

EQUITY PREMIUM PUZZLE: A CRITICAL REVIEW

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ABSTRACT

Economics, grappled with many unknowns, undoubtedly, radically affects our lives. Paradoxes and puzzles, which combine human behaviour and economics, have been striking subjects for many decades. One of the universally known puzzles, “Equity Premium Puzzle”, denominated by Mehra and Prescott (1985), is comprehensively reviewed throughout this study.

Equity risk premium, with its easiest meaning, is the reward for investors holding riskier assets in their portfolios. To calculate it, it is crucial to decide on its determinants; namely, market index, risk-free asset, time period of observations, maturity date of securities, and statistical preferences. As time goes by, the complexity of equity premium has been elevated.

Mehra and Prescott (1985), through examining the US data between the years 1889 and 1978, found that plausible values of relative risk aversion cannot explain the magnitude of the risk premium, when used a time-additive utility function. Their results were robust to probable errors in measuring inflation rate, tax considerations, changing time period, data generation process, growth rate persistence, firm’s commitments in fixed payments, and production and capital accumulation into the model.

After the introduction of the puzzle to the literature, large number of studies were done to solve the puzzle. Several studies query whether changing the time period and the location used in the study change the main study’s findings or not. Results of those studies usually support the main findings. Mean aversion and reversion are also incapable of solving the puzzle. Relaxing the parametric limitations, namely, the intertemporal elasticity of substitution and the coefficient of relative risk aversion, on main study do not work, as well. On the other hand, focusing on individual preferences rather than the theoretical and mathematical framework of the puzzle and describing investors as irrational may pave the way to solve the puzzle.

Keywords: Equity Premium Puzzle, Equity Risk Premium, Behavioural Finance.

1. INTRODUCTION

As Adam Smith, widely considered to be “The Father of Modern Economics”, stated in one of his best-known works, people are keenly interested in the unknown, indeed (Smith, 1887, p. 279). Economics, which includes many unknowns, has a substantial impact on our lives. Especially, microeconomics deals with paradoxes, and puzzles being continuously inherent in human nature.

This inference is consistent with what Hansen (1937) as cited in Mukherjee, et al. (2003, s. 1) said; economics is the study of the price and the humanity.

As a general truth, human beings are not perfectly designed by nature, and so is the economics. As time goes by, troubles which cannot be solved by using traditional finance models have been increasing; hence, behavioural economics have been one of the most popular fields in economics (Kahneman & Smith, 2002). The issues in traditional models are derived from the assumption of being rational of individual behaviour in economic theory (Skousen & Taylor, 1997, s. 1). However, especially, considering real economies, it is almost impossible.

One of the commonly known puzzles of microeconomics is “Equity Premium Puzzle” (EPP)¹, coined by Mehra and Prescott (M&P) (1985) which will have been examined throughout this article. What is more, this article presents a definition of the equity premium (ERP), an explanation to why it is widely accepted as a puzzle, how economists attempt to solve the EPP, and my own opinions regarding this famous puzzle in economics.

2. EQUITY PREMIUM PUZZLE: FOUNDATIONS

2.1. A Brief Definition of “Equity Premium” and Capital Asset Pricing Model (CAPM)

Before going into the details of so called “Equity Premium Puzzle” it is necessary that to clarify what equity premium is.

The most striking underlying aspect of finance is –undoubtedly- to create an investment portfolio to maximise returns through asset allocation, and simultaneously spread the risk of those assets in order to minimise risk on them (Bodie, Kane, & Marcus, 2011, s. 56). There are many financial instruments some of which are riskier compared to the others, and there must be a noticeable reward to hold these assets rather than less-risky assets. This difference of reward is called “Risk Premium (ERP)” (Bodie, Kane, & Marcus, 2011, s. 157).

To figure out how ERP is essential for finance models, it is required to briefly skim the most known traditional finance model -Capital Asset Pricing Model (CAPM)- because of its close relationship to ERP.

The foundation of CAPM based on Markowitz Portfolio Theory (Markowitz, 1959) in which investors choose assets only caring about the mean and variance of one-period-lasting observation process. Additionally, investors are assumed to be risk-averse, and they attempt to minimise variance², and maximise expected return. Sharpe (1964) and Lintner (1965) added two major assumptions to the Markowitz Model: According to the first assumption, considering the corresponding market-clearing asset prices at t-1, investors agree on the joint distribution of asset returns from t-1 to t; whereas, the second one assumes the same amount of borrowing and lending at a risk-free rate for all investors (Fama & French, 2004).

2.2. How to Determine Equity Risk Premium?

In order to calculate equity premium, it is necessary to decide on determinants creating the equation of risk premium. The first variable here is the market index. Hirt and Block (1996) as cited in Okorafor (2008, s. 80) stated market performance of securities must be valued by a certain standard. Therefore, indices measuring historical rates of return have been created proxied as standards. The other crucial determinant is to choose the

¹ Also known as “Market Premium Puzzle”, “Risk Premium Puzzle”.

² Variance is generally accepted the equivalent of risk in finance models.

“risk-free”³ asset among less volatile assets. There are also additional key factors, such as the time period which the data is observed, maturity date of securities, and statistical preferences.

As easily could be seen, there is not a single way to calculate equity risk premium. There are remarkable choices of determinants in the world. Considering investors and the real world, this complexity of equity premium have been increasing day by day.

2.3. Theoretical Background

As I have stated above, a famous puzzle in finance is “Equity Premium Puzzle” by Mehra & Prescott (1985). They examined a class of the US data (1889-1978) in which the equilibrium growth rate process on consumption and asset returns are constant to determine arithmetic average annual real return on the chosen index (S&P 500) and on relatively riskless treasury securities, and the process of the growth rate of consumption. They used a time-additive utility function restricted only by the value of constant relative risk aversion (CRRA), A . Consequently, they achieved that over the 90-year-period, the average return on S&P 500 Index was about 6.98, and the standard deviation was approximately 16.14; conversely, considering the relatively riskless security, these results were 0.80 and 5.67, respectively; thus, the risk premium was 6.18, and its volatility was 16.67. However, plausible range of A -values⁴ could not be able to explain this striking magnitude using a traditional pricing model. Accepting higher values of A meant accepting to pay more of your wealth to avoid of losing relatively lower values than the values connected to lower A -values of your wealth in a gamble, which seems implausible. Moreover, the set they used included after-tax returns and some measurement errors being ineffective in the robustness of their results.

A comprehensive study regarding the EPP was carried out by Abel (1991). According to his review, the CCAPM, which had been derived from the CAPM, was used also in a similar manner in the functions of M&P, and aggregate consumption was considered in his formula rather than the return on the market portfolio, should be encouraged to make further research in this area. Moreover, it might be required to take into account of modifications, such as investor preferences and generalised attitudes towards risk, which could assist to explain the huge discrepancy in asset returns.

Kocherlakota (1996) was another economist examining the striking EPP. He achieved the result that the EPP depended on the large discrepancy between the cost of trading and bond markets, and opposed to M&P, they imposed an idea - coefficient of CRRA could be larger than 10 concerning consumption.

A different study was conducted by Mankiw and Zeldes (1991), who questioned 2998 families on the size and allocation of their wealth. Although his data covered a short period of time, statistical errors, and just one type of consumption, he achieved that substantial consumption differences displayed between families, and stockholder consumption was more linked to excess equity returns than did to total consumption. As consistent with M&P results, CRRA-coefficient was still too large to be reasonable. Mehra and Prescott (2003) calibrated their data set between the years 1802 and 2000 and examined it for a certain number of countries. They obtained an ERP of 6.9, which was throughout the Post-World-War more striking, and statistical differences were like countries the UK, France, German and Japan. According to their results, although the more recent value had lower values of ERP, the historically observed ERP was considerably high for the economy.

A study denying the existing excess average return on equities was conducted by Rietz (1988). Rather than using a frictionless, pure exchange economy model, he used a crash-

³ Less volatile, less risky.

⁴ Between zero and ten.

possible model, and he argued that such a model was able to explain the high ERP and low returns on risk-free assets with a plausible range of time preferences and risk aversion. However, he is sharply criticised by Mehra and Prescott (1988): Data in his study had not been reasonably examined and there was a shortage of support; furthermore, it also comprised irrational equations and parameters. Consequently, the puzzle had not been extended in the same way as Barro (2006), a supporter of Rietz, which will be discussed in the next part of this paper.

3. ALTERNATIVE SOLUTIONS

Since M&P revealed the EPP, many studies carried out by economists. Some of them claim that they have already solved the puzzle, whereas the others come up against the idea of the presence of a solution to the EPP. Recent studies prove that this battle will never reach the end.

3.1. Diversification in Time (and Space)

One of the most challenging questions of the EPP is whether the time- and space-sample used in M&P's analysis represent the whole humanity.

Siegel performed quantitative analyses both of stock and treasury returns (1882-1990) over the U.S. data (Siegel, 1992a) and the real risk-free interest rate series (1800-1990) over the U.S. and the U.K. data (Siegel, 1992b). The results were striking: There was an upward trend in the mean of debt securities and stationary returns on stocks in the same period. Moreover, the returns on fixed income series were far higher than within the M&P period. Although his data differed in some ways from the M&P's data, he achieved similar results. A more attention-grabbing case was the priority of the return on debt between 1980 and 1990 over than any particular one decade-period excepting T-bills during the Great Depression. Finally, he revealed that ERP was approximately one-third as large outside the M&P period as within the M&P period. Although the ERP was observed 2.56% in strict contrast to M&P period, there was still an ERP larger than one, and CRRA should be between one and ten.

Barro (2005) claimed that the allowance for rare historical disasters could solve the EPP. Thus, he conducted an analysis over several OECD, Latin American and Asian countries using the same representative agent model with exogenous, stochastic production to extend the analysis Rietz (1988) had done. Consequently, he asserted that allowance for low-probability catastrophes enabled him to solve the puzzle, while the framework of agent function, time-additive and iso-elastic preferences remained stable. However, a study by Julliard and Ghosh (2012) refuted the validity of his study in a similar way as Mehra and Prescott (1988) did to Rietz (1988). They criticised him in his wrong preferences and his assumption regarding equivalent changes between consumption and GDP.

Other detailed study was done by Campbell (1996) He observed in his set 12 countries with most available data shifting between 16 and 104 years. He used a subset index of a large market index. Moreover, his assumptions were the dependence of on total national wealth, which was denied further for the U.S. and countries with relatively smaller stock markets, application of national preferences to data rather than individual preferences, which was resulted in appropriacy for only historical data, and to use of an aggregating representative agent utility function. Consequently, the EPP was declared to be a global phenomenon, and A was calculated many times greater than ten depending on long time horizons, and even sometimes negative due to the negative correlation between stock returns and consumption growth.

Villalobos (2017) examined the presence of the EPP for some ASEAN countries and the effect of the 2008 financial crisis on the course of the equity risk premium. By applying three model, including also traditional M&P one, they found contradictory

results regarding the existence of the puzzle as there are both negative and a magnitude of less than ten risk aversion values for the sample.

3.2. Mean Reversion & Aversion

The incapability of standard deviation on equity returns in explaining historical high returns created the equity premium puzzle (Siegel & Thaler, 1997). While observing the asset returns, they display mean reversion for equity, whereas they show mean aversion for bonds and bills. According to Gollier (2008), relative riskiness of equity compared to the same value of bonds and bills go down with the increase of time horizon. Therefore, short time investors should invest in debt obligations due to the limit of riskiness of stock returns for one-year-period. That is in accordance with the article of Siegel and Thaler (1997); for long time-horizons, the EPP should be negative.

3.3. Elasticity of Intertemporal Substitution and Constant Relative Risk Aversion

Traditionally assumed utility-function is generally denied predicting the elasticity of intertemporal substitution (EIS) because of including no connection between expected real consumption growth and the real interest rate (Liu & Sercu, 2009). Moreover, they assume that assets markets are complete and asset trading is costless. This no-frictionless model is therefore inadequate to solve the EPP (Kocherlakota, 1996).

To examine the EPP, Weil (1989) studied the effects of general equilibrium asset pricing using a non-expected utility function which assumes the interdependence between EIS and CRRA. However, it did not solve the equity puzzle; even created a new puzzle, which is called “The Risk-Free Rate Puzzle”. The additional problems there were inadequacy of individual consumption risk in order to decipher the degrees of risk aversion, and the implausibly high degree of the average rate of growth of individual consumption.

Kocherlakota (1990) calibrated the main equation of a standard utility function to separating the roles of CRRA and the intertemporal substitution. Changing preferences were able to affect the key points of the equation used (Canzoneri, Cumby, & Diba, 2007); however, they were not account for the empirical failure of the EPP. Kandel and Stambaugh (1991) separated also EIS and CRRA, and they achieved the same results advocating robustness of the EPP.

3.4. Calibrating Data Distributions

Changing data distributions is one of the means to calculate the equity premium. Through embracing Hansen and Jagannathan’s model (1991) that used volatility bounds on the standard deviation of intertemporal marginal rate of substitution (IMRS) rather than changing stochastic discount factor (SDF), Otrok, Ravikumar and Whiteman (2004) claim that for plausible risk aversion degrees, the volatility of SDF is too low to be compatible with return and consumption data. By using quarterly data between 1947 and 1977 and introducing volatility bounds to the model, they found better results when compared to the M&P study.

Lundtofte and Williamson (2013), rather than using log-linear approximations, worked with normal inverse Gaussian (NIG) distributed growth rates within their analyses. They found a more than halved relative risk aversion coefficient.

Shirvani, Stoyanov, Fabozzi and Rachev (2020) fitted log-normal compound inverse Gaussian distribution, able to catch extreme values, into the historical returns. Doing so, they claimed that the puzzle can be explained as the relative risk premium reduced. Additionally, Shirvani, Rachev and Fabozzi (2020) also asserted that employing a double subordinated model helps to resolve the puzzle, as well. However, according to Łukowski, Gemra, Maruszewski, Śliwiński and Zygmanski (2020), the success of those models is just an illusion of the time-period used there.

3.5. Investors and Their Preferences

One of the most consistent attempts to solve the EPP was, undoubtedly, considering human behaviours. Human beings always want to protect and to maintain the same level of his life standards which was entitled “Habit Formation” in finance. People paying more attention their habits dislike suddenly and large cuts in consumption; hence, a model is built for individuals behaving rational to consider holding risky assets, “time-seperable utility model” (Alvarez-Cuadrado, Monteiro, & Turnovsky, 2004). An alternative class of utility function is called “Catching up with the Joneses”, which allows the preference of national per capita consumption in the previous year. Abel (1990) built an aggregating utility function including all these tree classes. Results of his study showed striking results for further studies: Equity premium did never hit the level of 600 basis points at any A-value, volatile asset classes were extremely sensitive to the level of A, and conditional expected returns were required to conduct further studies.

Constantinides (1990) claimed that the EPP was resolved in a rational expectations model allowing time separability and habit persistence. In conformity with the assumptions of habit performance, the past consumption rate was positively related to subsistence rate of consumption, and habit performance played a substantial role between the CRRA and the inverse of the EIS. Thus, the puzzle was resolved.

As Abel (1990) stated, Chan and Kogan (2002) examined the model through separating unconditional moments of assets from conditional moments. They achieved similar results to him: The heterogeneity of the data hindered to observe plausible magnitudes of unconditional moments of assets, and to catch all features of the data.

The other tentative model regarding preferences is “Myopic Loss Aversion (MLA)”. The basic assumption of prospective theory is the foundation of MLA: “People pay more attention to losses than gains (Kahneman & Tversky, 1979).” Benartzi and Thaler (1995) harmonised this assumption with the concept of “Mental Accounting”⁵, which is defined by individual preferences to code and assess financial results. According to their results, the underlying aspect to solve the puzzle is to observe the wealth of any individual that requires a large ERP to accept volatility in returns with high sensitivity to losses, which leads to shift the orbit of the utility function.

In other study, Barberis and Huang (2008) integrated the concept of loss aversion with narrow framing defined by in case of a new gamble isolating the risk of this gamble from other risks of individuals. They also criticised the model of Benartzi and Thaler (1995) for not having a role of consumption in their model, and they pointed out the significance of the joint utility of returns and consumption. As a result, he found that to add the mix of narrow framing and loss aversion into traditional utility functions could solve the EPP.

Another factor under this title is ambiguity aversion, priority of well-defined risks over uncertain risks (Rieger & Wang, 2012). According to Erbas and Mirakhor (2010), ambiguity prevails in financial markets rather than quantifiable risk. They observed 53 markets (1996-2005), and they achieved the result that ERP was between 7.5 and 10.5 in these markets, and it is relatively higher in emerging markets compared to developed markets. Emerging markets tend to display more volatility than the others, and institutional quality indices play a substantial role to determine the ERP just in emerging markets. When ambiguity is taken account, a significant part of the premium could be related to the unquantifiable risk.

According to Rieger and Wang (2012), the problems of the study of Erbaş and Mirakhor (2010) are based on the time-preferences and semantic mistakes; thus, they undertook a

⁵ In the paper of Benartzi and Thaler (1995), mental accounting is accepted to be a definition by Kahneman and Tversky (1984) and by Thaler (1985).

survey among 5912 students from 45 different countries with cross-sectional data. Consequently, the EPP could be explained by ambiguity aversion. Moreover, they found a connection between the uncertainty avoidance of Hofstede's⁶ dimensions and the ERP: Cultural differences might affect market outcome.

4. CONCLUDING REMARKS

While some of the leading economists argue that the EPP has been already solved, whereas the others dispute that the EPP has still not been solved, even cannot be solved. As it has been already known, M&P were the originators of the EPP. They had consistent results, and they follow antitheses in this matter quite well, and they have never eschewed respond to antitheses. However, as they stated, their study includes irrefutable errors. A completely accurate study could not to be thought in the world, and in the reality, deviations from theories could be frequently seen.

Considering the CCAPM, Abel (1991) was the first author, who argued that the EPP could be solved when there was a possibility to create a method applying several modifications of behavioural finance into the CCAPM.

In my opinion, further studies regarding calibrating time preferences were generally just a little disappointing. For instance, a part of the series Siegel (1992b) used in his study covered not real proxies. The series of Campbell were also slightly complex, there was a scarcity of historical data, and the index was just a subset, even if it is assumed to be a reliable indicator for the whole world. Moreover, as the result of his paper, long horizons could assist to increase the CRRA because investors avoid repeating the same mistake.

Mean reversion and aversion are also an inadequate solution to the EPP, since developments on intertemporal preferences for bonds could not be associated with bills. As far as I am concerned, these arise out the complexity and idiosyncrasy of observed returns.

Calibrating data distributions may seem a resolution to the puzzle; however, as there is not a unique distribution, there cannot be a general resolution to the puzzle.

According to many economists, rather than focusing on theoretical and mathematical framework of the EPP, considering individual preferences can be able to solve the EPP. As even Mehra and Prescott (2003) stated that personal preferences have just a limited success to solve the puzzle, they have a spectacular success to solve the puzzle. One further point is here is the concept of the risk aversion. As Kocherlakota (1996) said, there is only a minute quantity of risk averse investors; therefore, it could be one of the common mistakes of authors to forget to evaluate investors as "irrational". As a result, the EPP could be solved to support the priority of investors' thoughts; more accurately, there is no puzzle anymore.

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⁶ Dutch Professor Geert Hofstede compared different countries according to their cultural dimensions he researched. For more information: <http://geerthofstede.com> (2021).

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