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Professional paper

INVESTING FINANCIAL CAPITAL IN RISKY BUSINESS CONDITIONS THROUGH PROBABILITY ASSESSMENT AND DISTRIBUTION

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Abstract
Investing financial capital is almost always risky, there is no safe investment, and any unplanned situation in the future, uncertainty or sudden events can mean risk. To assess risk and protect themselves from it, investors resort to probability distribution. From the above, the subject of the paper is derived, which is the investment of capital in conditions of risk with reference to the assessment and distribution of value.
Distribution is marked by all possible outcomes with the assigned probability of each result, and the aim of the scientific work is to explain how investors implement this mathematical-statistical method. The purpose of the scientific paper is to present the results of research based on read and processed literature, in foreign and domestic articles. The thesis put forward by the authors in their scientific paper is that "There is no method that will completely reduce the risks, because market risk is impossible to influence".
According to the authors, the risk is influenced by many variables, the more variables - the higher the risk, and in order for it to be precisely defined in the investment business, it is necessary to know its core, it is necessary to assess it. Any unplanned situation in the future, uncertainty or sudden events can mean risk. The probability distribution, on the other hand, is a list of all possible outcomes with the assigned probability of each outcome, and its most common parameters are the expected rate of return and standard deviation. Foreign authors mostly see investing capital in conditions of risk as an opportunity for investors who need to know at what point to invest, and therefore propose new theories. Surveys dealing with probability estimation and distribution were selected.

Keywords; capital investment, risk, valuation, distribution value of capital, portfolio

JEL Classification: F01, Z32

INTRODUCTION

The selected article as the starting point of scientific research is the article by Serbian authors Vitomir Starčević and Slobodan Subotić, "Investment decision-making in conditions of risk". They explain that risk is present, to a greater or lesser extent, in every investment, and that investors therefore choose and construct their portfolio based on the

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expected return and standard deviation. The results of his research are compared with the results of research by domestic authors.

The scientific paper is conceived in two interrelated chapters entitled: **Review of scientific research by foreign authors on the assessment and distribution of probabilities** and **Assessment and distribution of probabilities of capital investments in world and domestic practice.**

In short, the **first** chapter contains summaries of articles by foreign authors that talk about capital investment risk conditions, estimation, and probability distribution.

The **second** chapter presents the results of the research based on a selected article from foreign practice and several articles from Croatian practice that are compared with each other.

Capital investment has always been of interest to scientists, and in the end, it is a useful read if it is dealt with in the literature that cites concrete examples. There are many of them in this research, so only some of the research will be singled out, which will be discussed in more detail later. These are: a 2014 study by Tomić, Sesar, and Džaja on a comparative analysis of the European capital market and the Dow Jones Industrial Average Index, an article by Streitenberger and Sprčić "Predictive ability of financial indicators to predict loan repayment delays" from 2011, an article by Bestvina Bukvić "Research on the application of specific risk analysis in project financing" from 2013. Foreign research is led by: Dutta and Perry (2006), Schwartz (2007), Rampini and Viswanathan (2010) and many others.

In their scientific work, the authors used some of the scientific methods in writing and research, such as analytical-synthetic method in researching the subject of work, analysis and merging of fragments of research and concepts, methods of proving and refuting in proving the truth of certain knowledge and rejection of theses, compilation method in presenting results, mathematical method in using formulas, symbols and conclusions about research, historical method in chronological order of research, comparative method in comparison and method of classification in summarizing research in the paper.

1. REVIEW OF SCIENTIFIC RESEARCH BY FOREIGN AUTHORS ON PROBABILITY ESTIMATION AND DISTRIBUTION

Foreign authors mostly see investing capital in conditions of risk as an opportunity for investors who need to know at what point to invest, and therefore propose new theories. Surveys dealing with probability estimation and distribution were selected. Although this topic is a wide range, the most interesting articles were chosen. Analysis in the work of the authors (Mian, Vélez-Pareja 2007) proves that the only convincing property for advocating the use of the classical WACC equation is that it requires simplified cash flow. The often used discount rate is the company's weighted average cost of capital (WACC).

The author's work (Dutta, Perry 2006) seeks to better define operational risk procedures by performing rigorous analysis of internal loss data and experimenting with different modeling techniques used to measure operational risk, to determine which models perform best within the widest range of criteria.

Authors Starčević and Subotić (2010) in their research are based on investment decision-making in terms of risk, and argue that in every investment of a business

venture, risk is present to a greater or lesser extent. Investors, in order to minimize risk, construct their portfolio based on the expected return and standard deviation, which is considered a measure of portfolio risk (Starčević, Subotić 2010, 57).

Schwartz (2007) states that capital markets have always been and will always be a means of effectively distributing risk. Many financial instruments regulated by federal laws (relating to securities and commodities) allow their users to meet functions similar to a general contract security mechanism. However, any contract that allows for fee-based distribution should not be subject to regulation by state insurance laws.

A study on the features of the logistics project evaluation model is found in an article by Qiu and Zhou (2013) and considers the traditional valuation model. Based on this, and using "fuzzy" theory, the authors were able to identify several models for evaluating logistics projects in a "fuzzy" environment. The analysis of individual characteristics and the comparison of the calculated results of the three models show that these models are important methods of investment value of evaluated logistics.

Authors Rampini and Viswanathan (2010) assume that in a crisis, although cash flows are weak, investment opportunities grow as the cost of capital is low. More productive companies and companies with less capitalization can take advantage of such investment opportunities.

Authors Hlouskova, Mikoczioa, Sivak, and Tsigaris (2014) prove that risk taking is limited and positive under reasonable assumptions, and thus an investor who is not accustomed to risk will not choose infinite equilibrium despite the lack of applicable regulations. Unlike the expected service model, an increase in capital gains tax does not encourage risk-taking when the reference level is initial wealth or gross after-tax refund of the initial wealth investment in non-risk assets.

A general methodology for calculating specification curves is proposed by Kan, Robotti, Shanken (2009) - a robust asymptotic standard for estimating risk premium error. The authors also perform an asymptotic sample distribution and develop a test to determine the same population in two competitors - linear beta pricing models.

Authors Heina and Schoder (2011) analyze the effects of interest rate variation on capacity utilization rate, capital accumulation, and profit in a simple post-Kaleckian model of distribution and growth. This model leads to different potential accumulations of the regime, depending on the values of the parameters in the function of investment, savings and distribution.

Borio and Zhu (2008) state that investment projects can succeed or fail, and asymmetric information is critical. But overall, according to them, the models significantly limit the range of mechanisms by which risk perception and tolerance can influence behavior. Sometimes, the only source of risk is inherent in the company.

1.1 The Authors Position on the WACC Concept

A large percentage of companies use Discounted Cash Flow (DCF) as their primary technique for investing, evaluating projects and capital budgeting processes. This approach requires predicting the detailed cash flow of the project under estimation and discounting the resulting cash flow to the present value (Net Present Value - NPV) using an appropriate discount rate (Mian, Velez-Pareja 2007, 19).

The often used discount rate is the company's weighted average cost of capital (WACC). There is no shortage of literature on this topic, as it has been known as a

concept for the last 50 years or so. While most analysts believe the concept is simple and very well known, the irony is that misinterpretation and misapplication prevail. There are many versions of the WACC equation and each is specific to a particular cash flow. Using a classic WACC ratio in all cases can result in an overly optimistic NPV. Depending on the cash flow pattern, an investment may show a positive NPV on a classic WACC, but it will actually be a loss of capital (ibid.).

Analysis in the work of the authors (Mian, Vélez-Pareja 2007) proves that the only convincing property for advocating the use of the classical WACC equation is that it requires simplified cash flow. Based on the analyzes, the authors (Mian, Vélez-Pareja 2007) recommend using ECF (Equity Cash Flow) or a combination of capital costs to calculate NPV or use Adjusted Present Value (APV). The ECF is the cash flow that will be used to budget and plan the end use. The ECF methodology is a good way to obtain a lower limit for the value of capital (Mian, Vélez-Pareja 2007, 38).

1.2. Investment Decision Making in Risk Conditions

Authors Starčević and Subotić (2010) in their research are based on investment decision-making in terms of risk, and argue that in every investment of a business venture, risk is present to a greater or lesser extent. Investors, in order to minimize risk, construct their portfolio based on the expected return and standard deviation, which is considered a measure of portfolio risk (Starčević, Subotić 2010, 57).

Risk is defined as the deviation of the actual from the expected return (ibid.). For all investors, the rule is that the realized return may be lower than expected. The more, if more variables affect the possible yield and the risk itself will be higher. Given the importance of risk, the authors (Starčević and Subotić 2010) state that it always accompanies investments and that it is impossible to talk about a risk-free return.

The authors (Starčević and Subotić, 2010) point out that since the reality of investment decision-making excludes the possibility of deciding on only one project, the investment of a number of projects is presented. This is because an investor rarely invests all his wealth in just one asset or investment, but creates a portfolio (set of investments) and combines risks. Therefore, according to Starčević and Subotić (2010, 59, 60), new capital investment projects should not be considered only in correlation with each other, but also with already adopted and implemented projects in order to achieve maximum diversification, that is reduce the risk of the company as a whole, while achieving the highest possible return on its total business and own funds. Successful diversification should result in the risk of investing in a group or portfolio being less than the sum of the risks of individual projects, that is the deviation of returns on the asset portfolio may be less than the sum of deviations of expected returns on individual assets.

An important question of the author (Qiu, Zhou 2013) for state regulatory authorities is whether CDS (credit default swaps) as an instrument that distributes risk for compensation should be qualified as a product of the capital market that evades the regulation of state laws. For many market observers, the answer is echoing “yes” (Qiu, Zhou 2013, 173).

Insurance companies use the identity of those they insure to effectively assess and distribute risk. If the identity of the insured changes, the risk profile of the insured's contract also changes (ibid., 191).

The study on the features of the logistics project evaluation model considers the traditional valuation model. Based on this, and using "fuzzy" - "confused" theory, the authors (Qiu, Zhou 2013) were able to identify several models for evaluating logistics projects in a "fuzzy" environment. The analysis of individual characteristics and the comparison of the calculated results of the three models show that these models are important methods of investment value of evaluated logistics.

The application of net present value and other traditional methods of valuing a logistics project is easy to accomplish the goal of the venture and the actual deviation of value. Giving full attention to an unstable market, uncertainty, irreversibility and a realistic option is of great convenience. The application of the realistic option for estimating the investment value of a logistics project is widely used (ibid., 201).

1.3. Theories and Methodologies on Capital Investment in Risk Conditions

The authors (Hlouskova, Mikoczioa, Sivak, Tsigaris 2014) prove that risk taking is limited and positive under reasonable assumptions, and thus an investor who is not accustomed to risk will not choose infinite equilibrium despite the lack of applicable regulations. Unlike the expected service model, an increase in capital gains tax does not encourage risk-taking when the reference level is initial wealth or gross after-tax refund of the initial wealth investment in non-risk assets. When investors set their reference level to gross (pre-tax) income, investing initial wealth in risk-free assets increases not only risk-taking but also their private risks as measured by the standard deviation of their wealth after tax. However, this is not the case in the expected service model (ibid).

When we talk about risk-taking, we are talking about the share of initial wealth invested in risky assets. Changes in capital income taxation, like any other tax change, generate revenue and substitution effects. The substitution effect encourages risky activity (Mossin 1968) because risk-averse investors respond to tax levies by increasing the level of risk-taking to the same as before taxation, and having the expected fixed utility (ibid.).

The effects of the risk-taking tax remain unchanged in any continuous distribution of the risk assets' assets. The results of the authors (Hlouskova, Mikoczioa, Sivak, Tsigaris 2014) confirm that according to this general assumption, an investor not accustomed to risk will not choose infinite balance. In other words, the authors (Hlouskova, Mikoczioa, Sivak, Tsigaris 2014) show that the optimal share of investment in risky assets is final and positive, provided it is not limited by financial regulations (Hlouskova, Mikoczioa, Sivak, Tsigaris 2014, 376). The main data match this framework.

A non-loss-making investor will invest a certain positive amount in risky assets. There are reference levels that result in not stimulating risk-taking due to capital gains tax increases, even when tax regulation provides a full loss of default (contrary to expected utility models where tax increases stimulate investment in risky assets) (ibid., 385).

Since Black, Jensen, and Scholes (1972) and Fama and Macbeth (1973), the two-section cross-sectional regression (CSR) methodology has become the most popular approach to evaluating and testing asset pricing models. Statistical inference with this method is usually performed under the assumption that the models are correctly stated, that is, that the expected returns are exactly linear in the beta of the asset. This assumption can be a problem in practice, as all models are, at best, approximations of reality and

subject to a certain degree of erroneous specifications. The authors (Kan, Robotti, Shanken 2009) propose a general methodology for calculating incorrect specifications - a robust asymptotic standard for estimating premium risk error. Kan, Robotti, Shanken (2009) also perform an asymptotic sample distribution and develop a test to determine the same population in two competitors - linear beta pricing models. This test provides a formal alternative to common heuristics, simply by comparing estimates in evaluating the performance of a relative model. Finally, Kan, Robotti, Shanken (2009, 1) provide an empirical application, which shows the importance of their new results when applied to a variety of asset pricing models.

These authors (Kan, Robotti, Shanken 2009) provided a systematic analysis of the asymptotic statistical properties of traditional cross-sectional regression methodology and pooled "goodness-of-fit" measures when the original beta price model does not hold an exact value. The curve specification and robust standard error for the zero-beta rate and premium risk factor are derived in very general allocation assumptions, which draw on previously performed results by Shanken and Zhou (2007) (Kan, Robotti, Shanken 2009, 32). A good feature of these standard errors is that they can be used whether the model is correctly specified or not. The inter-temporal CAPM (Capital Asset Pricing Model) by Petkova (2006) and the three-factor model by Fam and French (1993) pass best in slow-motion tests by the authors (Kan, Robotti, Shanken 2009) while the CAPM model and the CAPM model Unconditional consumption is often dominated by other models. The inter-temporal CAPM of Petkov (2006), the conditional CAPM of Jagannathan and Wang (1996), and the CAPM of the conditional version of consumption, never exceeded 5% of the level (ibid., 33).

Most of the time, the risk channel should serve exclusively as a mechanism for "strengthening persistence", qualitatively similar to a kind of "financial accelerator". However, in some conditions, especially if the risk is underestimated and individual incentives are not aligned with the desired outcomes in the aggregate, the self-stabilizing property of the economy may not be enough to guarantee a completely benign increase in sustainability (Borio, Zhu 2008, 3).

This does not mean that risk elements are absent; investment projects can succeed or fail, and asymmetric information is critical. But overall, models significantly limit the range of mechanisms by which risk perception and tolerance can influence behavior. Sometimes, the only source of risk is inherent in the company. More often than not, beneficiaries treat project risk as exogenous and have no incentive to insure themselves against bankruptcy losses (ibid., 8).

While the risk channel has always been present, the evolution of the financial system has highlighted its place. Financial liberalization and innovation have greatly increased the possibility and incentive to obtain external financing, that is savings on it through leverage instruments and strategies such as "encourage and distribute". The relaxation of liquidity constraints has increased the potential for wealth and risk perception, in contrast to current income and cash flows, in spending decisions (ibid., 12).

Liquidity and risk-taking are closely linked, and can reinforce each other. For example, lower risk perception and higher risk tolerance weaken external financing and the transferability of constraints. On the other hand, weaker constraints may support greater risk-taking. In other words, by analogy with the notion of effective demand in macroeconomics, weaker constraints increase "effective" risk tolerance, allowing agents to engage in projects or investment strategies with higher risk, and usually higher

expected returns, than would otherwise be possible. The reverse is true when risk perception is increased, risk tolerance is weak and liquidity conditions are tightened, with market deterioration and potentially increased liquidity financing (Borio, Zhu 2008, 12)

The risk channel emphasizes the importance of how risk is distributed in the economy. Because agents may differ in their ability to measure and assume risk, this may affect their response to changes in policy rates (Borio, Zhu 2008, 13).

1.4. Estimation and Distribution of Capital Investment Probabilities

As financial institutions protect their market and credit risk through the securitization of assets and other assets, their exposure to operational risk represents a larger share of their overall risk profile. Only recently have financial institutions begun to assess their operational risk with greater quantitative precision, so these new techniques are still in their infancy. There are many models available to financial institutions to assess their operational risk, and it is important to choose the modeling technique that will be used to assess the severity (value in dollars) of operating losses.

An important question is whether the institution will use different models of the amount of losses and thus lead to different and inconsistent estimates of risk exposure, which may then result in the maintenance of inadequate capital reserves. The author's work (Dutta, Perry 2006) seeks to better define operational risk procedures by performing rigorous analysis of internal loss data and experimenting with different modeling techniques used to measure operational risk, to determine which models perform best in the widest range of criteria (Dutta, Perry 2006, 11).

The application of different models of estimating the amount of losses to a financial institution gives significantly different estimates of the risk of capital placement. This finding is important because it implies that when a financial institution limits the choice of technique to one that has good statistical performance, capital estimates can vary significantly. In several cases, when the same model was applied in different institutions, even when the model met the "goodness-of-fit" statistical criterion, it gave very inconsistent and unreasonable estimates in these institutions. However, the authors (Dutta, Perry 2006) note that when the state of realism is added to the "goodness-of-fit" criterion, different statistical techniques give very similar capital estimates. This result is significant because when "goodness-of-fit" and realism are imposed together, no variability in capital estimates is seen when using only "goodness-of-fit" criteria (Dutta, Perry 2006. 13).

Capital markets have always been and will always be a means of effectively distributing risk. Many financial instruments regulated by federal laws (relating to securities and commodities) allow their users to meet functions similar to a general contract security mechanism. However, any contract that allows for fee-based distribution should not be subject to regulation by state insurance laws. Derivatives represent one such instrument, and CDS (credit default swaps) represents another. While insurance companies target the individual consumer, with government efforts to ensure fair conditions for consumers, CDS transactions take place exclusively between banks and other sophisticated parties. Consideration is being given to whether the CDS should be regulated as an insurance contract under state law. State insurance regulators need to recognize the insoluble differences between the two groups of instruments because CDS is not insurance (Schwartz 2007, 201).

The identity of the insured, more precisely the real estate to which the insured has interest, to which the insurer's indemnity is linked, is very important because it is the best individual indicator of the probability that the insurer will make payment under the insurance contract. Insurers specialize in classifying and quantifying identity risk to maintain the ratio of profit to retained claims.

Commenting on insurer categorization efforts, Kenneth Abraham explains that the most effective tool for reducing the effects of moral hazard, maintaining a steady return and distributing risk is to create risk classes and different coverage prices, depending on the expected loss of each insured class. The more accurate and detailed this risk classification, the greater its impact on the distribution between loss prevention and insurance. In building a risk class, the insurer's goal is to determine the expected loss of each insured and to place the insured in a class with expected similar losses so that each can be charged at the same rate (ibid., 197).

Collateral constraints mean that financial management and risk management are fundamentally linked. The opportunity cost of engaging in risk management and maintaining debt capacity to protect future financing needs is a loss of current investment, and is greater for a more productive capitalized company holding. More and more limited companies are embarking on smaller risk management and thus can exhaust their debt capabilities and give up risk management, according to empirical evidence and contrary to accepted theory (Rampini, Viswanathan 2010, 2293).

When solar flows are low, such companies may be unable to take advantage of investment opportunities and be forced to downsize the company. Consequently, capital may be less productively deployed in crises.

This observation has important implications for debt capacity allocation, which is an endogenous model by Rampini and Viswanathan (2010). The authors (Rampini, Viswanathan 2010) assume that in a crisis, although cash flows are weak, investment opportunities grow as the cost of capital is low. More productive companies and companies that are less capitalized cannot take advantage of such investment opportunities. Such companies may be forced to cut investment during crises because their debt capacity has been exhausted. The authors (Rampini, Viswanathan 2010) note that companies choose optimally to exhaust their debt capacities and refrain from limiting their model, and not because of the company's inability to protect itself. In contrast, the authors (Rampini, Viswanathan 2010) state that less productive and well-capitalized firms can use their free debt capacities in such times to expand them. The dynamics of debt capacity allocation may imply that capital is less productively engaged in crises and thus the effects of distribution amplify cumulative productivity shocks (ibid., 2294).

Heina and Schoder (2011) analyze the effects of interest rate variation on capacity utilization rate, capital accumulation, and profit in a simple post-Kaleckian model of distribution and growth. This model leads to different potential accumulations of the regime, depending on the values of the parameters in the function of investment, savings and distribution. By estimating these underlying behavioral equations for the U.S. and Germany from 1960 to 2007, the authors (Heina, Schoder 2011) found significant and robust effects on interest rate payments with the expected sign in each of these equations. The results suggest, for both the US and Germany, that the effects of changes in real long-term interest rates on flat capacity utilization rates and capital and profit accumulation are characterized by a normal regime, that is a decline in capital utilization rates due to rising long-term real interest rates and profits, as well as redistributions to

the detriment of labor income, and thus an increase in the share of profits in both countries (Heina, Schoder 2011, 693).

The authors cite Kalecki (1937) ... and his "risk-increasing principle": distributed profits reduce internal financial resources for real investment purposes, but it also reduces access to external financial resources in incompletely competitive capital markets (ibid., 696).

Taking the debt-to-equity ratio, this model gives rise to various potential accumulation regimes, depending on the values of the function parameters of the investment, savings, and distribution models; "Normal regime" with a negative effect of interest rate increases on endogenously determined capacity utilization rates, capital accumulation and profits as a whole, "enigmatic regime" with a positive effect all the way and "medium regime" with positive effects on capacity and profit utilization rates and negative effects on the rate of capital accumulation (Heina, Schoder 2011, 715).

2. ESTIMATION AND DISTRIBUTION OF CAPITAL INVESTMENT PROBABILITIES IN WORLD AND DOMESTIC PRACTICE

Studying foreign scientific papers, it was decided to choose an article by Serbian authors Vitomir Starčević and Slobodan Subotić, which has a title almost identical to this research. The name of the scientific paper is "Investment decision-making in conditions of risk" or investment decision-making in conditions of risk. In this article, the authors summarize their basic theses and hypotheses. They explain that risk is present, to a greater or lesser extent, in every investment, and that investors therefore choose and construct their portfolio based on the expected return and standard deviation. This article was published on fourteen pages in the scientific journal Business Consultant Vol. 2, No. 6, April 2010.

Apart from the fact that the article by Starčević and Subotić (2010) is very clearly, concisely and simply written, it enters into the core issues of labor, which is how probability assessment and distribution influence capital investment decisions and whether they can really eliminate risk, explaining all procedures. a way that is suitable for both students and business practice.

The authors do not use a large number of bibliographic units, but use basic works related to investing capital in conditions of risk. These are, for example, Van Horne C. James, Wachowicz M. John, JR: Fundamentals of Financial Management from 2002 or Weston Fred and Bringham Eugene: Managerial Finance and from 1972. There are also other scientific papers Radomir Božić: Securities Portfolio Management from 2002, then Ćurčić N. Uroš and the book Banking Portfolio Management from 2002. He uses a selection of texts from the Faculty of Economics in Sarajevo, the work of Dragović Vase from 1999, there is also the work of Dejan Šoškić: Securities, portfolio management and investment funds from 2000 .; then Tuševljak Spasoje, Rodić Jovan and Finance of the Company from 2003. Furthermore, the book Vunjak Nenad Financial Management is a stronghold for theoretical assumptions in the paper, while in addition to these books uses four web references.

From the Croatian articles, those were selected that present concrete examples of risk assessment and distribution, namely articles: Tomić, Sesar, and Džaje from 2014, which talks about a comparative analysis of the European capital market and Dow Jones Industrial Average Index, then research by Ivan Šverk, Value at risk as a method of risk

management in financial institutions published in the Economic Review, vol 53 (7-8) on pages 640-657 in 2002. Marijana Dadić's dissertation "Beta coefficients as a measure of risk and return when investing in selected shares on ZSE", from the University of Split, Faculty of Economics, 2011 was used for certain examples. in loan repayment ”was published in the Economic Review, 62 (7-8) on pages 383-403, in 2011. There is also the article by Bestvina Bukvić "Research on the application of specific risk analysis in project financing" published in the Economic Journal on pages 481-495. from 2013. The last research reviewed in this chapter is that of Bendeković from 2000, which discusses approaches to risk assessment and return on investments in ordinary shares, and is published in Economic Review 51 (11-12). The research first presents a foreign article, followed by examples from Croatian practice.

2.1. The Basis of the Research an Article on Investing Capital in Conditions of Risk

The authors specifically analyze securities in their paper, and point out that investors choose a portfolio that maximizes the expected return for a given standard deviation (Starčević, Subotić 2010, 57). The authors state that in today's market conditions, no one is one hundred percent sure that they will succeed in their business intentions. Research is based on the fact that risk can be minimized but not completely eliminated.

According to the authors, the risk is influenced by many variables, the more variables - the higher the risk, and in order for it to be precisely defined in the investment business, it is necessary to know its core (ibid.). Any unplanned situation, uncertainty or sudden event can mean risk.

Authors Starčević and Subotić (2010, 58) state that the risk of a capital investment basically depends on the variability of the expected return. If investing in government bonds, the variability is negligible, that is the investment is very low risk. But if you invest in research or development, in the development of a new product, conquering new markets, the risk is very high and the returns are risky.

The authors distinguish between the concept of risk and uncertainty, because the event is a subject of risk, but all possible outcomes and relative probabilities are individually known, while in uncertainty no outcome is known, and the author therefore uses them as synonyms.

As the basis of the article, the authors Starčević and Subotić deal with portfolio risk, ie portfolio theories that include traditional, modern and postmodern. Traditional portfolio theory sees the need for an investment portfolio, while the selection of securities is not based on the analysis of returns and risks because it did not have the appropriate analytical indicators and equipment. This method was based only on the subjective choice of securities, taking into account the needs, goals and preferences of investors, so it is not precise enough.

Modern portfolio theory assumes that investors choose their portfolios based on expected returns and the standard deviation that is considered a measure of portfolio risk. Guided by the goal of high yield on the one hand and low standard deviation, that is risk on the other hand, investors must choose a portfolio that maximizes the expected return for a given standard deviation or minimizes the standard deviation for the expected return (Starčević, Subotić 2010, 59).

The third theory in the article is the normative portfolio theory, which set and created the rules of conduct of a rational investor, which must be respected in order to enable

portfolio optimization - maximization and investment goal. H. Markowitz contributes to the development of the theory by introducing the calculation of the effective set based on the input data on the expected return and risk for each individual security, as well as the correlation coefficients between each pair of securities.

The fourth theory presented by Starčević and Subotić (2010, 59) says that it is also called "positive portfolio theory" or "market equilibrium theory", and it studies the state of market equilibrium under the assumption that investors behave in accordance with normative portfolio theory. and includes capital investment valuation models - CAPM.

Postmodern portfolio theory is what scientists are striving for today, that is further development, modification and upgrading of modern portfolio theory. It treats the measure of bad risk, as Starčević and Subotić (2010) say, as variability in the rate of return to lower, compared to the expected value.

When explaining capital investment in risk conditions, the authors state that an investor should invest carefully and thoughtfully, and construct a portfolio. New investment projects should be considered in correlation with each other, as well as with those already adopted and implemented in order to achieve maximum diversification - reducing risk to the company as a whole (ibid.) And maximizing returns. Thus, successful diversification must result in the risk of investing in a group or portfolio being less than the sum of the risks of individual projects.

According to the authors (Starčević and Subotić 2010, 60), diversification is a combination of two or more securities whose yields move in different directions, in such a way that individual yields are compensated by holding a portfolio. Thus the portfolio risk is less than the risk of each individual security. Portfolio diversification is shown in the article using Chart 1, which follows:

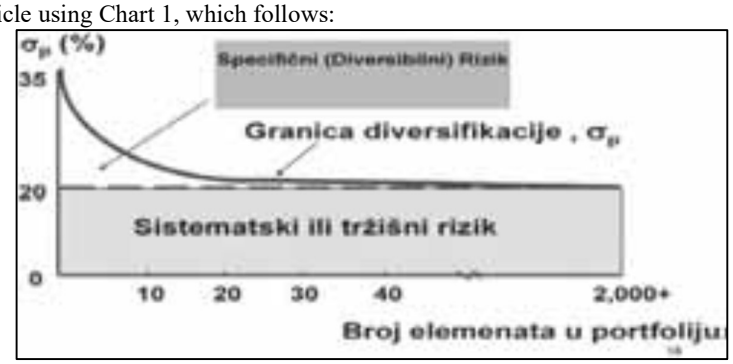

Figure 1. Example of the effect of diversification on portfolio risk
Source: Starčević and Subotić (2010, 60)

It can be seen that diversification reduces the risk, even the small one, the standard deviation decreases in the beginning with a stronger intensity, and with the increase of securities in the portfolio, the intensity decreases. Satisfactory performance is already achieved with a portfolio of about twenty securities. This risk, as the authors write (Starčević, Subotić 2010, 61), is called non-systemic risk. The risk that cannot be avoided by diversification is systemic or market risk.

2.2. Comparasion of Croatian Articles on Risk Capital Investment

A review of Croatian research begins with a study by Tomić, Sesar and Džaja (2014, 10) who state that the dynamics of correlation among national stock exchanges has direct consequences on the performance of international portfolios. They point out that one of the main reasons why investors hold international portfolios is the possibility of better portfolio diversification for the purpose of satisfactory risk distribution Kunovac (2010). They argue that if value is, the standard optimization program favors a portfolio with minimal variability.

Like Starčević and Subotić (2010), these authors confirm that by increasing risk tolerance, that is increasing the expected return on the portfolio, the optimization program includes in the portfolio assets that meet investor preferences, but with a higher percentage of shares. other assets - which is also observed in this paper.

If investors are rational, they choose safe markets or indices. Tomić, Sesar and Džaja (2014, 10) therefore present a table with the ten most attractive and most desirable on the EU market because they have the corresponding expected monthly rate of return. Table 1 comparatively shows the selected indices together with the corresponding expected monthly yield rate and standard deviation of yield in the period 2017 to 2011.

Table 1. Comparatively selected indices with yield rate and standard deviation from 2017 - 2021

State	Index	Yield rate	Standard deviation
DEU	DAX	1,49%	6,57%
ESP	IBEX 35	0,49%	7,36%
FIN	OMX HELSINKI 25	1,28%	6,95%
FRA	CAC 40	0,73%	5,96%
GBR	FTSE 100	0,93%	4,97%
HRV	CROBEX	0,57%	8,12%
ITA	FTSE MIB	0,30%	7,77%
POL	WIG 20	0,88%	6,74%
ROU	BET	1,65%	8,75%
SWE	OMX STOCKHOLM 30	1,41%	5,16%

Source: Tomić, Sesar, Džaja (2014, 10)

A greater degree of economic integration also increases the price correlation between capital markets. For this reason, investors are forced to review the applied strategies, that is markets, more often, in order to keep the level of diversification at an effective level. Tomić, Sesar, Džaja (2014, 4) Latković (2010) proves that a portfolio created by foreign companies can significantly reduce risk while maintaining the expected return on the portfolio, while problems such as diversification, securities analysis and asset allocation are still present (ibid., 5).

Šverko (2002) also mentions the method discussed in the first chapter of the paper. The basic concept of his research comes down to measuring and managing market risk using the Risk Value (VAR) method. Risk value is a measure of potential loss in a given

period due to changes in the prices of portfolio components, based on past data. In addition to market risk management, risk value can, and through some of its derivatives, be used to manage other risks (Šverko 2002, 640, 641.)

Šverko (2002) states that risk management methods are used much more in the countries of the world than in Croatia. Although this research is of an older date, it can be confirmed that the situation is similar today and that many managers and investors are insufficiently educated in activities that involve capital investment. According to Šverk, the reasons for this are objective and subjective. The paper therefore presents some advantages of these concepts, in order to encourage Croatian banks, insurance companies, investment funds and other companies to use these methods (ibid., 641).

Šverko states that the (ibid.) RiskMetrics model calculates how much money can be lost due to market changes in one day, according to the relationships that follow:

Risk value (VAR) = (market value of the position) * (price sensitivity) * (potential change in interest rates)

Or Risk value (VAR) = (market value of the position) * (price variability)

Thus, Šverko also takes into account variables that affect risk, which are also mentioned by Starčević and Subotić (2010) and Tomić, Sesar and Džaja (2014): market value and standard deviation and market value of the instrument (σ). Price variability is difficult to calculate, it carries certain assumptions - that they are preferably distributed by a normal curve, which is determined by statistical methods. Then, for example, as the author says (Šverko 2002) it is possible to predict that there is a 95% chance that the portfolio will not have a higher loss than some amount (based on past data). This normal distribution is shown in Graph 2.

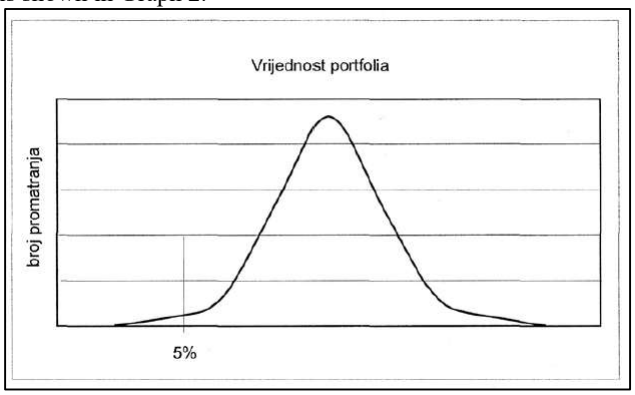

Figure 2. Normal distribution of the risk value method
Source: Šverko (2002, 648)

Assuming that price changes are normally distributed, probability levels can change, to e.g. 99%, etc. This higher level of probability is used more and more often in practice.

The first problematic assumption of the risk value method according to Šverk (2002) is the assumed normality of the distribution. Namely, research shows that market trends very often deviate from the mathematical ideal of normal distribution, as shown in Graph 3:

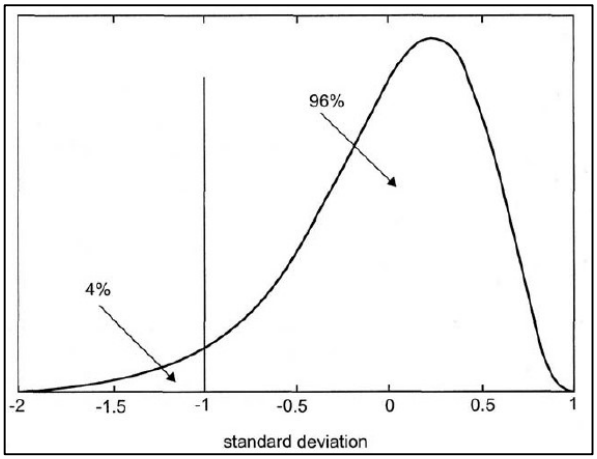

Figure 3. Possible market distribution
Source: Šverko (2002, 648)

Leading world experts such as Allan Greenspan, president of the Federal Reserve, state that Šverko (2002) points out that the biggest problem of risk management today is the very common case of deviating from normal distribution, which creates conceptual errors in existing models.

An interesting example was found in the thesis of Marijana Dadić, Beta coefficients as a measure of risk and return when investing in selected shares on ZSE from 2011. As well as Šverko (2002), Starčević and Subotić (2010) and Tomić, Sesar and Džaje (2014) mentions that in finance, a normal probability distribution is used to measure risk, describing possible outcomes and the probability of their occurrence. Probability distribution is a list of all possible outcomes with the assigned probability of each outcome. The basic parameters of the probability distribution are the expected rate of return and the standard deviation. The expected rate of return, the mean value of the distribution, is a weighted average of the rates of return where the weights are the probabilities of their occurrence. The normal probability distribution, as shown in Chart 2, can be used to measure risk if there are expert predictions about possible rates of return on the security and their probability of occurrence. The standard deviation is a measure of the dispersion, the variability of a series of observations. The higher it is, the greater the possible deviation from the expected rate of return and thus the greater the risk of investors (Dadić 2011, 16).

The research of Šverk (2002) expands and states that in fact the long periods in which returns arrive get the appearance of a "normal distribution", which has both a standard deviation and a mean value. In the case of shorter periods, the author states that the curve is different, and as soon as the period is extended, it returns to "normal". Therefore, although the sample return distribution only roughly shows the actual distribution, that is it carries some error in itself, it still describes it acceptably accurately.

Normal distribution has, therefore, the shape of a bell, as concluded by Streitenberger, Sprčić (2011, 395) who argue that the distribution of differences in the values of calculated indicators must be equal to (or approximately equal to) normal (Gaussian distribution). in previous research (Bendenković 2010) the area covered by the normal

curve represents 100%, because it includes all possible results (returns); 68.26% of the curve area lies within plus and minus one standard deviation from the mean. This can be seen in Graph 4.

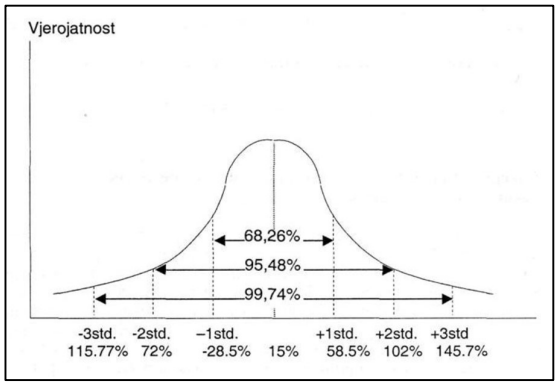

Figure 4. Normal probability distribution
Source: Bendeković (2000, 1292)

In other words, Bendenković (2000, 1292) states that there is a 0.6826 probability that the return of a share of company A will lie within plus and minus one standard deviation of the expected value of 15%. Or that means that in 68.26% of cases the return on investment will be from -28.5% to 58.5%. The probability that the return on investment will be within the plus and minus of the two standard deviations is 0.9548, because the area within the curve between these two points is 95.48% of the total area covered by the normal curve. For the three standard deviations, the area and probability are 99.74%.

Bestvina Bukvić (2013, 491) points out that the lack of a method of ranking value according to risk lies in the fact that it determines the possible reduction of net present value in the occurrence of each factor in the field of specific risks, but does not define the level of possible impact on cash flow in each year. He agrees with the observed foreign article and states that the factors change over time and those that were once the most important, may not be relevant in the future.

Namely, in the assessment of investment and thus distribution, it stands out as a very important piece of information on the magnitude of the impact of specific risk on cash flow in all years of economic life is important to calculate the internal rate of return of the project. Namely, the distribution of cash flows throughout the economic life of the project has a significant impact on the level of the internal rate of return (ibid.). Graph 5 therefore shows the distribution of net present values adjusted to the systemic risk of NPV with WACC, that is the previously mentioned weighted average cost of capital according to the method of determining:

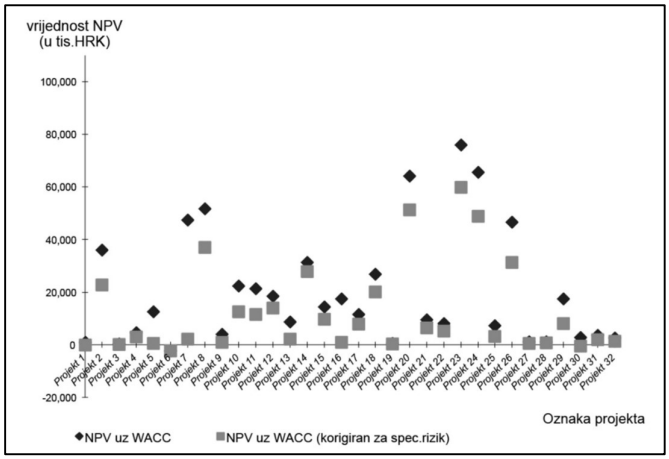

Figure 5. Distribution of net present values adjusted to the systemic risk of NPV with WACC according to the method of determination
Source: Bestvina Bukvić (2013, 491)

Therefore, it is logical for the author to claim that the application of these methods does not give exact results (as claimed by all other authors in their research). ends, however, show individual factors and their impact, as well as the potential risk of project survival if a risk factor is identified.

Quantification of risk and return on investment according to Bendeković is an inevitable part of the analysis in a market economy, where business success is measured at the end of the story by the wealth of owners or investors (Bendeković 2000, 1284). A review of the research follows.

2.3. Personal Point of View on the Conducted Research

When all the research analyzed in the scientific paper is taken into account, it is concluded that capital investment in risk conditions is a very complex process that requires a series of assessments both before the investment and during the investment.

When deciding on an investment, it may happen that a particular project is not selected because its performance is worse than the estimates of other projects, while the discount rate remains important, because it is important in such estimates.

It was seen that there is no option that determines with 100% certainty the impact of one specific risk on cash flows in years of investment, however, in the end, the probability distribution still shows certain factors and their impact, as well as the potential risk of project survival. factor.

The top of the company - the management - decides on the investment of capital, and makes other assessments in terms of risk, which concern capital investments. According to Starčević and Subotić, as well as other authors, these are the goals of a company. The goal of every company is to maximize profits, and the investment estimate must therefore include those factors that provide the best expected return at a certain rate of risk. The other thing that is important is that investors must be reasonable in their investments, so

set aside a certain amount that the company can "bear", which fits into the company's budget.

In particular, estimating the probability distribution in capital investments is the first step in forecasting its risk, so it can be said that it is also the initial stage in risk assessment in capital planning.

If the investment in capital is accepted by the management, then it is a risk that will be borne by the whole company, depending on the connection between the IRR-internal rate of return and the company's operations. The smaller the link between a company's business and internal rates, the lower the risk will be. If the investor's portfolio is well diversified, as the authors Starčević and Subotić mention in their research, then the most dangerous risk affecting the investor is the market risk, which cannot be controlled or reduced. Once the portfolio is diversified by shareholders, only then can they think about other risks.

In case management is not at risk, they should incorporate estimates of individual risk measurements into their analyzes, because future cash inflows change easily, and each project - capital investment - has its own lifespan, that is duration and a certain interest rate that may bring both profit and loss.

It was seen that there is a very useful method of distribution of net present values adjusted to the systemic risk of NPV with WACC, or weighted average cost of capital. Finally, sensitivity analysis is crucial in assessing capital investment because it allows any variables that affect investment changes to be identified. It basically singles out individual variables and tests possible changes in each of them, and is most often used when investing in today's modern environment. Changes are expressed as a percentage, after the starting values of the entire investment are determined.

Of course, nowadays all this is done with the help of sophisticated computer programs, where computers calculate all variables, first probability distributions and then their combination, then NPV - the current value of the project and finally IRR. These distribution results are ultimately assessed by risk assessment measures. In the end, it was seen that risk management methods are used much more in the world than in Croatia, which is definitely the first thing to do - create quality staff that will be able to keep pace with the risky market situation in the Republic of Croatia. and especially in tourism and hospitality.

CONCLUSION

Finally, the research is synthesized in this chapter. It was learned that the probability distribution is a list of all possible outcomes with the assigned probability of each outcome. The basic parameters of the probability distribution are the expected rate of return and the standard deviation. The expected rate of return, the mean value of the distribution, is a weighted average of the rates of return where the weights are the probabilities of their occurrence.

The variability of capital prices is difficult to calculate, and it carries with it certain assumptions - that they are preferably distributed by a normal curve, which is determined by statistical methods. Then, for example, it can be predicted that there is a 95% chance that the portfolio will not have a higher loss than some amount (based on past data). By increasing risk tolerance, ie increasing the expected return on the portfolio, the optimization program includes in the portfolio assets that meet the preferences of

investors, but with a higher percentage of shares, while other assets are very quickly excluded from optimization.

The paper presents a research by Serbian authors Vitomir Starčević and Slobodan Subotić, "Investment decision-making in risk conditions" or in Croatian investment decision-making in risk conditions. In this article, the authors summarize their basic theses and hypotheses. They explain that risk is present, to a greater or lesser extent, in every investment, and that investors therefore choose and construct their portfolio based on the expected return and standard deviation.

From the Croatian articles, those that present concrete examples of risk assessment and distribution were selected. What can be confirmed is that the situation in Croatia regarding the assessment and distribution of investment probabilities is still poorly used, and this is unfortunately possible due to uneducated staff but also due to poor business climate that does not even allow investment. It was also seen that some authors assume that in the crisis, although cash flows are weak, investment opportunities are growing as the price of capital is low, which can be a salvation for the Republic of Croatia.

Finally, it can be concluded that the assumptions defined by the authors, that "probability assessment and distribution prove useful because they indicate certain factors and their impact, and the potential risk of survival of a project if a risk factor is identified" are fully proven in scientific work. There is no option that determines with one hundred percent certainty the impact of one specific risk on cash flows in years of investment, however, in the end, still show certain factors and their impact, as well as the potential risk of project survival if identified risk factor. As for the time horizon of the investment, the long periods in which the return on a capital investment arrives take on the appearance of a "normal distribution", which has both a standard deviation and a mean value. If the periods are shorter, then the curve is different, and as soon as the period is extended, it returns to "normal". Therefore, although the sample return distribution only approximates the actual distribution, that is it carries a certain error, it can be concluded that it still describes the risk reasonably accurately.

If the investment in capital is accepted by the management, then it is a risk that will be borne by the whole company, depending on the connection between the IRR-internal rate of return and the company's operations. The smaller the link between a company's business and internal rates, the lower the risk will be. If the investor's portfolio is well diversified, as the authors Starčević and Subotić mention in their research, then the most dangerous risk affecting the investor is the market risk, which cannot be controlled or reduced. Once the portfolio is diversified by shareholders, only then can they think about other risks.

REFERENCES

Bendekovic, Dino. 2000. Approaches to risk and return assessment for investments in ordinary shares. Economic Review 51 (11-12): 1282-1312.

Bestvina Bukvic, Ivana. 2013. Research on the application of specific risk analysis in project financing. Economic Journal 26 (2): 481-495.

Borio, Claudio and Zhu, Haibin. 2008. Capital Regulation, Risk-Taking and Monetary Policy: A Missing Link in the Transmission Mechanism? Bank for International Settlements, BIS Working Paper No 268: 1-39

Dadic, Marijana. 2011. Beta coefficients as a measure of risk and return when investing in selected shares on ZSE. University of Split Faculty of Economics: 1-56.

Dutta Kabir, and Jason Perry.2006. A Tale of Tails: An Empirical Analysis of Loss Distribution Models for Estimating Operational Risk Capital. FRB of Boston Working Paper 06 (13): 11-14.

Eckhard Heina, and Christian Schoder. 2011. Interest Rates, Distribution and Capital Accumulation - A Post-Kaleckian Perspective on The US and Germany. International Review of Applied Economics 25 (6): 693–723.

Hlouskova, Jaroslava, Mikocziova, Jana, SIVAK, Rudolf and TSIGARIS, Peter. 2014. Capital Income Taxation and Risk-Taking under Prospect Theory: The Continuous Distribution Case. Finance and Assurance-Czech Journal of Economics and Finance 64 (5): 374-391.

Ivanovic, Zoran. Scientific research methodology. Kastav: SAIVA, 2011

Kan, Raymond, Robotti, Cesare and Jay Shanken. Pricing Model Performance and the Two-Pass Cross-Sectional Regression Methodology. Federal Reserve Bank of Atlanta, Working Paper 2009 (11): 14-26.

Mian, M. A., and Vélez-Pareja, Ignacio. 2007. Applicability of the Classic WACC Concept in Practice. Latin American Business Review 8 (2): 19-40.

Qiu, Ke, and Zhou, Cheng. 2013. The Analysis of Several Models of Investment Value of Logistics Project Evaluation. Economics Research International Volume 2013: 1-6.

Rampini, Adriano A. and Viswanathan, S. 2010. Collateral, Risk Management, and the Distribution of Debt Capacity. The Journal Of Finance LXV (6): 2293-2322

Schwartz, Robert F. 2007. Risk Distribution in the Capital Markets: Credit Default Swaps, Insurance and a Theory of Demarcation. Fordham Journal Ofcorporate & Financial Law 12 (1): 167-201.

Starčević, Vitomir, and Subotić, Slobodan. 2010. Investment decision making in risk conditions. Business Consultant 2 (6): 57-63.

Streitenberger, Miodrag, and Miloš Sprčić, Danijela. 2011. Predictive ability of financial indicators in predicting loan repayment delays. Economic Review 62 (7-8): 383-403.

Sverko, Ivan. 2002. Value at risk as a method of risk management in financial institutions. Economic Review 53 (7-8): 640-657.

Tomic, Bojan, Sesar, Andrijana, Dzaja, Tomislav. 2014. A Comparative Analysis of the European Capital Market and the Dow Jones Industrial Average Index. Accounting and Management No. 15th International Scientific and Professional Conference: 265-283.