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Equity Risk Premium for Investments Projects in Renewable Resources

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Abstract. *Risk premium is an important factor for different models that estimate the shareholders equity, the debt cost used to evaluate both the financial assets as well as investment projects. The paper presents a brief history of the risk premium, the main estimation methods together with the influence factors. Different risks are associated to the investments in the renewable resources and they are more difficult to evaluate than the investments in other projects.*

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The risk premium is the main component of any return-risk model from the finance field and it represents a factor that is included in the estimation of the shareholders equity, the cost of debt (by adding the credit risk spread) used in corporate finance and in the valuation of the financial assets. The scientific research about the risk premium is strongly related to the change of the investors' perceptions regarding the shares, and the first studies were done by the economists.

Goetzmann and Ibbotson (2005a) remind the definition given by John Stuart Mill in the now classic paper *The principals of political economy* (1848): writing about a farmer that was thinking to invest in some land, Mill argues that he will be probably willing to use the capital (for an instant return) in any way that will bring him a profit, no matter how small, but above the risk value, and above the interest that he is willing to pay for the capital if he will borrow it or that he will be able to acquire for the land, if the land would be his own. This way, Mill dived the concept of profit, that could be obtain by the investing in the land, in three parts: first – the interest that must be paid for the borrowed capital determined as opportunity cost of money. This is the equivalent to the risk-free rate. The second component is the "risk value" associated to the investment that is the equivalent to the risk premium. The third Mill's component is the excess profit, no matter how small. Today, the third component is the "alpha" coefficient – a part of the compensation that is expected to be small on a competitive market.

Eloquent data used to estimate the historic premium of the shares opposite to the bonds were collected in the middle of the 20th century, and the econometric estimations of the risk premium were used after the development of the theory that treats the risk premium as a central factor – *the Capital Asset Pricing Model* – CAPM.

Goetzmann and Ibbotson (2005a) consider that the empirical estimation of the risk premium was done by Smith in 1924 for the US capital market because the availability of historical data for the financial assets but, also, because of the 1920 capital market crash. The development of the financial theory from the beginning of the 60s leaded to the increased interest to the improvement of the models of risk premium estimation. Later on, we shall make a short presentation of the use of the "risk premium" term and of the first attempts to empirically estimate it and we shall continue by presenting the influence factors of the risk premium.

Aldea (2008) shows that Frank H. Knight is the first to present the distinction among "*risk*" and "*uncertainty*" and their role in the economic theory in the book *Risk*, *Uncertainty and Profit* (1921). He states that the "risk" notion is analyzed using the situations when the decidents can give probabilities

to the random events they are confronted with. The "uncertainty" is the form opposite to risk and it represents a process that is reflected by those situations where the events cannot be given probabilities and there is no scientific base to calculate them. But, in his paper, Knight didn't mention how the risk premium can be measured.

Goetzmann and Ibbotson (2005a) underline the role of Edgar Lawrence Smith that modified the paradigm regarding the stocks by recommending them as long run investments (in the book *Common stocks as long term investments*). Based on the data collected about stocks (prices and dividends) and bonds listed at New York and Boston stock exchanges during 1866-1923, Smith demonstrates that the stocks had larger returns than the bonds for the different intervals of the analyzed period of time. So, he introduced the concept of stocks being treated as medium and long-term investments.

John Burr Williams (1938, p. 67) was the first to define, model and estimate the risk premium. According to Williams, the traditional method used to determine the value of a risky asset was to always add a "risk premium". He offers a table with interest rates for "past, present and future" that shows the risk-free rate as being the rate of the long-term state bond (4%), and the expected return of the "good stocks" (5.5%) (Williams, p. 387). Williams estimated the future risk premium using a dividend discount model and explained that the past (historical) estimations offers a good forecast for the future even if there are deviations from the present situations.

Goetzmann and Ibbotson (2005a) shows that the most detailed empirical analysis of the long term performance of the US capital market was realized by Alfred Cowles III in 1938, when he published *Common stocks indexes*. The author's main purpose was to present the experience of the investors in this type of securities in US, during 1871-1937.

The empirical researches for the estimation of the stocks returns moved to another stage in the 60s, when the *Center for Research in Security Prices* – CRSP was created in Chicago, managed by Lawrence Fisher and James H. Lorie. They published their results about the US stocks returns in *Rates of Return on Investments in Common Stock: The Year-by-Year Record, 1926-65* (1964) and in a volume including the US state bonds in 1977. As Cowles, they based their analysis on the prices of the individual stocks and on the reinvestment of the dividends.

The 50s and 60s theoretical development of the Financial Economics increased the role of the empirical estimations of the rates of returns. In 1952, Harry Markowitz published his famous model of portfolio selection that made a connection between investments' risk and return. Markowitz considered the historic averages, variances and the covariance of the individual stocks as

factors of his models and states that this method can be improved using sophisticated forecasting instruments. The Markovitz model (as it is used now) identifies an optimum portfolio of financial assets based on the standard deviation and the expected return of the stock using a tangent line (that starts from the risk-free rate – with a 0 variance) to the portfolio frontier giving the largest return for every level of standard deviation. The difference between the risk-free asset rate of return and the expected return of the portfolio situated in the tangent point is given by the risk premium. From Markovitz point of view, the dimension of a risk premium is an empirical issue.

The *Capital Asset Pricing Model* (CAPM) Sharpe-Lintner-Mossin was independently developed in the 60s, as part of the method to identify the optimum portfolio of risky assets from the Markowitz theory. In the CAPM, if the form of the utility function and the coefficient of the risk aversion are known, then the computation of the variance of the risky assets portfolio is enough to identify the difference between the portfolios of risky and risk-free assets.

An important characteristic of the Markovitz model and of CAPM is the theoretical background used to estimate the risk premium directly from the investors' preferences.

The influence factors of the risk premium

The main influence factors of the risk premium identified in the literature by Damodaran (2011) are:

The risk aversion – it is the first and the most important factor because, accordingly to the modern Finance Theory, if the investors are more risk averse then their risk premium will decrease while if their risk aversion will decrease, their risk premium will decrease, too. The risk aversion varies with the different type of investors, but the collective risk aversion is the one that determine the risk premium. Among the factors that determine the dimension of the risk aversion we can find the investors' age and their preferences for the present consumption.

The economic risk – the risk premium is smaller for the predictable economies, with interest rates and economic growth with low volatility. Lettau, Ludwigson and Wachter (2007) proved the connection among the US risk premium changes and the changes in volatility of the real economy. Brandt and Wang (2003) proved the existence of a relation between the risk premium level and the uncertainty of the inflation rate, considering there is a low or very low correlation between the risk premium and the current level of inflation.

The quality information – the quality of the information send by the listed companies as well as their quantity influence the level of risk premium

estimated by the investors. Yee (2006) defines the quality of the profits by the volatility of the future profits and states that the risk premium must increase (decrease) at the same time with the decrease (increase) of the quality of the profits.

Liquidity – if the investors accept large discounts compared to the estimated value of the investments or if they pay large costs for closing depositions, than they will pay less for the stock at the present moment and they will ask for a larger risk premium. There is an opinion that states that the capital markets are wide and deep and, so, the effect of the liquidity on the aggregate risk premiums must be low.

The risk of a catastrophe event – a catastrophe refers to several events that have a low frequency and which lead into a significantly decreased wealth for an investor. It is very important that the risk premium must reflect the risk of a catastrophe event when we invest in a certain stock, although the event of a catastrophe has a low probability. The 2008 crisis on the financial and real estate markets is a new argument that favors the analysis of the elements that lead to a catastrophe.

The behavioral/irrational component

Two aspects of the analysis of the risk premium are presented in the context of the behavioral finance:

The illusion of money – Damodaran mentioned that Modigliani and Cohn (1979) showed that the low values estimated for the stocks during the 70s were due to the way that the investors interpreted the inflation. On one hand, the investors used larger discount rates that reflected the larger inflation rates, but they used previous growth rates (smaller because of a smaller inflation rate) in order to estimate future incomes. So, the result of asset pricing was small and the risk premium was high. The Modiglini-Cohn model shows that the risk premium will increase during periods when the inflation is higher than target and will decrease when the inflation is smaller than the target.

Narrowing frame analysis – it refers to the fact that, in the classical portfolio analysis, the risk of an investment is evaluated based on the risk that is added to the current portfolio by the financial asset. The modern economists consider that the investors evaluate each investment, which leads to the over-estimation of the risk premium, Benartzi and Thaler (1995).

Model of risk premium estimations and the experts' opinion

Fernandez (2006) identifies four different concepts of the risk premium: the historical risk premium (HEP) which refers to the historical market return and to the bonds' returns; the expected risk premium (EEP) which represents the difference between the market expected return and the bonds' returns; the

expected risk premium (REP) used to compute the cost of shareholders equity represented by the excess-return of the market portfolio computed to the risk-free rate; the implicit risk premium (IEP) which is the risk premium required after an asset pricing model is used, assuming that the market price is the correct one. HEP has the same level for all investors and its level can be computed while REP, EEP and IEP are different based on the investors' type and are not observable.

Fernandez (2006) shows that IEP has a main hypothesis the idea of the existence of the homogenous expectations among investors about the expected growth rate (g) and he shows that there are several pairs (IEP, g) that satisfy the current prices. He considers that different investors have different values for REP and that it is possible to determine the REP for all the market, because it doesn't exist.

In Goetzmann and Ibbotson (2005a) articles, we can see that there are several methods to estimate an expected risk premium used for forecasting. The first method is to extrapolate the historical risk premiums as it is done by Ibbotson and Siquefield (1976) in *Stocks, bonds, bills and inflation: Year-by-year historical returns (1926-1974)*. The capital market returns were computed as total returns based on the S&P 500, which didn't include dividends up to that moment. The authors also used data about state bonds from the CRSP, the index of the corporate bonds based on the bonds' return and inflation rates. The presentation of the total annual returns for the analyzed period of time was included in the paper which was made unique because it explicitly measured the historical risk premium not only for stocks but also included the maturity premium, the default premium and the real interest rate. These historical premiums were used (both in theory as in practice) as the risk premium for CAPM, but in other models also.

Later on, in 1976, Ibbotson and Sinquefield showed how the historical data can be used to simulate the probabilities distributions of the future returns. They started to compute the return curve from the specified moment, together with the structure of the forward implicit interest rate. They added different historical risk premiums – using *bootstrapping methods* – that reflect the structure of the correlation among groups of assets. They also used the historical risk premium geometrically measured for the previous half of century (of 6.3%) for the US bonds and an insignificant number of long-term bonds that included the *maturity risk premiums*.

The second method represents the use of the models of stock demand based on the investors' risk aversion, like in Mehra and Prescott (1985). Accordingly to Ibbotson, Siegel and Diermeier (1984), the investors' demand is

influenced not only by the systematic risk, but also by the liquidity, the tax system and the specific risk.

The third method is based on the analysis of the type of return offered by the corporate sector. Diermeier, Ibbotson and Siegel (1984) and, later on, Ibbotson and Chen (2003) use this approach. They explore the increase in cash flow and of the incomes generated by companies. These forecasting tend to be smaller than the historical risk premiums basically because a part of the total capital market returns comes from the increase of the price/net income per share ratio (P/E). The increase of the P/E indicator cannot continue indefinitely and might be removed from the expected risk premium.

In their paper on risk premium as a puzzle, Mehra şi Prescott (1985) show that the historical risk premium in US – measured as the excess return of the stocks to the US bonds' returns (considered to be risk-free assets) – was much larger than the risk premium would be expected to be accordingly to the modern Finance. Using the neoclassical financial economics paradigms together with the estimations of means, variance and auto-correlation of the annual consumption increase in the US economcy and, also, using the possible estimations of the risk aversion coefficient and the time preference, the authors stated that the stocks should offer an annual risk premium of at most 0.35% compared to the bonds' rate or return. By extending the parameters, they reached the conclusion that the risk premium should not be greater than 1% (Mehra, Prescott, 2003). This idea is opposite to the estimation of the average annual historical risk premium of 6.2%. The following years showed that the risk premium increased even more so that, during 1979-2005, the average annual risk premium compared to the US bonds' was of 8.1%. So, the risk premium becomes a quantitative puzzle that has two solutions: the standard models are wrong or the historical risk premium is misleading and we should really expect a smaller future premium.

In the attempt to solve this puzzle using the first approach, the researchers concentrated on the alternatives of the hypothesis about preferences, including the risk aversion; the incomplete markets and the shocks on the incomes that cannot be insured; the probability distributions modified to accept rare events; market imperfections such as borrowing restrictions and transactions costs; models of limited participations on the consumers on the capital market and explanations that use the behavior theories. Even if some of the models have the potential to solve the puzzle as in Crochane (1997), the most promising of them implies deep modifications of the standard models and that almost each success story requires a large amount of risk aversion.

This leads us to a second possible solution of the puzzle, which states that the historical premium might be misleading. The risk premium might be misleading because of two reasons:

- *Luck*

Perhaps the American investors had just luck and the XX century represented the "triumph of the optimists" (Dimson, Marsh, Staunton, 2002). Crochane (1997) stated that it might have been „100 years of luck" contrary to the well-known joke, according to which the soviet agriculture was the result of "100 years of bad luck".

- *choosing the country for which the estimation is done*

However, the past performance of the individual stocks doesn't offer a lot of information as regards the future returns. If there is a selection error *ex post* based on a previous success, the average historical rate of return will provide an erroneous over-valuation of the forecasted future returns. This is one of the reason for which the risk premium estimation is, usually, based on the performance of the entire market, including successful and unsuccessful stocks.

Nevertheess, the lack of data limited the research on long term stocks returns listed in other countries. Most of the research papers trying to solve the risk premium puzzle is focused on empirical studies on United States. Thus, considering that United States is not a typical country, the above mentioned research could start from wrong hypothesis regarding the past.

Cleijne and Ruijgrok (2004) stated that three types of risk should be crewarded in case of renewable energy resources investment projects, such as: operational risk, market risk and regulation risk. The authors said that in Holland the regulation risk had been translated in a significant risk premium for investment projects in wind energy and biomass, compared to risk premium for operational and market risk. The level of risk premiums differes from country to country, sources, generation, and the length period for which we estimate risk premium.

Moreover, a significant influence on the size of risk premium comes from the government intervention and the type of support provided to investors (i.e.: subsidies, taxes exemption) in order to benefit from running the renewable energy resources.

Conclusions

This literature review of the researches in risk premium estimation highlights the problems facing those who seek to identify the correct estimation model, and those who want to apply it. An estimation of equity risk premium for Romania is quite difficult because of a relative short history of the capital

market, low liquidity and persons who can make things to happen. Moreover, the difficulty is even higher in case of risk premium estimation for renewable energy projects, considering the lack of a consistent pursue of a long term strategy for energy sector. In these circumstances, it may prove more useful to adjust cash flows projected for such investment projects by taking into account the probable risks and simulate their impact on the projects' value.

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