

## **INVESTMENT PORTFOLIO OPTIMIZATION BY INVESTMENTS IN CATASTROPHE BONDS**

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**Abstract.** *Optimization of a diversified portfolio has been realized through the changes in the allocation of existing and new types of financial assets or changing the investment manager, which affects exposure to the systematic and non-systematic risk, well known as beta and alpha coefficients, with the ultimate goal of achieving a better relationship between portfolio risk and return. In the recent years one of the most significant developments in the field of risk management and insurance is risk securitization which means the transfer of insurance risk by creating financial instruments such as catastrophe bonds. Portfolio diversification can be achieved by investing in catastrophe bonds, because investors have the possibility of gaining higher return in comparison to investing in corporate bonds of the same credit rating. The risk and return of catastrophe bonds depend only on insurance market fluctuations and by investing in these bonds additional effects of risk diversification can be realized accompanied with avoidance of negative risks interdependence effects of securities related to their issuers' business performances and financial markets trends.*

**Key Words:** *investment, insurance, bond, catastrophe, optimization, portfolio.*

### **INTRODUCTION**

Securities related to insurance risk, such as catastrophe bonds contribute to the diversification of investment portfolios, allowing the reduction of the variability of portfolio performance and maximize expected returns at a given level of risk. By issuing catastrophe bonds, insurers and reinsurers obtain instant access to increased capacity on the basis of capital investment by institutional investors in these bonds (Njegomir, 2006). These bonds are products of the process of securitization in order to transfer insurance risk in

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liquid financial instrument that are traded in the capital market. In the last two decades, especially after a series of catastrophe events around the world, in the insurance and reinsurance occurs the convergence of the insurance and capital markets as a reflection of the need of using securitization instruments in the insurance risk management. Catastrophe bonds provide to the sponsor that in the case of the insured catastrophe event do not meet his obligations, at the same time investors in these bonds can lose interest and/or principal if the insured event is realized. For several years there has been an increasing interest of sponsors to diversify the available forms of risk management in relation to the traditional one-year reinsurance coverage. The aim of this paper is to focus on the main features and benefits of using catastrophe bonds in the offer of insurance and reinsurance companies, as well as their combined effects in terms of the insurance and capital markets.

### 1. POSSIBILITIES FOR PORTFOLIO OPTIMIZATION

The portfolio is a set of financial instruments of individual or institutional investor, in order to reach a proper return, by acceptable risk in terms of investors, owners and creators of the portfolio. Depending on the investment objective and risk tolerance, as well as situations and relationships in the financial market, the capital owner decides about investment timing and type of financial assets, which is the essence of portfolio management.

Combination of financial assets or securities in the portfolio provide different returns by various levels of risks, which means that by portfolio diversification the investor can achieve the maximum rate of return by acceptable level of risk or the expected rate of return by the as low as possible risk. The primary goal of maximizing profit with a certain tolerance of risk is in the interest of individual and institutional investors, but the whole economy and society, too (Njegomir, Ćirić, 2010). Investors who expect or estimate to achieve a higher rate of return must be willing to accept higher levels of risk, which is usually measured and expressed through variances or deviations of rate of return. Theoretically, if the assets in the portfolio are divided into risky and risk-free, the rate of return by risk-free assets would be stable, because of risk-free investment, and the variance would be zero, as well as the coefficient of correlation with other risky assets in the portfolio.

Each portfolio is exposed to the systematic and unsystematic risk. Systematic or market risk cannot be eliminated by diversification, because all assets are exposed to this risk, while unsystematic or specific risk of individual assets or securities in the portfolio can be reduced by diversification. Systematic risk is also known as the coefficient of proportionality or beta coefficient that tracks the relationship between the specific securities and the market and is very important in the process of investment portfolio optimization. It is expressed as the ratio between the standard deviation ( $\sigma_{im}$ ) of some security in relation to the market and the market variance ( $\sigma^2_m$ ).

$$\beta_i = \frac{\sigma_{im}}{\sigma^2_m} \quad (1)$$

If the value of the beta coefficient equals 1, the price of some securities (usually stocks) follows the market trends and selected market index. The value of beta coefficient above 1 indicates a higher volatility of the securities in relation to the market, and its in-

clusion in the portfolio increases systematic risk and exposure to market variations (Prigent, 2007, p. 118).

Beta coefficient is used for the valuation of the securities to be added to the portfolio, because this coefficient measures the additional risk caused by the inclusion of new security in the portfolio. Beta coefficient is also used to estimate the expected return of a security, as well as for performance analysis of the portfolio. Alpha coefficient is used for the assessment of expected return above the benchmark for specific security that will be achieved after the inclusion of the beta coefficient. A positive value of the alpha coefficient indicates that concrete diversified portfolio achieves better return than the market, while a negative value of alpha coefficient indicates the lag of portfolio return to the market "benchmark". The value of the alpha coefficient depends on the investment decisions of individual managers. Exposure to the overall portfolio risk, which means variation of the real portfolio return relative to the target market index or "benchmark", is by more than 90% affected by investment strategy, the choice of specific security, as well as the moment of its purchase or sale, or beta coefficient. In order to optimize the relationship between return and risk, which the portfolio is exposed to, it is necessary to examine relationships or correlations between: a) certain types of financial assets in the portfolio (the relations between their beta coefficients), b) the relationship between investment managers (the relationship between alpha coefficients) and c) the relationships between types of financial assets and investment managers (between values of beta and alpha coefficients).

According to the model developed by Markowitz, what are essential for portfolio optimization are the expected returns and variance or overall risk of all securities in the portfolio, as well as the covariance or relationships between pairs of securities in the portfolio, regarding their similar responses to the market trends. The total return of a security in the portfolio can be divided into: a) the return that depends on market trends and relationships, expressed as a market return weighted by the value of beta coefficient and b) the return that is independent of the market trends and it is characteristic for each individual security. If the market is fully effective, it is not possible to achieve return above the market and in this case the value of the coefficient  $\alpha$  which indicates above average returns and is a measure of the unsystematic risk, should be equal to 0. The expression incorporates the random variable ( $e_i$ ) which is assumed to be independent of market returns and should not be correlated to the random variable ( $e_j$ ) in the model based of one market index (Latković, 2001).

$$r_i = \alpha_i + \beta_i \cdot r_m + e_i \quad (2)$$

Comparing the above expression of determining return of a security to the Capital Assets Pricing Model – CAPM used for stock pricing, there is obvious similarity of the structure and essence of the model, but the CAPM model includes returns of risk-free securities (such as short term government securities). CAPM was developed by Markowitz in 1952 (Market Review 2010 and Outlook 2011, Munich Re, 2011) within the Modern portfolio theory (MPT) and it is used to analyze risk exposure measured by the beta coefficient if the aim is above average return of security in the portfolio. According to this model, the expected rate of return of a security or the entire portfolio should contain a rate of return based on risk-free investments ( $r_{rf}$ ) and additional market premium as the difference between the expected market rate of return (usually the S&P500 as a

"benchmark") and the rate of return on risk free investments ( $r_m - r_{rf}$ ) weighted by the coefficient of systematic risk ( $\beta$ ). If the expected rate of return does not meet this requirement, the capital should not be invested.

$$r_e = r_{rf} + (r_m - r_{rf}) \cdot \beta \quad (3)$$

Portfolio optimization is made by changes in the allocation of existing types of financial assets and by including the new one or by changes of investment managers, which affects the value of beta and alpha coefficients, in order to achieve a better relationship between risk and return of portfolio. The target result to be achieved by optimization can be maximization of absolute or relative return at different levels of risk, minimizing the overall risk "tracking error" at different rates of return, maximizing the value of coefficient alpha and Sharpe ratio. Certain restrictions are defined in the optimization process regarding the minimum or maximum amount that can be invested in particular types or groups of financial assets, as well as restrictions on the selection of investment managers. Portfolio optimization cannot eliminate all risks, or even mitigate the effects of certain risks, nor guarantee the realization of the target returns. But it helps to observe all components of risk caused by the types of financial assets in which capital is invested and by the investment decisions of individual managers.

## 2. THE MAIN CHARACTERISTICS OF CATASTROPHE BONDS

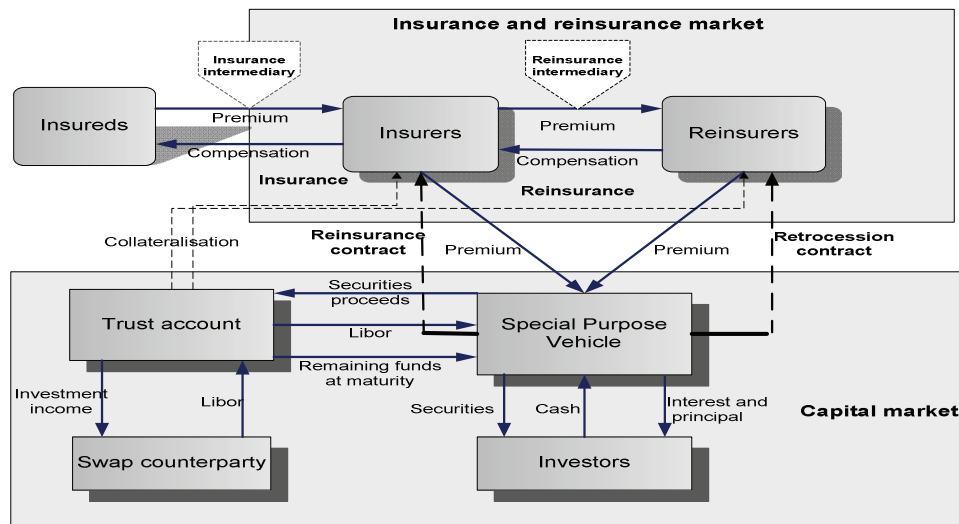
The number of catastrophe events caused by nature and man (Enz et al., 2008) and their financial impact (Geo Risks Research, Munich Re, 2007) is rising globally. This increase is caused by climate change and the concentration of population and material goods (Njegomir, Maksimović, 2009). Given that (re)insurers traditionally have financial potential to compensate the insured (Rejda, 2005), they are exposed to the influence of catastrophe events more than others.

Insurers and reinsurers traditionally manage exposure to risks associated with insurance on the base of central limit theorem and the law of large numbers. Risk retention depends on the available capital of insurer and risks above the level of retention are transferred to the reinsurance or retrocessionaires (in case of reinsurers). Given the increasing frequency and severity of catastrophe events, it became clear that capacities of global insurance and reinsurance markets are becoming limited, especially for the risks associated with catastrophe events (Himick, 1998). The solution for providing the additional capacity was found in the transfer of insurance risk to the capital market, considering that the much larger amounts of capital are available in the capital market. This can be illustrated by the fact that the total available capital of the reinsurance market in 2007 amounted to 129 billion dollars (Klein, Mooney, 2008), while the capital of the financial derivatives market, as a segment of the total capital market amounted to over US\$ 600 trillion (BIS - Bank for International Settlements Quarterly Review, 2008).

Catastrophe bonds, whose characteristics are similar to corporate bonds in terms of paying a fixed amount of principal and interest and having fixed maturities, are usually issued by insurers in order to transfer risks of catastrophe events. Unlike traditional insurable risks, that happen often with relatively low intensity of adverse effects, risks of ca-

tastrophe events are characterized by relatively low probability of happening followed by extremely harmful consequences (Njegomir, 2008b).

A simplified chart of the risk transfer through the insurance, reinsurance and capital market by using catastrophe bonds can be seen in Figure 1 (Njegomir, Maksimović, 2012).



**Fig. 1** Insurable risks transfer to the insurance, reinsurance and capital markets

In a typical transaction of insurance risk transfer to the capital market, insurance or reinsurance company as a sponsor of the transaction transfers risk to special purpose reinsurer, which has the role of reinsurer if sponsor is an insurance company, or role of retrocessionaires if sponsor is a reinsurance company. The coverage is usually provided by a special purpose reinsurer similar to quota reinsurance contract. Annually or quarterly the insurer or reinsurer pays a premium to the special purpose reinsurer, as compensation for the provided insurance coverage. Special purpose reinsurers issue bonds, relating to accepted insurance risk and place them to investors in the capital market, usually through the investment banks as intermediaries. The capital collected by issuing and selling bonds is equal to their nominal value and premiums the special purpose reinsurer holds in the special fund and place them in the short-term and highly rated investments, usually in the most quality securities in the financial market. The revenues generated by investments are exchanged via swap transactions with partners, mostly investment banks, for a given rate of return, usually based on the LIBOR rate, in order to minimize the investment risk. Interests based on the LIBOR rate plus a premium are periodically, usually quarterly, paid to investors in catastrophe bonds. Nominal value of issued and placed securities, interest and collected premiums create funds needed for covering costs of operating of special purpose reinsurers. If a catastrophe event is not realized during the period of catastrophe bonds coverage, investors will get the principal out of the fund. Otherwise if a catastrophe event is realized, investors can lose not only the interest, but the principal too.

### 2.1. Aspects of catastrophe bonds evaluation

The importance of evaluating catastrophe bonds can be viewed from two perspectives. From the aspect of investors evaluation of these bonds is necessary in order to determine their relative attractiveness compared to other securities, primarily corporate bonds. From the insurer's point evaluation of the bonds is needed in order to determine their relative attractiveness compared to traditional reinsurance coverage. This is a complex issue because it must take into account two aspects of evaluation: the aspect of capital markets which includes the evaluation of these bonds in market environment and actuarial aspect which includes the evaluation of these bonds necessary for the proper evaluation of the insurer's obligations. Without going into the details of mathematical explanation of individual models, we note that a number of authors, e.g. Lane (Lane, 2001) and Wang (Wang, 2002) dealt with issue of universal theories of catastrophe bonds evaluation, which includes both the above-mentioned aspects. Lane's research shows that corporate bonds and catastrophe bonds have a similar relationship between risk and return, but Wang pointed out that there are differences in the number of degrees of freedom of the student's "t" distribution (Stojković, 1995, p. 212),  $k = 5$  for corporate bonds and  $k = 6$  for catastrophe bonds, given that investors demand higher risk adjustment caused by parameter uncertainty by investing in catastrophe bonds. The conclusion of this study is that Wang's two-factor transformation of evaluating catastrophe bonds is more accurate than Lane's and offers an unified approach of evaluating, as well as credit and insurance risk in terms of extreme and parameter uncertainty.

## 3. CATASTROPHE BONDS AS AN INSTRUMENT OF INVESTMENT PORTFOLIO OPTIMIZATION

In the last twenty years, especially after the hurricane season of 2005, in the insurance and reinsurance market there is a tendency of the convergence of the insurance and capital markets as a reflection of the need for using securitization mechanisms in insurance risk management (Njegomir, 2008a). Insurers and reinsurers express the need for these mechanisms in order to achieve the monetization of illiquid assets, to finance increased regulatory demands in the field of life insurance, as well as to transfer insurance risks to the capital market. The need for risk transfer to the capital market in conditions of limited capacity occurs in the field of life and non-life insurance, most for the so-called risk peaks or catastrophe damages. The capital market offers almost unlimited possibilities for the placement of insurance risks, particularly in terms of high prices and limited reinsurance coverage. For example, while the total capital of reinsurance companies worldwide in late 2007 amounted to 129 billion US\$ and the total capacity of Lloyd's to only US\$ 32 billion, the global market of derivatives totaled over 600 trillion US\$. Instead of insurance risk transfer to reinsurers, or retrocessionaires (in case of reinsurers), risk transfer is achieved through the issue of securities which basically include insurance risk. The creation of securities based on insurance risk or liabilities positions in the balance sheet of insurance and reinsurance companies, it is possible to transfer insurance risk to investors in the capital market (Njegomir, 2011, p. 289).

Although the share of alternative approaches to insurance risk management through the capital market is still negligible compared to the reinsurance market, there has been continued growth even in terms of global economic crisis (except for the fourth quarter of

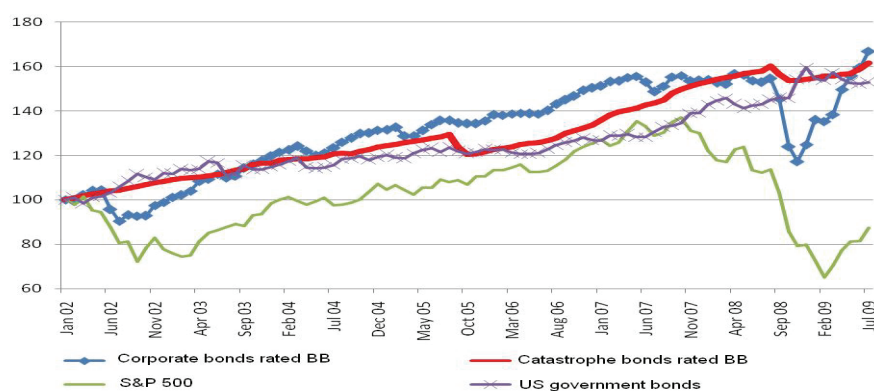
2008, when the issue of new securities related to insurance risk was fully suspended). The development of these instruments would not be significant without interests of investors for involvement of insurance risk in their investment portfolios. The emergence of securities related to insurance risk has enabled investors to improve risk diversification in an investment portfolio due to the fact that the insurance risk is not associated with other market risks, such as for example the risk of changes in interest rates or foreign exchange rates. The interest of investors is stimulated not only by the absence of correlation of insurance risks and risks inherent to the capital market, but also by the fact of minor participation of instruments associated with the insurance risk, as a cause of losing investors' interest and principal.

In the period before the hurricane season of 2005, investors in the capital market invested in the insurance sector through investments in shares and bonds of insurance and reinsurance companies, as a tool of portfolio diversification, but at the cost of accepting all risks related to the business of companies whose securities they invested in. The limited capacity of the traditional reinsurance market and emergence of large catastrophe losses caused the creation of extremely profitable opportunities for investment in the insurance risks, but through securities associated with insurable risks. Significant boost to investors' interest for investing in these securities was the education done mostly by investment banks, brokers and companies dealing with risk modeling. The education of investors implied understanding of common terminology specific to the insurance sector, improving the knowledge about the risks related to investment in these securities, understanding the correlation with other risks in the investment portfolio and the possibility of achieving relatively high returns.

Investors should consider three key elements by investing in securities related to insurance risk: the risk that is the subject of securitization transaction, the risk of a security that occurs as a product of securitization and the ability to realize return. In the analysis of the insurance risk it is essential to assess the probability of event's realization and the intensity of its potential consequences in order to determine the potential risk of investment in a security related to the risk. A key consideration is the analysis of the activator or "triggers" of the transaction, which can be divided into those based on compensation and those who are not. Activators that are not based on compensation are more understandable for investors given that the key parameters that determine the degree of loss caused by the realization of an event are defined in the transaction. In the case of application of the compensation-based activators, it is necessary to understand the real loss from the point of an insurance or reinsurance company. The risk analysis of the security involves analysis of the conditions, characteristics of the transaction, collaterals and especially mechanisms that allow each party to terminate the transaction. The analysis of these mechanisms is particularly important given that the optional recall clauses can be included in transactions of insurance risk's securitization, which means that the sponsor of transactions can achieve sufficient coverage without threatening the interests of the investor. For example, when it comes to winter storms in Europe whose season ends in April, in the event of cancellation of transactions in March, investors would get only a quarter of the premiums and would essentially be deprived because of the storm season towards the end. Recall clauses on the extension of coverage increase directly the risk exposure.

The possibility of realizing returns is in direct correlation with the price (interest rate, usually based on LIBOR + premium determined) that the sponsors are willing to pay.

Given their long-term character, securities related to insurance risk require long-term investor's bonding for particular return. It is well known that the price of these instruments is largely dependent on the cycles on the reinsurance and retrocessionaires markets, so in terms of high premiums in these markets investors can expect higher returns. In terms of decline in premiums, a positive price difference can be realized by later sale of these securities. There is a completely opposite situation if the transaction is agreed in the "soft" phase of the insurance premiums and investors are looking for sale in the "solid" phase of the cycle. Also returns will depend on the demand for coverage for a particular type of risk, which is a typical market reaction, given the law of supply and demand. Finally, on the financial markets returns are always compared with comparable investments.



**Graph 1** Comparison of trends in returns on catastrophe bonds with returns on shares, corporate and government bonds during the period 2002 - 2009

Note: end of the year 2001 = 100

Source: Frez, Kirova & Schmidt, 2009.

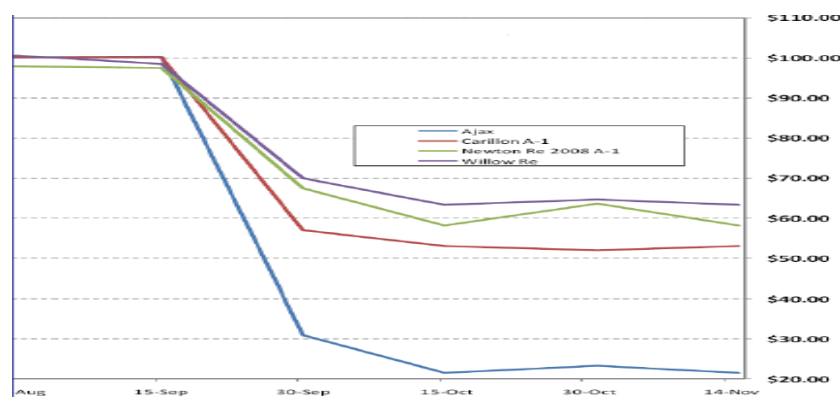
Graph 1 for the period 2002 – 2009 shows the parallel trends of the rates of return on catastrophe, corporate and US government bonds, as well as on shares compared to the benchmark – index S&P 500. Corporate bonds and catastrophe bonds are of the same credit rating BB and index S&P 500 tracks trend in rates of return on stocks of 500 leading companies in the U.S. Each year starting from the end of 2001 catastrophe bonds generated positive rate of returns. It can be seen that the rates of return on catastrophe bonds during the financial crisis were significantly above the rates of return on securities in the index S&P 500. The possibility of achieving relatively high returns by investing in catastrophe bonds continued in 2010 and 2011, too.

The key characteristic of the catastrophe bonds that caused increased interest of investors is their lack of correlation with other risks in the investment portfolios. The financial crisis has confirmed that there is no correlation between insurance risk and other financial risks. It is necessary to point out that to some extent there is a possibility of a positive correlation between insurance risk and financial risk marketed. For example the realization of the event – the earthquake in Japan would lead to the disruption in the financial market, but the possibility of realization of such event has mostly localized character and could hardly cause significant disruptions in terms of correlation with other risks.

The study of Heike and Kiernan (Heike, Kiernan, 2002) shows that the addition of catastrophe bonds in the investment portfolio allows investors to reduce variability of portfolio return and to improve future expected return. These authors explain such a contribution of securities that arise as products of the insurance risk securitization by performances of investment portfolio as the lack of correlation between risks inherent to products of the securitization, and economic risks (such as unemployment and slowing economic activities), legal risks, and geopolitical changes (such as wars or politically motivated unrest), as well as other factors that affect corporate profitability and lower variability of products of securitization relative to other securities. Less variability is confirmed by the weaker influence of terrorist attacks of 11 September 2001 in the U.S. on the changes in catastrophe bonds index (by bonds with a credit rating of BBB index changes were expressed in 20 basis points, while by bonds with BB credit rating changes in the index ranged from 55 to 100 basis points) in comparison to other debt securities (variations on the basic debt securities indexes with credit ratings of BB ranged between 300 and 400 basis points).

Securities related to insurance risk have diversification effect and make possible reducing the variability of investment portfolio performance and maximize expected return at a given level of risk. Recently investors create special portfolios of risk insurance in an attempt to optimize further the effects of diversification. In these cases it is necessary to analyze the profile of each individual security and to determine the existence of correlations between different insurance risks and then the correlation between the entire portfolio and other securities in order to determine the aggregate impact of investments in securities related to insurance risk to the overall portfolio.

We pointed out the resilience of securities related to insurance risk, that is which manifested during the crisis. However, the bankruptcy of investment bank Lehman Brothers caused by the financial crisis had an impact on the suspension of new issues of these securities at the end of 2008. Specifically, the Bank participated in the swap transactions of the four bonds whose credit rating was reduced after the bankruptcy of the bank in September 2008. Bonds prices had been decreased and investors had suffered significant loss due to credit risk exposure manifested in declining of credit rating.



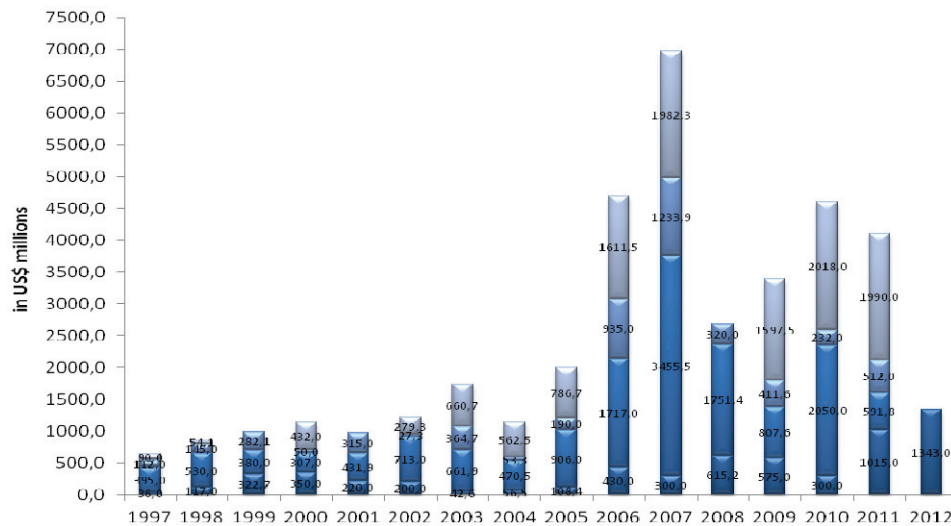
**Graph 2** Loss in value of four bonds included in partner's swap transactions of Lehman Brothers  
Source: Lane Financial LLC

After a longer period of reduced number and value of risk securitization transactions, particularly transactions with catastrophe bonds, caused by the financial crisis and the collapse of the investment bank Lehman Brothers, in 2010 the market of alternative transfer of insurance risk has been revived. The total value of newly issued catastrophe bonds rose by 42% compared to 2009. The total value of newly issued catastrophe bonds was 4.84 billion dollars (Market Review 2010 and Outlook 2011, Munich Re, 2011) and it was the second best year according to the amount of capital for covering secured insurance risk in the capital market. The total capital for covering the insurance risk is provided through the capital market. Actually it presents the difference between the newly issued and expired or realized bonds and had been increased by 840 million dollars compared to 2009, or about 12.84 billion dollars. The highest volume achieved in 2007 amounted to more than \$ 8 billion (Wittman et. al, 2010). The company realized 26 transactions and 3 of them are in the domain of the securitization of life insurance and 23 are in the field of non-life insurance, with a dominant share of catastrophe bonds. The reason for the rapid growth of the importance of these bonds is based on the increasing interest of sponsors, insurance and reinsurance companies, and investors for investing in the catastrophe bonds.

#### 4. TRENDS IN THE STRUCTURE OF INVESTORS IN CATASTROPHE BONDS

In the last three years sponsors of the transactions of risks securitization have continued the similar long-term trend manifested at the beginning of the new millennium, which means the integration of alternative forms of risk insurance transfer and traditional reinsurance in the total program of risk management. Although there is enough available capital for risk covering on the reinsurance market as well as the "soft" cycle phase of the reinsurance premiums, increased interests for investing in the catastrophe bonds are caused by the possibility given to the sponsors to diversify available forms of risk management compared to the traditional yearly reinsurance coverage. Also contacts with the actors in the transaction of securitization and reputation of risk innovators have motivating influence on sponsors to use securitization of risk. However we believe that a key reason for their increased popularity lies in the fact that securitization provides coverage for risks in the average period of three to five years, which in terms of currently low prices of coverage may seem stimulating, bearing in mind the possibility of fixing the current low price of coverage for the next three to five years. Such a possibility is extremely important especially if we take into account the forecasts of the potential growth of value of losses.

However, the interests of sponsors could not be realized if there were no interests of investors. Sponsors have benefited from increased interests of investor for investing in insurance risk in 2010 due to reducing costs of applying catastrophe bonds and increased interest of sponsors to get alternative insurance coverage at a lower price. The continued expanded demand for investing in these securities had also been followed by the decrease in the price range of secondary trading of these securities in 2010.

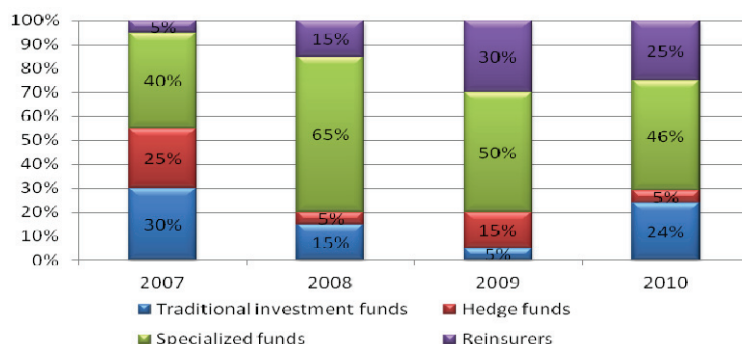


**Graph 3** New issues of catastrophe bonds, 1997 – 2012 (quarters)

\* 2012 – Only Q1

Source: GC Securities Proprietary Database, March 31, 2012

It is necessary to point out the fact that after absorbing the investment demand in the first half of 2010, it came to the stabilization of the price range and in the case of risks that are specific to the U.S. even a slight increase of prices was marked. However, brokerage Guy Carpenter estimates that total demand and interests of investors for products of insurance risk securitization is not completely satisfied. Investors in insurance risk typically include pension and hedge funds, banks, insurance and reinsurance companies and special and traditional investment funds. Recently there has also been a marked increasing interest of traditional investment funds for investing in products of insurance risk securitization. At the same time the interests of hedge funds for investing in products of securitization has been decreased (see Graph 3). The key reason for reduced interest of hedge funds is the economic crisis and the possibility of achieving higher rate of returns through investments in other securities. On the other hand, traditional mutual funds are attracted by the possibilities of portfolio diversification and reduction of risks. Except investors from Western countries, in 2010 there was also an increased interest for investing in these securities by institutions from Asia (especially Japan) and Australia and New Zealand (Global Reinsurance Outlook 2011, Guy Carpenter). Changes in the structure of investors in securities as products of insurance risk securitization usually emerged as a result of changes in the relative value of these securities compared to traditional debt securities and traditional reinsurance.



**Graph 4** Types of investors in securities related to insurance risk in the period 2007 – 2010  
 Source: Insurance Linked Securities: Market Review 2010 and Outlook 2011, Munich Re, 2011

One of the main reasons for investing in the securities that are the products of the securitization of insurance risk is the possibility of diversification. In the second half of 2010, there was increased interest of investors for investing in the different insurance risks in order to improve the diversification of investment portfolios additionally. A similar trend can be expected in the future. Historically, the most common risks in the implementation of alternative forms of risk transfer are geographically linked to the U.S. and in most cases to the risk of hurricanes in Florida and earthquakes in California. In 2010, 55% of the total securitization of catastrophe risks was related to the risk of earthquakes in the U.S., 30% to the risk of hurricanes in the U.S. and 1% to other risks connected with the U.S., while 6% of total risk securitization was related to Japan and 8% to winter storms in Europe. In 2009, 43% of catastrophe bonds were related to the transfer of hurricane risk in the U.S., 22% to the risk of earthquakes in the U.S., 1% to other risks in the U.S., 11% to the risk in Japan, 22% risk to winter storms in Europe and 1% to the risk worldwide. During the third quarter of 2010, the risk of a winter storm in Europe had been securitized and that is the risk that occupied a lot of investors' attention considering the great possibility of additional diversification of risks in portfolio. The second half of 2010 marked the first securitization of risk of extreme thunderstorm as well as the first securitization of health risks, which confirms the current trend of increasing interests of investors for risk diversification.

In order to promote the use of alternative mechanisms of insurance risks transfer, it will be necessary to provide greater efficiency of transactions and lower costs. This is the way to attract smaller companies to use alternative forms of insurance risks transfer, regarding transaction costs that amount to minimum US \$200 million dollars for life insurance and about US\$ 100 million for non-life insurance, as threshold for the justification of investment in these transactions. The consequence is that these transactions become unavailable for insurers and reinsurers with smaller amount of capital. This can be done by standardizing: transactions, supporting documentation, the contractual terms, the way of foundation and doing business of special purpose reinsurer. Also it is necessary to provide greater education of investors, as well as insurers and reinsurers about the advantages and disadvantages of transferring insurance risk to the capital markets in which investment banks and reinsurers, with experience in these transactions may have a crucial impact. A

greater interest of investors can be achieved by increasing liquidity and the development of a secondary market for trading with instruments of alternative insurance risk transfer. It will also be necessary to improve further the transparency of transactions, especially since the numerous problems manifested during the financial crisis, regarding the transactions related to the investment bank Lehman Brothers. One of the ways to improve the transparency of transactions is a listing of securities related to insurance risk within the stock market listing. According to its major characteristics, listing provides greater investors' confidence given that the world markets, including stock exchanges in the region, enabled to investors liquidity even in the terms of economic crisis and the consequent recession. By fulfillment of requirements for a stock market listing, the securities related to insurance risks, could additionally improve transparency, liquidity and accessibility. In terms of accessibility, we have in mind the fact that in many countries, regulations which direct the business of insurance companies and pension funds usually limit and in some cases completely prohibit the investment in securities that are not on the stock exchange listing.

#### 4. CONCLUSIONS

Catastrophe bonds are similar to corporate bonds in terms of fixed and guaranteed rate of return and fixed maturities, but the key difference is that catastrophe bond are issued by insurance companies as an innovative way and mechanism of transferring risks of catastrophe events to the capital market. Although catastrophe bonds are predominantly related to risk of catastrophe events, they can be successfully applied with other risks, too. The increasing frequency and intensity of harmful effects of catastrophe events around the world indicate future expansion of the demand for catastrophe bonds, as a complement to traditional risk transfer.

Each portfolio is exposed to systematic risk that cannot be eliminated by diversification and is expressed through the value of the beta ( $\beta$ ) coefficient of proportionality, which shows the relationship between particular security in the portfolio and the market or target market index (usually the S&P 500) and it is very important for the portfolio optimization. The other component of risk is unsystematic risk, which depends on the investment decisions of individual managers and is expressed through the value of coefficient alpha ( $\alpha$ ) and can be reduced by diversification, including investments in catastrophe bonds.

Portfolio optimization is done by changes in the allocation of existing and by inclusion of new types of financial assets or by change of investment managers, which affects the value of beta and alpha coefficients, in order to achieve the best possible relationship between portfolio's risk and return. Investors in catastrophe bonds have the opportunity to achieve higher rates of return compared to the return that would be realized by investing in corporate bonds, by the same level of risk, considering the same credit rating of catastrophe and corporate bonds. Investors can achieve portfolio optimization by investing in catastrophe bonds. It is also important to note that risk exposure by catastrophe bonds depends on the changes in the insurance market that are independent from the trends on the financial markets. In the case of corporate bonds risk exposure depends on the business performance of their issuers as well as the relationships and trends in the financial market. Bearing this in mind, investing in catastrophe bonds can generate additional effects of risk diversification while avoiding the negative effects of interdependence of risk of securities linked to the performance and trends in the financial markets.

The research of methods that regional insurers and reinsurers apply in risk management of catastrophe events indicates that traditional reinsurance is the only effectively implemented and by law obligatory way of risk transfer. There are many reasons for this situation, but the most important reasons are underdevelopment of the domestic insurance market and a lower frequency of catastrophe events. However economic growth and greater exposure to catastrophe events, cross-border consolidation followed by the increased and concentrated exposure to risks, as well as insufficient capacity of insurance companies in the region indicate necessity of including catastrophe bonds in their offer. In this way it facilitates access to the capital necessary to the insurance companies and their price competitiveness and certainty in the provision of insurance coverage are increased. A wider economic benefit is reflected in the development of capital markets as well as richer and deeper offer of financial instruments, as mechanisms of portfolio diversification of interested investors. By combining the positive effects of catastrophe bonds from the point of view of the insurance and capital markets, their use can contribute to the improvement of the overall economic development in the countries of South Eastern Europe.

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## **OPTIMIZACIJA INVESTICIONOG PORTFELJA OBVEZNICAMA ZA KATASTROFALNE ŠTETE**

**Vladimir Njgomir, Jelena Ćirić**

*Optimizacija diverzifikovanog portfelja se vrši promenama u alokaciji postojećih i uključivanjem novih vrsta finansijske imovine ili promenom investicionog menadžera, čime se utiče na izloženost sistemskom i nesistemskom riziku koji se izražavaju kroz vrednosti beta i alfa koeficijenta, sa krajnjim ciljem postizanja što boljeg odnosa između rizika i prinosa portfelja. Jedno od najznačajnijih dešavanja u oblasti upravljanja rizikom i osiguranja poslednjih godina jeste sekjuritizacija rizika koja podrazumeva transferisanje rizika osiguranja kreiranjem finansijskih instrumenata kao što su obveznice za katastrofalne štete. Investiranjem u obveznice za katastrofalne štete investitori vrše optimizaciju portfelja, jer imaju mogućnost da ostvare prinose više od prinosa koje bi ostvarili investiranjem u korporativne obveznice, i to uz isti nivo rizika, s obzirom da ove obveznice imaju isti kreditni rejting kao i korporativne obveznice. Rizik i prinos kod obveznica za katastrofalne štete zavise samo od kretanja na tržištu osiguranja, te se ulaganjima u ove obveznice ostvaruju i dodatni efekti diverzifikacije rizika uz izbegavanje negativnih efekata međuzavisnosti rizika hartija od vrednosti koji su povezane sa performansama njihovih emitenata i kretanjima na finansijskim tržištima.*

Ključne reči: investicije, osiguranje, obveznica, katastrofe, optimizacija, portfelj.