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Essays on the Equity Risk Premium

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ABSTRACT

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The equity risk premium (ERP) is an essential component of any asset pricing model both for academics and practitioners alike. Nevertheless, the financial literature does not accord much attention to the ERP estimation issues (Damodaran, 2015). The first chapter of this dissertation gives a summary of the recent literature review on the subject of the ERP. The second chapter explores four of the most commonly cited models in literature for estimating the ERP: the Historical Mean of Realized Returns Model (HMRRM), the Dividend Discount Model (DDM), the Free Cash Flow Model (FCFM), and the Sharpe Ratio Model (SRM). The results indicate that the estimates of the ERP vary considerably depending on (a) the variable of choice for the risk free rate; (b) the selection and the length of the estimation period; (c) and the estimation method. The DDM and the FCFM produce estimates for the implied ERP that are below the historical estimates, while the SRM produces implied ERP values that are usually higher than the historical values of the ERP. The post 2008 financial crisis period produces estimates for the historical ERP that are slightly higher or lower than the implied ERP estimates for the FCFM. The implied ERP estimates for the three models are more volatile than the historical ERP. In particular, estimates of the implied ERP from the SRM tend to overshoot the historical ERP estimates during periods of high volatility and fall below the historical level during periods of low stock market volatility.

The third chapter explores the relationship between the expected ERP and macroeconomic variables. The results from the four OLS regressions indicate that the relationship between the expected ERP and the unexpected inflation volatility is in general negative and insignificant even after accounting for recessionary periods. The results validate the Proxy Hypothesis theory of Fama. On the other hand, the expected ERP is found to be positively correlated with the stock market volatility in times of non-recessionary periods but negatively correlated in times of recessionary periods.

In the Name of Allah, the Most Gracious, the Most Merciful

I dedicate this work to Allah the almighty. I owe everything to Him and I hope and pray that He will accept this humble work as part of my good deeds.

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CHAPTER I

INTRODUCTION

The equity risk premium (ERP) is an essential component of any asset pricing model both for academics and practitioners alike. The prediction of the ERP has strong repercussions on the estimation of the cost of capital for firms. It is an important determinant of the measure of risk aversion and by consequence the asset allocation decisions for investors. Its magnitude affects the consumption and saving decisions of households and governments' expenditures. Its importance has far-reaching implications for the strength of the economy. Hall (2014) argued that the high level ERP reduced investments and prevented hiring post 2008 financial crisis. Kuehn, Petrosky-Nadeau and Zhang (2013) concluded that the ERP is countercyclical and tied to fluctuations in the labor market.

Theoretically, the ERP is the return on equity in excess of the risk-free rate. Since future equity market returns are not discernible at the current time, it is the expected ERP that investors are concerned with. As intuitive as the concept of ERP seems, in practice it does present a number of challenges.

VARIATION IN EQUITY RISK PREMIUM

Among academics, there are striking differences to what the ERP value actually is. Values vary from as low as 2 percent to as high as 13 percent (Welch, 2000). According to Damodaran

(2013), the wide variation in the estimates of the ERP could be explained by variation in sample period, variation in variables measurement, and variation in measurement techniques.

Variation in Sample Period

The questions that academics face is how far back in time one should go to estimate the ERP. Goetzmann and Ibbotson (2005) go as far back as 1792 to estimate an ERP of 3.76 percent between 1792 and 1925. Ibbotson Associates (2011) estimates go as far back as 1926. Other academics consider much shorter time periods ranging from thirty, twenty, or even ten years to estimate the ERP. Both sides have their rationales in selecting the time periods. Proponents of the longer time periods approach, argue for more data inclusiveness and therefore better predictability. However doing so will most likely generate estimates of the ERP that are less relevant to today's investors since market structures change over such a long period of time. In addition, data from earlier periods are much less reliable compared to more recent periods. On the other side, proponents of the shorter time periods approach argue that investors' risk aversion changes over time in relation to economic conditions and therefore shorter time periods will yield a more updated and adequate estimates of the ERP that are more aligned with the investors' risk aversion. Nonetheless, the disadvantage of such shorter time period approach is an increase in data volatility and therefore higher standard errors associated with the ERP estimates.

Variation in Variables Measurement

The ERP is the difference between the return on equities and the risk free rate. Whereas, the S&P 500 composite price index is often chosen as the market index that approximates for the return on equities, first because it is a much broader index and second because it is a market value weighted index. There is a debate among academics to what class of security better approximates for the risk free rate. A good number of academics use the Treasury bill yield as the risk free rate, while others use the Treasury bond yield. Those who favor the use of the Treasury bill do so because it is free from price risk, while the Treasury bond has a longer maturity period and therefore changes in interest rates can affect its value over time. Even if this argument does make sense over a single investment period, it does ignore the reinvestment risk associated with rolling over investment in Treasury bill over longer periods (Damodaran 2008). Conversely, individuals who invest for their retirement do so over a long period of time and therefore they are more likely to select the Treasury bond as the risk free rate to better approximate for the risk free used to compute the expected return on their investment.

Even if academics do agree on the nature of the risk free rate, they still have to find a consensus on whether to use a real or nominal risk free rate to calculate the ERP. The obvious argument is that since long term return on equity, in most part, is calculated using a real discount rate to account for changes in inflation rate, it makes sense to use a real risk free rate to estimate the ERP. In this case, the expected inflation rate can be subtracted from the nominal interest rate to arrive to the real risk free rate. Recently with the introduction of the Treasury Inflation Protected

Security, academics have for the first time access to a traded default-free security that can be used to proxy for the real risk free rate.

Variation in Measurement Techniques

The choice between the arithmetic mean and the geometric mean is the next decision in line that academics face before they can calculate the ERP. The arithmetic mean is simply the sum of all the returns over the period divided by the count of all the returns. Assuming a single period asset pricing model and uncorrelated returns over time, the arithmetic mean is the best approach for estimating the ERP. This approach loses its ground when we consider the fact that stocks are negatively correlated over a long period of time (Fama and French 1988, 1992), and using the arithmetic mean in this case will most likely overstate the risk premium (Damodaran 2013). Therefore, the geometric mean is a better fitting approach for estimating the ERP over a longer period of time and when stocks are correlated over time.

In the second chapter, I estimate the ERP over different horizons while approximating the risk free rate to a number of variables with different maturity periods. I consider the 3-Month Treasury Bill yield (TB), the 10-Year Treasury Constant Maturity Rate (TB10), the 30-Year Treasury Constant Maturity Rate (TB30), the 10-Year Treasury Inflation-Indexed Security constant maturity rate (TBI10), and 30-Year Treasury Inflation-Indexed Security constant maturity rate (TBI30).

ESTIMATION OF THE EQUITY RISK PREMIUM

Damodaran (2015) lists three main approaches for estimating the ERP. The first and the most widely used among academics and estimation services such as Ibbotson Associates is the historical premium approach. It consists of estimating the expected ERP by assessing the historical premium of past returns on equities over risk free assets. The second approach is a survey based approach that consists of surveying a sample of managers and investors about their future expectation for the ERP. The third approach is what Damodaran calls the “implied premium” approach, and it consists of estimating the ERP based on the value of traded assets today.

Duarte and Rosa (2015) classified the twenties’ models selected for their study into five main approaches based on their underlying assumptions. They are: historical mean of realized returns approach, dividend discount models approach, cross-sectional regressions approach, time-series regressions approach and surveys based approach. In the next chapter, I estimate the historical ERP using four different models: the historical mean of realized returns model, the dividend discount model, the free cash flow model, and the sharp ratio model. In addition I test and compare the predictability power of each of the four models.

UNEXPECTED INFLATION AND THE EQUITY RISK PREMIUM

The substantial variation of the ERP over the past two centuries is an indication that it may be subject to the underlying macroeconomic forces. Barro (2006) argued that during wartime the perceived increase in the probability of future economic disaster led to a decrease in the real interest rates and an increase in actual and expected level of inflation rates. He observed that the expected U.S. real interest rates fell during the Civil War, World War I, World War II, and more recently during the period of 2001 – 2005 following the attacks of September 11 through the conflict in Afghanistan and Iraq where the ten-year real rate fell from 3.8 percent to 1.6 percent. Moreover, and according to Barro, bonds tend to outperform stocks during periods of economic disaster which leads to an increase in the magnitude of the ERP.

Lettau, Ludvigson, and Wachter (2007) found a strong correlation between low frequency movements in macroeconomic volatility and low frequency movements in the stock market. In particular, they noticed that the sharp increase in the stock market during 1990s coincided with a move toward lower macroeconomic risk that led to a fall in expected future stock returns and a lower ERP after 1990. Their model predicted that the magnitude of the ERP plummets as the economy gears toward a state of low macroeconomic volatility.

In the third chapter, I explore the relationship between the ERP and macroeconomic variables. In particular, I postulate that an increase in uncertain inflation increases the market risk premium. This increase in the market risk premium leads to an increase in the required rate of return on stocks, which in turn causes the stock prices to decline.

LITERATURE REVIEW

Song (2007) identified "three major themes in the intellectual history of the equity premium." The first theme emerged with the paper of Gordon and Shapiro (1956) in which they argued for the use of the dividend discount model (DDM) to estimate the required return on capital as the dividend yield plus the expected dividend growth rate. The ERP can therefore be calculated by subtracting the risk free rate from the required return on capital. The DDM was the prevalent approach for estimating the ERP among practitioners and academics up to 1976 when Ibbotson and Sinquefield proposed a new estimation approach for the ERP based on the historical returns.

The second theme started with the Ibbotson and Sinquefield paper (1976). It consisted of estimating the arithmetic mean of the ERP from the historical returns of equity minus the risk free rate. The authors operated under the assumption that historical returns are stationary and therefore the appropriate length of time from which to estimate the ERP is the longest period of quality reliable historical data available. Ibbotson and Sinquefield's approach dominated the practitioners' estimates of the ERP from the late 1970s up to 1985 when it came under pressure from both the DDM and the ERP puzzle literature.

Mehra and Prescott (1985) started the third theme in the intellectual history of the equity premium by arguing that ERP estimate based upon Ibbotson and Sinquefield's approach for the period 1889–1978 required an investor risk aversion of 30 to 40 times higher than the prevalent risk aversion in the market. In addition the historical ERP estimate for the same period was too high to be explained by any of the models describing investors' behavior at that time. Mehra and

Prescott (1985) concluded that either the models were flawed or investors had received higher returns than they expected.

Ever since 1985 when Mehra and Prescott made the first attempt to answer the question whether the observed ERP is compatible with the theoretical ERP, many more academics have followed in their steps trying to resolve what is commonly referred to in the financial literature as the ERP puzzle. The attempts that followed can be classified into two main approaches. The first approach is the focus of the majority of research and tries to justify the size of the equity premium. The second approach focuses rather on explaining why investors have historically realized a larger premium than they might have. In the next sections I give a brief summary of the literature review for both approaches. Figure 1 illustrates the timeline of the literature for the ERP.

[Insert Figure 1 here]

Justifying the Equity Risk Premium

Ever since Mehra and Prescott introduced their famous paper "The Equity Premium a Puzzle" in 1985, a large number of studies have attempted to theoretically justify the size of the premium. Nevertheless, to this day there is no absolute consensus for a dominant theory over the rest of theories. In fact the only consensus in the field is that the ERP is still a puzzle as it was three decades ago (Mehra and Prescott 2008). Among the pioneers of the justifying approach are;

A Preferences Explanation

An intuitive explanation for the ERP is that a risk-averse investor demands a higher reward for bearing non-diversifiable aggregate risk. Mehra & Prescott (2008) estimate that historically the standard deviation associated with returns on equity is around 20 percent per annum, while the standard deviation associated with returns on Treasury-bills is only about 4 percent per annum. Therefore, investing in more risky asset commands a higher reward. Such explanation suffers from three perspectives: First, the low average debt security is not entirely a risk free asset as argued by DeLong and Magin (2009). Second, assuming that a low average debt is a risk free asset, the existence of such a high equity premium can only be explained by an extremely and unrealistically high degree of risk aversion. Dasgupta (2007) puts the coefficient of relative risk aversion to be in the range of 1 to 3, against a coefficient of 50 that is needed to explain the presence of the ERP. Third, Mehra and Prescott (1985) argue that under the same economic circumstances, stocks and bonds reward investors in a very similar way. In fact, they estimated that stocks on average should command no more than 1 percent return premium over bills.

A Non-Standard Preferences Explanation

Separating Risk and Time Preferences

Epstein and Zin (1989, 1991, 2001) formulated an intertemporal utility model that disentangles the risk aversion from the intertemporal substitution and allows for a temporal non-expected utility to influence the consumer risk behavior. In such a setting the undiversifiable risk component of the return is captured by the covariance of an individual asset’s return with the market portfolio, while the covariance of the individual asset's return with the consumption growth rate captures the risk across time periods.

Bansal, and Yaron (2004) presented a model with two main features. First, following on the footsteps of Epstein and Zin (1989), their model allows for a separation between the intertemporal elasticity of substitution and risk aversion. Second, the individual consumption and the dividend growth rates are subject to irregular volatility, which captures time-varying economic uncertainty. Based on these assumptions, individuals will demand a large equity risk premia every time they are faced with a reduction in economic growth prospects or a rise in economic uncertainty.

Kallenbrunner and Lochstoer (2007) relying on the time preference assumptions of Epstein and Zin (1989), studied the effects of transitory and permanent technology shocks on the long-run risk associated with an individual asset's return. Their results are summarized in two parts. First, they show that a model with transitory technology shocks and a low elasticity of intertemporal substitution will result in a low volatility of consumption growth and a high price of risk. The end result is a large ERP but a highly volatile risk free rate. Second, they demonstrate that a model with permanent technology shocks and a relatively high elasticity of intertemporal substitution will produce a relative stable consumption growth rate and a high price of risk. The end result is a low ERP.

The underlying critique to the time preference models is that they do leave high effective risk aversion largely unaccounted for, see for example DeLong and Magin (2007). In addition such attempts are only able to explain the ERP puzzle if they account for an extremely large coefficient of relative risk aversion and an economic agent that is implausibly risk-averse (see for example Donaldson and Mehra (2008)).

Non- Separable Utility Functions or Habit Formation

Sundaresan (1989) is pioneered for developing a model with a utility function that depends not only on consumption level at time t but also on the history of consumption up to time t. In theory, the existence of large ERP is only justified if the agent faces a large volatility in his or her per capita consumption growth or historically the agent has faced a very low volatility in his or her per capita consumption growth. By incorporating a habit consumption feature, the agent is no longer assumed to be averse to consumption variation but to variations in habit-adjusted levels of consumption. Such agent may require a large equity premium even if he or she faces a small change in consumption growth. Such variation may explain the ERP puzzle (see, e.g., Donaldson and Mehra (2008)).

Similarly, Constantinides (1990) argued that utility is not time separable but exhibits habit persistence. He justified the existence of the ERP in the presence of a low risk aversion element by developing a model characterized with high volatility in the marginal rate of substitution in consumption and low variability in the consumption growth rate. As such, a small drop in consumption generates a large drop in the marginal rate of substitution that is able to justify the observed ERP.

Campbell and Cochrane (1999) developed a "consumption-based model" with three distinctive features. First, the model assumes that individuals are subject to an external habit formation as opposed to internal habit formation. The individual habits are linked to the history of aggregate consumption (external) rather than to the individual's own past consumption (internal). Second, the relationship between the individual habits and the history of aggregate consumption exhibits a nonlinear trend. The nonlinearity assumption implies that habit is always below consumption level and that marginal utility is always finite and positive. Third, the individual habits react slowly and gradually to the change in the level of consumption. As such, the Campbell and Cochrane model is able to predict a large ERP even in the presence of low long-run consumption volatility. The main argument behind Campbell and Cochrane results is that individuals require a large premium because stocks do badly in times of economic contraction and not because stock returns are correlated with reduction in the individual's level of consumption or wealth.

Abel (2008) attempted to provide a closed-form solution to the ERP puzzle, first by adopting a habit formation model for canonical asset, and second by departing from the assumption of rational expectation. The end result was a generalized canonical asset pricing model capable of delivering empirical results for the equity premium, the risk free rate, and the standard deviation of the risk free rate that are close to the historical data and to the findings of Mehra and Prescott (1985). Nevertheless, the Abel model does so at the expense of high risk free rate volatility.

Habit formation models are not anomalies free. Heaton (1995) explained that although the ERP puzzle can be explained under the assumptions of the habit formation models, they do so at the expense of a highly volatile short-term interest rate which is contrary to the quite low volatility observed historically. Kocherlakota (1996) has shown that while it is true that habit formation models are able to explain the ERP puzzle by breaking the direct link between stock returns and temporary consumption level, they do so under the assumption that individuals are extremely averse to marginal variation in consumption level whether it is internal or external. This conclusion was echoed more recently by DeLong and Magin (2009) and Donaldson and Mehra (2008) who asserted the lack of empirical evidence supporting the assumptions of the external habit formation model.

Market Structure and Undiversifiable Risk Models Explanation

Limited Capital Market Participation

Mankiw and Zeldes (1991) explained that only a quarter of U.S. families own stocks. Therefore it is not fitting to test for the ERP using aggregate consumption across families who own stocks and those who do not own stocks. In fact, Mankiw and Zeldes (1991) found that the aggregate consumption of stockholders is not only more volatile but also more strongly correlated with excess equity return than total consumption is. Nevertheless, the authors admit that their results "cannot provide a complete resolution of the equity premium puzzle."

Brav, Constantinides, and Geczy (2002) challenged the assumption of a representative consumer which assumes that heterogeneous consumers are able to equalize their marginal rate of substitution under the assumption of full-information economy. The authors challenged this assumption by arguing that a stochastic discount factor (SDF) calculated as the weighted average of individual households' marginal rate of substitution with low value of relative risk aversion coefficient, as opposed to a SDF calculated as the per capita marginal rate of substitution, is able to generate an equity premium that conforms to its historical value during the period 1982-1996. The authors also argued that an SDF calculated as the per capita marginal rate of substitution is better able to explain the equity premium once the assumption of limited participation of households in the capital market is recognized.

Market Incompleteness

Constantinides and Duffie (1996) relied on the joint hypothesis of incomplete consumption insurance and consumer heterogeneity in order to construct a theoretical model where the source of the equity premium is measured by the covariance of the securities' returns with the cross-sectional variance of individual consumers' consumption growth. The authors argued that the joint hypothesis of incomplete consumption insurance and consumer heterogeneity provides an explanation for the ERP even without introducing borrowing constraints, short-sale restrictions, borrowing costs, transaction costs, or an unrealistic restriction on the net supply of bonds. The findings of Constantinides and Duffie (1996) come with the price of restricting the joint processes of dividends, aggregate income, and prices under the property of convex marginal utility.

Borrowing Constraints Models

Huggett (1993) suggested that the source of puzzle in the ERP emanates from the fact that the average real risk-free rate has been so low, an observation commonly termed the "risk-free rate puzzle". The argument is that economic agents are constrained to how much they can borrow but they are not constrained to how much they can save. The end result, a low risk free rate is needed in order to clear the excess reserves in the credit market.

Transaction Cost Models

Fisher (1994) argued that the equity premium should compensate an investor for the (1) risk bearing factor and also for the (2) trading cost incurred. Contrary to the general belief that transaction costs and aspects of trading volume are to be ignored in the asset pricing model for estimating returns on equity, Fisher (1994) asserted that even in the presence of a negligible risk aversion, the gross expected premium should average between 3 percent and 4 percent annually. Therefore in the presence of trading cost the ERP carries (1) a risk rewarding component and (2) a compensation for trading cost component.

Heaton and Lucas (1995) broadly surveyed the related literature to conclude that models with frictions in the form of borrowing constraints, transaction costs, and undiversifiable risk “can account for low-risk free rate and in some cases can explain the observed ERP.” Nevertheless, the authors were quick to point out that their results suggest that much remains to be explained and that the ERP is far from being completely resolved by the introduction of frictions in to the asset pricing models.

Heaton and Lucas (1996) assumed that individuals face systematic labor income risk and idiosyncratic labor income risk. Individuals trade in financial securities in hope of dissipating these risks. Nevertheless the ability of individuals to trade in financial securities is limited by borrowing constraints, short-sales constraints, and transaction costs. In particular the effect of transaction costs is amplified by the fact that individuals have to trade often in order to hedge against shocks to their individual incomes. The authors argued that the effect of the transaction costs on equity premium can be decomposed in two parts. First, a direct effect as a result of the gap between the higher rates that the lenders require and the lower rates that the borrowers require in order to compensate for transactions costs. Second, an indirect effect related to the fact that transaction costs limit the ability of individuals to use financial securities as a mean of protection against transitory shocks in individual consumption. The authors find that the indirect effect alone of transactions cots is approximately responsible for 20 percent of the observed equity premium. Nevertheless, the authors conceded that their results are “quite sensitive to the structure of transaction costs and the supply of tradable assets”.

Swan (2002) argued that equity markets are highly illiquid relative to government securities. The investors then require a higher compensation rate of return for holding such illiquid market securities. According to Swan, the equity premium is no more than compensation to equity holders for the illiquidity. Swan constructed a model were the equity premium depends on the amortized spread for equity less the amortized spread for Treasury bills after accounting for the transaction costs. The liquidity variable is approximated by the average turnover rate which is the ratio of securities traded relative to securities outstanding. Swan's results indicated that annualized security returns decrease at a rate of 0.54 percent for every 1 percent increase in equity turnover. The results also demonstrated that the turnover rate for bonds is 25 percent higher than the turnover rate for stocks. According to Swan, the liquidity differential between bonds and stocks is more than enough to account for the observed equity premium.

Jones (2002) estimated the annual proportional cost of aggregate equity by multiplying the annual turnover to the sum of half-spreads and one way weighted-average commission rate for trading NYSE. The results revealed that measures of liquidity in the form of bid-ask spreads and turnover rates are able to predict stock returns one year ahead. In particular, Jones showed evidences that high spreads predict high returns and high turnover predicts low returns. Nevertheless, the results fell short of solving the ERP puzzle. In fact, Jones's results indicated that the annual proportional cost of aggregate equity trading can only account for a small part of the observed equity premium.

Income Structure Models

Danthine, Donaldson, and Siconolfi (2005) argued that the variation in income shares between workers and capital owners represent an important risk factor for the owners of capital and a fundamental determinant of the return to equity. The non-competitive labor market as a result of political pressure through the tax systems and social forces in the form of trade unions, influence the sharing of income in the favor of workers vis-à-vis the owners of capital. The owners of capital are required to share in value added even when their cash flows are limited. This "distribution risk", as called by the authors, is of a great importance to the holders of capital, and it even exceeds the usual systematic risk of financial assets. As a consequence, the owners of capital require a substantial higher return on their investment that according to the authors is able to explain a high equity premium of 3.12 percent and in some instance 7.78 percent with high level of dividends volatility.

Guvenen (2005) proposed two assumptions for explaining the ERP puzzle. First is the assumption of limited participation in the stock market, where the majority of households do not participate in the stock market but have access to a risk-free bond and are able to accumulate wealth and smooth consumption intertemporally. The second assumption is related to the heterogeneity in the elasticity of intertemporal substitution. The combination of these two assumptions leads to a different growth in wealth distribution among the two categories of economic agents (households and stockholders) and over the different business cycle of the economy. For example, a positive and persistent technological shock increases the value of equity considerably and as a result the wealth of the stockholders. On the other hand, non-stockholders rely on a gradual increase in wages to accumulate more wealth. Therefore, because of the asymmetry in consumption smoothing opportunity, non-stockholders develop a stronger desire for a smooth consumption process compared to stockholders. In addition and for the same reasons, non-stockholders have to rely exclusively on the bond market in order to avoid high consumption volatility and will therefore demand a high equity premium in order to participate in the stock market. The analytical results of Guvenen (2005) showed an equity premium of 5.45 percent compared to the historical figure of 6.2 percent.

Beyond One Representative Agent Models

Chan and Kogan (2002) adopt a representative agent model with heterogeneous agents with constant individual risk aversion over time but variable across different segments of population. As such, the adopted representative agent model will generate an aggregate risk premium with countercyclical variation due to the endogenous disparity in wealth distribution across the different segments of economic agents. In particular, the segment of economic agents with relatively low risk aversion will require a higher ERP than the segment of agents with relatively high risk aversion. In fact, relatively "risk tolerant agents" will hold a higher proportion of their wealth in stocks compared to relatively less "risk tolerant agents". Therefore, relatively risk tolerant agents are more susceptible to wealth reduction due to a decline in the stock market than less risk tolerant agents. By consequence, a decline in the stock prices will result in a higher ERP. Empirically, Chan and Kogan (2002) found enough evidence to support their assumption of preference heterogeneity. Nonetheless, the authors also concede that "changes in expected stock returns in the model are still partly driven by the time varying interest rates."

Piazzesia, Schneidera, and Tuzel (2007) develop a consumption based asset pricing model where economic agents consider housing both as an asset and as consumption good. As such, an investor measures risk not only based on the overall size of future consumption but also on its uncertain composition between housing as an asset and other consumption. In other words, an investor will not only consider the intratemporal elasticity between present and future consumption but also will have to consider the intratemporal elasticity of substitution between housing and other consumption. This intratemporal substitution mechanism drives stock price down in times of recession by forcing investors to sell stocks today in order to secure present consumption. In particular, when the share of housing consumption is low, the recession is perceived to be severe and the downward effect on stock prices is accentuated. Empirically the model generates a sizeable 3.5 percent ERP with a low and smooth riskless rate with a mean of 1.8 percent.

Chapman and Polkovnichenko (2008) study asset pricing models with non expected utility hypothesis. In particular they consider rank-dependent expected utility (RDEU), disappointment aversion (DA) and generalized disappointment aversion (GDA), ambiguity aversion (AA), and a general form of reference-dependent utility to contrast assets' prices in a heterogeneous economy composed of two equally wealthy agents but with different first-order risk aversion to a homogenous economy composed of a single agent with a wealth equal to the weighted average of the utility parameters of the two equally wealthy agents. Their results show that the single agent model tends to overstate the equity premium and understate the value of risk free rate by 100 percent and 20 percent respectively, as compared to the two agent model. The authors argue that in the presence of two representatives in the economy, the agent who is more pessimistic or risk averse may decide not to bear any risk if he or she thinks that the risk premium is deemed insufficiently high. In this situation, the risk premium will be defined primarily by the agent who is more willing to take risk and therefore it is a mistake to equate between prices in the heterogenous agent model and prices in the weighted average agent model.

Behavioral Models

Prospect Theory

Kahneman and Tversky (1979), the authors criticized the utility theory model and its inconsistency in explaining choices under risky prospects. In particular the authors noted that economic agents tend to overweigh outcomes that are considered certain in comparison to outcomes that are merely probable. This "certainty effect" as labeled by the authors contradicts the principle of utility theory where utilities outcomes are weighted by their probabilities. In addition, the authors observed that economic agents more often discount components that are shared by all prospects in favor of components that distinguish them. They labeled this phenomenon the isolation effect which may produce inconsistent preferences away from the predictions of the utility theory. The authors then developed an alternative model called the prospect theory where they assign values to gains and losses rather than to final assets and where they consider decision weights rather than probabilities.

Disappointment and Generalized Disappointment Aversion Theory

Gul (1991) developed an axiomatic model of preferences over lotteries that relies on countercyclical risk aversion and where consumers are concerned particularly with disappointing outcomes. Consumers tend to react aversely when their level of realized consumption is expected to fall below a certain predetermined level. The significance of the Disappointment Aversion model is that it retains much of the expected utility theory while being immune to the most compelling argument of independence axiom against the expected utility theory.

Routledge and Zin (2010) generalized the Disappointment Aversion model of Gul (1991) by introducing a more relaxed definition of the endogenous disappointment outcomes that allows for focuses on more extreme outcomes. Such an outcome is considered to be a disappointing outcome not when it falls below a certain predetermined acceptable level by the economic agent, but rather when it is far below the confidence threshold of the agent. This introduced property of the Generalized Disappointment Aversion model, allowed the authors to focus on more extreme financial behavior. As such, the authors' model was able to produce a sizeable equity premium measure and a risk free rate with low volatility.

Loss Aversion Theory

Barberis, Huang, and Santos (2001), deviating from the traditional utility theory, the authors incorporate two well known ideas in psychology: the prospect theory of Kahneman and Tversky (1979) and the evidence of Thaler and Johnson (1990) on the influence of prior outcomes on the individual risk behavior, to develop a model capable of explaining the ERP puzzle. The prospect theory stipulates that the economic agent is more sensitive to changes in the value of his financial wealth from period to period rather than the absolute level or the final consumption outcomes. According to the prospect theory, the agent is also more sensitive to reductions in his financial wealth than to increases. In addition, the evidence of Thaler and Johnson (1990) indicates that prior gains and loses outcomes influence the risk behavior of the economic agent. In particular, an agent may find a fall in the stock market return to be less worrying if it is preceded by substantial earlier increase in wealth that makes the investor believe that he is better off compared to last period. According to Thaler and Johnson (1990), this finding explains why agents who experienced recent gains behave in a less risk-averse manner. On the contrary, agents who experienced recent losses tend to be much more risk-averse and tend to shy away from investment that they may have considered without these prior loses. This behavior is known in the financial literature as the "house money effect". By incorporating these two concepts into their model, the authors relate the high level of ERP to the high volatility of returns which leads to frequent losses and consecutively these losses cause loss-averse investors to be even more pessimistic. Therefore, a high equity premium is needed in order to convince loss-averse agents to invest in stock markets.

Narrow Framing Theory

Barberis and Huang (2001), assuming that economic agents are loss-averse and look at utility from a narrow framing point of view, studied stock returns in two different economies. The first economy was composed of agents that are loss averse over fluctuations of their entire stock portfolio in addition to their consumption level. The second economy was composed of agents that are loss averse over fluctuations of their individual stocks in addition to their consumption level. Their results indicate that aggregate stock returns in an economy where agents get their utility from fluctuations in individual stocks as opposed to the entire portfolio, have a high mean return and are more volatile and reasonably predictable over time. In addition such economies experience a low and constant risk free rate over time. Their results point to the fact that investors' mental accounting behavior can play a key role in explaining the relatively high ERP.

Barberis, Huang, and Thaler (2003) built on the concept of "narrow framing" that was first used by Kahneman and Lovallo in 1993, to develop a utility theory capable of explaining to a certain extent the ERP puzzle. The authors departed from the traditional utility theories who define the utility of the individual outcome in relation to the total wealth or consumption of the economic agent to a more narrowed approach that define utility directly from the individual outcome and independently from its contribution to total consumption or total wealth.

In relation to the ERP, the authors argue that in general even though stock markets appear to have relatively high mean return, many economic agents shy away from investing in them. This non participation stimulates from the fact that economic agents evaluate the outcome of the stock market risk independently from their other important risks such as labor income risk, proprietary income risk, and house price risk. Based on this observation, the authors argue that a first order risk aversion theory that allows for narrow framing is well suited to explain the rejection by economic agents to add even a relatively small uncorrelated stock market risk to their other risks and therefore generating a large ERP.

Barberis and Huang (2008) surveyed the financial literature for the loss aversion and narrow framing approach to the ERP puzzle solving. The authors concluded that models that integrate the loss aversion and the narrow framing concepts in framing the investor's utility function tend to generate a high equity premium, a low and stable risk-free rate and a low correlation between stock returns and consumption growth.

Happiness Maintenance Preferences Theory

Falato (2009) expended the standard asset pricing model of Mehra and Prescott (1985) to incorporate the concept of “happiness maintenance”. Falato started from the assumption that agents who feel happy are more risk averse than agents who feel neutral. As a result of this assumption, investing in equity is more risky for an economic agent with happiness maintenance preferences. Therefore there is a need for higher return on risky assets in order to induce the happy agent to invest in equity.

Explaining the Equity Risk Premium

Adherents to the “explaining approach” on the other side do not attempt to theoretically justify the ERP but rather strive to explain why investors have historically realized high premium. Among the pioneers of the explaining approach are;

Market Crash and Survivorship Models

Rietz (1988) demonstrated that by accounting for market crashes that are plausible, severe, and not too improbable, an Arrow-Debreu asset pricing model is capable of explaining a high ERP and a low risk–free returns. Rietz’s explanation is that with the assumption of credible, severe, but unlikely market crashes, risk-averse equity investors will demand a high return to compensate for the extreme losses they may incur. These plausible, severe but unlikely market crashes led to a historical high equity returns even in the absence of such events. Numerically and under the assumption of a severe market crash where output may fall to one-half of its normal expected value with a probability of occurrence ranging from 0.0008 to 0.0030, and a risk-aversion parameter between 5.30 and 7.05, Rietz's model was able to generate an ERP ranging from 5.92 to 6.38 percent with a risk free rate within the range of 0.73 to 0.89 percent.

Goetzmann and Jorion (1999) observed that out of a sample of 39 countries, the United States had the highest real return on equity at 4.32 percent per annum compared to 0.75 percent per annum for the entire sample. The authors advanced two explanations for this observation. The first is that the high equity premium observed in the United States is a compensation for a higher level of risk in comparison to the rest of the countries in the sample. Or, a measure of risk by means of volatility indicated that at 16.2 percent volatility, the United States market does not experience a particularly high risk when compared with other stock markets. This led the authors to conclude that the high equity premium observed in the United States is the exception and it does not seem to compensate for higher risk as measured by volatility. The second explanation advanced by Goetzmann and Jorion (1999) for the high equity premium observed in the United States is that of survivorship bias and a pricing of an infrequently occurring crash. The survivorship bias hypothesis suggests that the ex post observed equity returns in the United States may be higher than their ex ante expectation just because the United States stock market is a winner and is the only stock market in the sample without any break due to financial crises, wars, expropriations, or political upheaval.

Starting from the assumption that investors in the stock market tend to overreact to bad news in good times and underreact to good news in bad times, Veronesi (2004) went on to test the Peso Problem hypothesis which states: because no expected catastrophic event has ever materialized during the sampling period ex post realized returns in the United States are high even if ex ante expected returns are low. The simulation technique employed by Veronesi validates the conformity of the United States stock market returns to the Peso Problem hypothesis.

Building on Rietz (1988) paper, Barro (2006) went on to measure the frequency and the size of the international economic disasters, mainly World War I, the Great Depression, and World War II, and their impact on stock market returns. His analysis indicated a disaster probability of 1.5 to 2 percent per year coupled with a decline in per capita GDP ranging between 15 to 64 percent. He then constructed a model of the equity premium that extends Lucas (1978), Mehra and Prescott (1985), and Rietz (1988) to incorporate rare but probable economic disasters in the twentieth century. The model generated an average real rate of return of 0.071 for the G7 countries (Canada, France, Germany, Italy, Japan, U.K., and U.S.), an average real bill return of 0.001, and consequently an equity premium around 7 percent.

The effect of macroeconomic variables

Fama and French (2002) suggested that the decline in the discount rates during the period 1951 to 2000 has produced a large unexpected capital gain and concluded that the average stock return for the period in question is a lot higher than expected. In particular, they estimated the expected real equity premium to be 3.54 percent per year using the dividend growth model and 5.57

percent, 60 percent higher, using the average stock return model for the period 1872 to 2000. They attributed the difference between the two measures to the high average stock return during the period 1951 to 2000. In fact they calculated the equity premium for the period 1872 to 1950 to be 4.17 percent and 4.40 percent, only 5 percent higher, respectively for the dividend growth model and the average stock return model. In contrast and for the period 1951 to 2000, the dividend growth model generated an equity premium of 2.55 percent and the average stock return model generated an equity premium of 7.43 percent. As a result of these findings, Fama and French (2002) concluded that the observed high ERP during the period 1951 to 2000 is a lot higher than expected and that is mainly due to the decline in discount rate during that same period which produced a large unexpected capital gain.

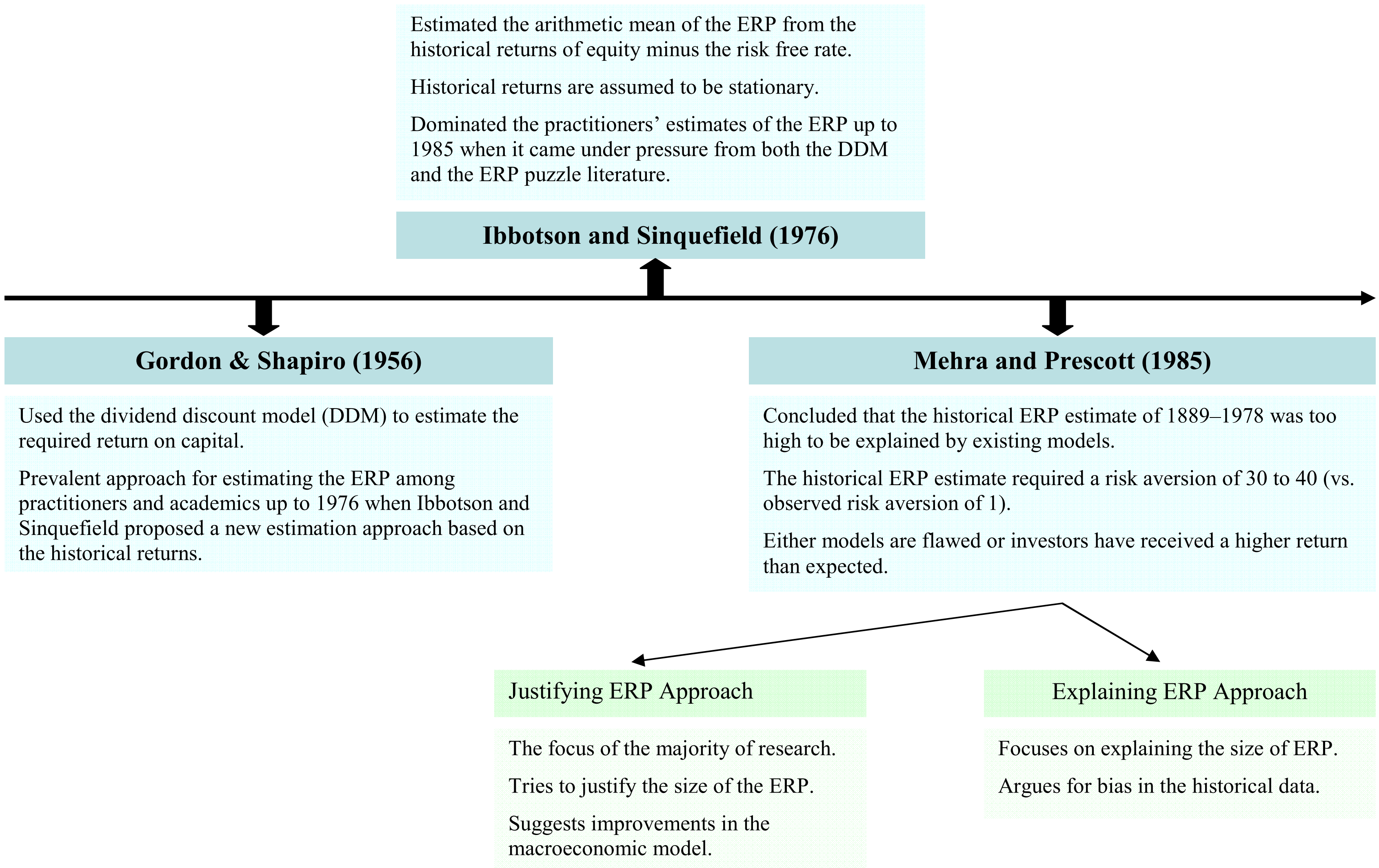
Lettau, Ludvigson, and Wachter (2007) suggested that the ERP is strongly correlated with the low-frequency movements in macroeconomic volatility both in the United States and internationally. Specifically, periods of low macroeconomic risk in the form of low consumption volatility generate low equity premium and periods of high macroeconomic risk engender large equity premium. In particular, the authors suggested that if the economic agent perceives the decline in the macroeconomic risk to be sufficiently long-lasting, he or she will demand a much lower risk premium because he or she expects an increase in stock prices which explains the boom in stock markets in Unites States during the 1990s.

Kyriacou et al. (2006) shed more light on the relationship between the macroeconomic fundamentals and the ERP by arguing that over the past 132 years the size of the equity premium has been positively related to the rate of inflation. In particular, the high inflationary period of post 1914 resulted in substantially higher equity premium compared to the relatively low inflation period of pre 1914. The authors' simulation model indicated that the average equity premium post 1914 would have been only 4.61 percent and not 7.34 percent had the inflation rate been zero. The authors theoretical explanation for the observed high equity premium during inflationary periods is based on the fact the bonds tend to be a significantly poorer hedge against inflation than stocks.

CONCLUSION

In conclusion, there is no one single theory that is better at explaining the ERP puzzle. Different theories should be looked at as different pieces of the puzzle that collectively give us a better answer as to why the observed ERP differ from the theoretical ERP. Damodaran (2015) stated that "the risk premium is a fundamental and critical component in portfolio management, corporate finance and valuation. Given its importance, it is surprising that more attention has not been paid in practical terms to estimation issues." In the next chapter, I take the challenge of Damodaran and try to contribute to the literature of the estimation of the ERP in practical terms. My research falls under the category of the explaining approach and focuses primarily on the impact of macroeconomic variables, and principally the unexpected inflation, on the ERP.

Figure 1. Timeline of the Literature for the ERP



CHAPTER II

ESTIMATION OF THE EQUITY RISK PREMIUM

DISCUSSION

Conceptually, the equity risk premium (ERP) is the excess return required by investors for holding risky assets. Reducing risky assets to equity, the ERP is then the excess return of a risky stock market portfolio over the risk free rate. Since future market returns are not discernible at the current time, it is the expected ERP that the investor is concerned with. Therefore, mathematically, the equity risk premium is simply the difference between the expected return on equity and the risk free rate and it can be stated as

$$ERP_t = E(R_{t+n}) - R_{t+n}^f \qquad (1)$$

where ERP_t is the expected ERP at time t, $E(R_{t+n})$ is the expect return on equity over the period [t , t+n], and R_{t+n}^f is the risk free rate over the same period [t , t+n]. As intuitive as this equation seems, in practice it does present a number of challenges. First, investors have to decide what constitutes a return on equity and how to estimate future expected returns. Even after reducing risky assets to equity, investors still have to decide which stock market index best proxy for the market return on equity. Some are price weighted indices, others are value or equal weighted indices. In addition, different indices cover different ranges of stocks. Even after having decided on the type of index, investors still have to choose among an array of models to estimate future expected returns. The capital asset pricing model, the arbitrage pricing model, the multi-factor models, the proxy models, they all represent different approaches for estimating the return on equity.

Second, investors have to decide which class of assets is free of default and liquidity risk and by consequence is a best proxy for the risk free rate. Investors have to choose between short and long term maturity, nominal versus real and inflation protected securities. Last and not least, investors have to settle on period over which to estimate the ERP.

In this chapter I test and compare the following four models: historical mean of realized returns model, dividend discount model, the free cash flow model, and the sharp ratio model.

MODELS AND VARIABLES CONSTRUCTION

Historical Mean of Realized Returns Model

The Historical Mean Realized Return Model (HMRRM) is the most widely applied model in academia for estimating the ERP, and according to Welch and Goyal (2008) it is the best predictor for out of sample estimates. It consists of finding the best linear historical estimates under the assumption that excess returns are stationary overtime. Derrig and Orr (2005) concluded that Ibbotson data for the period 1926 to 2002 is stationary. The obvious limitation of the model is that it presumes that future excess returns behave like past excess returns.

The estimation procedure for ERP under the HMRRM is given by the following equation

$$ERP_t = \frac{1 + R_t}{1 + R_t^f} - 1 \tag{2}$$

where ERP_t is the equity risk premium at time t, R_t is the return on equity at time t, and R_t^f is the risk free rate at time t. ERP_t is often approximated by the difference between return on equity and the risk free rate.

$$ERP_t = R_t - R_t^f \tag{3}$$

The S&P 500 Composite Price Index (SP) is my proxy variable for the market return. The return on equity (RE) is the value of the S&P 500 at time t divided by its value at time t-1 plus 1. The risk free rate will be approximated using a number of variables with different maturity periods. I consider the 3-Month Treasury Bill yield (TB), the 10-Year Treasury Constant Maturity Rate (TB10), the 30-Year Treasury Constant Maturity Rate (TB30), the 10-Year Treasury Inflation-Indexed Security constant maturity rate (TBI10), and 30-Year Treasury Inflation-Indexed Security constant maturity rate (TBI30). I calculate both the arithmetic and the geometric ERP. All data is monthly. Table 1 gives a brief summary of the variables and their sources. Table 2 provides the summary statistics for the variables.

[Insert Table 1 here]

[Insert Table 2 here]

Dividend Discount Model

The Dividend Discount Models (DDM) use current market value to determine the ERP. As stated by Gordon (1962), the value of a stock at time t is nothing other than the sum of expected future cash flows for holding the stock, discounted at time t to account for the time value of the money and the level of risk associated with the investment. Expected cash flows can arise from dividend pay-outs, spin-offs, mergers, buy-backs, etc. In practice, most academics focus on dividend pay-outs first because they constitute the bulk of cash flows, second because they are readily available through financial disclosure, and third because they tend to grow at a relatively constant rate over the long run (Duarte and Rosa 2015). As such we can express the price of the stock at any point in time in the following way

$$P_t = \sum_{t=0}^{\infty} \frac{D_{t+1}}{(1+R)^{t+1}} \tag{4}$$

where P_t is the price of the stock at time t, D_{t+1} is the expected dividend at time t+1, and R is the discount rate that accounts for the time value of the money and the level of risk associated with future expected dividends. It can be written as

$$R = R^f + ERP \tag{5}$$

where R^f is the risk free rate representing the time value of the money and ERP is the implied ERP representing the level of risk associated with future expected dividends that equates the left-hand side to the right-hand side of equation (5). As such the implied ERP can be derived by subtracting the R^f from the discount rate R that is calculated as the internal rate of return (IRR) that equates the discounted value of expected future dividends to the price of the stock at time t.

The main advantage of the DDM is that it generates an ERP that is forward looking implied from an equity market value that incorporates changes in the current market conditions. The disadvantage is that it relies heavily on earnings and dividends estimates that are based on accounting data, not updated frequently, and may not necessarily reflect the market cycles. Easton (2007) gives a summary of possible limitations of such models.

For estimation procedure, the DDM of Damodaran (2015) is adopted. Damodaran developed a two stages DDM where the dividend growth rate for the first five years is derived from the analysts' consensus estimates of growth in earnings for companies in the S&P 500 index. The dividend growth rate in the sixth year and thereafter is assumed to be equal to the ten-year nominal Treasury bond rate. The model is represented by the following equation

$$P_t = \frac{D_{t+1}}{(1+R)} + \frac{D_{t+2}}{(1+R)^2} + \frac{D_{t+3}}{(1+R)^3} + \frac{D_{t+4}}{(1+R)^4} + \frac{D_{t+5}}{(1+R)^5} + \frac{D_{t+6}}{(R-G)(1+R)^5} \quad (6)$$

where P_t is the closing price of S&P 500 index at time t. D_{t+i} is the expected dividend at time t+i. R is the expected return on the S&P 500 portfolio. G is the long term expected growth rate for dividend, and it is assumed to be equal to the ten-year nominal Treasury bond rate starting from year six. Note that for the first five years D_{t+i} grow at a rate equal to the analysts' consensus estimates of growth in earnings for companies in the S&P 500 index.

Using the IRR procedure and solving for R in equation (6) will yield an implied expected rate of return. Subtracting the ten-year nominal Treasury bond rate from R will yield the implied ERP.

Free Cash Flow Model

The Free Cash Flow Model (FCFM) adopted in this work is also developed by Damodaran (2015), and it is identical to his DDM except that expected free cash flow to equity (EFCFE) is used as proxy for potential dividend. The expected free cash flows for investors are calculated by adding stock buybacks to aggregate dividends paid. The model is represented by the following equation

$$P_t = \frac{EFCFE_{t+1}}{(1+R)} + \frac{EFCFE_{t+2}}{(1+R)^2} + \frac{EFCFE_{t+3}}{(1+R)^3} + \frac{EFCFE_{t+4}}{(1+R)^4} + \frac{EFCFE_{t+5}}{(1+R)^5} + \frac{EFCFE_{t+6}}{(R-G)(1+R)^5} \qquad (7)$$

where P_t is the closing price of S&P 500 index at time t. $EFCFE_{t+i}$ is the expected free cash flow to equity at time t+i for the first five years. R is the expected return on the S&P 500 portfolio. G is the long term expected growth rate for potential dividend after year five, and it is assumed to be equal to the ten-year nominal Treasury bond rate. The implied ERP is found by solving for R and subtracting out the risk free rate. Table 3 gives a brief summary of the variables and their sources for both the DDM and the FCFM. Table 4 provides the summary statistics for the variables.

[Insert Table 3 here]

[Insert Table 4 here]

Sharpe Ratio Model

The Sharpe Ratio Model (SRM) is inherited from the portfolio management theory and was first defined by William F. Sharpe in his 1966 paper. The ratio measures the excess return of a risky portfolio over the risk free rate per unit of risk. It is expressed as

$$S_p = \frac{R_P - R_f}{\sigma_p} \tag{8}$$

where S_p is the Sharpe ratio of a risky portfolio. R_P is the expected return on a risky portfolio. R_f is the risk free rate, and σ_p is the standard deviation of the risky portfolio. If we assume that the Sharpe ratio is relatively stable over the long run, equation (8) can be rearranged to calculate the implied ERP.

$$ERP = R_P - R_f = S_p \times \sigma_p \tag{9}$$

Equation (9) states that the implied ERP for the S&P 500 portfolio index is the product of the S&P 500 Sharpe ratio by a measure of its implied volatility. For estimation procedure, the VIX index, calculated by the Chicago Board Options Exchange (CBOE), is adopted as a measure of the implied volatility. The VIX index measures the volatility implied from options on the S&P 500 index over the next thirty calendar days. Mathematically it is an annualized standard deviation equal to the square root of the risk-neutral expectation of the S&P 500 variance.

Using annualized monthly values of the return on S&P 500 (RE), standard deviation of the S&P 500 (SD), and 3-Month Treasury Bill yield (TB), I estimate a Sharpe ratio (S_p) of 0.38 over the period 1929 to 2015. Using the 10-Year Treasury Constant Maturity Rate (TB10) instead of the TB yield, I compute a Sharpe ratio of 0.34 over the period 1953 to 2015. The Sharpe ratio estimates are consistent with the academic research estimates of 0.3 over the last fifty years. Table 5 gives a summary of the estimate of the Sharpe Ratio value using different risk free rates.

[Insert Table 5 here]

Assuming a constant S_p going forward, the implied ERP is equal to

$$ERP = \mathrm{S_P} \times VIX \qquad (10)$$

Using the SRM to estimate the implied ERP is not without limitations. Equation (10) depends on two statistical measures that have their share of criticism. Bailey and López de Prado (2012) made a valid argument when they demonstrated that the interpretation of the Sharpe ratio may be misleading if the assumption of the normality of the returns is broken. Chow, Jiang, and Li (2014) established that the VIX index tends to undervalue (overvalue) volatility when returns on the S&P 500 are negatively (positively) skewed. Table 6 gives a brief summary of the variables for the SRM. Table 7 provides the summary statistics for the variables.

[Insert Table 6 here]

[Insert Table 7 here]

EMPIRICAL RESULTS

Results for the Historical Mean of Realized Returns Model

Using the HMRRM, I calculated annual historical ERP as the excess RE over TB for the period 1928 to 2015, over TB10 for the period 1953 to 2015, over TB30 for the period 1977 to 2015, over TBI10 for the period 2003 to 2015, and over TBI30 for the period 2010 to 2015 respectively. The graphs in Figure 2 depict the arithmetic and the geometric movement of the historical ERP over the respective periods.

[Insert Figure 2 here]

It can be seen from the time series plots that the shorter the period the more volatile is the ERP. In addition, the ERP tends to exhibit higher volatility at the beginning of the period but later stabilizing towards the end. This pattern may indicate the existence of a mean-reversion process in the data set over the long term. The graphs also indicate that the historical ERP estimates using the arithmetic average are higher than the corresponding geometric average. Table 8 and 9 confirm these results. The arithmetic means for each time period, independently of the proxy variable for the risk free rate, generates historical ERPs that are consistently higher than the corresponding geometric means. The difference between the arithmetic means and the geometric means varies from as high as 2.66 points (7.09% - 4.43%) for the historical ERP as the excess RE over TB for the period 1928 to 2015, to as low as 0.29 points (8.72% – 8.43%) for the historical ERP as the excess RE over TB30 for the period 2010 to 2015. The 'Ibbotson's

Answer' research paper (n.d.) points out that the geometric average should be applied when analyzing historical returns, while the arithmetic average should be adopted for forecasting.

[Insert Table 8 here]

[Insert Table 9 here]

The results from tables 8 and 9 also indicate that ERP varies considerably both across periods and with the variable of choice for the risk free rate. For the estimates calculated as the excess RE over TB, the ERP varies from as high as 12.71percent for the arithmetic mean for the period 2010 to 2015, to as low as 6.79percent for the period 1978 to 2015 and from 12.40percent for the geometric mean for the period 2010 to 2015 to as low as 4.43percent for the period 1929 to 2015. The choice of the appropriate length of time from which to estimate the ERP is not a settled argument in the literature. Ibbotson Associates, one of the most widely used estimation service for the ERP, uses data going back to 1926. Their argument is that since serial correlation for annual ERP is close to zero, "the equity risk premium in one year cannot predict returns in the next" (The 'Ibbotson's Answer' research paper, n.d.); therefore, the appropriate length of time from which to estimate the ERP is the longest period of quality reliable data available. Figure 3 graphs the annual historical ERP estimates as the excess RE over TB for the period 1928 to 2015, over TB10 for the period 1953 to 2015, over TB30 for the period 1977 to 2015, over TBI10 for the period 2003 to 2015, and over TBI30 for the period 2010 to 2015 respectively. Table 10 presents the results for the Breusch-Godfrey Serial Correlation LM Test for the monthly ERP. The results of the LM test do not reject the null hypothesis of no serial correlation. Therefore, I conclude that the monthly historical ERP estimates are not serially correlated. This conclusion holds regardless of which variable I choose to proxy for the risk free rate.

[Insert Figure 3 here]

[Insert Table 10 here]

Many other analysts use much shorter periods, such as thirty, twenty or even ten years to estimate the historical ERP. Their argument is that recent time periods offer more updated estimates of the ERP because they incorporate recent changes in the perception of the risk aversion among the average investor (Damodaran, 2015). Given the observed greater noise in the ERP estimates with shorter time periods in tables 8 and 9, I proceed to calculate the standard errors and the confidence intervals for the equity risk premium ERP in Table 11.

[Insert Table 11 here]

The results from table 11 indicate that even with the choice of the longest period of time from 1929 to 2015, the magnitude of the standard error 2.05 percent is significantly large with 95 percent confidence interval of [2.98% , 11.20%] for the arithmetic average and [0.32% , 8.54%] for the geometric average for estimates of the ERP as the excess RE over the TB. Table 11 also shows that even with 38 years of data, one cannot be confident that the equity premium is greater than zero.

In terms of the variable of choice for the risk free rate, tables 8 and 9 show that the ERP calculated as the excess RE over TB30 yield the lowest estimates for both the arithmetic and geometric means and across all periods. The results also show that the ERP estimates vary overtime depending on the length of the period, indicating that the historical ERP may be subject to shifts in interest rates and macroeconomics variables.

Results for the Dividend Discount Model and Free Cash Flow Model

As Damodaran (2015) stated; “the problem with any historical premium approach, even with substantial modifications, is that it is backward looking.” The DDM allows us to calculate an implied ERP that is forward looking. The model makes three important assumptions. First, it assumes that markets are efficient and assets are correctly priced. Second, it uses potential dividends instead of actual dividends to estimate the growth rate in dividends in the short term. Precisely, Damodaran (2015) used the five years consensus estimate of growth in earnings for the S&P 500 index to estimate the growth rate in dividends. Third, the model makes an assumption about the long term growth of dividends by assuming that over the long term dividends grow at rate equal to the long run growth rate in GDP or the yield on the ten years Treasury bond. Damodaran (2015) assumes the latter. The FCFM makes the exact three assumptions except that EFCFE is used as proxy for potential dividend. The EFCFE for investors are calculated by adding stock buybacks to aggregate dividends paid.

Damodaran (2015) two stages DDM and FCFM estimates of the implied ERP are presented in Table 12.

[Insert Table 12 here]

Figure 4 graphs the implied ERP for the two models.

[Insert Figure 4 here]

Figure 4 shows that the estimates for implied ERP using the FCFM are higher than the estimates for the DDM. Damodaran (2015) explained that "the focus on dividends may be understating the ERP, since the companies in the index have bought substantial amount of their own stocks" over the period 1985 too 2015. Therefore, the FCFM is a better approach for estimating the implied ERP since it accounts for a more comprehensive return to investors. The implied ERPs for the DDM and the FCFM vary inversely with the economic growth. They increase at times of recession and decrease at times of economic expansion. During the financial crisis of 2007, both the implied ERP calculated using the DDM and the implied ERP calculated using the FCFM increased by more than two percentage points. The implied ERP using the DDM increased from 2.06 percent at the end of 2007 to 4.05 percent at the peek of the crisis in 2008. The implied ERP using the FCFM went from a value of 4.37 percent in 2007 to 6.43 percent in 2008.

Results for the Sharpe Ratio Model

The SRM implied ERP is the product of the S&P 500 Sharpe ratio by a measure of its implied volatility. For estimation procedure, the VIX index, calculated by the Chicago Board Options Exchange (CBOE), is adopted as a measure of the implied volatility. The Sharpe ratio calculated using the TB yields a value of 0.38 over the period 1929 to 2015. The Sharpe ratios calculated using the TB10 yields a value of 0.34 over the period 1953 to 2015. Table 13 gives the estimate of the annual implied ERP using the SRM over the period 1990 to 2015.

[Insert Table 13 here]

The estimates for the implied ERP using a Sharpe ratio of 0.38 and TB as a proxy for the risk free rate yield estimates that are slightly higher by 0.79 points compared to the estimates of the implied ERP using a Sharpe ratio of 0.34 and TB10 as a proxy for the risk free rate. The average implied ERP calculated using TB rate for the period 1990 to 2015 is 7.54 percent. The average implied ERP using the TB10 rate is 6.74 percent. As shown by figure 5, both implied ERPs exhibit the same time series patterns over the period. The implied ERP tends to increase during periods of economic contractions and decrease at times of economic growth. During the eight months recession period from March 2001 to November 2001, caused by the collapse of the speculative dot-com bubble and the September 11th attacks, the implied ERP increased by almost one and half percentage point from its pre-recession value of 8.88 percent to its post-recession value of 10.34 percent. During the subprime mortgage crisis from December 2007 to June 2009, the implied ERP increased even more dramatically by more than five percentage points from a value of 6.63 percent at the end of 2007 to 12.41 percent at the end of 2009. The increase in the implied ERP is a testimony of the severe volatility of the stock market and the fear that engulfed the minds of investors during the crisis.

[Insert Figure 5 here]

Comparison of the ERP Estimates across the Four Models over the Last Two Decades

Figure 6 plots the time series for the historical geometric ERP using the TB rate, the implied ERP based on the DDM, the implied ERP based on the FCFM, and the implied ERP based on the SRM for the periods 1990 to 2015. Implied ERP estimates for the DDM and FCFM are lower than the historical ERP for most of the period. Damodaran (2015) attributes this to the survivorship bias of the United States stock market that causes the implied ERP to be generally lower than the historical ERP. For the period beginning with the subprime mortgage crisis in late 2007, the implied ERP for the FCFM are only slightly lower or even higher than the historical ERP estimates. In table 14 I test for the equality of the mean for the implied ERP using FCFM and the historical Geometric ERP using TB rate over the period 2007 to 2015. The results do not reject the null hypothesis that the Mean of the implied ERP for the FCFM is equal to the Mean of the historical geometric ERP using TB rate over the period 2007 to 2015. Damodaran (2015) explained this by the decrease in the interest rates during recession periods, the large drop in the S&P 500 index value, and the changes in investors risk aversion.

[Insert Figure 6 here]

[Insert Table 14 here]

Figure 6 also shows that the implied ERP estimates from the SRM tend to overshoot the historical ERP estimates during times of increased volatility and revert back to the historical ERP levels at times of low volatility. This is evident with the dot-com bubble and the September 11^{th} attacks during the period of March 2001 to November 2001, and more recently with the subprime mortgage crisis and the financial crisis that followed during the period of December 2007 to June 2009. During these two recession periods the VIX index increased by 10.98 percent and 87.10 percent respectively. The VIX index also increased substantially during the period of strong bull market from 1995 to 2000. Particularly, the VIX index increased more than 30percent in 1996 and 1997. The relationship between the implied ERP and the VIX index is well documented in the literature. Harvey and Graham (2012) documented a positive relationship between the implied volatility and the implied ERP. The authors explained that an increase in volatility is perceived as an increase in probabilities of losses by investors.

CONCLUSION

In this chapter I tested and contrasted the results of four different models for estimating the ERP. Results from the HMRRM, the DDM, the FCFM, and the SRM indicate the following:

- The estimates of the ERP, both historical and implied, vary considerably depending on (a) the variable of choice for the risk free rate; (b) the selection and the length of the estimation period; (c) and the estimation method.
- The DDM and the FCFM produce estimates for the implied ERP that are below the historical estimates, while the SRM produces implied ERP values that are usually higher than the historical values of the ERP.
- The post 2008 financial crisis period produces estimates for the historical ERP that are slightly higher or lower than the implied ERP estimates for the FCFM. This result suggests that the subprime mortgage crisis may have resulted in market self-correction and in investor re-evaluation of the risk aversion level.
- The implied ERP estimates for the three models are more volatile than the historical ERP. In particular, estimates of the implied ERP from the SRM tend to overshoot the historical ERP estimates during periods of high volatility and fall below the historical level during periods of low stock market volatility.
- The choice between historical ERP estimates and implied ERP estimates is a question of belief. Models for the implied ERP assume that markets are efficient and securities are

correctly priced. Therefore if one believes in market efficiency then implied ERP is the best option for predicting future returns. On the other hand, if one is skeptical about the efficiency assumption and believes in market timing then the historical ERP is a better option.

Table 1. List of Variables for the Historical Mean Realized Return Model

This table lists the variables used for estimating the equity risk premium using the historical mean realized return model: S&P 500 composite price index (SP), 3-month treasury bill yield (TB), 10-year treasury constant maturity rate (TB10), 30-year treasury constant maturity rate (TB30), 10-year treasury inflation-indexed security constant maturity rate (TBI10), and 30-year treasury inflation-indexed security constant maturity rate (TBI30).

Symbol	Variable	Source	Frequency	Period
SP	S&P 500 Composite Price Index	Yahoo Finance data base	Monthly	01/1929 - 09/2015
TB	3-Month Treasury Bill	Federal Reserve Bank of St. Louis	Monthly	01/1929 - 09/2015
TB10	10-Year Treasury Constant Maturity Rate	Federal Reserve Bank of St. Louis	Monthly	01/1954 - 09/2015
TB30	30-Year Treasury Constant Maturity Rate	Federal Reserve Bank of St. Louis	Monthly	01/1978 - 09/2015
TBI10	10-Year Treasury Inflation-Indexed Security, Constant Maturity	Federal Reserve Bank of St. Louis	Monthly	01/2003 - 09/2015
TBI30	30-Year Treasury Inflation-Indexed Security, Constant Maturity	Federal Reserve Bank of St. Louis	Monthly	01/2010 - 09/2015

Table 1. (Continued)

Symbol	Notes	Link
SP	Close prices adjusted for splits and dividends	http://finance.yahoo.com/q/hp?s=%5EGSPC+Historical+Prices
TB	Secondary market average percentage rates, not seasonally adjusted	https://research.stlouisfed.org/fred2/series/TB3MS/
TB10	Period average percentage rate, not seasonally adjusted	https://research.stlouisfed.org/fred2/series/GS10/
TB30	Period average percentage rate, not seasonally adjusted*	https://research.stlouisfed.org/fred2/series/GS30/
TBI10	Period average percentage rate, not seasonally adjusted	https://research.stlouisfed.org/fred2/series/FII10/
TBI30	Period average percentage rate, not seasonally adjusted	https://research.stlouisfed.org/fred2/series/FII30/

* The Treasury department stopped issuing the 30-year Treasury constant maturity series on February 18, 2002, and reintroduced it on February 9, 2006. During that period the Treasury department published daily linear extrapolation factors that could be added to the Long-Term Average Rate to allow interested parties to compute an estimated 30-year rate.

Table 2. Summary Statistics of Variables for the Historical Mean of Realized Returns Model

This table provides the summary statistics of the variables used for estimating the equity risk premium using the historical mean realized return model: S&P 500 index return (RE), 3-month treasury bill yield (TB), 10-year treasury constant maturity rate (TB10), 30-year treasury constant maturity rate (TB30), 10-year treasury inflation-indexed security constant maturity rate (TBI10), and 30-year treasury inflation-indexed security constant maturity rate (TBI30). All observations are monthly.

Variable	Period	Obs.	Mean	Minimum	Maximum	Std. Dev.	Skewness	Ex. Kurtosis
RE	01/1929 - 09/2015	1041	0.8376%	-26.2033%	51.1583%	4.5500%	0.6688	18.7592
TB	01/1929 - 09/2015	1041	0.2819%	0.0008%	1.2666%	0.2498%	0.9639	0.8658
TB10	01/1954 - 09/2015	741	0.4872%	0.1266%	1.1949%	0.2189%	0.8263	0.3973
TB30	01/1978 - 09/2015	453	0.5603%	0.2023%	1.1483%	0.2211%	0.6135	-0.3403
TBI10	01/2003 - 09/2015	153	0.1021%	-0.0644%	0.2377%	0.0777%	-0.5018	-0.8108
TBI30	01/2010 - 09/2015	68	0.0962%	0.0275%	0.1782%	0.0425%	0.2415	-1.0228

Table 3. List of Variables for the Dividend Discount Model and the Free Cash Flow Model of Damodaran (2015)

This table lists the variables used for estimating the implied equity risk premium using the DDM and the FCFM developed by Damodaran (2015): S&P 500 composite price index (SP), dividend yield (DY), earnings yield (EY), and the 10-year nominal treasury bond rate at the end of the year (TB10).

Symbol	Variable	Source	Frequency	Period	Link
SP	S&P 500 Composite Price Index	Damodaran (2015)	Yearly	1978 - 2014	http://pages.stern.nyu.edu/~adamodar/
DY	Dividend Yield		Yearly	1978 - 2014	
EY	Earnings Yield		Yearly	1978 - 2014	
TB10	10-Years Nominal Treasury Bond Rate		Yearly	1978 - 2014	

Table 4. Summary Statistics of Variables for the Dividend Discount Model and the Free Cash Flow Model of Damodaran (2015)

This table provides the summary statistics of the following variables used for estimating the implied equity risk premium using the DDM and the FCFM developed by Damodaran (2015): S&P 500 index return (RE), dividend yield (DY), earnings yield (EY), and the 10-year nominal treasury bond rate (TB10). The sample period is yearly from 1978 to 2014.

Variable	Obs.	Mean	Minimum	Maximum	Std. Dev.	Skewness	Ex. Kurtosis
RE	37	13.0453%	-36.5523%	37.1952%	16.3490%	-0.9454	1.1531
DY	37	2.8363%	1.1374%	5.5700%	1.3230%	0.7038	-0.6627
EY	37	6.6061%	3.0741%	13.4800%	2.5729%	1.1311	0.8444
TB10	37	6.4708%	1.7600%	13.9800%	3.1552%	0.5436	-0.4055

Table 5. Summary of the Sharpe Ratio Estimates

This table provides the summary estimate of the Sharpe Ratio value using the risk free rates 3-month Treasury bill yield (TB), and 10-year treasury constant maturity rate (TB10) over the periods 1929 to 2015 and 1953 to 2015 respectively.

Estimates of the Sharpe Ratio		
	Using TB	Using TB10
Period	1929-2015	1953-2015
Average Annual ERP	7.53%	5.91%
Annual Stand. Dev. ERP	19.62%	17.37%
Sharpe Ratio*	0.3839	0.3400

* Sharpe Ratio = Average Annual ERP / Stand. Dev. ERP

Table 6. List of Variables for the Sharpe Ratio Model

This table lists the variables used for estimating the implied equity risk premium using the SRM: S&P 500 composite price index (SP), the 3-Month Treasury Bill yield (TB), the 10-Year Treasury Constant Maturity Rate (TB10), and the VIX index.

Name	Variable	Source	Frequency	Period
SP	S&P 500 Composite Price Index	Yahoo Finance data base	Monthly	01/1990 - 09/2015
TB	3-Month Treasury Bill	Federal Reserve Bank of St. Louis	Monthly	01/1990 - 09/2015
TB10	10-Year Treasury Constant Maturity Rate	Federal Reserve Bank of St. Louis	Monthly	01/1990 - 09/2015
VIX	VIX Index	Yahoo Finance data base	Daily	01/2/1990 - 09/30/2015

Name	Notes	Link
SP	Close prices adjusted for splits and dividends	http://finance.yahoo.com/q/hp?s=%5EGSPC+Historical+Prices
TB	Secondary market average percentage rates	https://research.stlouisfed.org/fred2/series/TB3MS/
TB10	Period average percentage rate	https://research.stlouisfed.org/fred2/series/GS10/
VIX	Average daily value for each month	http://finance.yahoo.com/q/hp?s=%5EVIX&a=00&b=2&c=1990&d=10&e=19&f=2015&g=m

Table 7. Summary Statistics of Variables for the Sharpe Ratio Model

This table provides the summary statistics of the following variables used for estimating the implied equity risk premium using the SRP: the return on S&P 500 index (RE), the 3-Month Treasury Bill yield (TB), the 10-Year Treasury Constant Maturity Rate (TB10), and the VIX index for the period 1990:M1 to 2015:M9.

Variable	Obs.	Mean	Minimum	Maximum	Std. Dev.	Skewness	Ex. Kurtosis
RE	309	0.7958%	-20.2040%	12.2924%	3.5569%	-0.9702	4.7429
TB	309	0.2403%	0.0011%	0.6355%	0.1851%	0.0445	-1.3054
TB10	309	0.3962%	0.1266%	0.7123%	0.1460%	0.0990	-0.7875
VIX	309	19.8617	10.8176	62.6395	7.6722	1.9669	6.4109

Table 8. Geometric Mean Estimates of the ERP for the HMRRM

This table presents the annualized geometric mean estimates of the equity risk premium (ERP) using the historical mean realized return model (HMRRM). The risk free rates used for the estimates are 3-month treasury bill yield (TB), 10-year treasury constant maturity rate (TB10), 30-year treasury constant maturity rate (TB30), 10-year treasury inflation-indexed security constant maturity rate (TBI10), and 30-year treasury inflation-indexed security constant maturity rate (TBI30). The return on equity (RE) is the S&P 500 index return. All variables are monthly and the sample period varies with the variable of choice for the risk free rate.

	Annualized Geometric Mean Historical ERP				
Period	RE-TB	RE-TB10	RE-TB30	RE-TBI10	RE-TBI30
1929-2015	4.43%				
1953-2015	8.65%	7.34%			
1978-2015	6.07%	4.61%	4.50%		
2003-2015	7.97%	5.78%	5.08%	8.07%	
2010-2015	12.40%	9.54%	8.43%	11.87%	11.03%

Table 9. Arithmetic Mean Estimates of the ERP for the HMRRM

This table presents the annual Arithmetic mean estimates of the equity risk premium (ERP) using the historical mean realized return model (HMRRM). The risk free rates used for the estimates are 3-month treasury bill yield (TB), 10-year treasury constant maturity rate (TB10), 30-year treasury constant maturity rate (TB30), 10-year treasury inflation-indexed security constant maturity rate (TBI10), and 30-year treasury inflation-indexed security constant maturity rate (TBI30). The return on equity (RE) is the S&P 500 index return. All variables are monthly and the sample period varies with the variable of choice for the risk free rate.

	Annualized Arithmetic Mean Historical ERP				
Period	RE-TB	RE-TB10	RE-TB30	RE-TBI10	RE-TBI30
1929-2015	7.09%				
1953-2015	10.20%	8.84%			
1978-2015	6.79%	5.32%	5.22%		
2003-2015	9.39%	7.16%	6.44%	9.47%	
2010-2015	12.71%	9.83%	8.72%	12.17%	11.33%

Table 10. Breusch-Godfrey Serial Correlation LM Test for the annual ERP

This table presents the results for the Breusch-Godfrey Serial Correlation LM Test for the monthly ERP. The null hypothesis; there is no serial correlation. The alternative hypothesis; there is serial correlation. Decision; reject the null hypothesis if the probability of Chi-Square is less than 5%.

The results of the LM test do not reject the null hypothesis of no serial correlation for all ERPs. The monthly historical ERP estimates are not serially correlated.

Breusch-Godfrey Serial Correlation LM Test for Monthly ERP = RE-TB

F-statistic	10.09366	Prob. F(1,1050)	0.0015
Obs*R-squared	1.031929	Prob. Chi-Square(1)	0.3097
Durbin-Watson stat	2.002125		

Breusch-Godfrey Serial Correlation LM Test for Monthly ERP = RE-TB10

F-statistic	1.753516	Prob. F(2,746)	0.1739
Obs*R-squared	0.000000	Prob. Chi-Square(2)	1.0000
Durbin-Watson stat	2.000461		

Breusch-Godfrey Serial Correlation LM Test for Monthly ERP = RE-TB30

F-statistic	1.252137	Prob. F(2,460)	0.2869
Obs*R-squared	0.000000	Prob. Chi-Square(2)	1.0000
Durbin-Watson stat	2.000522		

Breusch-Godfrey Serial Correlation LM Test for Monthly ERP = RE-TBI10

F-statistic	2.266588	Prob. F(2,149)	0.1072
Obs*R-squared	2.147223	Prob. Chi-Square(2)	0.3418
Durbin-Watson stat	2.012565		

Breusch-Godfrey Serial Correlation LM Test for Monthly ERP = RE-TBI30

F-statistic	2.118944	Prob. F(2,64)	0.1285
Obs*R-squared	0.000000	Prob. Chi-Square(2)	1.0000
Durbin-Watson stat	1.989860		

Table 11. Standard Error of ERP for the HMRRM

This table presents the annualized standard error and confidence interval for the equity risk premium (ERP) using the historical mean realized return model (HMRRM). The risk free rates used for the estimates are 3-month treasury bill yield (TB), 10-year treasury constant maturity rate (TB10), 30-year treasury constant maturity rate (TB30), 10-year treasury inflation-indexed security constant maturity rate (TBI10), and 30-year treasury inflation-indexed security constant maturity rate (TBI30). The return on equity (RE) is the S&P 500 index return.

Standard Error of ERP for the HMRRM								
ERP	Period	Obs.	Std. Dev.	Std. Error	Arith. Average	95% Conf. Interval	Geom. Average	95% Conf. Interval
RE-TB	1929-2015	87	19.15%	2.05%	7.09%	[2.98% , 11.20%]	4.43%	[0.32% , 8.54%]
RE-TB10	1953-2015	63	16.62%	2.09%	8.84%	[4.65% , 13.03%]	7.34%	[3.15% , 11.53%]
RE-TB30	1978-2015	38	14.95%	2.43%	5.22%	[0.37% , 10.07%]	4.50%	[-0.35% , 9.35%]
RE-TBI10	2003-2015	13	17.62%	4.89%	9.47%	[-0.30% , 19.24%]	8.07%	[-1.70% , 17.84%]
RE-TBI30	2010-2015	6	11.75%	4.80%	11.33%	[1.74% , 20.92%]	11.03%	[1.44% , 20.62%]

*The standard error is $\frac{Std.Dev.}{\sqrt{Obs.}}$

**The 95% confidence interval is $\left[ERP - (2 \times Std.Error), ERP + (2 \times Std.Error)\right]$

Table 12. ERP based on Damodaran (2015) Two Stages DDM and FCFM Estimates of the Implied ERP

This table presents the annual implied ERP based on Damodaran (2015) two stages dividends discount model (DDM) and free cash flows model (FCFM) for the periods 1961 to 2015 and 1985 to 2015 respectively.

Implied ERP					
Year	DDM	FCFE	Year	DDM	FCFE
1961	2.92%	-	1989	3.85%	3.51%
1962	3.56%	-	1990	3.92%	3.89%
1963	3.38%	-	1991	3.27%	3.48%
1964	3.31%	-	1992	2.83%	3.55%
1965	3.32%	-	1993	2.74%	3.17%
1966	3.68%	-	1994	3.06%	3.55%
1967	3.20%	-	1995	2.44%	3.29%
1968	3.00%	-	1996	2.11%	3.20%
1969	3.74%	-	1997	1.67%	2.73%
1970	3.41%	-	1998	1.38%	2.26%
1971	3.09%	-	1999	1.20%	2.05%
1972	2.72%	-	2000	1.65%	2.87%
1973	4.30%	-	2001	1.73%	3.62%
1974	5.59%	-	2002	2.29%	4.10%
1975	4.13%	-	2003	2.12%	3.69%
1976	4.55%	-	2004	2.02%	3.65%
1977	5.92%	-	2005	2.20%	4.08%
1978	5.72%	-	2006	1.97%	4.16%
1979	6.45%	-	2007	2.06%	4.37%
1980	5.03%	-	2008	4.05%	6.43%
1981	5.73%	-	2009	2.60%	4.36%
1982	4.90%	-	2010	2.24%	5.20%
1983	4.31%	-	2011	2.71%	6.01%
1984	5.11%	-	2012	2.47%	5.78%
1985	4.03%	3.84%	2013	2.03%	4.96%
1986	3.36%	3.58%	2014	2.24%	5.78%
1987	4.18%	3.99%	2015	2.46%	6.12%
1988	4.12%	3.77%	Avg.	3.31%	4.03%

Table 13. Estimate of the Annual Implied ERP using the Sharpe Ratio Model

This table provides the estimate of the annual implied ERP over the period 1990 to 2015 using Sharpe ratios values of 0.38 (calculated using TB rate) and 0.34 (calculated using TB10). The implied ERP is the product of the VIX index by the value of the Sharpe ratio.

Implied ERP for the Sharpe Ratio Model			
		Using TB and Sharpe Ratio of 0.38	Using TB10 and Sharpe Ratio of 0.34
Year	VIX Index	Annual ERP	Annual ERP
1990	23.0455	8.76%	7.84%
1991	18.4002	6.99%	6.26%
1992	15.4581	5.87%	5.26%
1993	12.6986	4.83%	4.32%
1994	13.9457	5.30%	4.74%
1995	12.3717	4.70%	4.21%
1996	16.4452	6.25%	5.59%
1997	22.4310	8.52%	7.63%
1998	25.5519	9.71%	8.69%
1999	24.4491	9.29%	8.31%
2000	23.3646	8.88%	7.94%
2001	25.9301	9.85%	8.82%
2002	27.2034	10.34%	9.25%
2003	22.0908	8.39%	7.51%
2004	15.4855	5.88%	5.27%
2005	12.7952	4.86%	4.35%
2006	12.7810	4.86%	4.35%
2007	17.4515	6.63%	5.93%
2008	32.6525	12.41%	11.10%
2009	31.6612	12.03%	10.77%
2010	22.5909	8.58%	7.68%
2011	24.0316	9.13%	8.17%
2012	17.7959	6.76%	6.05%
2013	14.2296	5.41%	4.84%
2014	14.1463	5.38%	4.81%
2015	16.5741	6.30%	5.64%
Avg.	19.8300	7.54%	6.74%

Table 14. Test for the Equality of the Mean for the Implied ERP using FCFM and the Historical Geometric ERP using TB Rate

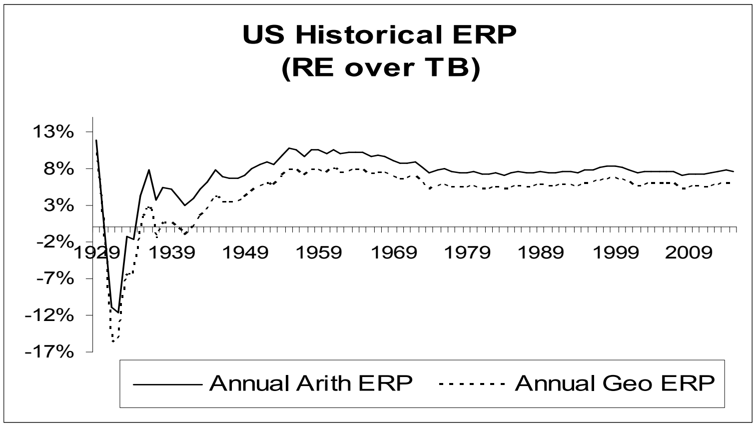
This table provides Test for the equality of the mean for the implied ERP using FCFM and the historical Geometric ERP using TB rate over the period 2007 to 2015.

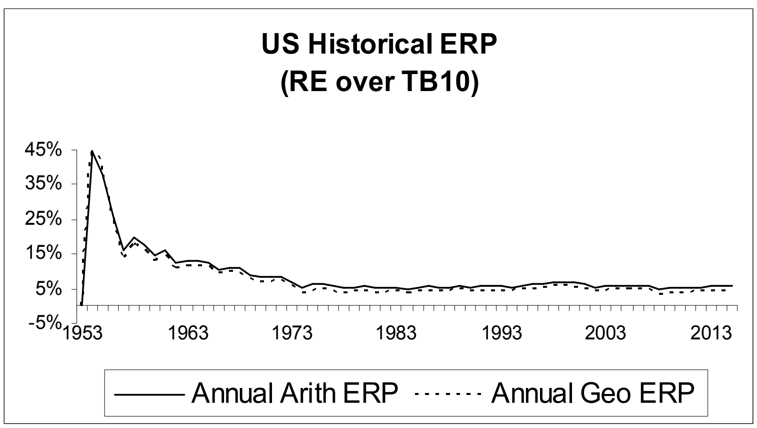
Test for the Equality of the Mean for the implied ERP using FCFM and the historical Geo ERP using TB		
Date: 04/04/16 Time: 03:15		
Hypothesis Testing		
H0: Mean of implied ERP FCFM - Mean historical Geo ERP TB = 0		
H1: Mean of implied ERP FCFM - Mean historical Geo ERP TB is different than 0		
Result: Reject H0 if probability <0.05		
Sample (adjusted): 2007 2015		
Included observations: 9 after adjustments		
Sample Mean = 0.001654		
Sample Std. Dev. = 0.008715		
Method	Value	Probability
t-statistic	0.569423	0.5847*

* I do not reject the null hypothesis that the Mean of the implied ERP for the FCFM is equal to the Mean of the historical geometric ERP using TB rate over the period 2007 to 2015.

Figure 2. Mean ERP Based on the Historical Mean of Realized Returns Model

This figure plots the time series for the arithmetic and geometric annual ERP calculated as the excess RE over TB for the period 1928 to 2015, over TB10 for the period 1953 to 2015, over TB30 for the period 1977 to 2015, over TBI10 for the period 2003 to 2015, and over TBI30 for the period 2010 to 2015 respectively.





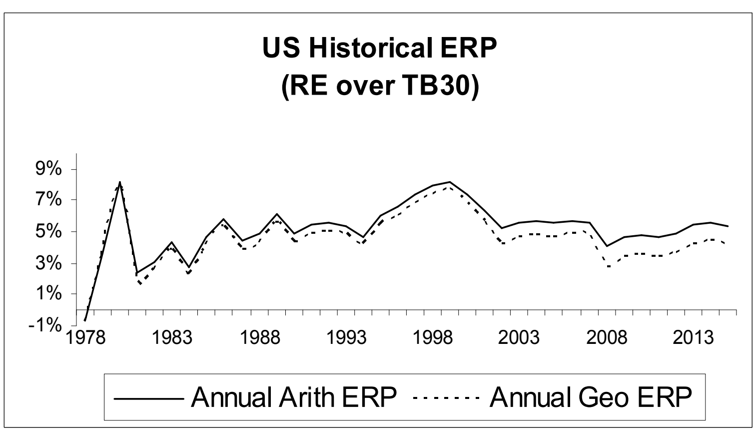
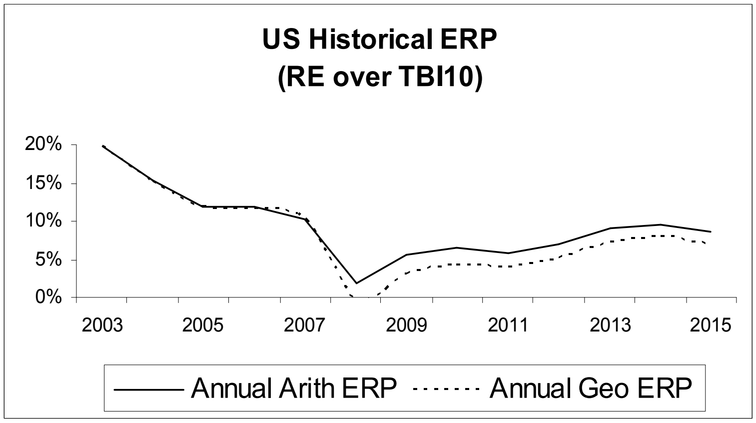


Figure 2. Continued



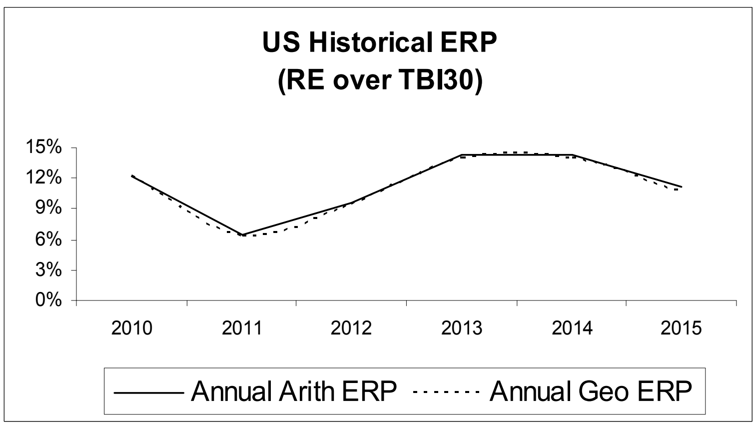
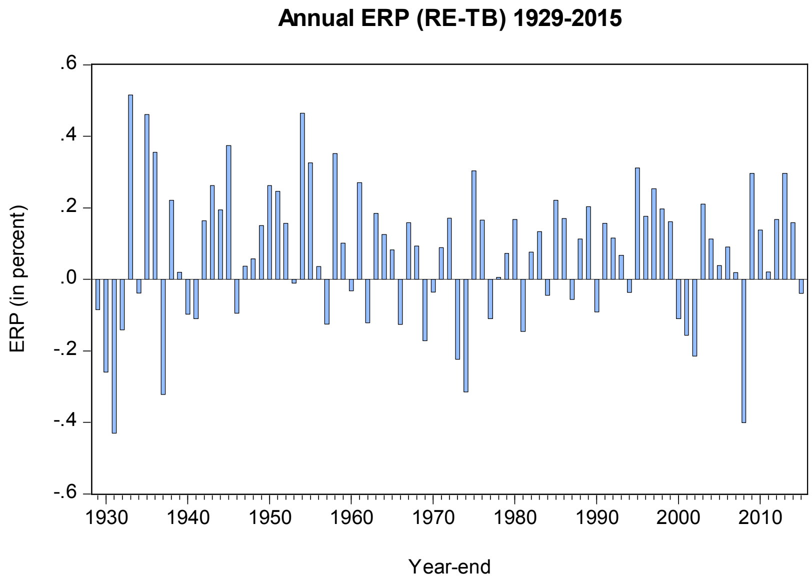


Figure 3. Annual ERP Based on the Historical Mean of Realized Returns Model

This figure plots the time series for annual ERP calculated as the excess RE over TB for the period 1928 to 2015, over TB10 for the period 1953 to 2015, over TB30 for the period 1978 to 2015, over TBI10 for the period 2003 to 2015, and over TBI30 for the period 2010 to 2015 respectively.



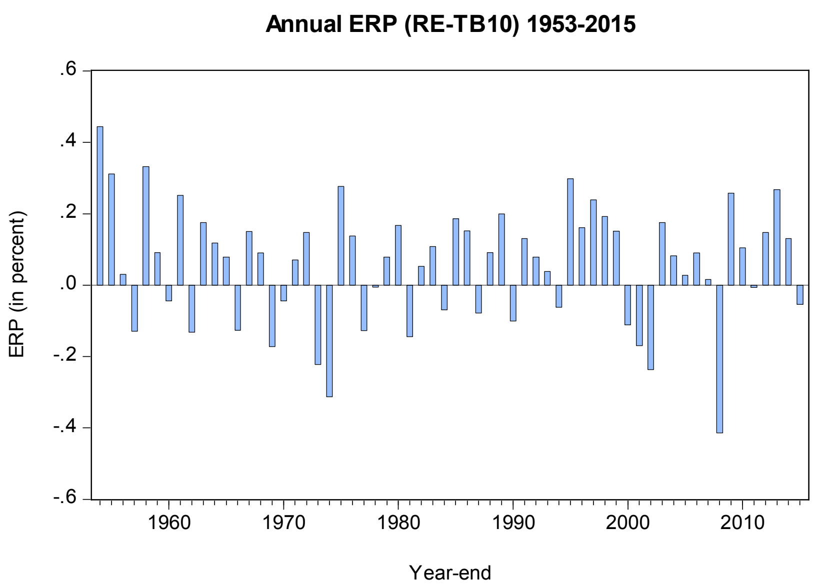
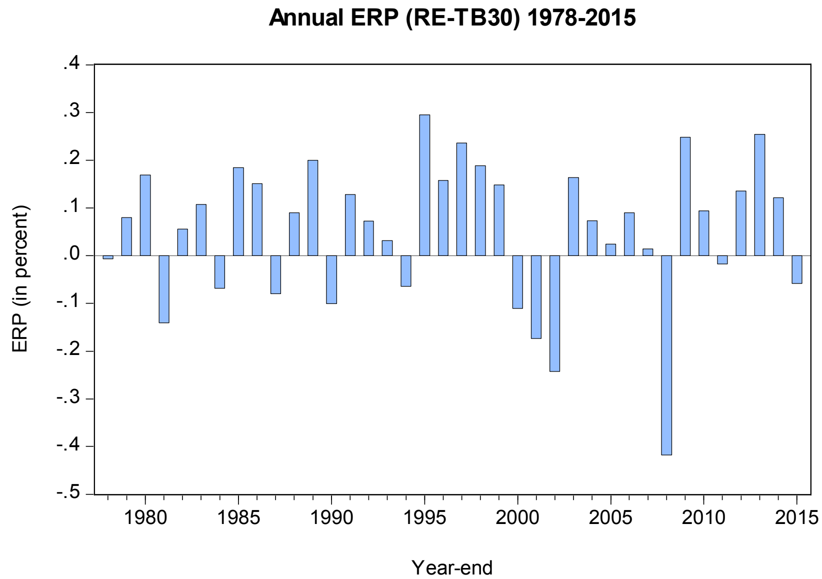
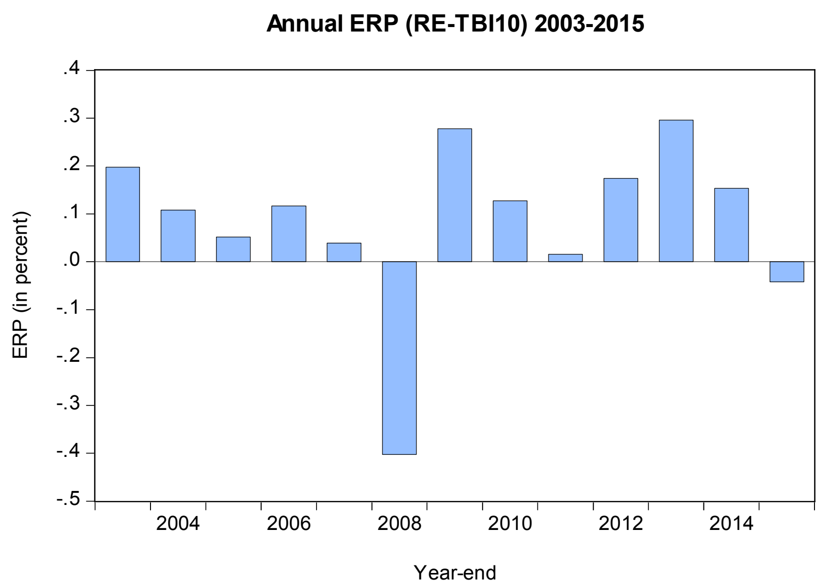


Figure 3. Continued





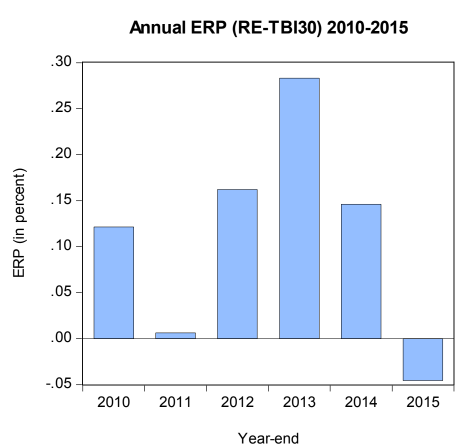


Figure 4. Annual Implied ERP Estimates Based on Damodaran (2015) Two Stages DDM and FCFM

This figure plots the time series for annual implied ERP based on Damodaran (2015) two stages DDM and FCFM for the periods 1961 to 2015 and 1985 to 2015 respectively.

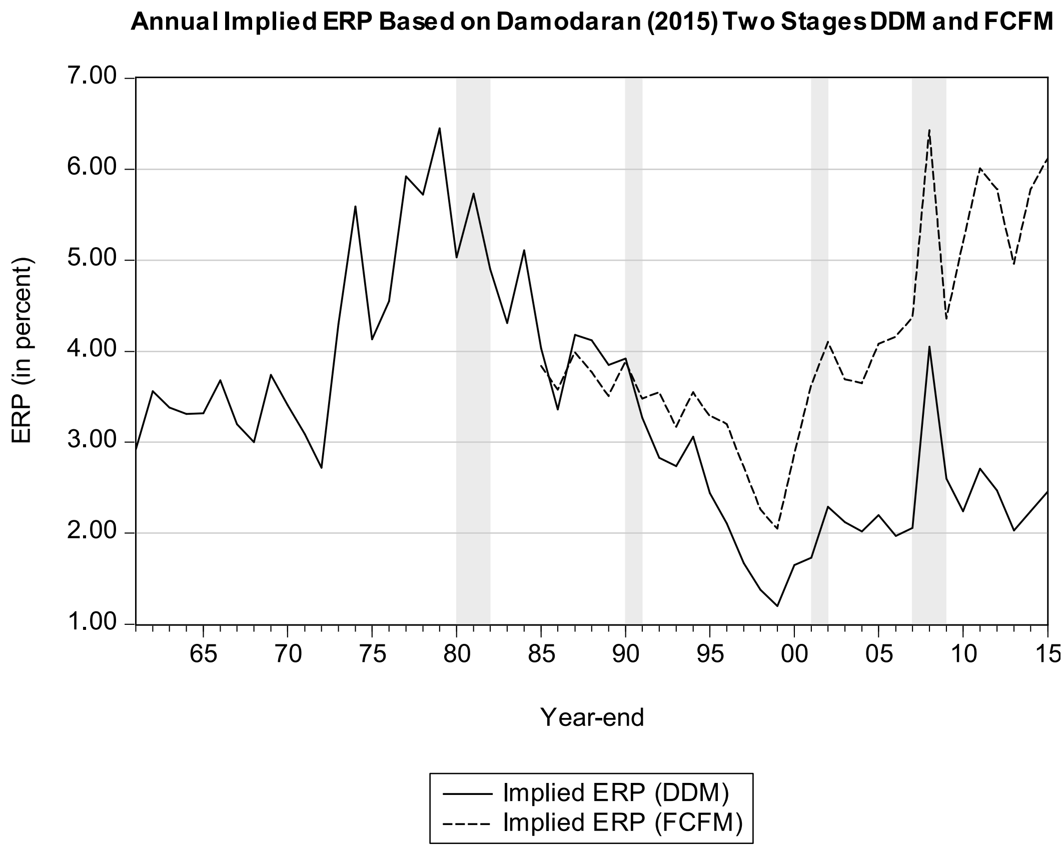


Figure 5. Annual Implied ERP Estimates for the Sharpe Ratio Model

This figure plots the time series for annual implied ERP based on the Sharpe Ratio Model for the periods 1990 to 2015.

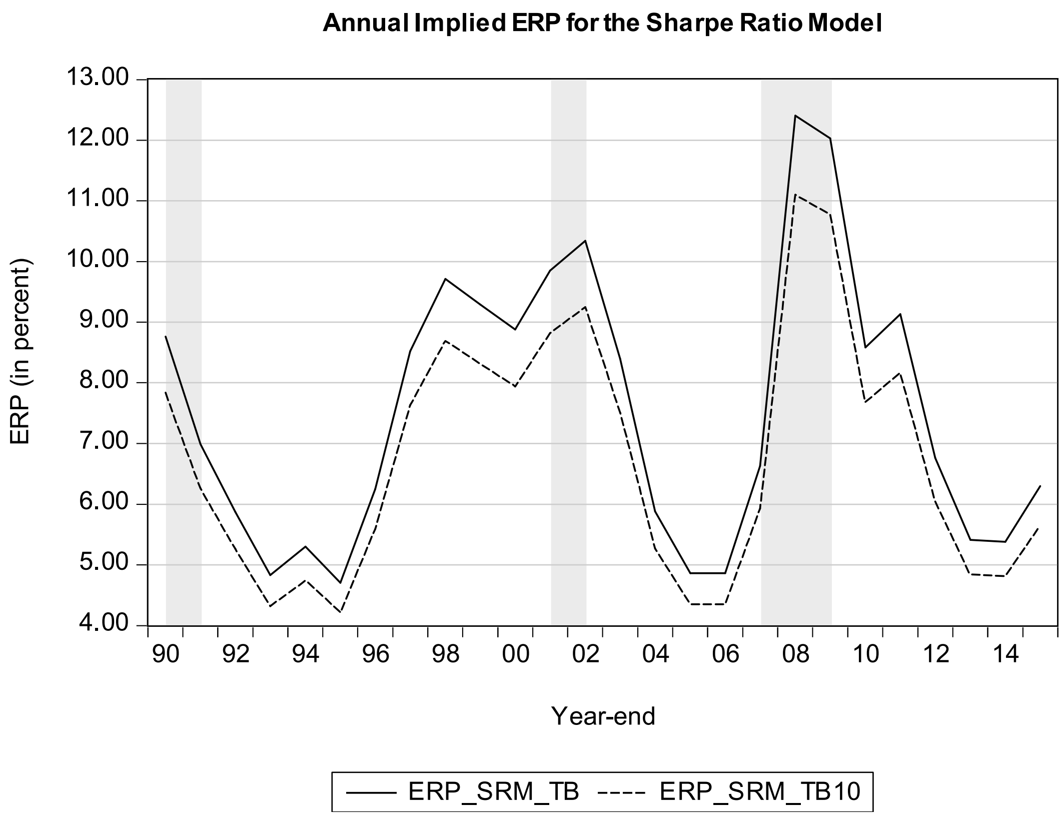
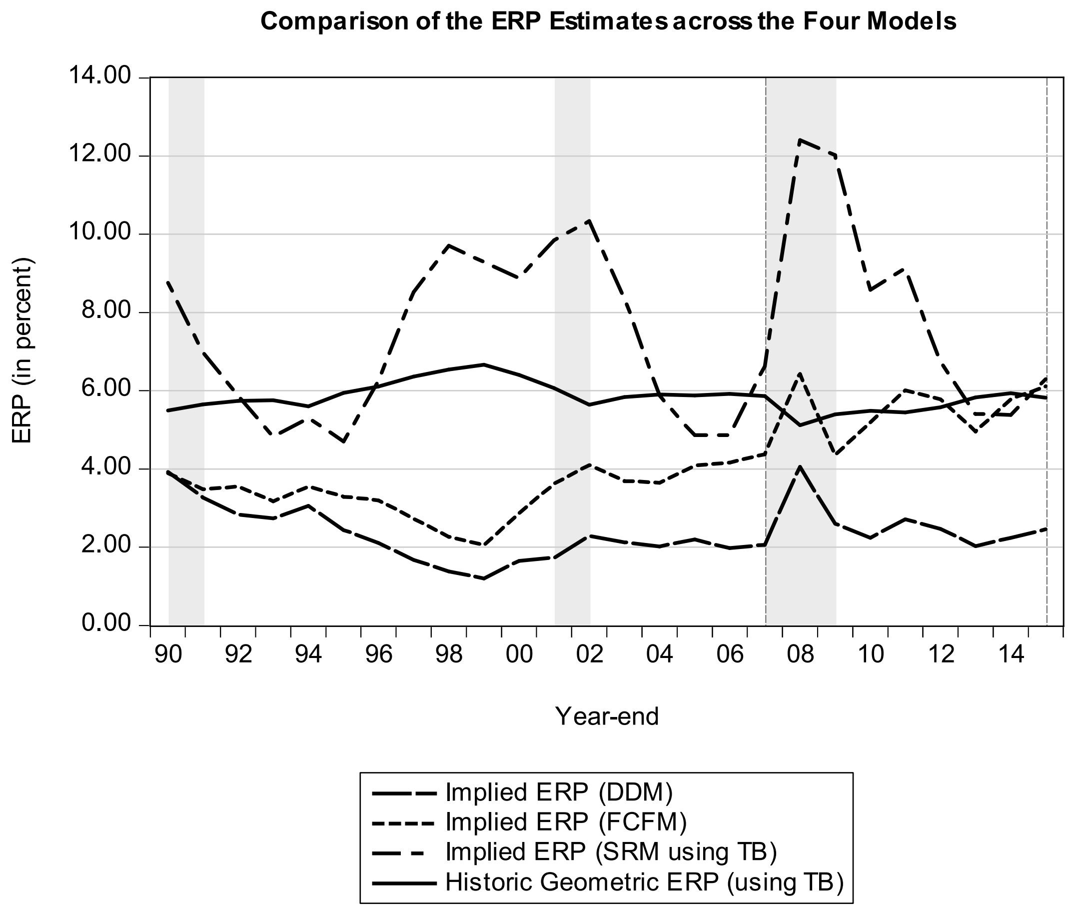


Figure 6. Comparison of the ERP Estimates across the Four Models

This figure plots the time series for the historical geometric ERP using the TB rate, the implied ERP based on the DDM, the implied ERP based on the FCFM, and the implied ERP based on the SRM for the periods 1990 to 2015.



CHAPTER III

MACROECONOMIC VARIABLES AND THE EQUITY RISK PREMIUM

DISCUSSION AND RELATED LITERATURE

Historically, the magnitude of the equity risk premium has undergone significant changes. Campbell (2007) summarized this fact by stating that:

> "The equity premium is not a constant number that can be estimated ever more precisely, but an unknown state variable whose value must be inferred at each point in time on the basis of observable data."

It is apparent from the data that the value of equity risk premium has undergone a significant increase in the 20th century compared to the 19th century. What is not clear though is when the shift took place exactly. Fama and French (2002) suggested that the year 1950 represents the break point between periods of relatively low and high equity risk premium. They computed an equity risk premium of 4.4 percent for the period 1872 – 1950 and 7.43 percent for the period 1951 – 2000. The authors argued that a reduction in the dividend-price ratio associated with a significant capital gain may be behind the significant increase in the magnitude of the equity risk premium in the U.S. since 1950. Others, such as Kyriacou et al. (2006), argued that the historical upward shift in the magnitude of the equity risk premium happened around World War One (more precisely in the year 1914) with inflation (specifically unanticipated inflation) as a triggering mechanism.

Unexpected Inflation and the Equity Risk Premium

Variation in the Equity Premium with Respect to Macroeconomic Variables

The substantial variation of the equity risk premium over the past two centuries is an indication that it may be subject to underlying macroeconomic forces. Barro (2006) argued that during wartime the perceived increase in the probability of future economic disaster led to a decrease in the real interest rates and an increase in actual and expected level of inflation rates. He observed that the expected U.S. real interest rates fell during the Civil War, World War I, World War II, and more recently during 2001 – 2005 period of September 11 attacks and the conflict in Afghanistan and Iraq where the ten-year real rate fell from 3.8 percent to 1.6 percent. Moreover and according to Barro, bonds tend to outperform stocks during periods of economic disaster which leads to an increase in the magnitude of the equity risk premium.

Lettau et al. (2007) found a strong correlation between low frequency movements in macroeconomic volatility and low frequency movements in the stock market. In particular, they noticed that the sharp increase in the stock market during 1990s coincided with a move toward lower macroeconomic risk that led to a fall in expected future stock returns and a lower equity risk premium after 1990. Their model predicted that the magnitude of the equity risk premium plummets as the economy gears toward a state of low macroeconomic volatility.

Smith et al. (2008) tested three leading general models of equity premium namely; the consumption-CAPM with power utility model, the Epstein and Zin General Equilibrium model with time non-separable preferences and the habit-persistence model. The authors found that the magnitude of the equity risk premium tends to increase sharply in economic periods characterized with negative excess returns and that a two factors model with consumption and inflation as main variables tend to be the best models that can explain the observed equity risk premium both for the U.S. and U.K.

Variation in the Equity Premium with Respect to Inflation

Copeland (1982) argued that in the presence of uncertain inflation, firms may recourse to prices increase in order to attenuate the effect of uncertain inflation. Whereas, bondholders do not have recourse to such an option and as such they face a higher risk of capital loss compared to stockholders in the presence of uncertain inflation. In addition, the presence of uncertain inflation makes bonds less attractive under the call-back provision. By consequence, the equity risk premium should be smaller in magnitude during periods of uncertain inflation. The author's empirical analysis yielded an equity risk premium of 3.2 percent during the period 1926-1978 after accounting for uncertain inflation, compared to Ibbotson and Sinquefield's (1979) equity risk premium of 5 percent during the same period. In addition, the author estimated an equity risk premium of negative 0.81 percent for the year 1980, which runs against the conventional wisdom at that time of a positive equity risk premium and higher return for stocks than for bonds.

Kyriacou et al. (2006) echoed the findings of Copeland (1982) by stating that the equity risk premium has been significantly positively related to the rate of inflation over the period 1871 – 2002. In addition, the relative poor performance of bonds during inflationary periods has resulted in a much higher equity risk premium in the post 1914 period than before. Numerically, had the inflation rate been zero for the period 1914 – 2002, the equity risk premium for the period would have been 4.61 percent and not 7.34 percent.

Moerman and Van Dijk (2010) relaxed the assumption that inflation rates are constant and tested the International Capital Asset Pricing Model (ICAPM) for the G5 countries (France, Germany, Japan, the UK and the US) over the period 1975 – 1998 and found that inflation risk is statistically and significantly priced in assets' return.

Schmeling and Schrimpf (2011) empirically showed that expected inflation rates are significant and strong predictors of future stock returns in several industrialized countries (Germany, United Kingdom, United States, France, Italy, and Japan). In particular, a one standard deviation increase in the expected rate of inflation decreases the stock returns by more than six percent over the following six months period which will lead to a higher equity risk premium over the same period. This negative relationship between inflation and stock returns may be triggered by a monetary policy transmission channel that starts by lowering the level of interest rate in order to boost output, raise investment activities and by consequence increase stock valuations. However, if the monetary policy is also seen as raising the inflation expectations, stock prices fall, the cost of capital increases and the equity premium increases.

Relationship between Stock Returns and Inflation

Non Negative Relationship between Stock Returns and Inflation

The paradigm that stock returns are positively correlated with inflation rate emanates from the original work of Fisher (1930) who stated that the expected rates of return on common stocks is the sum of the real return on common stocks plus the expected rate of inflation, also known as the Fisher Equation.

Firth (1979) examined the relationship between rates of return on common stocks and inflation in the U.K. for the period 1935 – 1976 and found evidence for the support of the Fisher Equation. In other words, nominal common stock returns in the U.K. tended to be positively correlated with the inflation rate.

Benderly and Zwick (1985) provided evidence that in the long run the relationship between real common stock returns and inflation is fully consistent with market efficiency and that the rate of return on equity is invariant to changes in nominal variables such as inflation. Nevertheless, the authors conceded that a negative relationship between stock returns and inflation may exist in the short run during periods of disequilibrium where the inflation rate did not fully adjust to the growth in money supply.

Titman and Warga (1989) documented a statistically significant positive relationship between stock returns and inflation for the period 1979 – 1982 in the U.S. Nevertheless, the authors remained puzzled why the positive relationship holds mainly in the above period. One advanced explanation is that the interest rate and the inflation rate were by some means more predictable during this period and by consequence more rapidly integrated into stock returns.

Mishkin (1992) reexamined the view that there was a strong Fisher effect in the U.S. during the post World War II before 1979 period and concluded that a strong Fisher effect occurs only during certain periods, mainly in the long run and when both inflation and interest rates exhibit common stochastic trend. The author found no support for the Fisher effect in the short term, implying a negative relationship between stock returns and inflation in the short run.

Boudoukh and Richardson (1993) accumulated two centuries of data on stocks, short-term and long-term bonds, and inflation in both the U.S. and the U.K from 1802 to 1990 and found evidence to suggest that nominal stock returns are positively correlated with both ex-ante and ex-post inflation over the long-term horizon in both countries.

Du (2006) postulated that the relationship between stock returns and inflation depended both on the monetary policy regime and the relative importance of the demand and supply shocks to the economy. Empirically, the author found that over the entire period of 1926 – 2001, only the sub-period 1926 – 1939 exhibited signs of a positive relationship between stock returns and inflation that was due mainly to strongly pro-cyclical monetary policy. For rest of the period from 1940 to 2001, the results strongly support a negative relationship between stock returns and inflation that the author attributed mainly to supply shocks.

Alagidede (2009) tested the relationship between stock returns and inflation in six African economies (Egypt, Kenya, Morocco, Nigeria, South Africa, and Tunisia) and concluded that stocks acted as a good hedge against inflation (positive relationship) over the long horizon in at least three markets (Kenya, Nigeria, and Tunisia).

Negative Relationship between Stock Returns and Inflation

The negative relationship between stock return and inflation is well documented in finance literature. Bodie (1976) attempted to address the question of how effective common stocks are in hedging against inflation. The author asserted that the answer to his question depends on two parameters. The first is the ratio of the variance of the non-inflation stochastic component of the real return on common stocks to the variance of unanticipated inflation. The larger this variance ratio is the less effective common stocks are in hedging against inflation. The second is the difference between the nominal return on the riskless asset and the coefficient of the unanticipated inflation. The greater the absolute value of this difference the more effective common stocks are in hedging against inflation. Estimates of the annual, quarterly, and monthly data for the period 1953 – 1972 revealed that the real return on equity is negatively related to both anticipated and unanticipated inflation. The author concluded that a sell short strategy is the only way for common stocks to effectively hedge against inflation.

Jaffe and Mandelker (1976) examined the relationship between the returns on common stocks and the inflation during the period 1953 – 1971 and found significant negative relationship between monthly returns on common stocks and both anticipated and unanticipated inflation.

However, when yearly returns on common stocks were used for the period 1875 - 1970, the negative relationship disappeared, suggesting that the negative relationship between returns on common stock and inflation is one of a short horizon.

Fama and Schwert (1977) tested the effectiveness of various types of assets in hedging again anticipated and unanticipated inflation during the period 1953 – 1971. Their findings indicated that only private residential real estate was an effective hedge instrument against both anticipated and unanticipated inflation. Government bonds and bills were only effective in hedging against anticipated inflation. Labor income appeared to have no relationship with both anticipated and unanticipated inflation at least in the short term. While, common stocks failed to act as a hedge instrument and showed negative relationship with respect to both anticipated and unanticipated inflation. Nonetheless, the authors were keen to note that the negative relationship between common stocks and inflation accounted only for a small portion of the returns variation and did not represent a reason for profitable trading opportunity.

Nelson (1979) used quarterly data for the period 1954 – 1970 and found that U.S. price level is very slow to respond to changes in nominal income and that inflation is deflationary, a result that the author found to be consistent with a negative relationship between the stock returns and inflation rates in the U.S.

Solnik (1983) extended the analysis further by testing the relationship between stock returns and inflation in nine countries (U.S., Japan, U.K., Switzerland, France, Germany, Netherlands, Belgium, and Canada) over the period 1971 – 1980. The results suggested a rejection of the assumption that real returns are independent of inflationary expectations. Instead the author found consistent support that stock returns tend to move downwards in the presence of inflationary expectations. This indicated that the negative relationship between stock returns and inflation is evident not only in the U.S. but also in major industrial countries.

Gultekin (1983) examined the relationship between common stock returns and inflation in twenty-six countries using monthly data for the period 1947 – 1979 and found evidence for the rejection of the Fisher hypothesis that real returns are independent of expected inflation and that nominal returns move on one-to-one basis with regard to expected inflation. Instead, the results indicated that the relationship between common stock returns and expected inflation is predominantly negative across the twenty-six countries.

Wahlroos and Berglund (1986) used data from the Finnish economy to test the Fisher hypothesis that real stock returns are independent of inflation rate. Their results showed a significant negative relationship between stock returns and both expected as well as unexpected inflation and whether they controlled for real activity or not in their testing model.

Laopodis (2006) looked at the relationship between real stock returns and inflation under three monetary policy regimes (Arthur Burns from 1970 to 1978, Paul Volcker from 1979 to 1987, and Alan Greenspan from 1988 to 2005) using bivariate and multivariate vector autoregressive cointegration specifications. The results indicated that the bivariate model supported a weak negative relationship in the 1970s and 1980s, while the multivariate model carried a strong negative relationship between real stock returns and inflation in the 1970s.

Explaining the Negative Relationship between Stock Return and Inflation

Many theories have been advanced to explain the negative relationship between stock return and inflation. For the purpose of this work I am going to focus on two of the more plausible theories: The Proxy Hypothesis of Fama (1981), and the Risk Premium Hypothesis of Tobin (1958).

The proxy hypothesis

The Proxy Hypothesis theory was first introduced by Fama in his 1981 paper. The basic argument of the Proxy Hypothesis theory is that stock returns are not only forecasted using real economic variables such as the annual growth rates of industrial production, change in the capital expenditures ratio, and change in the real rate of return on capital, but also exhibit positive relationships with these variables. Expected inflation is however negatively related to such expected real economic variables. By consequence, the negative relationship between stock return and expected inflation is a proxy for the positive relationship between stock return and future real economic variables.

Using monthly, quarterly, and annual data for the post-1953 period, Fama provided numerical evidences for the Proxy Hypothesis theory. In particular, the annual results indicated that the negative relationship between real stock returns and inflation rates disappears when growth rates of money and real activity variables are included in the forecasting equation. Nonetheless, the monthly and the quarterly empirical results suggested the presence of a negative explanatory power for unexpected inflation over the short term horizon. The author attributed this negative relationship between inflation and expected real return to the unexpected characteristics of the money supply during the post-1953 period.

Kaul (1987) analyzed data from four industrialized countries (U.S., Canada, U.K., and Germany) to conclude that the relationship between stock returns and inflation varies over time depending on the equilibrium process in the monetary sector. In particular, this relationship tends to be negative during times of counter-cyclical movements in money, prices, and stock returns and positive during times of pro-cyclical movements monetary responses.

Lee (1992) used a multivariate vector-autoregression (VAR) to explore the causal relationship between real stock returns, real interest rates, real activities (growth industrial production), and rate of inflation during U.S. postwar period of January 1947 to December 1987. He found that stock returns explained a very small portion of the variation in inflation in the presence of real interest rates in the VAR equation. In addition, inflation was responsible for a small variation in real activities with the latter responding negatively to shocks in inflation. These results lead the author to conclude no causal linkage existed between the real stock returns and money supply growth and between real stock returns and inflation rates.

Gallagher and Taylor (2002) developed a theoretical model to test Fama's Proxy Hypothesis theory using a multivariate innovation decomposition technique over the period 1957 through 1997. The contribution of the authors is in isolating the demand innovations that are assumed to be associated with temporary shocks to real economic variables from the supply innovations that are assumed to be associated with permanent shocks to real economic variables. Under these assumptions, real stock returns were found to be insignificantly correlated with inflation in the presence of demand shocks, but strongly significantly negatively correlated with inflation in the presence of supply shocks as predicted by the Proxy Hypothesis Theory.

Gregoriou and Kontonikas (2010) used data from sixteen OECD countries over the sample period 1970–2006 to examine the long-run relationship between stock prices and goods' prices and to test whether stocks' market investment can provide a hedge against inflation. The empirical analysis advocated a positive long-run relationship between goods' prices and stock prices and suggested that stocks hedge against inflation in the long run as predicted by the Fisher hypothesis.

The Risk Premium Hypothesis

The Risk Premium Hypothesis has its roots in Tobin's (1958) paper in which he argued that money demand depends, among other things, on the risk aversion of economic agents and on the perceived risk of competing assets. In particular, uncertainty about monetary policy increases inflation risk. And an unexpected increase in inflation causes the market risk premium to rise, resulting in an increase in the required rate of return on stocks. The increase in the required rate of return causes stock prices to fall.

Cornell (1983) studied the reaction of asset prices to money supply announcements by testing four of the major theories (the Risk Premium Hypothesis, the Expected Inflation Hypothesis, the Keynesian Hypothesis, and the Real Activities Hypothesis) that explained why money supply announcements alter asset prices. Results of his tests indicated that money supply announcements have an impact on the real rate. However, the author did not go as far as stating that monetary shocks affect the real rate, because the change in real rate could be also explained by changes in real economic variables as a result of the announcements about the money supply.

Wahlroos and Berglund (1986) used data from the Finnish economy first to test the Generalized Fisher Hypothesis that stock returns are independent of inflationary expectations and second to test whether Fama Proxy Hypothesis accounts for the negative relationship between stock returns and unexpected inflation in case of the rejection of the Fisher Hypothesis. The outcome was a rejection of the Fisher Hypothesis with a highly significant negative relationship between stock returns and expected inflation as well as stock returns and unexpected inflation. In addition, the negative relationship persisted even with the inclusion of measures of real activity into the equation. This led the author to conclude that the Proxy Hypothesis is unable to explain the strong negative relationship between stock returns and expected and unexpected inflation.

McCarthy, Najand, and Seifert (1990) collected data from the U.S., Germany, and the United Kingdom for the period January 1962 to September 1987 to test the proxy hypothesis. Using forecasted instead of actual variables and three methods for estimating expected inflation (Time-series model, random walk model, and weighted average model), the results failed to show a significant relationship between forecasted real stock returns and forecasted real activity. In contrast, the negative relationship between expected real stock returns and expected inflation persisted even after forecasted real activity was accounted for. In conclusion the authors rejected the argument of the proxy hypothesis in which the negative relationship between expected inflation and expected real stock returns is essentially a proxy for the true positive relationship between real stock returns and future real activity. The findings are in alignment with the Risk Premium Hypothesis.

Najand (1991) examined the Risk Premium Hypothesis as possible explanation for the observed negative relationship between common stock returns and inflation. Empirical evidence for U.S., United Kingdom, Germany and France showed a significant positive relationship between unexpected inflation and the market risk premium for each of the four countries. The findings suggested that an increase in uncertain inflation raises the market risk premium, which leads to an increase in the required rate of return on stocks and in turn causes stock prices to fall.

Wei and Wong (1992) analyzed the relationship between stock returns and inflation across ninteen different industry sectors for the prewar period (1926-1940) and the postwar period (1961-1985). The evidences indicated that the Proxy hypothesis failed to explain the negative relationship between stock returns and unexpected inflation in non-natural resource industries for the postwar period. In addition, the inclusion of future real activity failed to eliminate the spurious relation between stock returns and unexpected inflation.

Liu, Hsueh and Clayton (1993) tested the three propositions of the Proxy hypothesis: (1) stock returns are positively related to expected real activity (2) monetary policy is countercyclical and (3) expected inflation increases as a result of an expected increase in money supply. Analysis of the data from the U.S., the United Kingdom, Germany, and Canada generated a significant relation between expected inflation and expected real activity but an insignificant relation between real stock returns and expected real activity. The proposition that monetary policy is countercyclical was not supported by the results. In conclusion, the authors argued that the Proxy Hypothesis fell short of explaining the negative relation between real stock returns and expected inflation.

Najand and Noronha (1998) researched the existence and the direction of causal relationship between stock returns, inflation, interest rates, and real activity for Japan using the state space procedure from January 1977 to December 1994 period. The results pointed out that (1) inflation has negative and significant effect on real stock returns; (2) stock returns are negatively affected by an increase in interest rates; (3) inflation and interest rates influence the rate of growth in industrial production; (4) this result presents a partial support for Fama's Proxy hypothesis that inflation predicts real activity.

Kyriacou et al. (2006) measured the equity risk premium for ten industrial countries (Australia, Canada, France, Germany, Ireland, Italy, Netherlands, Spain, United Kingdom, and United States) over a period of 132 years from 1871 to 2002, and then used a pooled cross-section and time-series analysis to investigate the relationship between the equity risk premium and the rate of inflation. The results indicated that the equity risk premium has been significantly positively related to the rate of inflation. In particular, the equity risk premium increased significantly in periods of high inflation rates such as during the two world wars and the two oil price shocks in the 1970s. The results presented a strong argument for the Risk Premium Hypothesis that uncertainty about monetary policy increases inflation risk, and an unexpected increase in inflation causes the market risk premium to rise, resulting in an increase in the required rate of return on stocks. The increase in the required rate of return causes stock prices to fall.

MODEL AND VARIABLE CONSTRUCTION

The purpose of this section is to develop a model to study the impact of uncertain inflation on the equity risk premium. The model will provide a basis for empirical testing for the impact of uncertain inflation on risky assets. The following assumptions are made to derive the model:

(1) Investors are risk averse and aspire to maximize a single period expected utility of real terminal wealth.

(2) Investors have homogenous expectations with respect to the rate of assets returns and price changes.

(3) Returns on assets and price change follow continuous time stochastic (Weiner) processes.

The first assumption implies that the individuals' utility functions are assumed to be strictly concave. This implies that: (1) they always prefer more wealth to less (the marginal utility of wealth is positive, MU(W)>0), and (2) their marginal utility of wealth decreases as they have more and more wealth (dMU(W)/dW<0). Also since all investors maximize the expected utility of their end of period wealth, the model is implicitly a one period model.

The second assumption implies that investors make decisions based on an identical opportunity set. In other words, no one can be fooled because everyone has the same information at the same time.

The last assumption implies that (a) the capital market are assumed to be open all the time, and therefore economic agents have the opportunity to trade continuously, (b) asset prices traded in speculative markets satisfy the "Efficient Market Hypothesis" of Fama (1970) and Samuelson (1965). Namely, assets are priced so that the stochastic processes describing the unanticipated parts of their expected value are martingale. The notion that stochastic processes is martingale is generally accepted by financial economists (see for example; Fama (1965), Mandelbrot (1966)). A martingale is stochastic process (X_i), where for all i = 1,2…

1. $E(| X_i |)\langle\infty$; and
2. $E(X_{i+1} / X_1,..., X_i) = X_i$

This is often called a "fair game" since the expected future value of a variable is equal to its most recent realization. In a market characterized by risk averse investors, the martingale model is appropriate if the arbitrage profits are to be eliminated. A proof for this proposition is provided by Samuelson (1965). Markets characterized by the absence of arbitrage profits are generally accepted in the finance literature. If investors are risk averse, the appropriate arbitrage arguments deal not with "profits" of expected returns, but rather with expected utility. It is further assumed that the asset returns are generated by diffusion processes with continuous sample paths and that returns are serially independent and identically distributed through time, i.e., that prices follow a geometric Brownian motion or Wiener process, and hence the prices are log normally distributed.

The general Wiener process x is described by the following stochastic differential equation. This equation is often used as a model of the rate of return on stocks. See for example Merton (1973, 1978), and Friend, Landskroner, and Losq (1976) among others.

$$dx = adt + bdz \qquad (11)$$

Where $dz = \varepsilon\sqrt{dt}$, $\varepsilon =$ a standard normal variable with expected value of zero and variance of 1 and a and b are constants. The process is a Wiener process with drift a and variance b^2. The expected value of dx is adt. The drift, a, is often called the expected instantaneous rate of change of x.

Following Fischer (1975), suppose that the rate of inflation is stochastic and the price level is described by:

$$\frac{dp}{dt} = \pi = E(\pi)dt + s_\pi dz \qquad (12)$$

Where $dz = \varepsilon\sqrt{dt}$ as mentioned before, with ε a serially uncorrelated and normally distributed random variable with zero mean and unit variance, that is, z is a Wiener process. Thus over an interval dt, expected inflation is $\varepsilon(\pi)$ and its variance is s_π^2. Therefore, the standard deviation of the Wiener process of price changes (s_π) represents uncertain inflation. Substituting for dz, equation (12) can be written as:

$$\pi = E(\pi)dt + s_\pi \varepsilon_\pi \sqrt{dt} \qquad (13)$$

Similarly, the dynamic of the real return on equity is described as:

$$r_s = E(r_s)dt + s_s dz_s \quad (14)$$

where $E(r_s)$ is the expected return on equity per unit of time. Since this research is concerned about the effect of uncertain price change on the stock returns, another term should be added to equation (14) which reflects this effect. This is permissible, as Merton (1975) points out, as long as the added term reflects a specific additional source of uncertainty.

$$r_s = E(r_s)dt + s_s dz_s + \beta_s s_\pi dz_\pi \quad (15)$$

In equation (15) s_s is the stochastic component of asset returns which is independent of uncertain price change, i.e., $E(\varepsilon_s \varepsilon_\pi) = 0$ and $\beta_s = \mathrm{cov}(r_s, \pi) / s_\pi^2$. Substituting for dz:

$$r_s = E(r_s)dt + s_s dz_s + \beta_s s_\pi \varepsilon_\pi \sqrt{dt} \quad (16)$$

In equation (16) β_s measure the degree of the real stock returns with respect to uncertain price changes.

Following Fischer (1975), the return generating process for the risk-free asset is defined as:

$$r_F = (R_F - \pi + s_\pi^2)dt \quad (17)$$

where r_F is the real return on the risk-free asset and R_F is the nominal return on the risk free asset.

Next, following Friend, Landskroner, and Losq (1976), the real wealth dynamic for the investors is derived. It should be pointed out that Friend, Landskroner, and Losq derive the Capital Asset Pricing Model (CAPM) adjusted for inflation. However, this study derives the effect of uncertain inflation on the risk premium. Assuming the investors are rational, they adjust their portfolio upon the arrival of new information about any changes in the price level. The real wealth dynamic for the kth investor may be written in a stochastic differential equation form:

$$W_{k,t+dt} = W_{k,t}(1+\tau_{Fk} r_F dt + \tau_{sk} r_s dt) \qquad (18)$$

$$= W_{k,t} + (\tau_{Fk} r_F dt + \tau_{sk} r_s dt) W_{k,t}$$

where $W_{k,t}$ = the wealth of the kth investor at time t;

r_F = the real risk-free rate of return;

τ_{sk} = the proportion of the wealth invested in stocks by the kth investor; and

τ_{Fk} = the proportion of the wealth invested in the risk-free rate by the kth investor.

The investor's budget constraint is defined as:

$$\tau_{sk} + \tau_{Fk} = 1 \qquad (19)$$

By substituting equation (19) into equation (18), we get:

$$W_{k,t+dt} = W_{k,t} + [r_F dt + \tau_{sk}(r_s - r_F) dt] W_{k,t} \qquad (20)$$

Differentiating the expected utility of the final real wealth, $W_{k,t+dt}$, with respect to τ_{sk}, the first order condition for the maximum is derived.

$$E[u'(W_{k,t+dt})(r_s - r_F)dt] = 0 \tag{21}$$

Expanding the marginal utility of real wealth function in a Taylor series about $W_{k,t}$, equation (22) is obtained:

$$u'(W_{k,t+dt}) = u'(W_{k,t}) + u''(W_{k,t})(W_{k,t+dt} - W_{k,t}) + \varphi \tag{22}$$

where φ is the remaining terms in the Taylor series expansion. Pratt (1964) assumes that second order and higher terms are insignificant ($\varphi = 0$). By finding the value of $(W_{k,t+dt} - W_{k,t})$ from equation (20) and inserting into equation (22) and ignoring φ, we get:

$$u'(W_{k,t+dt}) = u'(W_{k,t}) + u''(W_{k,t})(W_{k,t})[r_F dt + \tau_{sk}(r_s - r_F)dt] \tag{23}$$

By substituting equation (23) into equation (21),

$$u'(W_{k,t})E(r_s - r_F)dt + u''(W_{k,t})W_{k,t}E[\{r_F dt + \tau_{sk}(r_s - r_F)dt\}(r_s - r_F)dt] = 0 \tag{24}$$

Since $E[r_F dt(r_s - r_F)dt] = \text{cov}(r_F, r_s - r_F)dt$ and $E[\{(r_s - r_F)dt\}^2] = \text{var}(r_s - r_F)dt$, equation (24) becomes:

$$u'(W_{k,t})E(r_s - r_F)dt + u''(W_{k,t})W_{k,t}\,\text{cov}(r_F, r_s - r_F)dt + \tau_{sk}\,\text{var}(r_s - r_F)dt = 0 \tag{25}$$

Equation (25) can be written in the following form:

$$E(r_s - r_F) = C_k[\text{cov}(r_F, r_s - r_F)] + \tau_{sk}\,\text{var}(r_s - r_F) \tag{26}$$

where $C_k = -W_{k,t}\{u''(W_{k,t})/u'(W_{k,t})\}$ is the Arrow-Pratt measure of relative risk aversion.

Following the aggregation method used by Friend, Landskroner, and Losq (1976), equation (26) is aggregated over individual investors according to their proportions of initial wealth to the total initial wealth. To derive market equilibrium condition let $\Gamma_k = W_{k,t}/\sum W_{k,t}$ and $\Omega = (\sum \Gamma_k / C_k)$. By multiplying both sides of equation (26) by Ω / C_k and aggregating over all investors, the market equilibrium is derived.

$$E(r_s - r_F) = \Omega[\mathrm{cov}(r_F, r_s - r_F)] + \tau_{sk}\ \mathrm{var}(r_s - r_F) \qquad (27)$$

In equation (27), Ω represents the market price of risk and τ_{sk} is the total value of common stock to the total value of all assets. Furthermore, it can be shown from return generating functions [equation (16) and (17)] that:

$$\mathrm{cov}(r_F, r_s - r_F) = s_\pi^2(\beta_s - 1) \qquad (28)$$

and

$$\mathrm{var}(r_s - r_F) = s_s^2 + s_\pi^2(\beta_s - 1)^2 \qquad (29)$$

By substituting equation (28) and (29) into (27):

$$E(r_s - r_F) = \Omega[s_s^2 + s_\pi^2(\beta_s^2 - \beta_s)]\tau_s \qquad (30)$$

Following Ross (1976), it is assumed that the net supply of the risk-free asset is zero, i.e., $\tau_s = 1$; then equation (30) becomes:

$$E(r_s - r_F) = \Omega[s_s^2 + s_\pi^2(\beta_s^2 - \beta_s)] \qquad (31)$$

by taking the first derivative of (31) with respect to s_π^2,

$$dE(r_s - r_F)/ds_\pi^2 = \Omega[(\beta_s^2 - \beta_s)] > 0 \tag{32}$$

Thus, the risk premium will rise with respect to an increase in uncertain price changes since the negative β_s (the negative relationship between stock returns and unexpected inflation) is well documented (see Linter (1975), Bodie (1976), Fama and Schwert (1977), among others).

The Fischer equations for stock returns and returns on risk-free assets are:

$$E(r_s) = E(R_s) - E(\pi) \tag{33}$$

$$E(r_F) = E(R_F) - E(\pi) \tag{34}$$

where R_s is the nominal return on stocks and R_F is the nominal return on risk-free rate. Subtracting equation (34) from equation (33),

$$E(r_s - r_F) = E(R_s - R_F) \tag{35}$$

Thus equation (31) becomes:

$$E(R_s - R_F) = \Omega(s_s^2) + [\Omega(\beta_s^2 - \beta_s)](s_\pi^2) \tag{36}$$

Equation (36) states that the equity risk premium is affected by the risk of common stocks which is independent of price changes (s_s^2), the standard deviation of price changes with respect to inflation uncertainty (s_π), and the degree of responsiveness of the stock returns with respect to uncertain price changes (β_s). This equation is the basis of my empirical study for measuring the effect of uncertain inflation on the market risk premium.

The model developed in this chapter provides an explanation for the effect of uncertain inflation on stock returns consisting of the following argument. An increase in uncertain inflation increases the market risk premium. This increase in the market risk premium leads to an increase in the required rate of return on stocks, which in turn causes the stock prices to decline.

DATA AND ESTIMATION PROCEDURE

To test for the relationship between the expected ERP and the unexpected inflation a least squares regression is run for the following model

$$ERP_t = \alpha_1 VINF_t + \alpha_2 VRS_t \qquad (37)$$

Where ERP_t is the expected risk premium at time *t*, $VINF_t$ is the measure of variability of uncertain inflation and VRS_t is the measure of variability of stock returns. α_1 is equal to the term $[\Omega(\beta_s^2 - \beta_s)]$ from equation (36), and α_2 is equal to the term Ω from equation (36).

Equation (37) states that the expected ERP is affected by the variance of price changes with respect to inflation uncertainty and the variance of common stocks' returns. As such, if α_1>0 then ERP is related to variability of uncertain inflation, and if α_2>0 then ERP is related to variability of stocks' returns.

For estimation purpose, I obtained monthly and quarterly ERP calculated as the difference between the returns on the S&P 500 and the TB10 rate. The VRS is the monthly stock market volatility index (VIX) measured by the Chicago Board Options Exchange. VINF is extracted from the Michigan Survey conducted by the Survey Research Center at the University of Michigan. The survey provides a measure for the volatility of unexpected inflation calculated as the difference between the 75th percentile and the 25th percentile of the observations. Following Sinclair (2010), this measure is adopted as a proxy for VINF. Data is monthly, 312 observations, for the period 1990 to 2015. Table 15 gives a brief summary of the data.

[Insert Table 15 here]

Table 15 shows that monthly ERPs are negatively skewed with kurtosis value much larger than three (the kurtosis value for normal distribution). This indicates that ERP has a long left tail with peaked (leptokurtic) distribution relative to the normal. VINF and VRS have positive skewness and larger than three kurtosis values. This indicates that the two variables have a long right tail with peaked distributions relative to the normal. The Jarque-Bera statistics rejects the null hypothesis of normal distribution for the three series, the ERP, the VRS, and the VINF.

To determine if any of the variables needs to be transformed before I estimate the model I run an Augmented Dickey-Fuller (ADF) test to check for stationarity. The results of the ADF test, presented in table 16, indicate that the ERP and the VRS are stationary at the level, while the VINF is nonstationary at the level but stationary at the first difference. Thus, the first difference of the volatility of expected inflation (DVINF) is utilized in model's estimation.

[Insert Table 16 here]

Since expected ERP is not directly observed, the next step is to estimate the expected ERP (EERP). The correlogram of ERP which plots the autocorrelation function (ACF) and partial autocorrelation function (PACF) is examined to determine a suitable Autoregressive Moving Average model (ARMA) for generating EERP. The Autoregressive term (AR) represents the dependency among successive observations and the Moving Average term (MA) represents the persistence of a random shock from one observation to the other. Few models are estimated, the model with the lowest Akaike Information Criterion (AIC) and the Schwarz Criterion (SC) is selected after passing certain diagnostic tests that include: Breusch-Godfrey Serial Correlation LM test, Jarque-Bera test for normality, the QQ-plots, and ARCH LM test for homoskedasticity.

Table 17 table provides the results for the Akaike Information Criterion (AIC) and the Schwarz Criterion (SC), Breusch-Godfrey Serial Correlation LM test, Jarque-Bera test for normality, the and ARCH LM test for homoskedasticity. The results indicate that MA(1) model is the best model based on the AIC, SC criteria. A constant term is included in the MA(1) model to account for a non-zero mean value. The EERPs are then approximated by the fitted values in the MA(1) model. The Breusch-Godfrey Serial Correlation LM test and ARCH LM test for homoskedasticity indicate no serial correlation and no heteroskedasticity. Jarque-Bera test for Normality rejects the null hypothesis that the residuals of all models are normally distributed. This is confirmed by the QQ-plots of residuals in figure 7. The residuals QQ-plots do not remain straight.

[Insert Table 17 here]

[Insert Figure 7 here]

RESULTS

Results for the Ordinary Least Squares Regressions

Four Ordinary Least Squares (OLS) regressions are run to test for Equation (37). If $\alpha_1 > 0$ then EERP is related to variability of uncertain inflation, and if $\alpha_2 > 0$ then EERP is related to variability of stocks' returns. Four OLS regressions are estimated. OLS1 regress the EERP on the difference of the VINF and the VRS. OLS2 regress the EERP on the difference of the VINF, the lagged difference of the VINF and the VRS. OLS3 is identical to OLS1 except that it accounts for recession periods in the estimation sample by introducing a dummy variable that take the value of 1 if there is a recession and the value of 0 if there is no recession. OLS4 is identical to OLS2 except that it accounts for recession periods in the estimation sample by introducing a dummy variable that take the value of 1 if there is a recession and the value of 0 if there is no recession. This table provides the results the four OLS regression of the EERP on the VINF and VRS. The results for the four OLS regressions along with the measure of Akaike Information Criterion (AIC), the Schwarz Criterion (SC), the Jarque-Bera test for normality, the Breusch-Godfrey Serial Correlation LM test, and ARCH LM test for homoskedasticity, are presented in table 18.

[Insert Table 18 here]

The results from OLS1 indicate that the coefficient of the VIN is negative and statistically insignificant, while the coefficient of the VRS is positive and statistically significant at one percent level. The adjusted R-squared is zero (negative). Based on these results, I conclude that the EERP is not related to variability of uncertain inflation, but related to variability of stocks' returns.

The results from OLS2 indicate that the coefficient of the VIN is negative and statistically insignificant at the level, and negative and statistically significant at one percent at the lagged level. The coefficient of the VRS is positive and statistically significant at one percent level.

The results from OLS3 indicate that the coefficient of the VIN is positive and statistically insignificant at the level in recession periods, and negative and statistically insignificant at the level in non-recession periods. The coefficient of the VRS is positive and statistically significant at one percent level in non-recession periods and negative and statistically significant at one percent level in recession periods. The adjusted R-squared is positive and equal to 2.4 percent.

The results from OLS4 indicate that the coefficient of the VIN is positive but statistically insignificant at the level in recession periods. The VIN coefficient is negative and statistically insignificant at the lagged level in non-recession periods. The VIN coefficient is negative and statistically insignificant at level in periods of non-recession but negative and statistically significant at five percent at the lagged level. The coefficient of the VRS is negative and statistically significant at one percent level in periods of recessions but positive and statistically significant at one percent level in non-recession periods. The adjusted R-squared is positive and equal to 4.5 percent.

The Akaike Information Criterion (AIC) and the Schwarz Criterion (SC) indicate that OLS4 represents an improvement in the estimation model for the EERP on the VINF and VRS. The Jarque-Bera test for normality indicates that the residuals do not follow a normal distribution and are negatively skewed with kurtosis value much larger than three. The Breusch-Godfrey Serial Correlation LM test, and ARCH LM test for homoskedasticity indicate that the residuals are not serially correlated and do not suffer from heteroskedasticity.

CONCLUSION

The relationship between the stock market returns, the unexpected inflation and the market volatility have been noticeably studied in the financial literatures. With some authors arguing that the relationship between the stock market returns and unexpected inflation is negative, while others stating that the relationship is positive. In this chapter, I develop a theoretical model to test for the relationship between the expected market risk premium, the unexpected inflation volatility, and the stock market volatility. The model predicts that the relationship between the expected market risk premium and the unexpected inflation volatility is positive as is the relationship between the expected market risk premium and the market volatility.

The testing results for the four regression models indicate that the relationship between the expected market risk premium and the unexpected inflation volatility is in general negative and insignificant even after accounting for recessionary periods. This is a clear indication that the stock market fully hedge against inflation in times of recession and in times of economic expansion. The results validate the Proxy Hypothesis theory of Fama (1981) that the negative relationship between stock return and expected inflation is a proxy for the positive relationship between stock return and future real economic variables.

On the other hand, the relationship between the expected market risk premium and the market volatility is more ambiguous. The results of the OLS regressions indicate that the expected equity risk premium is positively correlated with the stock market volatility in times of non-recessionary periods but negatively correlated in times of recessionary periods. On average a 1 percent increase in market volatility in times of economic expansion will increase the expected equity risk premium by 0.02 percent monthly (0.24 percent annually). While in times of recessions, a 1 percent increase in market volatility will decrease the expected equity risk premium by 0.012 percent monthly (0.14 percent annually). The results can be explained by the fact that investors perceive an increase in market volatility as a sign of a change in the direction of economic conditions. During recession periods, an increase in market volatility may be recognized as a sign that economic condition are about to improve and therefore investors will demand lower risk premiums for their future investments. Whereas in times of economic expansion, an increase in market volatility may be recognized as a sign that an economic downturn is in the horizon and in the process investors will demand higher risk premiums for their future investments.

Table 15. Summary Statistics of Monthly Variables Used in Testing the Impact of Stock Market Volatility and Unexpected Inflation Volatility on Expected Equity Risk Premium in Equation 37

Equation (37) $$ERP_t = \alpha_0 + \alpha_1 VINF_t + \alpha_2 VRS_t$$

This table provides the summary statistics of the monthly variables used for estimating the relationship expressed in equation 37 between the expected ERP, the stock market volatility and the unexpected inflation volatility. Where ERP is the ERP calculated as the difference between the return on the S&P 500 and the TB10 rate, VINF is the unexpected inflation volatility measure from the Michigan Survey, and VRS is stock market volatility measured by the VIX index provided by the CBOE.

Monthly obesrvations for the period 1990M01 to 2015M12					
	RE	TB10	ERP	VINF	VIX
Mean	0.008057	0.003943	0.004114	3.909295	19.83422
Median	0.0107	0.0039	0.00705	3.7	17.77045
Maximum	0.1229	0.0071	0.1205	7	62.63947
Minimum	-0.202	0.0013	-0.2051	3	10.81762
Std. Dev.	0.035485	0.001468	0.035488	0.651841	7.640597
Skewness	-0.968878	0.101921	-0.952368	1.597127	1.972798
Kurtosis	7.656295	2.183393	7.556509	6.713893	9.380319
Jarque-Bera	330.6677	9.209194	317.0673	311.9514	731.5907
Probability	0	0.010006	0	0	0
Sum	2.5139	1.2302	1.2837	1219.7	6188.278
Sum Sq. Dev.	0.391606	0.000671	0.391665	132.143	18155.78
Observations	312	312	312	312	312

Table 16. Augmented Dickey-Fuller (ADF) Test for Unit Root

This table provides the results for the ADF test for unit for the variables ERP, VRS, and VINF. The null hypothesis is the variable has a unit root. The results indicate that the ERP and the VRS are stationary at the level, while the VINF is nonstationary at the level but stationary at the first difference.

Augmented Dickey-Fuller test on ERP			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.991	0
Test critical values:	1% level	-3.451214	
	5% level	-2.870621	
	10% level	-2.571679	
Augmented Dickey-Fuller test on VRS			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.611007	0.0002
Test critical values:	1% level	-3.451351	
	5% level	-2.870682	
	10% level	-2.571711	
Augmented Dickey-Fuller test on VINF			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.135793	0.025
Test critical values:	1% level	-3.451491	
	5% level	-2.870743	
	10% level	-2.571744	

Table 17. ARMA Models Identification for Unexpected ERP

This table provides the results for the Akaike Information Criterion (AIC) and the Schwarz Criterion (SC), Breusch-Godfrey Serial Correlation LM test, Jarque-Bera test for normality, the and ARCH LM test for homoskedasticity.

	ARMA Models				
	ERP C AR1	**ERP C MA1**	**ERP C AR1 MA1**	**ERP C MA1 MA 2**	**ERP C MA1 MA6**
Akaike info criterion	-3.881316	-3.884969	-3.876951	-3.87868	-3.889109
Schwarz criterion	-3.857266	-3.860975	-3.840875	-3.84269	-3.853119
Log likelihood	605.5447	608.0551	605.8658	608.0741	609.701
Hannan-Quinn criter.	-3.871703	-3.875379	-3.862531	-3.864296	-3.874725
Durbin-Watson stat	1.982721	2.00299	2.000835	1.998727	1.98393
	Breusch-Godfrey Serial Correlation LM Test:				
Obs*R-squared	2.432273	0.995529	2.164531	1.341503	0.344962
Prob. Chi-Square(2)	0.2964	0.6079	0.3388	0.5113	0.8416
	Heteroskedasticity Test: ARCH				
Obs*R-squared	1.140232	1.212228	1.303782	1.272041	1.902875
Prob. Chi-Square(1)	0.2856	0.2709	0.2535	0.2594	0.1678
	Jarque-Bera Test for Normality				
Skewness	-0.698576	-0.707161	-0.721969	-0.712996	-0.774414
Kurtosis	7.340533	7.206851	7.18424	7.186233	6.776177
Jarque-Bera	269.433	256.0728	253.8903	254.254	216.559
Probability	0	0	0	0	0

Table 18. Results for the OLS regressions of EERP on the VINF and VRS

This table provides the results the four OLS regression of the EERP on the VINF and VRS. OLS1 regress the EERP on the difference of the VINF and the VRS. OLS2 regress the EERP on the difference of the VINF, the lagged difference of the VINF and the VRS. OLS3 is identical to OLS1 except that it accounts for recession periods in the estimation sample by introducing a dummy variable that take the value of 1 if there is a recession and the value of 0 if there is no recession. OLS4 is identical to OLS2 except that it accounts for recession periods in the estimation sample by introducing a dummy variable that take the value of 1 if there is a recession and the value of 0 if there is no recession.

The mean equations for OLS regression are:

For OLS1: EERP = α1 d(VINF) + α2 VRS + ε

For OLS2: EERP = α1 d(VINF) + α2 d(VINF(-1)) + α3 VRS + ε

For OLS3: EERP = α1 RECES*d(VINF) + α2 (1-RECES)*d(VINF) + α3 RECES*VRS + α4 (1-RECES)*VRS + ε

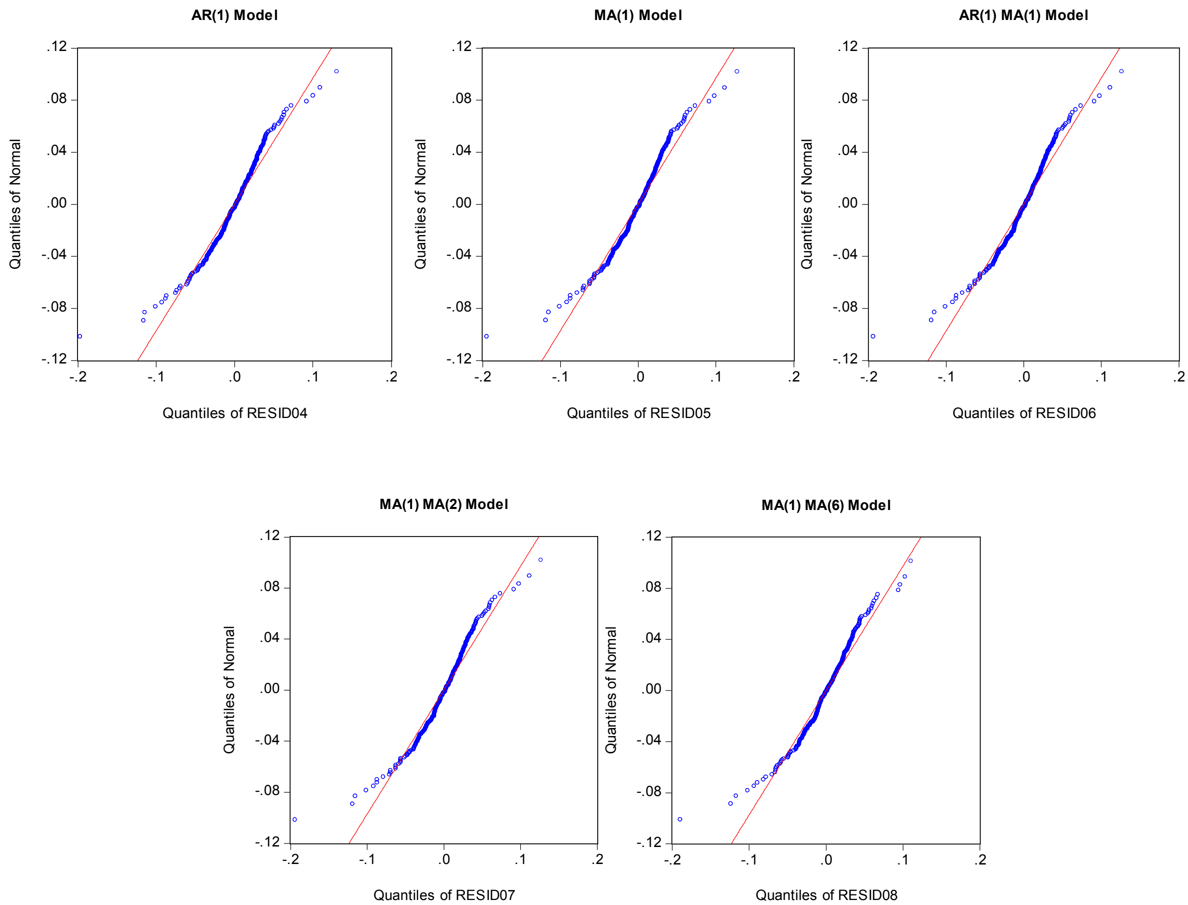
For OLS4: EERP = α1 RECES*d(VINF) + α2 RECES*d(VINF(-1)) + α3 (1-RECES)*d(VINF) + α4 (1-RECES)*d(VINF(-1)) + α5 (RECES*VRS) + α6 (1-RECES)*VRS + ε

	OLS1	OLS2	OLS3	OLS4
α1	-0.000148	-0.000994	0.001440	0.001245
	(0.900500)	(0.415300)	(0.345700)	(0.428300)
α2	0.000134	-0.003375	-0.001357	-0.000750
	(0.000000)	(0.005900)	(0.399300)	(0.642300)
α3		0.000137	-0.000124	-0.002401
		(0.000000)	(0.005000)	(0.151700)
α4			0.000221	-0.004170
			(0.000000)	(0.011300)
α5				-0.000120
				(0.006800)
α6				0.000219
				(0.000000)
R-squared	-0.126250	-0.099706	0.023839	0.045276
Adjusted R-squared	-0.129894	-0.106871	0.014300	0.029574
Akaike info criterion	-6.604999	-6.621802	-6.735158	-6.743823
Schwarz criterion	-6.580949	-6.585641	-6.687058	-6.671503
Durbin-Watson stat	1.798807	1.799869	2.005705	2.009547
Skewness	-1.057003	-0.963611	-0.293095	-0.298282
Kurtosis	8.167322	7.728397	6.546408	6.460551
Jarque-Bera	403.914300	336.762300	167.429900	159.279300
Probability	(0.000000)	(0.000000)	(0.000000)	(0.000000)
Breusch-Godfrey LM Test:				
Prob. Chi-Square(2)	(1.000000)	(1.000000)	(1.000000)	(1.000000)
ARCH Heteroskedasticity Test				
Prob. Chi-Square(1)	(0.129600)	(0.260100)	(0.669200)	(0.549900)

Note: P-Value are reported in parentheses

Figure 7. QQ-Plots for ARMA Models Identification for Unexpected ERP

This figures graph the QQ-Plots for ARMA Models Identification for Unexpected ERP



CHAPTER IV

CONCLUSION

The equity risk premium (ERP) is an essential component of any asset pricing model both for academics and practitioners alike. Nevertheless, the financial literature does not accord much attention to the ERP estimation issues (Damodaran, 2015). Theoretically, the ERP is the return on equity in excess of the risk-free rate. Since future equity market returns are not discernible at the current time, it is the expected ERP that investors are concerned with. As intuitive as the concept of ERP seems, in practice it does present a number of challenges. Among academics, there are striking differences to what the ERP value actually is. Values vary from as low as 2 percent to as high as 13 percent (Welch, 2000). The wide variation in the estimates of the ERP could be explained by variation in sample period, variation in variables measurement, and variation in measurement techniques. There are three main approaches for estimating the ERP. The first and the most widely used among academics and estimation services such as Ibbotson Associates is the historical premium approach. It consists of estimating the expected ERP by assessing the historical premium of past returns on equities over risk free assets. The second approach is a survey based approach that consists of surveying a sample of managers and investors about their future expectation for the ERP. The third approach is what Damodaran calls the “implied premium” approach, and it consists of estimating the ERP based on the value of traded assets today.

In the second chapter I explored four of the most commonly cited models in literature for estimating the ERP: the Historical Mean of Realized Returns Model (HMRRM), the Dividend

Discount Model (DDM), the Free Cash Flow Model (FCFM), and the Sharpe Ratio Model (SRM). The results indicate that the estimates of the ERP, both historical and implied, vary considerably depending on (a) the variable of choice for the risk free rate; (b) the selection and the length of the estimation period; (c) and the estimation method. The DDM and the FCFM produce estimates for the implied ERP that are below the historical estimates, while the SRM produces implied ERP values that are usually higher than the historical values of the ERP.

The post 2008 financial crisis period produces estimates for the historical ERP that are slightly higher or lower than the implied ERP estimates for the FCFM. This result suggests that the subprime mortgage crisis may have resulted in market self-correction and in investor re-evaluation of the risk aversion level. In addition, the implied ERP estimates for the three models are more volatile than the historical ERP. In particular, estimates of the implied ERP from the SRM tend to overshoot the historical ERP estimates during periods of high volatility and fall below the historical level during periods of low stock market volatility.

In conclusion the choice between historical ERP estimates and implied ERP estimates is a question of belief. Models for the implied ERP assume that markets are efficient and securities are correctly priced. Therefore if one believes in market efficiency then implied ERP is the best option for predicting future returns. On the other hand, if one is skeptical about the efficiency assumption and believes in market timing then the historical ERP is a better option.

The third chapter explored the relationship between the expected ERP and macroeconomic variables. The relationship between the stock market returns, the unexpected inflation and the market volatility have been noticeably studied in the financial literatures. With some authors arguing that the relationship between the stock market returns and unexpected inflation is negative, while others stating that the relationship is positive. I developed a theoretical model to test for the relationship between the expected market risk premium, the unexpected inflation volatility, and the stock market volatility. The model predicts that the relationship between the expected market risk premium and the unexpected inflation volatility is positive as is the relationship between the expected market risk premium and the market volatility.

The testing results for the four regression models indicate that the relationship between the expected market risk premium and the unexpected inflation volatility is in general negative and insignificant even after accounting for recessionary periods. This is a clear indication that the stock market fully hedge against inflation in times of recession and in times of economic expansion. The results validate the Proxy Hypothesis theory of Fama (1981) that the negative relationship between stock return and expected inflation is a proxy for the positive relationship between stock return and future real economic variables.

On the other hand, the relationship between the expected market risk premium and the market volatility is more ambiguous. The results of the OLS regressions indicate that the expected equity risk premium is positively correlated with the stock market volatility in times of non-recessionary periods but negatively correlated in times of recessionary periods. On average a 1 percent increase in market volatility in times of economic expansion will increase the expected equity risk premium by 0.02 percent monthly (0.24 percent annually). While in times of recessions, a 1 percent increase in market volatility will decrease the expected equity risk premium by 0.012 percent monthly (0.14 percent annually). The results can be explained by the fact that investors perceive an increase in market volatility as a sign of a change in the direction of economic conditions. During recession periods, an increase in market volatility may be recognized as a sign that economic condition are about to improve and therefore investors will demand lower risk premiums for their future investments. Whereas in times of economic expansion, an increase in market volatility may be recognized as a sign that an economic downturn is in the horizon and in the process investors will demand higher risk premiums for their future investments.

REFERENCES

Abel, A. B. (2008). Equity Premia with Benchmark Levels of Consumption: Closed-Form Results. In R. Mehra (Ed.), *Handbook of the Equity Risk Premium* (pp. 117-157). Handbooks in Finance. Amsterdam and Boston: Elsevier, North-Holland.

Alagidede, P. (2009). Relationship between stock returns and inflation. *Applied Economics Letters*, 16(14), 1403-1408. doi:10.1080/13504850701537682

Bailey, D., & de Prado, M. (2012). The Sharpe ratio efficient frontier. *Journal Of Risk*, 15(2), 3-44.

Bansal, R., & Yaron, A. (2004). Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles. *Journal Of Finance*, 59(4), 1481-1509. doi:10.1111/j.1540-6261.2004.00670.x

Barberis, N., & Huang, M. (2001). Mental accounting, loss aversion, and individual stock returns. *Journal Of Finance*, 56(4), 1247-1292.

Barberis, N., & Huang, M. (2008). The Loss Aversion/Narrow Framing Approach to the Equity Premium Puzzle. In R. Mehra (Ed.) , *Handbook of the Equity Risk Premium* 199-229. Handbooks in Finance. Amsterdam and Boston: Elsevier, North-Holland.

Barberis, N., Huang, M., & Santos, T. (2001). Prospect theory and asset prices. *Quarterly Journal Of Economics*, 116(1), 1-53.

Barberis, N., Huang, M., & Thaler, R. (2003). Individual Preferences, Monetary Gambles and the Equity Premium.

Barro, R. J. (2006). Rare Disasters and Asset Markets in the Twentieth Century. *Quarterly Journal Of Economics*, 121(3), 823-866.

Benderly, J., & Zwick, B. (1985). Inflation, Real Balances, Output, and Real Stock Returns. *American Economic Review*, 75(5), 1115.

Bodie, Z. (1976). Common Stocks as a Hedge against Inflation. *Journal Of Finance*, 31(2), 459-470.

Boudoukh, J., & Richardson, M. (1993). Stock returns and inflation – a long-horizon perspective. *American Economic Review*, 83(5), 1346-1355.

Brav, A., Constantinides, G., & Geczy, C. (n.d). Asset pricing with heterogeneous consumers and limited participation: Empirical evidence. *Journal Of Political Economy*, 110(4), 793-824.

Campbell, J. Y. (2007). Estimating the Equity Premium. *NBER Working Paper* No. 13423

Campbell, J. Y., & Cochrane, J. H. (1999). By Force of Habit: A Consumption - Based Explanation of Aggregate Stock Market Behavior. *Journal of Political Economy*, (2). 205. doi:10.1086/250059.

Chan, Y. L., & Kogan, L. (2002). Catching Up with the Joneses: Heterogeneous Preferences and the Dynamics of Asset Prices. *Journal Of Political Economy*, 110(6), 1255-1285.

Chapman, D. A., & Polkovnichenko, V. (2009). First-Order Risk Aversion, Heterogeneity, and Asset Market Outcomes. *Journal Of Finance*, 64(4), 1863-1887. doi:10.1111/j.1540-6261.2009.01482.x

Chow, V., Jiang, W., & Li, J. (2014). Does VIX Truly Measure Return Volatility? Available at SSRN: http://ssrn.com/abstract=2489345 or http://dx.doi.org/10.2139/ssrn.2489345

Constantinides, G. M. (1990). Habit Formation: A Resolution of the Equity Premium Puzzle. *Journal of Political Economy*, (3). 519.

Constantinides, G. M., & Duffie, D. (1996). Asset Pricing with Heterogeneous Consumers. *Journal of Political Economy*, (2). 219.

Copeland, B. L. (1982). Inflation, Interest Rates and Equity Risk Premia. *Financial Analysts Journal*, (3), 32-43.

Cornell, B. (1983). The Money Supply Announcements Puzzle: Review and Interpretation. *American Economic Review*, 73(4), 644.

Danthine, J., Donaldson, J. B., & Siconolfi, P. (2006). Distribution Risk and Equity Returns. *FAME - International Center for Financial Asset Management and Engineering*. Research Paper N°161

Damodaran, A. (2008). What is the Riskfree Rate? A Search for the Basic Building Block. Available at SSRN: http://ssrn.com/abstract=1317436 or http://dx.doi.org/10.2139/ssrn.1317436

Damodaran, A. (2013). Equity Risk Premiums (ERP): Determinants, Estimation and Implications. Available at *SSRN*: http://ssrn.com/abstract=2238064 or http://dx.doi.org/10.2139/ssrn.2238064

Damodaran, A. (2015). Equity Risk Premiums (ERP): Determinants, Estimation and Implications. Available at *SSRN*: http://ssrn.com/abstract=2581517 or http://dx.doi.org/10.2139/ssrn.2581517

Dasgupta, P. (2008). Discounting climate change. *Journal Of Risk & Uncertainty*, 37(2/3), 141-169. doi:10.1007/s11166-008-9049-6

DeLong, J. B., & Magin, K. (2009). The U.S. Equity Return Premium: Past, Present, and Future. *Journal Of Economic Perspectives*, 23(1), 193-208. doi:http://dx.doi.org.proxy.lib.odu.edu/10.1257/jep.23.1.193

Derrig, R. A., & Orr, E. D. (2005). Equity Risk Premium: Expectations Great and Small: Author's Reply. *North American Actuarial Journal*, 9(1), 124-126.

Du, D. (2006). Monetary policy, stock returns and inflation. *Journal Of Economics & Business*, 58(1), 36-54. doi:10.1016/j.jeconbus.2005.06.003

Duarte, F. M., & Rosa, C. (2015). The equity risk premium: a review of models. *Federal Reserve Bank of New York Staff Reports*, no. 714

Easton, P., & Sommers, G. (n.d). Effect of analysts' optimism on estimates of the expected rate of return implied by earnings forecasts. *Journal Of Accounting Research*, 45(5), 983-1015.

Epstein, L. G., & Zin, S. E. (1989). Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework. *Econometrica*, 57(4), 937-969.

Epstein, L. G., & Zin, S. E. (1991). Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: An Empirical Analysis. *Journal Of Political Economy*, 99(2), 263-286.

Epstein, L. G., & Zin, S. E. (2001). The Independence Axiom and Asset Returns. *Journal Of Empirical Finance*, 8(5), 537-572.

Falato, A. (2009). Happiness maintenance and asset prices. *Journal Of Economic Dynamics & Control*, 33(6), 1247-1262.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *Journal Of Finance*, 25(2), 383-417.

Fama, E. F. (1981). Stock Returns, Real Activity, Inflation, and Money. *American Economic Review*, 71(4), 545-565.

Fama, E. F., & French, K. R. (1988). Dividend yields and expected stock returns. *Journal Of Financial Economics*, 223-25. doi:10.1016/0304-405X(88)90020-7

Fama, E. F., & French, K. R. (2002). The Equity Premium. *Journal Of Finance*, 57(2), 637-659.

Fama, E. F., & Schwert, G. W. (1977). Asset Returns and Inflation. *Journal Of Financial Economics*, 5(2), 115-146.

Firth, M. (1979). The Relationship Between Stock Market Returns and Rates of Inflation. *Journal Of Finance*, 34(3), 743-749.

Fisher, I. (1930). *The Theory of Interest, as determined by Impatience to Spend Income and Opportunity to Invest it*. New York, NY: Macmillan. Available online at http://files.libertyfund.org/files/1416/Fisher_0219.pdf

Fisher, S. J. (1994). Asset trading, transaction costs and the equity premium. *Journal Of Applied Econometrics*, 9S71-S94.

Friend, I., Landskroner, Y., & Losq, E. (1976). The demand for risky assets under uncertain inflation. *The Journal Of Finance*, 31(5), 1287-1297. doi:10.1111/j.1540-6261.1976.tb03214.x

Jaffe, J. F., & Mandelker, G. (1976). The 'Fisher Effect' for Risky Assets: An Empirical Investigation. *Journal Of Finance*, 31(2), 447-458.

Jorion, P., & Goetzmann, W. N. (1999). Global Stock Markets in the Twentieth Century. *Journal Of Finance*, 54(3), 953-980.

Gallagher, L., & Taylor, M. (2002). The stock return-inflation puzzle revisited. *Economics Letters*, 75(2), 147-156.

Gordon, M. J. (1962). *The investment, financing, and valuation of the corporation*. Homewood, Ill., R.D. Irwin, 1962.

Gordon, M. J., & Shapiro, E. (1956). Capital Equipment Analysis: The Required Rate of Profit. *Management Science*, (1). 102-110.

Graham, J. R., & Harvey, C. R. (2012). The Equity Risk Premium in 2012. Available at SSRN: http://ssrn.com/abstract=2020091 or http://dx.doi.org/10.2139/ssrn.2020091

Gregoriou, A., & Kontonikas, A. (2010). The long-run relationship between stock prices and goods prices: New evidence from panel cointegration. *Journal Of International Financial Markets, Institutions & Money*, 20(2), 166-176. doi:10.1016/j.intfin.2009.12.002

Gul, F. (1991). A theory of disappointment aversion. *Econometrica*, 59(3), 667-686.

Gultekin, N. B. (1983). Stock Market Returns and Inflation: Evidence from Other Countries. *Journal Of Finance*, 38(1), 49-65.

Guvenen, M. F. (2003). A Parsimonious Macroeconomic Model for Asset Pricing: Habit Formation or Cross-sectional Heterogeneity?. Rochester Center for Economic Research. Working Paper No. 499

Hall, R. E. (2014). Quantifying the Lasting Harm to the U.S. Economy from the Financial Crisis. National *Bureau of Economic Research, Inc, NBER Working Papers:* 20183.

Heaton, J. (1995). An Empirical Investigation of Asset Pricing with Temporally Dependent Preference Specifications. *Econometrica*, (3). 681.

Heaton, J., & Lucas, D. (1995). The Importance of Investor Heterogeneity and Financial Market Imperfections for the Behavior of Asset Prices. *Carnegie-Rochester Conference Series On Public Policy*, 421-32.

Heaton, J., & Lucas, D. (n.d). Evaluating the effects of incomplete markets on risk sharing and asset pricing. *Journal Of Political Economy*, 104(3), 443-487.

Huggett, M. (1993). The risk-free rate in heterogeneous-agent incomplete-insurance economics. *Journal Of Economic Dynamics & Control*, 17(5-6), 953-969.

Ibbotson, R. G., & Goetzmann, W. N. (2005). History and the Equity Risk Premium. *Yale ICF* Working Paper No. 05-04. Available at SSRN: http://ssrn.com/abstract=702341

Ibbotson, R. G., & Sinquefield, R. A. (1976). Stocks, Bonds, Bills and Inflation: Year-by-Year Historical Returns (1926–74). *Journal of Business*, 49 (1), 11-47.

Ibbotson SBBI 2011 Classic Yearbook. Ibbotson Associates (2011).

Ibbotson's Answer (n.d.). Ibbotson Associates. https://corporate.morningstar.com/ib/documents/MethodologyDocuments/IBBAssociates/IntnlRiskPremium.pdf

Jones, C. M. (2002). A Century of Stock Market Liquidity and Trading Costs. Available at SSRN: http://ssrn.com/abstract=313681 or http://dx.doi.org/10.2139/ssrn.313681

Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, (2). 263-292.

Kaltenbrunner, G., & Lochstoer, L. A. (2010). Long-Run Risk through Consumption Smoothing. *Review Of Financial Studies*, 23(8), 3190-3224.

Kaul, G. (1987). Stock Returns and Inflation: The Role of the Monetary Sector. *Journal Of Financial Economics*, 18(2), 253-276.

Kocherlakota, N. R. (1996). The Equity Premium: It's Still a Puzzle. *Journal of Economic Literature*, (1). 42.

Kuehn, L., Petrosky-Nadeau, N., & Zhang, L. (2013). An Equilibrium Asset Pricing Model with Labor Market Search. *National Bureau of Economic Research, Inc, NBER Working Papers:* 17742.

Kyriacou, K., Madsen, J. B., & Mase, B. (2006). Does inflation exaggerate the equity premium?. *Journal Of Economic Studies*, 33(5), 344-356. doi:10.1108/01443580610706573

Laopodis, N. T. (2006). Dynamic Interactions among the Stock Market, Federal Funds Rate, Inflation, and Economic Activity. *Financial Review*, 41(4), 513-545.

Lee, B. (1992). Causal Relations among Stock Returns, Interest Rates, Real Activity, and Inflation. *Journal Of Finance*, 47(4), 1591-1603.

Lettau, M., Ludvigson, S., & Wachter, J. (2007). The declining equity premium: What role does macroeconomic risk play?. *Review Of Financial Studies*, 21(4), 1653-1687.

Lintner, J. (1975). Inflation and security returns. *The Journal Of Finance*, 30(2), 259-280. doi:10.1111/j.1540-6261.1975.tb01809.x

Liu, Y. A., Hsueh, L. P., & Clayton, R. J. (1993). A Re-examination of the Proxy Hypothesis. *Journal Of Financial Research*, 16(3), 261-268.

Mankiw, N. G., & Zeldes, S. P. (1991). The Consumption of Stockholders and Non-Stockholders.

McCarthy, J., Najand, M., & Seifert, B. (1990). Empirical Tests of the Proxy Hypothesis. *Financial Review*, 25(2), 251-263.

Mehra, R., & Prescott, E. C. (1985). The Equity Premium: A Puzzle. *Journal of Monetary Economics*, 15 (2), 145–161.

Mehra, R., & Prescott, E. C. (2008). Chapter 1: The Equity Premium. ABCs. *Handbook Of The Equity Risk Premium*, 1-36. doi:10.1016/B978-044450899-7.50004-X

Merton, R. C. (1973). An Intertemporal Capital Asset Pricing Model. *Econometrica*, (5), 867-887.

Mishkin, F. (2002). Is the Fisher effect for real? A reexamination of the relationship between inflation and interest rates. *Journal Of Monetary Economics*, 30(2), 195-215.

Moerman, G., & van Dijk, M. (n.d). Inflation risk and international asset returns. *Journal Of Banking & Finance*, 34(4), 840-855.

Najand, M. (1991). A Test of the Risk Premium Hypothesis. *Journal Of Financial Research*, 14(3), 207-216.

Najand, M., & Noronha, G. (1998). Causal Relations among Stock Returns, Inflation, Real Activity, and Interest Rates: Evidence from Japan. *Global Finance Journal*, 9(1), 71-80.

Nelson, C. R. (1979). Recursive Structure in U.S. Income, Prices, and Output. *Journal Of Political Economy*, 87(6), 1307.

Piazzesi, M., Schneider, M., & Tuzel, S. (2007). Housing, consumption and asset pricing. *Journal Of Financial Economics*, 83(3), 531-569. doi:10.1016/j.jfineco.2006.01.006

Rietz, T. A. (1988). The Equity Risk Premium: A Solution. *Journal Of Monetary Economics*, 22(1), 117-131.

Ross, S. A. (1976). The arbitrage theory of capital asset pricing. *Journal Of Economic Theory*, 13341-360. doi:10.1016/0022-0531(76)90046-6

Routledge, B., & Zin, S. (2003). Generalized Disappointment Aversion and Asset Prices. *Journal Of Finance*, 65(4), 1303-1332.

Samuelson, P. A. (1965). Proof That Properly Anticipated Prices Fluctuate Randomly. *Industrial Management Review*, 6(2), 41.

Schmeling, M., & Schrimpf, A. (2011). Expected inflation, expected stock returns, and money illusion: What can we learn from survey expectations?. *European Economic Review*, 55(5), 702-719.

Sharpe, W. F. (1966). Mutual fund performance. *Journal Of Business*, 39(1), 119-138.

Sinclair, P. (2010). *INFLATION EXPECTATIONS.* New York (NY): Routledge.

Smith, P. N., Sorensen, S., & Wickens, M. R. (2008). General Equilibrium Theories of the Equity Risk Premium: Estimates and Tests. *Quantitative and Qualitative Analysis in Social Sciences*, 2(3), 35-66.

Solnik, B. (1983). The Relation between Stock Prices and Inflationary Expectations: The International Evidence. *Journal Of Finance*, 38(1), 35-48.

Song, Z. (2007). The Equity Risk Premium: An Annotated Bibliography. *The Research Foundation of CFA Institute Literature Review*, 2 (1).

Sundaresan, S. M. (1989). Intertemporally dependent preferences and the volatility of consumption and wealth. *Review Of Financial Studies*, 2(1).

Swan, P. L. (2002). Does 'Illiquidity' Rather Than 'Risk Aversion' Explain the Equity Premium Puzzle?: The Value of Endogenous Market Trading. *University of Sydney School of Business* Working Paper; EFA 2002 Berlin Meetings Discussion Paper. Available at SSRN: http://ssrn.com/abstract=251399 or http://dx.doi.org/10.2139/ssrn.251399

Thaler, R. H., & Johnson, E. J. (1990). Gambling with the House Money and Trying to Break Even: The Effects of Prior Outcomes on Risky Choice. *Management Science*, 36 (6), 643-660. Available at SSRN: http://ssrn.com/abstract=1424076

Titman, S., & Warga, A. (1989). Stock Returns as Predictors of Interest Rates and Inflation. *Journal Of Financial And Quantitative Analysis*, 24(1), 47-58.

Tobin, J. (1958). Liquidity preference as behavior towards risk. *Review Of Economic Studies*, 2565-86.

Veronesi, P. (2004). The Peso problem hypothesis and stock market returns. *Journal Of Economic Dynamics & Control*, 28(4), 707-725.

Wahlroos, B., & Berglund, T. (1986). Stock Returns, Inflationary Expectations and Real Activity: New Evidence. *Journal Of Banking And Finance*, 10(3), 377-389.

Wei, K. J., & Wong, K. M. (1992). Tests of Inflation and Industry Portfolio Stock Returns. *Journal Of Economics & Business*, 44(1), 77-94.

Welch, I. (2000). Views of Financial Economists on the Equity Premium and on Professional Controversies. *The Journal of Business*, 73 (4), 501-537.

Welch, I., & Goyal, A. (2008). A comprehensive look at the empirical performance of equity premium prediction. *Review Of Financial Studies*, 21(4), 1455-1508.

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