

Myopic Loss Aversion, Asymmetric Correlations, and the Home Bias

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Abstract

Myopic loss aversion has been used to explain why a high equity premium might be consistent with plausible levels of risk aversion. The intuition is that it plays the role of high risk aversion in portfolio choice. But if so, should these agents not perceive larger gains from international diversification than standard preference agents with realistic levels of risk aversion? They might not because stock market returns are asymmetrically correlated. We analyze the portfolio problem of a myopic loss averse investor who has to choose between home and foreign equities in the presence of asymmetrically correlated returns. Perhaps surprisingly, depending on the horizon, this investor behaves similarly to one with standard preferences in the context of the home bias puzzle.

JEL classification codes: G11, G15

Keywords: myopic loss aversion, home bias, asymmetric correlations, equity premium puzzle

1 Introduction

Behavioral explanations, in particular myopic loss aversion (MLA), have been used to explain why a high equity premium might be consistent with plausible levels of risk aversion [Benartzi and Thaler (1995), Barberis et al. (2001)]. Loss averse decision makers have preferences over gains and losses relative to a reference point rather than overall wealth. Typically, the slope of the utility function over losses is steeper than the slope of the utility function over gains. Nondifferentiability of the utility function at the reference point is loosely analogous to locally high risk aversion. If, in addition, investors use short evaluation horizons, they may prefer safer bonds with low returns to riskier equities with high returns because of possible losses in the short term. Benartzi and Thaler show that this behavior can account for the equity premium in a one period model while Barberis et al. (2001) incorporate loss aversion into a general equilibrium pricing model.

Choosing between equities and bonds is just one dimension of the portfolio allocation problem. However well myopic loss aversion might explain portfolio allocation among equities and bonds, on first pass its plausibility in accounting for the observed allocation between domestic and foreign equities appears low. The intuition is that in order to account for the equity premium, investors must have high levels of risk aversion. With such high levels, the gains from diversification ought to be larger. For standard preferences, the gains from greater international portfolio diversification are large (van Wincoop, 1999). For MLA investors, these gains from international diversification should appear to be even larger. One might conjecture that any framework that resolves the equity premium puzzle would make it harder to explain why there is a home bias in equities. The exact welfare gains from international diversification are debatable, but van Wincoop (1999) reports that studies using standard preferences and a coefficient of relative risk aversion that matches the equity premium show high unexploited gains from diversification.

French and Poterba (1991) present evidence that households in the US, the UK, and Japan typically hold in excess of 80% of their equity portfolio in domestic equities. Three types of explanations have been offered: frictions and incomplete markets, behavioral explanations, and small or no gains from diversification. Transaction costs, taxes, and other legal restrictions may serve as a barrier to international investment. However, a number of authors argue that these

barriers are unlikely to account for the home equity bias (Tesar and Werner, 1995). Informational asymmetries may lead investors to invest more locally. Hau (2001) documents the performance of traders located in Frankfurt and traders located elsewhere on the German Security Exchange. Others authors suggest that the risk of confiscation and the alignment of the incentives of foreign governments might account for the home bias [see, for example, Kocherlakota (1996)]. Another group of explanations for the home bias are based on behavioral biases observed in individual decision making. Huberman (2001) documents familiarity bias in individual portfolio holdings. Individuals tend to hold a disproportionately large amount of their telephone company's equity and their employer's equity in their portfolios. The third group of explanations argues that the gains are small. For example, some find that the gains are not statistically distinguishable from zero (for a survey, see Lewis, 1999).

A desirable property of any potential explanation of either the equity premium puzzle or home bias in equities is that the resolution of one puzzle should not make the other puzzle more difficult to explain. Providing an additional explanation for the home bias in equities is not the purpose of this study. Instead, we would like to determine whether using myopic loss averse preferences as an explanation of the equity premium does in fact make the home bias puzzle harder to account for. Transaction costs, information problems, and familiarity bias may adequately account for the home bias puzzle. Do these explanations face an even larger task in a model with myopic loss averse investors? This remains an open question.

Taking a different approach, a number of others analyze the international portfolio selection problem in the context of asymmetrically correlated returns [Ang and Bekaert (2002), Das and Uppal (2004)]. Empirical work has shown that correlations between domestic and foreign equities tend to be higher when the markets are falling and tend to be lower when the markets are rising (Ang and Bekaert, 2002). In the context of standard preferences, this asymmetry in the correlations of stock market returns reduces the gain from international diversification; however, large gains still exist (Ang and Bekaert, 2002). For loss averse investors, the interaction of the asymmetric correlations conditional on up or down movements with the differences in slope of the loss utility and gain utility might reduce the gains from diversification significantly. At a given level of unconditional correlation between domestic and foreign equity returns, an increase in the asymmetry in

up correlations and down correlations decreases the perceived gain from diversification of portfolio holdings for risk averse investors. For the loss averse investor, the kink in the utility function might decrease this perceived gain further. From this argument, if the asymmetry in stock correlations is large enough, myopic loss averse preferences might be compatible with home bias in equities. Whether the asymmetry is indeed large enough is an empirical question.

We address this possibility by analyzing loss averse utility under asymmetrically correlated returns. These results are compared with constant relative risk aversion (CRRA) utility facing the same environment. We calculate the utility attained from empirical distributions of stock returns using repeated sampling methods. The gains from diversification are quantified for each utility specification by determining the minimum amount that must be added to the return of the domestic equity in order to shift the portfolio allocation away from optimal. The relevance of the asymmetric correlation is explored using simulation of returns under various correlation structures. The approach of this paper is to solve the portfolio allocation problem of a US investor who must decide between domestic equity and foreign equity. We take the correlation structure of returns as given in this model. We find that the interaction between asymmetrically correlated returns and the kink in the loss averse utility function depends on the evaluation horizon.

The next section presents empirical evidence on the correlation structure of stock returns. Section 3 formally presents the framework of myopic loss aversion to be analyzed. The simulation and repeated sampling methods are described. Section 4 presents the analysis of myopic loss aversion utility under asymmetrically correlated asset returns. Section 5 discusses the implications of the results and Section 6 concludes.

2 Some Evidence on Asymmetrically Correlated Returns

Work on ARCH processes (Engle, 1982) has led to the development of a number of tests for time-varying correlations between international assets. Longin and Solnik (1995) find that the asset returns of seven developed economies do not exhibit constant correlation over the period 1960-1990. They provide evidence that correlation increases in periods of high volatility. Using a slightly different setup, King et al. (1994) develop a model to explain time-varying correlations

with unobservable factors. Erb et al. (1994) argue that correlations vary with the business cycle. Ang and Bekaert (2002) employ a dynamic international asset allocation model with regime switching. They find that the returns of US, UK, and German equities are more highly correlated during bear markets. Das and Uppal (2004) model international equity returns as jump-diffusion processes. They suggest that because these jumps tend to occur simultaneously, equity returns are characterized by systemic risk.

Our focus is not on formal econometric tests of asymmetric correlation in stock market returns. We provide some evidence that the data we use display the correlation features explained by the authors mentioned above. Data on the stock market returns of the United States and other developed countries were obtained from the Morgan Stanley Capital International (MSCI) US and Europe, Australasia, and Far East (EAFE) indices.¹ Before tax returns at monthly frequency from January 1970 to November 2003 were used. As a diagnostic, we regressed US returns on EAFE returns and EAFE returns on US returns using the following specification:

$$r_{US,t} = a_0 + a_1 r_{EAFE,t} + \varepsilon_t$$

$$r_{EAFE,t} = b_0 + b_1 r_{US,t} + \nu_t$$

We also allowed for differences in slopes conditional on whether returns were positive or negative.

$$r_{US,t} = a_0 + a_1^+ r_{EAFE,t} \mathbb{1}\{r_{EAFE,t} > 0\} + a_1^- r_{EAFE,t} \mathbb{1}\{r_{EAFE,t} \leq 0\} + \varepsilon_t$$

$$r_{EAFE,t} = b_0 + b_1^+ r_{US,t} \mathbb{1}\{r_{US,t} > 0\} + b_1^- r_{US,t} \mathbb{1}\{r_{US,t} \leq 0\} + \nu_t$$

In both cases, standard F tests reject the null hypothesis that the slopes are equal.

For the US the compounded per annum growth rate is 10.73% with a standard deviation of 0.1575. For EAFE the compounded per annum growth rate is 10.55% with a standard deviation of 0.1688. Since the standard deviations are roughly equivalent, the asymmetry in the estimates of conditional β must be mainly due to asymmetric correlation. The unconditional cross-correlation is 0.5501. The two assets are roughly equivalent and in subsequent analysis, it should not matter which asset is treated as the home asset. We will use the US asset as the home asset.

¹Data are available at <http://www.msci.com>.

3 Framework and Methodology

We base our simulations on the framework of myopic loss aversion proposed by Benartzi and Thaler (1995) (henceforth, BT). Agent utility is defined over gains and losses in their portfolio (returns) relative to some reference point, rather than over terminal wealth. Loss aversion implies that the utility function representing agent preferences is steeper over losses than over gains, and displays a kink at zero (the reference point which corresponds to current wealth). The prospective utility of a given risky outcome is computed as a weighted average of the utility value of each possible realization. The weights, called *decision weights*, are nonlinear functions of the whole probability distribution of payoffs which capture some features of procedures that decision makers usually employ when having to make decisions involving risk. As set forth by BT, myopic behavior means that agents have an *evaluation period* at the end of which they review their portfolios and perceive utility. This differs from the agent’s investment horizon, which in general tends to be much longer.²

More specifically, we use a functional form, common in the prospect theory literature, originally proposed by Kahneman and Tversky (1979, 1992):

$$v(x) = \begin{cases} x^\alpha & \text{if } x \geq 0 \\ -\lambda(-x)^\beta & \text{if } x < 0 \end{cases}$$

where the degree of loss aversion is given by $\lambda \geq 1$, and α and β are parameters which provide some additional flexibility to capture agent behavior towards risk. For example, $\alpha, \beta < 1$ imply that agents are risk averse in the domain of gains and risk seeking in the domain of losses.

The prospective utility from investing in a given portfolio is³

$$V = \sum_{s \in S} \pi_s v(x_s),$$

where π_s ’s are the decision weights, x_s is the net return of the portfolio in state s and S denotes the set of possible states. For simplicity, these are ordered so that s_1 denotes the lowest possible return

²BT argue that due to principal-agent and career concerns issues, this tends to be the case even for long-term institutional investors.

³We formulate the problem in the context of a discrete state space as in BT, but it is straightforward to extend it to the case of a continuum of states.

realization. The π_s 's are obtained through a nonlinear transformation of the cumulative distribution of returns as follows: let p_s denote the probability that state s occurs. Define $P_s = \sum_{r \geq s} p_r$ and $P_s^* = \sum_{r > s} p_r$, i.e., the probabilities of obtaining a return at least as high as and strictly higher than x_s , respectively. Then, $\pi_s = \omega(P_s) - \omega(P_s^*)$, where ω is a nonlinear transformation which is (in general) different for gains and losses. We adopt the parameterization proposed by Kahneman and Tversky and used in BT:⁴

$$\omega(q) = \frac{q^{\zeta(q)}}{\left(q^{\zeta(q)} + (1-q)^{\zeta(q)}\right)^{1/\zeta(q)}}$$

The parameter values we used in the results reported in the next section are $\lambda = 2.25$, $\alpha = \beta = 0.88$, $\zeta(q) = \begin{cases} 0.61 & \text{if } q \geq 0 \\ 0.69 & \text{if } q < 0 \end{cases}$. They have been estimated in the context of experiments designed to study behavior towards risk and were not chosen to influence the results we obtain in any particular way.

We solve the portfolio problem by maximizing prospective utility over feasible portfolio weights.⁵ We look at two different environments: one in which the investor faces the empirical distribution of returns, obtained by sampling repeatedly (with replacement) from the data described in the previous section; the other in which returns are generated through Monte Carlo simulations, drawing the logarithmic returns from a joint normal distribution with first and second moments which match the data.⁶ We also solve the portfolio problem of an investor with CRRA preferences facing the same environments.

By comparing the results for the myopic loss averse investor with those of the CRRA investor in these two environments, we are able to isolate the roles of asymmetrically correlated returns and

⁴The qualitative results are the same if, instead, we set $\alpha = \beta = 1$ (i.e., a piecewise linear value function) and $\zeta(q) \equiv 1$ (i.e., the actual probabilities rather than the nonlinear decision weights are used). This pattern is also observed by BT and Barberis et al. (2001).

⁵We do not allow for short selling and maximize by searching over a portfolio weight grid of increment size 0.01.

⁶In all simulations, we draw samples of size $N = 500,000$ and construct the empirical distribution of returns with histograms (100 bins). Although this is not an estimation exercise, for short we refer to this process of sampling repeatedly as bootstrapping.

myopic loss aversion, and to study the interaction between the two.⁷ More specifically, we compare the gains from diversification for such investors by asking how much the average compounded annual return in the home market must increase to make the investor hold a portfolio with a smaller given fraction of foreign equities instead of the “optimal portfolio.” We refer to this difference in returns as the “additional required return” (ARR).⁸ In particular, in many cases we will be interested in finding the ARR which would induce the investor to hold a portfolio displaying the same degree of “home bias” as we see in the data. We could also calculate an alternative measure of the perceived gains from international diversification, by asking how much the average compounded annual return in the home market must increase to make the investor indifferent between holding only domestic stocks and holding the optimal portfolio. The subtle difference is that in the first experiment we increase the expected return in the home market but still give the investor the opportunity to diversify, while in the second experiment he must choose between a “home stocks only” portfolio and the optimal one.

4 Results

The first thing which stands out in the results for MLA investors, is that, contrary to the CRRA case, the gains from diversification measured by ARR do depend on the evaluation horizon. The fact that they do not for CRRA preferences is just a manifestation of results by Merton (1969) and Samuelson (1969). For MLA agents, the longer the evaluation horizon, the lower the gains from international diversification. This can be seen by comparing the portfolio choices presented in Figures 4 and 5: relative to the zero ARR case, the fraction of the portfolio invested in foreign equities falls when a positive ARR is introduced, and significantly more so for longer evaluation

⁷To be more precise, since we bootstrap from the data, it might be the case that other features of the empirical distribution are also important for the results. To really isolate the role of the asymmetry we would need a data generating process which allowed us to change the degree of asymmetry while keeping all other moments and the shape of the distributions the same.

⁸In the simulations the ARR is always measured in terms of percentage points added to the compound annual return.

horizons.⁹

We focus most of our analysis on the one year evaluation horizon for two reasons: it is the one for which MLA behavior has been shown to be able to account for the equity premium puzzle, and also because it is a realistic evaluation horizon, as argued by BT and Barberis et al. (2001). Nevertheless, we also emphasize some simulations for different evaluation horizons when they turn out to be helpful in understanding the effects driving the results.

First, we compare the results for an MLA investor with those for a CRRA investor with $\gamma = 7$, representing a high degree of risk aversion. With zero ARR, the optimal portfolios are quite similar: for both the bootstrapping and Monte Carlo cases, the optimal portfolios involve roughly a 50-50 split between home and foreign equities (Figures 4 , 6, 7 and 8). This is not surprising, given the similarities between the two distributions of returns. There is some tilting towards US/home equities, which reflects the slightly better risk-return profile in the sample that we consider (this moment differences are also incorporated in the Monte Carlo simulations). Overall, diversification motives seem to drive the portfolio decision. For both preferences, as we increase the ARR, portfolio weights tilt towards US/home equities. As a result of the horizon effect referred to above, for longer horizons the shift is relatively bigger for MLA investors (Figures 5 and 9). As Figures 5 and 10 show, for this level of risk aversion the gains from diversification appear to be much smaller for the MLA investor: for the latter, the ARR which supports a portfolio with roughly 10% in foreign equities is 3%, while for the CRRA investor the ARR which supports such a portfolio is slightly above 6%.

To assess the role of the asymmetry in the correlation structure, we perform the following experiment. For MLA preferences, we find the ARR which at the one year horizon would yield a portfolio share of around 10% in foreign equities, under the Monte Carlo simulation. This portfolio profile is chosen to represent empirically realistic degrees of “home bias”. This results in an ARR of 3% . The coefficient of relative risk aversion which, for this ARR, implies the same portfolio shares for a CRRA investor is $\gamma = 3.35$. We refer to this as the “benchmark CRRA investor” case.

⁹These figures present the results for the case of bootstrap, but the pattern is the same for the Monte Carlo simulations. In all cases, the circle over each curve indicates the point at which utility is maximized for that particular evaluation horizon. Starting from the bottom, the horizons are 2, 3, 4, 6, 12 and 18 months.

With these parameters, we then compute the optimal portfolios by bootstrapping from the data. For the benchmark CRRA investor, the effects of the asymmetry in terms of dampening the gains from diversification appear to be small. This finding is qualitatively similar to the ones found by Ang and Bekaert (2002) and Das and Uppal (2004), although there is no direct way to make a quantitative comparison with their results. The reduction in the fraction of the portfolio invested in foreign equities when the ARR of 3% is introduced is roughly the same under bootstrap and Monte Carlo simulations: from around 43% to 10% (see Figures 12, 13, 14 and 15). For the MLA investor, on the other hand, the reduction is larger in the case of the bootstrap, and more so for shorter evaluation horizons: for 1 year, the reduction is from around 42% to about 11% for Monte Carlo simulations, and to 8% for bootstrap; for 3 months, for instance, the fraction drops from 42% to 28% for Monte Carlo results, and from 45% to 23% for bootstrap (Figures 6, 11, 4 and 5).

5 Discussion

The key to understanding the results reported in the previous section is the interaction between the kink in the MLA utility function and the distribution of returns for any given evaluation horizon. Given the moments of this distribution, the shorter the horizon the more the returns are concentrated around the reference point. This contrasts with longer horizons, for which the distribution shifts more into the domain of gains and at the same time becomes more dispersed. So, the shorter the horizon, the more important the kink becomes in determining the behavior of the MLA agent towards risk, relative to the shape of the utility function away from the reference point. So, the shorter the horizon the more the MLA investor behaves as an extremely risk averse investor. On the other hand, in the domain of gains and away from the reference point, notice that the MLA investor tends to behave more like a CRRA investor. In particular, given the estimated parameter values which we borrowed from the literature, like a CRRA investor with $\gamma = 1 - 0.88 = 0.12$, which is a very low level of risk aversion.

With this intuition in mind we can account more easily for the behavior described in the previous section. For shorter evaluation horizons, the effect of the kink is very high, and the investor behaves like an investor with very high risk aversion. This can be seen in the comparison of the results

between an MLA investor and a CRRA investor with $\gamma = 7$. For instance, with $ARR = 3\%$, the MLA investor is almost as reluctant to shift to a portfolio that is more concentrated on US/home equities as the CRRA agent with $\gamma = 7$, for evaluation horizons of up to 4 months. Also, for these evaluation horizons, the asymmetry in the correlation of returns interacts with the kink around the reference point to dampen the gains from diversification more significantly, relative to the symmetric correlations case. This is because there is also a high asymmetry between gains and losses. Nevertheless, for short horizons the overall result is that the gains from diversification as we measure them are higher than for a CRRA investor with a realistic degree of risk aversion. The effect of asymmetrically correlated returns is not enough to counterbalance the fact that the MLA investor behaves like a very risk averse investor, and therefore we conclude that for these evaluation horizons, MLA turns out to make the home equity bias more of a puzzle.

The picture changes for longer evaluation horizons. Again, we focus on one year. In this case, it is much more likely the realized returns in both equity markets will be positive. So, the kink becomes less important in determining the investors' attitude towards risk, relative to the shape of the MLA utility function over gains. Loosely speaking, for the problem we are analyzing, this makes the investor behave more like an agent with standard preferences and a more reasonable degree of risk aversion. We motivated this similarity by comparison with the "benchmark CRRA investor." For this time horizon, this investor perceives similar gains from diversification when returns are not asymmetrically correlated (Monte Carlo simulations), and the MLA investor perceives slightly lower gains when returns are asymmetrically correlated. So, for this (and longer) evaluation periods, models which include MLA investors do not seem to make the home equity bias harder to account for.

6 Conclusion

The question driving this paper was whether introducing MLA into a problem of international portfolio diversification would make the home equity bias harder to account for. Although intuition suggests that this should be the case, we argued that the fact that international equity returns are asymmetrically correlated could be a reason to expect otherwise.

We analyzed the portfolio problem of a myopic loss averse investor in the context of asymmetrically correlated returns. We concluded that, depending on the evaluation horizon, MLA can perform as well as standard preferences with more realistic degrees of risk aversion when assessed against the background of the home equity bias puzzle. Put differently, while falling short of being an explanation for the puzzle, it does not make it more intriguing.

We intend to check the robustness of our results in a few directions. One is to extend the portfolio problem to a context of many countries instead of only US and an aggregate of other developed economies (represented here by EAFE), and a richer set of fixed income, as well as equity assets. Another is to quantify the gains from diversification with additional measures, including the one described in section 3. Finally, we intend to develop some analytical results to support our conclusions. While this should be reasonably straightforward in the case of symmetric correlations, the presence of asymmetrically correlated returns poses more of a challenge. One solution which appears to be promising is to use the framework proposed by Das and Uppal (2004), who manage to obtain closed form solutions for the problem of a CRRA investor in a model in which returns exhibit asymmetric correlations due to simultaneous jumps in asset prices.

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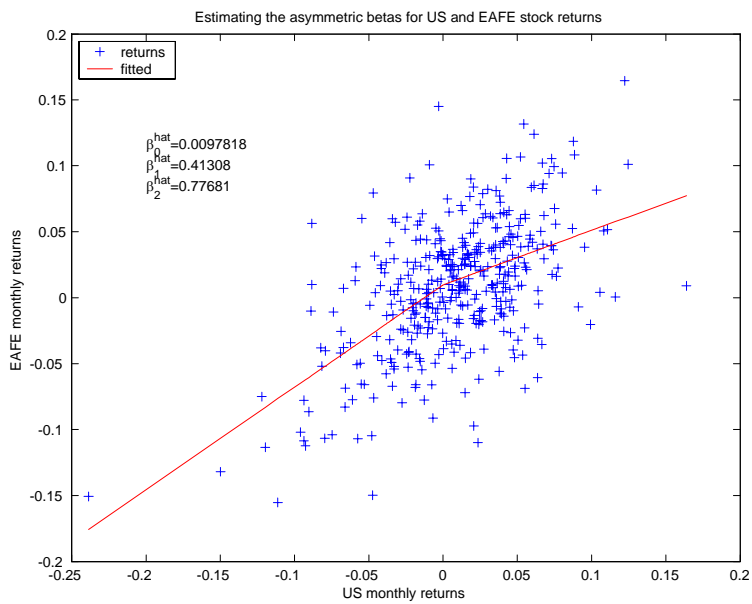


Figure 1: Regression of MSCI EAFE returns on US returns.

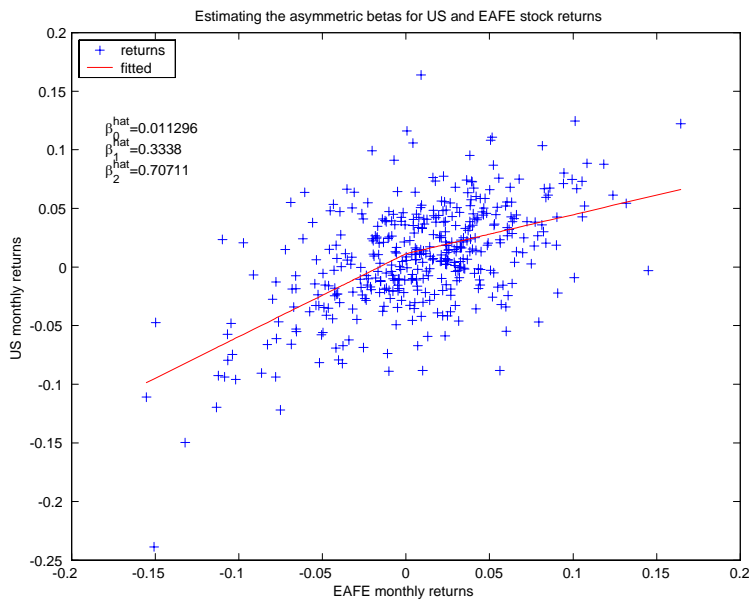


Figure 2: Regression of MSCI US returns on EAFE returns.

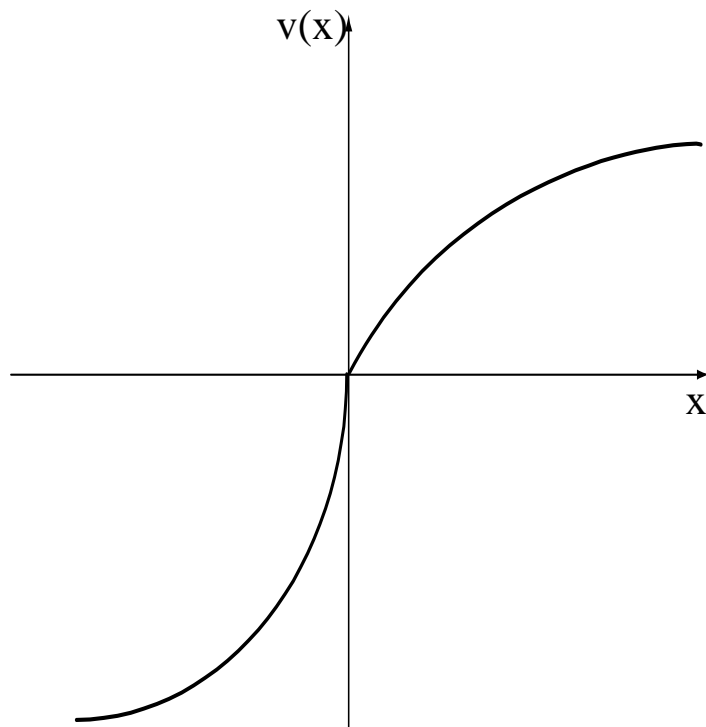


Figure 3: Loss averse utility functions display a kink at the reference point.

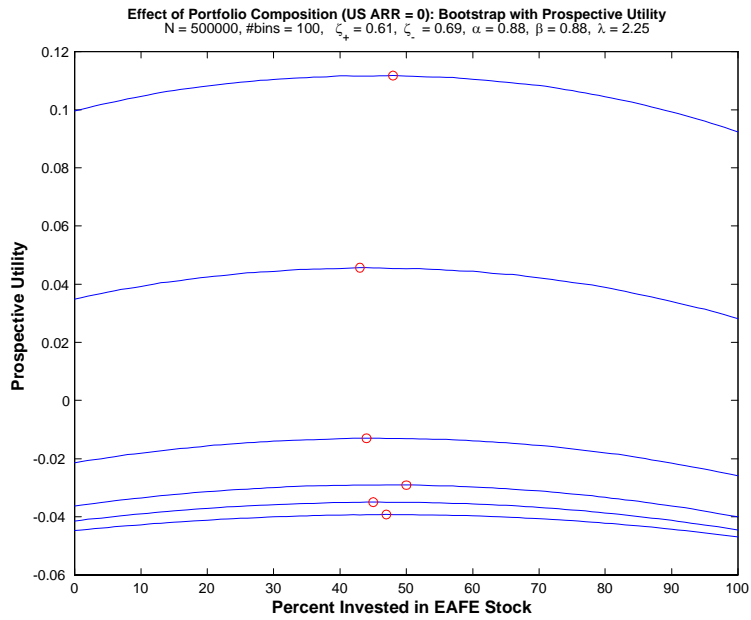


Figure 4: Myopic loss averse utility with bootstrapped data.

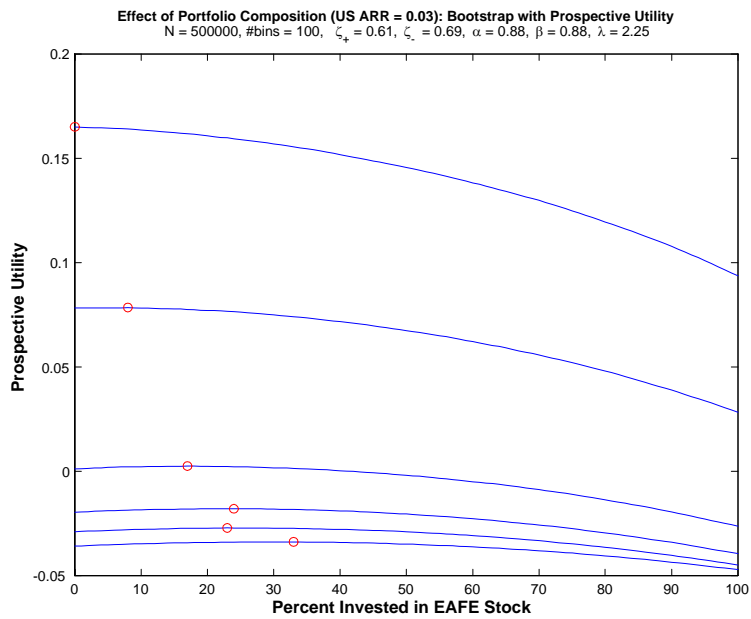


Figure 5: Myopic loss averse utility with bootstrapped data, ARR = 0.03.

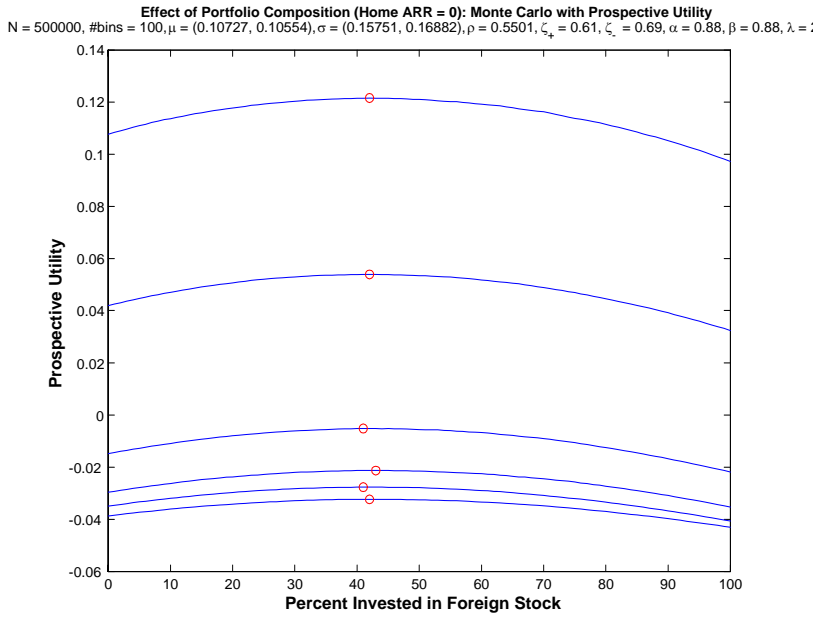


Figure 6: Myopic loss averse utility with simulated data using sample moments.

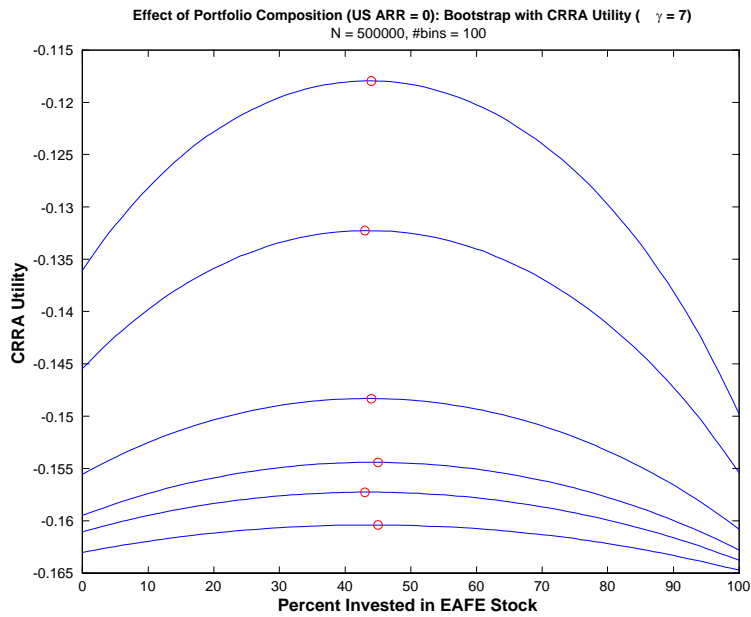


Figure 7: CRRA utility with bootstrapped data.

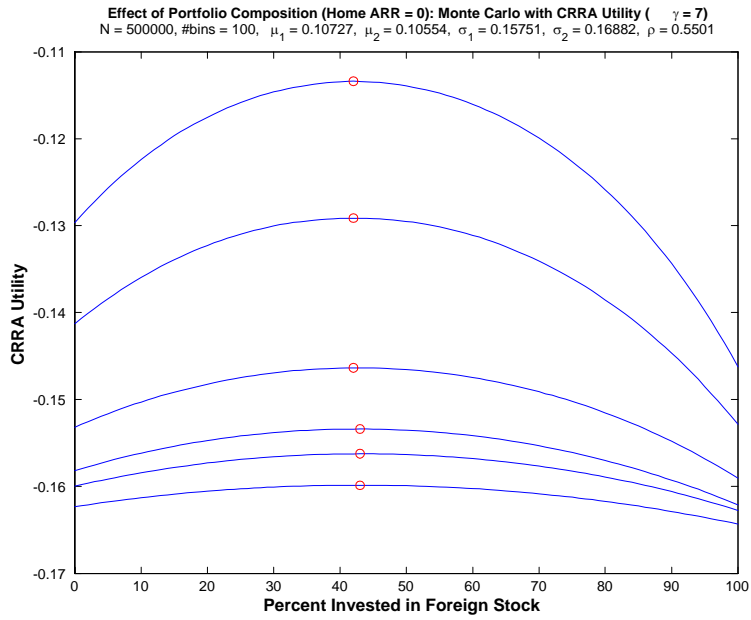


Figure 8: CRRA utility with simulated data using sample moments.

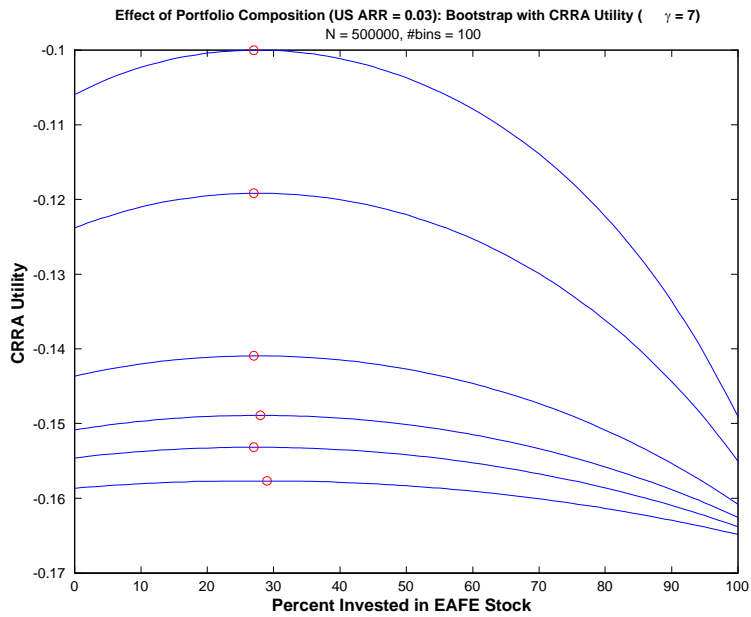


Figure 9: CRRA utility with $\gamma = 7$ with bootstrapped data, ARR = 0.03.

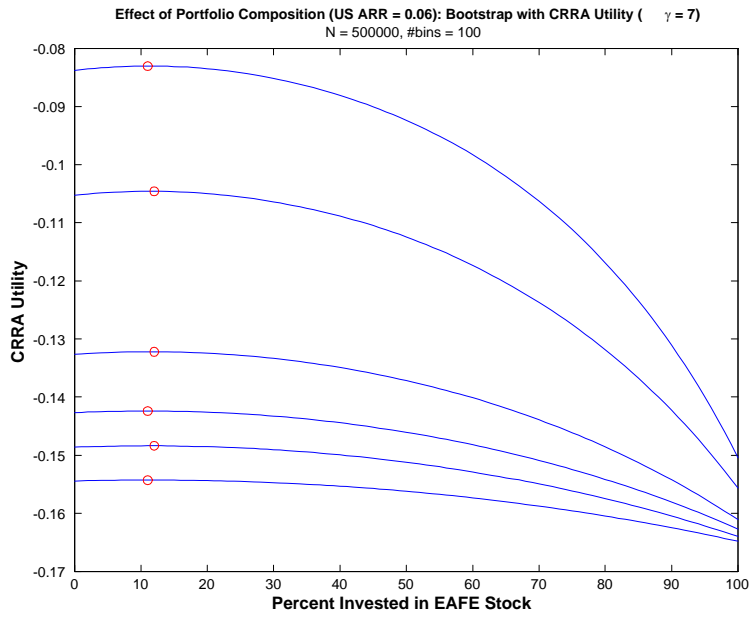


Figure 10: CRRA utility with $\gamma = 7$ with bootstrapped data, $ARR = 0.06$.

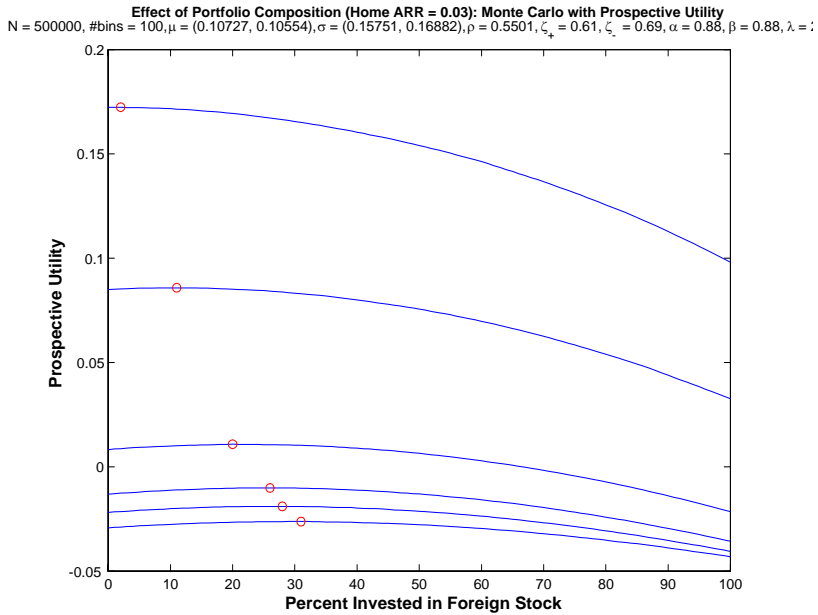


Figure 11: Myopic loss averse utility with simulated data using sample moments, $ARR = 0.03$.

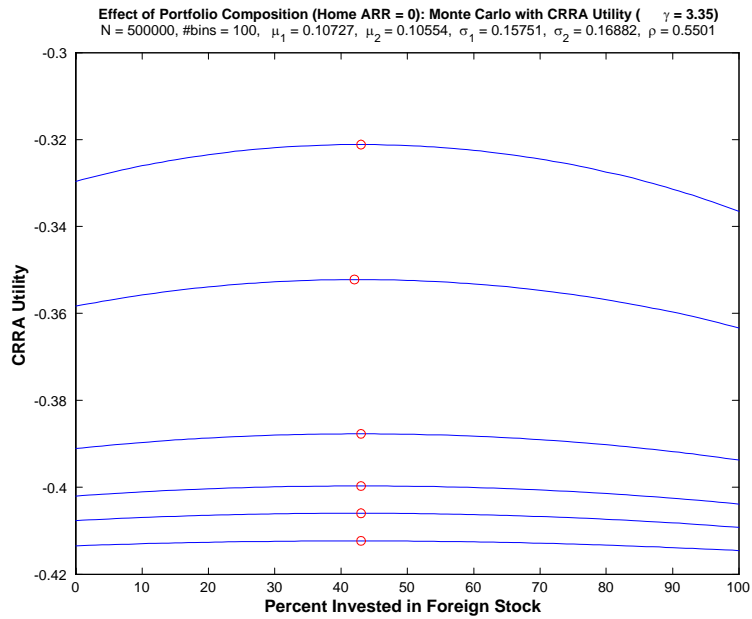


Figure 12: CRRA utility using the benchmark value for γ , simulated data using sample moments.

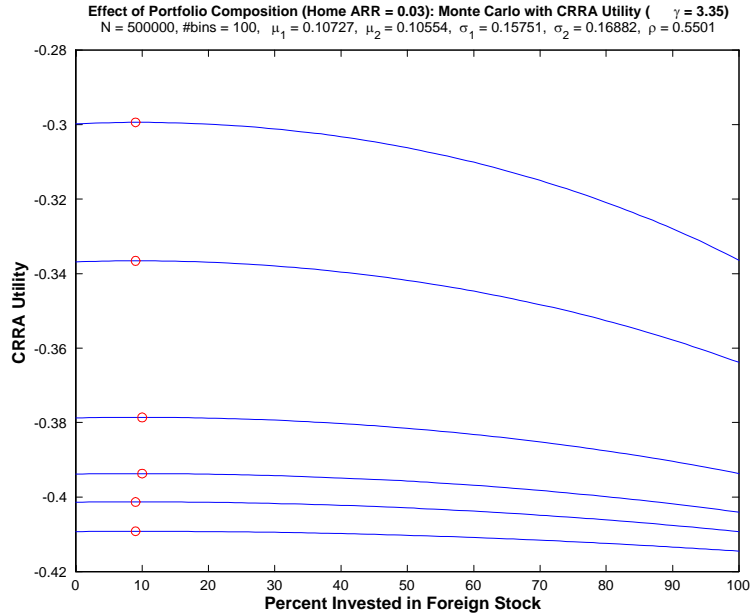


Figure 13: CRRA utility using the benchmark value for γ , simulated data using sample moments, ARR = 0.03.

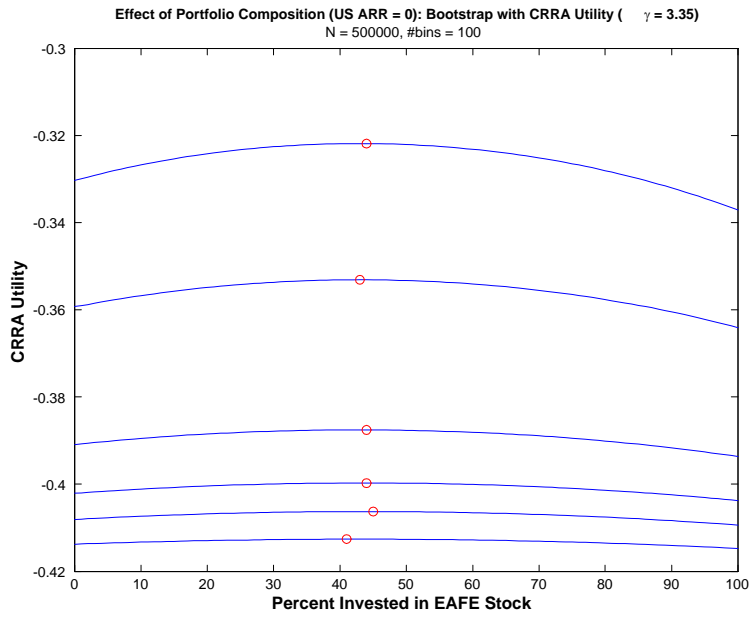


Figure 14: CRRA utility using the benchmark value for γ , bootstrapped data.

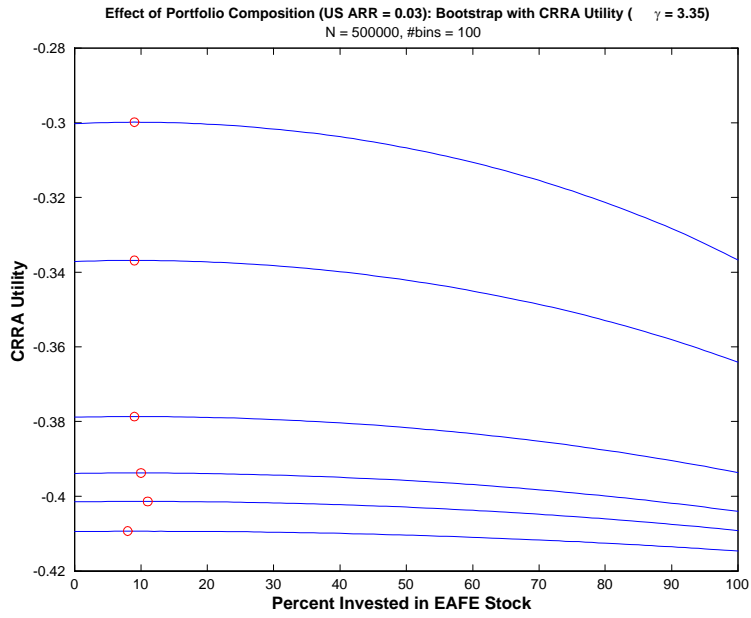


Figure 15: CRRA utility with benchmark value for γ , bootstrapped data, ARR = 0.03.