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MODERNA PORTFOLIO TEORIJA I DIVERSIFIKACIJA

Rezime

Savremena portfolio teorija predstavlja najznačajniju inovaciju XX vijeka na području investiranja i upravljanja portfolijom hartija od vrednosti. Prije moderne portfolio teorije smatralo se da svaku akciju treba analizirati putem fundamentalne analize i u portfolio uvrstiti one koji poseduju potencijal rasta. Moderna portfolio teorija je prva dala generalni pristup upravljanju portfolijom hartija od vrednosti. Osigurala je jedinstvenu platformu za posmatranje i ocenu pojedinih investicija. Koncept je teorijski jednostavan i empirijski dokazan kao pouzdan, u normalnim tržišnim uslovima. Cilj rada je da se ukaže na korisnost primene moderne portfolio teorije, kao i na njena ograničenja na tržištima u tranziciji.

Ključne reči: prinos, rizik, aktivna, pasivna strategija portfolia, diversifikacija

MODERN PORTFOLIO THEORY AND DIVERSIFICATION

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Summary

Modern portfolio theory represents the most significant innovation in the 20th century in the field of investment and securities portfolio management. Before the modern portfolio theory it was believed that each share is to be analyzed by means of fundamental analysis and that only those shares having growth potential should be included in the portfolio. Modern portfolio theory was the first to offer a general approach to securities portfolio management. It ensured a uniform platform for monitoring and assessment of individual investments. The concept is theoretically simple and empirically proven as reliable, in normal market conditions. The objective of this paper is to indicate the usefulness of modern portfolio theory implementation, as well as its limitations in transition markets.

Key Words: return, risk, active and passive portfolio strategy, diversification

Modernu portfolio teoriju (engl. *Modern Portfolio Theory*) razvio je profesor *Harry Markowitz* u svojoj doktorskoj disertaciji. Prezentirao ju je javnosti naučnim člankom "*Portfolio Selection*" objavljenim u časopisu "*Journal of Finance*" 1952. godine, i u knjizi "*Portfolio Selection: Efficient Diversification of Investments*" 1959. godine.

Za razliku od tradicionalnog upravljanja imovinom, koje se zasniva na fundamentalnoj analizi pojedinih akcija, sistem koji je razvio Markowitz, prati portfolio imovine na osnovu kombinacije rizika i stope prinosa portfolija. To je bio potpuno novi pristup ulaganju, kasnije poznat kao Moderna portfolio teorija (MPT). *Markowitzeva* hipoteza i njegov rad bili su toliko revolucionarni da mu je 1990. godine dodeljena Nobelova nagrada za izvanredno postignuće u ekonomiji.

Kao i mnoge dobre ideje i MPT izgleda jednostavno. "Osnovnih principa portfolio teorije dosetio sam se jednog dana dok sam čitao *John Burr Williams*-ovu "Teoriju investicijske vrednosti". *Williams* predlaže da vrednost akcije bude jednaka sadašnjoj vrednosti toka njenih budućih dividendi. Ali jasno je, da su dividende nesigurne, te sam stoga uzeo u obzir *Williamsov*-u preporuku da vrednost akcije bude očekivana vrednost njenih budućih diskontovanih tokova dividendi. Međutim, ako je ulagač zabrinut samo zbog očekivane vrednosti akcije, on mora biti zainteresovan i za očekivanu vrednost portfolija."

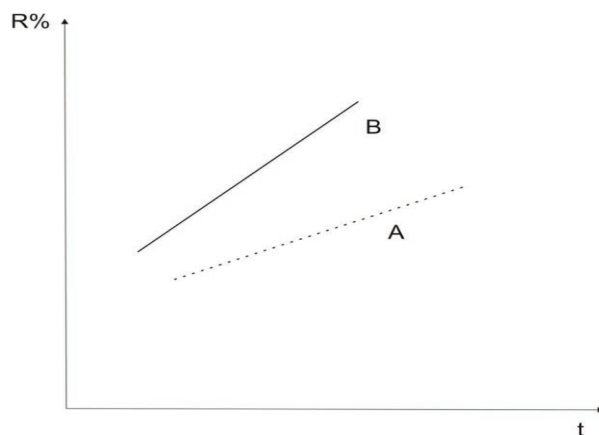
Markowitz smatra da će ulagač, koji sa sigurnošću zna buduće prinose, ulagati samo u jednu akciju, onu sa najvišom budućom stopom prinosa $R\%$. Ovakav izbor ulagača prikazaćemo na slici br. 1.

U prikazanoj nerealnoj situaciji, u kojoj investitor uzima u obzir samo stopu prinosa u određenom vremenu t , svi su prinosi sigurni, stoga se investitor odlučuje za višu stopu prinosa. Zbog toga svaki racionalni (*lat. ratio = razum*) investitor želi ulagati u akciju B, a ni jedan se ne bi odlučio za akciju A. Svi bi investitori imali isti rezultat ulaganja i ni jedan ne bi težio višim stopama prinosa.

Ako više hartija od vrednosti ima budući prinos jednako visok, tada će investitor biti indiferentan u njihovom odabiru, ili u bilo kojoj njihovoj kombinaciji. U tom slučaju, investitor neće preferirati diversifikovani portfolio. Takvo ponašanje koje se bazira samo na očekivanom prinosu (kao i ponašanje koje se bazira na sigurnoj budućnosti) mora se odbaciti kao opis stvarnog ili pak racionalnog ponašanja investitora.

Markowitzu se činilo očitim da investitori moraju voditi računa o riziku i prinosu, te ih je stoga potrebno meriti za portfolio u celini. Dakle, rizik je drugi važan faktor kod ulaganja koji nudi mogućnost ostvarivanja viših prinosa i koji omogućava izbor pri ulaganju, kao što je prikazano na slici br. 2.

Slika br. 1: Izbor ulagača između dve akcije sa sigurnim različitim stopama prinosa



IZVOR: Markowitz, H. M., "*Foundations of Portfolio Theory*", *The Journal of Finance*, Vol. 44, No. 2., (1991), str. 469-477.

Modern Portfolio Theory was developed by Professor Harry Markowitz in his doctoral dissertation. He presented it to the public in a scientific paper titled "Portfolio Selection", published in the magazine *Journal of Finance* in 1952, and in the book *Portfolio Selection: Efficient Diversification of Investments* in 1959.

As opposed to traditional assets management based on fundamental analysis of individual shares, the system developed by Markowitz monitors assets portfolio on the basis of a combination of portfolio risk and return rate. This was an entirely fresh approach to investment, later to be known as Modern Portfolio Theory (MPT). Markowitz's hypothesis and his work were so revolutionary that in 1990 he was awarded the Nobel Prize for an Extraordinary Achievement in Economics.

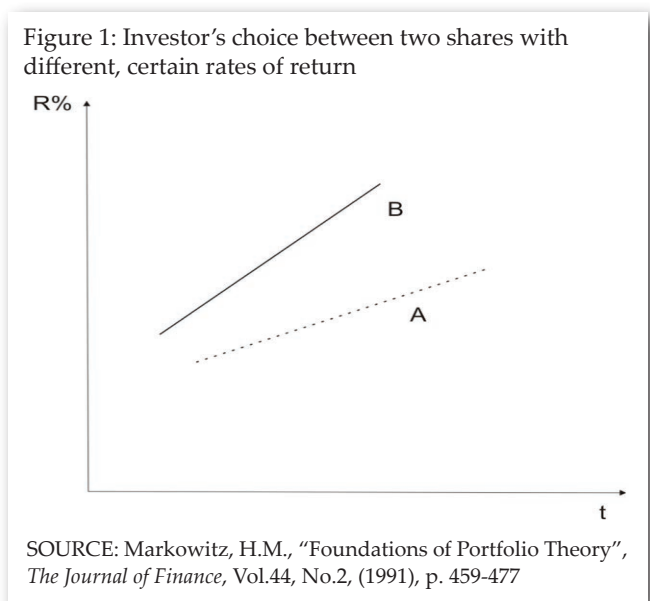
Like many good ideas, MPT, too, looks rather simple. "I thought of the main portfolio theory principles one day while reading *Investment Value Theory* by John Burr Williams. Williams proposes that a share's value should be equal to the present value of its future dividends' flow. But it is clear that dividends are unstable, therefore I took into consideration Williams' recommendation that a share's value should equal the expected value of its future discounted dividends' flow. However, if the investor is only concerned about the expected share's value, he has to be interested in the expected value of the portfolio, too."

Markowitz believes that the investor who is certain of future returns will only invest in one share - the one with the highest future rate of return $R\%$. Such choice by the investor is represented in Figure 1.

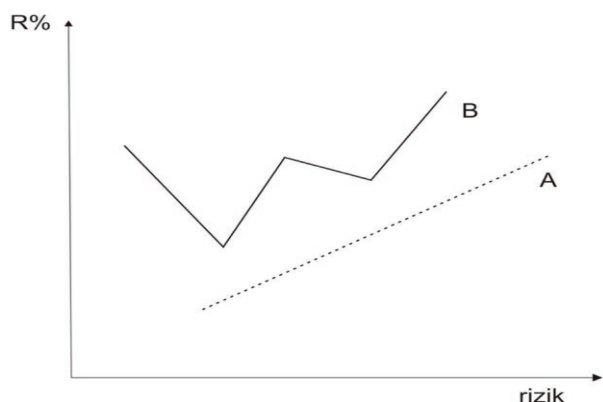
In the presented, unreal situation, in which the investor takes into consideration only the rate or return in a defined time t , all returns are certain, hence the investor opts for the higher rate of return. Therefore, every rational (*lat. ratio = common sense*) investor wants to invest in the share B , and none of them would opt for the share A . All investors would achieve the same investment result, and none of them would strive for higher rates of return.

If several securities have the equally high future returns, the investor will be indifferent in terms of their selection, or any kind of their combination. In that case, the investor will not prefer a diversified portfolio. Such a behaviour, being based only on expected returns (as well as the behaviour based on safe future), has to be rejected as a description of realistic or rational behaviour of an investor.

Markowitz thought it obvious that investors have to pay attention to risks and returns, hence the need to measure them at the level of the entire portfolio. In other words, risk is the second important factor in investment, which offers an opportunity for yielding higher returns and enables choice in the investment process, as is shown in Figure 2.



Slika br. 2: Izbor investitora između dve akcije s različitim stopama prinosa i rizikom



IZVOR: Markowitz, H. M., "Foundations of Portfolio Theory", The Journal of Finance, Vol. 44, No. 2., (1991), str. 470.

Na ovoj slici, koja predstavlja realniju sliku stvarnosti, postoji mogućnost stvarnog izbora. Investitor se suočava sa dvije stvari: preferirati siguran rezultat (kojeg nudi akcija A), ili preferirati višu stopu prinosa koju nudi akcija B. Polazna su osnova istraživanja profesora Markowitza stopa prinosa i rizik, odnosno neizvesnost, stoga će u nastavku biti više reči o načinu izračunavanja stope prinosa i rizika na akciju, da bi kasnije bilo reči i o portfoliju.

Finansijska imovina ima visok stepen likvidnosti i relativno je jednostavno utvrditi prinos koji ostvaruje. Prinos na određenu hartiju od vrednosti izražava se najčešće kroz ukupan prinos (engl. *total return*) ili kroz prinos za vremenski period držanja hartije od vrednosti (engl. *holding period return*).

Pri izračunavanju ukupnog prinosa mora se uzeti u obzir učinak dobijenih novčanih dohodaka od ulaganja u određenu imovinu i učinak promene njene vrednosti dok je u vlasništvu investitora. Novčani dohodci koje investitor dobija od neke imovine za određeni vremenski period njenog držanja zavise od oblika imovine, kao i od njene profitne snage. Prinos od akcija u vlasništvu u određenom vremenskom periodu sastoji se od novčanih dohodaka od isplaćenih dividendi (tzv. dividendni prinos) i od eventualnih razlika između kupovnog i prodajnog kursa (tzv. kapitalni dobitak).

Ako se žele posmatrati učinci posedovanja akcija u određenom vremenskom periodu,

tada primljene novčane dohotke i učinke promene vrednosti imovine za vremenski period posedovanja treba podeliti s vrednošću imovine na početku perioda, tj. s vrednošću po kojoj je imovina stečena. Na osnovu ovoga, stopa prinosa, kao relativni pokazatelj, računa se prema sledećoj formuli:

$$R = \frac{(C_1 - C_0) + d}{C_0} 100$$

gde je:

R - stopa prinosa akcije

C_1 - prodajna cena (kurs)

C_0 - kupovna cena (kurs)

d - isplaćena dividenda

Npr. ako je investitor kupio akciju A po kursu od 100 RSD, a nakon godinu dana istu je prodao za 105 RSD. Pretpostavimo da mu je u međuvremenu isplaćena dividenda u iznosu od 5 RSD. Stopa prinosa akcije A prema jednačini (1) računace se na sledeći način:

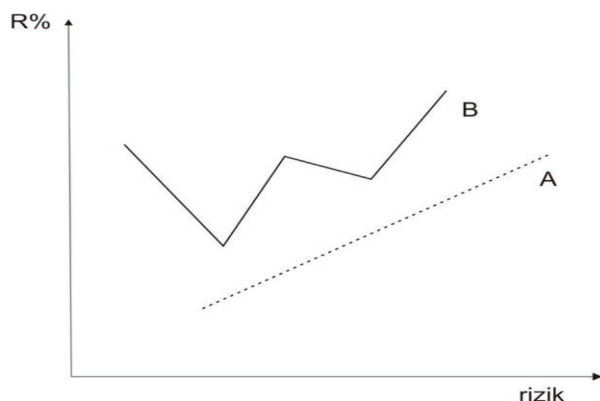
$$R_A = \frac{(105 - 100) + 5}{100} 100 = 10\%$$

Stopa prinosa akcije A je 10%. Stopa prinosa je jedini rezultat ulaganja, a sastoji se iz dva dela: stope prinosa od dividende ($\frac{d}{C_0} 100 = 5\%$) i stope prinosa od kapitalnog dobitka ($\frac{C_1 - C_0}{C_0} 100 = 5\%$). Tehnički gledano, stopa prinosa se računa *ex post* tj. na osnovu poznatih podataka o istorijskim prinosima. Međutim, imanentno svojstvo svakog investiranja je neizvjesnost i rizik, pa je nemoguće govoriti o budućem prinosu kao o sigurnoj veličini.

Budući da se sa sigurnošću budućnost ne može predvideti, radi procenjivanja očekivanih prinosa treba koristiti podatke iz prošlosti (istorijske podatke). *Bernstein* tvrdi da je potrebna vremenska serija podataka od najmanje 20 do 30 godina kako bi se stekla početna ideja o očekivanom prinosu, a od 5-10 godina podataka na mesečnom nivou za sticanje ideje o riziku.¹ Stoga, ako govorimo o budućnosti, treba govoriti o očekivanom prinosu i očekivanoj stopi prinosa.

¹ Bernstein, W.J., "The Intelligent Asset Allocator - Portfolio Theory for the Small Investor", McGraw-Hill, 2000.

Figure 2: Investor's choice between two shares with different rates of return and risks



SOURCE: Markowitz, H.M., "Foundations of Portfolio Theory", *The Journal of Finance*, Vol.44, No.2, (1991), p.470

In this graph, presenting a more realistic picture, there is a possibility of real choice. The investor faces two options: to prefer safe result (offered by the share A), or to prefer higher rate of return offered by the share B. Rate of return and risk, i.e. uncertainty, make the starting point of Professor Markowitz's research, hence we will dwell more on the method for calculation of rate or return and risk of a share, after which we will deal some more with the portfolio itself.

Financial assets are highly liquid and it is relatively simple to determine the return it yields. The return on a certain security is usually expressed through total return or through holding period return.

When calculating total return, one has to take into consideration the return on capital gains from the investment in certain assets and the return on its value fluctuations while it was in the possession of the investor. Profit gained by the investor from certain assets in a defined holding period depends on the type of asset, and on its profit strength. Return on shares held for a certain period of time consists of profit from paid out dividends (the so-called dividend yield) and from potential differences between the purchase and selling rate (the so-called capital gain).

If one wants to monitor the returns on shares held in a certain time period, the achieved profits and assets value fluctuations in the holding period need to be divided by the assets value

at the beginning of the concerned period, i.e. by the value at which the assets were acquired. Based on this, rate of return, as a relevant indicator, is calculated according to the following formula:

$$R = \frac{(C_1 - C_0) + d}{C_0} 100$$

with:

R - rate of return on a share;

C_1 - selling price (rate);

C_0 - purchase price (rate);

d - paid-out dividend.

For instance, the investor purchased a share A at the rate of RSD 100, and after a year sold the same share at the rate of RSD 105. Let us assume that, in the meantime, he was paid out a dividend in the amount of RSD 5. The rate of return of the share A according to the formula (1) is calculated as follows:

$$R_A = \frac{(105 - 100) + 5}{100} 100 = 10\%$$

The rate of return of the share A is 10%. Rate of return is the only result of the investment, and it consists of two parts: dividend yield ($\frac{5}{100} 100 = 5\%$) and return on capital gains ($\frac{105-100}{100} 100 = 5\%$). Technically speaking, rate of return is calculated *ex post*, i.e. on the basis of available data on historic returns. However, the imminent feature of each investment is uncertainty and risk, which is why it is impossible to talk about future return as a definite amount.

Given that the future cannot be predicted with certainty, one should use the past data (historic data) when assessing the expected returns. Bernstein claims that it takes a time series of data of at least 20 or 30 years in order to get a basic idea about the expected return and from 5 to 10 years of data on a monthly level in order to assess the risk.¹ Therefore, when it comes to the future, we need to discuss expected return and expected rate of return.

For the expected (average) rate of return of a certain security, different outcomes need

¹ Bernstein, W. J., *The Intelligent Asset Allocator - Portfolio Theory for the Small Investor*, McGraw-Hill, 2000

Za očekivanu (prosečnu) stopu prinosa pojedine hartije od vrednosti moraju se predvideti različiti ishodi, i to da se za svaku moguću stopu prinosa predvidi i verovatnoća nastupanja. Primenom podataka iz prošlosti koji se projiciraju u budućnost, investitori mogu predvideti verovatnoću nastupanja određene stope prinosa.

Moderna portfolio teorija može se posmatrati kroz tri postulata. Prvi, koji je postavio *Harry Markowitz*, odnosi se na povezanost i ravnotežu preuzetog rizika i očekivanog prinosa, koja zavisi od diversifikacije. Drugi, koji je razradio *William Sharpe*, obuhvata pojednostavljeni model analize portfolija, u odnosu na *Harry Markowitz*-ev, odnosno model za vrednovanje kapitalne aktive (engl. *Capital Asset Pricing Model - CAPM*) i koeficijent beta. Treći je hipoteza o efikasnom tržištu (EMH) *Eugena Fama*.

Merenje tržišnog prinosa i rizika

Portfolio teorija koju je razvio *Harry Markowitz* jedan je od ključnih elemenata koji pomažu investitorima da odaberu portfolio vrijednosnih papira, koji će davati što veći prinos uz željeni nivo rizika. Donošenje odluke o izboru vrijednosnih papira, tj. pronalaženje optimalnih udijela vrijednosnih papira, vrši se na osnovu kriterijuma korisnosti.

Pri ulaganju u pojedinu hartiju od vrednosti, rizik portfolija predstavlja mogućnost da se ne ostvari planirani prinos, odnosno da investirana sredstva donesu manju dobit od očekivane ili čak ostvare i gubitak. Odstupanja vrednosti oko njene očekivane srednje vrednosti, mogu se meriti varijansom i standardnom devijacijom. Varijansa predstavlja sumu ponderisanih kvadrata odstupanja mogućih prinosa oko očekivane srednje vrednosti. Ponderi predstavljaju verovatnosti nastupa svakog pojedinog prinosa. Što su veća moguća odstupanja oko očekivane srednje vrednosti i što je veća verovatnost njihova nastajanja, varijansa će biti veća. Standardna devijacija je izražena u istim jedinicama u kojima je izražena i aritmetička sredina, stoga je standardna devijacija apsolutna mera disperzije. Za izračunavanje varijanse σ^2 , koristi se formula:

$$\sigma^2 = \sum_{i=1}^N (R_i - \bar{R})^2 X_i p_i$$

gde je σ^2 - varijansa, R_i - moguća odstupanja (oscilacije) oko srednje vrednosti, \bar{R} - očekivana srednja vrednost, p_i - verovatnost nastupa određene vrednosti. Standardna devijacija σ , predstavlja drugi koren iz varijanse:

$$\sigma = \sqrt{\sum_{i=1}^N (R_i - \bar{R})^2 X_i p_i}$$

Standardna devijacija kao apsolutna mera disperzije nije prikladna za upoređivanje veličine disperzije dveju distribucija sa različitim bročanim vrednosnim obeležjima. Za takvu uporedbu treba koristiti relativnu meru disperzije kojom se eliminiše uticaj različite brojčane vrednosti obeležja jedinica jednog i drugog uzorka. Relativna mera disperzije koja se bazira na standardnoj devijaciji je koeficijent varijacije:

$$V = \frac{\sigma}{\bar{R}} \times 100$$

gde je V - koeficijent varijacije, σ - standardna devijacija, \bar{R} - očekivana srednja vrednost.

Očekivani prinos portfolija se izračunava kao ponderisana suma prinosa pojedinih vrijednosnih papira koji čine portfolio. Udio pojedinog vrijednosnog papira u portfoliju služi kao ponder:

$$E(R_{port}) = \sum_{i=1}^N X_i E(R_i)$$

gde je $E(R_{port})$ - očekivani prinos na portfolio, X_i - procentni udeo hartija od vrednosti (i) u portfoliju, $E(R_i)$ - očekivani prinos hartije od vrednosti (i). Varijansa portfolija se izračunava na sledeći način:

$$\sigma^2 = \sum_{i=1}^N X_i^2 \sigma_i^2 + \sum_{i=1}^N \sum_{j=1}^N X_i X_j \sigma_i \sigma_j \rho_{ij}$$

gde je σ_i^2 - varijansa i -te hartije od vrednosti, σ_i - standardna devijacija i -te hartije od vrednosti, ρ_{ij} - koeficijent korelacije između prinosa hartija od vrednosti (i) i (j). Poslednji deo jednačine (6) ($\sigma_i \sigma_j \rho_{ij}$), može se zameniti statističkim izrazom

to be predicted, including the probability of occurrence for each potential rate of return. By applying the historic data which are projected into the future, investors may predict the probability of occurrence of a certain rate of return.

Modern portfolio theory may be viewed through three postulates. The first one, defined by Harry Markowitz, is related to the connection and balance between the assumed risk and expected return, which depends on diversification. The second one, developed by William Sharpe, incorporates a simplified model of portfolio analysis, in comparison with the one by Harry Markowitz, i.e. *Capital Asset Pricing Model - CAPM*, and beta coefficient. The third one is the efficient market hypothesis (EMH) by Eugene Fama.

Market return and risk measurement

Portfolio theory developed by Harry Markowitz is one of the key elements helping investors to choose the securities portfolio that will yield the highest possible return at the desired level of risk. The decision on securities selection, i.e. finding the optimum share of securities, is made based on the usefulness criterion.

In the process of investment in a certain security, portfolio risk represents the possibility of the projected return not being achieved, i.e. of invested funds yielding lower profit than expected, or even yielding a loss. Deviations of value from its expected mean value can be measured by means of variance and standard deviation. Variance is the sum of weighted squared deviations of potential returns from the expected mean value. The weights represent the probability of occurrence of each individual return. The higher the potential deviations from the expected mean value and the higher the probability of their occurrence, the bigger the variance. Standard deviation is expressed in the same units as arithmetic mean; hence standard deviation is the absolute measure of dispersion. Variance σ^2 is calculated according to the following formula:

$$\sigma^2 = \sum_{i=1}^N (R_i - \bar{R})^2 X p_i$$

with σ^2 - variance, R_i - potential deviations (oscillations) from the mean value, \bar{R} - expected mean value, p_i - probability of occurrence of a certain value. Standard deviation σ is the square root of variance:

$$\sigma = \sqrt{(R_i - \bar{R})^2 X p_i}$$

Standard deviation as an absolute measure of dispersion is not appropriate for comparing dispersion sizes of two distributions with different numerical value characteristics. Such a comparison should be based on a relative measure of dispersion which eliminates the influence of different numerical value characteristics of units within the two samples. Relative measure of dispersion, based on standard deviation, is a variation coefficient:

$$V = \frac{\sigma}{\bar{R}} \times 100$$

with V - variation coefficient, σ - standard deviation, \bar{R} - expected mean value.

Expected portfolio return is calculated as a weighted sum of returns on certain securities that constitute the portfolio. The portion of a certain security within the portfolio is used as the weight:

$$E(R_{port}) = \sum_{i=1}^N X_i E(R_i)$$

with $E(R_{port})$ - expected portfolio return, X_i - percentage share of securities (i) in the portfolio, $E(R_i)$ - expected return on the security (i). Portfolio variance is calculated in the following way:

$$\sigma^2 = \sum_{i=1}^N X_i^2 \sigma_i^2 + \sum_{i=1}^N \sum_{j=1}^N X_i X_j \sigma_i \sigma_j \rho_{ij}$$

with σ_i^2 - variance of the i^{th} security, σ_i - standard deviation of the i^{th} security, σ_{ij} - correlation coefficient between the returns of (i) and (j) securities. The last part of the equation (6) ($\sigma_i \sigma_j \rho_{ij}$) can be replaced by the statistical equation Cov_{ij} (covariance) in order to simplify the equation, given that:

$Cov_{i,j}$ (kovarijansa), kako bi se pojednostavila jednačina, budući da je:

$$\rho_{i,j} = \frac{Cov_{i,j}}{\sigma_i \sigma_j}$$

Kovarijansa se dobija iz slijedeće formule:

$$Cov_{i,j} = \frac{1}{N-1} \sum_{i=1}^N [(x_i - \bar{x})(y_i - \bar{y})]$$

Pojam i funkcija diversifikacije

Nije ni malo jednostavno uvek naći hartije od vrednosti sa međusobno niskim koeficijentima korelacije. Jedan način da se smanji ukupan rizik portfolija je povećanje broja hartija od vrednosti u njemu, tj. uvećanje njegove diversifikacije. Taj tradicionalni pristup, poznatiji je kao prosta diversifikacija i podrazumeva investiranje u veći broj različitih hartija od vrednosti (akcija, obveznica i dr.). Rukovodeći se ovim pristupom, na prvi pogled može izgledati da bi investicija u npr. stotinu različitih hartija od vrednosti imala četiri puta niži rizik od investicije u dvadeset i pet takvih hartija od vrednosti. Banke, penzioni fondovi, osiguravajuća društva i druge finansijske organizacije su čak i zakonski obavezne da formiraju diversifikovani portfolio. Diversifikacijom se rukovode i individualni investitori. Gledajući iz ugla investitora, nije toliko važno da li cene nekih hartija od vrednosti rastu ili padaju, važan je prinos njegovog portfolija i portfolio rizik. Samim tim, prinos i rizik određenih hartija od vrednosti treba da budu analizirani u uslovima u kojima oni utiču na prinos i rizik portfolija u kojem se nalaze.

Investitor u svom portfoliju može da držati i akcije preduzeća koje nije mnogo poznato, čije akcije nisu likvidne, čija zarada je varirala u prošlosti i koje nije isplatilo dividendu. Sve navedeno ukazuje na akcije sa visokim rizikom, kojem bi trebalo da odgovara i visoki prinos. Međutim, u praksi se može desiti da takve akcije imaju mali prinos. To znači da su investitori ovo preduzeće smatrali kao niskorizično, uprkos niskoj zaradi. Razlog tome nalazi se u diversifikaciji i njenom uticaju na rizik. Naime, zarada tog preduzeća i cene hartija od vrednosti rastu za vreme recesije, kada cene većine drugih akcija padaju. Zbog toga držanje ovih hartija od

vrednosti u portfoliju stabilizuje prinos celog portfolija. Stepens diversifikacije zavisi od:

- obima ponude hartija od vrednosti na tržištu,
- obima ulaganja,
- mogućnosti pristupa tržištu i
- obaveštenosti investitora.

Korak dalje u analizi diversifikacije predstavlja međunarodna diversifikacija. Ona investitoru nudi još bolju priliku za povećanje prinosa i redukovanje rizika u isto vrijeme. Sa druge strane, međunarodna diversifikacija implicira izloženost deviznom riziku i riziku zemlje. Međunarodna diversifikacija predstavlja posebnu mogućnost. Investitori su tradicionalno investirali uglavnom na svojim nacionalnim finansijskim tržištima. U želji da diversifikuju svoje plasmane okretali su se investiranju u različite privredne oblasti i različite hartije od vrednosti. Danas, najpre zahvaljujući razvoju telekomunikacija, prevladuje opredeljenje da diversifikacija plasmana pokuša da se uveća i investicijama na inostranim finansijskim tržištima, pa je proces globalizacije finansijskog tržišta postao svetski trend.

Sistematski tj. tržišni rizik, predstavlja donju granicu do koje se rizik portfolija može umanjiti diversifikacijom na domaćem finansijskom tržištu. Dodatna diversifikacija može imati efekte u smislu daljeg smanjivanja rizika portfolija, ispod nivoa tržišnog rizika, samo ako je usmerena na inostrana finansijska tržišta. Po određenim tradicionalnim procenama, međunarodno diversifikovani portfolio bi trebao da ima upola manji rizik od portfolija diversifikovanog samo na nacionalnom finansijskom tržištu SAD (slika br. 3). Iako globalizacija finansijskog sistema u svetu doprinosi većoj uzajamnoj zavisnosti nacionalnih finansijskih tržišta, između njih ipak nema perfektno korelacije i to je ono što omogućava dodatno obaranje rizika međunarodno diversifikovanog portfolija. Međutim i tome ima granica. Granice su tzv. globalni faktori tj. okolnosti koje utiču na volatilnost svetskih finansijskih tržišta u celini i mogu se smatrati globalnim sistematskim ili tržišnim rizikom (donja isprekidana linija na slici br. 4). Globalni tržišni rizik po nekim novim procenama iznosi 56% nacionalnog tržišnog rizika. Dodatni faktor u minimiziranju rizika

$$\rho_{ij} = \frac{Cov_{i,j}}{\sigma_i \sigma_j}$$

Covariance is calculated according to the following formula:

$$Cov_{i,j} = \frac{1}{N-1} \sum_{i=1}^N [(x_i - \bar{x})(y_i - \bar{y})]$$

Concept and purpose of diversification

It is by no means simple to always find the securities with mutually low correlation coefficients. One way to reduce the total portfolio risk is to increase the number of securities in it, i.e. to increase its diversification. This traditional approach is more commonly known as simple diversification and implies the investment in a larger number of securities (shares, bonds, etc.). Following this approach, it may seem, at the first glance, that the investment in, for instance, a hundred different securities would bear the four times lower risk than the investment in twenty five such securities. Banks, pension funds, insurance companies and other financial organizations are even bound by law to form a diversified portfolio. Individual investors, too, follow the rules of diversification. From the point of view of investors, it is not that important whether the prices of certain securities rise or fall; what matters is the return of their portfolio, along with portfolio risk. Therefore, return and risk of certain securities need to be analyzed in the conditions under which they influence the return and risk of the portfolio whose integral part they are.

An investor's portfolio may contain the shares of a company which is not widely renowned, whose shares are not liquid, whose profit has been variable in the past, or which has failed to pay out the dividends. All the above-mentioned indicates the shares with high risk, which should be in correlation with high returns. However, it may happen in practice that such shares have a low return. This means that the investors considered this company to be of low risk, despite the low profit. The reason for this can be found in diversification and its impact on risk. Namely, the profit of this company and the prices of its securities

grow in times of recession, when the prices of most other shares fall. Therefore, holding these securities in the portfolio stabilizes the return of the overall portfolio. The level of diversification depends on the following:

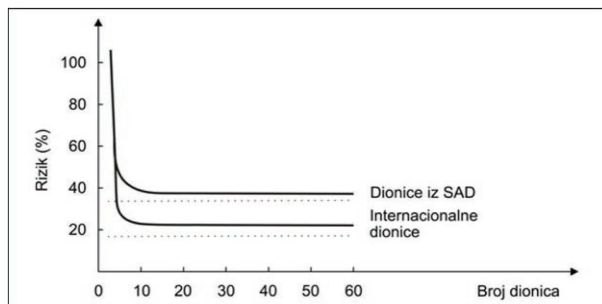
- Volume of securities' supply in the market;
- Volume of investment;
- Possibilities to access the market; and
- Level of investors' information.

International diversification is a step further in diversification analysis. It offers even a better opportunity to an investor to increase the return and reduce the risks at the same time. On the other hand, international diversification implies exposure to FX risk and country risk. International diversification represents a special opportunity. Traditionally, investors invested primarily on their national financial markets. Wishing to diversify their placements, they turned to investment in various economic sectors and various securities. Today, mostly thanks to the development of telecommunication, the predominant approach is to try and increase diversification of placements additionally by investing on the foreign financial markets, hence the process of financial market globalization has become the worldwide trend.

Systematic, i.e. market risk, represents the lower limit for portfolio risk reduction by means of diversification on the domestic financial market. Additional diversification may produce effects in terms of further portfolio risk reduction, below the market risk level, only if it is directed at foreign financial markets. According to certain traditional assessments, an internationally diversified portfolio should have a half lower risk than the portfolio diversified only in the national US financial market (Figure 3). Although the globalization of the worldwide financial system contributes to the higher interdependence of national financial markets, still there is no perfect correlation among them, and this is what enables additional reduction of risk in internationally diversified portfolios. However, this also holds only to a certain limit. The limits are the so-called global factors, i.e. the circumstances which influence the volatility of global financial markets overall, and may be considered the global systematic or market risk (lower dotted line in Figure 4).

kroz međunarodnu diversifikaciju portfolija, može se stvoriti i hedžing transakcijama, mada njihova efikasnost može biti pod bitnim uticajem stanja deviznih kurseva. Širenje potencijalnih međunarodnih investicionih mogućnosti sa akcija na obveznice, dodatno doprinosi podizanju performansi tako konstruisanih portfolija. Iako je dodatno obaranje rizika kroz međunarodnu diversifikaciju ograničeno, ono ipak pruža značajne koristi za investitore.

Slika br. 3: Rizik međunarodnog diversifikovanog portfolija i portfolija diversifikovanog na nacionalnom tržištu SAD



IZVOR: Solnik, B. "Why Not Diversity Internationally Rather than Domestically?", Financial Analysts Journal, July-August, (1974), str. 119-138.

Obaranje rizika je samo jedna strana medalje u međunarodnoj diversifikaciji portfolija. Druga, često bitnija strana su potencijalno viši prinosi. Potencijalno viši prinosi, u osnovi mogu proisticati iz dva razloga. Prvo, globalno finansijsko tržište pruža veći izbor za investiranje tj. omogućava investitorima da ulažu u kompanije koje im nisu dostupne posredstvom nacionalnog finansijskog tržišta. Drugo, ono omogućava i špekulativne dobitke koji se oslanjaju na fluktuacije u deviznim kursovima, čime se prinos na investicije u inostranstvu može bitno uvećati, ako domaća valuta investitora deprecira u odnosu na valutu u kojoj je investirao, ali i umanjiti ako domaća valuta aprecira. Izbor zemalja u koje treba investirati bazira se na stabilnosti nacionalne valute, kapitalnoj aprecijaciji njihovih finansijskih tržišta i ostvarivih prosečnih dividendnih prinosa.

Na nacionalnom finansijskom tržištu diversifikacijom se rizik može spustiti ispod nivoa sistematskog, tj. tržišnog rizika, jedino uz pomoć tzv. *Markowitz* diversifikacije i pronalaženjem hartija od vrednosti sa

međusobno nižim nivoima korelacija, kada važi pravilo da što je koeficijent korelacije između prinosa na hartije od vrednosti u portfoliju niži, to su i efekti diversifikacije veći. Međutim, vrlo je malo hartija od vrednosti koje imaju međusobno niske nivoe korelacije, pa *Markowitz* diversifikacija zahteva kompjutersku bazu podataka finansijskih statistika velikog broja hartija od vrednosti. Kompjuterska primena ovog metoda diversifikacije naziva se *Markowitz* portfolio analiza i nalazi se u osnovi moderne portfolio teorije.

Upravljanje portfolijom

Analiza je sastavni deo izgradnje portfolija. Ona je ujedno i sastavni deo upravljanja portfolijom, odnosno upravljanja investicijama. Kada se govori o upravljanju portfolijom potrebno je raspraviti i o samom stilu upravljanja. U tom se smislu uobičajeno govori o:

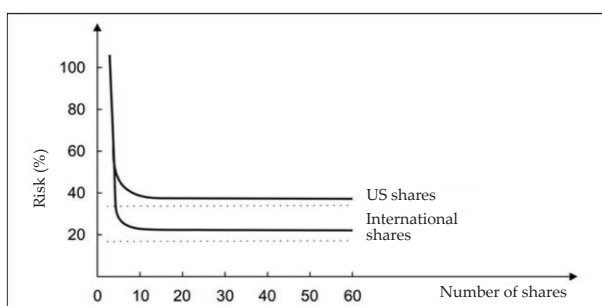
- Pasivnom i
- Aktivnom upravljanju portfolijom.

Pasivno upravljanje portfolijom pojednostavljeno se označava izrazom "kupi i drži" (engl. *buy and hold*). Time se sugeriše najjednostavniji mogući pristup investiranju. Problem ovakvog pristupa je u tome što je tržište akcija i drugih investicija živo i na njenu stalno dolazi do promena, kao što su i emitenti akcija i drugih hartija od vrednosti "žive" pravne osobe čija se relativna kvaliteta života poslovanja tokom vremena menja. To praktično znači da jednom izabrana investicija tokom vremena može bitno odstupati od ciljeva i kriterija po kojima je inicijalno kupljena. Zbog toga je pravilnije pasivno upravljanje odrediti nešto drugačije.

Pasivno upravljanje portfolijom polazi od pretpostavke da se tržište ne može pobediti. Nevidljiva je ruka tržišta toliko delotvorna da je najbolje investicijski portfolio izgraditi tako da oponaša kretanje ukupnog tržišta. Takvo upravljanje portfolijom omogućava investitoru dugoročno zarađivanje, slično onome koje odgovara dugoročnom rastu tržišta. Rizik takvog načina vođenja portfolija ogleda se pre svega u trenutku izlaska iz investicijske pozicije, dakle u trenutku unovčenja portfolija. Tada se može dogoditi da je tržište privremeno

The global market risk, according to some new assessments, amounts to 56% of the national market risk. Additional factor in minimization of risk by means of international portfolio diversification may be created by hedging transactions, although their efficiency may be considerably influenced by foreign exchange rates. Broadening the range of potential international possibilities for investment from shares to bonds additionally contributes to better performance of thus constructed portfolios. Although additional risk reduction through international diversification is limited, it, nevertheless, provides significant benefits for investors.

Figure 3: Risk of an internationally diversified portfolio and of a portfolio diversified at the national US market



SOURCE: Solnik, B., "Why Not Diversity Internationally Rather than Domestically?", *Financial Analysts Journal*, July-August, (1974), p.119-138

Risk reduction is just one side of the medal in international portfolio diversification. Another, often much more important side relates to potentially higher returns. Potentially higher returns essentially may be incurred by two reasons. First, the global financial market offers a wider choice for investment, i.e. enables investors to invest in companies that are not available to them in the national financial market. Second, it enables speculation-based profit which is based on fluctuations in FX rates, whereby the return on foreign investment may increase considerably, if the investor's local currency depreciates in relation to the currency of his investment, but also decrease, if the local currency appreciates. The selection of countries in which to invest is based on the stability of their national currency, capital appreciation of their financial markets and achievable average dividend returns.

In the national financial market diversification can lower the risk below the level of systematic, i.e. market risk, only by means of the so-called Markowitz's diversification and by locating the securities with mutually lower correlation levels, when the following rule applies: the lower the correlation coefficient between the returns on portfolio securities, the stronger the diversification effects. However, there are only a few securities with mutually low correlation levels, which is why Markowitz's diversification requires a computer database of financial statistics concerning a large number of securities. Computer-based application of this diversification method is called Markowitz portfolio analysis and is the basis of modern portfolio theory.

Portfolio management

Analysis is the integral part of portfolio composition. It is, at the same time, the integral part of portfolio management, i.e. investment management. When it comes to portfolio management, the management style itself has to be discussed. To this end, the differentiation commonly made is as follows:

- Passive; and
- Active portfolio management.

Passive portfolio management is, in simplified terms, referred to as "buy and hold". This suggests the simplest possible approach to investment. The problem with such approach is that the market of shares and other investments is lively and constantly changing, just like the issuers of shares and other securities are "live" legal entities whose relative quality of business lifecycle changes in time. This practically means that once chosen investment may in time considerably deviate from the objectives and criteria under which it was initially bought. Therefore, it is much more appropriate to determine passive management somewhat differently.

Passive portfolio management starts from the assumption that the market cannot be beaten. The invisible hand of the market is so powerful that the best thing is to create an investment portfolio which follows the movements of the overall market. Such portfolio management

u nazadovanju, što će uslediti sa određenim apsolutnim ili pak, češće, oportunističnim gubicima za investitora koji je prisiljen tada unovčiti svoj portfolio.

Ovako opisano pasivno upravljanje zahteva provođenje analize i nakon izgradnje portfolija. Razlog je povremeno usklađivanje investicijskog portfolija sa promenama koje su se zbile na tržištu. Za razliku od aktivnog upravljanja, pasivna strategija zahteva manje analize, a time i manje troškova provođenja analize, i ređe trgovanje, a time i manje transakcijske troškove, ali i manje plaćene poreze, ako su prihodi od kapitala, posebno kapitalni dobiti, oporezivi.

Filozofija pasivnog upravljanja odudara od prirode čoveka kao kreativnog bića. To pogotovo vredi za ljude spremne za učenje i aktivnost finansijske analize. Znamo da tržište nije tako savršeno. Zašto onda ne razmišljati da ga je moguće pobediti. Na tim razmišljanjima nastaje ideja *aktivnog upravljanja*. Aktivnim upravljanjem nastoje se izabrati pobedničke investicije, dakle one koje će zaraditi više od prosečnih na tržištu. Aktivnim se upravljanjem investitori nastoje prilagoditi i situacijama na tržištu, tako da u uslovima *bikovnog* tržišta nastoje držati hartije od vrednosti čije cene rastu brže od ukupnog tržišta, a u uslovima medvedeg tržišta hartije od vrednosti čije cene padaju sporije od ukupnog tržišta.

Aktivno upravljanje obećava veće zarade od pasivnog upravljanja, ali i traži veće analitičke napore čime smanjuje nivo prilagođavanja pojedinaca. Kako tržište investicija stalno fluktuiraju, kao što i stalno nastaju novi "pobednici", a stari mogu postati "gubitnici", aktivno upravljanje zahteva dodatne analitičke napore i intenzivnije trgovanje od pasivnog upravljanja. Intenzivnije trgovanje znači i veće transakcijske troškove, te veće poreze, ako se realizovani kapitalni dobiti oporezuju. To upućuje na opasnost da se upravljanjem koje je pobedilo tržište mogu ostvariti i manji prinosi od pasivnog upravljanja kada se i jedni i drugi prinosi koriguju za troškove upravljanja: *troškove analize i upravljanja portfoliom, te transakcione troškove i poreze.*

Zaključak

Iako su zasluge i prednosti moderne

portfolio teorije mnogobrojne, njene kritike su jednako tako bitne i indikativne za potencijalne probleme koji mogu nastati njenom primenom. Moderna portfolio teorija pojednostavljuje realnost u mnogim stvarima. Izbor optimalnog portfolija se ne promatra kao kontinuirani proces praćenja promena i prilagođavanja portfolija kroz vreme, već kao odluka koju treba doneti jednokratno. Dodatni nedostatak moderne portfolio teorije jeste činjenica da se pri izboru optimalnog portfolija, transakcioni troškovi ne uzimaju u obzir. Operativne kritike koje se mogu pripisati modernoj portfolio teoriji su slijedeće: a) problemi u proceni podataka koji su potrebni za proračun (posebno korelacijske matrice), b) vreme i novac potrebni za prikupljanje podataka i stvaranje efikasnih portfolija, c) problem optimizacije ne predstavlja linearno programiranje već kvadratno, d) problem u obrazovanju ljudi, posebno portfolio menadžera, da osim očekivanog prinosa i rizika pojedine hartije od vrednosti uzimaju u obzir i njenu korelaciju sa ostalim hartijama od vrednosti koje čine portfolio, e) mnogi investitori ne slede principe racionalnog ponašanja i u složenim situacijama se ne ponašaju na isti način kao u jednostavnim. Sam *Markowitz* priznaje da ne postoji čovek koji zna svoju funkciju korisnosti.

Među najznačajnijim kritikama koje se iznose u vezi moderne portfolio teorije jeste i ona da pri finansijskim krizama koeficijenti korelacije konvergiraju ka jedan, te nestaju prednosti diversifikacije i rizik portfolija postaje jednak jednostavnoj ponderisanoj sumi pojedinačnih rizika hartija od vrednosti od kojih je sastavljen. Zabeleženo je da čak i na razvijenim tržištima, u situacijama bez značajnih finansijskih šokova, može doći do relativno naglih promena koeficijenata korelacije. Kada se formiraju portfoliji na područjima tranzicijskih zemalja, važna činjenica koju ne poštuje moderna portfolio teorija jeste relativno niska i promenljiva likvidnost hartija od vrednosti. Pretpostavka o relativnoj stabilnosti koeficijenta korelacije između hartija od vrednosti i konstantnoj volatilnosti hartija od vrednosti, nije realna pretpostavka za tranzicijska tržišta.

Postoje mnogobrojna regulatorna ograničenja, ekonomski, sociološki i politički

enables long-term profit to the investor, similar to those which relates to the long-term market growth. The risk of such portfolio management is reflected mostly in the moment of exiting the investment position, i.e. in the moment of liquidating the portfolio. It may happen then that the market is temporarily in recession, which may result in certain absolute or, more frequently, opportunity losses for the investor who is forced to liquidate his portfolio at that moment.

Passive management as described above requires the analyses to be conducted even after the portfolio has been composed. The reason for this is the occasional adjustment of investment portfolio with the changes having occurred in the market. As opposed to active management, passive strategy requires analyses of smaller scope, which is why it incurs lower analysis-related costs and less frequent trading, which, in turn, incurs lower taxes, if capital incomes, in particular capital gains, are taxable.

The philosophy of passive management is incompatible with the nature of man as a creative being. This especially holds for people prepared to learn and cope with the activity of financial analysis. We know that the market is not that perfect. Why not believe then that it is possible to beat it. Such lines of thought are the basis for the idea of *active management*. The objective of active management is to choose winning investments, i.e. those that will earn more than the average ones in the market. By means of active management, investors tend to adjust to the current position in the market, so that in bull market they tend to hold securities whose prices grow faster than the overall market, and in bear market they tend to hold securities whose prices fall slower than the overall market.

Active management promises higher profits than passive management, but it also requires higher analytical efforts, whereby it reduces the level of an individual's adjustment. Given that investment market constantly fluctuates, just as there are always new 'winners', and the old ones may turn 'losers', active management requires additional analytical efforts and more intensive trading than passive management. More intensive trading implies higher transaction costs, and, in turn, higher taxes,

if the realized capital gains are taxable. This indicates the danger of management which beat the market achieving lower returns than passive management, when both returns get adjusted by management costs: *analysis and portfolio management costs, transaction costs and taxes*.

Conclusion

Although the merits and advantages of modern portfolio theory are numerous, its weaknesses are equally important and indicative for the potential problems that may occur due to its implementation. Modern portfolio theory simplifies reality in many aspects. The choice of the optimal portfolio is not viewed as a continuous process of fluctuations monitoring and portfolio adjustment over time, but as a decision that should be made on a one-off basis. An additional drawback of modern portfolio theory is the fact that in the process of optimal portfolio selection, transaction costs are not taken into account. Operational downsides that may be attributed to modern portfolio theory are the following: a) problems in assessing data required for the calculation (especially correlation matrices), b) time and money needed for data collection and efficient portfolio creation, c) optimization problem does not represent linear, but square programming, d) problems concerning the training of people, especially portfolio managers, to take into consideration not only expected return and risk of a certain security, but also its correlation with other securities within the concerned portfolio, e) many investors do not follow the principles of rational behaviour, acting differently in complex situations as opposed to simple ones. Markowitz himself admits that there is no man who knows his usefulness function.

One of the most significant objections articulated concerning modern portfolio theory is that in times of financial crisis correlation coefficients converge towards one, hence the advantages of diversification are obliterated and the portfolio risk becomes equal to a simple weighted sum of individual risks of the underlying securities. It has been recorded that even in developed markets, in the conditions without any considerable financial shocks,

razlozi koji sprečavaju adekvatnu međunarodnu diversifikaciju. Tranzicijska tržišta imaju mnogo zajedničkih karakteristika koje direktno utiču na sastavljanje portfolija i bitno se razlikuju od formiranja portfolija na razvijenim tržištima. Primjenu moderne portfolio teorije ozbiljno ugrožavaju slijedeći faktori koji su prisutni u tranzicijskim zemljama: plitko tržište, niska likvidnost, problem pouzdanosti informacija i finansijskih izvještaja, funkcionisanje pravne države, transparentnost tržišta, nepredviđene oscilacije prinosa, ne uzimanje u obzir privrednih kretanja, kretanja unutar pojedine grane privrede, promene valutnih kurseva, te mnogi drugi faktori. Pri formiranju portfolija u Srbiji, potencijalni investitor bi trebao rešiti sledeća problematična pitanja: a) koliko portfolija treba sastaviti uzimajući u obzir

ograničen broj hartija od vrednosti na tržištu i njihov ograničen promet? b) koliko hartija od vrednosti uključiti u portfolio? c) koje hartije od vrednosti razmotriti za uži izbor u portfolio, s obzirom na njihovu nisku likvidnost? d) na koji način meriti stope prinosa, rizik i korelacije, budući da su vremenske serije podataka kratke ili nepostojeće?

Na tržištima kapitala u tranziciji, niske likvidnosti, gde se odvija koncentracija vlasništva, vrlo je bitno studiozno proučiti šta se krije iza same akcije, odnosno koji je posao u pitanju. Osim konsolidacije vlasništva, period konsolidacije poslovanja emitenata nije okončan. Stoga, moderna portfolio teorija i diversifikacija se ne smeju odbaciti, ali ni shvatiti kao najbolji način upravljanja rizikom.

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relatively sudden changes of correlation coefficient may occur. When it comes to portfolios created in countries in transition, an important fact which has been disregarded by modern portfolio theory is the relatively low and variable liquidity of securities. The assumption about the relative stability of correlation coefficient between securities and constant volatility of securities is not a realistic assumption for transitional markets.

There are numerous regulatory restrictions, economic, sociological and political reasons which prevent an adequate international diversification. Transitional markets have many common characteristics directly influencing the process of portfolio composition and considerably differing from portfolio composition in developed markets. Implementation of modern portfolio theory is seriously undermined by the following factors present in transitional countries: shallow market, low liquidity, unreliability of information and financial reports, functioning of the rule of law, market transparency, unexpected oscillations of returns, disregard

of economic trends, movements within a certain branch of economy, foreign exchange rate fluctuations, and so on and so forth. When it comes to portfolio composition in Serbia, the potential investor should address the following problematic issues: a) how many portfolios to compose bearing in mind the limited number of securities in the market and their limited turnover? b) how many securities to include in a portfolio? c) which securities to consider to be short-listed for the portfolio, given their low liquidity? d) how to measure return rates, risks and correlations, given that data time series are short or non-existent?

In transitional capital markets, of low liquidity, where concentration of ownership is ongoing, it is very important to thoroughly examine what lies behind the share itself, i.e. what is the underlying business. Except for ownership consolidation, the period of consolidation of issuers' operations has not been completed. Therefore, modern portfolio theory and diversification must not be discarded, but they should not be taken as the best way to manage risks either.