Estimating the Fixed Transaction Costs in Turkish Financial Markets

by

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This is to certify that I have examined this copy of a master's thesis by

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and have found that it is complete and satisfactory in all respects,
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To my family

ABSTRACT

Stock market participation is very costly for Turkish investors. This fact is empirically accompanied by low levels of direct market participation. Using Luttmer's (1999) framework, I estimate the lower bound for fixed cost of information acquisition implied by a welfare analysis. An average Turkish consumer with log utility who does not participate in securities markets should be confronting a fixed cost of at least 5.22 percent of his quarterly private consumption. The fixed cost bound significantly decrease when a borrowing constraint is imposed.

Keywords: Information Acquisition, Stock Market Participation, Fixed Transaction Costs, Welfare Analysis.

ÖZET

Türk yatırımcıları arasında hisse senedi piyasalarına katılım çok düşüktür. Luttmer'ın (1999) yöntemi kullanılarak yapılan bu çalışmada Türk yatırımcılarının doğrudan hisse senedi piyasalarına katılımamasını rasyonel kılan en küçük sabit bilgi akışı maliyeti hesaplanmıstir. Genel olarak, logaritmik fayda fonksiyonuna göre davranan ve hisse senedi piyasalarına dahil olmayan ortalama bir Türk yatırımcısı bu seçimini rasyonel kılmak için üç aylık tüketim harcamalarının en az yüzde 5,22'si kadar bir sabit maliyetle karşı karşıya kalıyor olmalıdır. Hesaplanan sabit maliyet, kisa satışlar da dikkate alındığında ciddi şekilde düşmektedir.
Anahtar Kelimeler: Bilgi Akışı, Hisse Senedi Piyasalarına Katılım, Sabit Alış-Veriş Maliyeti, Refah Çözümlemesi.

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Chapter 1

INTRODUCTION

1.1 The Equity Premium and Risk Free Rate Puzzles

In financial economics, it is usually taken for granted that there is a negative relationship between asset returns and the riskiness of the assets. One simple logic behind this principle is that individuals are risk averse, i.e. they dislike risk and try to hedge themselves again it whenever they can. If so, then an asset A, which is riskier than another asset B has to offer a higher return in order to persuade investors to hold itself. However, the notion of risk must be clarified. In the recent literature, models which explain consumption and saving decisions and asset returns together in a general equilibrium framework tell us that securities are priced with respect to the relationship between their return and consumption growth (Altug and Labadie, 2008[2]). As Grossman and Shiller (1981[11]) point out, consumption based representative agent models reflect all sorts of uncertainty regarding investment decisions of people, because uncertainty is reflected in consumption. Hence, risk means consumption risk. Economists typically explain the differentials between different types of securities by referring to the degree to which a security's return covariates with the representative investor's consumption growth (Kocherlakota,1996[18]), depending on the risk attitude of the investor. From this perspective, if consumption growth and a security's return has a high positive correlation, then that asset is counted as risky. If the return on an asset is low when consumption decreases and high when consumption increases, that asset is considered to be risky, because it does not hedge a risk averse investor against bad situations.

From an empirical point of view, it is quite difficult to say that representative agent models are successful in explaining the historically observed comovements among consumption and asset returns. In the last two decades, researchers discovered many different anomalies with these models. One of the main implications of the representative agent models is that stock prices are the expected discounted value of all future dividends, the discount factors being a function of consumption growth. However, Grossman and Shiller (1981[11]) analyze the U.S. data for the period 1889-1979 and conclude that for reasonable utility functions exhibiting risk aversion features, asset prices are too volatile to be explained by the variation in dividends and consumption. Hall (1988[14]) argues that consumption does not respond enough to the changes in the expected returns.

Among these inconsistencies in the data, perhaps the most famous one is *The Equity Premium Puzzle*, which was first put forward by Mehra and Prescott (1985[20]), who calibrated the 1889-1978 U.S. data on consumption and asset returns in a general equilibrium model within the representative agent paradigm, in order to match common stock returns and short term relatively riskless government bond returns. However, their model failed to match the high premium historicaly observed in risky stocks over bonds. They could only generate a small equity premium and a greater risk-free real interest rate than observed. Their findings opened an extensive research area on the equity premium puzzle, which has became a famous problem unsolved in asset pricing.

This pattern of stock and bond performance is not unique to the United States. Mehra (2003[21]) documents evidence for the equity premium puzzle for France, Germany, Japan, and united Kingdom, which constitute 85 percent of the world's market capitalization. In an empirical work, Salomons and Grootveld (2003[23]) investigate the equity risk premium in a number of international markets, with attention paid to the emerging markets. They find that equity risk premium is higher in emerging market economies than it is in developed markets. They also find that the extent to which the emerging markets reward investors varies through time, and the period of high reward does not depend on the breakpoints identifying financial market liberalizations in developing countries.

1.2 Proposed Solutions in the Literature

In their model, Mehra and Prescott used a simple version of a consumption-based model of pricing stocks and government bonds, in which the preferences in every period exhibit constant relative risk aversion (CRRA) feature, individuals can hedge against any kind of risk (complete markets) and there are no frictions in the market, such as taxes, trading costs of stocks and bonds, short-sale constraints. Any approach trying to provide an explanation with the equity premium puzzle should relax at least one of these assumptions.

Epstein and Zin (1989[10]) deviates from the CRRA type of period utility forms by introducing generalized expected utility, in which the risk aversion coefficient σ that appears in CRRA form need not equal to the inverse of elasticity of intertemporal substitution. In the generalized expected utility form, individuals' attitudes toward risk and their attitudes toward consumption growth are controlled by separate parameters. Therefore, highly risk averse consumers need not be consumption smoothers. Although their idea is promising for the equity premium puzzle, they could not solve the risk free rate puzzle.

Constantininides (1990[6]) and Heaton (1995[15]) relaxed time separability of the overall utility of the individuals by allowing habit persistence. Their idea is that a consumer who consumes a lot in a particular period also desires to consume a lot in the next period, because he is used to consume in high amounts. They incorporated this idea by letting the periodic utility function depend positively on the current period's consumption and negatively with the previous period's consumption. They find that introducing habit persistence does not solve the equity premium puzzle, but it solves the risk free rate puzzle by generating realistically lower risk free rate compared to Mehra and Prescott.

A related preference modification to explain the high observed equity premium is offered by Abel (1990[1]), in which an individual's utility in a particular period depends on his consumption relative to the average consumption in the population and his utility displays habit persistence. Abel was successful in matching the unconditional expected returns for reasonable risk aversion patterns. However, conditional moments of the returns are too volatile in his model.

A plethora of research papers relaxed the Mehra and Prescott's assumption of well structured securities markets. Constantinides et. al. (2002[7]), for example incorporate individual heterogeneity in a very nice way with markets which are frictioned and incompelte. They construct and calibrate an overlapping generations model, in which young people are unable to invest enough on stocks, because they have low income, and incomplete markets imposes a burden on them by preventing them from borrowing against their future income. Relaxing the borrowing constraints would increase the demand for stocks, raise the risk-free rate and decrease the equity premium. Therefore, young people's financial constraint in the securities markets from the frictionless markets is an important reason for high observed equity risk premium.

Basak and Cuoco (1998[3]) construct and calibrate a continuous time model in which agents are not homogenous. Some individuals' behavor might be distorted by market frictions and have limited or no access to financial markets. Another relevant study about limited participation is by Guo (2004[13]), which proposes a consumption based model and makes progress in explaining equity premium puzzle in two ways: first, due to the borrowing constraints, income risk is not diversified and hence a larger premium is demanded by investors for risk and second, because of limited stock market participation, investors need precautionary saving demand, which lowers the risk free rate and generates the risk free rate puzzle.

Costly information acquisitions may prevent investors from participating actively in the stock market, even if it offers attractive investment opportunities. One of the most plausible and obvious reasons of non-stock market participation other than high fixed costs would be, according to Guiso and Jappelli (2005[12]), that a significant portion of the population is unaware of certain forms of saving. Indeed, in their field research, they discovered that an important portion of households are unaware of mutual funds and simple stocks. Furthermore, among those who know what a stock is, investors use only a small portion of assets to use their savings. Therefore, people in general do not form diversified portfolios, regardless of whether they are aware or unaware of stock markets. Those who are likely to be aware of any financial instrument have higher years of education, high financial wealth, are born after 1940s, follow national newspapers which are printed in areas where active investors live about and have close social interactions.

It is not always people's choice whether to be aware or not. Distributors of information may advertise or not about their financial instruments, for example. Distributors may choose not to inform the public about the products if the cost of information dissemination about that instrument is huge. However, after their econometric analysis, Guiso and Jappelli predict that if all people would be aware of the saving opportunities available to them, stock market participation would go up to a significant extent. However, even if everybody is aware of the existence of all saving possibilities, still a huge percentage of people do not choose to participate in the stock market. Forming social interactions with brokers, hiring financial analysts, subscriptions to financial analysis reports, magazines, membership to investment clubs, making phone calls, being ready to respond immediately to any incoming news are all costly.

This study aims at calculating the fixed costs in order to rationalize the observed consumption choices. Only a negligible ratio, 0.02 percent of Turkish people, invest directly in the stock market, which is anomalously low. The majority of the market capitalization in Turkey is owned by foreigners, and Turkish citizens choose to invest in stocks indirectly through mutual funds. There are potentially profitable trading opportunities in stock markets for a rational investor who trades actively. However, the huge fixed costs of information, on which he constructs his trading rules, prevents him from actively trading in the stock market and result in the observed consumption choices, along with the profitable stock and bond market returns. Luttmer (1999) performs the same analysis for monthly U.S. data, which gives an estimate of 3 percent of observed per capita consumption for a consumer with preferences over consumption represented by log utility.

The rest of this study is organized as follows. Section 2 presents the economic model and describes the estimation technique, section 3 is about the data, section 4 presents and discusses the estimation results. Section 5 concludes.

Chapter 2

MODEL AND ESTIMATION

2.1 The Economic Model

The empirical analysis is based on the framework offered by Luttmer (1999), who calculates lower bounds for the level of the fixed costs in order to reconcile the observed U.S. data on consumption and various asset returns. In his model, there is a representative consumer, whose consumption pattern is similar to the observed consumption data. His periodic utility function is $u(\cdot)$, which is a strictly increasing and concave function of consumption. There are also a number of investment opportunities such as bank deposits, insurance contracts, company stocks, derivative contracts, pension funds as well as the possibility of physical storage of consumption goods and real estate available to his use. The main assumption is that a subset of these investment opportunities can be used only after paying a fixed cost, or put differently, using more broader trading opportunities requires more information, which is costly to acquire. This fixed cost can be the cost of information acquisition about the current news pertinent to the market, e.g. overall macroeconomic news about GDP, inflation, inflation expectations of the market, news about the future behavior of influential public and private actors. There is an important degree of information asymmetry among the players in financial markets. Hence, the fixed costs can also represent the cost of establishing contacts to more informed players in the market. An investor may have to make phone calls to a broker or get contact to an insider from a company or a public policy making institution, as well as he could incur the cost of buying or subscribing magazines and newspapers about financial markets. Especially if she is applying momentum trading strategies, she has to watch the news about the current and past stock prices and check her accounts frequently. One should also count the opportunity cost of time spent to get more information as part of the fixed cost. If an investor is very active in the market, he or she has to be in contact with a lot of people in order to get the information and be focused on security trading in order to coordinate the new information arrivals quickly in order to make use of the information in its best way. From another perspective, these fixed costs are the additional fixed costs of information acquisition that investors are required to incur in order to trade more profitably then they actually do. The existence of these costs cause limited financial market participation.

Assume that $\{c_t\}_{t=1}^{T}$ is an optimal consumption path, without using the investment opportunities which can only be accessed through the payment of the fixed cost. After paying the cost, the individual can diverge from the observed consumption path, and trade in various securities in order to achieve an alternative path that yields a better lifetime utility. Let r_{t+1}^{k} be one period return on security k from time t to $t+1$. For holding periods j longer than one period, the gross returns $r_{t,t+j}^{k}$ are the compounded one period returns from t to $t+j$, i.e.

$$r_{t,t+j}^{k} = \Pi_{i=1}^{j} r_{t+i}^{k} \tag{2.1}$$

In the specification (2.1), all the proceeds from a security is assumed to be invested in the same security in the interior periods between t and $t+j$. For securities $1,\ldots,K$, the K vector of j period compounded returns is then

$$r_{t,t+j} = \left(r_{t,t+j}^{1},\ldots,r_{t,t+j}^{K}\right) \tag{2.2}$$

If the consumer decides to use the costly investment opportunities, then he has to incur a cost of δc_t at time t, where δ is a parameter that shows the cost as a percentage of the investor's consumption in period t. In this study, δ is the parameter to be estimated.

Let G_t be the portion of the information set available to the researcher, belonging to the consumer who does not use the costly investment opportunities. Payment of the fixed cost δc_t will provide the individual with a wider information set. So, let F_t be his or her information set available to the researcher after paying the fixed cost, where $G_t \subseteq F_t$. Suppose that the vector x_t is a trading strategy available with F_t, its size is equal to the number of assets that the individual can trade after costly information acquisition. The components of x_t shows the amount of money invested into the assets, in terms of real 2007 TL. $v_{t+1}(x_t, \delta)$ is the ex-post utility gain from trading according to x_t. That is;

$$v_{t+1}(x_t, \delta) = u(c_t(1-\delta) - x_t' 1_t) + \beta u(c_{t+1}(1-\delta) + x_t' r_{t+1}) - u(c_t) - \beta u(c_{t+1}) \quad (2.3)$$

1_t in (2.3) is a vector of ones. $u(c_t) + \beta u(c_{t+1})$ is the level of utility with the optimal consumption stream at period t and $t+1$, and $u(c_t(1-\delta) - x_t' z_t) + \beta u(c_{t+1}(1-\delta) + x_t' r_{t+1})$ is the utility that can be reached by using the costly investment opportunities. Since given G_t, the consumer's choice $\{c_t\}_{t=0}^{T}$ is an optimal consumption path, the rational consumer should not reach a higher utility by paying a fixed cost and using alternative investment opportunities. Therefore, given x_t and assuming the absence of arbitrage opportunities, we should have the following:

$$E\left[v_{t+1}(x_t, \delta) | G_t\right] \leq 0 \quad (2.4)$$

Not every period's ex-post utility gain is weighted equally. Suppose $\omega_t \in G_t$ are weights of ex-post utility gains each period that are available to the researcher. Weights are strictly positive with positive probability. The set of trading rules after payment of fixed costs include the no trade rule. Equation (2.4) will hold true for any trading strategy $x_t \in F_t$, i.e. given his current information set, the representative individual thinks that it is not worth bearing the cost of being informed about the market. Running (2.4) over all possible ω_t and x_t, we obtain the following:

$$\sup\{E(\omega_t v_{t+1}(x_t, \delta)), \omega_t \in G_t, x_t \in F_t\} \leq 0 \tag{2.5}$$

For any $\delta > 0$ that satisfy (2.5), any other $\tilde{\delta} > \delta$ will also satisfy (2.5), because given a trading rule x_t, $v_{t+1}(x_t, \tilde{\delta}) < v_{t+1}(x_t, \delta)$. Running over all possible trading rules available with F_t,

$$\sup\{E(\omega_t v_{t+1}(x_t, \tilde{\delta})), \omega_t \in G_t, x_t \in F_t\} \leq \sup\{E(\omega_t v_{t+1}(x_t, \delta)), \omega_t \in G_t, x_t \in F_t\} \leq 0 \tag{2.6}$$

Therefore, one cannot determine the exact fixed cost parameter using (2.5). Nevertheless, one can estimate a lower bound for the actual fixed cost parameter δ by solving the following:

$$\sup\{E(\omega_t v_{t+1}(x_t, \delta)), \omega_t \in G_t, x_t \in F_t\} = 0 \tag{2.7}$$

2.2 Estimation

In order to estimate δ from (2.7), I use its sample counterpart, which means that method of moments technique is employed in this study. For calculation purposes, the weights and trading strategies will depend on some parameters a and g, hence we have $\omega_t = \omega_t(a)$ and $x_t = x_t(g)$, where $a \in A$ and $g \in B$ respectively. Then, a lower bound for the fixed cost parameter can be estimated via solving the sample counterpart of (2.7):

$$max_{a \in A, g \in B} \frac{1}{T} \sum_{t=0}^{T} \omega_t(a) v_{t+1}(x_t(g), \hat{\delta}) = 0 \tag{2.8}$$

The first question to be asked about (2.8) is the existence of $\hat{\delta}$, i.e. whether it is solvable for $\hat{\hat{\delta}}$ or not. I choose the parameters a and g from compact and finite dimansional parameter spaces. Since $\omega_t(a)v_{t+1}(x_t(g), \hat{\hat{\delta}})$ is a continuous function of the parameters, the maximum of the sample counterpart of the expected ex-post utility gain exists. Then, the theorem of maximum will say that LHS is a continuous function of $\hat{\hat{\delta}}$. Moreover, if there are some trading rules x_t for which LHS is positive and some trading rules for which it is negative, then intermediate value theorem concludes that (2.8) is solvable. δ is unique, since the left hand side of (2.8) is a strictly decreasing function of δ.

According to Luttmer, there are two possible reasons that $\hat{\hat{\delta}}$ is only an estimate of a lower bound:

1. The actual fixed costs are so large that the representative consumer never chooses to deviate from the observed consumption path.

2. A wider set of trading opportunities become available to the consumer after information acquisition than we might ever guess.

Equation (2.8) is solved in this study by a MATLAB program via a bisection method. In the first round, starting upper and lower bounds are assigned to $\hat{\hat{\delta}}$ (which are chosen as 1 and 0 respectively, although there is no particular reason to do so) and the LHS of (2.8) is evaluated, and upper and lower bounds are updated according to the result. The iterative procedure continues until $\hat{\hat{\delta}}$ converges, i.e. the difference between the updated upper and lower bounds become smaller than 10^{-6}. The average of the upper and lower bounds are then assigned as the estimate for $\hat{\hat{\delta}}$.

2.3 Statistical Properties

The standard deviation of $\hat{\hat{\delta}}$ is calculated based on Cameron and Trivedi (2005), where a consistent estimator for the variance $\hat{V}$ of $\sqrt{T}(\hat{\hat{\delta}} - \delta)$ is calculated as follows:

$$\hat{V} = (\hat{C}\Omega^{-1}\hat{C})^{-1} \tag{2.9}$$

In (2.9), $\hat{C} = \partial\hat{g}(\delta)/\partial\hat{\delta}$ where $\hat{g}(\delta)$ is the LHS of (2.8). In a model where there are more moment conditions than parameters to be estimated, the choice Ω is very crucial, because one can give weights to individual moment conditions via changing the matrix Ω. However, in our case since there is one parameter accompanied by one moment condition, the choice of Ω is not important. I simply chose it as he identity matrix, which is the singleton 1 in the current context. Then, Cameron and Trivedi (2005[5]) show that

$$\sqrt{T}\left(\hat{\delta} - \delta\right) \xrightarrow{d} \mathcal{N}\left(0, \hat{V}\right) \tag{2.10}$$

Furthermore, as suggested by Newey and West (1987[22]), I also allowed possible autocorrelation of four periods in variables in the estimation of the covariance matrix.

2.4 Trading Rules

In order to determine estimates of fixed cost bounds, we have to compare the maximum level of conditional expected utility that the consumer can achieve by extra information acquisition to his current observed consumption. Costly information acquisition allows some instruments in making their portfolio decisions. These instruments are proven to consistently predict the future stock returns. The amount of money invested in assets is a linear function of the instruments:

$$x_t = g \cdot z_t \cdot c_t \tag{2.11}$$

In (2.11), $g \in B$ is a 3×2 matrix whose entries take on values between -1 and 1. Hence, the maximum is taken over all possible x_t, each of which depends on a particular

g. This might seem restrictive on the grounds that the trading rules that the representative individual may use is restricted only to a subset of what can be achieved using the matrix g whose entries can take on bounded values, so that the individuals are not allowed to make full use of the information that they acquired. For low risk aversion levels of the individual, especially under risk neutrality, the individual wants to benefit from the differences in expected returns of the assets by going long in the high expected return assets and going short in the low expected return assets in arbitrarily large amounts, so that he earns unboundedly high expected consumption in the next period at zero cost. Such an objection would be true in low risk aversion levels. However, as the empirical results part of this study show, in higher risk aversion levels the trading rules does not have bites in the matrix g, so broader set of possible values for g do not affect the results significantly.

Chapter 3

DATA

The data in this study consist of consumption, stock returns, bond returns series and instruments which generate the trading rules in the securities markets. Quarterly data is used, in which 83 time series observations from the first quarter of 1987 to the third quarter of 2007 are included. Summary statistics are described in Table 1, both for the whole sample and the subsamples of subsequent 4 year periods. It would be better to use panel data in such a study and follow individuals' consumption and asset holdings over time. For example, Heaton and Lucas (1996[16]) analyze the interaction between various trading frictions and asset prices using data from Panel Study of Income Dynamics. In the Turkish case, a panel data which incorporates individual asset holdings and consumption is nonexistent. Therefore, I resort to the aggregate data. Unavailability of individual wealth and asset holding data also prevents me from using value functions and therefore count the effects of deviation from optimal consumption on the future choice set of consumption and future utilities, which would give me potentially tighter fixed cost bound estimates.

3.1 Consumption

Consumption in this study is per capita real consumption in Turkey. This is the highest frequency consumption data, and determines the frequency in this study. The per capita consumption series was available only annually, which would lead to very few number of observations, since Turkish stock market is open for only about two decades. However, the quarterly series for aggregate private consumption is available at the Central Bank of the Republic of Turkey (CBRT) website, starting from the 1^{st} quarter of 1987. The quarterly per capita series are then obtained by dividing the aggregate series by the total population of Turkey in that quarter. In Turkey, population is not counted very often (once in every 5 years until 1990 and once in every 10 years since 1990). I use linear interpolation of the population count results in 1985, 1990, 1997[1] and 2000 over the entire range of the data. The resulting series from the division of aggregate consumption by linearly interpolated population series is the one I use in estimation.

Consumption is rising in Turkey over time on the average, with a growth rate of 1.63 per cent per year. As it is clear from Figure 3.1.1, it also exhibits annual seasonality. It makes a peak in every third quarter of any given year, and takes its lowest value in the last quarter. The economic crises in 1999 and 2001 adversely affected the the subsample 1997:1 - 2001:4, where consumption decreases on the average. Although not being statistically significant, one can see that consumption growth is high in the last subsample, averaged 3.50 percent per year, starting from 2002. After 2001 crisis, which was the worst crisis that the country ever had since the establishment of the republic, very solid steps were taken especially in reshaping the financial system and making it one of thew most transparent financial systems of the world. Along with the improvements in the financial system, the political environment was quite stable, which also contributed to relatively healthy economic environment.

3.2 Stock Returns

The data on the stock market returns come from Istanbul Stock Exchange (ISE), which is the first stock market in Turkey, and operated in 1986. One index that is used to evaluate the overall performance of the market is the ISE-100 index, which shows the value weighted average of the biggest 100 business enterprises according to the value that operate in the stock exchange. I assume that the representative investor replicates the composition of the

[1]The count in 1997 is not a comprehensive population count. It was only aimed at updating the database of voters to be used in elections. There were no information on economic and social status of citizens. However, it contains numerical results about the overall population. See http://www.belgenet.com/arsiv/nufus.html

	consumption growth		bond returns		stock returns		inflation	
Time periods	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.
Full Sample	1.63	6.54	4.61	16.62	24.77	84.38	56.91	30.23
1987:1-1991:4	1.72	6.51	-3.31	19.71	64.42	50.02	64.14	12.68
1992:1-1996:4	2.66	6.48	4.25	18.39	7.54	53.40	83.39	19.73
1997:1-2001:4	-1.62	7.27	6.07	16.58	20.66	69.31	68.30	16.90
2002:1-2007:4	3.50	5.13	10.55	08.31	14.00	31.12	18.64	16.00

Table 3.1: Summary Statistics

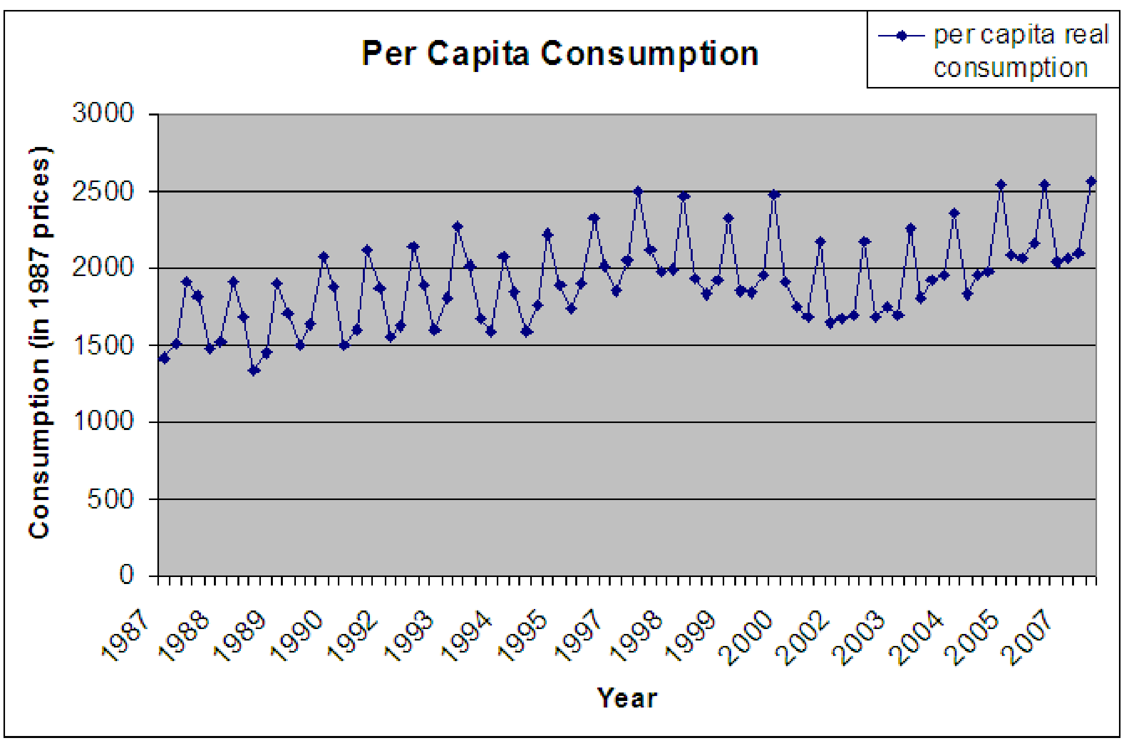


Figure 3.1.1: Per Capita Consumption in Turkey

ISE-100 index when trading in the stock market. In the context of this study, risky stock returns means the percentage change in the value of that index. Over the entire sample, real return on stocks is 24% each year on the average. The real return is as high as 64% between 1987 and 1991 and as low as 7% between 1992 and 1996. The subperiod 1987-1991 includes the financial liberalization that took place in 1989, after which the country became more even more sensitive to worlwide economic crises and capital mobility. The 70% equity risk premium in this subperiod also reflects the risky economic and financial situation of the country. Figure 3.2.1 displays the quarterly stock returns year by year.

3.3 Bond Returns

The bond returns data are collected from the CBRT archives. I used the simple annual returns to 90 day government bill returns issued to the public by auction. In most of the quarters, the government arranged more than one auction to sell 3 month notes. In those cases, I took the arithmetic mean of that quarter's returns. Another option could be to take the returns of the last auction in each quarter. However, these auctions are not regularly arranged. Therefore, the last auction of a quarter is arranged in the first few weeks of the quarter for some observations, as well as it happened to be in the last few days of the quarter. Therefore, averaging the series seems to be better informative of the behavior of the government short term bill returns. In some quarters, no auctions were arranged to sell government financing instruments with 3 month maturity. I replaced those observations with the derived returns to the secondary market data from the government instruments that expire after 3 months. On the average, bonds performed at 4.6 % per year net of inflation, leading to a 20% equity risk premium. Bonds performed their best in the recent subsample, where they averaged 10.55 percent per year, along with an equity risk premium as low as 3.5%. Bonds performed their worst between 1987 and 1991 with an annual growth rate of -3.3%. Figure 3.4.1 displays the quarterly returns to the 3 month notes for each quarter in the sample.

3.4 Instruments

The instruments in this study serve for generating the set of trading rules over which the maximum operator is taken in the definition of the fixed cost bound. Following Fama and French (1989) and Hodrick (1992), Luttmer uses four instruments: constant, term spread, default spread and and price-dividend ratio, which are proven to predict the stock returns. Corporate bonds in Turkey are not issued since 1995, because of the crowding out effect of high interest rates on the government bonds. Therefore, I dropped default spread and use three instruments instead. The first instrument is a constant vector of ones. The second instrument represents term spread, which is the ratio of gross yields on the long-term government bonds over the three month treasury bills. The treasury could not sell bonds having maturities longer than one year between the years 1991-1997. Therefore, the long term bond returns are gross returns of one year government bonds, which are divided by short term bonds are 3 month notes. The third instrument is the price-dividend ratio, which is taken from the ISE website. Sice dividends are generally paid annually, the the price dividend ration is the ratio of current price to the last end of year dividend payment. All the instruments are positive.

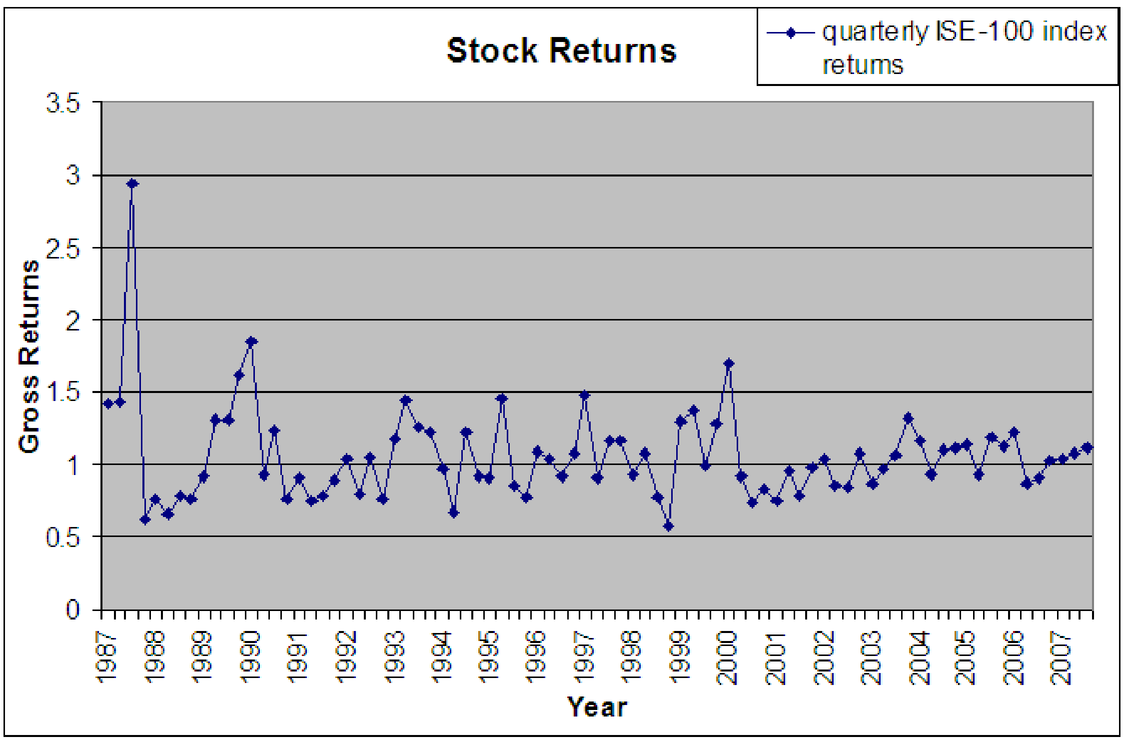


Figure 3.2.1: Stock Returns

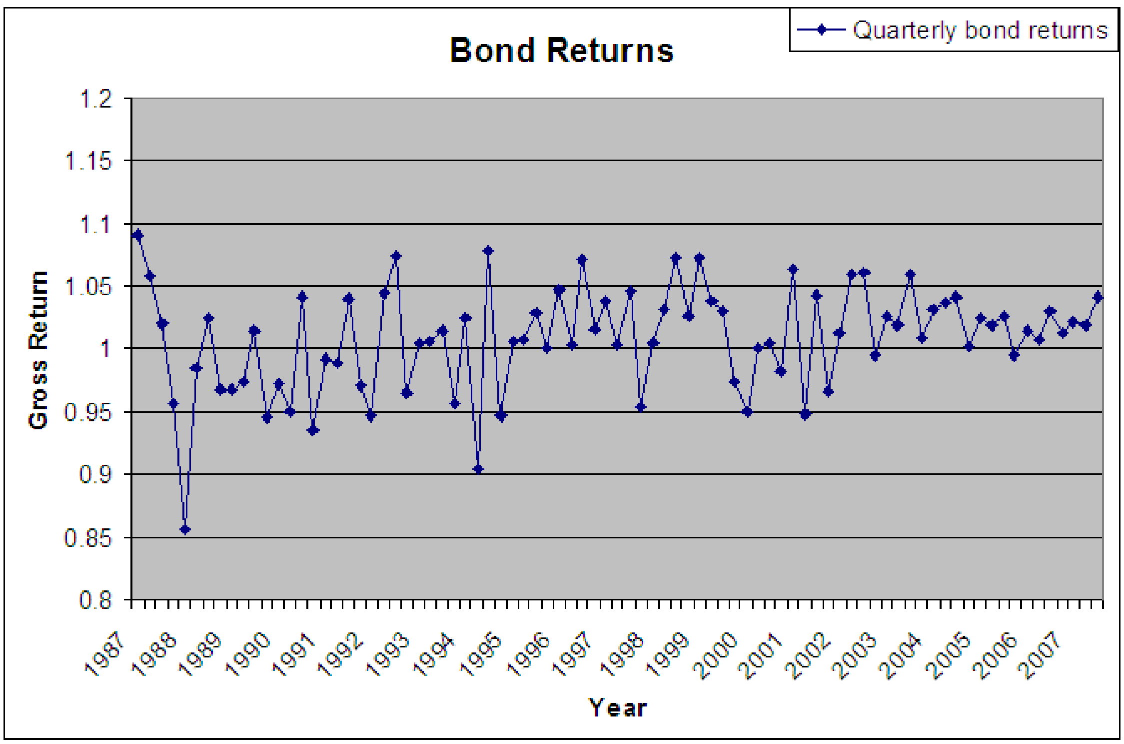


Figure 3.4.1: Bond Returns

Chapter 4

RESULTS

4.1 Simple Results with Different Holding Periods

Mehra and Prescott (1985) document the equity premium puzzle by calibrating a simple model with a representative agent having preferences over consumption sequences represented by constant relative risk aversion (CRRA) utility function. In this study, I use CRRA utility functions as well, along with allowing habit formation, where past consumption imposes negative externality to current utility. Hence, the consumer is assumed to choose his lifetime consumption sequence according to the period utility function given below:

$$u(c_t) = \begin{cases} \frac{(c_t - \theta c_{t-4})^{1-\sigma} - 1}{1-\sigma} & \text{if } \sigma \neq 1 \\ \ln(c_t - \theta c_{t-4}) & \text{if } \sigma = 1 \end{cases} \tag{4.1}$$

The consumer maximizes the expected value of the present value of utilities throughout his life. Lifetime utility is not separable with respect to consumption in each period. Furthermore, σ is the relative risk aversion coefficient when $\theta = 0$. The consumer's utility in each period depends on his consumption in that period net of his habit from the previous period. In order to avoid seasonalities, the stock of habits at quarter t is represented by c_{t-4}, one year lagged consumption. This setting is in order to avoid seasonalities and focus on habits only. Throughout this study, the time discount factor from one quarter ahead to the present is taken as $\beta = 0.99$. The weights of each period are nonrandom, being $\omega_t = c_t^{-(\sigma+1)}$, so that if marginal utility is high, then that period is given more weight, which makes sense. The holding period for deviating portfolios is chosen as one year, which is reasonable and consistent with empirical evidence. For example, Benartzi and Thaler (1995[4]), using simulations of U.S. data, show that optimal evaluation period of portfolios is around one year. According to them, individual investors check their savings, retirements or mutual funds accounts once a year, and institutional investors take the annual reports seriously (Benartzi and Thaler, 1995). However, I also report estimates also for quarterly, semi-annually and biannually portfolio holding periods.

Table 4.1 shows the estimates of fixed cost bounds along with the standard errors, for some commonly used values of σ. Mehra and Prescott (1985) and Kocherlakota (1996) for example, choose $\sigma \in [0, 10]$ as reasonable risk aversion parameters. I report estimates for σ between 0 and 6, beyond which the fixed cost bound estimates become very low.

Since returns on stocks are higher than the returns on the government bonds on the average; a risk neutral investor, when acquires information by paying fixed cost, goes short on bonds and goes long on stocks as much as he can in order to have unboundedly high returns at the end of the holding period, since all he cares about is the expected return from his portfolio. In order to rationalize observed per capita consumption, then, there needs to be unboundedly high fixed costs. Therefore, the fixed cost bound diverges as σ approaches to 0. Similarly, low risk aversion is consistent with observed consumption choices and asset returns only if there are high fixed costs: the fixed cost bound ranges from 2.15 percent of quarterly consumption at $\sigma = 2$ to 10.48 percent at $\sigma = 0.5$. In order to present more meaningful results, let me remind that real per capita consumption in the third quarter of 2007 was 2567 TL[1]. So, if we assume that the average consumer in Turkey has log-utility, then a fixed cost of $2567 \times 0.0522 \approx 134$TL woud rationalize the observed consumption choices of a Turkish consumer. If we assume higher risk aversion levels, then the fixed cost bound diminishes. Only a $2567 \times 0.0004 = 1$TL fixed cost is sufficient to rationalize observed consumption choices for an individual with $\sigma = 6$, who is virtually indifferent between 57TL for sure and a lottery having outcomes 50TL and 100TL with equal probabilities.

[1]New Turkish Liras, which is adopted in 2002.

Figure 4.1.1 displays the optimal trading strategies that would have been taken by an investor having log utility and a holding period of one year for the deviating portfolios. Clearly, shorting the government bonds and longing in risky stocks is the optimal investment strategy. These zero cost portfolios do not reduce the utility in the buying period, but significantly makes the investor better period in liquidation at the end of the holding period. According to the figure, in the 1989-1990 period, stock market was highly volatile and returns on stocks were high, because of the financial market liberalization in Turkey in 1989. There were high profit opportunities in that period. However, because of possible financial market volatility associated with the liberalization, only the risk tolerant consumers take that risk to go long in stocks leveraged by government bonds at those years. Indeed, a risk averse individual with $\sigma = 6$ does not invest too much in stocks in the 1989-90 period, as shown in Figure 4.1.2, because he does not want to take risk, what he looks for is consumption smoothing possibilities. As people become risk averse, not only pattern, but also the magnitude of trading also changes. A visual inspection reveals that a log utiliy consumer acts more aggressively than a consumer with $\sigma = 6$.

Columns (1), (2) and (4) of Table 4.1 display fixed cost bounds for holding periods of one quarter, six months and two years respectively. For columns (1) and (2), consumption series are deseasonalized by Hodrick-Prescott filter. The decreasing pattern of fixed cost bound along with increasing risk aversion is still present with different holding periods. For a given risk aversion level, however, the higher the holding period, the higher the fixed cost bound. If the investor's holding period is long, he does not rebalance his portfolio frequently, and high compounded returns also entail high fixed costs to rationalize his actual choices. There might be also variable costs of trading: for example, bid-ask spreads, capital gains taxes and brokerage fees might be levied o the investor depending on his trading volume. Long holding periods also save the investor from these variable costs. For $\sigma = 1.5$, one quarter holding period of portfolios is associated with $\hat{\delta} = 0.0045$ (i.e. 11.5TL), whereas for biannual portfolio holding period, the associated fixed cost bound is

	Quarterly		Semi-annually		Annually		Bi-annually	
σ	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.
0.5	0.0170	0.0227	0.0476	0.0428	0.1048	0.0759	0.2487	0.1541
1	0.0080	0.0153	0.0247	0.0228	0.0522	0.0359	0.1157	0.0720
1.5	0.0045	0.0062	0.0129	0.0194	0.0337	0.0242	0.0662	0.0415
2	0.0033	0.0060	0.0059	0.0074	0.0215	0.0200	0.0437	0.0317
2.5	0.0025	0.0031	0.0047	0.0064	0.0117	0.0190	0.0332	0.0214
3	0.0022	0.0030	0.0037	0.0062	0.0027	0.0203	0.0271	0.0190
3.5	0.0019	0.0029	0.0029	0.0057	0.0016	0.0094	0.0226	0.0176
4	0.0016	0.0028	0.0021	0.0056	0.0012	0.0094	0.0190	0.0169
4.5	0.0013	0.0028	0.0015	0.0052	0.0010	0.0100	0.0160	0.0166
5	0.0011	0.0027	0.0009	0.0014	0.0007	0.0107	0.0136	0.0167
5.5	0.0008	0.0027	0.0008	0.0014	0.0006	0.0111	0.0114	0.0169
6	0.0006	0.0027	0.0008	0.0014	0.0004	0.0119	0.0095	0.0174

Table 4.1: Results with Different Holding Periods

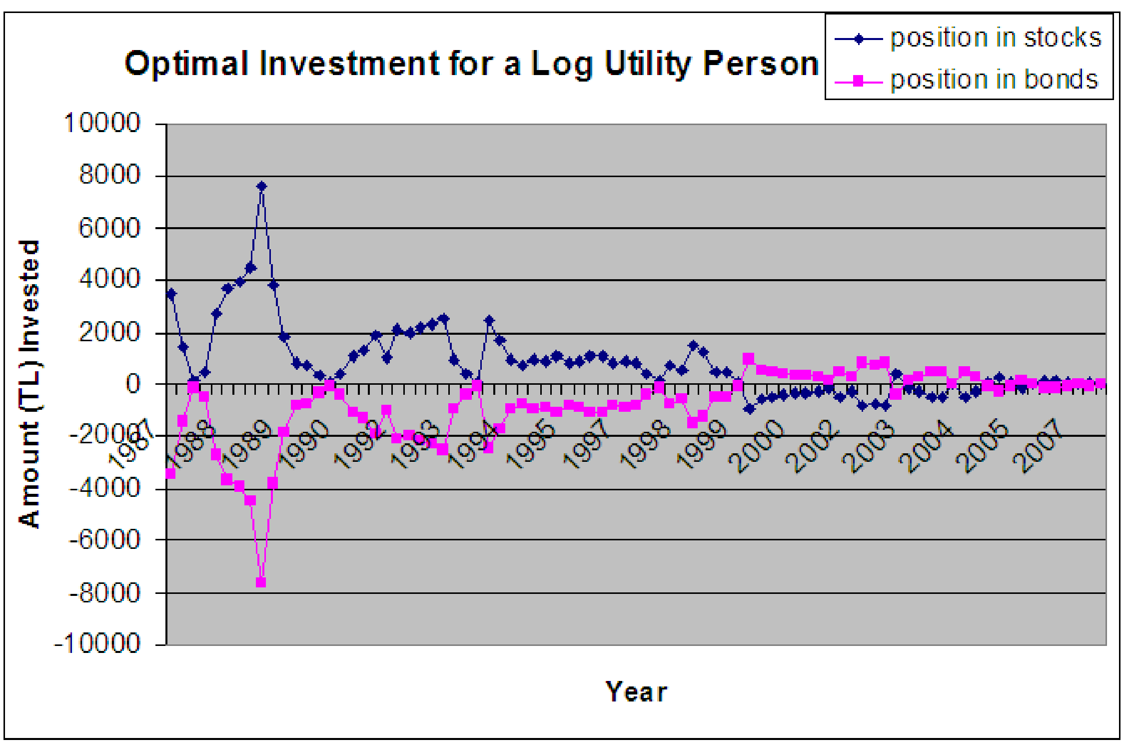


Figure 4.1.1: Optimal Investment of A Person with Log Utility

$\hat{\delta} = 0.0662$ (i.e. 170TL). Of course, actual fixed costs can be far above these figures. With biannual holding period, a person need not put effort for information acquisition frequently. From another perspective, an investor who holds quarterly portfolios can take better advantage of short term profitable fluctuations in asset prices, however only a small fixed cost is enough to prevent the investor to do so. This is confusing[2]. On the one hand, there are big potential gains from compounded returns over long holding periods, therefore implying high δ, whereas on the other hand one can profit from short run asset price fluctuations by frequent trading and short holding period of portfolios. A more general model allowing investors to choose the holding period of portfolios is needed, which is beyond the scope of this exercise.

4.2 Different Subsamples

Table 4.2 displays the estimates $\hat{\delta}$ under 4 different subsamples. For all risk aversion levels, the highest estimates belong to the earliest subsample, which cover the years 1987-1991, the first few years of ISE, at least for low risk aversion levels. The stock market offered opportunities from which only the sufficiently risk tolerant agents would benefit. That subsample also witnesses a structural change by allowing foreigners to trade in Turkish capital markets without any legal restrictions.Between the years 1997-2001, there were recessions and stock market crashes. Consumption was risky and there not good hedging opportunities. A log utility consumer faced 23.9 percent fixed cost between 1987-1991 (i.e. 613.5TL), whereas it was 9.30 percent between 1997-2001 (i.e. 238.7TL).

[2]Hereby the results I have just presented depend on exogenous holding period and on the assumption that δ is the same over the whole sample period. However, relaxing this assumption and endogenizing the holding periods would give me a clearer upper bound. However, calculating fixed cost bounds exceeds the computational capacity of my computer. Therefore, I leave it for future research.

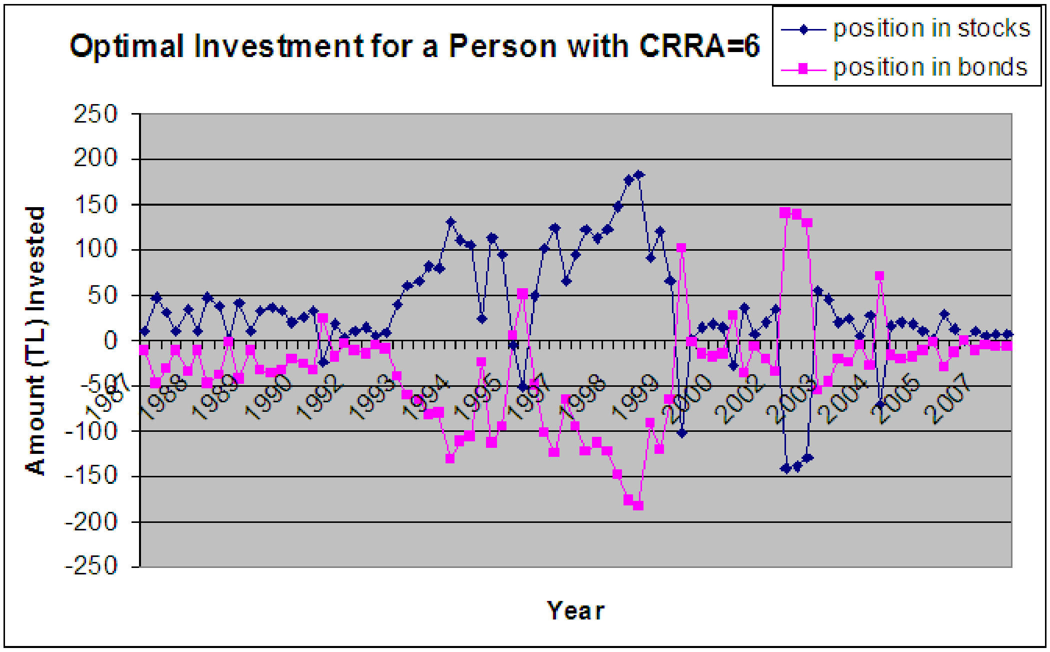


Figure 4.1.2: Optimal Investment of A Person with $\sigma = 6$

	1987:1-1991:4		1992:1-1996:4		1997:1-2001:4		2002:1 - 2007:3	
σ	coeff.	std. err.	coeff.	std.err.	coeff.	std. err.	coeff.	std.err.
0.5	0.4298	0.0878	0.1371	0.0595	0.1103	0.0181	0.1047	0.0463
1	0.2393	0.0442	0.0835	0.0313	0.0930	0.0138	0.0649	0.0309
1.5	0.1418	0.0319	0.0556	0.0165	0.0798	0.0138	0.0461	0.0250
2	0.1022	0.0219	0.0450	0.0135	0.0677	0.0141	0.0350	0.0208
2.5	0.0785	0.0191	0.0372	0.0127	0.0564	0.0145	0.0280	0.0172
3	0.0601	0.0175	0.0303	0.0124	0.0500	0.0112	0.0230	0.0142
3.5	0.0453	0.0166	0.0245	0.0116	0.0440	0.0114	0.0190	0.0135
4	0.0328	0.0161	0.0200	0.0117	0.0407	0.0090	0.0162	0.0141
4.5	0.0220	0.0159	0.0174	0.0102	0.0381	0.0087	0.0140	0.0139
5	0.0124	0.0157	0.0155	0.0107	0.0355	0.0088	0.0123	0.0148
5.5	0.0038	0.0162	0.0140	0.0106	0.0334	0.0073	0.0107	0.0158
6	0.0016	0.0128	0.0125	0.0110	0.0325	0.0077	0.0096	0.0164

Table 4.2: Results in Different Subsamples

4.3 Habit Persistence

In Table 4.3, fixed cost bounds are drawn along with σ for different intensities of habit persistence in consumption, where holding period of portfolios is one year. Stronger habit persistence in consumption choices of individuals allows us to rationalize the observed consumption choices with relatively low levels of fixed costs. For $\theta = 0.2$ and $\sigma = 0.5$, the required fixed cost is 7.89 per cent (i.e. 202.5TL), whereas for $\theta = 0.6$ and $\sigma = 0.5$, only a 1.88 percent (48.2TL) fixed cost is sufficient. Here, the stock of habits is exogenous, the investor is assumed not taking the effect of consumption changes in the current period on the stock of habits in the future. An individual displaying high level of habit persistence does not like to deviate too much from the observed consumption. His high degree of habit persistence makes him less tolerant to changes in his consumption. Therefore, he anyway does not want to deviate too much from observed consumption, compared to investors displaying low or no habit persistence. Therefore, lower fixed costs are enough to rationalize his consumption, compared to benchmark results in Table 4.1.

4.4 Bid-Ask Spreads

Given that people are already informed about what is going on in the securities market, one possible form of transactions cost can reduce the profitability of the assets traded, for example brokerage fees and bid-ask spreads. These costs are the most common type of proportional transaction costs, they are incurred after information aquisition. Demsetz (1968) explain the presence of bid-ask spreads by an immediacy argument as follows: when sellers and buyers try to interact directly in the market, it is not possible most of the time to match the sellers and the buyers to make the transaction. After they submit their buy/sell orders, sellers wait in order to be matched to a buyer. Waiting in the market is not costless, however. This happens especially when a person is trading an illiquid asset. The waiting costs then become even more pronounced. In organized markets, there are people who incur this waiting cost on behalf of traders, in return of charging brokerage fees from the traders and giving rise to or bid-ask spreads. Traders, on the other hand, paying an extracomission to the market specialists, can enjoy the benefits of buying and selling their assets immediately. One apparent example from the real life is the real estate markets, in which real estate brokers, whose primary job is to match the landlords and tenants as well as sellers and buyers, are present in the housing market. Their income consists of comissions, generally from buyers and tenants of the houses. Their presence enables people find housing quickly, so that they do not have to search for houses street by street. Similarly in the stock exchange markets, buyers and sellers submit their orders and the brokers match them to realize the trade.

In Table 4.4, the fixed cost bounds are calculated by also considering the fact that there might exist bid-ask spreads in trading in the securities market. Bid-ask spreads are variable costs, which depend on the amount invested in the security. The previously reported simple estimators may be biased because of not identifying fixed costs alone, by separating it out of the effect of various market frictions and variable costs therefore induced. In the calculation, an artificial bid-ask spread of 0.5 percent is created by simply multiplying the returns of both stocks and bonds by 1.005 when buying and by 0.995 when selling the security. Hence, for trading rule x_t, let x_t^+ and x_t^- be the vectors of long and short positions of the representative investor at time t respectively. Hence, $x_t = (x_t^+, x_t^-)$. Then, the welfare change under bid-ask spread $\tilde{v}_{t+j}$ is

$$\tilde{v}_{t+j}(x_t, \delta) = u(c_t^*) + \beta^j u(c_{t+1}^*) - u(c_t) + \beta^j u(c_{t+1}) \tag{4.2}$$

where c_t^* and c_{t+j}^* now are represented by

$$c_t^* = c_t(1-\delta) - 1.005 \cdot (x_t^+)' 1_t^+ - 0.995 \cdot (x_t^-)' 1_t^- \tag{4.3}$$

$$c_{t+j}^* = c_{t+j}(1-\delta) + 0.995 \cdot (x_t^+)' r_{t,t+j}^+ + 1.005 \cdot (x_t^-)' r_{t,t+j}^- \tag{4.4}$$

	$\theta = 0.2$		$\theta = 0.4$		$\theta = 0.6$		$\theta = 0.8$	
σ	coeff.	std. err.	coeff.	std.err.	coeff.	std. err.	coeff.	std.err.
0.5	0.0789	0.0546	0.0581	0.0428	0.0188	0.0304	0.0025	0.0036
1	0.0407	0.0295	0.0230	0.0235	0.0031	0.0056	0.0005	0.0012
1.5	0.0218	0.0212	0.0033	0.0055	0.0015	0.0035	0.0000	0.0000
2	0.0073	0.0191	0.0020	0.0034	0.0007	0.0024	0.0000	0.0000
2.5	0.0022	0.0044	0.0013	0.0023	0.0004	0.0012	0.0000	0.0000
3	0.0016	0.0034	0.0008	0.0023	0.0001	0.0013	0.0000	0.0000
3.5	0.0012	0.0023	0.0005	0.0012	0.0000	0.0000	0.0000	0.0000
4	0.0008	0.0023	0.0003	0.0012	0.0000	0.0000	0.0001	0.0019
4.5	0.0006	0.0012	0.0001	0.0013	0.0000	0.0000	0.0004	0.0018
5	0.0004	0.0012	0.0000	0.0000	0.0000	0.0000	0.0007	0.0017
5.5	0.0003	0.0012	0.0000	0.0000	0.0000	0.0000	0.0009	0.0016
6	0.0002	0.0013	0.0000	0.0000	0.0000	0.0000	0.0011	0.0015

Table 4.3: Results under Habit Persistence

	no BA spread		0.5 % BA spread	
σ	coefficient	std. error	coefficient	std.error
0.5	0.1048	0.0759	0.1010	0.0760
1	0.0522	0.0359	0.0501	0.0353
1.5	0.0337	0.0242	0.0318	0.0237
2	0.0215	0.0200	0.0196	0.0195
2.5	0.0117	0.0190	0.0098	0.0186
3	0.0027	0.0203	0.0018	0.0088
3.5	0.0016	0.0094	0.0013	0.0093
4	0.0012	0.0094	0.0010	0.0093
4.5	0.0010	0.0100	0.0008	0.0099
5	0.0007	0.0107	0.0006	0.0102
5.5	0.0006	0.0111	0.0004	0.0110
6	0.0004	0.0119	0.0003	0.0117

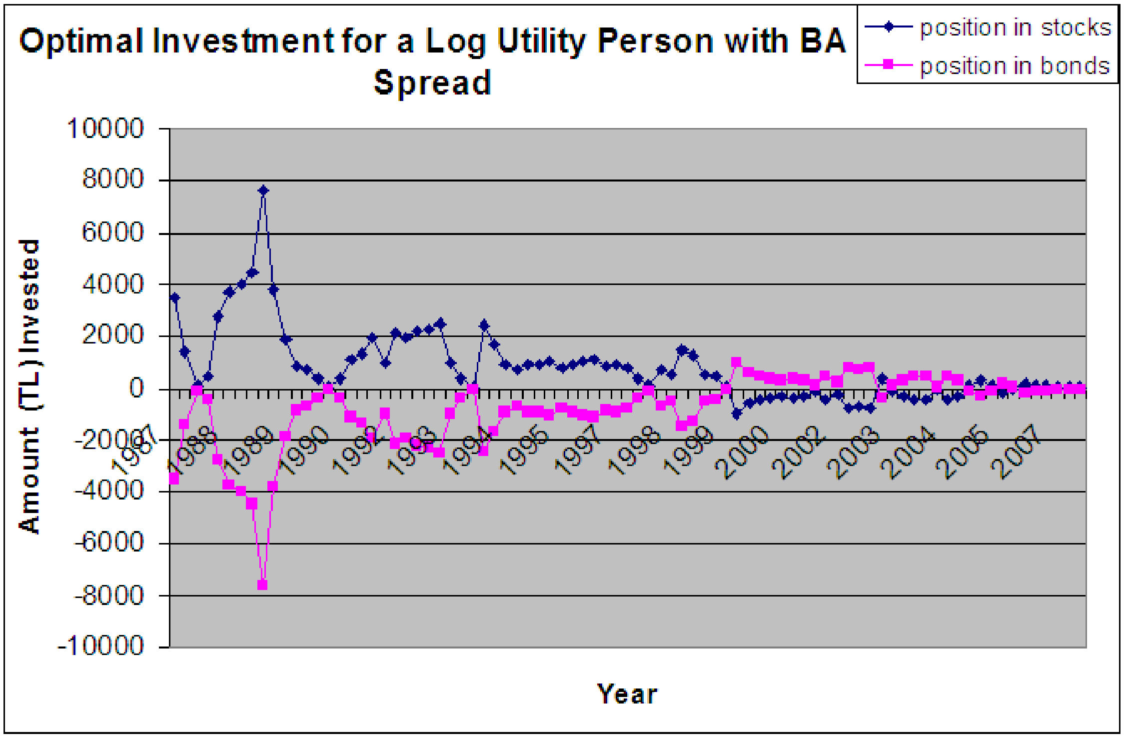
Table 4.4: Results with Bid-Ask Spread

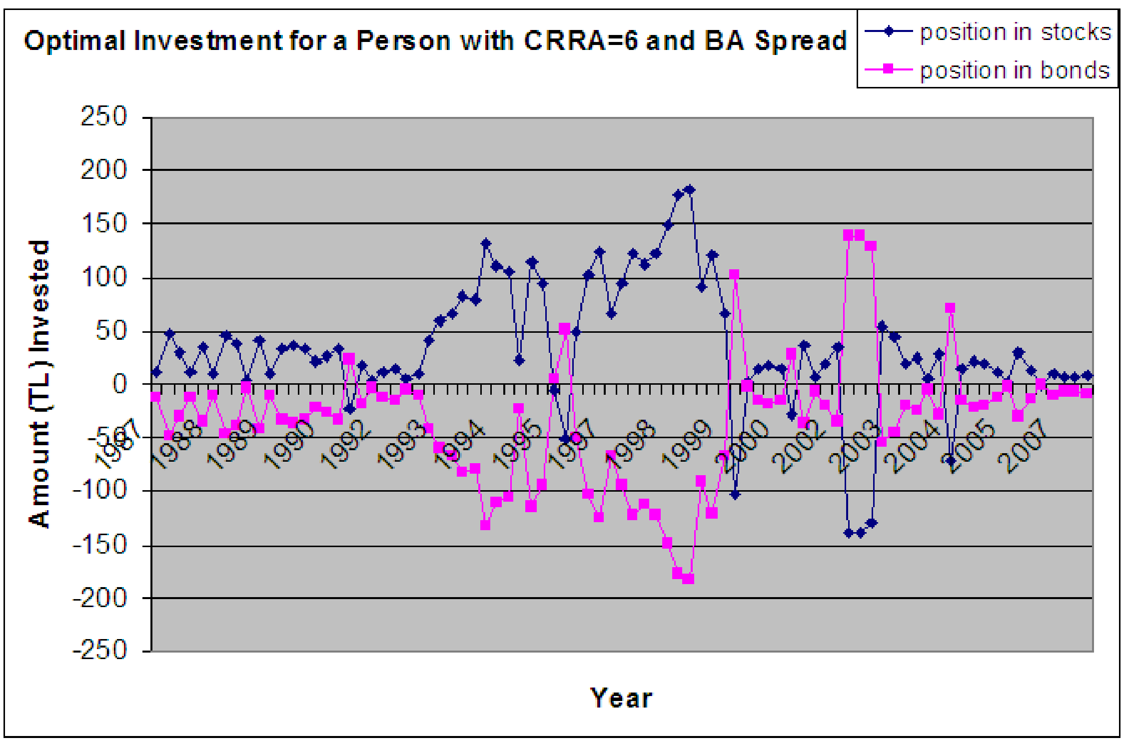
Furthermore, for the sake of efficiency, the individual is not allowed to have both short and long positions in stocks and bonds separately. The obvious impact of such a bid-ask spread is to reduce the profitability of the investments, which in turn effects the fixed cost bounds in order to rationalize the observed consumption. As seen in Figure 4.4, the reduction due to the bid-ask spreads is quite low. For a log-utility consumer, the estimated fixed cost bound is 5.01 per cent (i.e. 128.6TL)compared to the estimation without frictions, which is 5.22 per cent (i.e. 134TL). As one observes the trading patterns, it is clear that roughly the same trading strategies would be followed, i.e. shorting bonds and taking long positions in company stocks. Therefore, the fixed cost bound is robust, so the cost of obtaining information plays a significant role in people's consumption and stock market participation decisions.

4.5 Short Sale Constraints

Previously, the most profitable investments were done when the trading rules were such that the investor short sells relatively riskless bonds and goes long in risky stocks, hence asset trades are fully leveraged bets. If a short-sale constraint is applied, then it is reasonable to expect that there will be a sharp decline in profits of the investor. Referring to the introduction part, short sale constraints can be motivated by Constantinides et. al. (2002), in which young people cannot borrow because of collateral constraints or because of incomplete markets, they cannot write contracts against their future labor income. Hence, a young person may realistically be short sale constrained. To analyze the effect of short-sale constraints, I consider the trading rules x_t such that $x_t(g) = \max\{gz_tc_t, 0\}$.

According to Table 4.5, the impact of the shor-sale constraints is drastic, as expected. For $\sigma = 1$, the fixed cost bound drops from 5.22 percent to 0.0013 percent (i.e. 3.3TL). A very small amount of fixed costs is enough to make such constrained people out of the market. Hence, one can interpret this finding as the short sale and borrowing constraints being the primary reason why they do not participate so much in the financial markets (of


Optimal Investment for a Log Utility Person with BA Spread
position in stocks
position in bonds
10000
8000
6000
4000
2000
0
-2000
-4000
-6000
-8000
-10000
Amount (TL) Invested
1987
1988
1989
1990
1992
1993
1994
1995
1997
1998
1999
2000
2002
2003
2004
2005
2007
Year


Optimal Investment for a Person with CRRA=6 and BA Spread
position in stocks
position in bonds
250
200
150
100
50
0
-50
-100
-150
-200
-250
Amount (TL) Invested
1987
1988
1989
1990
1992
1993
1994
1995
1997
1998
1999
2000
2002
2003
2004
2005
2007
Year

course, if they have an observed consumption similar to per capita real consumption in Turkey). One can also analyze weaker forms of short-sale constraints by considering the trading rules of the form

$$x_t(g) = max\{gz_tc_t, -\phi c_t\} \tag{4.5}$$

for various values of ϕ. The results for $\phi = 1$ and $\phi = 2$ are also shown in Table 4.5. As expected, as the investors face weaker short-sale constraints by increasing ϕ (for example if they have higher personal debt capacity), trading opportunities become more profitable and hence, the fixed cost bound required to keep the investors out of these opportunities increase as well. For a log utility consumer, the fixed cost bound is 1.46 (i.e. 37.4TL) percent for $\phi = 1$ and 4.14 percent (i.e. 106.2TL for $\phi = 2$.

	$\phi = 0$		$\phi = 1$		$\phi = 2$	
	coeff.	std. err.	coeff.	std.err.	coeff.	std. err.
0.5	0.0029	0.0080	0.0383	0.0515	0.0756	0.0492
1	0.0013	0.0020	0.0146	0.0243	0.0414	0.0241
1.5	0.0008	0.0066	0.0084	0.0172	0.0201	0.0201
2	0.0005	0.0069	0.0045	0.0148	0.0072	0.0168
2.5	0.0005	0.0071	0.0029	0.0098	0.0029	0.0098
3	0.0004	0.0075	0.0021	0.0094	0.0021	0.0094
3.5	0.0004	0.0080	0.0016	0.0093	0.0016	0.0093
4	0.0003	0.0086	0.0012	0.0093	0.0012	0.0093
4.5	0.0003	0.0092	0.0010	0.0099	0.0010	0.0099
5	0.0003	0.0099	0.0007	0.0106	0.0007	0.0106
5.5	0.0003	0.0106	0.0006	0.0110	0.0006	0.0110
6	0.0003	0.0114	0.0004	0.0117	0.0004	0.0117

Table 4.5: Results with Short-Sale and Borrowing Constraints

Chapter 5

CONCLUDING REMARKS

Although I did not delve into the determinants of stock market participation decision of an average Turkish citizen, using Luttmer's (1999) framework, I calculated the fixed cost lower bounds that should be prevailing in order to keep people away from the benefits of stock markets. The fixed cost bounds come up implicitly from a welfare analysis of stock market trading. A consumer who has preferences represented by logarithmic utility should be facing 5.22 percent of his consumption as fixed cost (of information acquisition). Luttmer find the lower bound on fixed cost as 3 per cent.

The approach employed in this study does not incorporate subsequent effects of trades in stock markets on investors' welfare. Once an investor is allowed to deviate from his observed consumption only once, which does not seem realistic. Presence of individual wealth data would allow me to use value functions and hence incorporate the permanent effects of stock market participation decisions. Such models would give higher fixed cost bounds.

Although testing statistical significance of figures is not possible under this framework, adding short sale constraints makes the fixed cost bound economically insignificant, which of course does not mean that the actual fixed costs are also economically insignificant. However, inability of people to write contingency contracts against their future income as a market incompleteness appears to be a major reason why people do not actively trade in stock markets. Therefore, based on the results, any plausible model which explores people's stock market participation decisions should not exclude the borrowing constraints of especially young people who earn low and co not have personal debt capacities.

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