YALE
INTERNATIONAL
CENTER
FOR FINANCE

Yale ICF Working Paper No. 05-20

August 2005

Institutional Perspectives on Real Estate Investing: the Role of Risk and Uncertainty

William N. Goetzmann, Yale School of Management, Yale University

Ravi Dhar, Yale School of Management, Yale University

Institutional Perspectives on Real Estate Investing: the Role of Risk and Uncertainty[1]

Ravi Dhar, Yale School of Management
William N. Goetzmann, Yale School of Management

First draft: February 20, 2005
Current Draft: Tuesday, June 07, 2005

[1] Acknowledgements: We would like to thank the PREA for funding our proposal for research. We would like to thank Drew Haluska for able research and Greenwich Associates for implementation support. We particularly thank the respondents to our survey for their willingness to participate in this academic study.

Synopsis

In this paper we address the factors influencing the institutional decision to allocate resources to real estate. We survey a sample of major institutional investors via a web questionnaire. They answered questions about their target real estate allocation, their plans to increase or decrease their allocation, the major reasons for investing in real estate, and views on the major risks and relative expense of doing so.

Our major empirical findings are:

- Diversification and inflation hedging are given as the main reasons for investing in real estate.

- Liquidity risk, lack of reliable valuation data and risk of poor management are given as the main risks of real estate investing.

- Endowments have a relatively short history of real estate investment but are currently increasing their allocation to the asset class, more so than pension funds.

- The most important factors influencing the real estate asset allocation decision are statistical estimates of risk and return, advice from external consultants and long-term historical performance.

- The expected return of real estate is perceived as mid-way between U.S. stocks and bonds, and the expected risk of real estate is perceived as mid-way between U.S. Stocks and bonds.

- Investor comfort with extrapolation of past returns for real estate is significantly above that of other alternative investment vehicles such as hedge funds and venture capital.

- There is a strong relationship between the confidence of extrapolation and target allocation to real estate.

- There is a strong relationship between length of time the institution has invested in real estate and the comfort with extrapolating part returns.

We interpret these results as evidence that uncertainty as well as risk plays an important role in the decision about how much to allocate to real estate. We are puzzled, however by the scale of allocation to other alternative asset classes, given the high degree of uncertainty expressed by institutional investors with regards to the use of past historical returns as a guide to future performance.

I. Introduction

Institutional investors face a complex set of choices with respect to the composition and management of the investment portfolio. While modern portfolio theory provides a theoretical framework for this process, in practice, allocation decisions must be made in an environment of incomplete information, changing estimates of return, and shifting definitions of the risk of investment. Real estate presents a particularly interesting case for institutional investors. Not only have choices about investment vehicles expanded over the past two decades with the rise of REITs, but the secular trends in property returns – ranging from the credit crunch of 1990 to the boom in values in the early 2000's – have made long-term forecasts of risk and return somewhat challenging.

In this study, we focus on current institutional investor views about real estate as an asset class. In particular, we seek to understand the factors that determine an institution's allocation to real estate. Our approach is direct. We survey a large sample of major institutional investors via a web questionnaire. Investors in our sample were willing to answer an array of questions about their target real estate allocation, their plans to increase or decrease their allocation, the major reasons for investing in real estate and their views on the major risks and relative expense of doing so. They also provided us with information about their basic approach to portfolio allocation decisions, and how real estate fit into this approach.

Our findings from this survey not only tell us a lot about how investors view real estate as an asset class, but are instructive about the current state of the art in institutional asset allocation decision-making. In particular, consistent with modern portfolio theory, long-term estimates of risk and return are the driving factors in the investment decision process. Despite this, we found a strong trend among institutional managers towards increasing their real estate allocation. Interestingly, this trend that was more pronounced for those managers who felt relatively comfortable in relying on historical statistics about real estate returns. These basic findings lead us to some conjectures about the role of uncertainty – as opposed to risk -- in the investment decision process.

Risk is a statistical input that is clearly defined and easily handled by modern portfolio theory. However uncertainty is a lack of confidence about exactly what statistical inputs to use in the decision model. Our results suggest that uncertainty plays some role in decision-making. This is interesting from an academic perspective because it suggests that uncertainty can affect demand for assets and thus ultimately affect their price. It is important practically because it suggests that more complete information about the long-term performance of an asset class may actually help resolve uncertainty and affect institutional investor demand.

On the other hand, we find some results suggesting that investors are comfortable with high levels of uncertainty with respect to other asset classes -- particularly hedge funds and venture capital in particular. Although uncertainty appears to affect the choice about real estate at the margin, our survey finds that institutions as a whole are investing in some asset classes for which they are not generally comfortable using past results to

forecast future performance. We conjecture that alternative models, such as return-chasing or following industry leaders might explain the phenomenon.

The reminder of this paper is organized as follows. Section II will describe the process of data collection. Section III presents the results of the questionnaire. Section IV discusses and tests hypotheses about risk and uncertainty. Section V concludes.

II. Data Collection

As a preliminary to the development of the questionnaire, we conducted a series of interviews with leading real estate professionals. These included institutional managers, as well as consultants. The goal of these interviews was to understand the major issues confronting institutional investors with respect to real estate, and to ensure that the questionnaire reflected actual practice. The interviewees had a number of helpful insights about how real estate is treated in the investment decision-making process, the role of consultants and the basis for estimation of risk and return. These views were incorporated into the structure of the questionnaire.

We engaged Greenwich Associates to conduct the questionnaire on our behalf. The target audiences for the query were chief investment officers and real estate professionals at major public and private institutions. They were approached by E-mail regarding their willingness to participate in a research survey conducted by the authors. Their responses were collected via a website. They were not asked to identify themselves or their institution, but were asked some general information about the firm and their position. Approximately 1,500 E-mails were sent, and we ultimately collected 173 completed questionnaires, plus an additional 30 incomplete questionnaires with some prompting and additional communication helping to increase the sample size. As part of our communication, we promised to make the research paper resulting from the analysis available to the participants.

Table 1 summarizes the sample. Respondents identified the type of institution and the assets currently under management. Corporate pension plan sponsors are the largest group by number in the sample and public pension plan sponsors are the largest by assets, with more than one trillion dollars in late 2004 when the survey was conducted. Respondents also supplied their titles. One hundred twenty-two of the titles were indicative of a leading or at least a significant decision-making role in asset allocation policy. The largest group of these included 22 chief investment officers, but other respondents identified themselves variously as chief financial officers, directors of investments, treasurers or presidents. Twenty identified themselves as real estate specialists within the organization.

Table 1: Sample Size, Composition and Assets Under Management

	Responses	Complete	Assets (in $MM)
Endowment/Foundation	65	60	94,184

Corporate Pension	83	68	274,556
Public Pension	52	43	1,114,916
Union	2	2	1,310
Total	202	173	1,484,966

III. Questionnaire and Results

III.1 Real Estate Investment Policies

Questions 1 through 5 address the real estate investment policy specifically. We asked how long the institution has been invested in real estate, what form the investment takes, what the target allocation is, whether the institution is near its target, and whether they are planning to increase their allocation.

Question 1 (see figures below) indicates that a surprising number of institutions, nearly 60, do not invest in real estate at all. The distribution of funds who do invest in real estate is bimodal, with 35 investing in real estate less than three years, with most of the others investing more than 10 years.

Question 2 indicates that comingled funds and partnerships are the primary forms of institutional investment, however more than 60 funds reported they used real estate investment trusts [REITs]. Of those funds invested in real estate, replies to question 3 indicate that the modal allocation is 3%-5%, with 10% or more being extremely rare. The two major reported target allocations, reported in question 4 are 3%-5% and 7%-10%.

Despite these relatively low current allocations to real estate, a large number of funds said that they were somewhat below their target and planned to increase their allocations (Questions 5 and 7). In Question 7, for example, more than 30 funds reported plans to increase their allocations, while only two planned to decrease it. This provides an opportunity to not only investigate the stated reasons associated with a particular allocation, but also to understand the factors related to a change in position – in this case a recent increase.

Table 2: Cross-Tabulation of Investment in Real Estate vs. Type of Institution
Note: rows sum to 100%

	0 to 2 years	3 to 4 years	5 to 10 years	11 to 20 years	20+ years	No RE
Endowment/Foundation	0.328	0.069	0.207	0.172	0.052	0.172
Corporate Pension	0.121	0.045	0.106	0.182	0.136	0.409
Public Pension	0.088	0.059	0.059	0.441	0.176	0.176

Table 2 cross-tabulates the response of each category of investor by the length on investment in real estate. Endowments and foundations have the shortest average experience with the asset class. Thirty-three percent of this group has been invested less

than three years. The public pension plans have a fairly long-term experience with real estate. More than half have a greater than ten years of real estate investment history. Corporate pensions are the largest group with no real estate -- 41% are out of the asset class entirely.

Table 3: Cross-Tabulation of Plans to Increase Allocation vs. Type of Institution
Note: rows sum to 100%

	Increase	Decrease	Stay the Same	Uncertain
Endowment/Foundation	0.552	0.000	0.276	0.172
Corporate Pension	0.288	0.045	0.470	0.197
Public Pension	0.294	0.029	0.500	0.176

Table 3 reports the results of a question asking whether the institution is planning to increase or decrease allocation to real estate. It classifies results by type of institution, and scales the results into percentages for comparison. More than half of the endowments and foundations seek to increase their exposure to real estate, compared to less than 30% for the other two classes. None of the endowments or foundations are planning to decreasing real estate exposure. [2]

There are a number of theories that might explain the contrast between endowments vs. pension plans, ranging from differing liability structures, differing regulatory constraints, differing use of advisors and consultants -- even "cultural" differences in investment management. Although we do not often think of universities and endowments in a competitive framework, their level of activity relies significantly on their funds. The endowment community, for example, has regular surveys of peer allocations and practices, which might induce similar behavior. For universities, deviation from the allocation norm brings the potential for a relative increase in assets, but also the risk of a permanent negative shock to spending capacity.[3]

Regardless of the reasons for institutional differences, taken together, tables 2 and 3 suggest heterogeneity in the respondents with respect to experience with real estate as an asset class, and also with respect to plans to increase investment – endowments and foundations have less relative experience and are, as a group, planning to increase their investment.

III.2 Views on Real Estate Risk and Return

One set of questions directly solicited view on the benefits and risks of real estate investment and the factors influencing the decision to allocate to real estate. Question 8 asked for three top reasons for investing in real estate: diversification, cash generation,

[2] As a check of internal consistency we asked whether those planning to increase their allocation to real estate also reported being below their target allocation. The relationship was positive and highly significant.

[3] We were able to test the proposition that reliance on actions taken by industry peers or advice from external consultants might influence differences in the decision to increase allocation to real estate. Neither factor explained the decision to increase vs. the decision to stay the same or decrease allocation.

potential for capital gains, inflation hedging, long-term benefits or other. Diversification and inflation hedging are the leading reasons for real estate in the portfolio, as opposed to long term return or income generation.

Question 11 asks for the main risk factors associated with real estate investing. Liquidity risk, lack of reliable data and the risk of making a poor investment are the top three perceived risk factors. Contrary to what we might expect from a classical asset allocation model, the asset volatility was not regarded as a major risk factor. To look deeper into the perceived risks, and whether a different perception of real estate risk might explain non-participation in the asset class, we isolated the responses to question 11 for those who replied in question 1 that they were not in real estate at all. The distribution of responses was virtually identical.

Question 12 asks for the three main factors influencing the real estate investment decision. This considerable list, generated with the help of our interviewees, includes statistical estimates of risk and return, advice from internal staff, advice from external consultant, advice from other investors, economic forecasts, current market values of asset, recent trends in the market, long term historical performance, expected changes in the economic outlook, actions taken by industry peers, relative skill of external manager with this asset class. The top three of these are statistical estimates of risk and return, long-term historical performance and the relative skill of the external manager with the asset class. We asked the same set of questions about equity investment in question 13 and the distribution of responses was similar.

The responses to question 12 are largely consistent with modern portfolio theory. Portfolio theory stresses the long term historical performance and relies upon statistical estimates of risk and return. This framework is not exactly congruent with replies to question 12. The risk factor in the standard portfolio optimization model is quantified as asset volatility. Uncertainty about the inputs – i.e. lack of reliable data was more important to the respondents to question 11 than volatility, suggesting that uncertainty, as opposed to risk, might loom large as a determinant of allocation. We will examine this issue in greater depth later in the paper.

We cross-tabulated the "statistical estimates of risk and return" and "long term historical performance" responses with whether or not investors held real estate. For both responses there was a significantly significant negative relationship. Thus, being out of real estate is consistent with placing less emphasis on these two inputs to the allocation process.[4]

III.3 Relative Perceptions of Real Estate

The survey posed a number of questions about real estate compared to other asset classes. Many of these questions were in the form of a matrix that implicitly required relative ranking of risk and return among a broader set of asset classes. Question 9 asked "Based

[4] Chi-squared for "Statistical Estimates of Risk and Return" = 4.7215, df = 1, p-value = 0.02979. Chi-squared for "Long Term Historical Performance" = 8.3748, df = 1, p-value = 0.003805.

on the scale below, how does the long-term expected return, for the real estate component in your portfolio, compare with the long-term expected return for the following asset classes in your portfolio?" Table 4 reports the results. Most managers believe real estate has an expected return a little above fixed income and a little less than equity. They expect hedge funds and absolute return strategies to return about the same, and private equity, venture capital and emerging markets to returns are expected to be a little greater or significantly greater. The last row in the table reports frequencies of the "I don't know" response which can be interpreted as not having a clear expectation of the relative return of real estate with respect to the given asset class. For the standard asset classes – stocks and bonds – this was an infrequent response. For the alternatives, "I don't know" was much more common. Nearly 40% of respondents could not rank the relative return of real estate vs. hedge funds. It is of potential interest that they did not take a Bayesian approach to this and rank the expected returns about equal, which was the next highest frequency count. Given the contrast between the results for stocks and bonds and the results for the last three asset classes, one interpretation of table 9 is that there is a high degree of uncertainty about the expected returns to alternatives.

Table 4: Responses to Question 9, Relative Expected Return[5]

	Equity	Fixed	Hedge/AR	PE/VC	EM
ER of RE significantly less	6.4%	1.7%	4.0%	30.1%	24.3%
ER of RE Little less	42.2%	4.6%	16.8%	31.8%	34.1%
ER of RE same	22.5%	5.8%	24.3%	7.5%	6.9%
ER of RE little more	15.0%	55.5%	13.3%	1.7%	4.6%
ER of RE significantly more	1.7%	20.2%	2.3%	0.6%	0.6%
Don't know	12.1%	12.1%	39.3%	28.3%	29.5%

Table 5 represents the relative ranking in terms of risk. These responses are broadly similar to the relative ranking of expected returns – and reflect equilibrium expectation that higher expected return compensates for higher risk. Interestingly, the "don't know" response for risk is less frequent for all asset classes. From a statistical perspective this is consistent with the idea that risk can be better estimated over shorter horizons than expected return.

Table 5: Responses to Question 10, Relative Risk

	Equity	Fixed	Hedge/AR	PE/VC	EM
ER of RE significantly less	11.6%	2.3%	9.8%	42.8%	41.0%
ER of RE Little less	49.1%	11.0%	30.6%	30.6%	31.2%
ER of RE same	21.4%	14.5%	18.5%	5.8%	5.2%
ER of RE little more	11.0%	54.3%	13.3%	1.2%	1.2%
ER of RE significantly more	0.6%	11.0%	3.5%	2.3%	1.7%
Don't know	6.4%	6.9%	24.3%	17.3%	19.7%

[5] A statistical test of responses to question 9 rejects the null significantly: Chi-squared = 2.94, df=20, p-value=1.

Our interviews suggested that the relative management cost of real estate vs. other assets might be an important factor in the decision to invest in the asset class. Question 14 asks about the relative cost of managing various asset classes. The general result is that real estate is perceived as more costly to manage than stocks and bonds but less costly than other alternative asset classes. An important caveat is that "I don't know" was the most frequent response in comparing the costs of real estate to alternatives.

Table 6: Responses to Question 14 Relative Cost

	Equity	Fixed	Hedge/AR	PE/VC	EM
ER of RE significantly less	4.6%	6.4%	15.0%	21.4%	4.6%
ER of RE Little less	7.5%	4.6%	20.8%	23.7%	15.6%
ER of RE same	12.7%	5.8%	15.0%	18.5%	22.0%
ER of RE little more	38.7%	23.1%	4.6%	0.0%	19.7%
ER of RE significantly more	17.3%	41.0%	0.0%	1.7%	2.9%
Don't know	19.1%	19.1%	44.5%	34.7%	35.3%

Absent any difference in relative cost, the estimates for real estate in tables 4 and 5 should put it roughly between stocks and bonds in mean-standard deviation space. This does not mean that it would dominate the optimal portfolio for its level of risk, however. It is conceivable that a very low correlation between stocks and bonds, together and a high correlation between stocks and real estate could lead to a small real estate allocation among optimal portfolios. We did not directly ask about correlation to other asset classes, but the single largest categorical response to question 8, which asked for the primary reasons to invest in real estate, was diversification, which implies an expectation of low correlation between real estate and other assets in the portfolio. Taken together, the results of the questionnaire responses about relative risk and return appear inconsistent with the reported low allocation to real estate in the survey – at least if their portfolio choice is based upon modern portfolio theory and the classical approach of estimating statistical inputs, constructing an efficient set of portfolios and investing in one of these that best suits the risk preferences of the institution.

What factors might explain this apparent contradiction? First, allocation might not be based on modern portfolio theory. Second, additional factors affecting risk and return estimates – such as the higher relative cost of real estate reported in table 6 or the liquidity risk and risk of poor management mentioned in question 11, might explain the low relative allocations. Allocations might instead be based upon other factors such a peer group allocations, or the relative recent performance of asset classes. Consistent with this notion is that real estate has done well relative to stocks and bonds recently, and a number of institutions report investing in the asset class only recently, and there is a clear trend in the responses towards increasing real estate exposure. This behavioral explanation is certainly worth considering, however the respondents in the survey are the clearly among the leading professionals in the investment management business – this would not be the natural group to look for casual, biased or irrational decision-making. Another explanation we explore in the paper is whether uncertainty itself might play a role in the allocation choice. This is the topic of the next section of the study.

IV. Uncertainty and Decision-Making

The application of modern portfolio theory – as developed by Harry Markowitz -- is almost mechanical once all of the parameters of the asset return distributions are known, however, in practice, the investor is faced with considerable uncertainty about the true underlying return-generation process. The uncertainty is chiefly about whether past performance in a particular asset can be relied upon to provide meaningful inputs to the investment process. More broadly, the investor faces uncertainty about the general set of distributions that may characterize a particular asset. For example, are the statistical parameters estimable from historical data, or are they changing and evolving through time? How does survival bias affect the statistical inputs? Is there a significant potential of market failure for the asset. Will covariances suddenly shift? These questions form the very real backdrop of institutional investor choice, and yet the Markowitz model is largely silent on these issues.

IV.1 Background

Economists have recently become interested in modeling investment decision-making under the broader context of uncertainty. In 1986, Bewley revived interest in Frank Knight's 1921 study *Risk, Uncertainty and Profit* as a framework for studying economic choice. Bewley reformulated Knight's general distinction between risk and uncertainty into an explicit model of economic decision-making in a setting in which the agent does not know which distribution of risky outcomes he or she confronts. He found in this context that investors were prone to inertia – the tendency to remain with the *status quo* choice. He conjectured that this "Knightian" uncertainty might even explain the gross under—diversification observed among individual investors.

Most of the work on Knightian uncertainty since Bewley's study has focused on refining the definition of uncertainty and on predicting its effects on decision-making under uncertainty. Asano (2004) finds support for the conjecture about investor inertia or unwillingness to invest beyond a current set of assets. Epstein and Schneider (2002), show how uncertainty can lead to non-participation in a market. Epstein and Wang (1994) show how uncertainty might explain excess volatility of security prices and a high equity premium. Routledge and Zin (2001) argue that uncertainty explains liquidity crises in financial markets. Walden (2004) shows how uncertainty – as opposed to risk – can lead to high investment hurdle rates and under-investment in a setting in which decisions are irreversible. The most general conclusion one can draw about decision-making under uncertainty is that it can cause the prices paid for assets to deviate significantly from economic value, and can cause risk-taking behavior to appear irrational when measured against the classical framework.

All of the papers above are theoretical studies of uncertainty. There have been only a few tests of uncertainty effects in the laboratory setting and virtually no examination of uncertainty effects in an industrial setting. In the laboratory, Camerer and Kunreuther (1989) and Di Mauro and Maffioletti (2001) run experiments with small payoffs and

multiple sessions and find that repetition and learning can bring subjects to treat uncertainty as risk. In an industrial setting, Lensink, van Steen and Sterken (2000) survey Dutch firms and find a relationship between uncertainty and an aversion to invest in projects. This paucity of information about uncertainty and its effects on investment make it a potentially interesting topic to include in a questionnaire to leading investment managers.

Psychological research on individual behavioral decision making under uncertainty also has some potentially useful predictions. Recent evidence demonstrates that the underestimation of uncertainty is moderated by the level of knowledge of the assessor (Kruger 1999). In other words, while individuals on average often believe they have superior skill is a certain domain, there are other domains in which they believe they are worse than average. This effect would predict that institutions with less experience in an asset class might under-invest because of a perceived disadvantage – and their perceptions may or may not be accurate.

The asymmetry between funds that are planning an increase in their allocation compared to a decrease can also be viewed in terms of the anchoring process. Experimental studies suggest that people often form judgments by adjusting from an initial estimate, and since these adjustments are typically insufficient, this procedure should lead to underestimation. The anchoring and adjustment heuristic was proposed by Tversky & Kahneman (1974) as a cognitive rule that captures how many judgments under uncertainty are made. Although this survey focuses on the behavior of institutions, their choices are a result of the cognitive processes of individual decision-makers.

Specifically, cognitive theory would suggest that investors may determine future allocation by initially anchoring on their current allocation. In this sense, the current allocation is conceptually a safe harbor and become the benchmark from which the institution deviates as new information becomes available, and the yardstick by with the magnitude of deviation is measured. Thus, if the initial allocation were 3%, then a 6% allocation would be regarded as a fairly extreme deviation from policy – a doubling of exposure. Evidence from behavioral studies suggests that the more complex the task, the stronger the anchor on the status quo. The greater the uncertainty about the inputs tothe allocation process, and the greater its complexity cognitive theory would predict that adjustments away from the current allocation would tend to be insufficient.

Finally, economists modeling institutional behavior as opposed to individual behavior are able to make predictions about the conditions under which the status quo strategy will be preserved. In particular, Hirshleifer and Welch (2002) model the organization as distinct from the manager. As the institutional memory for why a decision was originally made fades with the disappearance of people from the organization, remaining managers have a strong bias towards the status quo in a steady economic environment, although in a volatile environment they might exhibit impulsiveness. The documented relationship between length of time in real estate and the intent to change allocation might thus reflect an institutional model as opposed to a model of individual investor decision-making.

IV.2 Questions Related to Non-Statistical Risk and Uncertainty

While we cannot hope to test the entire range of theories about decision-making under uncertainty, our questionnaire provides some potential basis for investigating at least two key facets. Of the three primary risk factors identified by our subjects about real estate investing, two relate to uncertainty about asset valuation and price efficiency and one relates to uncertainty about historical estimates of risk and return.

IV.2.1 Efficiency

Liquidity risk is the risk that you cannot sell the asset for what it is worth –i.e. its economic value -- when you need to. The risk of making a bad investment is the risk that you pay too much for a property. Both of these relate to the efficiency of the market. Question 16 asks about the relative efficiency of the major asset classes. It states, "'One definition of an efficient market is a market in which the price of an asset is highly likely to be equal to its economic value. By this measure, and based on the following scale, how does the efficiency of the real estate market compare to the following asset classes?"

Table 7: Responses to question 16: Relative Efficiency of Asset Classes

Real estate is:	EQ	FEQ	EM	Debt	HY	Com
Substantially less Efficient	22.5%	11.0%	4.6%	28.3%	5.8%	11.6%
Somewhat less	30.6%	34.7%	18.5%	33.5%	31.2%	20.8%
About as	17.9%	16.8%	16.2%	21.4%	30.1%	14.5%
Somewhat more	15.0%	20.2%	29.5%	2.9%	13.9%	15.6%
Substantially more Efficient	4.0%	4.6%	13.9%	2.9%	2.3%	3.5%
Don't know	9.8%	12.7%	17.3%	11.0%	16.8%	34.1%

The responses place real estate somewhere between emerging markets and high yield debt in terms of efficiency. Real estate is perceived as substantially or somewhat less efficient than U.S. Equities, Foreign Equities and Fixed Income. The most common response for commodities was "don't know". To test whether views of real estate efficiency influenced the target allocation to the asset class, we took the relative efficiency to emerging markets (as well as High Yield) as potentially salient and tested the relationship. We found a positive but statistically marginal co-variation in these two tests.[6]

IV.2.2 Uncertainty

To address the issue of uncertainty regarding statistical estimates – our closest analogue to Knightian uncertainty -- we ask about the level of comfort in extrapolating future performance from historical performance. Question 15 states: "Based on the scale below, for which of the following asset classes are you most comfortable extrapolating future

[6] Emerging markets: Chi-squared = 21.415, df = 15, p-value = 0.1241. High Yield: Chi-squared = 22.367, df = 15, p-value = 0.09854.

performance from historical performance?" Responses were on a five point scale from "Least Comfortable" to "Most Comfortable" as well as "Don't Know." Besides real estate, we asked about U.S. equities [EQ], foreign equities [FEQ], emerging markets [EM], fixed income [Debt], high yield debt [HY], commodities [Com], hedge funds [HF] and venture capital [VC]. Respondents were most comfortable with extrapolating the performance of U.S. equities and fixed income from historical performance and least comfortable with extrapolating the performance of hedge funds, commodities and venture capital. Real estate was closer to stocks and bonds than other alternatives – investors were slightly more comfortable with historical data from real estate that from high yield debt and foreign equities. As with previous results, the "don't know" response was common for many kinds of alternatives.

Table 8: Question 15, Tabulation of Extrapolation Comfort

	Least con	2	3	4	Most con	Don't know
RE	9.8%	15.0%	30.1%	30.6%	4.0%	10.4%
EQ	10.4%	15.0%	26.0%	29.5%	14.5%	4.6%
FEQ	11.6%	26.6%	27.2%	24.3%	4.0%	6.4%
EM	22.5%	35.3%	19.7%	11.6%	0.0%	11.0%
Debt	8.1%	11.0%	27.7%	31.2%	16.8%	5.2%
HY	13.9%	20.2%	33.5%	21.4%	1.2%	9.8%
Com	27.2%	21.4%	15.6%	7.5%	0.0%	28.3%
HF	34.7%	21.4%	15.0%	4.0%	0.0%	24.9%
VC	26.0%	27.2%	21.4%	4.6%	0.0%	20.8%

The striking evidence in Question 15 is the uncertainty associated with hedge funds, venture capital and commodities. Most recent surveys of institutional investors report a significant allocation to hedge funds. It is difficult to reconcile this with our questionnaire evidence. Given that our study finds that modern portfolio theory is the basis for asst allocation, it is difficult to see how more than 60% of the investors in our survey scored hedge funds in the "least comfortable" or "Don't know" category.

To look at the relationship between comfort and allocation *within* an asset class, we test ed whether the comfort of extrapolation is associated with allocation to real estate. We cross-tabulated allocation with the responses to question 15. These are reported in table 9. It shows clearly that, despite the fact that managers were relatively confident about real estate as opposed to other alternative asset classes, table 9 indicates a strong relationship between confidence of extrapolation and target allocation. Thus – *at the margin*, uncertainty matters, however the informational basis for large-scale decisions about asset classes remain somewhat of a puzzle.

Table 9: Tabulation of Target Allocation to Real Estate With Comfort of Extrapolation.[7]

Allocation	Least con	2	3	4	Most con	Don't know
0-1	18.4%	18.4%	20.4%	14.3%	0.0%	28.6%
1-5	8.0%	20.0%	40.0%	24.0%	2.0%	6.0%
5-9	5.9%	5.9%	29.4%	52.9%	2.9%	2.9%
>9	5.0%	12.5%	30.0%	40.0%	12.5%	0.0%

Table 9 suggests that one of two things is going on – either investors base their allocation decision about real estate on the degree of certainty about the statistical inputs to the optimization process, or else they are justifying their relatively high allocation *ex post* by claiming to be more confident. The latter explanation is less persuasive given the overall low allocation to real estate by the institutions in the sample – although they are likely to all be aware of peer allocations and their relative position.

A measure related to confidence about the performance of real estate may be the direct experience the fund has had with the asset class. We cross-tabulated this variable as well.

Table 10: Tabulation of Years Invested in Real Estate With Comfort of Extrapolation.[8]

Years	Least.com	2	3	4	Most.com	Don't know
0-2	18.2%	9.1%	29.1%	20.0%	0.0%	23.6%
3-4	5.7%	24.5%	34.0%	26.4%	3.8%	5.7%
5-10	3.7%	14.8%	25.9%	44.4%	7.4%	3.7%
11-20	9.7%	9.7%	25.8%	45.2%	6.5%	3.2%
20+	0.0%	14.3%	42.9%	28.6%	14.3%	0.0%

Table 10 shows a strong relationship between length of time invested in RE, however it is non-linear. For those invested less than 10 years in RE, the comfort level with extrapolation is 3. For those between 11 and 20 years, the comfort level is 4. For those over 20 years, comfort level is 3. This might be a sign that 1980's boom and crash affected trust in historical data inputs for institutions lived through the experience.

Closely related to uncertainty about the distribution is the expectation of a crash in asset prices – in statistical terms "tail" event risk. In question 17 we asked: 'In your opinion, and based on the scale below, how likely is it that you will experience a "crash" in values of the following asset classes in the next 10 years? (A "crash" is defined as a decrease in values of more than 30%.).

[7] The Chi-square test of independence of rows and columns is rejected with a high degree of confidence. Chi-squared = 55.4947, df = 15, p-value = 1.474e-06.

[8] The Chi-square test of independence of rows and columns is rejected with a high degree of confidence. Chi-squared = 37.8769, df = 20, p-value = 0.009167.

Table 11: Question 17: Crash Likelihood in the Next 10 years

A Crash is:	Real Estate	U.S. Equities	Fixed Income
Not at all likely	2.9%	1.7%	13.9%
Not too likely	45.7%	30.6%	50.9%
Somewhat	28.3%	43.9%	20.2%
Very	10.4%	13.9%	5.2%
Extremely	1.2%	0.6%	0.0%
Don't know	11.6%	9.2%	9.8%

Equities are regarded as having the highest likelihood of a crash in the next decade, with the median answering "somewhat likely" and nearly 14% regarding the event as very likely. In contrast, both real estate and fixed income score lower on crash likelihood, with the median response being not too likely. To test whether crash assessment is associated with investment in real estate, we cross tabulated this variable with target allocations. There was a negative and statistically significant relationship between crash assessment in real estate and investment in real estate.[9]

It is interesting to note that judgments of low probability events such as crashes are rarely based on complete data but rather what is available. In particular, investment decisions require investors to take into account worst case scenarios, such as bubbles and crashes. Research in judgment and decision making finds that certain type of information is over-weighted in making judgments of events relative to other data. In particular, investors are likely to estimate the likelihood of such an event from the ease of recalling instances. Furthermore, investors who recall the real estate crash relatively easily are more likely to be averse to investing in the real estate market even though the future occurrence of the event is unlikely. Since availability is affected by factors other than probability, the reliance on availability leads to potential bias against investing in real estate.

V. Conclusions

In this study we have collected information about the real estate allocation choices, beliefs and viewpoints of a set of the nation's leading investment managers. The results of this questionnaire provides a rare glimpse into the framework used to evaluate the relative attractiveness of real estate as an asset class. First, we identified significant institutional differences in the sample – endowments and foundations have a relatively short history of real estate investing and are more likely to be shifting towards the asset class.

Our investigation of the asset allocation process gave interesting results. There is strong evidence to suggest that modern portfolio theory forms the general basis for the asset allocation decision – statistical risk and return estimates and long term performance are the major determinates of the allocation decision. Our respondents located real estate between stocks and bonds in both dimensions. They regarded the costs associated with real estate investing as relatively high compared to stock and bond portfolios.

[9] Chi-square = 25.4751, df = 15, p-value = 0.04392

One of the main goals of this study was to explore the potential role of a broader range of risk and uncertainty measures in the investment decision-making process – particularly with regard to real estate in the institutional portfolio. By focusing on investors' perceptions about what they don't know, we sought to test some hypotheses about the influence uncertainty and multi-dimensional risk.

The potential relevance of uncertainty is immediately evidence from many of the questionnaire results. In many questions, we observed significant differences in the "I don't know" response with regard to views on various asset classes. This alone suggests a heterogeneity in uncertainty about the statistical distribution of returns.

In our asset-class questions, we including the risk of the asset selling for a price different than its economic value (characterized as inability to sell at the right price and risk of buying at the wrong price), a Knightian uncertainty variable capturing uncertainty about the extrapolation of historical performance, and a measure of extreme negative events – a crash likelihood. The results of our tests are suggestive of the relevance of both uncertainty and efficiency. We found positive but insignificant association between efficiency measures and allocation, positive and significant association between historical extrapolation confidence and allocation, and marginal (but significant) evidence of a negative relation between crash risk and allocation to real estate.

These are potentially interesting relationships between beliefs and decision-making under uncertainty, although we cannot infer causality from these associations. There is considerable behavioral evidence that people adjust beliefs to match actions rather than vice-versa. If this is true, then perception follows action, rather than vice-versa. Given the strong trend into real estate, it would thus be interesting to track the evolution in beliefs about the asset class conditional upon past choice.

While the results in our paper reveal factors influencing the allocation to real estate, the overall logic of portfolio allocation to assets other than stocks and bonds remains somewhat of a mystery. Although we find that investors rely heavily on statistical inputs for the allocation decision, they are least comfortable with using past returns to extrapolate performance of hedge funds, venture capital and commodities. This evidence is clearly in conflict with the dramatic increase in hedge fund and venture capital allocations by institutional investors over the last market cycle. Alternative motives such as return-chasing and following the industry leader must be considered as alternative explanations for the data.

References

Asano, Takao, "Portfolio Inertia and Contaminations" (June 2004). ISER Discussion Paper No. 610. http://ssrn.com/abstract=562621

Basili, Marcello, "Knightian Uncertainty in Financial Markets: An Assessment" (February 2000). University of Siena, Department of Economics, WP No. 281. http://ssrn.com/abstract=237279

Bewley, Truman F., 1986, ”Knightian Decision Theory - Part I,” Cowles Foundation Discussion Paper No. 1053.

Camerer, Colin F., and H. K. Kunreuther. 1989. “Decision Processes for Low Probability Risks: Policy Implications." *Journal of Policy Analysis and Management*, 8, 565-92.

Di Mauro, Carmela and Anna Maffioletti, 2001, “Reaction to Uncertainty and Market Mechanisms: Experimental Evidence, “working paper, Mannheim University,

Dow, J., and S. da Costa Werlang, 1992, Ambiguity Aversion and Incompleteness of Financial Markets, *Econometrica* 60, 197–204.

Epstein, Larry and Martin Schneider, 2002, "Learning Under Ambiguity" Working paper, http://ssrn.com/abstract=344920.

Epstein, Larry G. and Tan Wang, 1994, "Intertemporal Asset Pricing Under Knightian Uncertainty," *Econometrica*, Econometric Society, vol. 62(2), pages 283-322.

Hirshleifer, David and Ivo Welch, 2002, “An Economic Approach to the Psychology of Change: Amnesia, Inertia, and Impulsiveness.” *Journal of Economics and Management Strategy* 11-3, 379-421.

Knight, F.H., 1921, *Risk, Uncertainty and Profit*, Houghton Mifflin, Boston.

Kruger, J.,1999, “Lake Wobegon be Gone! The ‘Below-Average Effect’ and the Egocentric Nature of Comparative Ability Judgments.” *Journal of Personality and Social Psychology*, 77, 221-232.

Lensink, Robert, Paul van Steen, Elmer Sterken, 2000, “Uncertainty and the Growth of the Firm”, University of Groningen, CCSO Centre for Economic Research in its series CCSO Working Papers.

Routledge, Bryan R. and Zin, Stanley E., 2001, "Model Uncertainty and Liquidity" Working paper, http://ssrn.com/abstract=302485.

Tversky, Amos. And Daniel Kahneman, 1974. “Judgment Under Uncertainty: Heuristics and Biases. “ *Science*, 185, 1124-1131.

Walden, Johan, 2004, "Real Investments under Knightian Uncertainty" Yale ICF Working Paper No. 04-08. http://ssrn.com/abstract=509643.

How Investors Think About Real Estate

October 11, 2004

Introduction:

Thank you for taking the time to complete this online survey. Your feedback is integral to our academic research in understanding how institutional investors conceptualize risk and return for various asset classes. Specifically, we want to uncover why real estate is such a limited part of most institutional portfolios?

Your answers will remain strictly confidential and will be used for research purposes only. The survey should take about 10 minutes to complete.

Thank you again for your time.

Professors William Goetzmann and Ravi Dhar
Yale School of Management

1. How long has your institution invested a significant portion of its portfolio in real estate?

a) 0 – 2 years
b) 3 – 4 years
c) 5 – 10 years
d) 11 – 20 years
e) 20+ years
f) We do not invest in real estate.

2. Which of the following is the method most frequently used by your institution to invest in real estate? (Pick more than one if needed.)

a) None
b) REITs
c) Separate, managed accounts
d) Co-mingled real estate fund
e) Partnerships
f) Sole, direct investment
g) Other

3. What % of your assets are currently held in real estate?

____ ____ ____%

4. What, if any, is your target allocation to real estate?

____% of total portfolio assets

5. Over the next 2-3 years, do you expect to increase or decrease your assets allocated to real estate?

a) Increase
b) Decrease
c) Stay the Same
d) No Answer
e) Uncertain

6. Why do you expect an increase/decrease/no change? (Open-ended question)

7. On a 5-point scale, with 1 being "Much Below," and 5 being "Much Above," are you at, above or below your target allocation?

1	2	3	4	5	
Much below	Somewhat below	Just about right	Somewhat above	Much above	N/A

8. Which of the following, up to 3, are the most attractive reasons for investing in real estate?

	Most	Diversification
	_____	
Cash generation	_____	
Potential for capital gains	_____	
Inflation hedging	_____	
Long-term benefits	_____	
Other (please specify) _____	_____	

9. On a 5-point scale, with 1 being "Significantly Less," and 5 "Significantly Greater," how does the long-term, expected return for the *real estate* component in your portfolio *compare with the long-term expected return* for the following asset classes in your portfolio?

	Significantly less	Somewhat less	Approximately equal	Somewhat greater	Significantly greater	Don't know
	1	2	3	4	5	
Equity						
Fixed Income						
Hedge Funds/ Absolute Return Investments						
Private Equity/Venture Capital						

Emerging Markets						

10. On a 5-point scale, with 1 being "Significantly Less," and 5 "Significantly Greater," in your view, how do the risks of *real estate* as an asset class *compare with the risks* of the following other asset classes in your portfolio?

	Significantly less	Somewhat less	Approximately equal	Somewhat greater	Significantly greater	Don't know
	1	2	3	4	5	
Equity						
Fixed Income						
Hedge Funds/ Absolute Return Investments						
Private Equity/Venture Capital						
Emerging Markets						

11. In your view, which of the following are the top three major risk factors in real estate investment?

a) Asset volatility
b) Liquidity risk
c) Risk of a crash
d) Lack of reliable valuation data
e) Moral hazard/ operational risk
f) Macro-economic uncertainty
g) Legal and regulatory risk
h) Risk of poor professional advice
i) Hard to determine the best opportunities
j) Risk of making a poor investment
k) Other (please specify) _____

12. Which of the following are the three most important factors influencing your *real estate* asset allocation decision?

a) Statistical estimates of risk and return
b) Advice from internal staff
c) Advice from external consultant
d) Advice from other investors
e) Economic forecasts
f) Current market values of asset
g) Recent trends in the market
h) Long term historical performance
i) Expected changes in the economic outlook
j) Actions taken by industry peers
k) Relative skill of external manager with this asset class
l) Other _____

13. Which of the following are the three most important factors influencing your *U.S. equity* asset allocation decision?

a) Statistical estimates of risk and return
b) Advice from internal staff
c) Advice from external consultant
d) Advice from other investors
e) Economic forecasts
f) Current market values of asset
g) Recent trends in the market
h) Long term historical performance
i) Expected changes in the economic outlook
j) Actions taken by industry peers
k) Relative skill of external manager with this asset class
l) Other _____

14. On a 5-point scale, with 1 being "Significantly Less," and 5 "Significantly Greater," how does your institution's cost of managing real estate compare with the cost of managing the following asset classes in the portfolio?

	Significantly less	Somewhat less	Approximately equal	Somewhat greater	Substantially greater	Don't know
	1	2	3	4	5	
Equity						
Fixed Income						
Hedge Funds/						

Absolute Return Investments						
Private Equity/Venture Capital						
Emerging Markets						

15. On a 5-point scale, from 1 “Least Comfortable Using Historical Performance,” to 5 “Most Comfortable Using Historical Performance,” for which of the following asset classes are you most comfortable extrapolating future performance from historical performance?

	Least Comfortable Using Historical Performance				Most Comfortable Using Historical Performance	Don’t know
	1	2	3	4	5	
Real Estate						
U.S. Equities						
Foreign Equities						
Emerging Markets						
U.S. Debt markets						
High Yield Fixed Income						
Commodities						
Hedge Funds						
Venture						

Capital						

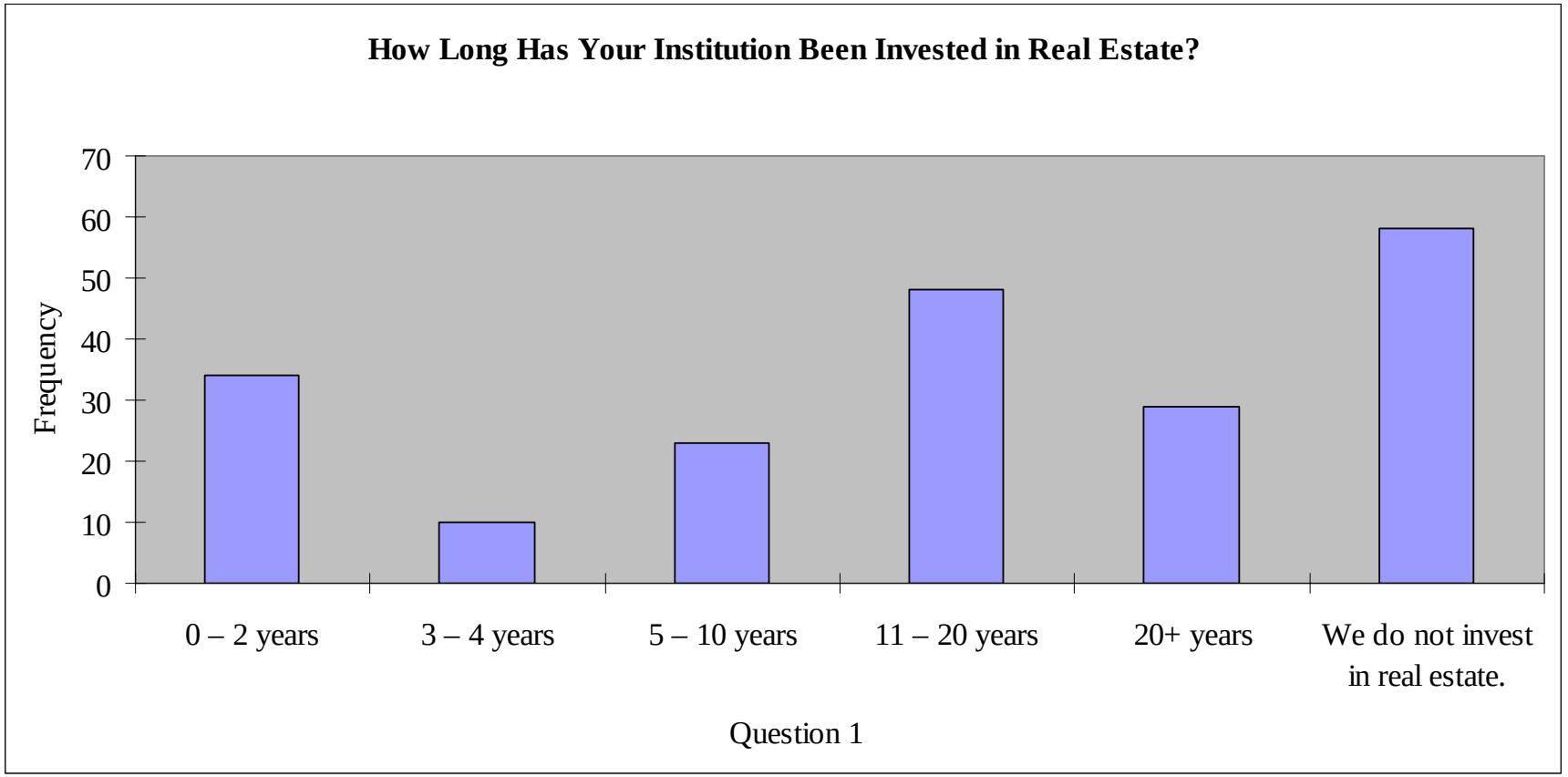
16. One definition of an efficient market is a market in which the price of an asset is highly likely to be equal to its economic value. By this measure, on a 5-point scale, from 1 “Substantially Less Efficient,” to 5 “Substantially More Efficient,” how does the efficiency of the real estate market compare to the following?:

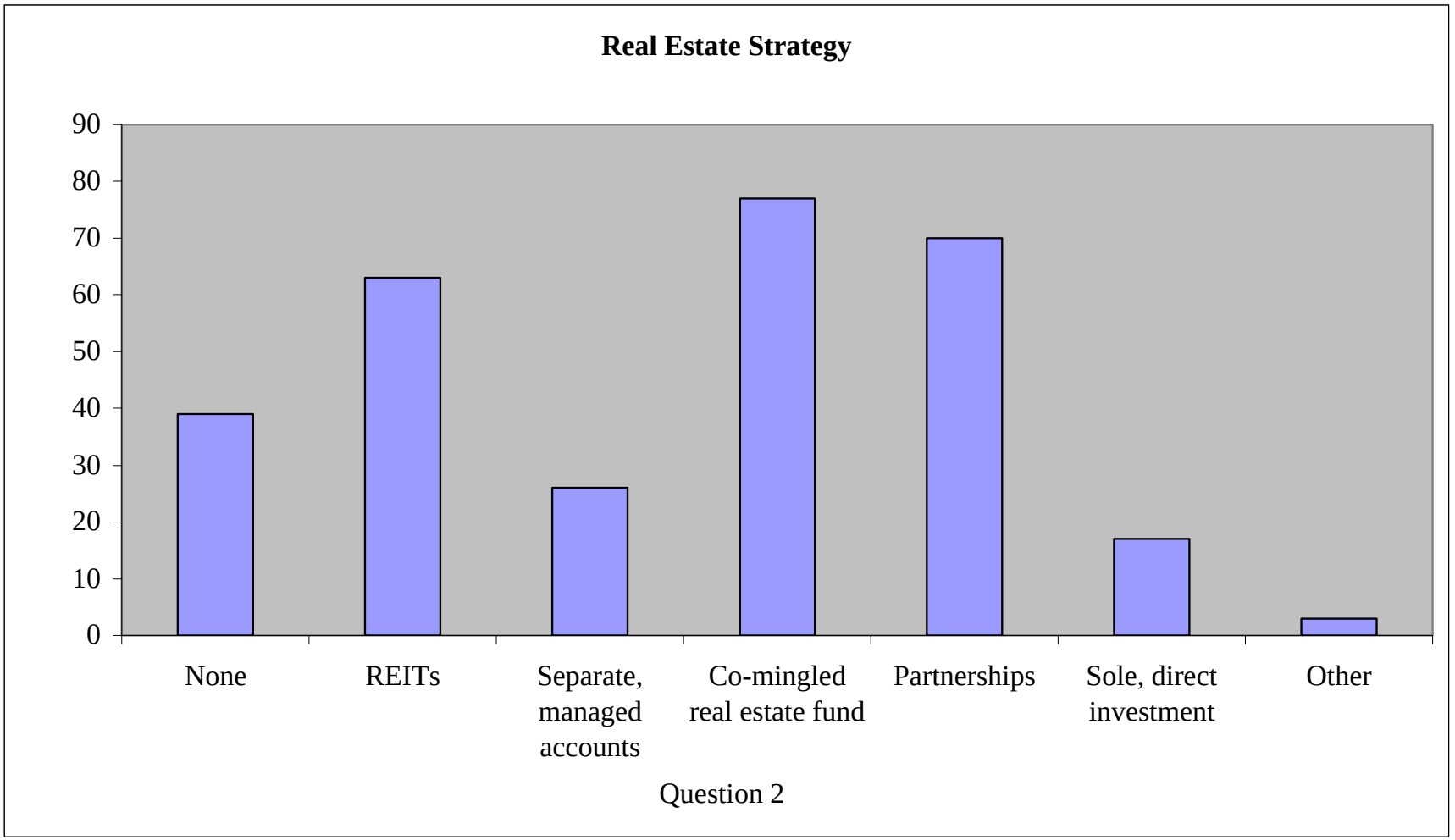
	Substantially less efficient	Somewhat less efficient	About as efficient	Somewhat more efficient	Substantially more efficient	Don’t know
	1	2	3	4	5	
U.S. Equities						
Foreign Equities						
Emerging Markets						
U.S. Debt markets						
High Yield Fixed Income						
Commodities						

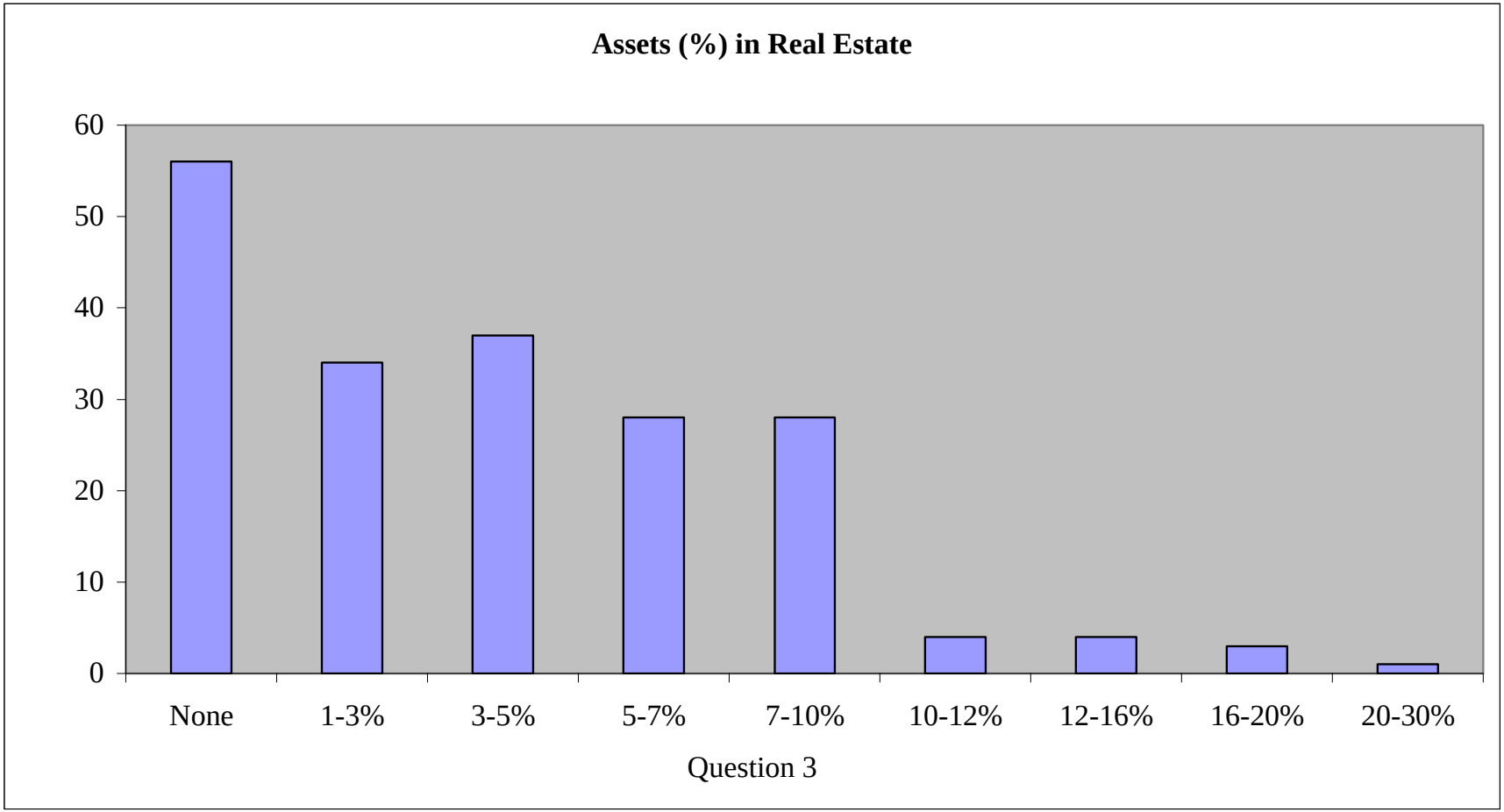
17. On a 5-point scale, from 1 “Not at all likely,” to 5 “Extremely likely,” in your opinion, how likely is it that you will experience a “crash” in values of the following asset classes in the next 10 years? (A “crash” is defined as a decrease in values of more than 30%.)

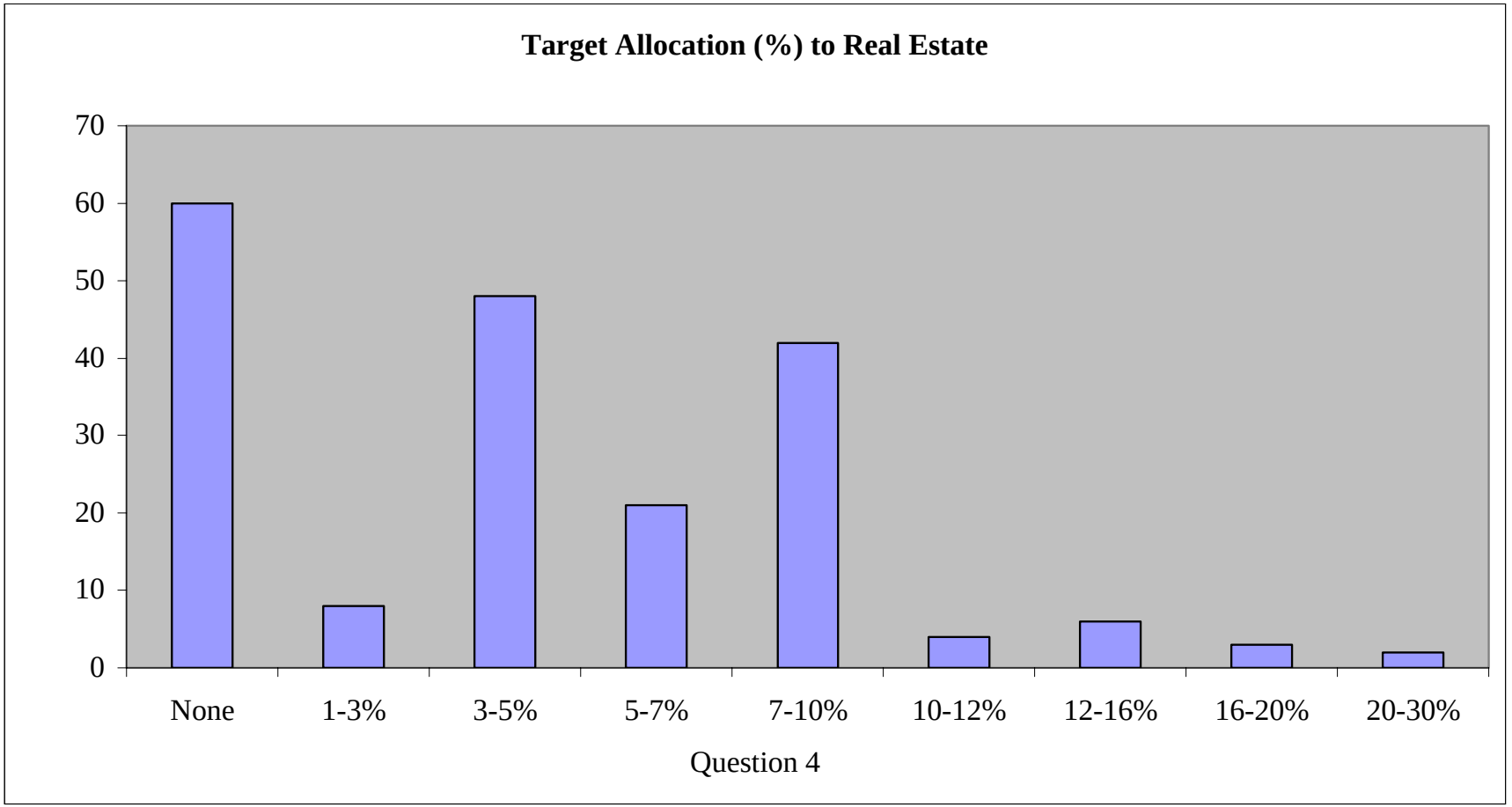
	Not at all likely	Not too likely	Somewhat likely	Very likely	Extremely likely	Don’t Know
	1	2	3	4	5	
Real Estate						
U.S. Equity						
U.S. Fixed Income						

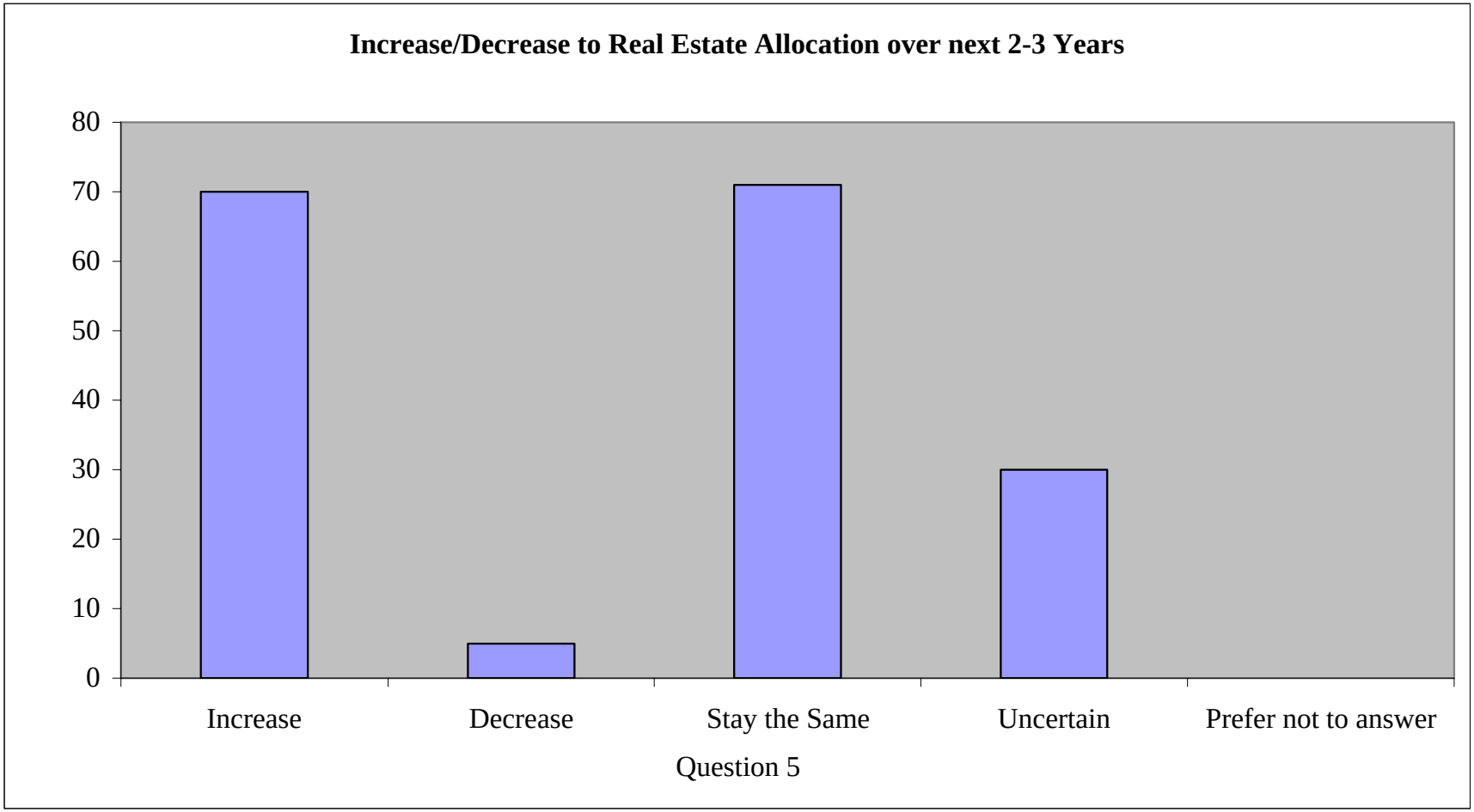
Figures

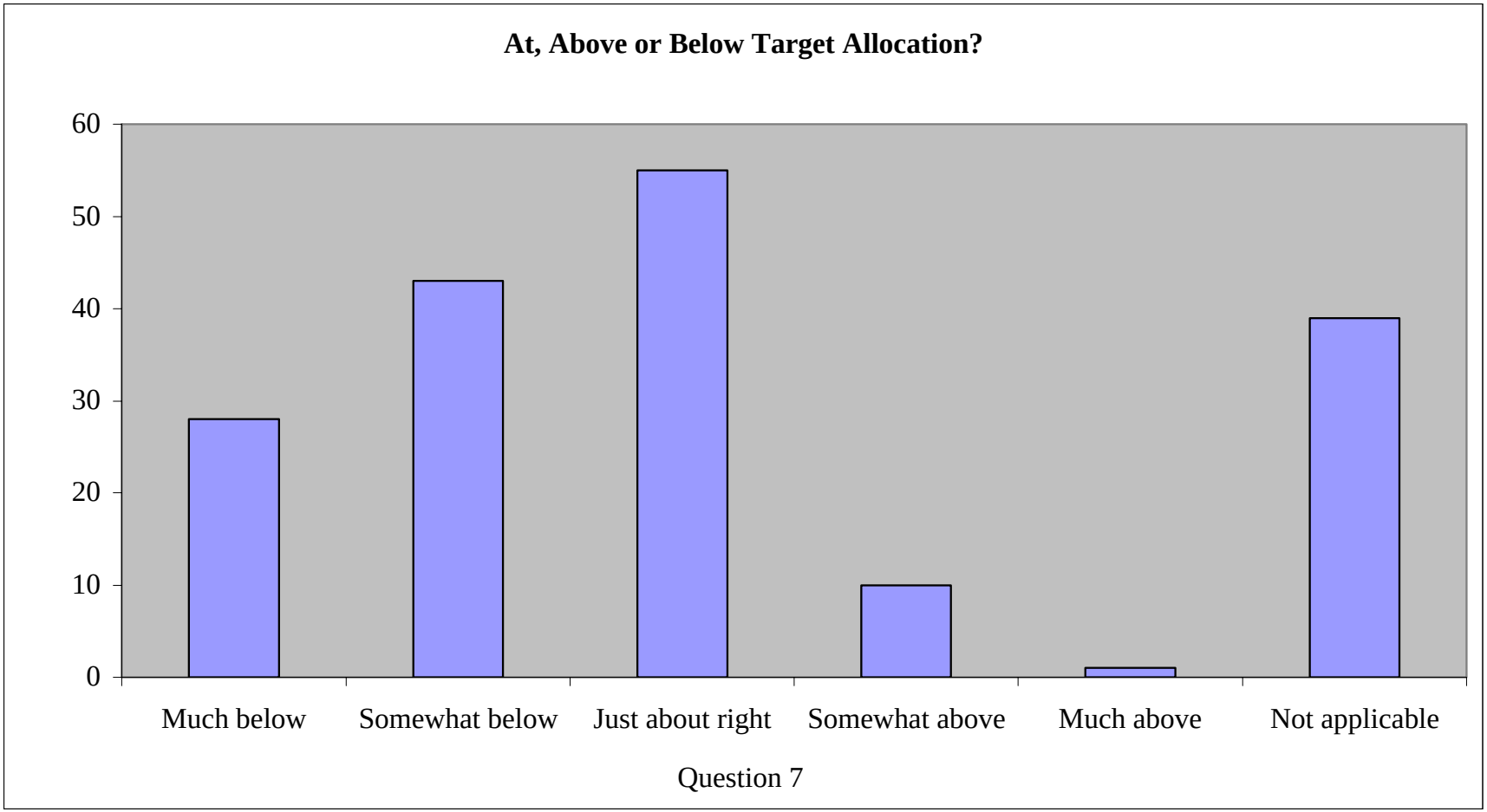

How Long Has Your Institution Been Invested in Real Estate?
Frequency
70
60
50
40
30
20
10
0
0 – 2 years
3 – 4 years
5 – 10 years
11 – 20 years
20+ years
We do not invest in real estate.
Question 1

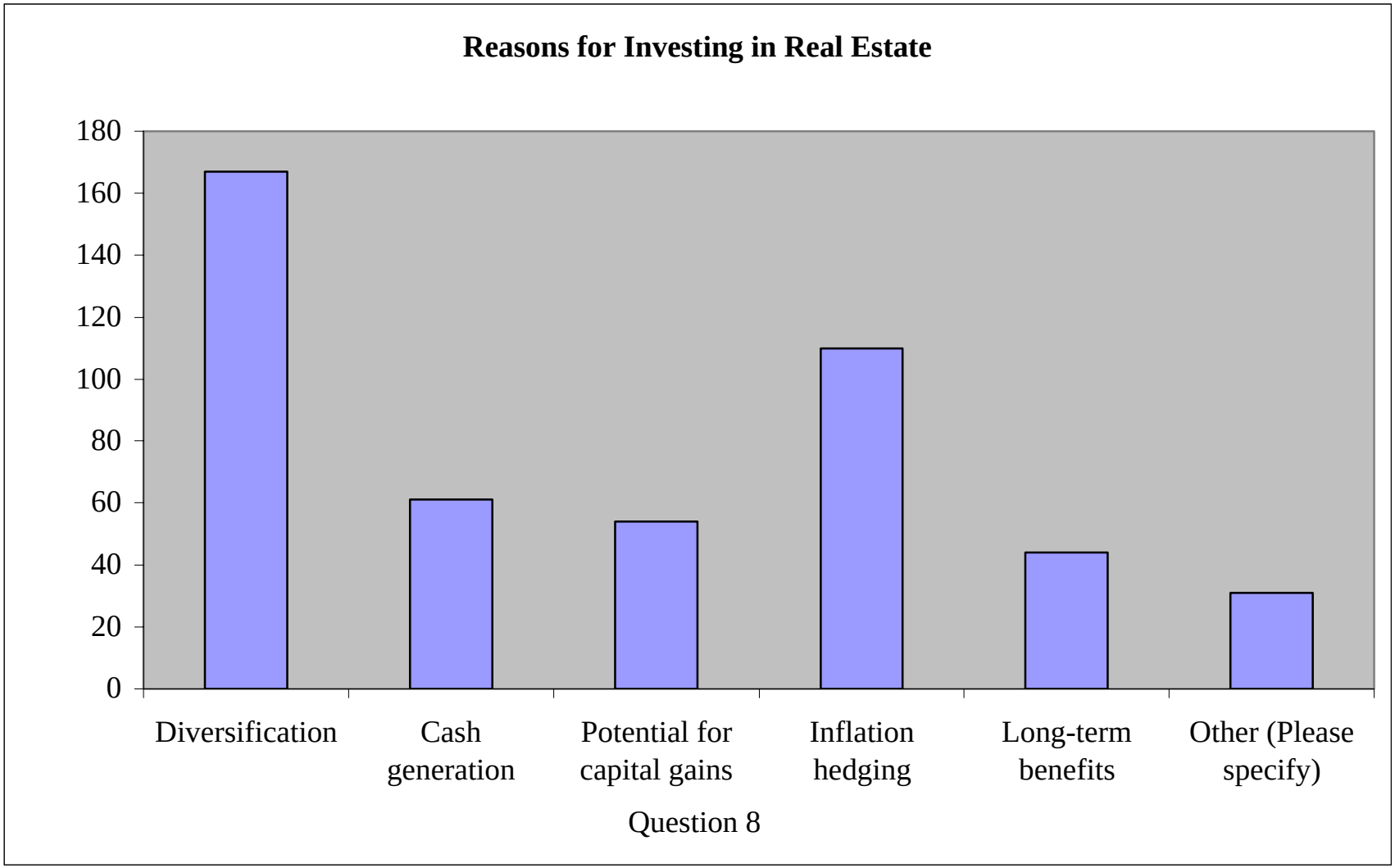

Real Estate Strategy
90
80
70
60
50
40
30
20
10
0
None
REITs
Separate, managed accounts
Co-mingled real estate fund
Partnerships
Sole, direct investment
Other
Question 2

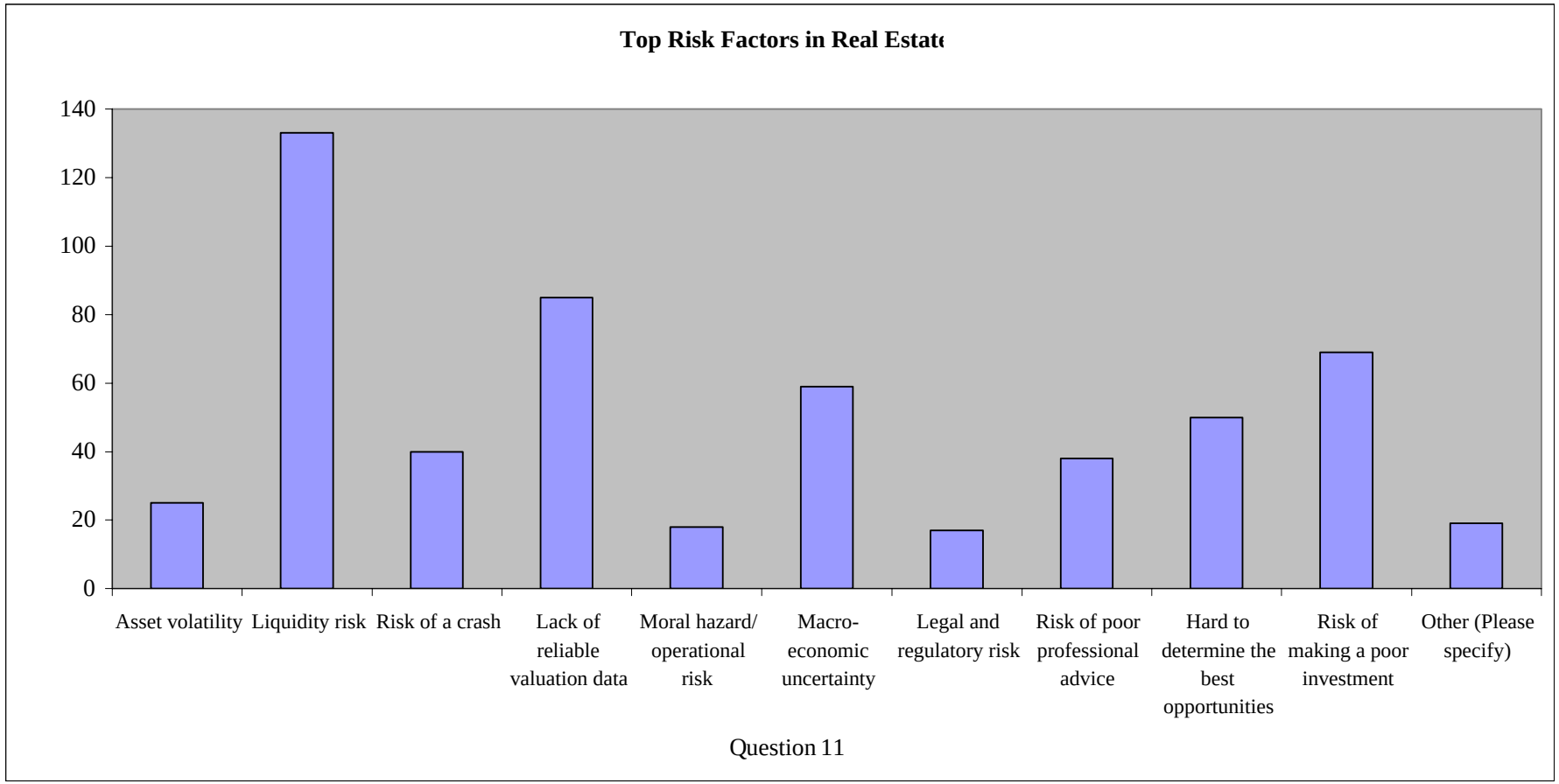

Assets (%) in Real Estate
60
50
40
30
20
10
0
None
1-3%
3-5%
5-7%
7-10%
10-12%
12-16%
16-20%
20-30%
Question 3

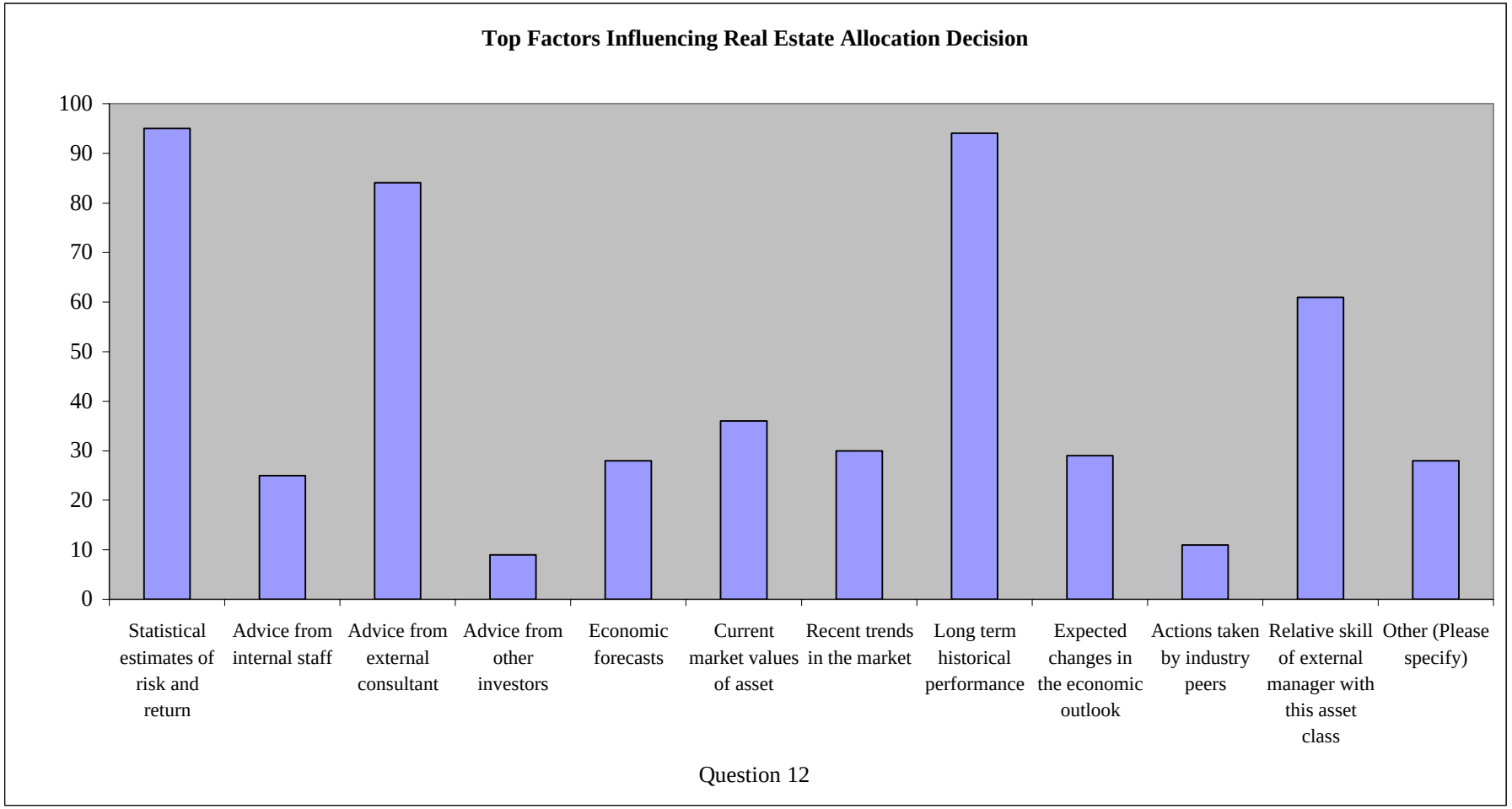

Target Allocation (%) to Real Estate
70
60
50
40
30
20
10
0
None
1-3%
3-5%
5-7%
7-10%
10-12%
12-16%
16-20%
20-30%
Question 4

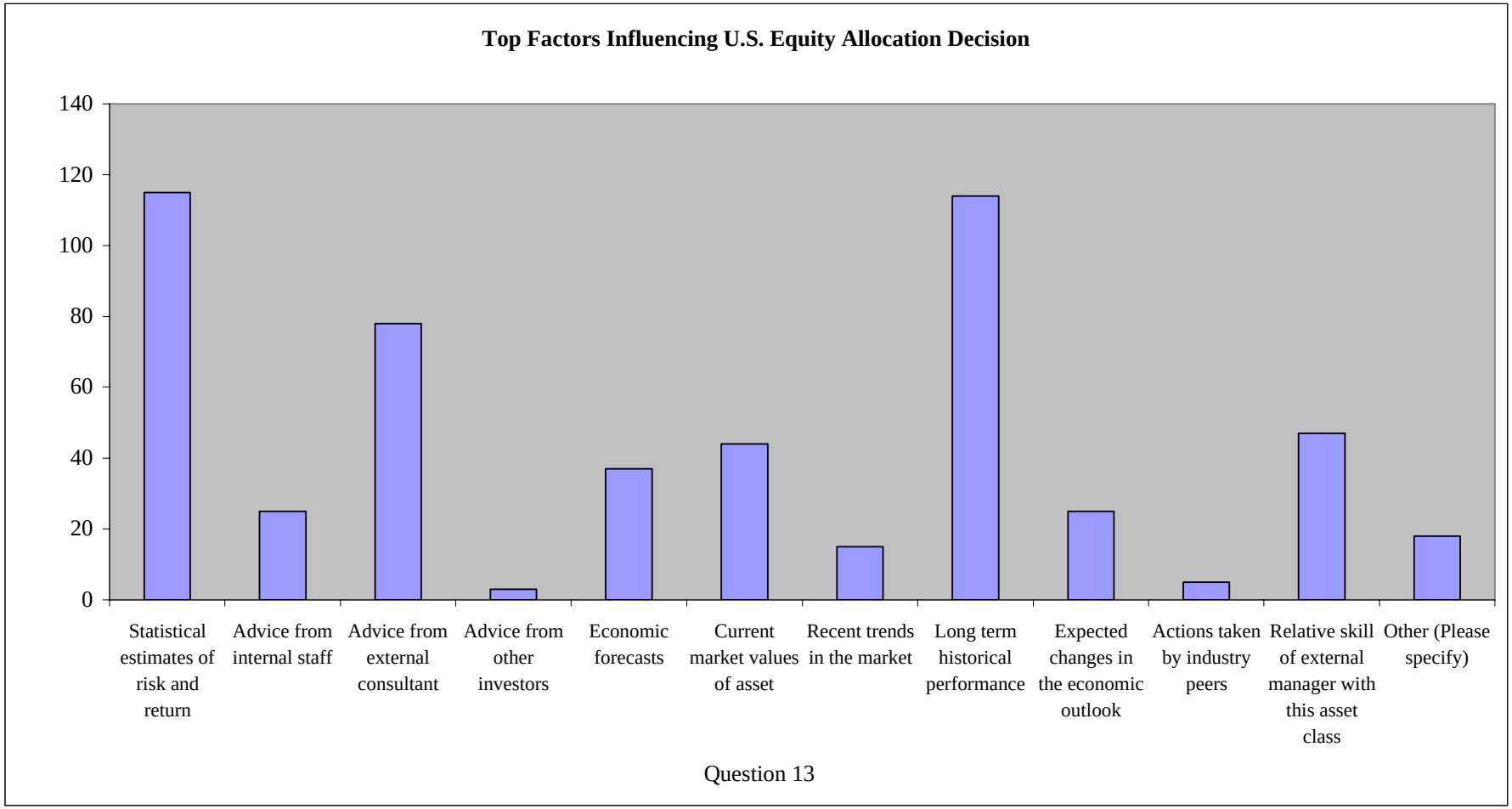

Increase/Decrease to Real Estate Allocation over next 2-3 Years
80
70
60
50
40
30
20
10
0
Increase
Decrease
Stay the Same
Uncertain
Prefer not to answer
Question 5


At, Above or Below Target Allocation?
60
50
40
30
20
10
0
Much below
Somewhat below
Just about right
Somewhat above
Much above
Not applicable
Question 7


Reasons for Investing in Real Estate
180
160
140
120
100
80
60
40
20
0
Diversification
Cash generation
Potential for capital gains
Inflation hedging
Long-term benefits
Other (Please specify)
Question 8


Top Risk Factors in Real Estate
140
120
100
80
60
40
20
0
Asset volatility
Liquidity risk
Risk of a crash
Lack of reliable valuation data
Moral hazard/ operational risk
Macro-economic uncertainty
Legal and regulatory risk
Risk of poor professional advice
Hard to determine the best opportunities
Risk of making a poor investment
Other (Please specify)
Question 11


Top Factors Influencing Real Estate Allocation Decision
100
90
80
70
60
50
40
30
20
10
0
Statistical estimates of risk and return
Advice from internal staff
Advice from external consultant
Advice from other investors
Economic forecasts
Current market values of asset
Recent trends in the market
Long term historical performance
Expected changes in the economic outlook
Actions taken by industry peers
Relative skill of external manager with this asset class
Other (Please specify)
Question 12


Top Factors Influencing U.S. Equity Allocation Decision
140
120
100
80
60
40
20
0
Statistical estimates of risk and return
Advice from internal staff
Advice from external consultant
Advice from other investors
Economic forecasts
Current market values of asset
Recent trends in the market
Long term historical performance
Expected changes in the economic outlook
Actions taken by industry peers
Relative skill of external manager with this asset class
Other (Please specify)
Question 13