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TOWARDS SUSTAINABLE FINANCIAL MARKETS: IMPACT OF STRUCTURED SECURITIES ON PORTFOLIO MANAGEMENT

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Abstract. Financial globalization created an environment for structured product development in financial markets. With the help of these instruments it is possible to transform an asset into a new investment vehicle, that opens new investment possibilities for risk averse investors, along with those investors who are searching for higher yield. This paper analyses different structured products and their influence on investment management using ratio analysis, Markowitz portfolio optimization model and Monte Carlo simulation. Analysis revealed that structured products have a significant positive effect on investment management on diversification and yield enhancement sides.

Keywords: sustainable financial markets, portfolio management, structured products, securitization

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JEL Classifications: G1, G11, G12

Introduction

Sustainable functioning of financial markets and sustainable development of economies of countries are interdependent (Stasytytė 2015; Travkina, Tvaronavičienė 2015). IT increases this interdependency (Samašonok et al. 2016; Raudeliūnienė et al. 2016). Therefore, tools allowing stabilizing financial markets acquire very important role in the periods of economic crises.

Throughout the 2016 the overwhelming majority of developed world's government bonds offered negative bond yields or yields close to zero. This is a unique situation, considering the fact, that some investors are willing to pay banks for holding their assets. Moreover, divergence in monetary policies (United States is the only major country using contractionary monetary policy, while China, Japan and Europe using expansionary monetary policies), the uncertainty in oil market and growing debt burden creates high systemic risk and deepens uncertainty among investment managers. Such an environment raises many discussions about currency wars and appropriate level of risk for major financial institutions, that are heavily regulated e.g. pension funds, mutual funds, insurance companies, etc. Due to the reasons mentioned above a big part of financial market participants consider taking more exposure towards structured securities¹. Structured products can significantly enhance diversification effect, what in turn reduces risk and may increase portfolio return. Considering the

¹ Structured products and structured securities will be used interchangeable throughout the text

financial environment created by certain economic events and extreme measures taken by central banks this paper discusses the impact of structured products on investment management.

Aim of this paper – To determine what influence, if any, structured securities have on investment management.

Research part consists of statistical and financial ratio analysis, as well as Markowitz portfolio optimization model and Monte Carlo simulation. This paper is important in current financial markets considering the high degree of uncertainty created by: low oil prices, divergence in monetary policies, China’s slowing economic growth and the shift towards consumer based economy. Empirical literature supports the idea of lower risk involved in structured products, therefore, it would make sense to try to incorporate and analyze the effect that structured products have, if any, on investment management.

1. Literature review of structured products investments and securitization techniques

Structured products have been developed from the needs of companies that wanted to raise capital at lower cost. At that time – 19th century, mostly bonds and issuance of shares were used for capital raise. Following this need market developed convertible bonds. Later investment banks added specific limits and features to convertible bonds through options and other derivatives. Even in twenty first century bond and option combinations remain one of the most common structures. By combining and modifying a variety of asset classes or combining structured securities among themselves the new and more sophisticated products can be created, whose market volume is growing rapidly (Bikas, 2013).

The increasing volume of structured products can be observed in constantly evolving financial markets and continuously growing demand in the fields of financial economics, financial mathematics, personal finance, corporate finance and others. Bloomberg (review, outlook 2011-2013) estimates that during the period of three years from 2010 to 2013, banks issued \$174 billion worth of structured products in United States and additional \$318 billion globally. There are a wide variety of definitions of structured products, depending on the author and the classification of financial instrument itself (Table 1).

Table 1. Definitions of structured products and securitization

AUTHOR	YEAR	DEFINITION
STRUCTURED PRODUCTS		
Credit Suisse	2011	Structured products - combination of a traditional investment (equities, currencies, bonds, commodities, or mutual/investment funds) and one or more derivatives that are structured into one securitized instrument. These investment instruments can be tailored to investors specific market view in order to match desired risk profile and expectations.
BNP Paribas	2006	In their simplest form, structured products, offer investors full or partial capital protection coupled with equity linked performance and variability degree of leverage. They are commonly used as portfolio enhancement tool to increase returns while limiting the risk of capital loss.
Swiss Finance Institute	2015	Structured products are investments whose repayment value derives from the development of one or more underlying assets. These underlyings are often combinations of traditional securities such as equities, bonds, commodities, and one or more derivative components. Derivative components are used to transform the risk-return characteristics of the traditional products such that the specific needs of an investor are met.
SECURITIZATION PROCESS		
International Monetary Fund	2008	Securitization the process in which certain types of assets are pooled so that they can be repackaged into interest bearing securities.
Ian Giddy	2001	Securitization is the transformation of an illiquid asset into a security.
Hyun Song Shin	2009	Securitization is described as a factor that enhances financial stability by dispersing credit risk.
Federal Deposit Insurance Corporation	1998	Securitization is the process by which assets with generally predictable cash flows and similar features are packaged into interest-bearing securities with marketable investment characteristics.

Source: Composed by Authors

Overall, we can say that there are two main aspects of structured products:

- combination of two or more different assets;
- individually tailored specifications based on investor's views and risk tolerance.

Structured products are released in to the market through the securitization process. Securitization scheme and process depends on the needs of the investor. However, we can single out two main ways of securitization: Securitization linked to off-balance sheet asset transfer and securitization linked solely to exchange traded instruments (Figure 1).

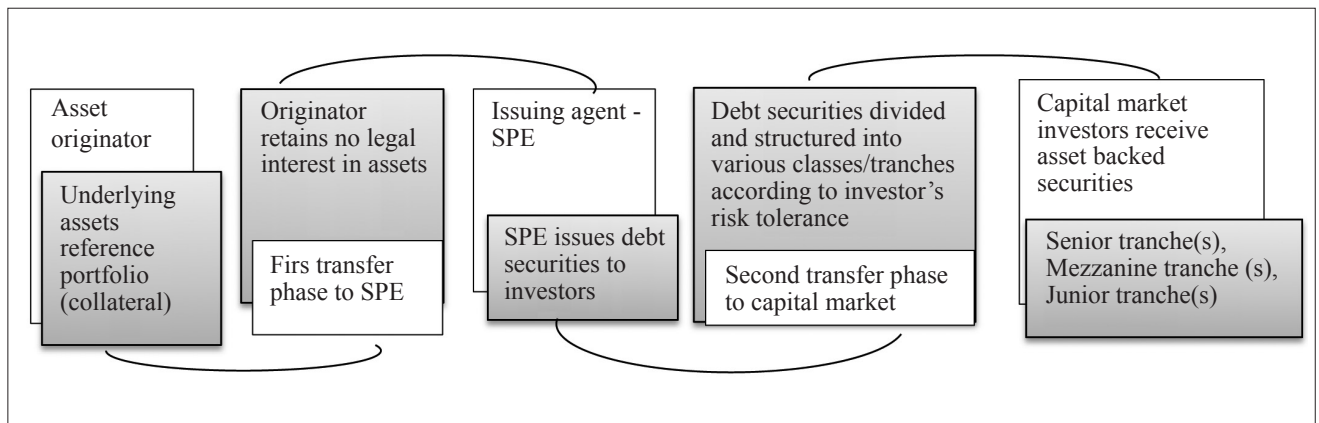


Fig. 1. Off-balance securitization technique. Created by authors based on International Monetary Fund (2008), Ian Giddy (2001)

Off-balance sheet securitization technique involves two main phases. Throughout the first phase, company that engages in operating activity and which has income generating assets – originator – chooses the assets that it wants to remove from its balance sheet and pools them into specific portfolio – reference portfolio. Throughout the first step originator sells reference portfolio to special purpose entity (SPE). Most of the time SPE is set up by financial institution, specifically to acquire the assets and realize their off-balance treatment. SPE finances the acquired pool of assets by creating debt securities, that are backed by interest bearing assets (pooled assets). In the second phase SPE sells debt constructed securities that are divided into different tranches and classes (based on their risk level) to capital markets. Furthermore, capital market investors receive fixed or floating rate payments, which are financed by cash flows generated from initially pooled assets. In most of the cases asset originator collects the loans from constructed portfolio and then passes them (after receiving service fee) directly to SPE, which in latter stage pays interests to capital market investors. This structure is insured by guarantor *i.e.* bank or insurance company, which ensures that payments to special purpose entity are delivered on time. Asset originator pays fees to guarantor. Therefore, these structured products are backed by assets and warrant by guarantor.

The products released into the capital market usually are rated by different rating agencies according to their risk level. With higher risk exposure investor is prepared to receive higher returns (principal plus interest payments). The holders of least risky tranche have the first call on interest generating underlying assets, whereas the riskiest tranche holder receives the interest payment last. The riskiest tranche and usually the smallest one is concentrated towards risk seekers *e.g.* hedge funds, investment banks etc. However, latter pays the highest interest payments. The senior tranche has the lowest probability of portfolio losses – defaults on payments. The main achievement of this combination is lower credit risk (also may be interest rate and currency risk) transfer from issuer to investor.

Second securitization technique, the one that we will focus on in this paper, involves structured products that are created most of the time without using special purpose entities, or transferring underlying assets from balance sheets. The simplest combination of these products comprises two components: fixed income security – most of the time zero coupon bond, which guarantees part or all of the invested principal and an option or somehow related instrument that provides investor with an additional payoff. The payoff of former is linked to the performance of underlying asset. The form of underlying asset may be regular coupons as well as one-off gain at the maturity. It can be considered that securitization process unfolds while pooling different assets in one product

that would generate a fixed interest or would have other appealing particularities for individual investor.

Throughout the last decade a considerable amount of empirical research has been done linked to structured products and their significance to investment management.

Edwards and Swidler (2005) investigated whether or not Equity Linked Certificates of Deposits have the same returns as simple equity instruments. Equity-linked certificates of deposit (ELCDs) are structured securities with underlying asset usually bond and derivative *i.e.* option of one of the market's indices such as S&P 500 or STOXX Europe 600. The analysis of authors compared the performance of a standard 5-year ELCDs to the returns generated by 5-year investment in the S&P 500 Index. Their time period consisted of 23 years, from 1981 to 2004. Authors found that earnings of ELCDs products were only slightly lower than S&P 500 Index. Latter, including dividends, returned to the investor an average annual return of 14.49 %, whereas ELCDs generated on average 13.28 %. However, S&P 500 demonstrated a standard deviation of 8.1 % compared to 7.3 % of ELCDs. Authors also noted that ELCDs had a beta of 0 in a declining market due to the underlying and a beta of close to 1 when stock market was growing, due to a call option.

K. C. Chen and R. S. Sears (1990) investigated the structured product called SPIN issued by Solomon Brothers, which essentially was S&P 500 Index Note. The SPIN was a four-year, 2 % (semiannual) coupon bond, with full principal paid at maturity plus the excess (if there was any) of the S&P 500 index value at the time of exercise. $SPIN = Bond + (Call\ option * Multiplier)$. The study focused on the pricing and risk measures of the SPIN. The paper analyzed three periods between September 1, 1986 (issuance date) and December 31, 1987. The results suggested that even though there were some mismatches – in the first sub period, structured product was over-priced by ~5 %, whereas in the two latter periods SPIN was under-priced. The main arguments for this valuation was higher volatility and on-going learning phase.

D. Maringer *et al.* (2015) used survey conducted among major issuers of structured products to estimate risk management cost and investment behavior in Switzerland. Their analysis consisted of 20 000 and 7 275 products for performance and cost analyses respectively. The product types that they used were: barrier reverse convertibles, bonus certificates, capital protection certificates, discount certificates and tracker certificates. Authors note that there has been a high correlation between structured products and equity or bond markets *i.e.* worst years for structured products were 2011 and 2008 due to the high volatility and declines in equity markets. Moreover, capital protection products according to authors represented performance similar to bond market. The main conclusion that authors draw from their research is that Swiss investors would rather invest in barrier reverse convertibles than in stocks and such investments are made more often in a low volatility markets. Authors note that this investment psychology is odd because in turbulent markets investors carrying barrier reverse convertibles receive a higher coupon and/or are able to choose a lower barrier for the same periodic payment than in normal markets. Authors highlight that behavioral motives appear to play a major role in the investment decisions.

C. Bernard *et al.* (2007) analyzed the most suitable design of structured products to a specific customer's needs. Author highlights that in most cases investors ask for downside protection when markets are declining and high participation in equity market during the expansionary equity market cycles. They indicate products such as: certificates, reverse convertibles and reverse convertible bonds among others. Authors found that when structured products include capital protection the design on structured product depends more on the issuer's risk preference, rather than on utility function. Furthermore, at the time when structured product does not include capital protection, it is impossible to find an optimal investment linked product for a range of particular utility functions.

In conclusion, different authors arrive at different conclusions related to the usage of structured products in investment management. Nevertheless, we can exclude few concepts that prevail in majority of the studies. First, the irrational behavior among investors while choosing the investment vehicle. Second, structured products usually generate similar returns (depending on the product) while carrying a lower risk. In addition, authors highlight the need for judgment while choosing structured products depending on one's investment purpose and risk preference.

Overall, structured products are widely spread and used around the world. They are created using securitization techniques that suit these products to specific need of the clients. However, the process of securitization is somewhat complex, therefore these products fit only for sophisticated investors. Main features that structured products possess are: capital protection and yield enhancement. However, there are a wide variety of combinations of two *e.g.* participation or leveraged products. Furthermore, there are empirical evidence that structured products enhance returns and reduce volatility of the portfolio.

2. Research methodology

Research consists of three parts. In the first part, single indices of structured products were compared to their benchmarks to figure out their superiority over each other *i.e.* support the claims of their advantages and disadvantages (if any). For the analysis part, first we used ratio analysis to determine the main characteristics of each product separately, while for the second part Markowitz's portfolio optimization model was developed, which helped to find the most efficient portfolios and analyze them from portfolio management perspective. For the last part, simple Monte Carlo simulation was used to determine the possible future returns and probable Value at Risk of selected portfolios.

For the ratio analysis part, three indices of structured products were analyzed and compared to their benchmarks. Each of the indices represents a different strategy and comprises of different structured products (SP). Also, each of the indices includes the structured products listed in SIX Structured Product Exchange that belong to appropriate category *i.e.* "Participation", "Yield Enhancement", "Capital Protection". Each SP in indices are weighted equally. One index comprises of minimum five and a maximum of ten different products. There are no identical SPs in each index. The structured product indices in the text had a base of 1000 points in February 27, 2009. The returns of the indices represent a total return (return that includes dividends and other additions). Benchmarks of SPs represent total returns as well. Main limitations that structured product indices include:

1. Index must represent three or more different issuers;
2. Products are not included if they have low liquidity (does not have "Derivative Partners Research" liquidity rating and/or fair value gap);
3. SPs are benchmarked to Euro Stoxx 50 if there are not enough structured products that use SMI (Swiss Market Index) as their benchmark.

For our analysis three main indices were selected:

SSPP – Participation Index (ISIN: CH0113557455). Tries to mimic the performance of the underlying 1 to 1, product is leveraged or leveraged plus additional payout. It comprises of tracker certificates, bonus certificates, outperformance certificates and outperformance bonus certificates. The benchmark of this index is SMI. SSPP index was introduced on February 27, 2009 at 1000 points (SIX Strategy Indices Flyer, 2015).

SSPC – Capital Protection Index (ISIN: CH0113557521). The most defensive index is suited for risk-averse investors. Index uses bonds, among other products, to maintain principal or minimize potential losses. The main products that SSPC contains are: capital protection certificate without cap, exchangeable certificates and capital protection with cap. Index was introduced on February 27, 2009 at 1000 points. The benchmark of SSPC index is Swiss Bond Index (Ticker - SZGATR) (SIX Strategy Indices Flyer, 2015).

SSPY – Yield Enhancement Index – (ISIN: CH0113557489). This product contains both risk management (some degree of capital protection) and enhancement returns due to leverage, discount or additional payout. Main structured products in the index are: discount certificates, barrier discount certificates, reverse convertibles and barrier reverse convertibles. Benchmark comprises of two asset classes *i.e.* 60% of equity - Swiss Market Index (Ticker - SMI) and 40% of bonds – Swiss Total Return Bond (Ticker - SZGATR) (SIX Strategy Indices Flyer, 2015).

For analysis part, historical prices of indices of structured products and their benchmarks were used. Price range is from 27th February, 2009 to 4th January, 2016. Market theory suggests that historical price range sup-

posed to include at least 2 market cycles, or approximately 10-14 years to yield a comprehensive result. Nevertheless, considering the high volatility of Swiss market we believe that the selected time frame is appropriate for the analysis. Few examples of Swiss market volatility include: 27% drop in SMI throughout the period of three months from 9th May, 2011 to 11th August; 2011; 52% appreciation through the period of three years starting 16th May, 2009; 13% shrink in one and a half month starting 13th May, 2013 and a drop of 16% in 3 days, after Swiss franc corridor was lifted.

In the first part, single indices of structured products were compared to their benchmarks in order to figure out their superiority over each other. We began by calculating the average returns and standard deviations of indices against benchmarks. Average daily return was calculated as continuously compounding, thus we used logarithmic function:

$$R = \ln\left(\frac{P_t}{P_{(t-1)}}\right) \quad (1)$$

Where: P_t – current price, P_{t-1} – price at previous period, R_t – return at time t .

Daily standard deviation was calculated by:

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (R_i - \bar{R})^2}{n-1}} \quad (2)$$

Where: n – number of observations, R – daily return, \bar{R} – mean return.

For the sake of argument, we also calculated expected return according to capital asset pricing model. However, we do not believe that it makes any fundamental significance or represents the possible true expected future value. This view is based on empirical studies of: Fama and French (1992), Stephen A. Ross APT theory (2003) and Goldman Sachs (2012).

CAPM was calculated by:

$$R_e = R_f + \beta * (R_m - R_f) \quad (3)$$

Where: R_e – Expected return, R_f – Risk free rate β – Beta, R_m – Return of the market

Beta in CAPM was calculated using regression analysis. Moreover, for regression analysis we used S&P 500 Index ETF (Bloomberg ticker: SPY US Equity) as a benchmark. Further in the analysis we calculated Skewness and Kurtosis of our structured product indices and their benchmarks to figure out their return distributions and asses some sort of risk level.

Skewness was calculated by:

$$S_k = \left(\frac{n}{(n-1)(n-2)}\right) \frac{\sum_{i=1}^n (R_i - \bar{R})^3}{\sigma^3} \quad (4)$$

Where: n – number of observations, R – daily return, \bar{R} – mean return, σ – standard deviation

Kurtosis was calculated by:

$$K_e = \left[\frac{n(n+1)}{(n-1)(n-1)(1-3)}\right] \frac{\sum_{i=1}^n (R_i - \bar{R})^4}{\sigma^4} - \frac{3(n-1)^2}{(n-2)(n-3)} \quad (5)$$

Where: n – number of observations, R – daily return, \bar{R} – mean return, σ – standard deviation.

Afterwards, Sharpe and M2 ratios were calculated to get a better view of return taking into account the risk level. Sharpe ratio was calculated by:

$$\text{Sharpe ratio} = \frac{R_p - R_f}{\sigma_p} \quad (6)$$

Where: R_p – return of the portfolio. Even though Sharpe, Treynor's and M2 ratios are mainly used for portfolio comparison and analysis authors assume that each index is a separate portfolio, since it is composed of more than 100 assets. R_f – risk free rate, σ_p – standard deviation of the portfolio.

M2 was calculated by:

$$M^2 = (R_p - R_f) \frac{\sigma_m}{\sigma_p} - (R_m - R_f) \quad (7)$$

Where: σ_p - standard deviation of the portfolio, σ_m - standard deviation of the market, R_p return of the portfolio, R_f – risk free rate.

After adjusting total risk by systematic risk, due to the fact, that priced in the market is only systematic risk it would be more rational to look at Treynor's ratio. This theory goes from the fact that if non-systematic risk would be priced, investor could diversify it by adding more assets. As the number of assets in the portfolio increases, the potential return from non-systematic risk decreases to zero.

Treynor ratio was calculated by:

$$\text{Treynor ratio} = \left(\frac{R_p - R_f}{\beta_p} \right) \quad (8)$$

Where: R_p – return of the portfolio, R_f – risk free rate, β_p – portfolio beta.

At the end, we calculated value at risk for each index and its benchmark.

Value at risk was calculated by:

$$VaR = \alpha \sigma - \bar{R} \quad (9)$$

Where: α – represents number of standard deviations from the mean considering the specified confidence interval, \bar{R} represents the mean return, σ – standard deviation. In the second part of the research we analyzed what influence did structured products have, if any, to portfolio management.

Second part of the research presents Markowitz's Efficient Frontier portfolio optimization method. Few scenarios will be considered such as: equal weights, maximum return, minimum volatility or maximum Sharpe ratio.

For the following analysis, to portfolios which each consists of seven investment products will be used. Portfolios consist of three structured products (already described in the first part of the analysis), as well as additional four indices or exchange traded funds. First of all, SPDR S&P 500 exchange traded fund (Ticker - SPY) is included. This ETF is a passive management fund that tracks the performance of index composed of 500 biggest U.S. companies. Next, Bloomberg Commodity Index (Ticker - BCOM) was included. It tracks the performance of aggregate world commodity prices. The biggest weights in the index are attributed to gold² (13.44%), natural gas³ (9.38%) and corn⁴ (8.13%). Furthermore, AlphaClone Hedge Fund Downside Hedged Index was added. Index tracks the performance of U.S. traded equities chosen based on a proprietary hedge fund position that

² GOLD 100 OZ FUTR, Expiration February 16 (Bloomberg terminal), weight as of December 10, 2016)

³ Natural Gas Future, Expiration March 16 (Bloomberg terminal), weight as of December 10, 2016

⁴ Corn Future, Expiration March 16 (Bloomberg terminal), weight as of December 10, 2016

is calculated by AlphaClone LLC (Ticker - ALPHACLN). Finally, analysis incorporates Vanguard REIT ETF, which is an exchange traded fund that tracks the performance of U.S. real estate market⁵ (Ticker VNQ). All returns and other calculations are based on Swiss franc currency. Historical prices for analysis were taken for the period that starts March 2nd, 2009 and ends at January 4th, 2016.

Markowitz’s Efficient Frontier model tries to distribute weights of assets in the selected portfolio in a way that best risk/return ratio would be achieved. First of, two initial portfolios were created (Table 2.). Note that both portfolios represent main asset classes *i.e.* equity, commodities, real estate, fixed income and alternative investments.

Table 2. Initial portfolios

PORTFOLIO 1	PORTFOLIO 2
SZGA TR INDEX	SSPC
SMI INDEX	SSPP
60% SMI, 40% SZGA TR	SSPY
SPY US EQUITY	SPY US EQUITY
BCOM INDEX	BCOM INDEX
ALPHACLN INDEX	ALPHACLN INDEX
VNQ US EQUITY	VNQ US EQUITY

Source: Composed by Authors.

Next, Variance-Covariance matrices of each portfolio were calculated.

Covariance between assets was calculated by:

$$Cov_{x,y} = \sum_{t=1}^N \frac{(X_t - \bar{X})(Y_t - \bar{Y})}{N} \quad (10)$$

Where: N – number of observations, X_t – asset one at time t, Y_t – asset two at time t, \bar{X} - mean of asset one, \bar{Y} - mean of asset two.

Then, excess returns from the mean for each daily logarithmic return were calculated. Date range is from March 2nd, 2009 to January 4th, 2016. At this point excess return matrix is denoted as – “X” and this notation will be used for further formulas unless specified otherwise. Afterwards, Variance - Covariance matrix has been created using the function below:

$$Var - Cov = \frac{X^T X}{N} \quad (11)$$

Where: N – number of observations, T – represents transpose function for matrix multiplication, X – excess return matrix.

Variance – Covariance matrix was calculated by dividing excess return matrix by the number of observations (N) – 1658. Standard deviation of each asset was calculated by regression analysis.

Correlation was calculated by:

$$\rho_{i,j} = \frac{Cov(X_i, X_j)}{\sigma_i \sigma_j} \quad (12)$$

Where: - $Cov(X_i, X_j)$ covariance of asset one and asset two, - σ_i standard deviation of asset one, σ_j standard deviation of asset two.

⁵ VNQ ETF tracks the performance of MSCI REITI Index, weight as of December 10, 2016

To calculate the expected returns for composed portfolios, weights had to be linked to Variance – Covariance matrix. That was done by multiplying average returns by weights (used matrix multiplication formula):

$$E(R_p) = w^T \bar{R} \quad (13)$$

Where: w - weight of the asset, T - transpose function, \bar{R} - mean return.

For standard deviation, we multiplied weights by Variance - Covariance matrix and by mean of each asset (used matrix multiplication) and then took the square root of the results.

$$\sigma_p = (W^T \Sigma W)^{1/2} \quad (14)$$

Where: w - weight of the asset, T - transpose function

For further model manipulation program in Excel called “Solver” was used, to find the best risk/return outcomes. Portfolio Value at Risk was calculated by:

$$VaR = \sum_{i=1}^N w_i^2 \sigma_i^2 + \sum_{i,j=1, i \neq j}^N w_i w_j \rho_{ij} \sigma_i \sigma_j \quad (15)$$

Where: ρ_{ij} - correlation between two assets, w_i - weight of asset one, w_j - weight of asset two, σ_i - standard deviation of asset one, σ_j - standard deviation of asset two.

To develop an efficient frontier few restrictions were established: model assigns minimum weight of 5% and maximum of 35% to each of the assets. This restriction comes from the assumption that lower than 5% invested in the one asset would not be sufficient to generate any diversification effect and higher weight than 35% would overweight the asset.

In the third part, we created a simple Monte Carlo simulation to get a sense of potential future development of created portfolios. For simulation Norm.Inv (Rand) function was used in Excel to generate random returns for five years. Next, cumulative returns of the fifth-year investment were computed. After that, fifth-year returns were simulated 1000 times in order to calculate the mean, median, standard deviation, and percentiles of selected portfolios (Table 3).

Table 3. Performance and risk measures using Monte Carlo simulation (in USD, except percentiles)

PORTFOLIO 1		PORTFOLIO 2	
MEAN	119.902,38	MEAN	177.020,71
MEDIAN	119.672,68	MEDIAN	177.036,23
5 th PERCENTILE	109.782,45	5 th PERCENTILE	152.682,07

Source: Composed by Authors

3. Results

Results from the ratio analysis part are depicted in Table 4. Ratio analysis revealed that two out of three structured products, namely SSPC and SSPP, on average generated higher returns compared to their benchmarks. Also, SSPP did that with a ¼ lower volatility. Furthermore, while index of yield enhancement had more than two times lower standard deviation than its benchmark, SSPC incorporated higher level of total risk. Based on the ratio analysis we also see that all structured products and their benchmarks have long left tails – negatively skewed and only participation product has a lower probability of extreme losses than its benchmark.

Table 4. Financial analysis ratios

	SSPC	SSPP	SSPY	SZGA TR Index	SMI Index	60 % SMI, 40 % SZGATR
Average annual return	4,35 %	11,21 %	5,00 %	3,74 %	9,68 %	9,53 %
Average annual st. dev.	6,68 %	12,79 %	7,04 %	3,62 %	16,59 %	16,19 %
CAPM	2,87 %	4,99 %	3,16 %	1,10 %	6,45 %	6,32 %
Skewness	-1,725	-0,615	-0,92	-0,198	-0,714	-0,719
Kurtosis	22,144	6,336	30,244	4,341	6,141	6,165
Min	-1,55 %	-9,07 %	-8,90 %	-14,28 %	-13,98 %	-14,54 %
Max	1,90 %	4,74 %	4,54 %	1,28 %	4,90 %	4,75 %
Range	3,54 %	13,18 %	13,44 %	15,56 %	18,88 %	19,29 %
Sharpe	0,422	0,757	0,492	0,611	0,491	0,494
Jensen's alpha (CAPM)	1,48 %	6,22 %	1,84 %	2,64 %	3,23, %	3,21 %
Treynor's ratio	0,256	0,34	0,259	-0,625	0,201	0,203
VaR	6,64 %	9,83 %	6,59 %	2,21 %	17,61 %	17,09 %
M2	-3,37 %	3,60 %	-1,91 %	0,56 %	-1,93 %	-1,86 %
Correlation to S&P 500	34,32 %	46,33 %	39,54 %	20,34 %	50,77 %	50,69 %
Adjusted R Square	11,72 %	21,41 %	15,59 %	4,08 %	25,73 %	25,65 %
Annual alpha	0,22 %	0,44 %	0,20 %	0,26 %	0,26 %	0,26 %
Beta	0,11	0,285	0,134	-0,035	0,405	0,394

Source: Computed by Authors

Both structured products and their benchmarks have an excess Kurtosis. Nonetheless, SPs represent fatter tails, which means that structured products have higher frequency of average value. However, even though structured products possess higher probability of positive returns, they also bear a higher probability of extreme losses. It would seem that benchmarks outperform SPs at the majority of instances. Higher Sharpe ratio suggests that for every unit of risk SZGATR and 60% SMI/40% SZGATR would give investor a higher return compared to respective structured product index. Treynor's ratio suggests the same *i.e.* while SSPC and SSPY under-performs relative to the market, participation index over-performs considering specific risk tolerance. Treynor's ratio revealed that structured products outperform market more than their benchmarks after adjusting for systematic risk. This situation occurs due to lower correlation to S&P 500. Calculated Value at Risk of each of the indices reveals that while participation and yield enhancement indices indicate that there is a 95 % probability that during a one-year period investor would not lose more than 9.83% and 6.59% respectively, of their investment, their benchmarks could lose substantially higher amounts.

Overall, first part of the research revealed that capital protection structured product had the worst performance among structured products. Higher volatility did not compensate for higher returns estimated by Sharpe and M2 ratios. Also, high negative Skewness and Kurtosis relates to the higher than its benchmark Value at Risk. Furthermore, SSPC index correlates and is explained by S&P 500 more than Swiss bond index, which in normal conditions would raise the question of its usefulness to investment management. Nonetheless, we must take into account the structure of this product. Capital protection products usually protect from 70% to 100% of its initial investment, thus we have to be careful interpreting downside risk – VaR, Skewness or Kurtosis. As the return part is concerned we saw that SSPC generated higher returns than its benchmark, what has a significant weight, considering the origin of this index. Participation and Yield enhancement structured products in the majority of instances were superior to their benchmarks. It would seem that participation products could have the biggest positive impact to the investment management due to the fact that they generated higher returns with lower volatility, what in turn yielded superior Sharpe, Treynor and M2 ratios, whereas Yield enhancement products struggled to produce returns higher than their benchmarks. Furthermore, SSPP was less negatively skewed than its benchmark and had lower correlation with lower explanatory variable and higher alpha. All of these, reasons contributed to lower value at risk measure.

Based on the arguments mentioned above we can create an assumption that structured products may be inferior to common indices or ETFs for a retail investor as a single asset investment due to higher potential fees, lower returns and higher probabilities of extreme positive or negative returns. Nonetheless, structured products supposed to be superior in portfolio management due to lower correlation, beta and explanatory variable.

In the second part of the analysis we tested an argument that structured products are useful diversification and portfolio return enhancement tools. For this test, we created four scenarios.

1st scenario Equal weights – each asset class in the portfolio received the same weight.

2nd scenario. Maximum return – solver was used to find the optimal combination of asset’s weights to generate a maximum return.

3rd scenario. Minimum standard deviation – solver was used to find minimum possible volatility of the portfolio by changing weights.

4th scenario. Maximum Sharpe ratio – solver was used to find weights of the portfolio that would yield the highest possible Sharpe ratio.

Table 5. Weight distribution for selected portfolio

PORTFOLIO 1					PORTFOLIO 2				
	1 st scenario	2 nd scenario	3 rd scenario	4 th scenario		1 st scenario	2 nd scenario	3 rd scenario	4 th scenario
	Equal weights	Max. return	Min. St.dev.	Max Sharpe		Equal weights	Max. return	Min. St.dev.	Max Sharpe
SZGA TR INDEX	14,29%	5%	35%	10,00%	SSPC	14,29%	5,00%	35,00%	14,66%
SMI INDEX	14,29%	5,00%	10,00%	5,00%	SSPP	14,29%	10,00%	6,09%	35,00%
60% SMI, 40% SZGA TR	14,29%	5,00%	5,00%	5,00%	SSPY	14,29%	5,00%	35,00%	27,61%
SPY US EQUITY	14,29%	35,00%	5,00%	35,00%	SPY US EQUITY	14,29%	35,00%	5,00%	5,64%
BCOM INDEX	14,29%	5,00%	5,00%	5,00%	BCOM INDEX	14,29%	5,00%	8,91%	5,00%
ALPHA CLN INDEX	14,29%	10,00%	5,00%	5,00%	ALPHA CLN INDEX	14,29%	5,00%	5,00%	5,67%
VNQ US EQUITY	14,29%	35,00%	7,43%	35,00%	VNQ US EQUITY	14,29%	35,00%	5,00%	6,42%
Weights sum	100,00%	100%	100,00%	100,00%	Weights sum	100%	100%	100%	100%
Exp. return	8,35%	12,77%	7,43%	12,41%	Exp. return	8,00%	12,66%	5,49%	8,16%
St. dev. Portf.	4,49%	5,67%	3,27%	5,46%	St. dev. Portf.	3,17%	4,76%	1,93%	2,41%
Sharpe ratio	1,518	1,983	1,802	1,993	Sharpe ratio	2,043	2,658	2,846	3,380

Source: Composed by Authors

It would appear that Portfolio 2 lacks behind in all of the scenarios looking from expected return perspective (Table 5.) However, we can also see that during all of the mentioned scenarios Portfolio 2 has taken less risk (in this case measured by standard deviation) to generate corresponding returns. Sharpe ratio depicts similar conclusions – Portfolio 2 was more efficient compared to Portfolio 1.

In order to depict an Efficient frontier graph, two portfolios with the same standard deviation were selected, see Table 6.

Table 6. Portfolios with the same standard deviation

Portfolio 1.									
St.Dev.	Exp. Return	Weight (%)							Total
		SZGATR INDEX	SMI INDEX	60% SMI, 40% SZGA TR	SPY US EQUITY	BCOM INDEX	ALPHACLN INDEX	VNQ US EQUITY	
4,01%	9,50%	31,66%	5,00%	5,00%	35,00%	5,00%	5,00%	13,34%	100%
Portfolio 2.									
St.Dev.	Exp. Return	Weight (%)							Total
		SSPC	SSPP	SSPY	SPY US EQUITY	BCOM INDEX	ALPHACLN INDEX	VNQ US EQUITY	
4,01%	12,00%	5,00%	35,00%	5,00%	11,13%	5,00%	5,00%	33,87%	100%

Source: Composed by Authors

Figure 2 reflects the return distribution of two portfolios (portfolios with the same standard deviation) with respect to standard deviation. We can see that structured products have a positive effect to portfolio management. It is clear, that for every unit of risk Portfolio 2 (dotted line) generates superior returns than Portfolio 1 (solid line). This fact occurs mainly due to lower correlation between assets which was depicted in Table 4.

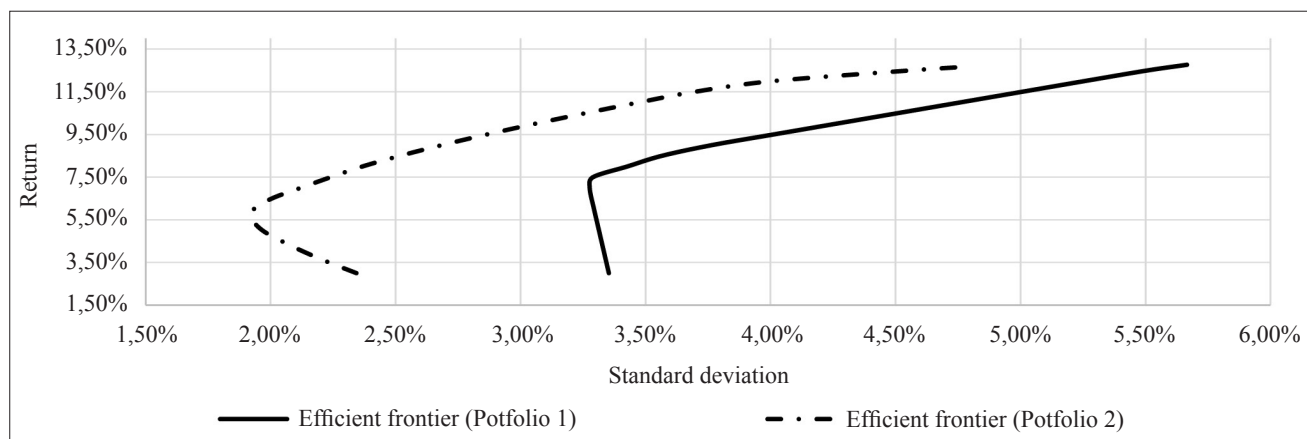


Fig.2. Efficient frontier.

Source: Composed by Authors.

For further analysis, Value at Risk for two portfolios with the same standard deviation was calculated. Note, that expected return is higher for portfolio with structured products (Portfolio 2). We find that, by investing \$100 000 in Portfolio 1 there is a 95% probability that investor would not lose more than \$21 505 in one year, whereas investor invested in Portfolio 2 throughout the same period would have a 95% probability of not losing more than \$15 903.

Overall, Markowitz’s Efficient Frontier model suggests that structured products incorporated in the portfolio of main asset classes would reduce the portfolio’s volatility and enhance returns. Moreover, findings highlight the fact, that while investing with structured products investor would experience a lower possible value that could be lost with 95% certainty. These findings reveal that structured products have a positive influence to investment management.

A Monte Carlo simulation findings support results calculated using Markowitz’s efficient frontier. According to Monte Carlo simulation \$100 000 invested at year 1 in Portfolio 2, assuming a normal standard distribution, in 5 years could grow to \$177 thousands, that is on average 15% per year. In addition, that is 47 % higher overall return compared to Portfolio 1, if we would have done the same. Moreover, there is a 5% probability of having less than \$109 782.42 and \$152 682.07 in Portfolios 1 and Portfolio 2 respectively, after five years, taking into account the expected returns and standard deviations.

Conclusions

Overall, structured products entail two main qualities that are enhanced to generate superior returns or achieve a lower risk level. That is, combination of two or more assets and flexibility. The latter part is especially important for an investor due to better possible need exploitation and better adjustment to market conditions.

Structured products can be created through the process called securitization, which is usually accomplished either by pooling different assets together and selling them to broad market (off-balance securitization), or by connecting structured products to securities. Key differences between two techniques mainly relates to operator needs. While securitization of off-balance assets usually is used for credit risk reduction, structured product connection to securities is aimed at special need fulfillment.

The empirical studies draw different conclusions out of their studies. However, overall few main aspects prevail. The majority of authors agree that during decision making process irrational behavior dominates. Furthermore, empirical studies suggest that most of the time structured products yield higher returns while incorporating lower risk. Last point would suggest that structured products are an important asset in the investment management.

Financial ratio analysis of structured products versus their benchmarks indicate that capital protection index demonstrated the worst performance taking into account risk and return ratios, where higher returns did not compensate for higher volatility. Moreover, higher potential amount that could be lost with 95% confidence level and greater correlation to S&P 500, compared to the equity benchmark raises questions about capital protection index usefulness. However, considering the nature of capital protection product, combination of 70% to 100% capital protection and higher return than its benchmark highlights the main advantage *i.e.* even though capital protection structured product deviates from the mean by higher degree than its benchmark throughout the investment period (result of leverage used in product composition) at the maturity date investor could enjoy the benefit of higher return, regardless of volatility.

Participation and Yield enhancement structured products overall demonstrated superior ratios than their benchmarks. Nonetheless, participation products stood out with not only better risk management, but with higher returns as well. Both products demonstrated a superior Value at Risk, Sharpe, Treynor's and M2 ratios what supports the view of the empirical studies. However, both SSPP and SSPY had fatter tails than their benchmarks, what indicates a higher probability of extreme losses. Financial ratios also imply that structured products have lower correlation, beta and explanatory variables than S&P 500. That indicates a possible positive diversification effect in portfolio management.

Markowitz's Efficient Frontier model found that structured products have a significant positive influence to portfolio management. It revealed that portfolio with structured products is able to generate higher returns for every possible risk level, compared to portfolio without structured products. In addition, results indicate that investor having a portfolio with structured products could enjoy a lower Value at Risk.

Monte Carlo simulation backed the previous findings *i.e.* Portfolio with structured products generated higher returns and lower Value at Risk. Findings above give some degree of proves that structured products have a positive influence to portfolio management, what in turn makes them an important diversification and return generating tool.

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