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A PUZZLE OF EXCESSIVE EQUITY RISK PREMIUM AND THE CASE OF POLAND

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Abstract

The article presents a historical review of the literature related to the empirical problem of excessive risk premium. The risk premium (the difference between the return on equities and risk-free rate) observed in financial markets cannot be reconciled with theoretical models of financial markets – it is too high ("excessive"). We present the original model from the seminal work of Mehra and Prescott (1985), where this problem has been signaled. The article gives an overview of the main trends in the literature concerning this problem, of the proposed solutions and of the extension to the model. Finally, we consider the problem in the Polish context, estimating the original Mehra-Prescott model using data from the Polish financial market.

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Introduction

In the paper we try to give a review of literature concerning the empirical problem considered in the financial literature for the last thirty years. The problem, called the "equity premium puzzle", is that observed rates of return on equity are "excessive", i.e. they are much higher than it is predicted by the theory based on general equilibrium models. In particular, in the past the difference between returns on equity and risk free interest rates was too high. In the theory of finance this difference is called risk premium. The attempts to solve this problem were important incentives in the development of the microeconomic foundations of finance theory in the last quarter of the century.

This paper is mainly a review of the literature and presentation of the latest developments. We present the genesis of the problem, briefly introducing the seminal paper of Mehra and Prescott from 1985. The model that was presented in that paper was very simple, and we show that the problem is more profound and can be seen for many standard models of financial markets. We present the possible solutions to this problem that were proposed in the literature in the last thirty years. The literature on this subject still continues to grow and for some narrow topics, especially connected with a highly mathematical approach, we present here only a brief overview. For some other topics we try to present more extensive descriptions.

In the last part of the paper we present estimations concerning the Polish financial market and we try to combine the results with the proposed solutions to the equity premium puzzle. It is impossible to perform thorough research concerning Poland because the time series are too short, however one can obtain some preliminary results and compare them with the theory. This is what we try to do here. In particular, we argue that the results from the Polish market seem to confirm the hypothesis that the excessive premium is due to some features of the economy of the United States, where this phenomenon was observed.

Mehra-Prescott model

In 1985 Rajnish Mehra and Edward C. Prescott published in "Journal of Monetary Economics" an article entitled *Equity premium: a puzzle*. In the paper the authors questioned the capital assets pricing models based on general equilibrium theory with rational expectations – models that are central for contemporary theory of capital markets based on microfoundations. They pointed out that the conclusions from the theory were inconsistent with the empirics and the gap was so huge that it cannot be explained by better estimations of theoretical models or slight changes in the assumptions or values of parameters: see (Mehra & Prescott, 1985).

The starting point was a very simple model of an exchange economy with capital markets and economic growth, based on Lucas' (1978) setup. It was assumed that a representative agent chooses investment and consumption in subsequent time periods. This agent tries to achieve the highest discounted utility from consumption, so he solves the following problem:

$$max \sum_t \beta^t E[U(c_t)]\,, \tag{1}$$

where c_t is consumption in the period t, β is the discount factor with the values in the interval from 0 to 1, and U is utility function. The value of the discount factor describes how much the consumer prefers current consumption compared with consumption in the future. The lower the discount factor is, the stronger the agent prefers current consumption. The value $\beta > 1$ would mean that the consumer prefers future consumption to current. To assure the stability of the equilibrium the authors assumed that the representative agent's utility function U belongs to the class of constant relative risk aversion function (CRRA) and has the following form:

$$U(c) = \frac{c^{1-\alpha} - 1}{1-\alpha}\,, \tag{2}$$

where $0 < \alpha < \infty$ is relative risk aversion. The higher values of this parameter mean that the consumer tries to avoid risk.

The agents can buy and sell shares of companies. At any time they can obtain dividends from the firms in which they have shares and the value of the dividends is random. The flow of dividends is described by some stochastic process. At each moment the growth rate can take one of a few values and the realization is random. The agent can also invest some part of his wealth in a risk-free bond.

The model can be simplified even further, as it was presented in (Lengwiler, 2004), retaining its essential nature and the conclusions obtained by the authors. We can assume that there are only two periods: moment *t=0* and final moment *t=1*. At the end two states of the world are possible: the rate of growth of dividends (equal to the rate of growth of the whole economy) can be equal either to g_1 or to g_2, with $g_1>g_2$. Thus in the future the situation of the economy can be either better or worse. It is also assumed that both situations are equally probable. Figure 1 presents an illustration of the structure of the model. The representative agent optimizes his expected utility from consumption in two time periods, so he solves the following problem

$$\max_{c_0, c_1} U(c_0) + \beta E[U(c_1)], \quad (3)$$

With this simple structure of the model it is easy to compute the expected utility from the consumption analytically.

In the economy described in this way, there is room for two financial instruments, in which the agents can invest: equities (shares) that pay dividends in the final period, and a risk free instrument (bond). Unlike bonds the equities are risky instruments, because the amount of dividends (and thus the return on the investment) depends on the situation in the economy in the final period. In this simple model it is possible to solve the problem (3) analytically and to compute the equilibrium on the financial market. In the equilibrium the rate of return of the riskless bond equals

$$R^f = \frac{2}{\beta[(1+g_1)^\alpha + (1+g_2)^\alpha]} - 1, \quad (4)$$

and the expected rate of return on the equity is equal to

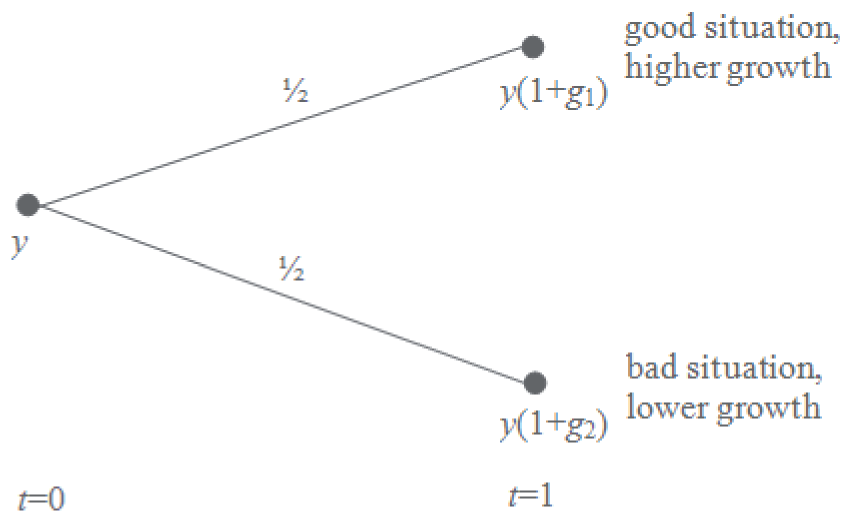
$$E[R] = \frac{2+g_1+g_2}{\beta[(1+g_1)^{1-\alpha} + (1+g_2)^{1-\alpha}]} - 1, \quad (5)$$

The difference between expected rate of return on equity and risk-free rate is the (equity) risk premium. It is a compensation for the investor for allocating part of his/her wealth in a risky financial instrument. As one can see from (4) and (5) both the value of the risk-free rate and the size of the risk premium depend on four parameters: discount factor (β), relative risk aversion (α) and possible rates of growth of consumption (g_1 and g_2). Substituting appropriate values of parameters to the formulas (4) and (5) one can obtain the values of risk premium and the risk-free rate resulting from the theoretical, general equilibrium model.

The problem

Mehra and Prescott verified the model using data concerning share prices, mean dividends, bond yields and consumption of non-durable goods in the United States in the years from 1889 to 1978. Based on the observations of consumption they found that real consumption per

Figure 1: The structure of the simplified Mehra-Prescott model



Source: Based on Lengwiler, Y. (2004). Microfoundations of Financial Economics. Princeton: Princeton University Press capita in this period grew with the mean rate 1.83% yearly with the standard deviation 3.70%. These values allow us to determine possible growth rates g_1 and g_2. In the model depicted in Figure 1 these values of expected growth rate and standard deviation can be obtained taking g_1=*5.4%* and g_2=*-1.8%*.

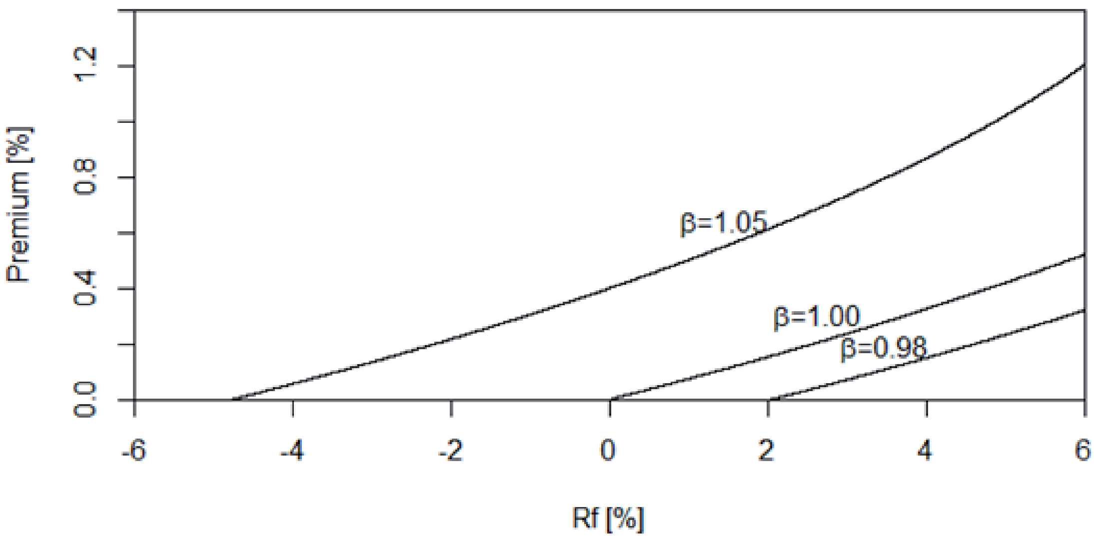
The data on mean yearly values of the Standard&Poor 500 stock market index, augmented by the mean amount of dividends and divided by inflation rate were treated as observation of real prices of a risky instrument. Yearly returns of this time series were treated as the empirical equivalent of returns on equity in the model. The mean value of these returns served as the *ex post* estimation of expected rate of return on the equity. The risk-free interest rate was estimated from the yields of government bonds corrected for inflation. For the years 1920-1978 the yield of 90-day treasury bills were taken and for the period prior to 1920 the authors used treasury bills with the maturity from 60 to 90 days.

Mehra and Prescott found that the mean value of the risk-free rate in the period under consideration was 0.80% yearly with the standard deviation 5.67%. Mean value of return on risky assets was 6.98% yearly with the standard deviation 16.54%. It means that risk premium in the considered period was on average equal to 6.18%. The standard deviation of the risk premium was equal to 16.67%.

Figure 2 shows all combinations of risk-free rate R^f and risk premium $E[R]-R^f$ that are possible to obtain in the Mehra-Prescott model calibrated to the consumption growth pattern in the US economy (i.e. g_1=*5.4%* and g_2=*-1.8%*). The graph should be interpreted as follows: the line marked β=*1.05* depicts all possible combinations of risk premium and risk-free rate, assuming that discount factor equals 1.05 and risk-aversion factor can change freely. Similarly, the line market β=*1.00* depicts all possible combinations of risk premium and risk-free rate, with different values of the parameter α and discount factor parameter equal to 1.00. Some values of R^f in the abscissa are negative, but one should bear in mind that there are theoretical values obtained in the model, and that in the historical real risk-free rates (i.e. corrected for inflation) these were in fact negative in some periods.

As one can easily see, there is no combination of the parameters that allows obtaining both characteristics of the model (risk premium and risk-free rate) in accordance with observed values. For each reasonable value of parameters the risk premium is "excessive" – much higher that the model predicts. Assuming (contrary to common sense), that the discount factor is greater than 1, one can obtain risk premium a little higher than 1%, but only for a rather high risk-free rate. The disproportion is by no means small or subtle. The point representing observed values of the characteristics (0.08%, 6.18%) cannot be even placed on the graph.

Figure 2: Risk-free rate and risk premium in the Mehra-Prescott model for different values of discount factor and risk aversion



Source: Based on Mehra, R., Prescott, E.C. (1985). The Equity Premium: a Puzzle. Journal of Monetary Economics, vol. 15, pp. 145-161; Lengwiler, Y. (2004). Microfoundations of Financial Economics. Princeton: Princeton University Press

The Mehra-Prescott model was very simplified but the puzzle remains in more general and realistic models. The general equilibrium model of Radner (1972) allows for many risky financial assets, many possible states of the world and the time horizon is infinite. In this exchange model there are many agents who buy and sell financial products in order to maximize their utility, and prices are set to establish market equilibrium. As it was shown for example in (Campbell & Cochrane, 1999) or (Kandel & Stambaugh, 1991), assuming that the representative agent has utility function with constant relative risk aversion (CRRA), the following conclusions concerning pricing of a financial instrument in the equilibrium can be drawn from the model:

$$\ln R^f \approx \alpha E[g] - \ln\beta, \quad (6)$$

and

$$E[R^i] - R^f \approx \frac{\alpha}{1-\alpha E[g]} cov(R^i, g), \quad (7)$$

where R^i is rate of return of any equity, R^f is risk-free rate, $\alpha>0$ is relative risk aversion, $\beta\in(0,1)$ is discount factor and g is rate of growth of consumption. Campbell (2003) has calculated risk-free rates and average rates of growth of consumption $E[g]$ for a set of countries, including the United States, United Kingdom, Germany, Italy, Canada and Japan. Assuming that the discount factor does not surpass unity, the equation (6) gives the values of relative risk aversion α. The estimated numbers are in the interval from 0.98 to 3 and these values are consistent with intuition and with other estimates of risk aversion. The problem is with the equation (7), according to which the risk premium on equity is proportional to the covariance between rate of return of this equity and growth rate of the consumption. The risk premium is usually very high, while the consumption is usually smoothed across periods and it has low variance. The covariance between growth rate of consumption and returns on equity is also typically small. To fulfill the equation (7) one should take the high value of relative risk aversion α – even greater than 10. Combining this with the equation (6) leads to high values of the discount factor. Again, one obtains a discount factor greater than 1, which is counterintuitive, because it means that the representative agent is infinitely patient – he prefers consumption far in the future over present consumption.

The height of the risk premium can be assessed also with the capital asset pricing model (CAPM). One of the main indicators for *ex post* evaluation of investments is Sharpe ratio (introduced in Sharpe, 1966).S^i defined as the ratio of risk premium to the standard deviation of return from the investment:

$$S^i = \frac{E[R^i] - R^f}{\sigma_i}, \quad (8)$$

where σ_i is standard deviation of the rate of return of the equity. Hansen and Jaganathan (1991) used Consumption-based Capital Asset Pricing Model (CCAMP) (see for example Romer, 1996, p. 329) to compute upper limitations on the values of this ratio. According to their calculations the Sharpe ratio cannon surpass the value $\alpha(1+R^f)\sigma_g$, where σ_g is the standard deviation of growth rate of consumption. For the data from Mehra and Prescott paper this limitation is 0.0373 α, while the value of Sharpe ratio for S&P 500 in the period under consideration was 0.374. It means that risk aversion should be greater than 10, which is a very high value and cannot be reconciled with other estimations of these parameters. For example Friend and Blume (1975) based on the analysis of data concerning incomes and wealth of households estimated relative risk aversion to be equal more or less to 2. Chetty (2006) based on the analysis of elasticity of work supply concluded that upper limitation for relative risk aversion is 3.

As one can see, the risk premium for American equities estimated by Mehra and Prescott cannot be reconciled not only with their simple model, but it is also inconsistent with observed covariances between returns on equities and consumption growth, as well as with the conclusions from the standard CAPM model. In other words, the evidence presented by those two authors was the challenge for the modern theory of finance.

Proposed solutions and extensions

Although Mehra and Prescott (1985) were not the first who pointed out the excessive equity risk premium – similar remarks were made by Grossman and Shiller (1981), Shiller (1982) as well as by Mankiw (1981) – it was their explicit articulation of the problem that lead to the development of the rich literature concerning this question. Some of the later papers contain extensions of the simple Mehra-Prescott model. Other works undertake efforts to solve the empirical puzzle: either by new empirical research or by suggesting corrections to the theory and taking into account some new, important phenomena, like sample bias or changes in the risk premium We will state a brief overview of this literature.

The extensions of the model

The model that was used by Mehra and Prescott as well as the more sophisticated model of Radner that produced equations (6) and (7) are pure exchange models without production. If there is no production, intertemporal transfers of consumption are impossible – all the endowments should be consumed at the spot and cannot serve as an input for the production processes that result in the next moment. In the equilibrium all resources are consumed immediately. Jermann (1998) developed a model for pricing assets in the productive economy. Similarly to Rouwenhorst (1995) he pointed out that accounting for production makes the problem of excessive risk premium even more biting, because it allows the agents to invest in productive capital, which facilitates intertemporal transfers of consumption and allows us to smooth consumption even more. More smoothed consumption means less risk, thus the risk premium should be even smaller than in a pure exchange model. The only possibility to explain higher risk premium is to assume that there are very huge adjustment costs (costs of installing and deinstalling productive capital), like in the model of Tobin's q (see for example Romer, 1996, p. 348).

Solutions based on the difference between measured and real risk

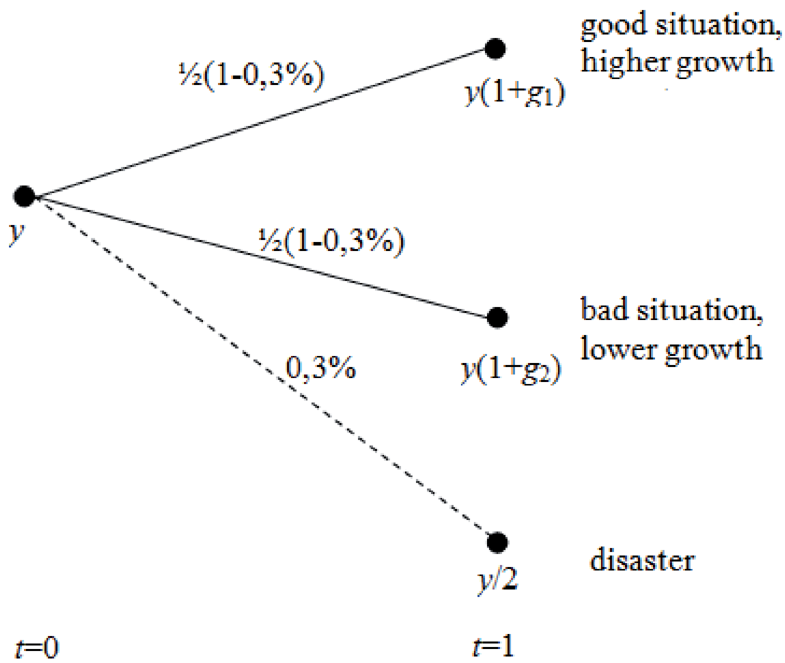
The risk premium is the difference between expected return of a risky asset and risk-free interest rate. Expected return is a theoretical concept; it refers to the future possible outcomes and expectations concerning future results. In the research and measuring of risk premium the historical data was used. There is a group of solutions to the puzzle that is based upon the discrepancy between *ex post* and *ex ante* judgments.

Poterba and Summers (1988) considered a possibility of long-term relationships in the returns on equity. The existence of positive relationships would mean that long-term return on equity is more risky than returns in the one-year period, that were used by Mehra and Prescott. The risk, as measured with variance of rate of return, would grow with the length of time-period with greater pace than linearly. If the agents in the economy had a sufficiently long planning horizon, then the higher long-term risk would account for the higher risk premium. On the other hand, the negative long-run relationships would make the problem more severe – the long-term risk would be lower than the values calculated on the basis of variances of yearly returns. The risk premium would be even greater with respect to long-term risk of returns and this would increase the Sharpe ratio.

Poterba and Summers looked for such relationships in the returns of equities in United States in the period 1871-1986 and in seventeen other countries in the period 1957-1985. They also performed the research for 82 individual companies in the period 1926-1985. They tested for autocorrelation in the return series for the lags from one month up to 8 years. The results were ambiguous. In some countries the relationships were negative and in other countries – there were positive autocorrelations. In both cases the relationships were not very strong.

Rietz (1988) claimed that historical (*ex post*) mean returns and variations of the returns could be significantly different from the *ex ante* values of these characteristics, and that the risk measured from historical data is too small compared to its real value, because historical data does not account for situations that could have happened, but haven't happened in the actual course of history. He proposed a slight modification of the Mehra-Prescott model by addinga third possible state of the world that can be interpreted as a "disaster", and in which the agent loses a significant part of his wealth. Figure 3 depicts the structure of this modification. It is assumed that the probability of the "catastrophe" is 0.3% and that in this state the agent will lose half of his wealth (it is only one of many parameterizations. Rietz has considered the losses of wealth in the interval from 25% to 98%). As Rietz has calculated, in such a model the discount ratio $\beta=0,9$ combined with the relative risk aversion $\alpha=5$ allows us to explain observed risk premium. The estimations of Mehra and Prescott were based on US data, where such a disastrous state has not happened in the considered period. However in other countries similar "catastrophes" have taken place and perhaps there are reasons to believe that a representative agent, while forming his expectations, takes into account the possibility of such situations.

Figure 3: Mehra-Prescott model with catastrophic state



Source: Based on Rietz, T.A. (1988). The Equity Premium: a Solution. Journal of Monetary Economics, vol. 22, pp. 117-131

The disadvantage of Rietz's solution is that there is no way to verify it empirically. The hypothesis does not seem to be falsifiable. The solution was immediately criticized by Mehra and Prescott (1988), who claimed that the proposed disastrous scenarios are too extreme and there is lack of historical precedents supporting Rietz's considerations. They also noted that in many crises the government bonds (that were used to estimate risk-free rates) have lost their values (because of high inflation or refusal to pay off the debt). With the existence of such a disastrous state the risk-free bond in the model becomes a risky asset and the difference between expected return on equity and risk-free rate should not grow sufficiently to explain the observed risk premium.

Rietz's proposal was restored by Barro (2005), according to whom extreme events can in fact explain the risk premium. In his paper he used a more complicated model than Rietz's, introducing also labor market and taxation. He also collected historical precedents of severe falls in GDP during wars and depressions. He pointed out that in many of these events, the returns on equities have fallen much deeper than yields of government bonds and in many cases there weren't any declines in the real interest rates.

Solutions based on consumer customs

Constantides (1990) proposed a solution to the equity premium puzzle, by rejecting the assumption that a representative agent is interested only in the current value of the stream of utility from consumption. He assumed that there is some optimal level of consumption, which forms with time as a result of a consumer's habit formation. The consumption in the past lowers the utility of the current consumption because of two reasons. Firstly, the past consumption forms some reference level and expectations for the future: being accustomed to some level of consumption lowers the utility from the current consumption. There is also a second mechanism with which consumption in the past influences current utility: some part of consumption spending is on durable goods. Buying a washing machine, house or car affects utility far in the future.

The conclusions from the model proposed by Constantides were tested empirically: in the original paper as well as in other works (among others: Dunn & Singleton, 1986; Eichenbaum & Hansen, 1990; Ni, 1993). However the results were ambiguous. There is some local influence of past consumption on the utility of the current consumption, but the influence was not as longlasting as in the Constantides model. According to Ni (1993) the problems with the estimation of the model might result from the problems with the evaluation of the consumption of durable goods.

Jobert, Platania and Rogers (2006) considered how consumers form their expectations. They assumed that a representative agent is not perfectly sure that he knows the real values of parameters of distribution that describes future dividends. If the situation on the market changes, than the agent will change his expectations concerning parameters. The authors assumed that the agent has some expectations *a priori* and then he changes them rationally, according to Bayes' rule. They pointed out the well-known fact that estimating expected returns is more difficult and more uncertain than the estimation of the variance. In their approach the excessive risk premium stems from the delay in the evaluation of the changes in expected returns on equities – the representative agent is for too long convinced that the risk premium is lower than it really is.

A sample bias

One of the solutions to the excessive risk premium puzzle is based on the distinction between premium *ex ante* and premium *ex post*. In a way it resembles the disastrous state hypothesis, proposed by Rietz (1988). Mehra and Prescott have used the data for the US economy. In the period under consideration this economy experienced unparalleled success, which is hard to find somewhere else in the world. Much other empirical research that confirms the existence of the excessive risk premium is based on US data. To some extent it is connected with the fact that many research economists live and work right in the United States. Until 2013 out of a total number of 74 Nobel-prize winners in economics, 51 worked in the United States, which is almost 70%. The fact that so many economists work in the US is to a great extent connected with the fact that the economy of this country developed very much at the end of the 19th century and in the 20th century. A huge part of this growth was however unforeseen. As Brown, Goetzmann and Ross (1995) pointed out, reasoning with the evidence based on the US data is biased, because of the bias in sampling[1].

The research by Siegel (1988) seems to support this hypothesis. Based on the time series of the returns on equities in Germany, Japan and United Kingdom he claimed that the risk premium was in these countries much smaller than in the United States. In his further work Siegel (1999) has detected a fall in the risk premium in the United States. He also has observed that in the countries that had survived huge collapses in financial markets, the owners of bonds usually suffered large losses because of inflation. Thus estimating the risk-free interest rate from the yield of government bonds is not fully proper practice. However in long periods of history there were no inflation-indexed bonds, so to find a good empirical counterpart for the riskless rate is not an easy task.

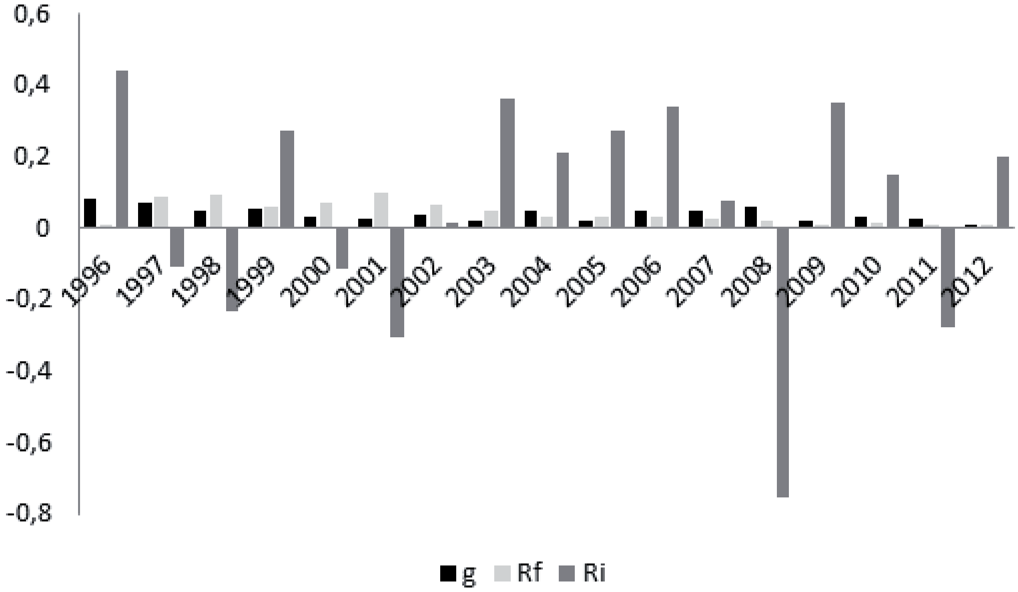
Risk premium for Poland

To check how the excessive risk premium puzzle relates to the Polish market, we tried to calibrate the original model of Mehra and Prescott to the Polish data. The calculations cover the period from 1995 to 2012. Based on the yearly data on consumption and consumer price index we have calculated yearly growth rates of real consumption. The average was 3.7% yearly with the standard deviation 1.7%. Using these values one can calculate possible growth rates of the consumption in the model, obtaining $g_1=5.4\%$ and $g_2=2.0\%$. The real returns on equities were calculated using data on the yearly returns of WIG market index (the main index in the Polish stock market, which describes the whole stock exchange) corrected for inflation. The average return was 3.5% and the standard deviation was 31.5%. The risk-free interest rate was calculated from the yields of treasury bonds diminished by inflation. The average risk-free rate was 3.8% and the standard deviation of this quantity was 3.3%. As one can see the risk premium was negative and amounted to -0.3%, which suggests that for Poland the "excessive" risk premium, that cannot be explained theoretically, does not exist.

1 This effect, known in the statistics as survivorship bias, appears for example, when one is estimating the immunity to some illness using data from this part of the population that manage to survive the epidemic. Those who survived are usually more immune to this illness – the less immune ones have died.

Another example from the realm of economics is estimating investment results in the stock market using historical data for the companies that are on the stock market now, without accounting for the companies that have left the market (because of bankruptcy or poorer financial results).

Figure 4: Rates of growth of consumption (g), risk-free rates (Rf) and risky rates (Ri) – all corrected for inflation

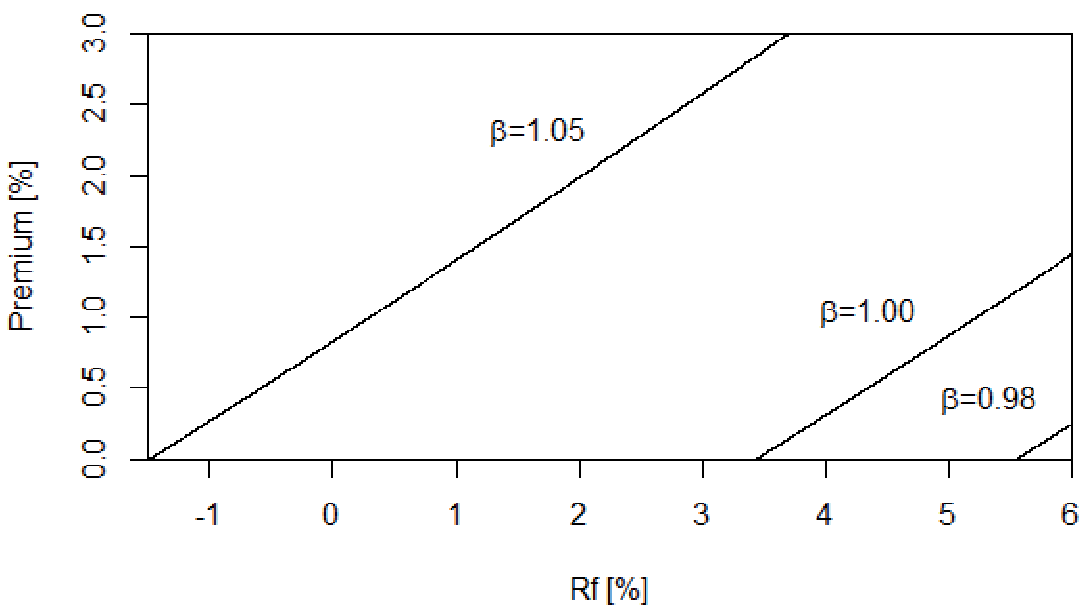


Source: Own calculation based on data from Polish Statistical Yearbooks and the Internet service www.stooq.pl

Figure 4 presents the data. As the previously calculated characteristics revealed, the consumption is the smoothest – there are only small year-to-year changes in its rates of growth. On the other hand the risky rate is the most volatile. The biggest change in this rate took place in the year 2008 (the year of financial crisis), when the WIG index (Warsaw Stock Exchange Index) had fallen by half.

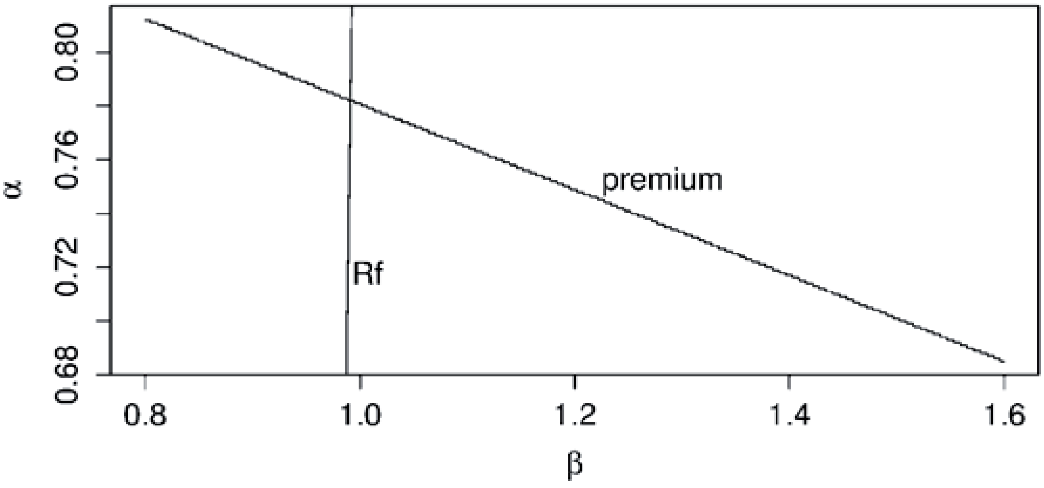
Figure 5 is the counterpart to Figure 2 for the model calibrated to the Polish data. It depicts possible combinations of risk-free interest rate (R^f) and risk premium for different values of the parameters describing discount factor (β) and risk aversion (α). As one can see for reasonable values of the discount factor one can obtain from the model the results consistent with the observations. To show this more thoroughly, in Figure 6 we have put a graph depicting the correspondence of the model with the data. The line "premium" joins all the combinations of parameters α and β for which the risk

Figure 5: Risk-free rate and risk premium in Mehra-Prescott model calibrated to the Polish data



Source: Own computations

Figure 6: The values of models' parameters for which the theoretical values of risk premium ("premium") and risk-free rate ("Rf") equals observed values



Source: Own computations

premium in the model equals the risk premium observed in Poland in the period under consideration. The line marked as "Rf" joins all the combinations of parameters' values for which the risk-free rate in the model equals the risk-free rate observed in Poland. The intersection of these two lines represents the values of parameters with which the predictions from the model fit the reality. In this intersection point the discount factor amounts to $\beta=0.99$, so it is close to unity but does not surpass it. This value means that the yearly discount rate for utility from consumption is about 1%, which seems to be a reasonable value. The relative risk aversion in the intersection point equals $\alpha=0.78$, which is an acceptable value and agrees with other estimates of this parameter. It means that the returns on securities in Polish stock market can be reconciled with the conclusions of general equilibrium models, such as the Mehra-Prescott model.

Conclusions

Mehra and Prescott have shown that the returns on equities in the United States in the period from 1889 to 1978 were too high to be consistent with standard financial market models based on general equilibrium. The difference between return on equity and risk-free rate stems from the fact that investors should expect higher returns on a risky asset to consider buying it instead of investing everything in securities with a riskless rate. However for the difference equal to 6%, one should assume a unrealistically high risk aversion coefficient.

One should note that mean rate of return expected by an investor is not the same as average rate of return calculated from the historical data. Some of the explanations for the puzzle indicated by Mehra and Prescott utilize this fact. The evidence used by these authors to support their conclusions referred to a specific country and specific time period. It is hard to reconstruct the expectations that consumers had at the beginning of this period. It may be, as Rietz suggested, that they were afraid of the possible future "catastrophe", which would not happen, or they were searching for the true parameters of the distributions of returns using Bayes' rule. It may be also that the results of Mehra and Prescott are valid only for a very specific choice of research sample. The results from the Polish market suggest that this may be the case and the development of the Polish market can be described by general equilibrium models (such as the Mehra and Prescott model). In the last 18 years the risk premium in Poland was close to zero and even a little negative, so there is no evidence of excessive risk premium.

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