general public. Table 1 shows the recommendations of four financial advisors. The recommendations in part A come from a newsletter sent by Fidelity Investments (Larry Mark, 1993), a large mutual-fund company. Those in part B come from a book promoted by Merrill Lynch (Don Underwood and Paul B. Brown, 1993), a large brokerage firm. Those in part C come from a book by Jane Bryant Quinn (1991), a prominent journalist who writes on personal financial planning. Those in part D come from an article in the "Your Money" section of *The New York Times* (Mary Rowland, 1994).

Each of the advisors presents recommended allocations among stocks, bonds, and cash for three investors with different preferences toward risk. (Here "cash" is interpreted as short-term, money-market instruments, not currency.) In the last column we present the ratio of bonds to stocks, which we use to measure the composition of risky assets. The consistency of the advice is striking. For all of the advisors, the recommended ratio of bonds to stocks falls as the investor becomes more willing to take on risk.

TABLE 1—ASSET ALLOCATIONS RECOMMENDED BY FINANCIAL ADVISORS

Advisor and investor type	Percent of portfolio			Ratio of bonds to stocks
	Cash	Bonds	Stocks	
A. Fidelity[a]				
Conservative	50	30	20	1.50
Moderate	20	40	40	1.00
Aggressive	5	30	65	0.46
B. Merrill Lynch[b]				
Conservative	20	35	45	0.78
Moderate	5	40	55	0.73
Aggressive	5	20	75	0.27
C. Jane Bryant Quinn[c]				
Conservative	50	30	20	1.50
Moderate	10	40	50	0.80
Aggressive	0	0	100	0.00
D. *The New York Times*[d]				
Conservative	20	40	40	1.00
Moderate	10	30	60	0.50
Aggressive	0	20	80	0.25

Sources:
[a] Mark, 1993.
[b] Underwood and Brown, 1993.
[c] Quinn, 1991.
[d] Rowland, 1994.

Figure 1 shows a scatterplot of the recommended portfolios. The horizontal axis shows the fraction of the portfolio made up of stocks; in all the settings we examine, this fraction is a good proxy for tolerance toward risk. The vertical axis shows the ratio of bonds to stocks. The set of optimal portfolios according to the mutual-fund separation theorem is the horizontal line labelled "CAPM Assumptions." (For now, ignore the other two curves in the figure.) The set of points representing the portfolios recommended by the popular advisors very clearly slopes downward. The inconsistency of these "data" with the celebrated mutual-fund separation theorem has not, to our knowledge, previously been noted. This figure suggests that textbook theory does not well describe the behavior of actual investors (or at least investment advisors).

One might argue that this failure of the mutual-fund separation theorem is not surprising, because various studies have shown that the CAPM does not fit the data on asset returns. It is important to note, however, that the validity of the mutual-fund separation theorem does not depend on the CAPM being the right model of asset returns. Empirical tests of the CAPM, such as examinations of whether a stock's beta is related to its mean return, are premised on the assumption that all investors act according to the model. Even if this condition is false, a particular set of investors could still choose portfolios on the mean-variance efficient frontier. Thus, the fact that the CAPM has often been rejected as a model of asset returns should not preclude an investment advisor from recommending portfolios that satisfy the mutual-fund separation theorem.

One might also argue that the mutual-fund separation theorem is obviously false because, in the world we observe thousands of mutual funds rather than a single mutual fund. The existence of many mutual funds, however, can be explained by differences in expectations. If different people have different subjective distributions over future returns, then they will combine risky assets in different proportions. One virtue of studying the advice of popular advisors is that each advisor gives three portfolio allocations for investors with different risk tolerance. Presumably, the advisor's subjective distribution of returns is being held constant across the three recommended portfolios. Thus,

although different expectations can explain the diversity of mutual funds in the world, it cannot explain the popular advice we document in Table 1.

In addition to the regularity documented in Table 1, there is another common feature of popular advice. Popular advisors tend to recommend that an investor's time horizon, as well as his tolerance toward risk, should influence the composition of his portfolio. According to these advisors, younger investors—who have long time horizons—should invest more aggressively than older investors. For example, a commonly cited rule of thumb states that the stock allocation should equal 100 minus an investor's age. As another example, Fidelity Investments (1994) offers a worksheet to help investors choose a portfolio allocation. The worksheet guides investors to a conservative, moderate, or aggressive portfolio based on a combination of risk preference and time horizon. Similarly, many mutual-fund companies offer "life cycle" funds in which the portfolio mix becomes more conservative as the investor ages (Vanessa O'Connell, 1995).

As Paul A. Samuelson (1963) first pointed out, this dependence of portfolio allocation on time horizon is inconsistent with basic models of portfolio choice. A large literature, discussed recently by Samuelson (1989, 1994), tries to resolve this discrepancy. As far as we know, there is no literature documenting or explaining the puzzle that is the focus of this paper. Moreover, the various resolutions that have been proposed for the Samuelson puzzle appear not to explain the puzzle featured here.

III. Is the Advice Optimal?

As the title of this paper suggests, we view popular advice on asset allocation as a puzzle. In some circumstances, economists should not expect people to act exactly according to theory, because theory often predicts complicated behavior. But the mutual-fund separation theorem indicates that optimal behavior is exceedingly simple. What is surprising about popular advice on portfolio allocation is that it is both systematic and more complicated than indicated by textbook theory.

It is possible, of course, that popular financial advice on portfolio allocation is simply

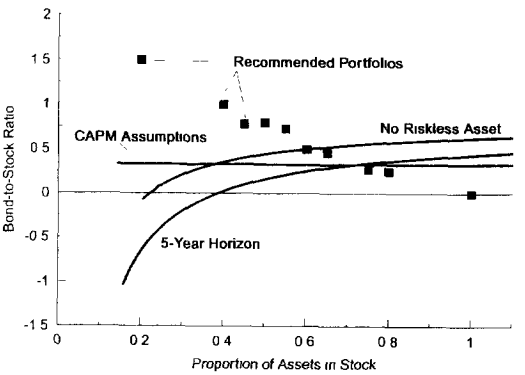

FIGURE 1. OPTIMAL AND RECOMMENDED PORTFOLIOS

wrong. Such a conclusion would be troubling, however. Economists routinely assume that people act optimally. When confronted with the observation that people do not have the tools to perform formal optimization, economists often argue that people follow rules of thumb that allow them to act "as if" they were optimizing. Popular advice, such as that documented in Table 1, would seem to be an ideal device for allowing people to act optimally in an environment where formal optimization is difficult. The fact that such advice is widely disseminated suggests that it affects behavior. If this popular advice is wrong, then it would constitute prima facie evidence that people do not optimize.

An alternative to concluding that people do not optimize is to argue that popular advice is not wrong but that the economic model it contradicts is lacking. Indeed, this seems like a natural presumption. Since the popular advice is so systematic, perhaps there is good reason for it. If so, academic financial economists may be able to learn from popular advisors.

Like all conclusions from theory, the mutual-fund separation theorem rests on assumptions. In this section, we discuss the five key assumptions listed above, in reverse order. Our goal is to see if relaxing these assumptions can explain the disparity between the portfolios dictated by theory and those recommended by popular advisors.

The approach we take is necessarily numerical rather than analytic. Most deviations from the mutual-fund separation theorem will yield

TABLE 2—THE DISTRIBUTION OF ANNUAL REAL RETURNS 1926–1992

Asset	Arithmetic mean return (percent)	Standard deviation (percent)	Correlation with	
			Bonds	Stocks
Treasury bills	0.6	4.3	0.63	0.09
Long-term government bonds	2.1	10.1	1.00	0.23
Common stock	9.0	20.8	0.23	1.00

predictions conditional on the distribution of returns. Therefore, as we relax assumptions, we calculate optimal portfolios based on the historical distribution of returns from 1926 to 1992. Table 2 shows the means, standard deviations, and correlations of annual real returns for this period. (The underlying data are from Ibbotson Associates, 1993.) Below we also consider the possibility that the advisors' subjective distribution might differ from this historical distribution.

A. *Absence of a Riskless Asset*

The most obvious assumption to relax is the existence of a riskless asset. Although U.S. Treasury bills are riskless in nominal terms, inflation makes their return uncertain in real terms. If we retain the other assumptions of the CAPM but allow for the absence of a riskless asset, two-fund separation continues to apply, but now both funds include risky assets. Without a riskless asset, optimal portfolios need not contain the same relative proportions of risky assets. The curve in Figure 1 labelled "No Riskless Asset" shows the set of mean-variance efficient portfolios given the historical distribution of returns.

The result of relaxing the riskless-asset assumption is to raise the disparity between optimal and recommended portfolios. Financial advisors tell their clients to create riskier portfolios by *decreasing* the ratio of bonds to stocks. Yet calculations of mean-variance efficient portfolios suggest very different advice. According to these calculations, as an investor creates a riskier portfolio, he should allocate more assets to both stocks and bonds but should *increase* the ratio of bonds to stocks. Thus, allowing cash to be risky only deepens the asset allocation puzzle.

The intuition for this result comes from noting that the real returns on cash and bonds are highly correlated. For a low-risk investor, bonds are quite unattractive as a risky investment, because this investor holds a high proportion of his portfolio in cash. Thus, the ratio of bonds to stocks will be low. Indeed, the investor may even take a short position in bonds in order to hedge the risk inherent in his large cash holdings. As the investor takes on more risk, the cash proportion of his portfolio falls, and so the high correlation between cash and bond returns is not as problematic. Thus, the ratio of bonds to stocks rises.

B. *Beyond the Mean-Variance Objective Function*

Rational investors care about only the mean and variance of portfolio returns if returns are normal or if utility is quadratic. In practice, neither of these conditions is likely to hold. Various studies have documented that stock returns are skewed and kurtotic (for example, see John Y. Campbell and Ludger Hentschel, 1992). Moreover, quadratic utility generally is considered an unappealing assumption, as it implies decreasing absolute risk aversion. That is, under quadratic utility, a person's willingness to accept a risk of fixed size declines as wealth increases. This behavior is intuitively implausible.

A natural alternative to quadratic utility is the Constant Relative Risk Aversion (CRRA) utility function: $U(W) = W^{1-A}/(1-A)$. With this utility function, investors will care about more than the mean and variance of returns. That is, holding constant the mean and variance of returns, changing the skewness or kurtosis will affect investors' behavior. We now consider optimal portfolios given the historical distribution of returns and CRRA utility.

To generate a set of optimal portfolios for investors with objective functions of this form, we used a hill-climbing algorithm to choose the portfolio that maximizes expected utility for various values of the risk-aversion parameter. Expected utility was computed based on the historical distribution of returns. In particular, each realization of annual returns from 1926 to 1992 was taken to be equally likely. This approach assumes that all the moments of the subjective distribution of future returns exactly match the moments of the historical distribution.

The set of optimal portfolios generated by this procedure, presented in Canner et al. (1994), looks qualitatively similar to that derived for quadratic utility. In both cases, the ratio of bonds to stocks increases as the proportion of stock rises. It seems that CRRA objective functions cannot resolve our asset allocation puzzle.

C. *A Digression: Subjective versus Historical Distributions*

The optimal portfolios shown by the curves in Figure 1 depend on the particular distribution of returns used in the calculations. We used the historical distribution of real returns from 1926 to 1992. In doing this, we assumed that the historical distribution is a good proxy for the popular advisors' subjective distributions. To the extent that the historical and subjective distributions differ, optimal portfolios as we calculate them can differ from those recommended by popular advisors. There are two plausible ways in which this might occur.

First, it is possible that the distribution of returns has changed. In particular, the data from the volatile 1930's could in principle be having an excessive effect on the results. One might argue that the Great Depression is given too much weight when using the entire sample because the depression was an unusual event that popular advisors believe will not be repeated. Similarly, one might argue that more recent data are more relevant for future returns simply because they are more recent. To investigate this issue, we recalculated the optimal portfolios using only returns since 1946. We found that the optimal quantity of bonds is lower using data only from this recent period. Nonetheless, across efficient portfolios, the ratio of bonds to stocks rises as the proportion in stocks increases. Thus, the inconsistency of recommended and efficient portfolios shown in Figure 1 cannot be resolved simply by excluding data from the Great Depression.

Second, even if the subjective distribution of returns is the same as the distribution that generated the data, the subjective and historical distributions could differ because of sampling error. To investigate this possibility, we followed a bootstrap procedure. We generated 2,000 artificial samples of the same size as our actual sample by drawing from the historical distribution with replacement. For each of the 2,000 replications, we calculated how the optimal ratio of bonds to stocks varies with risk aversion. In over 95 percent of the replications, the ratio of bonds to stocks rose as the investor became more willing to take on risk. This was true whether or not we used data from the Great Depression. Thus, the key result illustrated in Figure 1 cannot be explained by sampling error.

D. *Constraints on Short Sales*

The CAPM as usually implemented assumes that investors can hold long or short positions in all assets. And, indeed, some of the optimal portfolios in Figure 1 include a negative position in cash. None of the popular advisors, however, recommends that investors take such a short position. One possible reason is that advisors believe their readers face a higher interest rate when borrowing cash than when lending. Alternatively, there may be institutional restrictions—such as mutual-fund regulations—that make short positions impractical. As can be seen in Table 1, two of the four advisors recommend that their most aggressive investors hold zero cash, while the other two recommend that their most aggressive investors hold only 5 percent in cash, possibly considering this small amount the minimum necessary for reasons of liquidity. Constraints on short positions might plausibly influence these recommended portfolios.

What is the set of optimal portfolios for investors who cannot go short cash? The answer depends on whether the short constraint is

binding. For a risk-tolerant investor who otherwise wants to go short cash, the optimal portfolio consists of only stocks and bonds. As this constrained investor becomes less risk averse, he optimally will hold a lower ratio of bonds to stocks. This is qualitatively consistent with the portfolios recommended by popular advisors.

Yet constraints on short sales cannot completely resolve the puzzle. Three out of four advisors recommend conservative and moderate portfolios with substantial cash and different ratios of bonds to stocks. In each case, the portfolios include at least 10 percentage points more in cash than is recommended for the aggressive portfolio. Thus, for the conservative and moderate portfolios, the short-sale constraint is not binding and, therefore, should not matter. The fact that the ratio of bonds to stocks declines as risk aversion falls remains a puzzle.

E. *Dynamic Portfolio Allocation*

Although the CAPM assumes that investors face a one-period planning problem, actual investors make decisions over many periods. If the set of investment opportunities were the same each period—that is, if asset returns were independently distributed over time—then the dynamic problem essentially would be the same as the one-period problem. Yet this condition does not hold. The real interest rate (the return on cash) is serially correlated. Moreover, stock returns are serially heteroskedastic: high volatility in one period predicts high volatility in future periods. Hence, the set of investment opportunities is not constant over time.

In a world in which the distribution of asset returns changes, investors should attempt to hedge their portfolios against adverse shifts in the asset-return distribution. For instance, Robert C. Merton (1973) considers the case in which the riskless rate is the single state variable determining the distribution of asset returns. In this case, rational investors should hedge movements in the riskless rate. Covariance with the riskless rate enters into the equilibrium prices of assets in a manner parallel to that of covariance with the market.

Can intertemporal hedging reconcile popular investment advice and financial theory? At this point we cannot offer a definitive answer. In principle intertemporal hedging of the sort discussed by Merton could point in the right direction. More risk-averse investors should hedge their portfolios against adverse movements in mean asset returns to a greater extent than do their more aggressive counterparts. Because downward shifts in real interest rates both worsen the investment opportunity set and lead to positive returns for bondholders, intertemporal considerations provide a reason for more risk-averse investors to hold a greater proportion of their portfolio in bonds. Unfortunately, the magnitude of this effect is not evident a priori, and the empirical literature on intertemporal hedging lags far behind the theoretical literature.

To incorporate the dynamics of asset returns in an empirically tractable way, we follow an approach used by Stanley Fischer (1983). We suppose that the investor faces a one-period problem but that the investor's time horizon exceeds one year. Varying the time horizon changes the variance-covariance matrix of returns and, therefore, the optimal portfolio implied by the CAPM. It thus takes into account the changes in the distribution in returns over time that are the essence of the intertemporal-hedging problem. In particular, because bill returns are positively serially correlated, cash looks relatively more risky over longer time horizons.

To see whether a longer time horizon might resolve our puzzle, we calculated the mean-variance efficient portfolios based on the distribution of returns for five- and ten-year returns. Although varying the time horizon does indeed affect the composition of optimal portfolios, over each horizon the ratio of bonds to stocks *increases* with the overall riskiness of the portfolio. Figure 1 shows the results for the five-year horizon. It appears impossible to reconcile the advice of financial advisors with the textbook CAPM by changing the time horizon.[1]

[1] The Fischer problem that we have solved is similar to the Merton problem discussed earlier, but it is not exactly the same. There are, however, substantial obstacles to implementing the full Merton solution. Second moments as well as first moments of asset returns appear to change

F. *Nontraded Assets: Human Capital*

The mutual-fund separation theorem is based on the assumption that all assets are traded. Yet much wealth is not traded as readily as stocks and bonds. Human capital—the present value of future labor earnings—is probably the most important nontraded asset. If investors hold nontraded assets and care about their total return, the optimal quantities of traded assets will reflect their covariances with nontraded assets.

The existence of human capital potentially can explain popular advice on portfolio allocation. The key condition is that human capital be more similar to stocks than to bonds. To see why, consider a simple example. Imagine that every investor holds a certain amount of human capital. Also imagine that human capital has exactly the same return as stocks. In this case, human capital is just another name for stock. For all investors to hold risky assets in the same proportion, as the mutual-fund separation theorem dictates, the following ratio must be constant:

$$\frac{\text{BONDS}}{\text{HUMAN CAPITAL} + \text{STOCKS}}.$$

Investors who are more willing to take on risk would reduce their cash position and increase the numerator and denominator of this expression by the same proportion. But, since the amount of human capital is fixed, the amount of stock must rise proportionately more than the amount of bonds. The ratio BONDS/STOCKS would, therefore, be lower for these investors.

To evaluate whether human capital can, in fact, explain popular advice on portfolio allocation, one would need to measure the return on human capital and compute the covariance with other assets. Moreover, if preferences are not quadratic, one would need to take into account that each person's human capital generates a large amount of idiosyncratic risk that cannot be diversified through markets. Such an exercise is beyond the scope of this paper.

Yet, for two reasons, we are skeptical that the existence of human capital can explain popular advice on portfolio allocation. First, it is not obvious that human capital is similar to stock. Because the labor share of national income is fairly constant, labor earnings—the aggregate dividends on human capital—are highly correlated with measures of the business cycle. Both interest rates and stock prices have some predictive value for the business cycle. Therefore, the implicit return on human capital is probably correlated with both stock and bond returns.

Second, if human capital were an important consideration behind popular advice, a natural conclusion would be that individuals who hold more human capital (young people) should hold a smaller fraction of their traded portfolio in the form of stocks. Yet, as noted earlier, this is exactly the opposite of conventional wisdom among popular financial advisors. Young people, because of their long investment horizons, are counselled to hold a higher fraction of stocks than are the elderly.[2]

G. *Nontraded Assets: Nominal Debts*

Another important nontraded asset for many investors is debt, such as mortgages and student loans. These debts are often long term and nominal. Therefore, they represent a short position in bonds. If these debts are taken into account, then the investor should hold the following ratio constant to satisfy the mutual-fund separation theorem:

$$\frac{\text{BONDS} - \text{DEBT}}{\text{STOCKS}}.$$

over time, and these changes are not simply functions of the riskless rate. To develop an empirically realistic model of intertemporal hedging, one would need to identify a small number of state variables that determine the distribution of asset returns. Campbell's (1987) results suggest that identifying such a set of variables is difficult. Further consideration of intertemporal hedging appears to be a fruitful direction for further research.

[2] There are, of course, other differences between young people and old people beyond the fact that the young have more human capital. Zvi Bodie et al. (1992) point out that the young have greater flexibility in their labor supply and, as a result, might be more tolerant toward risk. They use this observation to explain the Samuelson puzzle that the young are advised to hold riskier portfolios than are the old. Extending their analysis to consider the allocation among risky assets, so that it could then address the puzzle documented here, is a possible avenue for future research. We conjecture that if human capital is like stock, then the young in such a model would be advised to hold less cash than the old, but a higher ratio of bonds to stocks.

Investors more willing to accept risk would proportionately increase both the numerator and denominator of this expression. If DEBT is held constant, then BONDS/STOCKS would be lower. Thus, the existence of nominal debt can potentially explain popular advice.

Yet we doubt that this explanation is the right one. First, it cannot explain the advice that the young hold more stock than the old. Since the young have more debt, the opposite should be true. Second, if the existence of nominal debt were important for popular advice, the advice should be different for homeowners and renters, as well as for those with fixed-rate mortgages and adjustable-rate mortgages. (Adjustable-rate mortgages are more like a short position in cash.) Yet popular advice does not seem to take account of these differences among investors.

IV. The Costs of Nonoptimization

An assumption that underlies almost all models in economics, including the CAPM, is that people optimize perfectly. That is, people are assumed to choose the exact values of the variables under their control that maximize their objective function. Yet, as George A. Akerlof and Janet L. Yellen (1985) emphasize, small deviations from optimal settings result in only second-order losses. Therefore, one should not be surprised to see behavior that is only "near rational." In this section, we ask whether near rationality can help explain the observed discrepancy between the prediction of the mutual-fund separation theorem and popular advice on portfolio allocation.

Near rationality on the part of investors can take two forms: selection of a portfolio that is off the mean-variance efficient frontier, and selection of a portfolio that is at the wrong point on the frontier. An observer who does not know the investor's preferences toward risk can only detect the first type of error. Here we assume that the CAPM without a riskless asset is the right model and ask how far the recommended portfolios are from the efficient frontier.

When the means and variances of the recommended portfolios are compared to the mean-variance efficient frontier, the results are surprising. Although the asset allocations of some of the recommended portfolios look quite different from efficient portfolios, the cost of nonoptimization is small. For example, the most inefficient recommended portfolio is the conservative portfolio of Fidelity Investments (Mark, 1993) and Quinn (1991). Yet even this portfolio is only 22 basis points, or 0.22 percent, off the efficient frontier. All the other portfolios were even closer to the frontier. Thus, even if the portfolio recommendations of popular advisors are not fully rational, they appear nearly rational.

To gauge the magnitude of this deviation from the efficient frontier, one can compare it to investors' other costs. One such cost is the annual expenses associated with mutual funds. As John C. Bogle (1994) reports, the average stock mutual fund has annual expenses of 150 basis points. Moreover, the difference in expenses between high-cost and low-cost mutual funds is over 150 basis points. Thus, relative to the other costs facing investors, the cost of being away from the efficient frontier is small.

One might be tempted to conclude that because the recommended portfolios are close to optimal, there is no puzzle to be explained. Yet, for several reasons, this conclusion is not satisfying. First, although near rationality might explain why an investor would not bother to rebalance a portfolio that is off the efficient frontier, it cannot explain the recommendations of popular advisors who assume that investors begin with a clean slate. Second, if popular advisors recommended some rule of thumb that was almost optimal, one might conclude that they were optimizing subject to the constraint that their advice be simple. But popular advice is, in fact, less simple than the advice given by the mutual-fund separation theorem. Third, popular advice differs from theory in a consistent way. Appealing to near rationality does not explain why the deviation from full optimality is so systematic.

V. Conclusion

In this paper we have treated the recommended portfolios of financial advisors as data that any theory of portfolio allocation must

confront. These data exhibit a pronounced regularity: those portfolios with a high proportion of stocks have a small ratio of bonds to stocks. This regularity is noteworthy because it contradicts the predictions of the textbook mutual-fund separation theorem.

The purpose of this paper has been both to document this regularity of popular advice on portfolio allocation and to attempt to explain it. In the end, we must conclude that explaining popular advice is difficult using models of fully rational investors. The loss from the apparent failure of optimization, however, is not very great. In particular, although popular advice on portfolio allocation is below the efficient frontier, investors who follow the advice lose at most 22 basis points of return.

The failure of popular advice to match the predictions of economic theory is hardly the only puzzle in financial economics. Lack of diversification by many investors, for example, also is an important puzzle. Yet the failure of advice, as opposed to behavior, strikes us as particularly surprising. Financial decisions are widely viewed to be difficult to make, and advisors are experts who are trying to help people optimize. That the advice being offered does not match economic theory suggests that our understanding of investor objectives (as opposed to their ability to reach those objectives) is deficient.

Although we have not been able to explain popular advice within a rational model, it is possible that others will succeed where we have failed. Our results here indicate that the absence of a riskless asset and simple deviations from mean-variance preferences are unlikely to help resolve the puzzle. By contrast, it is harder to evaluate the roles of intertemporal hedging and nontraded assets. It is also possible that nonstandard preferences may help explain popular advice. Developing portfolio models that include these features and that are simple enough to implement empirically remains a challenge for future research.

REFERENCES

Akerlof, George A. and Yellen, Janet L. "Can Small Deviations from Rationality Make Significant Differences in Economic Equilibria?" *American Economic Review*, September 1985, *75*(4), pp. 708–21.

Bodie, Zvi; Merton, Robert C. and Samuelson, William F. "Labor Supply Flexibility and Portfolio Choice in a Life Cycle Model." *Journal of Economic Dynamics and Control*, July/October 1992, *16*(3/4), pp. 427–49.

Bogle, John C. *Bogle on mutual funds: New perspectives for the intelligent investor*. New York: Irwin, 1994.

Campbell, John Y. "Stock Returns and the Term Structure." *Journal of Financial Economics*, June 1987, *18*(2), pp. 373–99.

Campbell, John Y. and Hentschel, Ludger. "No News Is Good News: An Asymmetric Model of Changing Volatility in Stock Returns." *Journal of Financial Economics*, June 1992, *31*(3), pp. 281–318.

Canner, Niko; Mankiw, N. Gregory and Weil, David N. "An Asset Allocation Puzzle." National Bureau of Economic Research (Cambridge, MA) Working Paper No. 4857, September 1994.

Fidelity Investments. "Managing Risk in Today's Marketplace: A Long-Term Investment Perspective." *Special reports*, Boston, MA, 1994.

Fischer, Stanley. "Investing for the Short Term and the Long Term," in Zvi Bodie and John B. Shoven, eds., *Financial aspects of the U.S. pension system*. Chicago: University of Chicago Press, 1983, pp. 153–76.

Ibbotson Associates. *Stocks, bonds, bills, and inflation: 1993 yearbook*. Chicago: Ibbotson Associates, 1993.

Lintner, John. "The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." *Review of Economics and Statistics*, February 1965, *47*(1), pp. 13–37.

Mark, Larry. "Asset Allocation: Finding the Right Mix." *Fidelity Focus: The magazine for Fidelity investors*, Winter 1993, p. 11.

Merton, Robert C. "An Intertemporal Capital Asset Pricing Model." *Econometrica*, September 1973, *41*(5), pp. 867–87.

Mossin, Jan. "Equilibrium in a Capital Asset Market." *Econometrica*, October 1966, *34*(4), pp. 768–83.

O'Connell, Vanessa. "Life-Cycle Funds Simplify Investment Choices." *The Wall Street Journal*, 4 August 1995, p. C1.

Quinn, Jane Bryant. *Making the most of your money*. New York: Simon and Schuster, 1991, p. 489.

Rowland, Mary. "Seven Steps to Handling an Inheritance." *The New York Times*, 5 February 1994, p. 34.

Samuelson, Paul A. "Risk and Uncertainty: A Fallacy of Large Numbers." *Scientia*, April–May 1963, pp. 1–6.

_____. "The Judgement of Economic Science on Rational Portfolio Management: Indexing, Timing, and Long-Horizon Effects." *Journal of Portfolio Management*, Fall 1989, *16*(1), pp. 4–12.

_____. "The Long-Term Case for Equities and How It Can Be Oversold." *Journal of Portfolio Management*, Fall 1994, pp. 15–24.

Sharpe, William F. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." *Journal of Finance*, September 1964, *19*(3), pp. 425–42.

Underwood, Ron and Brown, Paul B. *Grow rich slowly: The Merrill Lynch guide to retirement planning*. New York: Viking, 1993, p. 257.