REVERSE BONUS CERTIFICATE DESIGN AND VALUATION USING PRICING BY DUPLICATION METHODS

Martina BOBRIKOVÁ[*], Monika HARČARIKOVÁ[**]

Abstract

In this paper we perform an analysis of a capped reverse bonus certificate, the value of which is derived from the value of an underlying asset. A pricing formula for the portfolio replication method is applied to price the capped reverse bonus certificate. A replicating portfolio has profit that is identical to profit from a combination of positions in spot and derivative market, i.e. vanilla and exotic options. Based upon the theoretical option pricing models, the replicating portfolio for capped reverse bonus certificate on the Euro Stoxx 50 index is engineered. We design the capped reverse bonus certificate with various parameters and calculate the issue prices in the primary market. The profitability for the potential investor at the maturity date is provided. The relation between the profit change of the investor and parameters' change is detected. The best capped reverse bonus certificate for every estimated development of the index is identified.

Keywords: capped reverse bonus certificate, underlying asset, replicating profit, vanilla option, up-and-out option

JEL classification: G11, G13

1. INTRODUCTION

Nowadays the structured products continue to be an attractive and interesting business segment for many financial institutions. Therefore financial institutions are still creating new types of these sophisticated products according to requirements of the investors.

Swiss Structured Product Association (SVSP, 2015) defines the structured products as innovative and flexible investment vehicles based on derivatives, which provide an attractive alternative to direct financial investments such as a share in a company, a basket of shares, an entire index, commodity or currency. Investors can have an access to asset classes through structured products that are difficult and expensive to invest in. For example studies like Benet *et al.* (2006), Bluemke (2009), Rossetto and Bommel (2009) deal with the structured products. They can be created for every risk-return profile with various levels of capital protection or without protection, but with determination of the maximum potential

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[*] Faculty of Economics, Technical University of Košice, Slovakia; e-mail: *martina.bobrikova@tuke.sk.*

[**] Faculty of Economics, Technical University of Košice, Slovakia; e-mail: *monika.harcarikova@tuke.sk.*

loss to the initial invested amount. Therefore they are ideal additions to any portfolio. The role of structured products in behavioural portfolios is studied in works like Breuer and Perst (2007) or Das and Statman (2013).

The biggest part of the structured products introduces investment certificates. Investment certificates became popular in Europe in the 1990s during a period of low interest rates. Nowadays, they are the fastest growing retail financial products in the capital markets around the world.

Investment certificate is a security, the value of which is derived from the value of an underlying asset. The underlying asset is usually a share in a company, a basket of shares or an index. There is a suitable kind of certificate (linear, guaranteed, airbag, discount, outperformance, turbo, bonus etc.) for every estimated development of an asset (growth, fall or stagnation) or for every attitude to risk (conservative or aggressive investor). Investment certificates are created through the process of financial engineering as a combination of the underlying asset with derivatives, often an option (vanilla and/or exotic option). Outperformance certificate is examined by Šoltés (2010b) and Hernandez et al. (2013). Hernandez et al. (2011) and Gordiaková and Younis (2013) analyse the various types of investment certificates creation. The construction of the investment certificates through the option strategies is investigated in papers like Šoltés (2010a, 2012) and Šoltés (2011).

Valuation of every investment certificate is based on pricing by duplication methods. The value of the investment certificate is identical to the value of the replicating portfolio. The replicating portfolio is created as a combination of the position in the underlying asset together with the option position. Papers like Burth et al. (2001), Wilkens et al. (2003), Grunbichler and Wohlwend (2005), Stoimenov and Wilkens (2005), Henderson and Pearson (2011) deal with the issue of the valuation. Wilkens and Stoimenov (2007) and Baule and Tallau (2011) provide the empirical research of the pricing for investment certificates in the German market. Hernandez and Liu (2014) analyse the pricing of exotic bonus certificates.

Options are the basic part of every investment certificates. Due to options, the specific risk-return profile of investment certificates is secured. Hull (2012) defines vanilla option as a financial contract granting its holder (the buyer) the right, but not the obligation, to buy (call option) or sell (put option) a given underlying asset at a predetermined price (the strike price or the exercise price) of the option at any time within a specified expiration period of option (American style) or at the time of expiration of option (European style). For this right the option premium is paid to the option seller (the writer). Exotic options have some different characteristics compared to vanilla options, however the essential features are the same. Probably the most popular type of exotic option is barrier options. Barrier options are new generation of options, which contain the second strike price, referred as the barrier level according to Taleb (1997). Exceeding the barrier level during the option life means activation (knock-in) or deactivation (knock-out) of option. The barrier may be over (up) or below (down) the actual price of the underlying asset at the time of closing option contracts. More detailed descriptions of classic vanilla and barrier options exist in the literature (Nelken, 1996; Zhang, 1998; Haug, 2007).

Profit functions in the analytical form of options and options strategies allow for expressing the trading and hedging option position. The optimal algorithm for vanilla option trading strategies is presented in the paper by Šoltés (2001). Hedging by means of options strategies using barrier options is discussed in several works (Šoltés and Rusnáková, 2013; Gordiaková and M., 2014; Lalić and Szabo, 2014). This approach can be also used in investment certificate formation. In other papers (Younis and Rusnáková, 2014; Rusnáková

et al., 2014, Gordiaková and M., 2014; Šoltés and Harčariková, 2015) authors create the replicating portfolio to investment certificates using an analytical form of profit functions. Following the mentioned studies we provide our certificate analysis.

The aim of this paper is to perform an analysis of a capped reverse bonus certificate. We apply portfolio replication method to price the capped reverse bonus certificate. The replicating portfolio has a profit function that is identical to the profit function from a combination of position in the underlying asset and positions in options. The application to the Euro Stoxx 50 index is provided. Note that this method is robust for various types of the underlying asset. In this paper, market European vanilla call/put option prices are taken from Bloomberg database. Market barrier option data are not available, therefore the values of the position in European style of barrier options are calculated by Bloomberg. Based on the data set, we design the capped reverse bonus certificate with various parameters. We provide the profitability analysis for the potential investor at the maturity date. The design of investment certificates is highly complicated and difficult to understand for average investor. Therefore our findings should help all investors to understand the structure of this product with the ability to choose the best product according to the expectations in the market.

The paper is organized on the following sections. In the first part a capped reverse bonus certificate description is presented. This is followed by the application to the Euro Stoxx 50 index. The capped reverse bonus certificates with various parameters are designed and compared. The final section contains the conclusions.

2. CAPPED REVERSE BONUS CERTIFICATE

The capped reverse bonus certificates are appropriate investment tools for declining market of some underlying asset. The profit profile depends on breaking a barrier. The barrier (B) is a limit above the actual spot price of the underlying asset. If the barrier is not reached during the time to maturity (t), the investor will be paid at a minimum the bonus level (B_L). The profit can be limited by a cap. The cap (C) is the maximum value which the investor can get from the certificate at the maturity date. If the underlying asset value rises above the barrier during the time to maturity, then this protection is cancelled and the investor participates in the loss in full. One of the key factors is a multiplier (p) (usually 0.01 or 0.001). For example, if the underlying asset has a value of 100 units and the subscription ratio is 0.01, the certificate will have a value of 1 unit. This makes the certificates suitable for every investor. Other basic parameters are the issue date (T_0) and the maturity date (T) of the certificate.

Let us denote the price of the underlying asset at the issue date with S_0 and the price of the underlying asset at the maturity date with S_T. The profit function of the capped reverse bonus certificate at the maturity date is as follows:

$$P_{IC}\left(S_T\right) = \begin{cases} -p*C+k_0 & \text{if } S_T < C, \\ -p*S_T+k_0 & \text{if } C \leq S_T < B_L, \\ -p*B_L+k_0 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) < B \wedge B_L \leq S_T < 2*S_0, \\ -p*S_T+k_0 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) \geq B \wedge B_L \leq S_T < 2*S_0, \\ -2*p*S_0+k_0 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) \geq B \wedge S_T \geq 2*S_0. \end{cases} \quad (1)$$
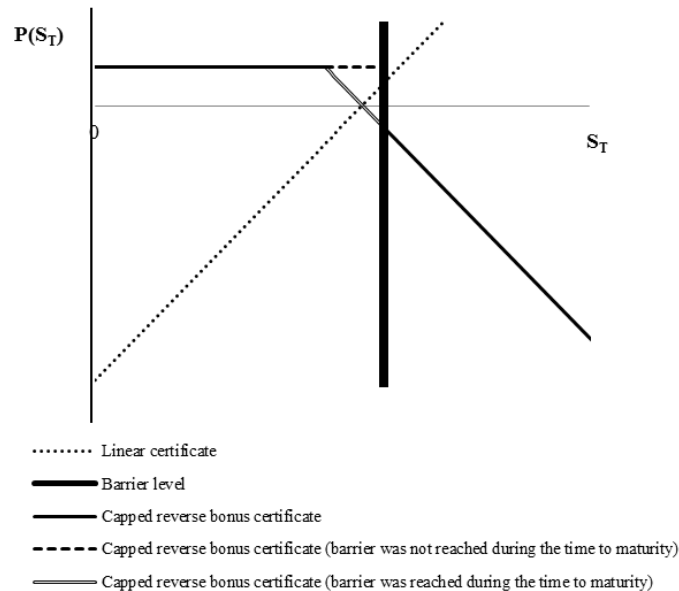
The profit function of the capped reverse bonus certificate is shown in Figure 1. If the underlying price during the time to maturity does not grow above the barrier and:

1) it is lower than the cap level at the maturity date, than the investor in the capped reverse bonus certificate obtains the higher fixed profit ($-p*C+k_0$);
2) it is between the cap and the bonus level at the maturity date, than the investor obtains the profit ($-p*S_T+k_0$);
3) it is the higher than the bonus level at the maturity date, than the investor obtains the lower fixed profit ($-p*B_L+k_0$).

If the underlying price during the time to maturity grows above the barrier and:

1) $S_T<C$, then the profit from the capped reverse bonus certificate is ($-p*C+k_0$);
2) $C \leq S_T < 2*S_0$, then the profit from the capped reverse bonus certificate is ($-p*S_T+k_0$);
3) $S_T \geq 2*S_0$, then the profit from the capped reverse bonus certificate is ($-2*p*S_0+k_0$).

There is an inverse relation between the profit of the capped reverse bonus certificate and the profit of the linear certificate (i.e., a long underlying position).

.... Linear certificate

▬▬▬ Barrier level

——— Capped reverse bonus certificate

- - - - Capped reverse bonus certificate (barrier was not reached during the time to maturity)

═══ Capped reverse bonus certificate (barrier was reached during the time to maturity)

Source: own design

Figure no. 1 – Profit function of capped reverse bonus certificate

Let us propose an alternative investment which is engineered from a combination of four positions, i.e., a short position in the underlying asset with the price at the issue date S_0 and price at the maturity date S_T, a short position in put options with the lower strike price (the cap level), a long position in up-and-out call options with a higher strike price (the bonus level) and a long position in call options with the highest strike price in the amount of $2*S_0$. The profit function of short position in the underlying asset at the maturity date is:

$$P_1(S_T) = S_0 - S_T. \tag{2}$$

The short position in put option represents an obligation to buy an underlying asset for a given strike price. The profit function of short put position is:

$$P_2\left(S_T\right) = \begin{cases} S_T - C + p_S & \text{if } S_T < C, \\ p_S & \text{if } S_T \geq C, \end{cases} \tag{3}$$

where p_S is a premium for an option.

The long position in up-and-out call option represents a right to buy an underlying asset for a given strike price if the barrier level is not exceeded over the time to maturity. The profit function for long position in up-and-out call option has the following form:

$$P_3\left(S_T\right) = \begin{cases} -c_{BUO} & \text{if } S_T < B_L, \\ S_T - B_L - c_{BUO} & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) < B \wedge S_T \geq B_L, \\ -c_{BUO} & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) \geq B \wedge S_T \geq B_L. \end{cases} \tag{4}$$

where c_{BUO} is a premium for an option.

The long position in call option is a right to buy an underlying asset for a given strike price. The profit function of long call position is:

$$P_4\left(S_T\right) = \begin{cases} -c_B & \text{if } S_T < 2 * S_0, \\ S_T - 2 * S_0 - c_B & \text{if } S_T \geq 2 * S_0, \end{cases} \tag{5}$$

where c_B is a call option premium.

The profit function from alternative investment at the multiplier p expressed as the sum of the individual functions (2), (3), (4) and (5) is:

$$P_{RP}\left(S_T\right) = \begin{cases} -p * C + k_0 & \text{if } S_T < C, \\ -p * S_T + k_0 & \text{if } C \leq S_T < B_L, \\ -p * B_L + k_0 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) < B \wedge B_L \leq S_T < 2 * S_0, \\ -p * S_T + k_0 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) \geq B \wedge B_L \leq S_T < 2 * S_0, \\ -2 * p * S_0 + k_0 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) \geq B \wedge S_T \geq 2 * S_0. \end{cases} \tag{6}$$

Assuming the following condition:

$$k_0 = p * S_0 + p * p_S - p * c_{BUO} - p * c_B, \tag{7}$$

the profit function of the replicating portfolio is the same as the profit function of the capped reverse bonus certificate. Using these alternative investment positions we derived the profit profile of the capped reverse bonus certificate.

3. APPLICATION TO THE EURO STOXX 50 INDEX

In this section, we will propose the capped reverse bonus certificates on the Euro Stoxx 50 index and perform the analysis of their profitability. We examine the profitability from the certificates of the investor at the maturity date. We are going to show which parameters the investor should pay attention to when deciding to invest into the given investment certificate. We will use European style vanilla and barrier options on the Euro Stoxx 50 index in the creation of investment certificates.

3.1. Data description

The Euro Stoxx 50 index is a blue-chip index for the Eurozone. The index value on December 1, 2014 was 3,232.91 EUR. European style vanilla and barrier call/put option prices on the Euro Stoxx index 50 with various strike prices and the barrier levels are obtained from Bloomberg. We considered options with the issue date December 1, 2014 and the maturity date September 18, 2015. The strike prices of the barrier options are similar to the vanilla prices. The barrier levels are selected by authors. The higher the barrier level, the higher the option premium and vice versa. Therefore we have not selected very high levels. The dataset used in our application can be provided upon request. The common key data for the proposed certificates are presented in Table 1. The multiplier is selected by authors as 0.01.

Table no. 1 – Common data about capped reverse bonus certificates

Key data	
Underlying	Euro Stoxx 50
Underlying price (S_0)	3,232.91EUR
Issue date (T_0)	1/12/2014
Maturity date (T)	18/9/ 2015

Source: own design

3.2. Proposal of capped reverse bonus certificate

Let us propose the capped reverse bonus certificate as a combination of a short position in Euro Stoxx 50 with actual price 3,232.91 EUR, a short position in put option on Euro Stoxx 50 with the cap level 2,800, premium 89.15 EUR for an option, a long position in up-and-out call option on Euro Stoxx 50 with the bonus level 2,900, the barrier level 3,500, premium of 37.59 EUR for an option, and a long position in call option on Euro Stoxx 50 with the strike price 6,465.82, premium of 0.002 EUR for an option. The profit function of the capped reverse bonus certificate at the maturity date using the replicating portfolio formula (6) is represented by the following equation:

$$P\left(S_T\right) = \begin{cases} 4.84 & \text{if } S_T < 2,800, \\ -0.01 * S_T + 32.84 & \text{if } 2,800 \leq S_T < 2,900, \\ 3.84 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) < 3,500 \wedge 2,900 \leq S_T < 6,465.82, \\ -0.01 * S_T + 32.84 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) \geq 3,500 \wedge 2,900 \leq S_T < 6,465.82, \\ -31.81 & \text{if } \max_{0 \leq t \leq T}\left(S_T\right) \geq 3,500 \wedge S_T \geq 6,465.82. \end{cases} \tag{8}$$

The fair value of this certificate based on (7) can be calculated as:

$$0.01*(\,3,232.91+89.15-37.59-0.002\,)=32.84 \qquad (9)$$

Any issue price above the fair value 32.84 is the gain of the certificate issuer.

Let us propose the capped reverse bonus certificate as a combination of a short position in Euro Stoxx 50 with actual price 3,232.91 EUR, a short position in put option on Euro Stoxx 50 with the cap level 2,800, premium of 89.15 EUR for an option, a long position in up-and-out call option on Euro Stoxx 50 with the bonus level 2,900, the barrier level 3,600, premium of 66 EUR for an option, and a long position in call option on Euro Stoxx 50 with the strike price 6,465.82 premium 0.002 EUR for an option. The profit function of the proposed capped reverse bonus certificate at the maturity date is as follows:

$$P\left(S_T\right)=\begin{cases} 4.56 & \text{if } S_T < 2,800, \\ -0.01*S_T+32.56 & \text{if } 2,800 \le S_T < 2,900, \\ 3.56 & \text{if } \max_{0\le t\le T}\left(S_T\right) < 3,600 \wedge 2,900 \le S_T < 6,465.82, \\ -0.01*S_T+32.56 & \text{if } \max_{0\le t\le T}\left(S_T\right) \ge 3,600 \wedge 2,900 \le S_T < 6,465.82, \\ -32.10 & \text{if } \max_{0\le t\le T}\left(S_T\right) \ge 3,600 \wedge S_T \ge 6,465.82. \end{cases} \qquad (10)$$

The fair value of this certificate is EUR 32.56.

The profit from the proposed capped reverse bonus certificate with the barrier 3,500 and the capped reverse bonus certificate with the barrier 3,600 depending on the development of the Euro Stoxx 50 index at the maturity date of the certificates is showed in Table 2. We compare the profit of the certificates at possible future scenarios of underlying price development.

Table no. 2 – Profitability analysis of the proposed capped reverse
bonus certificates with the barrier 3,500 and 3,600

Barrier level 3500	Barrier level 3600	Intervals of Euro Stoxx 50 values at the maturity date	Profit of certificate with barrier 3500		Profit of certificate with barrier 3600	
			Min	Max	Min	Max
		$S_T \le 2,800$	**4.84**	**4.84**	4.56	4.56
		$2,800 \le S_T \le 2,900$	**3.84**	**4.84**	3.56	4.56
not reached	not reached	$2,900 \le S_T \le 2,928$	**3.84**	**3.84**	3.56	3.56
reached	not reached	$2,900 \le S_T \le 2,928$	**3.56**	**3.84**	3.56	3.56
reached	reached	$2,900 \le S_T \le 2,928$	**3.56**	**3.84**	3.28	3.56
not reached	not reached	$2,928 \le S_T \le 3,600$	**3.84**	**3.84**	3.56	3.56
reached	not reached	$2,928 \le S_T \le 3,600$	-3.16	3.56	**3.56**	**3.56**
reached	reached	$2,928 \le S_T \le 3,600$	**-3.16**	**3.56**	-3.44	3.28
		$3,600 \le S_T \le 6,465.82$	**-31.81**	**-3.16**	-32.10	-3.44
		$6465.82 \le S_T$	**-31.81**	**-31.81**	-32.10	-32.10

Source: own calculations

Considering the results of the profitability analysis we have the following findings. If the Euro Stoxx 50 value during the period to maturity grows above the barrier 3,500 but does not grow above the barrier 3,600 and it belongs to the interval [2,928; 3,600] at the maturity date, then the capped reverse bonus certificate with the barrier 3,600 is the best variant, otherwise, the capped reverse bonus certificate with the barrier 3,500. The capped reverse bonus certificate with the higher barrier ensures the higher profit if the investor expects low volatility of the underlying. Further, we can conclude that the certificates with the lower barrier levels are more expensive when compared with those having the higher barrier level. This is due to the fact that the risk of breaking the barrier is higher in the first case.

Let us propose the capped reverse bonus certificates on Euro Stoxx 50 with various parameters, specifically the bonus levels and the capped levels. These parameters impact on the profit of the potential investor. Table 3 shows the proposed capped reverse bonus certificates for further analysis. The chosen certificates are certificates with the barrier levels 3,500, different bonus and cap levels.

Table no. 3 – Parameters of the proposed capped reverse bonus certificates on Euro Stoxx 50

| Denotation	Barrier level	Cap level	Put premium	Bonus level	Up-and-out call premium	Issue price
I_1	3,500	2,700	72.06	2,700	85.23	32.46
I_2	3,500	2,700	72.06	2,900	37.59	31.98
I_3	3,500	2,800	89.15	2,800	58.69	32.02
I_4	3,500	2,800	89.15	2,900	37.59	32.84

Source: own design

Using the replicating formula (6) we calculate the issue prices of each certificate. The issue prices are shown in Table 4.

Table no. 4 – Parameters of the proposed capped reverse bonus certificates on Euro Stoxx 50

| Denotation	Issue price
I_1	32.46
I_2	31.98
I_3	32.02
I_4	32.84

Source: own calculations

We evaluate the profitability of the capped reverse bonus certificate I_1 with the bonus level 2,700 and the capped reverse bonus certificates I_2 with the bonus level 2,900 from the investor's point of view (see Figure 2 and Figure 3). If the value of Euro Stoxx 50 index during the time to maturity does not grow above the barrier 3,500 and it is lower than 2,747 at the maturity date, then the capped reverse bonus certificate I_2 is the best variant, otherwise the capped reverse bonus certificate I_1 is the adequate choice. If the value during the time to maturity grows above 3,500, then the capped reverse certificate, I_2 ensures the highest profit for the investor. The results indicate that the capped reverse bonus certificate I_1 as well as the capped reverse bonus certificate I_2 may generate the maximum profit. Therefore, it is important to select the certificate with the most appropriate parameters based on investor's expectation of underlying price development.

Barrier level was not reached
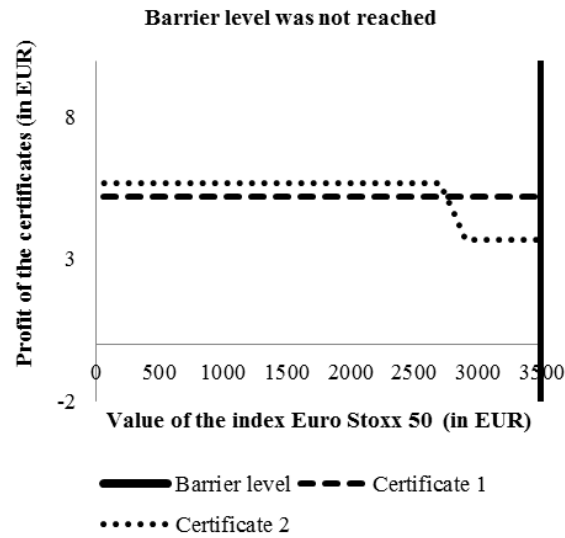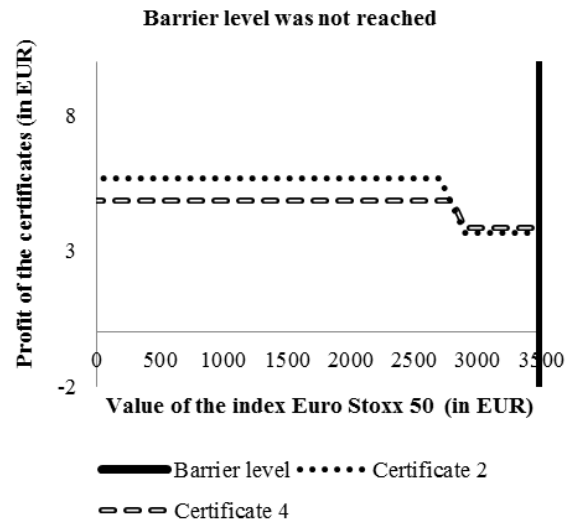

Source: own design

Figure no. 2 – Profit of the capped reverse certificates I_1 and I_2

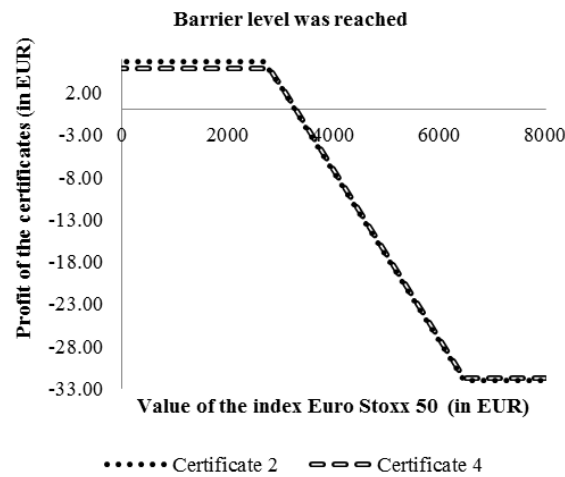**Barrier level was reached**
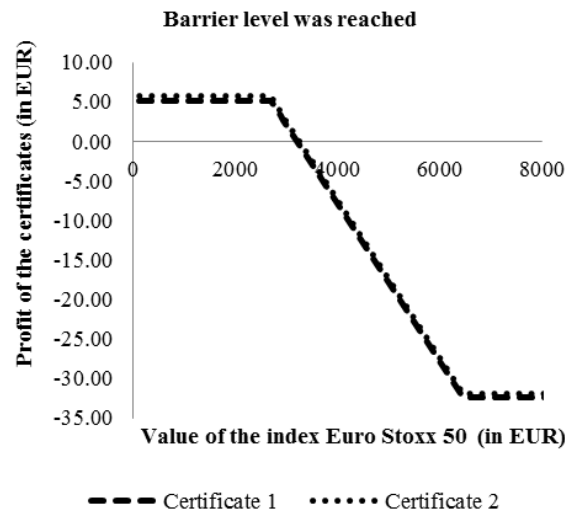
Source: own design

Figure no. 3 – Profit of the capped reverse certificates I_1 and I_2

The profit from the capped reverse bonus certificate I_2 with the cap level 2,700 and the certificate I_4 with the cap level 2,800 are shown in Figure 4 and Figure 5. If the value of Euro Stoxx 50 index is lower than 2,783 at the maturity date, then the capped reverse bonus certificate I_2 ensures the highest profit for the investor. If the value of Euro Stoxx 50 index is higher 2,783 at the maturity date, then the capped reverse bonus certificate I_4 is the best variant.

Barrier level was not reached

Source: own design

Figure no. 4 – Profit of the capped reverse certificates I_2 and I_4

Barrier level was reached

Source: own design

Figure no. 5 – Profit of the capped reverse certificates I_2 and I_4

Profitability analysis of the proposed certificates for the selected intervals of Euro Stoxx 50 value at the maturity date is displayed in Table 5 (the barrier level was not breached during the time to maturity) and Table 6 (the barrier level was breached during the time to maturity).

Table no. 5 – Profitability analysis of the proposed capped reverse bonus certificates if the barrier level 3,500 was not reached during the time to maturity

Investment certificate	I_1		I_2		I_3		I_4	
Intervals of Euro Stoxx 50 values at the maturity date	Min	Max	Min	Max	Min	Max	Min	Max
$S_T \leq 2,700$	5.20	5.20	**5.67**	**5.67**	4.63	4.63	4.84	4.84
$2,700 \leq S_T \leq 2,747$	5.20	5.20	**5.20**	**5.67**	4.63	4.63	4.84	4.84
$2,747 \leq S_T \leq 2,800$	**5.20**	**5.20**	4.67	5.20	4.63	4.63	4.84	4.84
$2,800 \leq S_T \leq 2,900$	**5.20**	**5.20**	3.67	4.67	4.63	4.63	3.84	4.84
$2,900 \leq S_T$	**5.20**	**5.20**	3.67	3.67	4.63	4.63	3.84	3.84

Source: own calculations

Table no. 6 – Profitability analysis of the proposed capped reverse bonus certificates if the barrier level 3,500 was reached during the time to maturity

Investment certificate	I_1		I_2		I_3		I_4	
Intervals of Euro Stoxx 50 values at the maturity date	Min	Max	Min	Max	Min	Max	Min	Max
$S_T \leq 2,700$	5.20	5.20	**5.67**	**5.67**	4.63	4.63	4.84	4.84
$2,700 \leq S_T \leq 2,783$	4.37	5.20	**4.84**	**5.67**	4.63	4.63	4.84	4.84
$2,783 \leq S_T \leq 2,800$	4.20	4.37	4.67	4.84	4.63	4.63	**4.84**	**4.84**
$2,800 \leq S_T \leq 6,465.82$	-32.46	4.20	-31.98	4.67	-32.02	4.63	**-31.81**	**4.84**
$6,465.82 \leq S_T$	-32.46	-32.46	-31.98	-31.98	-32.02	-32.02	**-31.81**	**-31.81**

Source: own calculations

Based on the performed profitability analysis and the comparison of the proposed capped reverse bonus certificates, we report the following findings. If the index value during the time to maturity does not grow above the barrier level 3,500 and it is lower than 2,747 at the maturity date, then the capped reverse bonus certificate I_2 is the best variant, otherwise, the capped reverse bonus certificate I_1. If the index value during the time to maturity grows above 3,500, then:

1) the capped reverse bonus certificate I_2 ensures the highest profit for the price lower than 2,783;

2) the capped reverse bonus certificate I_4 for the price higher than 2,783.

4. CONCLUSIONS

In this paper we focused on the capped reverse bonus certificate. We presented the review of the literature dealing with this type of certificate and presented its profit function. On the basis of the existing empirical studies, the scientific problem of our paper was to examine the nature of this investment certificates creation using the portfolio replication method. We demonstrated that the profit of the capped reverse bonus certificate can be replicated by the combination of a short position in some underlying asset, a long position in put options with cap level, a short position in up-and-out call options with the bonus level and short position in call options.

Our empirical approach is applied on the Euro Stoxx 50 index. Based upon the theoretical option pricing models, the replicating portfolio for capped reverse bonus

certificate on the Euro Stoxx 50 index is engineered. We proposed the capped reverse bonus certificates with various the cap and the bonus levels. We performed profitability analysis of the proposed certificates to the investor, showing which parameters the investor should focus and are significant for the profit profile.

We also identified the best certificates for the potential investor. If the investor expects low volatility of the underlying value, he should choose the certificate with lower bonus level. If the investor expects bigger decreases in the underlying value, he should choose the certificate with lower cap level. The relation between the profit change of the investor and parameters' change (the bonus and/or the cap level) was detected using the proposed certificates, but the results are generally valid considering the same change of the parameter.

Further, we can conclude that the certificates with lower cap levels are more profitable when the investor does not expect breaking the barrier during the time to maturity. If the investor expects breaking the barrier during the time to maturity, then he decides between the capped reverse bonus certificate with higher bonus level and lower cap level and the capped reverse bonus certificate with higher bonus and higher cap level.

In general, investment certificates are investment products, which contain more complex structures combining different components, in order to implement certain investment strategies. This paper has given a new approach integrating the design of the investment certificates using the option pricing by duplication methods. The main aim was to perform an analysis of the capped reverse bonus certificate creation through the analytical expression of the replicated profit profiles. From the methodological point of view, our methodology can serve as a model for an analysis of other structured products.

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