Multiple Asset Class Investing: Equilibrium Asset Pricing Evaluation of Real Estate Risk and Return across Four Quadrants

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Abstract

The major objective of this study is to test equilibrium asset pricing models with respect to how well they price risk across multiple asset classes; including the four quadrants of real estate. While using the Geltner (1999) paper as a springboard for our approach, this thesis both updates Professor Geltner's earlier work and extends its scope through the testing of additional models and asset classes. Using historical data to derive beta estimates, we empirically test several variations of the Capital Asset Pricing Model (CAPM). These variations include the traditional, single-beta, Sharpe-Lintner CAPM, as well as the multi-beta, Fama-French CAPM. For the single-factor formula we explore the use of two different market portfolio proxies, the S&P 500 Index and the National Wealth Portfolio (NWP). We also apply the single-factor formula to a non-wealth based, consumption oriented approach.

Test results show the NWP based CAPM to be the strongest model, being both robust and statistically significant in its pricing of asset volatility. When using the traditional S&P 500 index as the market proxy, the basic CAPM performs surprisingly well, though not as well as the NWP version. The multi-beta Fama-French model explains a large amount of price variation, however, only the market and size factors prove to be statistically significant at the 95% confidence level. In a dramatic departure from what was found roughly fifteen years ago, the consumption model's performance was lackluster; supporting a widespread belief that there may be empirical issues with the measurement of quarterly consumption. The most interesting finding across all models tested was the behavior of the housing asset class. Housing appears to be an outlier that doesn't seem to fit in with the rest of the asset classes using linear pricing models. All the models display a statistically significant intercept, suggesting that there is a component of risk, perhaps a significant component (as perceived by investors relative to treasury bills), that is not captured in any of these risk models.

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Literature Review

The literature pertinent to the topic explored in this thesis dates back to 1952 when Harry Markowitz published "Portfolio Selection" in the *Journal of Finance*. Prior to this work investors looked at the risk-reward characteristics of securities individually and portfolios were simply a collection of individually analyzed assets. Conversely, Markowitz suggested that security selection should be based on the overall risk-reward characteristics of a portfolio. By looking at the interrelationship of expected returns, standard deviations and correlations for a given set of assets we can find the optimal balance of risk and return. Or, in other words, we find the portfolio with the highest overall expected return for a given level of volatility. Such a portfolio is said to fall on the efficient frontier.

Others built on the Modern Portfolio Theory foundation laid by Markowitz and pioneered the Capital Asset Pricing Model (CAPM). [Treynor (1961), Sharpe (1964), Lintner (1965), though Treynor's paper was never published.] While quite possibly the most widely known model in modern finance and the foundation for much academic study over the past forty years, the CAPM introduced the notion of separating risk into two types: systematic and specific. Systematic risk is the risk associated with holding the market portfolio and it is rewarded by the capital market. Specific risk is unique to a given asset and can be diversified away when held in combination with other assets and, thus, is not rewarded by the capital market.

According to CAPM theory, an asset's contribution to portfolio risk depends on the asset's sensitivity to changes in the value of the market portfolio. Systematic risk, or the marginal contribution of a given asset to the risk of the market portfolio, can be measured using beta. Beta is calculated as follows:

$$\beta_i = cov(r_i,r_m) / \sigma_m^2$$

where

- $cov(r_i,r_m)$ is the covariance between the asset return and the market return, and
- σ^2_m is the variance of the market return

Having calculated beta, the remainder of the CAPM formula then becomes:

$$E(r_i) = r_f + \beta_i[E(r_m)-r_f]$$

where

- $E(r_i)$ is the expected return of an asset
- r_f is the risk free rate
- $\beta_i[E(r_m)-r_f]$ is beta times the market price of risk (or risk premium)

The CAPM, as does any economic model, takes a simplified view of the world. It assumes there are no taxes or transaction costs, that all investors have identical investment horizons and identical perceptions regarding expected returns, volatilities and correlations of available risky investments.

The viability of these assumptions along with the applicability of the CAPM equation has been the subject of empirical testing over the years. The two most important early tests were by Black, Jensen and Scholes (1972) and Fama and McBeth (1973). More recent studies include

Fama and French (1992) and Black (1993). In general the tests take a representative value-weighted index, such as the S&P 500, as the market portfolio, and then see whether the historical average return on a security can be explained by the equation. All these studies focus on whether beta alone can explain the historical average returns on portfolios. The results support the notion of a linear relationship between expected return and beta, however it was found that the simple beta calculation doesn't present the most accurate measure of expected return.

Alternatively, several other related asset pricing theories have surfaced over the years. Studies by Breeden (1979) and Breeden, Gibbons and Litzenberger (1989) suggested that people aren't as concerned about wealth (as measured by the standard CAPM) as they are the ability the wealth gives them to consume. If individuals derive utility from consumption then what we care about is the sensitivity of consumption with the return on the market portfolio. Breeden's consumption CAPM (C-CAPM) defines risk as consumption's sensitivity to the market portfolio [Parks and Davis (2005)].

$$E(C_i) = r_f + \beta_i[E(r_m)-r_f]$$

where

- C = consumption
- $\beta_i = \mathrm{cov}(C_1, r_m) / \sigma_m^2$

Another alternative approach was put forward in a study by Ross (1976) wherein potential negative issues regarding beta calculation relative to the market portfolio are circumvented by addressing capital asset pricing from an entirely different angle. The arbitrage pricing theory (APT) suggested by Ross takes a seemingly unlimited number of factors into consideration in order to calculate expected returns. The model does not, however, stipulate what those factors are.

$$E(r_i) = r_f + \beta_1(r_{factor\ 1}-r_f) + \beta_2(r_{factor\ 2}-r_f) + \beta_3(r_{factor\ 3}-r_f) + \ldots + \beta_n(r_{factor\ n}-r_f)$$

The most recent CAPM variation was put forward by professors Fama and French. In their aforementioned 1992 paper, they go on to conclude that there are three factors which in combination do a good job of explaining risk pricing by the capital market. The factors include a market factor, a size factor and a book-to-market factor

$$E(r_i) = r_f + \beta_{market}(r_{market\ factor}) + \beta_{size}(r_{size\ factor}) + \beta_{book\text{-}to\text{-}market}(r_{book\text{-}to\text{-}market\ factor})$$

where

- market factor: return on market index minus risk-free interest rate
- size factor: return on small-firm stocks less return on large firm stocks
- book-to-market factor: return on high book-to-market-ratio stocks less return on low book-to-market-ratio stocks. [Breeley and Myers (2001), p.209]

Despite the negative empirical results for the standard Sharpe-Lintner CAPM and the potential confusion that can arise out of having a variety of “new and improved” CAPMs to choose from, the standard capital asset pricing model is widely used by firms in practice. Graham and Harvey (2001) “indicate that the CAPM is by far the most popular method of estimating the cost of equity capital: 73.5% of (survey) respondents always or almost always use the CAPM. The second and third most popular methods are average stock returns and a multibeta CAPM, respectively."

According to Geltner and Miller (2001), "By the 1970s and1980s, the CAPM was so popular and widely used in the investment industry that many began to wonder why it was not being applied to real estate investment decision making." They go on to describe how when analysts initially applied the standard CAPM to real estate they would often arrive at a zero or even negative beta, which at face value says that real estate doesn't require a risk premium. This sparked a debate wherein it was argued that either real estate provided supernormal returns for its given level of risk or that the CAPM was fundamentally flawed in some way since it didn't work for such a major asset class as real estate.

Up to that point, application of the CAPM had been focused on the stock market where it was generally understood that a composite stock market index such as the S&P 500 was a sufficient proxy for the market portfolio. Intuitively, such a myopic view of the market portfolio doesn't make sense when considering equilibrium asset pricing for real estate. Two doctoral dissertations in the late 1980s sought to expand the perception of the market portfolio in addition to addressing other data issues unique to real estate in order to more appropriately analyze asset pricing models.

In a paper spawned by one of the dissertations, Geltner (1989) took a look at the systematic risk of unsecuritized investment grade commercial real estate using both the standard and consumption based capital asset pricing models. He found that the stock market based beta which is generally used with the standard CAPM appeared to be practically zero. Interestingly, the consumption based beta proved to be substantially positive.

In an effort to be more precise in dealing with real estate returns data, Geltner adjusted the data to account for smoothing in the appraisal-based aggregate level returns. In a follow on paper, Geltner (1991), a conceptual analysis of the smoothing of appraisal-based returns series in commercial real estate was presented. The overall conclusion being that appraisal-based returns can be very useful in studying the risk characteristics of commercial real estate assets, provided that this type of data is corrected for smoothing.

Liu, Hartzell, Grissom and Grieg (1990), a paper which stemmed from the second doctoral dissertation, looked at how the composition of the market portfolio affects asset pricing for real estate investments. They found that the market proxy does not necessarily lead to different inferences on real estate investment performance, although superior real estate investment performance arises from the omitted asset phenomenon and also from smoothing bias in general.

By applying the approaches developed by the Geltner and Liu dissertations it has been found that "the basic Sharpe-Lintner CAPM does work, in essence, for real estate after all, at least at a broad-brush level *across* the asset classes. This is a level that is useful for broad strategic and tactical investment policy making for managers responsible for mixed-asset portfolios, that is, portfolios that potentially include all the major asset classes."[Geltner and Miller (2001), p.572].

From there, much of the asset price testing involving real estate moved away from the standard single-factor CAPM in the direction of more robust multi-factor modeling (APT). The empirical advantage of multi-factor models, "from a statistical perspective, (is that) the more explanatory variables you have in the right-hand side of a regression of asset returns onto risk factors, the more variability in asset returns you can explain with the regression." [Geltner and Miller (2001), p.579].

Titman and Warga (1986) analyzed the returns of a sample of Real Estate Investment Trusts (REITs) and examined their risk-adjusted performance using both the standard CAPM and multifactor models. They found that actual performance measures sometimes differed substantially, though the lack of statistical significance cast some doubt on exactly how applicable the modeling was.

An analysis of monthly returns on REITs by employing a multifactor model was conducted by Chan, Hendershott and Sanders (1990). They found that real estate, at least as measured by the return performance of equity REITs, is less risky than stocks generally, but does not offer a superior risk-adjusted return and is not a hedge against unexpected inflation.

Mei and Lee (1994) studied the variation of expected returns on five different asset portfolios in a multifactor model and found the presence of a real estate factor in addition to both a stock factor and bond factor. They imply that real estate assets can be treated just like other assets as far as mean-variance efficient asset allocations are concerned.

In the study by Karolyi and Sanders (1998), the predictable components of returns on stocks, bonds, and REITs were examined. They employed a multiple-beta asset pricing model and found that there are varying degrees of predictability among stocks, bonds, and REITs. Furthermore, They found that most of the predictability of returns is associated with the economic variables employed in the asset pricing model. The stock market risk premium is highly important in capturing the predictable variation in stock portfolios, and the bond market risk premiums (term and risk structure of interest rates) are important in capturing the predictable variation in bond portfolios. For REITs, however, both the stock and bond market risk premiums capture the predictable variation in returns. Karolyi and Sanders found that REITs have comparable return predictability to stock portfolios and conclude that there is an important economic risk premium for REITs that are not captured by traditional multiple-beta asset pricing models.

About this same time professors Ling and Naranjo conducted research which moved beyond the scope of the previous studies that simply looked at publicly traded real estate and delved into the application of APT modeling to private real estate. As a preface to their study, they indicated that a great deal of research has focused on the linkages between stock and bond market returns and macroeconomic events such as fluctuations in interest rates, inflation rates and industrial production. They go on to say that although the comovements of real estate and other asset prices suggests that these same systematic risk factors were likely to be priced in real estate markets, no study had formally addressed this issue. Their findings were detailed in two articles, Ling and Naranjo (1997) and Ling and Naranjo (1998).

Ling and Naranjo identified the growth rate in real estate per capita consumption, the real T-bill rate, the term structure of interest rates, and unexpected inflation as fundamental drivers or "state variables" that systematically affect real estate returns. They found a consistently significant risk premium on consumption, which has important ramifications for the past literature that has examined the risk-adjusted performance of real estate, because it suggests that prior findings of significant abnormal returns (either positive or negative) that have ignored consumption are potentially biased by an omitted variables problem. The results also have important implications for dynamic asset allocation strategies which involve the predictability of real estate returns using economic data.

In addition to testing the asset price models themselves and searching for those factors which best quantify the systematic risk of real estate, studies have been conducted which look at asset pricing differences between the public and private market for real estate. The question boils down to one of segmentation or market integration between the public capital market and privately traded real estate.

Liu, Grissom and Hartzell (1990) investigated the impact of market imperfections on real estate returns and optimal investor portfolios in a CAPM context. In their analysis they relaxed the CAPM assumptions to recognize illiquidity, the consumption and investment attributes of owner-occupied housing and a mildly segmented real estate market structure. They found that relaxing these assumptions lead to a separate pricing paradigm for financial assets, income-producing real estate and owner-occupied housing.

Giliberto and Mengden (1996) took a look at the differences between public and privately held real estate and found that differences in valuation parameters cause most of the observed differences in performance. Virtually all the apparently significant differences in correlations and volatilities disappeared when results were adjusted for these effects.

Other studies that found evidence of a lack of integration between the public and private asset markets include the previously referred to Mei and Lee (1994), and Karolyi and Sanders (1998) papers. The most recent work, however, was done by Ling and Naranjo.

Ling and Naranjo (1999) tested whether commercial real estate markets (both exchange-traded and non-exchange-traded) are integrated with stock markets using multifactor asset pricing models. They found that publicly traded real estate stocks, REITs, are well integrated with the general stock market. However, their test results also show that REITs and privately traded real estate are not fully integrated. They also found that the growth rate in real per capita consumption is consistently priced in both commercial real estate markets and stock markets, whereas previous studies found mixed evidence on the role of consumption in explaining ex ante stock returns.

The most breadth we have seen to date of a study done across multiple real estate sectors with respect to asset pricing appears in an unpublished paper that accompanied a presentation given by professor Geltner (1999) at the AIMR Conference held in Boston. Part of the paper explores arriving at the market price of risk for each of the four quadrants (using their respective indices) shown below:

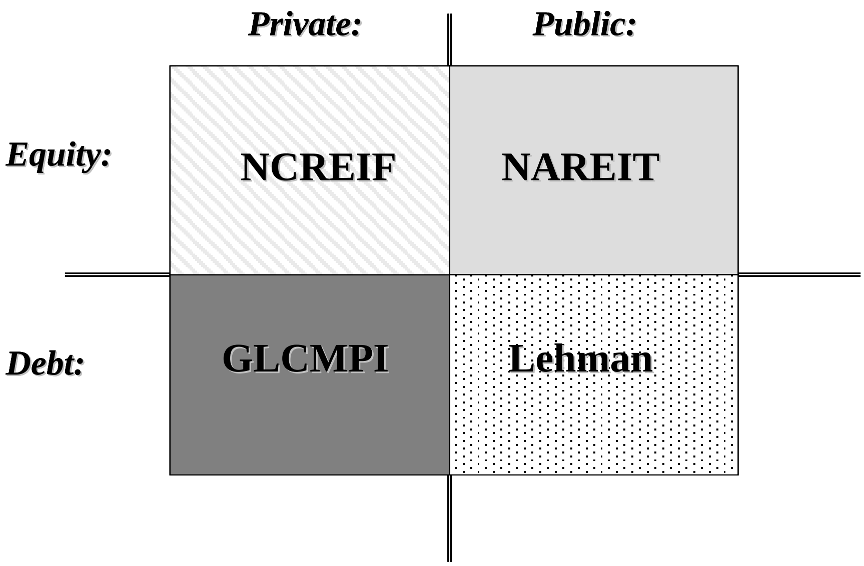

Figure 1 Real Estate Investment across Four Quadrants

While the single-factor, Sharpe-Lintner CAPM was used in the analysis, an important adjustment was made with respect to how beta was defined. Rather than use the S&P500 as a proxy for the market portfolio, which has traditionally been done, the National Wealth Portfolio (NWP) was incorporated. A much more expansive representation of investable assets, the NWP make up included 1/3 stocks, 1/3 bonds and 1/3 real estate. The results indicate that the market seems unable to distinguish differences in risk within the northwestern quadrant, or private equity sector. There were, however, clear differences in risk and expected returns across the quadrants.

This use of a broader representation for the market portfolio to include real estate assets is supported in a working paper by Kullmann (2003) wherein empirical evidence is found to support the notion that capital markets do price real estate risks. The study concludes that the inclusion of returns to real estate improves the empirical performance of linear asset pricing regardless of which assets are being priced.

Objective

The major objective of this study is to test equilibrium asset pricing models with respect to how well they price risk across multiple asset classes; including the four quadrants of real estate. While using the aforementioned Geltner (1999) paper as a springboard for our approach, this thesis both updates Professor Geltner's earlier work and extends its scope through the testing of additional models. Using historical data to derive beta estimates, we empirically test several variations of the Capital Asset Pricing Model (CAPM). These variations include the traditional, single-beta, Sharpe-Lintner CAPM, as well as the multi-beta, Fama-French CAPM. For the single-factor formula we explore the use of two different market portfolio proxies, the S&P 500 Index and the National Wealth Portfolio (NWP). We also apply the single-factor formula in a non-wealth based, consumption oriented approach.

Methodology

In order to run our calculations we collected total returns data, on a quarterly basis, for the following ten asset classes: U.S. 30 Day Government Treasury Bills, U.S. Long Term Government Bonds, U.S. Intermediate Term Government Bonds, the S&P 500 Index, U.S. Small Stocks, the NCREIF Property Index (NPI), NAREIT Equities, the Lehman Brothers Mortgage Index, the Giliberto-Levy Commercial Mortgage Price Index (GLCMPI), and the Conventional Mortgage Home Price Index (CMHPI). Though available through a variety of sources, time series returns data for the first eight of these asset classes were obtained from the Ibbotson Associates Database utilizing EnCorr Analyzer software. The proprietary GLCMPI was graciously provided by the John B. Levy Company in conjunction with the Property & Portfolio Research organization. Lastly, the CMHPI, was downloaded directly from the Freddie Mac website.

While the majority of these time series are commonly used and familiar to most, a few of them merit brief explanation and clarification. The Lehman Brothers Mortgage-Backed Securities Index is a benchmark index that includes 15- and 30-year fixed-rate securities backed by mortgage pools of the Government National Mortgage Association (GNMA), Federal Home Loan Mortgage Corporation (FHLMC), and Federal National Mortgage Association (FNMA).

The GLCMPI is produced quarterly, but returns are actually computed monthly and then chain linked. The producers of the index originally used ACLI data, which remains true for many data points, however, beginning in 2000 John Levy conducted a survey of loan originations on a loan-by-loan basis; and those loans, provided they meet the index criteria, are now the main source. The GLCMPI total returns include the effect of credit losses.

In the case of single-family detached residential real estate, which is represented by the CMHPI, adjustments were made to the data. In order to compare apples to apples, so to speak, when judging housing against other more traditional capital assets, the returns data must include the same components. It is generally accepted that R = y + g, where "R" is the total return, "y" is the yield (or cash flow component) and "g" is the growth (or appreciation component). Since homeowners do not pay themselves rent, and yet still receive the benefits of using the space, we have to look at housing as if it were owned and subsequently rented out to an outside party. As the CMHPI is an index of price appreciation only, we added a constant 6% annual (1.47% per quarter) income return component, to reflect “imputed rent”. This is consistent with Geltner (1999) wherein it was stated that, “as almost all of the volatility in any index of periodic returns is in the appreciation component, the simplification in this assumption should not much affect the estimation of betas”.

Our study coverage starts with the 4th quarter of 1979 and runs through the 2nd quarter of 2004. Thus, for each of our first stage regressions (explained in detail further below) we were able to utilize 99 observations for each asset class. While some of the data sets reached back as far as the 1920s, we were constrained on the front end by the NPI and GLCMPI, which only go back as far as the 1st quarter of 1978. Due to the backward looking, tempered nature of both of these indices, we had to take steps to unsmooth the data. Removing the appraisal based effects then enabled us include the asset classes in the National Wealth Portfolio. However, by so doing, we effectively lost four quarters worth of observations since the autoregressive unsmoothing process we employed requires lagging each index four times (t-1, t-1, t-1, t-4).

In addition to this, we lost three more observations off the front end as we further sought to adequately deal with the unique characteristics of the NCREIF and GLCMPI data. We lagged the market portfolio time series three quarters (t-1, t-2, t-3) for use in the stage one regression analyses for both the NPI and GLCMPI, wherein we arrived at aggregated multi-beta estimations.

On the back end, our data was cut off after the 2nd quarter of 2004. This constraint stemmed from our consumption calculations. In brief, we used per capita consumption changes as our percentage based time series wherein we had to divide real national consumption by population figures. June 2004 marks the most recent date for which a reliable population estimate is currently available. (More detail on consumption calculations can be found in the "Consumption CAPM" section.)

Lastly, our analyses were conducted using the risk premia for each of the asset classes. With the objective being to test the applicability of equilibrium asset pricing models and try to see how effectively they deal with risk across asset classes, we thought it more in line with the underlying theory if we isolated that portion of the risk that matters to the captial markets. Using the U.S. 30 Day Government Treasury Bill returns as proxy for the risk-free rate, the risk premia were calculated in the following manner: $RP = R - R_f$, where "RP" is the risk premium, "R" represents the total return, and "R_f" is the risk-free interest rate.

Traditional S&P 500 based CAPM

For this portion of the study, we used the S&P 500 stock index as proxy for the market portfolio. The calculations themselves consisted of numerous regression analyses in a two stage process as follows:

1) Run time series regressions to estimate characteristic line and β_i relative to the market portfolio for each asset class.

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{i,t} (R_{m,t} - R_{f,t}) + \varepsilon_{i,t}$$

2) Run cross sectional regression using the results from first stage β_i estimates along with their respective risk premia [Avg(R_i-R_f)].

$$Avg(R_i - R_f) = \gamma_0 + \gamma_1 \beta_i + \varepsilon_i$$

As mentioned previously, for two of the first stage regressions we incorporated the unsmoothing technique found in Geltner (1989) in order to adequately deal with the appraisal based nature of the NCREIF and GLCMPI data. Specifically, we lagged the market portfolio three quarters (t-1, t-2, t-3) for both asset classes as follows:

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{0,i} (R_{m,t} - R_{f,t}) + \beta_{1,i} (R_{m,t-1} - R_{f,t-1}) + \beta_{2,i} (R_{m,t-2} - R_{f,t-2}) + \beta_{3,i} (R_{m,t-3} - R_{f,t-3}) + \varepsilon_{i,t}$$

The simulated beta for NCREIF and GLCMPI then became the sum of the multiple beta estimates.

$$\beta_i = \beta_{0,i} + \beta_{1,i} + \beta_{2,i} + \beta_{3,i}$$

National Wealth Portfolio CAPM

Following the lead of Geltner (1999), we defined a simplified proxy to represent the entire realm of investable assets and called it the National Wealth Portfolio (NWP). This NWP is comprised of equal one-third shares of stocks, bonds, and real estate. Each broad asset class is then made up of two sub-components. The stock market component is characterized by nine-tenths S&P500 and one-tenth small-cap stocks. Bonds consist of nine-tenths long-term Treasury Bonds and one-tenth commercial mortgages (proxied by the GLCMPI, adjusted for credit losses). The real estate element is made up of two-thirds single-family home equity and one-third commercial property. The latter is represented by the NPI and the former by the CMHPI, adjusted to include imputed rents. Both have been corrected for smoothing.

The method we used to unsmooth, or "pre-whiten", the NCREIF and CMHPI data for use in the NWP portfolio is different than the one described above for multi beta estimation. By applying a zero-autocorrelation-based procedure to these appraisal-based returns we were able to get rid of the stale appraisal effect found in both the NPI and CMHPI. The technique begins with a first- and fourth-order autoregressive model of the indices:

$$r_t^* = a_0 + a_1 r_{t-1}^* + a_4 r_{t-4}^* + e_t$$

$$(1/W) = \lambda / \sigma e$$

$$r_t = (1/w)\, e_t$$

"r_t^*" is the return in quarter t, and "r_t" is the unsmoothed (liquid, or full information) return (characterized by lack of autocorrelation). "a_1, a_4" are factors reflecting autocorrelation (including seasonality: the fourth-order lag), to be estimated in the auto regression model. "w" is a weight chosen to give the unsmoothed returns the desired volatility and "λ" is an a-priori volatility assumption we set at 10% for NPI annual returns, 5% for NPI quarterly returns, 3% for CMHPI quarterly returns. Lastly, "e_t" is the regression residual for period t and "σ_e" is the standard deviation of regression residual.

Once set up, we followed the same two stages of regression (and multiple beta estimation for NCREIF and CMHPI) as we did with the S&P 500 CAPM analysis, except we replaced $R_{m,t} - R_{f,t}$ with $R_{nwp,t} - R_{f,t}$.

Consumption CAPM

While data for the various asset classes in our analysis were readily obtained in a workable form, a usable consumption proxy was a little harder to come by. From the website of the U.S. Department of Commerce Bureau of Economic Analysis, we downloaded Table 2.3.3., "Real Personal Consumption Expenditures by Major Type of Product, Quantity Indexes" and Table 2.3.6. "Real Personal Consumption Expenditures by Major Type of Product, Chained Dollars". The latter provided us with consumption data, in dollars, from 1990 forward. The former yielded the same information, going further back in time, however, in the form of an index. Using the following de-index technique, we obtained pre-1990 consumption expenditures data.

$$CE_t / Index_t = CE_{t-n} / Index_{t-n} \qquad (n = 1, 2, 3, 4, \ldots.)$$

Since this data represented aggregate national consumption, we then divided it by national population figures in order to quantify per capita consumption. Furthermore, whereas the U.S. Census Bureau only estimates population on an annual basis, we first had to use the following straight line methodology to derive quarterly numbers.

$$P_{t,\,qn} = P_t + n((P_{t+1} - P_t)/4) \qquad (n = 1, 2, 3, 4)$$

Once we had historical real national consumption on a per capita basis, we then "pre-whitened" the year-over-year periodic changes in order to calculate the consumption beta. That is, we built a time-series model of the real national consumption per capita changes and then we took the residuals (zero autocorrelation) from this time-series model to get rid of the autocorrelation in the consumption.

$$dC(t) = a + b(dC(t-1)) + c(dC(t-4)) + e(t)$$

“dC(t)” is the percentage change in real national consumption per capita in period t. "a" is a constant and "b" and "c" are parameters estimated by the regression. "e(t)" is the regression residual for period t, which effectively became our new time series and is what we used to estimate the consumption beta.

The underlying reason behind our “pre-whitening” efforts is that consumption data is smoothed to a certain extent. This smoothing is due to both the difficulty of consumption measurement and the nature of its reporting. In order to estimate a meaningful beta we had to remove the predictability in the data. By definition, volatility, or unpredictable changes are what matter to investors.

A unique attribute of the consumption based CAPM (CCAPM) is that it’s not wealth based. This stands in direct contrast to the asset pricing efforts of the other models in our study, which attempt to price risk with respect to changes in wealth. The CCAPM, however, essentially looks past wealth to price risk according to how consumption is affected. The supporting economic theory being that wealth is only a means to an end; which ultimately is consumption in some form.

Once set up, we followed the same two stages of regression (and multiple beta estimation for NCREIF and CMHPI) as we did with both the S&P 500 and NWP based CAPM analyses, except we replaced Rm,t – Rf,t with e(t) from above calculations.

Fama-French Factors

We downloaded time series data for the three Fama-French factors directly from the website maintained by Dr. Kenneth R. French of Dartmouth College. This multi-beta approach to asset pricing includes a market factor (Rm-Rf), a factor that looks at entity size, or in other words, the return on small-firm stocks less the return on large-firm stocks (SMB), and a book to market factor that looks as the return on high book-to-market-ratio stocks less the return on low book-to-market-ratio stocks (HML). In a similar fashion to the process followed for the single factor models, the calculations themselves consisted of numerous regression analyses in a two stage approach as follows:

1) Run time series regressions to estimate characteristic line and β_i relative to the market portfolio for each asset class.

$$R_{i,t} – R_{f,t} = \alpha_{i,t} + \beta_{Mi,t} (R_{m,t} – R_{f,t}) + \beta_{SMBi,t} (R_{SMB,t}) + \beta_{HMLi,t} (R_{HML,t}) + \varepsilon_{i,t}$$

2) Run cross sectional regression using the results from first stage β_{Mi}, β_{SMBi}, β_{HMLi} estimates along with their respective risk premia [Avg(R_i-R_f)].

$$Avg(R_i-R_f) = \gamma_0 + \gamma_1\ \beta_{Mi} + \gamma_1\ \beta_{SMBi} + \gamma_1\ \beta_{HMLi} + \varepsilon_i$$

As was the case with the single factor modeling, for two of the first stage regressions we incorporated the unsmoothing technique found in Geltner (1989) in order to adequately deal with the appraisal based nature of the NCREIF and GLCMPI data. Specifically, we lagged the the three Fama-French factors three quarters (t-1, t-2, t-3) for both asset classes as follows:

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{0,\,Mi}\,(R_{m,t} - R_{f,t}) + \beta_{1,\,Mi}\,(R_{m,t-1} - R_{f,t-1}) + \beta_{2,\,Mi}\,(R_{m,t-2} - R_{f,t-2}) + \beta_{3,\,Mi}\,(R_{m,t-3} - R_{f,t-3}) + \beta_{0,\,SMBi}\,(R_{SMB,t}) + \beta_{1,\,SMBi}\,(R_{SMB,t-1}) + \beta_{2,\,SMBi}\,(R_{SMB,t-2}) + \beta_{3,\,SMBi}\,(R_{SMB,t-3}) + \beta_{0,\,HMLi}\,(R_{HML,t}) + \beta_{1,\,HMLi}\,(R_{HML,t-1}) + \beta_{2,\,HMLi}\,(R_{HML,t-2}) + \beta_{3,\,HMLi}\,(R_{HML,t-3}) + \varepsilon_{i,t}$$

The simulated beta for NCREIF and GLCMPI then became the sum of the multiple beta estimates.

$$\beta_{Mi} = \beta_{0,\,Mi} + \beta_{1,\,Mi} + \beta_{2,\,Mi} + \beta_{3,\,Mi}$$

$$\beta_{SMBi} = \beta_{0,\,SMBi} + \beta_{1,\,SMBi} + \beta_{2,\,SMBi} + \beta_{3,\,SMBi}$$

$$\beta_{HMLi} = \beta_{0,\,HMLi} + \beta_{1,\,HMLi} + \beta_{2,\,HMLi} + \beta_{3,\,HMLi}$$

Results & Conclusions

When combing through the results of our analyses, the most glaring discovery was the effect housing had on the various models tested. Essentially, housing is a bit of an outlier. When housing is removed, the statistical output improves for all four models. The only partial exception being the consumption based CAPM (which proves to be a poor model anyway) where the intercept increases slightly.

	NWP		S&P 500		Consumption		Fama French	
	w / Housing	*w /o Housing*	*w / Housing*	*w /o Housing*	*w / Housing*	*w /o Housing*	*w / Housing*	*w /o Housing*
Multiple R	0.91	0.96	0.94	0.96	0.51	0.55	0.97	0.99
R Square	0.83	0.92	0.88	0.92	0.26	0.30	0.95	0.98
Adjusted R Sq.	0.81	0.91	0.87	0.91	0.16	0.18	0.92	0.97
Standard Error	0.30	0.22	0.25	0.22	0.64	0.67	0.20	0.12
Observations	9	8	9	8	9	8	9	8
	Coeff (t Stat)	*Coeff (t Stat)*	*Coeff (t Stat)*	*Coeff (t Stat)*	*Coeff (t Stat)*	*Coeff (t Stat)*	*Coeff (t Stat)*	*Coeff (t Stat)*
Intercept	0.50 (2.87)	0.31 (2.10)	0.83 (7.61)	0.75 (7.01)	1.40 (6.51)	1.45 (5.96)	0.79 (7.19)	0.66 (8.23)
Rm-Rf	0.92 (5.90)	1.04 (8.53)	1.49 (7.32)	1.58 (8.34)	0.21 (1.58)	0.23 (1.59)	1.31 (5.98)	1.46 (9.98)
SMB							0.67 (3.59)	0.58 (4.86)
HML							0.38 (0.58)	0.68 (1.62)

Table 1 Statistics Summary of Four Models

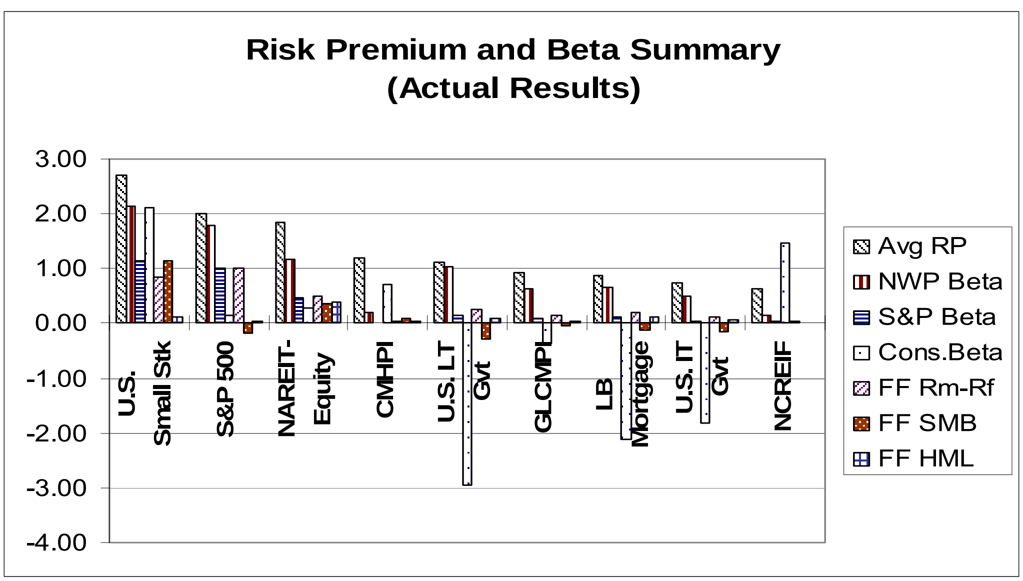

Figure 2 Risk Premium and Beta Summary of Four Models (Actual Results)

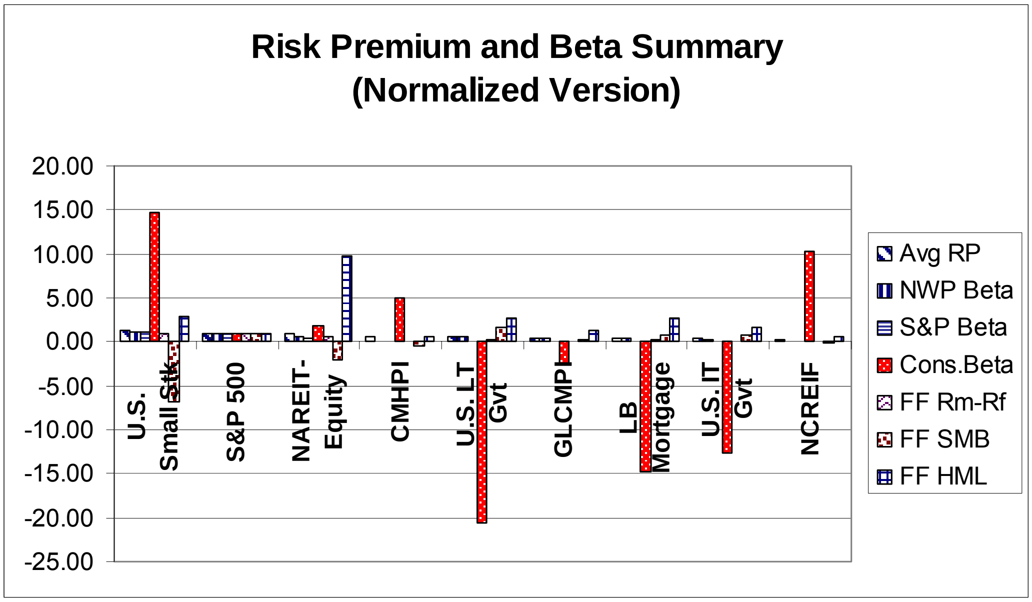

Figure 3 Risk Premium and Beta Summary of Four Models (Normalized Version)

These findings are sensitive to our assumption of a 6% housing yield, a figure which has been used in earlier studies (Geltner, 1999) and seems reasonable. The results suggest that either housing is not fitting in with the rest of the capital market, and, in essence, is really a different kind of animal from the perspective of explaining risk and return, or else housing has a really small yield. If the latter is true, then housing yields may be smaller than most people think they are.

Over the twenty-five year period covered by our data set, 1979 Q.4 to 2004 Q.2, it would seem that housing yields have not been exceptionally low on average. During the most recent few years, however, we have certainly seen lower yields (given the inverse relationship of rent yields to prices and the somewhat drastic price escalations experienced in some markets). The current low-yield-high-price environment has drawn much attention from both the media and general public and is now being deemed by some a “housing market bubble”.

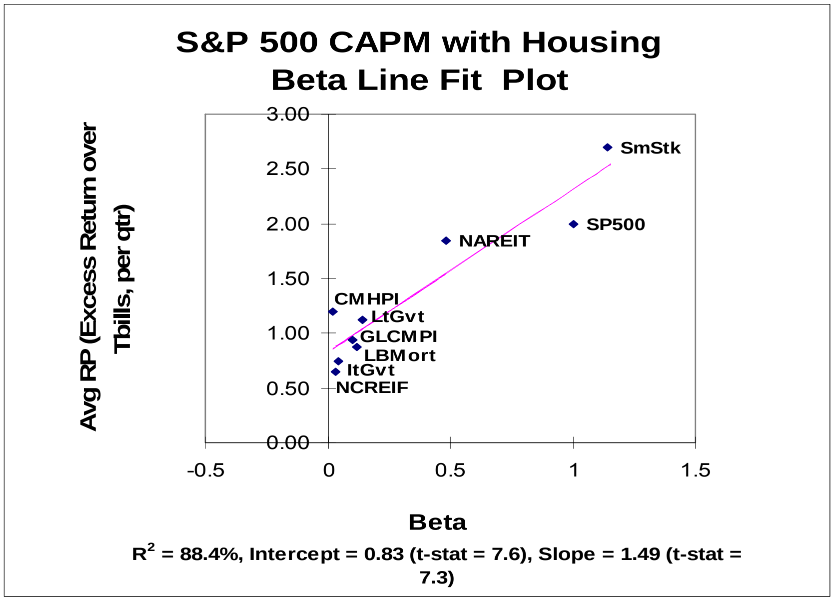

Figure 4 S&P 500 CAPM with Housing Beta Line Fit Plot

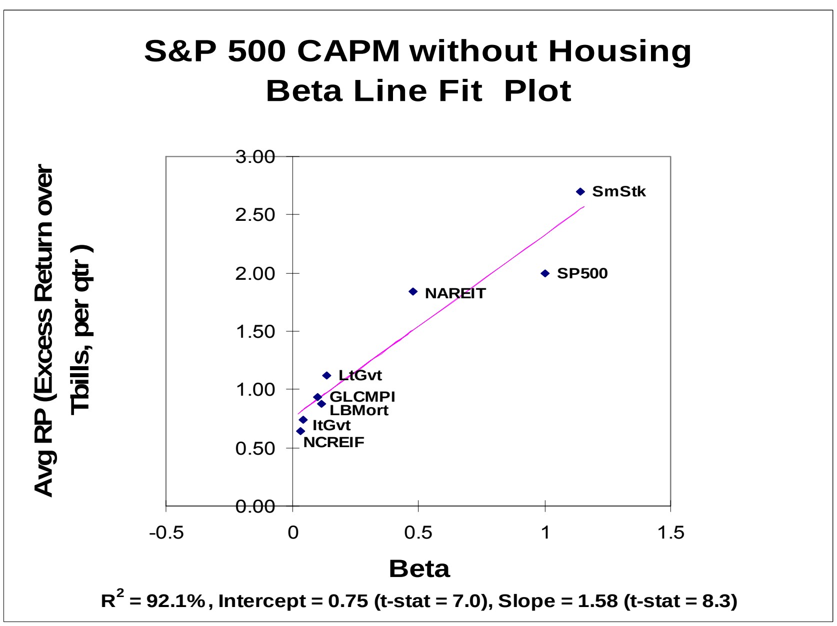

Figure 5 S&P 500 CAPM without Housing Beta Line Fit Plot

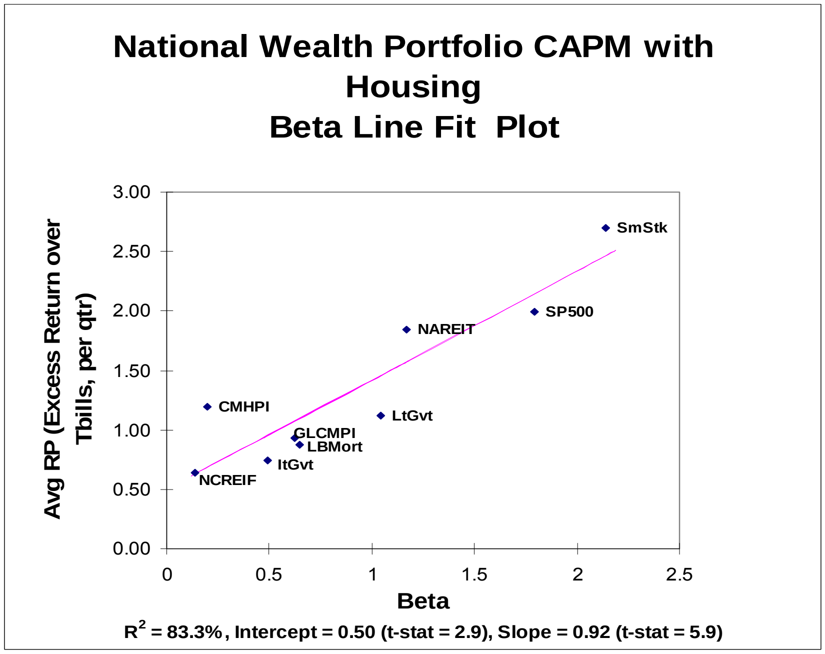

Figure 6 National Wealth Portfolio CAPM with Housing Beta Line Fit Plot

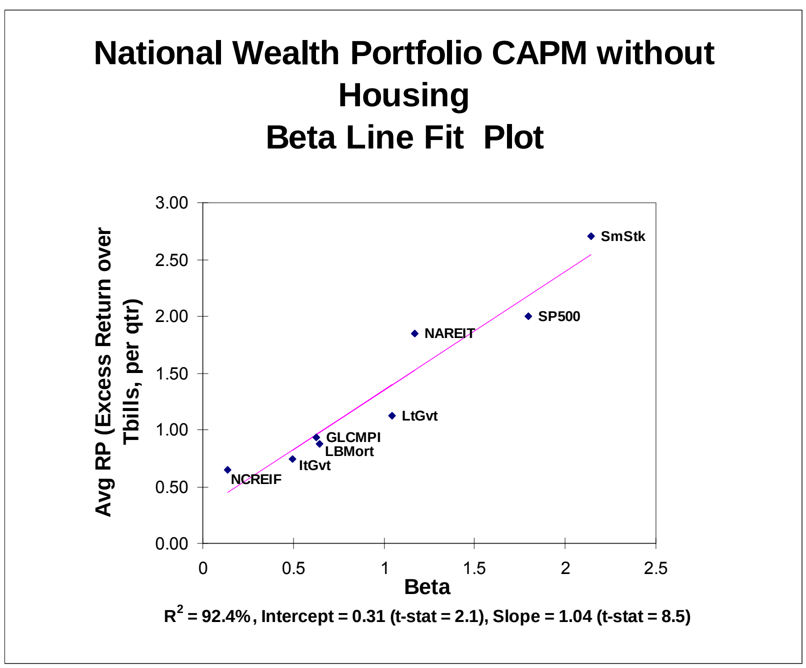

Figure 7 National Wealth Portfolio CAPM without Housing Beta Line Fit Plot

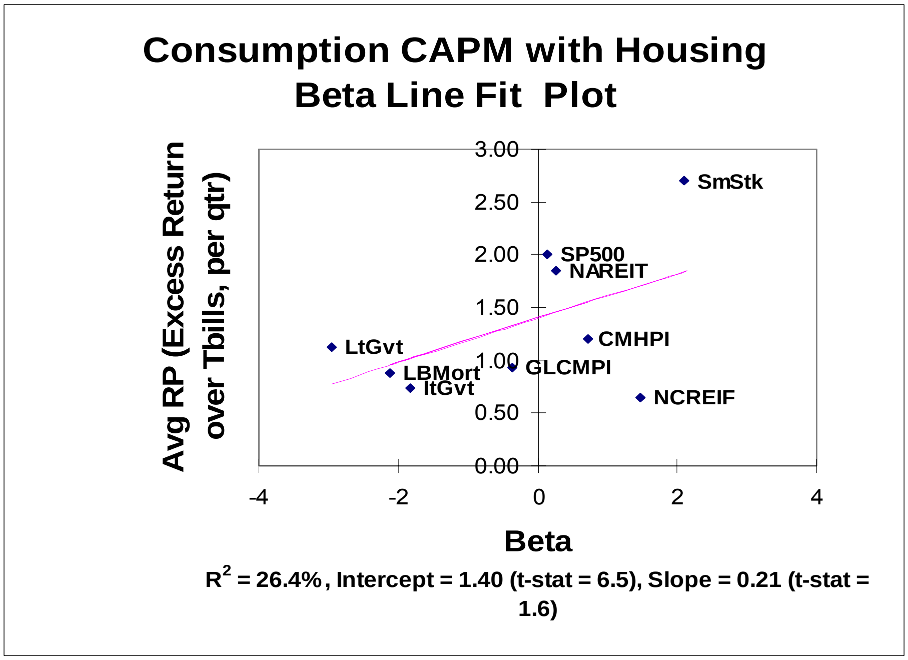

Figure 8 Consumption CAPM with Housing Beta Line Fit Plot

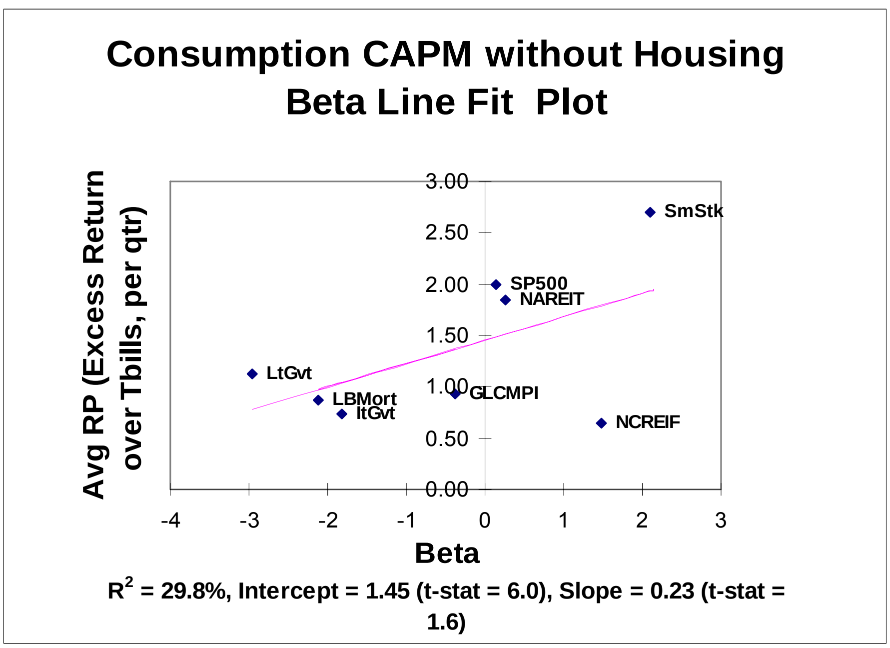

Figure 9 Consumption CAPM without Housing Beta Line Fit Plot

It could be that housing has historically been a bargain. In light of our results, one way to explain the possible "bubble" is to say that in recent years housing has been bid up to be in equilibrium with the rest of the asset classes. The dual nature of housing is such that it is both a consumption good and an investment vehicle. People may be moving from a regime where housing has been viewed primarily as a consumption item (and therefore, not really priced with the rest of the capital assets) to a regime where it is mainly viewed as an investment (and therefore, must be in equilibrium with the rest of the investment market). Such a fundamental perception shift could mean that the run up in housing prices is here to stay, or, at least, here to stay until perception swings back the other direction.

Within the set of asset classes selected for this study, or in other words, the population that we used to define the capital market, the single-beta National Wealth Portfolio CAPM is the best model. Contrary to several well known studies that empirically raise doubts as to whether or not Sharpe and Lintner produced a good model for pricing risk in the capital market, our findings support the basic CAPM theory. We say this with the caveat that, as the intercept is significant, there is some component of risk (relative to t-bills as perceived by the market) that is not captured by the CAPM. (We don't want to reach too far and place wild guesses as to what that component might be; however, perhaps it is "illiquidity risk"?) That said, part of the fundamental underlying theory that the single-beta capital asset pricing model rests on is that an asset's risk and return can be explained linearly through an asset's covariance with the "market". At its most basic level the "market" should be fairly broad in scope and represent all investable assets. The National Wealth Portfolio approach attempts to do this by incorporating real estate and bonds, in addition to the usual stock index, into an overall market proxy.

Due to the availability and reliability of historical stock market indices, both industry practitioners and academics have relied on them. Interestingly, our results show that the traditional use of the S&P 500 works surprisingly well as the market proxy for the single-beta CAPM. The regression results are both robust and statistically significant. However, when looking at the model graphically you can see that it only works well because of the role of the stocks. The cluster of other asset classes by themselves doesn't show much of a shape.

The multi-beta Fama French model works pretty well from the standpoint of explaining a high percentage of the variation in asset returns. In fact, our results show an Adjusted R Square of 97%, several percentage points above what the other models explain. This, of course, is to be expected since it is a statistical inevitability that the more independent variables you include in a regression the more volatility you'll be able to explain. However, when scrutinized on an individual factor basis the HML (High book-to-market minus Low book-to-market) component is not statistically significant. Intuitively, this is the dimension which is least meaningful for the non-stock asset classes included in our definition of the capital market. It almost seems silly to think that book values would matter to risk pricing for privately held assets.

The other distinctive Fama-French factor, SMB (Small minus Big), could be meaningful because it's related to liquidity. This makes more logical sense since the liquidity of an asset readily plays into how risky the asset may or may not be. Furthermore, the SMB factor proves to be strongly statistically significant.

It is worth noting that the multi-factor Fama-French model does not greatly improve on the classical, purely beta based (single-factor) CAPM when real estate is included as part of the capital market population; whereas it does improve the results when looking exclusively at the stock market. Said another way, the basic role that Fama-French plays in the stock market does not carry over into the broader mixed-asset perspective.

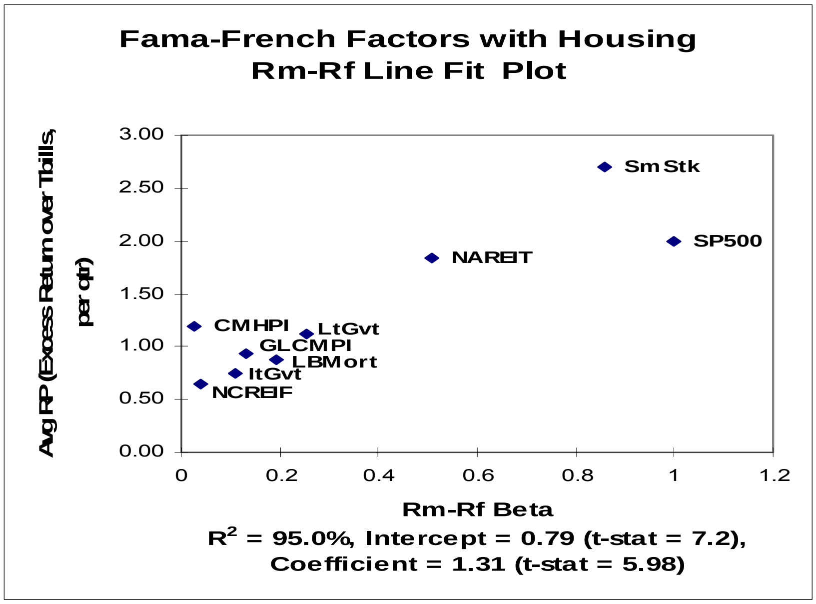

Figure 10 Fama-French Factors with Housing Rm-Rf Beta Line Fit Plot

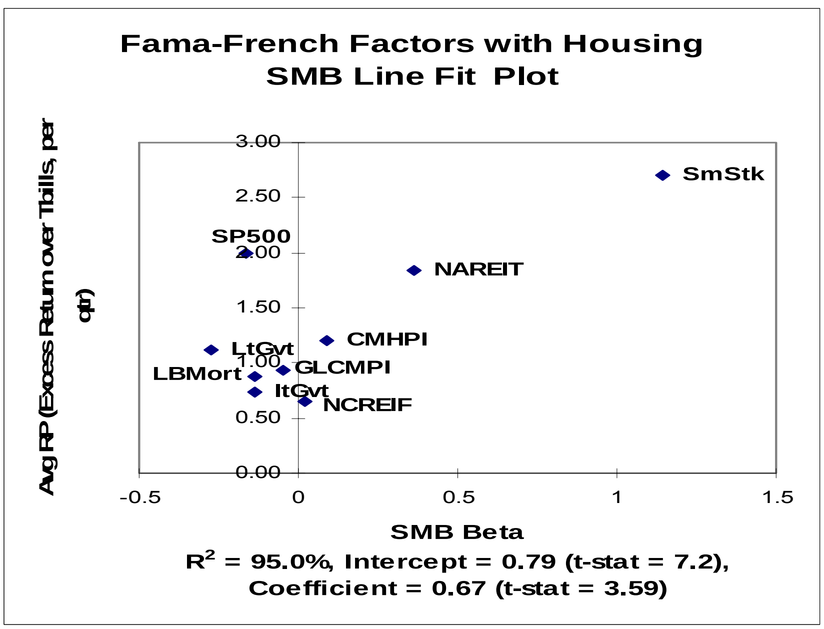

Figure 11 Fama-French Factors with Housing SMB Beta Line Fit Plot

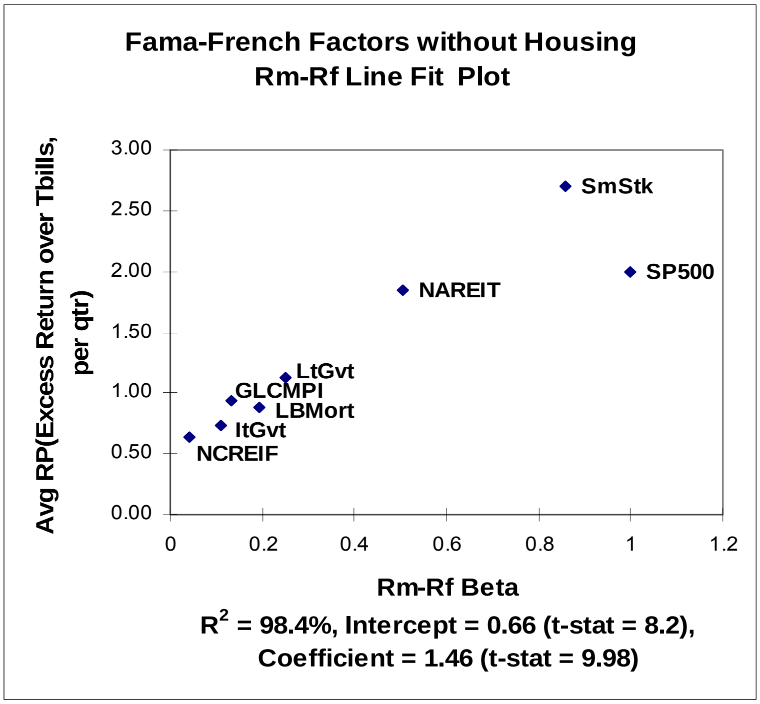

Figure 12 Fama-French Factors without Housing Rm-Rf Beta Line Fit Plot

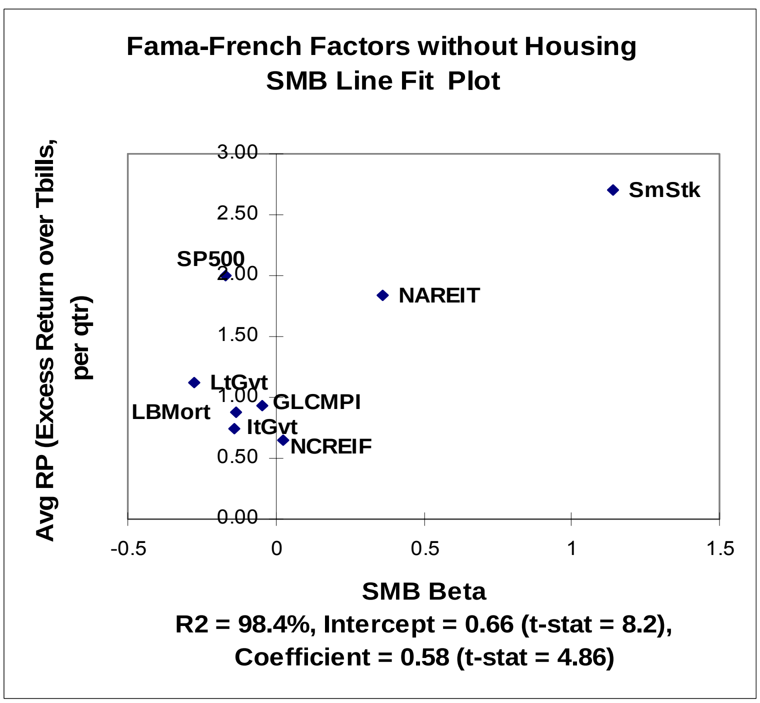

Figure 13 Fama-French Factors without Housing SMB Beta Line Fit Plot

In a dramatic departure from what was found fifteen years ago (Geltner, 1989??) the consumption based CAPM proved to be the weakest model tested. It explains very little of the price volatility, the intercept is large, and the beta is not statistically significant. In the earlier Geltner study, the consumption oriented pricing model worked better than the wealth based versions. The main difference between then and now being the passage of time and corresponding additional data that includes a complete trip through the real estate market cycle.

Actual, sorted by NWP Beta

	Avg RP	NWP Beta	S&P Beta	Cons.Beta	FF Rm-Rf	FF SMB	FF HML
U.S. Small Stk	2.70	2.14	1.14	2.10	0.86	1.14	0.12
S&P 500	2.00	1.79	1.00	0.14	1.00	-0.17	0.04
NAREIT-Equity	1.84	1.17	0.48	0.27	0.51	0.36	0.39
U.S. LT Gvt	1.12	1.04	0.14	-2.96	0.25	-0.27	0.11
LB Mortgage	0.88	0.65	0.12	-2.11	0.19	-0.14	0.11
GLCMPI	0.94	0.63	0.10	-0.38	0.13	-0.05	0.05
U.S. IT Gvt	0.74	0.49	0.05	-1.82	0.11	-0.14	0.07
CMHPI	1.20	0.20	0.02	0.71	0.03	0.09	0.03
NCREIF	0.64	0.14	0.03	1.47	0.04	0.02	0.02

Normalized to the S&P 500, sorted by NWP Beta

	Avg RP	NWP Beta	S&P Beta	Cons.Beta	FF Rm-Rf	FF SMB	FF HML
U.S. Small Stk	1.35	1.19	1.14	14.69	0.86	-6.80	2.95
S&P 500	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NAREIT-Equity	0.92	0.65	0.48	1.88	0.51	-2.15	9.71
U.S. LT Gvt	0.56	0.58	0.14	-20.66	0.25	1.64	2.63
LB Mortgage	0.44	0.36	0.12	-14.74	0.19	0.81	2.75
GLCMPI	0.47	0.35	0.10	-2.62	0.13	0.29	1.21
U.S. IT Gvt	0.37	0.28	0.05	-12.73	0.11	0.83	1.67
CMHPI	0.60	0.11	0.02	4.99	0.03	-0.52	0.64
NCREIF	0.32	0.08	0.03	10.29	0.04	-0.14	0.55

Actual, sorted by Consumption Beta

	Avg RP	NWP Beta	S&P Beta	Cons.Beta	FF Rm-Rf	FF SMB	FF HML
U.S. Small Stk	2.70	2.14	1.14	2.10	0.86	1.14	0.12
NCREIF	0.64	0.14	0.03	1.47	0.04	0.02	0.02
CMHPI	1.20	0.20	0.02	0.71	0.03	0.09	0.03
NAREIT-Equity	1.84	1.17	0.48	0.27	0.51	0.36	0.39
S&P 500	2.00	1.79	1.00	0.14	1.00	-0.17	0.04
GLCMPI	0.94	0.63	0.10	-0.38	0.13	-0.05	0.05
U.S. IT Gvt	0.74	0.49	0.05	-1.82	0.11	-0.14	0.07
LB Mortgage	0.88	0.65	0.12	-2.11	0.19	-0.14	0.11
U.S. LT Gvt	1.12	1.04	0.14	-2.96	0.25	-0.27	0.11

Normalized to the S&P 500, sorted by Consumption Beta

	Avg RP	NWP Beta	S&P Beta	Cons.Beta	FF Rm-Rf	FF SMB	FF HML
U.S. Small Stk	1.35	1.19	1.14	14.69	0.86	-6.80	2.95
NCREIF	0.32	0.08	0.03	10.29	0.04	-0.14	0.55
CMHPI	0.60	0.11	0.02	4.99	0.03	-0.52	0.64
NAREIT-Equity	0.92	0.65	0.48	1.88	0.51	-2.15	9.71
S&P 500	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GLCMPI	0.47	0.35	0.10	-2.62	0.13	0.29	1.21
U.S. IT Gvt	0.37	0.28	0.05	-12.73	0.11	0.83	1.67
LB Mortgage	0.44	0.36	0.12	-14.74	0.19	0.81	2.75
U.S. LT Gvt	0.56	0.58	0.14	-20.66	0.25	1.64	2.63

Table 2 Comparison between NWP Beta and Consumption Beta

Despite the poor statistical performance of the Consumption CAPM, the theory itself remains a beautiful, elegant theory supported by both logical reasoning and intuition. This, coupled with the fact that the Bureau of Economic Analysis has to grapple with the difficulties associated with measuring the flow of real national consumption as a stock, leads us to believe that the reason for the lackluster results is empirical. It's hard to measure national consumption in a way that would really provide for a good test of the theory.

On a strictly comparative scale, it is interesting that real estate has a high consumption beta; almost as high as small stocks. The rank ordering of asset classes by risk drastically changes when using a consumption based CAPM rather than a wealth based CAPM. In a consumption model, real estate looks much riskier than it does when using a wealth based version. With the caveat that we may not be measuring consumption in a way that is fair for this kind of model; we can say that with the exception of small stocks, real estate is more highly positively correlated with national consumption, or rather, the national economy, than the other asset classes. This suggests that real estate may not be a good hedge against what your income, or equivalent consumption, would typically be.

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Appendix

Exhibit 1

S&P 500 CAPM Step 1 Regression Summary Output (US LT Gvt)

Dependent Variable	RP of US LT Gvt
Independent Variable	RP of S&P 500 as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.17821818
R Square	0.03176172
Adjusted R Square	0.02177988
Standard Error	6.33067606
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	127.5245117	127.5245	3.181951	0.077582954
Residual	97	3887.513561	40.07746		
Total	98	4015.038073			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.84302033	0.655131746	1.286795	0.201228	-0.4572341	2.14327477	-0.457234104	2.143274773
S&P 500 TR	0.13936707	0.078129207	1.783802	0.077583	-0.0156977	0.29443183	-0.015697695	0.294431829

Exhibit 2

S&P 500 CAPM Step 1 Regression Summary Output (US IT Gvt)

Dependent Variable	RP of US IT Gvt
Independent Variable	RP of S&P 500 as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.103873442
R Square	0.010789692
Adjusted R Square	0.000591648
Standard Error	3.568810856
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	13.47532387	13.47532	1.058016	0.306226259
Residual	97	1235.43186	12.73641		
Total	98	1248.907184			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.649066508	0.369319369	1.757467	0.081993	-0.0839298	1.3820628	-0.0839298	1.382062813
S&P 500 TR	0.045303623	0.04404401	1.028599	0.306226	-0.0421115	0.1327187	-0.0421115	0.132718742

Exhibit 3

S&P 500 CAPM Step 1 Regression Summary Output (S&P 500)

Dependent Variable	RP of S&P 500
Independent Variable	RP of S&P 500 as Market Portfolio Proxy

Regression Statistics	
Multiple R	1
R Square	1
Adjusted R Square	1
Standard Error	2.0693E-15
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6565.583808	6565.584	1.53E+33	0
Residual	97	4.15364E-28	4.28E-30		
Total	98	6565.583808			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	2.14145E-16	0	1	-4.25017E-16	4.2502E-16	-4.2502E-16	4.25017E-16
S&P 500 TR	1	2.55383E-17	3.92E+16	0	1	1	1	1

Exhibit 4

S&P 500 CAPM Step 1 Regression Summary Output (Small Stocks)

Dependent Variable	RP of Small Stk
Independent Variable	RP of S&P 500 as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.79755201
R Square	0.63608921
Adjusted R Square	0.63233755
Standard Error	7.10134083
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	8550.185585	8550.186	169.5488	5.14582E-23
Residual	97	4891.617034	50.42904		
Total	98	13441.80262			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.42203989	0.734884201	0.574294	0.567098	-1.03650101	1.8805808	-1.03650101	1.880580785
S&P 500 TR	1.14117197	0.087640265	13.02109	5.15E-23	0.967230402	1.3151135	0.967230402	1.315113539

Exhibit 5

S&P 500 CAPM Step 1 Regression Summary Output (NCREIF)

Dependent Variable RP of NCREIF Unsmoothed
Independent Variable RP of S&P 500 as Market Portfolio Proxy with Lags

Regression Statistics	
Multiple R	0.123753289
R Square	0.015314877
Adjusted R Square	-0.02658662
Standard Error	1.512003982
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	3.342334015	0.835584	0.365497	0.832634584
Residual	94	214.898668	2.286156		
Total	98	218.241002			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.576950993	0.169084241	3.41221	0.000952	0.241230441	0.91267155	0.241230441	0.912671546
S&P 500 TR	-0.00227057	0.018676559	-0.121573	0.903497	-0.039353295	0.03481216	-0.03935329	0.03481216
S&P 500 TR (t-1)	0.008385686	0.018652662	0.44957	0.654055	-0.028649593	0.04542097	-0.02864959	0.045420965
S&P 500 TR (t-2)	0.018666918	0.018647877	1.001021	0.319387	-0.018358859	0.0556927	-0.01835886	0.055692696
S&P 500 TR (t-3)	0.008661376	0.018791202	0.460927	0.645916	-0.028648976	0.04597173	-0.02864898	0.045971729

Exhibit 6

S&P 500 CAPM Step 1 Regression Summary Output (NAREIT)

Dependent Variable RP of NAREIT
Independent Variable RP of S&P 500 as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.56414628
R Square	0.31826103
Adjusted R Square	0.31123279
Standard Error	5.78747001
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1516.752009	1516.752	45.2832	1.19558E-09
Residual	97	3248.996482	33.49481		
Total	98	4765.748491			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.88257409	0.598917919	1.473614	0.143823	-0.306111527	2.0712597	-0.306111527	2.071259703
S&P 500 TR	0.48064078	0.071425301	6.729279	1.2E-09	0.338881407	0.62240015	0.338881407	0.62240015

Exhibit 7

S&P 500 CAPM Step 1 Regression Summary Output (LB Mortgage)

Dependent Variable	RP of LB Mortgage
Independent Variable	RP of S&P 500 as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.22633054
R Square	0.05122551
Adjusted R Square	0.04144433
Standard Error	4.20638038
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	92.66423438	92.66423	5.237151	0.024279531
Residual	97	1716.282683	17.69364		
Total	98	1808.946917			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.63886501	0.435298426	1.467648	0.145435	-0.225081384	1.50281141	-0.22508138	1.502811405
S&P 500 TR	0.11880081	0.051912491	2.288482	0.02428	0.015768942	0.22183268	0.01576894	0.221832675

Exhibit 8

S&P 500 CAPM Step 1 Regression Summary Output (GLCMPI)

Dependent Variable	RP of GLCMPI
Independent Variable	RP of S&P 500 as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.221625374
R Square	0.049117806
Adjusted R Square	0.039314897
Standard Error	3.722268094
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	69.42234534	69.42235	5.010534	0.027479913
Residual	97	1343.962137	13.85528		
Total	98	1413.384482			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.729699124	0.385199933	1.894339	0.061159	-0.034815687	1.49421393	-0.034815687	1.494213935
S&P 500 TR	0.102828373	0.045937883	2.238422	0.02748	0.011654443	0.1940023	0.011654443	0.194002303

Exhibit 9

S&P 500 CAPM Step 1 Regression Summary Output (CMHPI)

Dependent Variable RP of CMHPI Unsmoothed
Independent Variable RP of S&P 500 as Market Portfolio Proxy with Lags

Regression Statistics	
Multiple R	0.12350057
R Square	0.01525239
Adjusted R Square	-0.02665176
Standard Error	1.14986863
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.925028967	0.481257	0.363983	0.833695462
Residual	94	124.2865986	1.322198		
Total	98	126.2116276			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.15899514	0.128587402	9.013287	2.3E-14	0.903681973	1.41430831	0.903681973	1.414308314
S&P 500 TR	0.00865636	0.014203395	0.609457	0.543692	-0.019544798	0.03685752	-0.0195448	0.03685752
S&P 500 TR (t-1)	0.01430418	0.014185221	1.008386	0.315858	-0.013860893	0.04246926	-0.01386089	0.042469257
S&P 500 TR (t-2)	-0.00333388	0.014181582	-0.235085	0.814654	-0.03149173	0.02482397	-0.03149173	0.024823969
S&P 500 TR (t-3)	-0.00086691	0.01429058	-0.060663	0.951756	-0.029241174	0.02750736	-0.02924117	0.027507359

Exhibit 10

S&P 500 CAPM Step 1 Results

	Beta	Avg RP
U.S. LT Gvt	0.13936707	1.12
U.S. IT Gvt	0.04530362	0.74
S&P 500	1	2.00
U.S. Small Stk	1.14117197	2.70
NCREIF	0.03344341	0.64
NAREIT-Equity	0.48064078	1.84
LB Mortgage	0.11880081	0.88
GLCMPI	0.10282837	0.94
CMHPI	0.01875975	1.20

Exhibit 11

S&P 500 CAPM Step 2 Regression Summary Output (with Housing)

Dependent Variable	Avg RP
Independent Variable	Beta

Regression Statistics	
Multiple R	0.940447206
R Square	0.884440947
Adjusted R Square	0.867932511
Standard Error	0.251594942
Observations	9

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.391303958	3.391304	53.57509	0.000160058
Residual	7	0.443100103	0.0633		
Total	8	3.834404061			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.829600446	0.109042728	7.608031	0.000125	0.571755551	1.0874453	0.571755551	1.087445341
Beta	1.490431257	0.203624718	7.319501	0.00016	1.008935654	1.9719269	1.008935654	1.97192686

Exhibit 12

S&P 500 CAPM Step 2 Regression Summary Output (without Housing)

Dependent Variable	Avg RP
Independent Variable	Beta

Regression Statistics	
Multiple R	0.959473633
R Square	0.920589653
Adjusted R Square	0.907354595
Standard Error	0.224600067
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.508811272	3.508811	69.556904	0.000161383
Residual	6	0.302671141	0.050445		
Total	7	3.811482413			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.753622641	0.107467731	7.012548	0.0004194	0.490658385	1.0165869	0.490658385	1.016586897
Beta	1.578102978	0.189219206	8.340078	0.0001614	1.115099921	2.04110603	1.115099921	2.041106035

Exhibit 13

National Wealth Portfolio CAPM Step 1 Regression Summary Output (US LT Gvt)

Dependent Variable RP of US LT Gvt
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.62238428
R Square	0.3873622
Adjusted R Square	0.38104634
Standard Error	5.03571175
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1555.273971	1555.274	61.33172	6.11046E-12
Residual	97	2459.764102	25.35839		
Total	98	4015.038073			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.60168379	0.510442292	1.17875	0.241381	-0.411402294	1.61476988	-0.41140229	1.614769878
NWP	1.04485516	0.133417716	7.831457	6.11E-12	0.780058071	1.30965224	0.780058071	1.309652242

Exhibit 14

National Wealth Portfolio CAPM Step 1 Regression Summary Output (US IT Gvt)

Dependent Variable RP of US IT Gvt
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.52773971
R Square	0.27850921
Adjusted R Square	0.27107116
Standard Error	3.04785717
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	347.832148	347.8321	37.44385	1.988E-08
Residual	97	901.0750358	9.289433		
Total	98	1248.907184			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.49376086	0.308944451	1.598219	0.113247	-0.119408	1.10692974	-0.119408009	1.106929737
NWP	0.49412576	0.080750877	6.119138	1.99E-08	0.3338577	0.65439381	0.333857714	0.654393812

Exhibit 15

National Wealth Portfolio CAPM Step 1 Regression Summary Output (S&P 500)

Dependent Variable RP of S&P 500
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.83521381
R Square	0.69758211
Adjusted R Square	0.6944644
Standard Error	4.52433287
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4580.033784	4580.034	223.7482	6.212E-27
Residual	97	1985.550024	20.46959		
Total	98	6565.583808			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.10622427	0.458606639	2.412142	0.01774	0.1960175	2.016431	0.19601755	2.016430991
NWP	1.79302762	0.119869084	14.95822	6.21E-27	1.5551208	2.0309344	1.555120801	2.030934437

Exhibit 16

National Wealth Portfolio CAPM Step 1 Regression Summary Output (Small Stocks)

Dependent Variable RP of Small Stk
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.69702055
R Square	0.48583765
Adjusted R Square	0.480537
Standard Error	8.44098304
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6530.533737	6530.534	91.65636	1.117E-15
Residual	97	6911.268882	71.25019		
Total	98	13441.80262			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.63721884	0.855615839	1.913498	0.058633	-0.0609408	3.3353785	-0.06094081	3.33537848
NWP	2.14105083	0.223638034	9.573733	1.12E-15	1.6971915	2.5849102	1.697191483	2.58491017

Exhibit 17

National Wealth Portfolio CAPM Step 1 Regression Summary Output (NCREIF)

Dependent Variable RP of NCREIF Unsmoothed
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy with Lags

Regression Statistics	
Multiple R	0.204054147
R Square	0.041638095
Adjusted R Square	0.000856737
Standard Error	1.491657162
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	9.087139588	2.271785	1.021008	0.400625329
Residual	94	209.1538624	2.225041		
Total	98	218.241002			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.577912096	0.154290113	3.74562	0.00031	0.271565617	0.88425858	0.271565617	0.884258576
NWP	0.015224876	0.039575865	0.384701	0.701328	-0.063353892	0.09380364	-0.06335389	0.093803643
NWP(t-1)	0.026431289	0.039606966	0.667339	0.50619	-0.052209229	0.10507181	-0.05220923	0.105071808
NWP(t-2)	0.06210486	0.039597391	1.568408	0.120146	-0.016516649	0.14072637	-0.01651665	0.140726369
NWP(t-3)	0.034158081	0.040090365	0.852027	0.396365	-0.045442238	0.1137584	-0.04544224	0.113758399

Exhibit 18

National Wealth Portfolio CAPM Step 1 Regression Summary Output (NAREIT)

Dependent Variable RP of NAREIT
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.638986483
R Square	0.408303725
Adjusted R Square	0.402203763
Standard Error	5.391742092
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1945.872861	1945.873	66.93546	1.10304E-12
Residual	97	2819.87563	29.07088		
Total	98	4765.748491			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.26157511	0.546531122	2.308332	0.023104	0.176862726	2.34628749	0.176862726	2.34628749
NWP	1.168718366	0.142850495	8.181409	1.1E-12	0.885199836	1.4522369	0.885199836	1.4522369

Exhibit 19

National Wealth Portfolio CAPM Step 1 Regression Summary Output (LB Mortgage)

Dependent Variable RP of LB Mortgage
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.57247901
R Square	0.32773222
Adjusted R Square	0.32080162
Standard Error	3.54077389
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	592.8501818	592.8502	47.28774	5.983E-10
Residual	97	1216.096735	12.53708		
Total	98	1808.946917			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.55531697	0.358908697	1.547237	0.125063	-0.157017	1.26765098	-0.15701704	1.267650984
NWP	0.64509714	0.093810367	6.876608	5.98E-10	0.4589096	0.83128465	0.458909636	0.831284646

Exhibit 20

National Wealth Portfolio CAPM Step 1 Regression Summary Output (GLCMPI)

Dependent Variable RP of GLCMPI
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy

Regression Statistics	
Multiple R	0.62872207
R Square	0.39529144
Adjusted R Square	0.38905733
Standard Error	2.96836534
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	558.698784	558.6988	63.40785	3.21728E-12
Residual	97	854.6856982	8.811193		
Total	98	1413.384482			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.62361486	0.300886803	2.07259	0.040863	0.026438176	1.22079153	0.026438176	1.220791535
NWP	0.62624101	0.078644796	7.962905	3.22E-12	0.470152943	0.78232907	0.470152943	0.782329069

Exhibit 21

National Wealth Portfolio CAPM Step 1 Regression Summary Output (CMHPI)

Dependent Variable RP of CMHPI Unsmoothed
Independent Variable RP of National Wealth Portfolio as Market Portfolio Proxy with Lags

Regression Statistics	
Multiple R	0.4017158
R Square	0.16137558
Adjusted R Square	0.12568943
Standard Error	1.06113224
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	20.36747461	5.091869	4.522079	0.002194802
Residual	94	105.844153	1.126002		
Total	98	126.2116276			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.10055307	0.109758607	10.02703	1.61E-16	0.882624891	1.3184812	0.882624891	1.318481244
NWP	0.05862928	0.028153404	2.082494	0.040014	0.002730067	0.1145285	0.002730067	0.114528496
NWP(t-1)	0.09387438	0.028175528	3.33177	0.001235	0.037931239	0.1498175	0.037931239	0.149817525
NWP(t-2)	0.01500694	0.028168717	0.532752	0.595463	-0.040922683	0.0709366	-0.04092268	0.070936556
NWP(t-3)	0.03097016	0.028519407	1.085933	0.280286	-0.025655764	0.0875961	-0.02565576	0.087596082

Exhibit 22

National Wealth Portfolio CAPM Step 1 Results

	Beta	Avg RP
U.S. LT Gvt	1.044855	1.12
U.S. IT Gvt	0.494126	0.74
S&P 500	1.793028	2.00
U.S. Small Stk	2.141051	2.70
NCREIF	0.137919	0.64
NAREIT-Equity	1.168718	1.84
LB Mortgage	0.645097	0.88
GLCMPI	0.626241	0.94
CMHPI	0.198481	1.20

Exhibit 23

National Wealth Portfolio CAPM Step 2 Regression Summary Output (with Housing)

Dependent Variable Avg RP
Independent Variable Beta

Regression Statistics	
Multiple R	0.912430503
R Square	0.832529422
Adjusted R Square	0.808605054
Standard Error	0.30287901
Observations	9

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.192254197	3.192254	34.79839	0.000600076
Residual	7	0.642149863	0.091736		
Total	8	3.834404061			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.500246932	0.174481554	2.867048	0.024093	0.087663915	0.91282995	0.087663915	0.91282995
Beta	0.915833218	0.155251868	5.899016	0.0006	0.548721147	1.282945289	0.548721147	1.28294529

Exhibit 24

National Wealth Portfolio CAPM Step 2 Regression Summary Output (without Housing)

Dependent Variable Avg RP
Independent Variable Beta

Regression Statistics	
Multiple R	0.961180441
R Square	0.923867839
Adjusted R Square	0.911179146
Standard Error	0.219915284
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.521306021	3.521306	72.81032	0.000142024
Residual	6	0.290176392	0.048363		
Total	7	3.811482413			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.306086544	0.145704423	2.100736	0.080396	-0.050439597	0.66261269	-0.0504396	0.662612685
Beta	1.04480225	0.122444033	8.532896	0.000142	0.745192275	1.34441223	0.74519227	1.344412226

Exhibit 25

Consumption CAPM Step 1 Regression Summary Output (US LT Gvt)

Dependent Variable	RP of US LT Gvt
Independent Variable	Consumption

Regression Statistics	
Multiple R	0.280630407
R Square	0.078753425
Adjusted R Square	0.069256038
Standard Error	6.175141445
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	316.1980015	316.198	8.292115	0.004899825
Residual	97	3698.840071	38.13237		
Total	98	4015.038073			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.143881744	0.620673669	1.842968	0.068388	-0.087982988	2.37574648	-0.08798299	2.375746477
Consumption	-2.95913211	1.027618003	-2.879603	0.0049	-4.998668247	-0.91959597	-4.99866825	-0.919595975

Exhibit 26

Consumption CAPM Step 1 Regression Summary Output (US IT Gvt)

Dependent Variable	RP of US IT Gvt
Independent Variable	Consumption

Regression Statistics	
Multiple R	0.31006257
R Square	0.0961388
Adjusted R Square	0.08682064
Standard Error	3.41137991
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	120.068436	120.0684	10.31736	0.00178862
Residual	97	1128.838748	11.63751		
Total	98	1248.907184			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.75337867	0.342883431	2.197186	0.030388	0.07285036	1.43390699	0.07285036	1.433906986
Consumption	-1.82347251	0.567694755	-3.212065	0.001789	-2.9501888	-0.6967562	-2.95018882	-0.6967562

Exhibit 27

Consumption CAPM Step 1 Regression Summary Output (S&P 500)

Dependent Variable	RP of S&P 500
Independent Variable	Consumption

Regression Statistics	
Multiple R	0.01062044
R Square	0.00011279
Adjusted R Square	-0.0101953
Standard Error	8.22671237
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.74055629	0.740556	0.010942	0.916905187
Residual	97	6564.843252	67.6788		
Total	98	6565.583808			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.9972004	0.826880452	2.415344	0.017593	0.356072512	3.63832829	0.356072512	3.63832829
Consumption	0.14320686	1.369024145	0.104605	0.916905	-2.57392558	2.86033931	-2.57392558	2.86033931

Exhibit 28

Consumption CAPM Step 1 Regression Summary Output (Small Stocks)

Dependent Variable	RP of Small Stk
Independent Variable	Consumption

Regression Statistics	
Multiple R	0.109030926
R Square	0.011887743
Adjusted R Square	0.001701018
Standard Error	11.70162114
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	159.792692	159.7927	1.166984	0.282700491
Residual	97	13282.00993	136.9279		
Total	98	13441.80262			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.686524184	1.176149274	2.284169	0.024542	0.352194755	5.02085361	0.352194755	5.020853613
Consumption	2.103600431	1.947290869	1.08027	0.2827	-1.761230745	5.96843161	-1.76123075	5.968431607

Exhibit 29

Consumption CAPM Step 1 Regression Summary Output (NCREIF)

Dependent Variable	RP of NCREIF Unsmoothed
Independent Variable	Consumption with Lags

Regression Statistics	
Multiple R	0.32496547
R Square	0.10560256
Adjusted R Square	0.06754309
Standard Error	1.44101838
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	23.04680788	5.761702	2.774673	0.031435757
Residual	94	195.1941941	2.076534		
Total	98	218.241002			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.63188267	0.144896906	4.360912	3.31E-05	0.344186612	0.91957873	0.34418661	0.919578728
Consumption	0.33559091	0.247320965	1.356904	0.178061	-0.155470412	0.82665224	-0.15547041	0.826652237
Consumption t-1	0.46195795	0.241457315	1.913208	0.058765	-0.017460967	0.94137686	-0.01746097	0.941376864
Consumption t-2	0.30819384	0.239131345	1.288806	0.200628	-0.166606812	0.78299449	-0.16660681	0.782994486
consumption t-3	0.36844306	0.244771217	1.505255	0.135611	-0.117555677	0.85444181	-0.11755568	0.854441807

Exhibit 30

Consumption CAPM Step 1 Regression Summary Output (NAREIT)

Dependent Variable	RP of NAREIT
Independent Variable	Consumption

Regression Statistics	
Multiple R	0.0233948
R Square	0.0005473
Adjusted R Square	-0.0097563
Standard Error	7.007463
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.60837087	2.608371	0.053119	0.818208057
Residual	97	4763.14012	49.10454		
Total	98	4765.748491			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.8409989	0.704331681	2.613824	0.01038	0.443096223	3.2389015	0.443096223	3.238901495
Consumption	0.268763	1.166126342	0.230475	0.818208	-2.045673704	2.5831997	-2.0456737	2.583199686

Exhibit 31

Consumption CAPM Step 1 Regression Summary Output (LB Mortgage)

Dependent Variable	RP of LB Mortgage
Independent Variable	Consumption

Regression Statistics	
Multiple R	0.2982895
R Square	0.08897662
Adjusted R Square	0.07958463
Standard Error	4.12184641
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	160.9539907	160.954	9.473668	0.002710155
Residual	97	1647.992926	16.98962		
Total	98	1808.946917			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.89222036	0.414293592	2.153594	0.03375	0.069962719	1.714478	0.06996272	1.714477996
Consumption	-2.11123059	0.685924948	-3.077932	0.00271	-3.472600972	-0.7498602	-3.47260097	-0.7498602

Exhibit 32

Consumption CAPM Step 1 Regression Summary Output (GLCMPI)

Dependent Variable	RP of GLCMPI
Independent Variable	Consumption

Regression Statistics	
Multiple R	0.0600232
R Square	0.0036028
Adjusted R Square	-0.0066693
Standard Error	3.8103121
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5.09212289	5.092123	0.350734	0.55507594
Residual	97	1408.292359	14.51848		
Total	98	1413.384482			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.9380177	0.38298076	2.449255	0.016109	0.177907303	1.698128	0.177907303	1.69812804
Consumption	-0.375521	0.634081874	-0.592228	0.555076	-1.633997297	0.8829553	-1.6339973	0.882955291

Exhibit 33

Consumption CAPM Step 1 Regression Summary Output (CMHPI)

Dependent Variable	RP of CMHPI Unsmoothed
Independent Variable	Consumption with Lags

Regression Statistics	
Multiple R	0.297171219
R Square	0.088310733
Adjusted R Square	0.049515445
Standard Error	1.106392385
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	11.14584139	2.78646	2.276326	0.066782053
Residual	94	115.0657862	1.224104		
Total	98	126.2116276			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.195542291	0.11124968	10.74648	4.81E-18	0.974653556	1.416431	0.974653556	1.416431026
Consumption	0.131890325	0.189889342	0.694564	0.489042	-0.245139223	0.5089199	-0.245139223	0.508919873
Consumption t-1	-0.12762821	0.185387319	-0.688441	0.492871	-0.495718893	0.2404625	-0.495718893	0.240462468
Consumption t-2	0.344958914	0.183601474	1.878846	0.063364	-0.019585931	0.7095038	-0.019585931	0.709503759
consumption t-3	0.365185631	0.187931683	1.943183	0.054986	-0.007956942	0.7383282	-0.007956942	0.738328204

Exhibit 34

Consumption CAPM Step 1 Results

	Beta	Avg RP
U.S. LT Gvt	-2.959132	1.12
U.S. IT Gvt	-1.823473	0.74
S&P 500	0.143207	2.00
U.S. Small Stk	2.1036	2.70
NCREIF	1.474186	0.64
NAREIT-Equity	0.268763	1.84
LB Mortgage	-2.111231	0.88
GLCMPI	-0.375521	0.94
CMHPI	0.714407	1.20

Exhibit 35

Consumption CAPM Step 2 Regression Summary Output (with Housing)

Dependent Variable	Avg RP
Independent Variable	Beta

Regression Statistics	
Multiple R	0.51362009
R Square	0.26380559
Adjusted R Square	0.15863496
Standard Error	0.63503283
Observations	9

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.011537233	1.011537	2.508358	0.157260971
Residual	7	2.822866828	0.403267		
Total	8	3.834404061			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.3992902	0.214994257	6.5085	0.000331	0.890909932	1.90767047	0.890909932	1.907670473
Beta	0.20903253	0.131983338	1.58378	0.157261	-0.103058252	0.52112331	-0.10305825	0.521123306

Exhibit 36

Consumption CAPM Step 2 Regression Summary Output (without Housing)

Dependent Variable	Avg RP
Independent Variable	Beta

Regression Statistics	
Multiple R	0.545655489
R Square	0.297739913
Adjusted R Square	0.180696565
Standard Error	0.667913664
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.13483044	1.13483	2.543843	0.161835787
Residual	6	2.676651973	0.446109		
Total	7	3.811482413			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.450605635	0.243243365	5.963598	0.000996	0.855410127	2.0458011	0.855410127	2.045801143
Beta	0.226982931	0.142314136	1.594943	0.161836	-0.121247469	0.5752133	-0.12124747	0.575213331

Exhibit 37

Fama-French Factors Step 1 Regression Summary Output (US LT Gvt)

Dependent Variable RP of US LT Gvt
Independent Variable Fama-French Factors: Rm-Rf, SMB, and HML

Regression Statistics	
Multiple R	0.290961213
R Square	0.084658427
Adjusted R Square	0.055752904
Standard Error	6.219774292
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	339.9068091	113.3023	2.928798	0.037619083
Residual	95	3675.131264	38.68559		
Total	98	4015.038073			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.715235818	0.658671145	1.085877	0.280281	-0.592390797	2.0228624	-0.5923908	2.022862433
Rm-Rf	0.252174615	0.090019511	2.801333	0.006167	0.073463418	0.4308858	0.073463418	0.430885812
SMB	-0.274633389	0.130288152	-2.107892	0.037673	-0.533287888	-0.0159789	-0.53328789	-0.01597889
HML	0.105317911	0.099136078	1.062357	0.290767	-0.091491946	0.3021278	-0.09149195	0.302127768

Exhibit 38

Fama-French Factors Step 1 Regression Summary Output (US IT Gvt)

Dependent Variable RP of US IT Gvt
Independent Variable Fama-French Factors: Rm-Rf, SMB, and HML

Regression Statistics	
Multiple R	0.2424959
R Square	0.05880426
Adjusted R Square	0.02908229
Standard Error	3.5175741
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	73.44106352	24.48035	1.978478	0.122423878
Residual	95	1175.46612	12.37333		
Total	98	1248.907184			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.56189484	0.372509428	1.508404	0.13477	-0.177629346	1.30141903	-0.17762935	1.301419026
Rm-Rf	0.10877127	0.050910256	2.13653	0.035206	0.007701707	0.20984084	0.007701707	0.209840836
SMB	-0.13907068	0.073684061	-1.887392	0.06216	-0.285351931	0.00721057	-0.28535193	0.007210571
HML	0.06677521	0.056066102	1.191009	0.236618	-0.044529997	0.17808041	-0.04453	0.178080414

Exhibit 39

Fama-French Factors Step 1 Regression Summary Output (S&P 500)

Dependent Variable	RP of S&P 500
Independent Variable	Fama-French Factors: Rm-Rf, SMB, and HML

Regression Statistics	
Multiple R	0.99717206
R Square	0.99435211
Adjusted R Square	0.99417376
Standard Error	0.62476685
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	6528.502114	2176.167	5575.147	1.2811E-106
Residual	95	37.08169369	0.390334		
Total	98	6565.583808			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.06132139	0.066162513	0.92683	0.356364	-0.070027709	0.19267049	-0.07002771	0.19267049
Rm-Rf	0.99914588	0.009042323	110.4966	3.8E-102	0.981194609	1.01709714	0.981194609	1.01709714
SMB	-0.1677932	0.013087246	-12.82113	1.94E-22	-0.193774695	-0.1418118	-0.19377469	-0.14181179
HML	0.03998883	0.009958068	4.015722	0.000118	0.020219582	0.05975808	0.020219582	0.05975808

Exhibit 40

Fama-French Factors Step 1 Regression Summary Output (Small Stocks)

Dependent Variable	RP of Small Stk
Independent Variable	Fama-French Factors: Rm-Rf, SMB, and HML

Regression Statistics	
Multiple R	0.97755079
R Square	0.95560555
Adjusted R Square	0.95420362
Standard Error	2.50628991
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	12845.06115	4281.687	681.6357	4.29207E-64
Residual	95	596.7414681	6.281489		
Total	98	13441.80262			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.11686161	0.265414912	0.440298	0.660722	-0.410053236	0.64377645	-0.41005324	0.643776451
Rm-Rf	0.85901053	0.036273823	23.68128	1.23E-41	0.786997938	0.93102312	0.786997938	0.931023122
SMB	1.14080889	0.052500278	21.72958	1.23E-38	1.036582738	1.24503505	1.036582738	1.245035049
HML	0.11813135	0.03994739	2.957173	0.003917	0.038825805	0.19743689	0.038825805	0.197436885

Exhibit 41

Fama-French Factors Step 1 Regression Summary Output (NCREIF)

Dependent Variable RP of NCREIF Unsmoothed
Independent Variable Fama-French Factors: Rm-Rf, SMB, and HML with Lags

Regression Statistics	
Multiple R	0.178265982
R Square	0.03177876
Adjusted R Square	-0.103321878
Standard Error	1.567495312
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	12	6.935428503	0.577952	0.235223	0.995977222
Residual	86	211.3055735	2.457042		
Total	98	218.241002			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.528656649	0.193025706	2.738789	0.007495	0.144934557	0.91237874	0.144934557	0.91237874
Rm-Rf	-0.001123427	0.023927333	-0.046952	0.962661	-0.048689352	0.0464425	-0.048689352	0.046442498
SMB	-0.00963783	0.035041387	-0.275041	0.783944	-0.079297746	0.06002208	-0.079297746	0.060022085
HML	-0.01091229	0.026093294	-0.418203	0.676841	-0.062784001	0.04095942	-0.062784001	0.04095942
Rm-Rf t-1	0.015805376	0.023857176	0.6625	0.509423	-0.031621082	0.06323183	-0.031621082	0.063231833
SMB t-1	0.004253769	0.035062386	0.12132	0.903721	-0.065447891	0.07395543	-0.065447891	0.073955429
HML t-1	0.018462918	0.026492615	0.696908	0.48774	-0.034202614	0.07112845	-0.034202614	0.07112845
Rm-Rf t-2	0.021308793	0.023796593	0.895456	0.373043	-0.02599723	0.06861482	-0.02599723	0.068614816
SMB t-2	0.017414134	0.035102505	0.496094	0.621094	-0.052367279	0.08719555	-0.052367279	0.087195548
HML t-2	0.012369473	0.026235693	0.471475	0.638495	-0.039785315	0.06452426	-0.039785315	0.064524262
Rm-Rf t-3	0.004162852	0.024022642	0.173289	0.862832	-0.043592541	0.05191824	-0.043592541	0.051918245
SMB t-3	0.010866287	0.035160356	0.309049	0.758031	-0.059030132	0.08076271	-0.059030132	0.080762705
HML t-3	0.002133276	0.02607918	0.0818	0.934996	-0.049710377	0.05397693	-0.049710377	0.053976928

Exhibit 42

Fama-French Factors CAPM Step 1 Regression Summary Output (NAREIT)

Dependent Variable RP of NAREIT
Independent Variable Fama-French Factors: Rm-Rf, SMB, and HML

Regression Statistics	
Multiple R	0.73536568
R Square	0.54076268
Adjusted R Square	0.52626045
Standard Error	4.79979116
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	2577.138945	859.0463	37.28824	5.1432E-16
Residual	95	2188.609546	23.038		
Total	98	4765.748491			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.2844282	0.508295606	0.559572	0.577088	-0.7246654	1.29352183	-0.72466544	1.293521834
Rm-Rf	0.50686275	0.069467931	7.296356	8.87E-11	0.36895157	0.64477393	0.36895157	0.644773933
SMB	0.36000828	0.100543185	3.580633	0.000542	0.16040496	0.5596116	0.16040496	0.559611597
HML	0.38824054	0.076503173	5.074829	1.92E-06	0.23636265	0.54011843	0.23636265	0.540118435

Exhibit 43

Fama-French Factors Step 1 Regression Summary Output (LB Mortgage)

Dependent Variable	RP of LB Mortgage
Independent Variable	Fama-French Factors: Rm-Rf, SMB, and HML

Regression Statistics	
Multiple R	0.31441698
R Square	0.09885804
Adjusted R Square	0.07040093
Standard Error	4.14235881
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	178.8289475	59.60965	3.473931	0.019081768
Residual	95	1630.11797	17.15914		
Total	98	1808.946917			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.49559572	0.438673832	1.129759	0.261422	-0.375281322	1.36647276	-0.37528132	1.36647276
Rm-Rf	0.1917755	0.059952837	3.198773	0.001876	0.07275415	0.31079684	0.07275415	0.31079684
SMB	-0.1355326	0.086771681	-1.561945	0.121626	-0.307796042	0.03673085	-0.30779604	0.036730846
HML	0.11015675	0.066024455	1.668423	0.098525	-0.020918275	0.24123177	-0.02091827	0.241231767

Exhibit 44

Fama-French Factors Step 1 Regression Summary Output (GLCMPI)

Dependent Variable	RP of GLCMPI
Independent Variable	Fama-French Factors: Rm-Rf, SMB, and HML

Regression Statistics	
Multiple R	0.251631889
R Square	0.063318607
Adjusted R Square	0.033739195
Standard Error	3.733054267
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	89.49353703	29.83118	2.140631	0.10021287
Residual	95	1323.890945	13.93569		
Total	98	1413.384482			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.662283076	0.395328675	1.675272	0.09717	-0.122543	1.44710916	-0.12254301	1.447109162
Rm-Rf	0.132846618	0.054028925	2.458805	0.01575	0.02558572	0.24010752	0.025585717	0.24010752
SMB	-0.04850634	0.078197812	-0.620303	0.536543	-0.2037485	0.10673583	-0.20374852	0.106735831
HML	0.048566762	0.059500609	0.81624	0.416405	-0.0695568	0.16669032	-0.0695568	0.166690321

Exhibit 45

Fama-French Factors Step 1 Regression Summary Output (CMHPI)

Dependent Variable RP of CMHPI Unsmoothed
Independent Variable Fama-French Factors: Rm-Rf, SMB, and HML with Lags

Regression Statistics	
Multiple R	0.32343697
R Square	0.10461147
Adjusted R Square	-0.0203265
Standard Error	1.14632093
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	12	13.20318424	1.100265	0.837308	0.612179338
Residual	86	113.0084434	1.314052		
Total	98	126.2116276			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.06072135	0.141161128	7.51426	5.03E-11	0.780102543	1.34134016	0.780102543	1.341340156
Rm-Rf	0.00432013	0.017498236	0.246889	0.805582	-0.030465183	0.03910544	-0.03046518	0.039105443
SMB	0.04547038	0.025626026	1.774383	0.079539	-0.005472429	0.09641319	-0.00547243	0.096413195
HML	0.00800088	0.019082219	0.419284	0.676054	-0.029933287	0.04593504	-0.02993329	0.045935044
Rm-Rf t-1	0.02103554	0.017446929	1.205687	0.231245	-0.013647775	0.05571886	-0.01364777	0.055718864
SMB t-1	0.01132649	0.025641383	0.441727	0.659795	-0.039646847	0.06229983	-0.03964685	0.062299834
HML t-1	0.00748496	0.019374245	0.386336	0.700202	-0.031029732	0.04599966	-0.03102973	0.045999655
Rm-Rf t-2	0.00703485	0.017402625	0.404241	0.687039	-0.027560391	0.0416301	-0.02756039	0.041630098
SMB t-2	0.0056716	0.025670722	0.220937	0.825665	-0.045360059	0.05670327	-0.04536006	0.056703269
HML t-2	0.02273829	0.019186356	1.185128	0.239231	-0.015402897	0.06087947	-0.0154029	0.060879469
Rm-Rf t-3	-0.0054303	0.017567936	-0.309106	0.757989	-0.040354219	0.02949353	-0.04035422	0.029493526
SMB t-3	0.02521788	0.025713029	0.980743	0.32947	-0.025897891	0.07633365	-0.02589789	0.076333646
HML t-3	-0.0126853	0.019071898	-0.665128	0.507748	-0.050598899	0.0252284	-0.0505989	0.025228395

Exhibit 46

Fama-French Factors Step 1 Results

	Rm-Rf Beta	SMB Beta	HML Beta	Avg RP
U.S. LT Gvt	0.252174615	-0.274633389	0.105317911	1.12
U.S. IT Gvt	0.108771272	-0.13907068	0.066775208	0.74
S&P 500	0.999145877	-0.167793245	0.039988832	2.00
U.S. Small Stk	0.85901053	1.140808893	0.118131345	2.70
NCREIF	0.040153594	0.02289636	0.022053377	0.64
NAREIT-Equity	0.506862751	0.36000828	0.388240542	1.84
LB Mortgage	0.191775495	-0.135532598	0.110156746	0.88
GLCMPI	0.132846618	-0.048506343	0.048566762	0.94
CMHPI	0.026960181	0.087686359	0.025538874	1.20

Exhibit 47

Fama-French Factors Step 2 Regression Summary Output (with Housing)

Dependent Variable	Avg RP
Independent Variable	Rm-Rf Beta, SMB Beta, and HML Beta

Regression Statistics	
Multiple R	0.974665104
R Square	0.949972065
Adjusted R Square	0.919955304
Standard Error	0.195871037
Observations	9

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	3.642576744	1.214192	31.64805	0.001119833
Residual	5	0.191827316	0.038365		
Total	8	3.834404061			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.785734234	0.109230795	7.19334	0.000809	0.504947995	1.066520473	0.504947995	1.066520473
Rm-Rf Beta	1.305660066	0.218332617	5.980142	0.001874	0.744419123	1.866901009	0.744419123	1.866901009
SMB Beta	0.669319365	0.186643137	3.586091	0.015773	0.189538692	1.149100039	0.189538692	1.149100039
HML Beta	0.377374341	0.651585041	0.579164	0.587591	-1.297575594	2.052324276	-1.29757559	2.052324276

Exhibit 48

Fama-French Factors Step 2 Regression Summary Output (without Housing)

Dependent Variable	Avg RP
Independent Variable	Rm-Rf Beta, SMB Beta, and HML Beta

Regression Statistics	
Multiple R	0.992074449
R Square	0.984211712
Adjusted R Square	0.972370497
Standard Error	0.12265478
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	3.751305632	1.250435	83.11745	0.000464914
Residual	4	0.060176781	0.015044		
Total	7	3.811482413			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.661043938	0.080345006	8.227567	0.00119	0.437969978	0.8841179	0.437969978	0.884117898
Rm-Rf Beta	1.460498606	0.146397195	9.976274	0.000567	1.054033987	1.86696322	1.054033987	1.866963224
SMB Beta	0.584398123	0.120350143	4.855816	0.008304	0.250251866	0.91854438	0.250251866	0.918544381
HML Beta	0.683896094	0.420975025	1.624553	0.179582	-0.484920375	1.85271256	-0.48492037	1.852712563

Exhibit 49

NCREIF Property TR (NPI) Unsmoothing Regression Summary Output

Dependent Variable NCREIF Property TR (NPI)
Independent Variable NPI t-1, NPI t-4

Regression Statistics	
Multiple R	0.790335788
R Square	0.624630657
Adjusted R Square	0.617197601
Standard Error	1.02570869
Observations	104

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	176.8210399	88.41052	84.0341622	3.2372E-22
Residual	101	106.2599101	1.0520783		
Total	103	283.08095			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.280143083	0.182858082	1.5320246	0.12864273	-0.082598113	0.642884279	-0.082598113	0.642884279
NPI t-1	0.391619861	0.075285442	5.2018007	1.037E-06	0.242273817	0.540965905	0.242273817	0.540965905
NPI t-4	0.479213222	0.075266681	6.3668707	5.7485E-09	0.329904395	0.628522049	0.329904395	0.628522049

Exhibit 50

NCREIF Property TR (NPI) Unsmoothing Regression Residual Output

Observation	*Residuals*	*Observation*	*Residuals*
1	-0.16650241	53	1.753230116
2	1.076600653	54	-1.30318662
3	1.153526293	55	-0.158634263
4	1.227096697	56	-0.363623869
5	1.009927599	57	1.604685123
6	-2.159918235	58	-0.328100757
7	0.309371238	59	1.124699501
8	0.589287797	60	0.385664224
9	-2.058401996	61	0.758767701
10	1.659718923	62	0.861846072
11	-0.542913209	63	0.099627786
12	1.20334282	64	1.128314232
13	-1.280283287	65	0.465842257
14	-1.212348468	66	0.235550647
15	-1.10907064	67	0.24167564
16	-0.370443218	68	-0.897800855
17	-0.913908385	69	0.681851369
18	0.582550789	70	0.073205747
19	0.956738371	71	0.465868197
20	2.413853932	72	0.77755427
21	0.151732315	73	-0.112382655
22	0.350728797	74	0.526068162
23	-0.476132983	75	0.735158134
24	0.421849848	76	1.855435276
25	-1.454226994	77	0.89396843
26	-0.009026177	78	0.937169404
27	-0.087219249	79	-0.080770993
28	0.496397783	80	-0.34224208
29	-0.707648668	81	-1.064336331
30	-0.361085779	82	-0.682341925
31	-0.693037612	83	-0.154264869
32	-0.085038194	84	-0.191801832
33	-0.429408968	85	-0.253086728
34	-0.746065345	86	0.574430607
35	0.625009448	87	0.118827185
36	0.339793426	88	0.513568312
37	-0.362728309	89	-0.374348955
38	0.429012638	90	-0.195966284
39	0.32506156	91	-1.056331014
40	0.574386145	92	-1.832514891
41	-0.614168386	93	-0.163471595
42	0.076095715	94	-0.445145733
43	-0.158702407	95	0.112607785
44	-0.804148391	96	0.367784506
45	-0.424100979	97	0.222239783
46	-0.259004936	98	0.30207829
47	-1.017792378	99	0.013579739
48	-2.877726906	100	0.908079709
49	-0.331440928	101	0.298065242
50	-1.018128174	102	0.845754437
51	-1.016598389	103	0.970036703
52	-4.795633621	104	1.717888498

Exhibit 51

CMHPI Unsmoothing Regression Summary Output

Dependent Variable CMHPI
Independent Variable CMHPI t-1, CMHPI t-4

Regression Statistics	
Multiple R	0.568726198
R Square	0.323449489
Adjusted R Square	0.310052449
Standard Error	0.686822505
Observations	104

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	22.77805569	11.38902784	24.14335499	2.69254E-09
Residual	101	47.64424051	0.471725154		
Total	103	70.4222962			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.016116088	0.266293592	3.815773714	0.000234117	0.487861308	1.544370869	0.487861308	1.544370869
CMHPI t-1	0.381215777	0.095601878	3.987534382	0.000126423	0.191567393	0.57086416	0.191567393	0.57086416
CMHPI t-4	0.253237133	0.092344557	2.742307076	0.007218259	0.070050397	0.436423869	0.070050397	0.436423869

Exhibit 52

CMHPI Unsmoothing Regression Residual Output

Observation	*Residuals*	*Observation*	*Residuals*
1	0.558101298	53	-0.514380896
2	1.032164462	54	-0.952288121
3	-0.304473579	55	0.6079918
4	-0.51225541	56	-0.749641047
5	0.080413338	57	-0.914135283
6	-0.077465801	58	0.427686685
7	0.732982354	59	-0.371448789
8	-1.419647763	60	-0.019832638
9	-0.251789454	61	-0.170899139
10	1.162189663	62	-0.326272614
11	-0.70410842	63	-0.339353271
12	-0.588824723	64	-0.912176795
13	0.656359645	65	-0.159346269
14	-1.856520045	66	0.922905663
15	-1.325838122	67	0.322349177
16	0.0415634	68	-0.235602713
17	0.835601126	69	0.364763198
18	-0.204691843	70	-1.004774446
19	0.008433314	71	-0.414244731
20	-0.57089364	72	-0.006792834
21	0.256216029	73	-0.191271213
22	0.379891371	74	0.014705666
23	-0.25776311	75	0.543685798
24	-0.251585367	76	0.065039423
25	0.255854338	77	0.292299
26	-0.067405994	78	-0.507296848
27	0.462454341	79	0.266771848
28	-0.171714654	80	-0.146316044
29	0.748815483	81	-0.262656055
30	0.510439177	82	0.343286442
31	-0.11554278	83	0.290311468
32	0.2454692	84	-0.223622674
33	0.511021258	85	0.887717089
34	-0.024227472	86	0.070361401
35	-0.179997131	87	0.399469825
36	-0.603756761	88	0.075042841
37	0.491317988	89	1.007358705
38	0.621234343	90	-0.134757529
39	-0.523678652	91	0.01539562
40	-0.006749904	92	-0.292669335
41	0.130502768	93	0.002580279
42	-0.072601439	94	0.306411971
43	1.061430098	95	0.493353735
44	-0.602911087	96	-0.066922288
45	-0.731748966	97	-0.172328537
46	-0.86757598	98	-0.190977765
47	-0.65369043	99	0.00401916
48	-1.228643741	100	2.625626742
49	0.392636248	101	-0.731133593
50	-0.26362535	102	1.097710897
51	-0.730146781	103	2.308955902
52	0.996039151	104	-0.745914854