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Preliminary statement

DESIGN PRINCIPLES OF CAPPED BONUS AND CAPPED TWIN-WIN CERTIFICATES

The paper analyses the innovative financial products – capped bonus certificate and special type of this certificate called capped twin-win certificate. An analysis of the certificates' creation through the combination of traditional financial instrument and derivative products, especially vanilla and/or exotic options, is provided. Formulas for their pricing are presented as well. Performed analysis is robust to different underlying stocks without the cash dividends. Based upon theoretical pricing models are designed 80 certificates of both types on the Google stock with various parameters. The conditions under which the issuers earn a profit in the primary market and the profitability for the investor at the maturity date are identified in the paper, too.

Key words: structured products, investment certificates, capped bonus certificate, capped twin-win certificate, vanilla and barrier option pricing

Introduction

Bonus and twin-win certificates belong to the group of modern innovative financial products called structured products. According to Swiss Structured

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Product Association (SSPA), structured products consist of multiple investment instruments, one being generally a finance derivative, usually vanilla and/or exotic option. Investment certificates are mainly issued by large commercial European or U.S. banks including, i.e. Raiffeisen Centrobank, Erste Group, Deutsche Bank, Société Générale, HSBC, Citigroup etc. Several studies (Benet et al., 2006), (Bluemke, 2009), (Rossetto and Bommel, 2009), (Hernandez et al., 2011), (Hernandez et al., 2013) deal with the structured products. According to Hernandez et al. (2012), structured products have been growing explosively in volume and complexity during the last two decades. The complexity can be attributed to the incorporation of exotic derivatives in their design, including barrier options. Role of structured products in behavioural portfolios is studied in works (Breuer and Perst, 2007), (Das and Statman, 2013).

Capped bonus and twin-win certificates are certificates with partial risk protection. They are suitable mainly when growth or stagnation in the market is expected. The returns on the certificates are subject to a maximum limit, therefore they are referred to as capped certificates. As we will see later, they are formed by using vanilla and barrier options, specifically down-and-out put barrier options.

Plain vanilla options are the standard type of options, one with a single expiration date, strike price and no additional features. Plain vanilla is the opposite of an exotic instrument. Detailed description of options and options strategies exists in the literature (Gardijan, 2011), (Hull, 2008), (Kolb, 1995), but also (Šoltés, 2002).

Barrier options according to Zhang (1998) are path-dependent exotic options a payoff of which depends on whether during the life of the option the price of underlying asset hits the pre-set barrier level defined as a marginal price of an underlying asset. Unlike standard options, barrier options are activated (knock-in), respectively deactivated (knock-out) breaching or exceeding a barrier (Taleb, 1997). This barrier can be set above (up) or below (down) the current price at the time of options contract issue. Down-and-out put option is one type of barrier options, which is deactivated by breaking (knock-out) of barrier during the life of option and holder of option loses the right to sell an underlying asset for an agreed strike price.

The purpose of this paper is to provide economic analysis for capped bonus and capped twin-win certificates to explore how are applied the principles of financial engineering to the creation of structured products. We show that the profit from analysed investment certificates can be replicated by the combination of a long position in an underlying asset and the positions in vanilla and barrier options. A pricing formula of the investment certificates is developed by using option pricing models. 80 certificates on the stock Google with various parameters are designed and analysed followed by investigation of their profitability. Our findings

help to raise the ability of retail investors to understand these sophisticated products constructions.

The rest of the paper is organized as follow. First, we introduce the creation of the capped bonus and capped twin-win certificate. Second section presents the pricing models of the certificates. In the third part we create new certificates based on our theoretical results. The conclusions are summarized in the last section. An appendix describing 80 Google stocks' based certificates is presented at the end of this paper.

1. Nature of the creation

Investment certificates are offered by large commercial banks on the financial market. The profit from the investment in the certificate is contingent upon the performance of pre-specified underlying asset (usually stock or stock index) over the time to maturity t and at the maturity date T (ending date or expiration date). The price of the underlying at the issue date is referred to as the starting price S_0 (reference price) and the price of the underlying at the maturity date is referred to as S_T. Further, the profit depends on the multiplier p (often 0.01 or 0.001). The multiplier is a number of rights required to purchase a single share of a security in a rights offering. If an underlying has the starting value of 10000 points, then the most probable multiplier is 0.001 and the fair value of the certificate k_0 is 10 units. The certificate price is thus available even for small investors identified as retail clients. Authors Šoltés (2010), (2012) and Šoltés (2011) analyse the various types of investment certificates.

This paper is focused on bonus and twin-win certificates. No study has yet provided analysis of twin-win certificates. Bonus certificates was investigated by Hernandez et al. (2008) and Šoltés and Kundríková (2007). Following the mentioned study we realize more comprehensive analysis.

Every bonus and twin-win certificate has also defined the parameter known as barrier level B. Barrier is a limit which the underlying asset price should not breach or fall below from the issue date to the maturity date due to protection. The barrier level is generally determined below the starting price of the underlying at the issue date S_0. If the underlying asset value falls below the barrier level, then the protection is cancelled and the investor has full participation in loss as with linear certificate.

Another parameter is the strike level (exercise level) X. The strike level of every twin-win certificate is equal to the starting price S_0. In addition to twin-win certificate, bonus certificate has defined the strike level above the starting price of

the underlying known as the bonus level B_L. In the case of not breaching or falling below the barrier level by underlying value, at the maturity date investor will be paid a minimum bonus level. The profit of the capped certificates is also subject to higher strike price known as cap level *C*. Cap is the highest possible participation in the growth rate of an underlying value at the expiration date.

A **capped bonus certificate** is defined by SSPA as a certificate with limited participation in rising markets up to the cap as well as a barrier. If the barrier has not been breached during the lifetime of the product, investor receives a minimum redemption equal to the bonus level. Should the barrier level be breached during the lifetime of the product, the capped bonus certificate turns into a linear certificate with a cap. The profit function of a capped bonus certificate with the fair value k_0, the parameter *k*, the starting price S_0, the price at the maturity date S_T, the time to maturity *t*, the multiplier *p*, the barrier level *B*, the bonus level B_L, the cap level *C* at the maturity date *T* is:

$$P\left(S_T\right)=\begin{cases} p*B_L-k & if \min\limits_{0\le t\le T}\left(S_t\right)>B\wedge S_T<B_L, \\ p*S_T-k_0 & if \min\limits_{0\le t\le T}\left(S_t\right)\le B\wedge S_T<B_L, \\ p*S_T-k_0 & if\ B_L\le S_T<C, \\ p*C-k_0 & if\ C\le S_T. \end{cases} \tag{1}$$

The profit of a capped bonus certificate is equal to the profit from holding following alternative portfolio:

1) a long position in the number of *p* underlying asset with the starting price S_0

$$P_1\left(S_T\right)=p*\left(S_T-S_0\right), \tag{2}$$

2) a long position in the number of *p* down-and-out put options on the underlying asset with the starting price S_0, the strike level referred to as the bonus level B_L, the barrier level *B*, the premium p_{BPDO} for an option and the time to maturity of the option *t* equals the time to maturity of the certificate *t*

$$P_2\left(S_T\right)=\begin{cases} -p*\left(S_T-B_L+p_{BPDO}\right) & if \min\limits_{0\le t\le T}\left(S_t\right)>B\wedge S_T<B_L, \\ -p*p_{BPDO} & if \min\limits_{0\le t\le T}\left(S_t\right)\le B\wedge S_T<B_L, \\ -p*p_{BPDO} & if\ B_L\le S_T, \end{cases} \tag{3}$$

3) a short position in the number of p call options on the underlying asset with the strike level referred to as the cap level C, the premium p_{SC} for an option and the time to maturity of the option t equals the time to maturity of the certificate t

$$P_3\left(S_T\right)=\begin{cases} p^*p_{SC} & if\ S_T<C, \\ -p^*\left(S_T-C-p_{SC}\right) & if\ C\le S_T. \end{cases} \tag{4}$$

Profit function for possible scenarios at the expiration date from the alternative portfolio expressed as the sum of the individual positions (2), (3) and (4) has the following form:

$$P\left(S_T\right)=\begin{cases} p^*\left(B_L-S_0-p_{BPDO}+p_{SC}\right) & if\ \min\limits_{0\le t\le T}\left(S_t\right)>B\wedge S_T<B_L, \\ p^*\left(S_T-S_0-p_{BPDO}+p_{SC}\right) & if\ \min\limits_{0\le t\le T}\left(S_t\right)\le B\wedge S_T<B_L, \\ p^*\left(S_T-S_0-p_{BPDO}+p_{SC}\right) & if\ B_L\le S_T<C, \\ p^*\left(C-S_0-p_{BPDO}+p_{SC}\right) & if\ C\le S_T. \end{cases} \tag{5}$$

If the following formula is met:

$$k_0=p^*\left(S_0+p_{BPDO}-p_{SC}\right), \tag{6}$$

then the profit function of the alternative portfolio (5) is identical to the profit function of the capped bonus certificate (1). Any selling price of the certificate above the fair value k_0 is the gain to the certificate issuer. Thus the issuer will be profitable at the issue date if the price of this investment certificate is defined in accordance with the condition:

$$actual\ price\ of\ the\ capped\ bonus\ certificate\ at\ the\ market > p^*\left(S_0+p_{BPDO}-p_{SC}\right). \tag{7}$$

Four variants of underlying price development can occur at the maturity date of a capped bonus certificate. If the barrier level is not breached by the underlying asset price over the time to maturity and the price at the maturity date is below the bonus level, then the investor will obtain fixed profit $\left[p^*B_L-k_0\right]$. If the barrier level is breached by the underlying asset price over the time to maturity and the price at the maturity date is under the bonus level, the bonus certificate is linear in payoff, i.e. its profit (respectively loss) replicates underlying price development $\left[p^*S_T-k_0\right]$. If the price at the maturity date is between the bonus and cap level

without affecting breaching or non-breaching barrier level, the bonus certificate is linear in payoff $\left[p * S_T - k_0 \right]$. If the price at the maturity date is above the cap level, the investor will obtain fixed profit $\left[p * C - k_0 \right]$ and he cannot participate in the price increase.

A **capped twin-win certificate** is defined by SSPA as a certificate with limited participation in rising and limited participation in falling markets if the barrier has not been breached. The profit function of a capped twin-win certificate with the fair value k_0, the starting price S_0, the price at the final valuation date S_T, the time to maturity t, the multiplier p, the barrier level B, the cap level C at the maturity date T is:

$$P\left(S_T\right) = \begin{cases} -p * S_T + k_0 & if \ \min\limits_{0 \le t \le T}\left(S_t\right) > B \wedge S_T < S_0, \\ p * S_T - k_0 & if \ \min\limits_{0 \le t \le T}\left(S_t\right) \le B \wedge S_T < S_0, \\ p * S_T - k_0 & if \ S_0 \le S_T < C, \\ p * C - k_0 & if \ C \le S_T. \end{cases} \tag{8}$$

The profit function of a capped twin-win certificate can be replicated by following positions of the alternative portfolio:

1) a long position in the number of p underlying asset with the starting price S_0

$$P_1\left(S_T\right) = p * \left(S_T - S_0\right), \tag{9}$$

2) a long position in the number of $2*p$ down-and-out put options on the underlying asset with the starting price S_0, which is identical with the strike level, the barrier level B, the premium p_{BPDO} for an option and the time to maturity of the option t equals the time to maturity of the certificate t

$$P_2\left(S_T\right) = \begin{cases} -2p * \left(S_T - S_0 + p_{BPDO}\right) & if \ \min\limits_{0 \le t \le T}\left(S_t\right) > B \wedge S_T < S_0, \\ -2p * p_{BPDO} & if \ \min\limits_{0 \le t \le T}\left(S_t\right) \le B \wedge S_T < S_0, \\ -2p * p_{BPDO} & if \ S_T \ge S_0. \end{cases} \tag{10}$$

3) a short position in the number of p call options on the underlying asset with the strike level referred to as the cap level C, the premium p_{SC} for an option and the time to maturity of the option t equals the time to maturity of the certificate t

$$P_3\left(S_T\right)=\begin{cases} p^*p_{SC} & if\ S_T<C, \\ -p^*\left(S_T-C-p_{SC}\right) & if\ C\le S_T. \end{cases} \tag{11}$$

The profit function from the alternative investment portfolio expressed as a sum of individual profit functions (9), (10) and (11) has a form:

$$P\left(S_T\right)=\begin{cases} -p^*\left(S_T-S_0+2^*p_{BPDO}-p_{SC}\right) & if\ \underset{0\le t\le T}{min}\left(S_t\right)>B\wedge S_T<S_0, \\ p^*\left(S_T-S_0-2^*p_{BPDO}+p_{SC}\right) & if\ \underset{0\le t\le T}{min}\left(S_t\right)\le B\wedge S_T<S_0, \\ p^*\left(S_T-S_0-2^*p_{BPDO}+p_{SC}\right) & if\ S_0\le S_T<C, \\ p^*\left(C-S_0-2^*p_{BPDO}+p_{SC}\right) & if\ C\le S_T. \end{cases} \tag{12}$$

Using alternative investment (12) we have derived the profit function identical to the profit function of capped twin-win certificate (8) if the fair value is:

$$k_0=p^*\left(S_0+2^*p_{BPDO}-p_{SC}\right). \tag{13}$$

Any actual price of the twin-win certificate above the fair value k_0:

$$actual\ price\ of\ the\ capped\ twin\text{-}win\ certificate\ at\ the\ market\ >p^*(S_0+2^*p_{BPDO}-p_{SC}) \tag{14}$$

is the gain to the certificate issuer.

At the maturity date, profit function of capped twin-win certificates can have four possible variants depending on the underlying asset's price development. If the barrier level is not breached by the underlying asset price over the time to maturity and the price at the maturity date is below the strike level (starting price S_0), then the investor will obtain the payoff $\left[-p^*\left(S_T-2^*S_0\right)-k_0\right]$. If the barrier level is breached by the underlying asset price over the time to maturity and the price at the maturity date is under the strike level or the price at the maturity date is between the strike and cap level without affecting breaching or non-breaching barrier level, the profit respectively loss replicates underlying price development $\left[p^*S_T-k_0\right]$. If the price at the maturity date is above the cap level, the investor will obtain fixed profit $\left[p^*C-k_0\right]$.

2. Pricing

The fair value of the certificate can be calculated based on the value of individual components from which the given product is constructed, i.e. an alternative portfolio as combination of an underlying asset position and positions in options. In works (Burth et al., 2001), (Stoimenov and Wilkens, 2005), (Grunbichler and Wohlwend, 2005), (Wilkens and Stoimenov, 2007) (Henderson and Pearson, 2010), (Hernández et al., 2012) and (Baule and Tallau, 2011) authors deal with the problem of valuation of structured product.

The fair value of the capped bonus certificate based on the value of the alternative portfolio is expressed by the equation (6) and the fair value of the capped twin-win certificate is expressed by (13).

Consequently, we need to obtain values of the vanilla and barrier option positions. The values of the position in European vanilla call option on the stock without dividends can be priced using the most basic model of option valuation – Black-Scholes model introduced in the work (Black and Scholes, 1973). Black-Scholes-Merton formula considers the pricing of options on stocks with dividends (Merton, 1973). Dividends d_t are paid continuously at a (constant) annual dividend rate q. If S is value of the underlying asset, then the value of the parameter q can be expressed mathematically as:

$$q = ln\left(1 + \frac{d_t}{S}\right). \tag{15}$$

We look at real vanilla option data in this paper. Because of the absence of market barrier option data, the values of the position in down-and-out put option on the stock are calculated. The classical Black-Scholes approach does not directly suit barrier options, because the next factor – a barrier influences on height of option premium. Merton (1973) modified Black-Scholes model and derived a first relationship to calculate down-and-out call European type option price. Later Rubinstein and Reiner (1991) applied Black-Sholes-Merton formula on eight basic types of barrier options and Haug (1998) on all sixteen single types. New method for pricing exotic options is discussed in work Nishiba (2012).

In determining the theoretical price of standard European barrier option, price is based on the analytical model Haug (1998). Let us denote the barrier B, the strike price X, actual spot price of underlying asset S_0, compensation K, the risk-free interest rate r (usually interest rate of government bond), implied volatility of the underlying asset returns σ and time to maturity of option t, we calculate the theoretical down-and-out put barrier option price p_{BPDO} with barrier lower than the strike price as:

$$p_{BPDO} = A - B + C - D + F \qquad \eta = -1, \phi = 1, \tag{16}$$

where

$$A = \phi S_0 e^{-qt} N(\phi x_1) - \phi X e^{-rt} N(\phi x_1 - \phi\sigma\sqrt{t}), \tag{17}$$

$$B = \phi S_0 e^{-qt} N(\phi x_2) - \phi X e^{-rt} N(\phi x_2 - \phi\sigma\sqrt{t}), \tag{18}$$

$$C = \phi S_0 e^{-qt} (B/S_0)^{2(\mu+1)} N(\eta y_1) - \phi X e^{-rt} (B/S_0)^{2\mu} N(\eta y_1 - \eta\sigma\sqrt{t}), \tag{19}$$

$$D = \phi S_0 e^{-qt} (B/S_0)^{2(\mu+1)} N(\eta y_2) - \phi X e^{-rt} (B/S_0)^{2\mu} N(\eta y_2 - \eta\sigma\sqrt{t}), \tag{20}$$

$$F = K\left[(B/S_0)^{\mu+\lambda} N(\eta z) + (B/S_0)^{\mu-\lambda} N(\eta z - 2\eta\lambda\sigma\sqrt{t})\right], \tag{21}$$

and

$$x_1 = \frac{\ln\left(\frac{S_0}{X}\right)}{\sigma\sqrt{t}} + (1+\mu)\sigma\sqrt{t}\ , \tag{22}$$

$$x_2 = \frac{ln\left(\frac{S_0}{B}\right)}{\sigma\sqrt{t}} + (1+\mu)\sigma\sqrt{t}\ , \tag{23}$$

$$y_1 = \frac{\ln\left(\frac{B^2}{S_0 X}\right)}{\sigma\sqrt{t}} + (1+\mu)\sigma\sqrt{t}\ , \tag{24}$$

$$y_2 = \frac{ln\left(\frac{B}{S_0}\right)}{\sigma\sqrt{t}} + (1+\mu)\sigma\sqrt{t}\ , \tag{25}$$

$$z = \frac{ln\left(\frac{B}{S_0}\right)}{\sigma\sqrt{t}} + \lambda\sigma\sqrt{t}\ , \tag{26}$$

$$\mu = \frac{r - q + \frac{\sigma^2}{2}}{\sigma^2}, \tag{27}$$

$$\lambda = \sqrt{\mu^2 + \frac{2r}{\sigma^2}}\ . \tag{28}$$

According to Thierry and Chiraz (2001), the patterns of changes in implied volatilities are investigated across strike prices and time to maturities.

Let us denote the price of the underlying asset at time m S_m, the price of underlying asset at time m-1 S_{m-1}, number of observations N, price monitoring period t_s, then the value of implied volatility σ can be calculated using the following relation (Ambrož, 2002):

$$\sigma = \sqrt{\frac{\left(\overline{X} - X_i\right)^2}{N-1}} * \sqrt{t_S}\ , \tag{29}$$

where

$$\overline{X} = \frac{\sum_{i=1}^{N} X_i}{N}, \tag{30}$$

$$X_i = ln \frac{S_m}{S_{m-1}}. \tag{31}$$

The change of one´s parameter has the influence to change of option price.

3. Design of the innovative investment certificates

In this section, we will propose capped bonus certificates and capped twin-win certificates on the Google stocks and perform the analysis of their profitability. We examine the profitability from the certificates to the issuer at the time of issue on primary market and also the profitability from the certificates to 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 certificates. We will use European style vanilla and barrier options on Google in the creation of investment certificates.

3.1. Data description

Google Inc. (GOOG.O) is a multinational corporation with rapid growth since its incorporation. The price of stock Google reached a value of 860.38 USD in September 3, 2013. The actual price of Google on November 20, 2013 is 1025.20 USD. Google Inc. does not pay dividends at the moment. We expect a growth within a year or two years. At the same time, we consider a big increase of the price improbable. We have taken potential drop not exceeding certain level into consideration, too. We expect the share value to remain above the pre-set barrier. Therefore we focus on capped bonus certificate and capped twin-win certificate, which are suitable for these assumptions. Vanilla option prices on the stock Google with various strike prices and maturities are obtained from the web page of Morningstar. In order to calculate down-and-out barrier option prices based on equation (16), we need the maturity dates, the strike prices, the barrier levels, the risk-free interest rates and the implied volatilities. The multiplier is 0.1 or 0.01.

The maturity dates, specifically 16/1/2015 and 14/1/2016, and strike prices are similar as the vanilla options. The barrier levels are selected by authors at the

levels 600, 700, 800 and 900. Lower the barrier level, higher the option premium and vice versa. Therefore we have not selected very low and high levels. Note that the price can be calculated for every barrier level. The risk-free interest rates are the yields of government bonds with similar maturity as the options from the Bloomberg. The implied volatilities are calculated based on equations (29). We double check the implied volatilities on the call and put options in several websites to ensure their accuracy. The dataset used in our economic analysis can be provided upon request. In order to simplify all calculations, we implement them in the statistical program R (Iacus, 2001).

3.2. Analysis of proposed capped bonus certificate and capped twin-win certificate

The common proposed data about the certificates is in Table 1.

Table 1

COMMON DATA ABOUT CAPPED BONUS CERTIFICATE AND CAPPED TWIN-WIN CERTIFICATE

Key data	
Underlying	Google
Underlying price (S_0)	1 025.2 USD
Multiplier (p)	0.1
Issue date	20/11/2013
Maturity date (T)	14/1/ 2016

Source: Own design

Let us propose capped bonus certificate. In order to replicate the profit of capped bonus certificate we create the replicating portfolio as a combination of a long position in Google with actual price 1025.2 USD, a long position in down-and-out put option on Google with the bonus level 1200, barrier level 800, premium 33.05 USD for an option, maturity date 14th January 2016 and a short position in call option on Google with cap level 1300, premium 62.20 USD for an option, maturity date 14th January 2016.

The profit function of designed capped bonus certificate at the maturity date based on (5) is represented by the following equation:

$$P(S_T)=\begin{cases}20.395 & if \min\limits_{0\le t\le T}(S_t)>800\wedge S_T<1200,\\ 0.1*S_T-99.605 & if \min\limits_{0\le t\le T}(S_t)\le 800\wedge S_T<1200,\\ 0.1*S_T-99.605 & if\ 1200\le S_T<1300,\\ 30.395 & if\ S_T\ge 1300.\end{cases} \tag{32}$$

The fair value of this certificate based on (6) can be calculated as:

$$0.1*(1025.2+35.05-62.2)=99.605. \tag{33}$$

Any issue price above the fair value 99.605 is the gain to the certificate issuer.

Let us propose capped twin-win certificate as a combination of a long position in Google with actual price 1025.2 USD, two long positions in down-and-out put options on Google with the strike level 1025.2 USD, the barrier level 800, premium 7.25 USD for an option, maturity date 14th January 2016 and a short position in call options on Google with cap level 1300, premium 62.2 for an option, maturity date 14th January 2016.

The profit function of proposed capped twin-win certificate at the maturity date based on (12) is as follows:

$$P(S_T)=\begin{cases}-0.1*S_T+107.29 & if \min\limits_{0\le t\le T}(S_t)>800\wedge S_T<1025.2,\\ 0.1*S_T-97.75 & if \min\limits_{0\le t\le T}(S_t)\le 800\wedge S_T<1025.2,\\ 0.1*S_T-97.75 & if\ 1025.2\le S_T<1300,\\ 32.25 & if\ S_T\ge 1300.\end{cases} \tag{34}$$

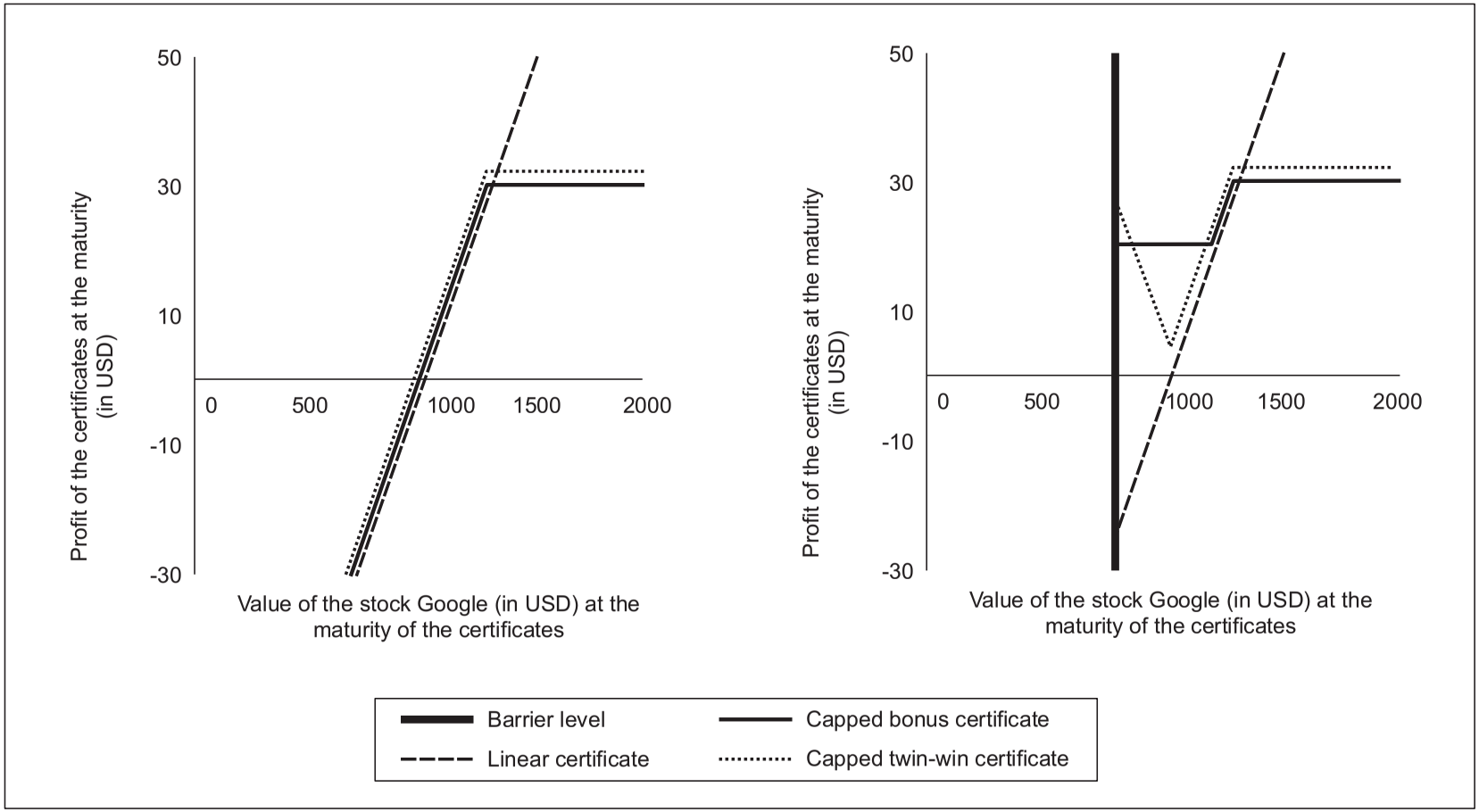
The fair value of this certificate based on (13) can be calculated as:

$$0.1*(1025.2+2*7.25-62.2)=97.75. \tag{35}$$

The comparison of profit from the proposed capped bonus certificate and capped twin-win certificate on Google with the bonus level 1200, the barrier level 800, the cap level 1300 depending on the development of the stock Google at the maturity date of the certificates is illustrated in Figure 1 and Figure 2. We compare the given investment certificates at possible future scenarios of underlying price's development and we give recommendations for potential investor.

Figure 1 PROFIT FROM THE PROPOSED CAPPED BONUS CERTIFICATE AND CAPPED TWIN-WIN CERTIFICATE, IF THE BARRIER LEVEL WAS BREACHED DURING THE TIME TO MATURITY

Figure 2 PROFIT FROM THE PROPOSED CAPPED BONUS CERTIFICATE AND CAPPED TWIN-WIN CERTIFICATE, IF THE BARRIER LEVEL WAS NOT BREACHED DURING THE TIME TO MATURITY



Source: Own design

It can be seen and also calculated exactly using equations (32) and (34) that: 1) twin-win certificate ensures the highest profit at all expected intervals of underlying price at the maturity date if the barrier level was breached during the time to maturity; 2) if the barrier level was not breached during the time to maturity, the best results are obtained through capped bonus certificate if <868.95, 1181.45> or capped twin-win certificate at other intervals. As we mentioned earlier, the starting price of Google is 1025.2 USD. It follows that the capped bonus certificate is suitable for an investor who expects the small decline in price, i.e. up to 15.24%, or the small underlying price increase, i.e. up to 13.23%. Therefore, we recommend the bonus certificate for these assumptions. Otherwise, capped twin-win certificate is more profitable.

The fair value of the capped bonus certificate is 99.605 and the fair value of the capped twin-win certificate is 97.75. Now, we suppose issue prices with gain 0% and 3% from the fair value for the issuer at the time of issue of the certificates and calculate the profit of the issuer. The profit of the issuer represents the amount of the issue price of the certificate by subtracting the price paid by the issuer to the investor at the maturity date. The assumed percentage change of gain is the only variable parameter affecting the issue price. Hence, the obtained results of the analysis would be similar if we assumed different percentage change of gain.

The profit for the issuer from the proposed certificates if the barrier level 800 was reached during the time to maturity is in Table 2. The percentage change of the issuer's profit from capped bonus and twin-win certificates is from interval <3%, 102.5%>. It can be concluded that capped bonus certificate with issue price in the amount of fair value + 3% from fair value is the most profitable for issuer at the maturity date. If it is expected a price drop then the percentage change in the issuer's profit at the maturity is higher at the capped twin-win certificate, otherwise at capped bonus certificate.

Table 2

COMPARISON OF THE PROFIT FOR THE ISSUER FROM THE PROPOSED CERTIFICATES AT VARIOUS UNDERLYING PRICES AT THE MATURITY DATE IF THE BARRIER LEVEL 800 WAS REACHED DURING THE TIME TO MATURITY

Capped bonus certificate							
Gain of the issuer from the issue price	**Google price at the maturity date**						
	0	**800**	**868.95**	**1025.2**	**1181.45**	**1200**	**1300**
0%	99.605	19.605	12.71	-2.915	-18.54	-20.395	-30.395
3%	**102.593**	**22.593**	**15.698**	**0.073**	**-15.552**	**-17.407**	**-27.407**
Change in the profit of the issuer	3%	15.24%	23.5%	102.5%	16.12%	14,65%	9.83%
Capped twin-win certificate							
Gain of the issuer from the issue price	**Google price at the maturity date**						
	0	**800**	**868.95**	**1025.2**	**1181.45**	**1200**	**1300**
0%	97.75	17.75	10.855	-4.77	-20.395	-22.25	-32.25
3%	100.683	20.683	13.788	-1.837	-17.462	-19.317	-29.317
Change in the profit of the issuer	3%	16.52%	27.02%	61.49%	14.38%	13.18%	9.09%

Source: Own calculations

Profit for the issuer from the proposed certificates at various underlying prices at the maturity if the barrier level 800 was not breached during the time to maturity is in Table 3. If a significant price drop or increase is expected then the capped bonus certificate is more profitable. Otherwise, the capped twin-win certificate ensures higher profit for the issuer. The percentage change in the profit at the maturity for both certificates is between 9.09% and 61.49% and it is higher at the capped twin-win certificate.

Table 3

COMPARISON OF THE PROFIT FOR THE ISSUER FROM THE PROPOSED CERTIFICATES AT VARIOUS UNDERLYING PRICES AT THE MATURITY DATE IF THE BARRIER LEVEL 800 WAS NOT REACHED DURING THE TIME TO MATURITY

Capped bonus certificate							
Gain of the issuer from the issue price	**Google price at the maturity date**						
	0	**800**	**869.5**	**1025.2**	**1180.9**	**1200**	**1300**
0%	-	-20.395	-20.395	-20.395	-20.395	-20.395	-30.395
3%	-	**-17.407**	**-17.407**	-17.407	**-17.407**	**-17.407**	**-27.407**
Change in the profit of the issuer	-	14.65%	14.65%	14.65%	14.65%	14.65%	9.83%
Capped twin-win certificate							
Gain of the issuer from the issue price	**Google price at the maturity date**						
	0	**800**	**869.5**	**1025.2**	**1180.9**	**1200**	**1300**
0%	-	-27.29	-20.34	-4.77	-20.34	-22.25	-32.25
3%	-	-24.357	**-17.407**	**-1.837**	**-17.407**	-19.317	-29.317
Change in the profit of the issuer		10.75%	14.42%	61.49%	14.42%	13.18%	9.09%

Source: Own calculations

Bonus level, barrier level, cap level, multiplier and maturity date are specified at the time of issue. These parameters impact on the profit of the investor. Let us suppose various parameters and calculate the profit of the potential investor from the capped bonus certificates and capped twin-win certificates on Google with actual price 1025.2 USD and issue date November 20, 2013. Data of proposed certificates with different parameters are summarized in Appendix 1 (Table 4, 5 and 6).

The relation between the issue profit change of the investor and parameters' change is detected using the selected certificates but the results are generally valid considering the same change of the parameter. Table 7 shows the selected capped bonus and capped twin-win certificates for further analysis. The chosen certificates are certificates with barrier levels 600 and 900, different strike levels (bonus levels in the case of capped bonus certificates) and cap levels. In order to calculate the profit of the issuer, we also need the issue price of each certificate. Complete profitability analysis is in Appendix 2.

Table 7

PARAMETERS OF SELECTED CAPPED BONUS AND CAPPED TWIN-WIN CERTIFICATES[1] WITH THE MATURITY DATE 14/1/2016

Denotation of investment certificate	Barrier level	Strike level	Down-out Put premium	Cap level	Call premium	Multi-plier	Issue price
I_1	600	1030	68.80	1100	119.25	0.1	97.475
I_2	600	1100	98.90	1300	62.20	0.1	106.19
I_3	600	1200	149.50	1300	62.20	0.1	111.25
I_4	600	1025.2	67.00	1100	119.25	0.1	103.995
I_5	600	1025.2	67.00	1300	62.20	0.1	109.7
I_6	900	1030	0.75	1100	119.25	0.1	90.67
I_7	900	1100	2.60	1300	62.20	0.1	96.56
I_8	900	1200	7.80	1300	62.20	0.1	97.08
I_9	900	1025.2	0.70	1100	119.25	0.1	90.735
I_{10}	900	1025.2	0.70	1300	62.20	0.1	96.44

Source: Own design

The profit of the issuer from the given certificates for the selected intervals of underlying price at the time of maturity if barrier level 600 was reached during the maturity is in Table 8.

[1] Denotation of capped bonus certificates: I_1-I_3, I_6-I_8 and capped twin-win certificates: I_4, I_5, I_9, I_{10}.

Table 8

COMPARISON OF SELECTED INVESTMENT CERTIFICATES IF BARRIER LEVEL 600 WAS BREACHED DURING THE TIME TO MATURITY

Investment certificate	**I_1**		**I_2**		**I_3**		**I_4**		**I_5**	
Intervals of underlying price at the maturity date	**Profit of the investor**									
	Mini-mum (min)	**Maximum (max)**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
$S_T \leq 1100$	**-97.475**	**12.525**	-106.19	3.81	-111.25	-1.25	-103.995	6.005	-109.7	0.3
$1100 \leq S_T \leq 1187.15$	**12.525**	**12.525**	3.81	12.525	-1.25	7.65	6.005	6.005	0.3	9.015
$1187.15 \leq S_T \leq 1300$	12.525	12.525	**12.525**	**23.81**	7.465	18.75	6.005	6,005	9.015	20.3
$1300 \leq S_T$	12.525	12.525	**23.81**	**23.81**	18.75	18.75	6.005	6.005	20.3	20.3

Source: Own calculations

The profit of the investor from the given certificates for the selected intervals of underlying price at maturity date if barrier level 600 was not breached during the time to maturity is in Table 9.

Table 9

COMPARISON OF SELECTED INVESTMENT CERTIFICATES IF BARRIER LEVEL 600 WAS NOT BREACHED DURING THE TIME TO MATURITY

Investment certificate	I_1		I_2		I_3		I_4		I_5	
Intervals of underlying price at the maturity date	Profit of the investor									
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
$600 \leq S_T \leq 922.95$	5.525	5.525	3.81	3.81	8.75	8.75	**8.75**	**41.045**	3.045	35.34
$922.95 \leq S_T \leq 1025.2$	5.525	5.525	3.81	3.81	**8.75**	**8.75**	-1.475	8.75	-7.18	3.045
$1025.2 \leq S_T \leq 1030$	5.525	5.525	3.81	3.81	**8.75**	**8.75**	-1.475	-0.995	-7.18	-6.7
$1030 \leq S_T \leq 1062.25$	5.525	8.75	3.81	3.81	**8.75**	**8.75**	-0.995	2.23	-6.7	-3.475
$1062.25 \leq S_T \leq 1100$	**8.75**	**12.525**	3.81	3.81	8.75	8.75	2.23	6.005	-3.457	0.3
$1100 \leq S_T \leq 1187.15$	**12.525**	**12.525**	3.81	12.525	8.75	8.75	6.005	6.005	0.3	9.015
$1087.15 \leq S_T \leq 1200$	12.525	12.525	**12.525**	**13.81**	8.75	8.75	6.005	6.005	9.015	10.3
$1200 \leq S_T \leq 1300$	12.525	12.525	**12.525**	**23.81**	8.75	18.75	6.005	6.005	10.03	20.3
$1300 \leq S_T$	12.525	12.525	**23.81**	**23.81**	18.75	18.75	6.005	6.005	20.3	20.3

Source: Own calculations

We evaluate the profitability of capped bonus certificates I_1-I_3 and capped twin-win certificates I_4-I_5 with barrier level 600 from the investor' point of view. The results indicate that the capped bonus certificate as well as capped twin-win certificate 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. If the price of Google during the time to maturity drops below the barrier 600 and it is lower than 1187.15 at the maturity date, than the capped bonus certificate I_1 is the best variant, otherwise, the capped bonus certificate I_2. If the price during the time to maturity does not drop below 600 than the capped twin-win certificate I_4 ensures the highest profit for the price lower than 922.95; the capped bonus certificate I_3 for the price from the interval <922.95, 1062.25>; the capped bonus certificate I_1 for the price from the interval <1062.25, 1187.15> and the capped bonus certificate I_2 for the price for the price higher than 1187.15.

The profit of the investor from the given certificates with the barrier 900 for the selected intervals of underlying price at the maturity date is in Table 10 and Table 11.

Table 10

COMPARISON OF SELECTED INVESTMENT CERTIFICATES IF BARRIER LEVEL 900 WAS BREACHED DURING THE TIME TO MATURITY

Investment certificate	I_6		I_7		I_8		I_9		I_{10}	
Intervals of underlying price at the maturity date	Profit of the investor									
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
$S_T \leq 1100$	**-90.67**	**19.33**	-96.56	13.44	-97.08	12.92	-90.735	19.265	-96.44	13.56
$1100 \leq S_T \leq 1157.7$	**19.33**	**19.33**	13.44	19.21	12.92	18.69	19.265	19.265	13.56	19.33
$1157.7 \leq S_T \leq 1300$	19.33	19.33	19.21	33.44	18.69	32.92	19.265	19.265	**19.33**	**33.56**
$1300 \leq S_T$	19.33	19.33	33.44	33.44	32.92	32.92	19.265	19.265	**33.56**	**33.56**

Source: Own calculations

Table 11

COMPARISON OF SELECTED INVESTMENT CERTIFICATES IF BARRIER LEVEL 900 WAS NOT BREACHED DURING THE TIME TO MATURITY

Investment certificate	I_6		I_7		I_8		I_9		I_{10}	
Intervals of underlying price at the maturity date	Profit of the investor									
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
$900 \leq S_T \leq 913.85$	12.33	12.33	13.44	13.44	22.92	22.92	**22.92**	**24.305**	17.215	18.6
$913.85 \leq S_T \leq 1025.2$	12.33	19.33	13.44	19.21	**22.92**	**22.92**	11.785	19.265	6.08	19.33
$1025.2 \leq S_T \leq 1030$	12.33	12.33	13.44	13.44	**22.92**	**22.92**	11.785	12.265	6.08	6.56
$1030 \leq S_T \leq 1100$	12.33	19.33	13.44	13.44	**22.92**	**22.92**	12.265	19.265	6.56	13.56
$1100 \leq S_T \leq 1193.6$	19.33	19.33	13.44	22.8	**22.92**	**22.92**	19.265	19.265	13.56	22.92
$1193.6 \leq S_T \leq 1200$	19.33	19.33	22.8	23.44	22.92	22.92	19.265	19.265	**22.92**	**23.56**
$1200 \leq S_T \leq 1300$	19.33	19.33	23.44	33.44	22.92	32.92	19.265	19.265	**23.56**	**33.56**
$1300 \leq S_T$	19.33	19.33	33.44	33.44	32.92	32.92	19.265	19.265	**33.56**	**33.56**

Source: Own calculations

Note that results of the profitability analysis of the certificates I_6-I_{10} with barrier level 900 are not equal to previous results. If the price during the time to maturity drops below the barrier 900 and it is lower than 1157.7 at the maturity date, then the capped bonus certificate I_6 is the best variant, otherwise, the capped twin win certificate I_{10}. If the price during the time to maturity does not drop below 900 then the capped twin-win certificate I_9 ensures the highest profit for the price lower than 913.85; the capped bonus certificate I_8 for the price from the interval <913.85, 1193.6> and the capped twin-win certificate I_{10} for the price higher than 1193.6.

Based on the performed analysis and comparison of certificates we have the following findings. If the investor expects bigger decreases in the price of underlying, he should choose the certificate with lower barrier level. Further, we can conclude that the certificates with 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 lower in the first case. If the investor decides between the capped bonus and capped twin-win certificate with identical characteristics but different barrier levels, higher profits are gained when he chooses the certificate with higher barrier level no matter which type of certificate (bonus or twin-win) he purchases.

Conclusion

In this paper we analysed new types of financial products known as capped bonus certificate and capped twin-win certificate and we provided detailed descriptions of these products specifications. We presented pricing formulas for these types of certificates and we found the conditions under which the issuers can be profitable in the primary market. Underlying assets are stocks without the cash dividends.

This paper showed that the payoff of capped bonus certificate can be replicated by the combination of a long position in the underlying asset, a long position in down-and-out put option, and short position in call option. Payoff of capped twin-win certificate can be replicated by the combination of a long position in the underlying asset, a long position in two down and out put options, and a short position in call option.

Futher, there were designed 80 certificates on the stock Google with various parameters. We presented the analysis of their profitability to the issuer. We compared the proposed capped bonus and capped twin-win certificates at possible future scenarios of underlying price development. The results showed certificates which ensure the highest profit for issuer.

We also performed complete profitability analysis of the selected certificates to the investor at the maturity date, showing which parameters the investor should focus and are significant for the profit profile. We found the best certificates for the potential investor.

The segment of modern structured products has been gaining in popularity and is going through a continuous boom again. Our analysis offers the possibility for general public to understand the structure of these complicated products and to contribute the intellectualization of potential investors. The presented aproach based on the analytical expression of the profit functions from the investment certificates can also be used in practice as a priceless aid in deciding which investment certificate is the most suitable. The methodology used in this paper can serve as an inspiration for an analysis of other structured products. Further studies are needed to compare the analysed investment certificates with other certificates from the market.

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Appendix 1

Table 4

PARAMETERS OF POTENTIAL CAPPED BONUS CERTIFICATES WITH MATURITY DATE 16/1/2015

Barrier level	Bonus level	Down-out Put premium	Cap level	Call premium	Multiplier	Issue price
600	1030	86.10	1100	74.10	0.1	103.72
700	1030	52.35	1100	74.10	0.1	100.345
800	1030	18.10	1100	74.10	0.1	96.92
900	1030	2.15	1100	74.10	0.1	95.325
600	1030	86.10	1200	44.95	0.01	10.6635
700	1030	52.35	1200	44.95	0.01	10.326
800	1030	18.10	1200	44.95	0.01	9.9835
900	1030	2.15	1200	44.95	0.01	9.824
600	1100	125.40	1200	44.95	0.01	11.0565
700	1100	85.00	1200	44.95	0.01	10.6525
800	1100	36.90	1200	44.95	0.01	10.1715
900	1100	7.40	1200	44.95	0.01	9.8765
600	1100	125.40	1300	26.70	0.1	112.39
700	1100	85.00	1300	26.70	0.1	108.35
800	1100	36.90	1300	26.70	0.1	103.54
900	1100	7.40	1300	26.70	0.1	100.59
600	1200	193.15	1300	26.70	0.1	119.165
700	1200	142.75	1300	26.70	0.1	114.125
800	1200	74.40	1300	26.70	0.1	107.29
900	1200	21.65	1300	26.70	0.1	102.015
600	1200	193.15	1400	15.75	0.01	10.026
700	1200	142.75	1400	15.75	0.01	11.522
800	1200	74.40	1400	15.75	0.01	10.8385
900	1200	21.65	1400	15.75	0.01	10.311

Source: Own design

Table 5

PARAMETERS OF POTENTIAL CAPPED BONUS CERTIFICATES WITH MATURITY DATE 14/1/2016

Barrier level	Bonus level	Down-out Put premium	Cap level	Call premium	Multiplier	Issue price
600	1030	68.80	1100	119.25	0.1	97.475
700	1030	29.85	1100	119.25	0.1	93.58
800	1030	7.70	1100	119.25	0.1	91.365
900	1030	0.75	1100	119.25	0.1	90.67
600	1030	68.80	1200	86.50	0.01	10.075
700	1030	29.85	1200	86.50	0.01	9.6855
800	1030	7.70	1200	86.50	0.01	9.464
900	1030	0.75	1200	86.50	0.01	9.3945
600	1100	98.90	1200	86.50	0.01	10.376
700	1100	48.80	1200	86.50	0.01	9.875
800	1100	15.85	1200	86.50	0.01	9.5455
900	1100	2.60	1200	86.50	0.01	9.413
600	1100	98.90	1300	62.20	0.1	106.19
700	1100	48.80	1300	62.20	0.1	101.18
800	1100	15.85	1300	62.20	0.1	97.885
900	1100	2.60	1300	62.20	0.1	96.56
600	1200	149.50	1250	73.35	0.01	11.0135
700	1200	83.05	1250	73.35	0.01	10.349
800	1200	33.05	1250	73.35	0.01	9.849
900	1200	7.80	1250	73.35	0.01	9.5965
600	1200	149.50	1300	62.20	0.1	111.25
700	1200	83.05	1300	62.20	0.1	104.605
800	1200	33.05	1300	62.20	0.1	99.605
900	1200	7.80	1300	62.20	0.1	97.08

Source: Own design

Table 6

PARAMETERS OF POTENTIAL CAPPED TWIN-WIN CERTIFICATES WITH MATURITY DATE 16/1/2015 AND 14/1/2016

Maturity date	Barrier level	Strike level	Down-out Put premium	Cap level	Call premium	Multiplier	Issue price
16/1/2015	600	1025.2	83.70	1100	74.10	0.1	111.85
16/1/2015	700	1025.2	50.50	1100	74.10	0.1	105.21
16/1/2015	800	1025.2	17.15	1100	74.10	0.1	98.54
16/1/2015	900	1025.2	1.95	1100	74.10	0.1	95.5
16/1/2015	600	1025.2	83.70	1200	44.95	0.01	11.4765
16/1/2015	700	1025.2	50.50	1200	44.95	0.01	10.8125
16/1/2015	800	1025.2	17.15	1200	44.95	0.01	10.1455
16/1/2015	900	1025.2	1.95	1200	44.95	0.01	9.8415
16/1/2015	600	1025.2	83.70	1300	26.70	0.1	116.59
16/1/2015	700	1025.2	50.50	1300	26.70	0.1	109.95
16/1/2015	800	1025.2	17.15	1300	26.70	0.1	103.28
16/1/2015	900	1025.2	1.95	1300	26.70	0.1	100.24
16/1/2015	600	1025.2	83.70	1400	15.75	0.01	11.7685
16/1/2015	700	1025.2	50.50	1400	15.75	0.01	11.1045
16/1/2015	800	1025.2	17.15	1400	15.75	0.01	10.4375
16/1/2015	900	1025.2	1.95	1400	15.75	0.01	10.1335
14/1/2016	600	1025.2	67.00	1100	119.25	0.1	103.995
14/1/2016	700	1025.2	28.75	1100	119.25	0.1	96.345
14/1/2016	800	1025.2	7.25	1100	119.25	0.1	92.045
14/1/2016	900	1025.2	0.70	1100	119.25	0.1	90.735
14/1/2016	600	1025.2	67.00	1200	86.50	0.01	10.727
14/1/2016	700	1025.2	28.75	1200	86.50	0.01	9.962
14/1/2016	800	1025.2	7.25	1200	86.50	0.01	9.532
14/1/2016	900	1025.2	0.70	1200	86.50	0.01	9.401
14/1/2016	600	1025.2	67.00	1250	73.35	0.01	10.8585
14/1/2016	700	1025.2	28.75	1250	73.35	0.01	10.0935
14/1/2016	800	1025.2	7.25	1250	73.35	0.01	9.6635
14/1/2016	900	1025.2	0.70	1250	73.35	0.01	9.5325
14/1/2016	600	1025.2	67.00	1300	62.20	0.1	109.7
14/1/2016	700	1025.2	28.75	1300	62.20	0.1	102.05
14/1/2016	800	1025.2	7.25	1300	62.20	0.1	97.75
14/1/2016	900	1025.2	0.70	1300	62.20	0.1	96.44

Source: Own design

Appendix 2

Table 8

COMPARISON OF SELECTED INVESTMENT CERTIFICATES IF BARRIER LEVEL 600 WAS BREACHED DURING THE MATURITY

Investment certificate	I_1		I_2		I_3		I_4		I_5	
Intervals of underlying price at the maturity date	Profit of the investor									
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
$S_T \leq 600$	**-97.475**	**-37.457**	-106.19	-46.19	-111.25	-51.25	-103.995	-43.995	-109.7	-49.7
$600 \leq S_T \leq 922.95$	**-37.457**	**-5.18**	-46.19	-13.895	-51.25	-18.955	-43.995	-11.7	-49.7	-17.405
$922.95 \leq S_T \leq 1025.2$	**-5.18**	**5.045**	-13.895	-3.67	-18.955	-8.73	-11.7	-1.475	-17.405	-7.18
$1025.2 \leq S_T \leq 1030$	**5.045**	**5.525**	-3.67	-3.19	-8.73	-8.25	-1.475	-0.995	-7.18	-6.7
$1030 \leq S_T \leq 1062.25$	**5.525**	**8.75**	-3.19	0.035	-8.25	-5.025	-0.995	2.23	-6.7	-3.475
$1062.25 \leq S_T \leq 1100$	**8.75**	**12.525**	0.035	3.81	-5.025	-1.25	2.23	6.005	-3.475	0.3
$1100 \leq S_T \leq 1187.15$	**12.525**	**12.525**	3.81	12.525	-1.25	7.465	6.005	6.005	0.3	9.015
$1187.15 \leq S_T \leq 1200$	12.525	12.525	**12.525**	**13.81**	7.465	8.75	6.005	6.005	9.015	10.3
$1200 \leq S_T \leq 1300$	12.525	12.525	**13.81**	**23.81**	8.75	18.75	6.005	6.005	10.3	20.3
$S_T \geq 1300$	12.525	12.525	**23.81**	**23.81**	18.75	18.75	6.005	6.005	20.3	20.3

Source: Own calculations

Table 9

COMPARISON OF SELECTED INVESTMENT CERTIFICATES IF BARRIER LEVEL 600 WAS NOT BREACHED DURING THE MATURITY

Investment certificate	I_1		I_2		I_3		I_4		I_5	
Intervals of underlying price at the maturity date	Profit of the investor									
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
$600 \leq S_T \leq 922.95$	5.525	5.525	3.81	3.81	8.75	8.75	**8.75**	**41.045**	3.045	35.34
$922.95 \leq S_T \leq 1025.2$	5.525	5.525	3.81	3.81	**8.75**	**8.75**	-1.475	8.75	-7.18	3.045
$1025.2 \leq S_T \leq 1030$	5.525	5.525	3.81	3.81	**8.75**	**8.75**	-1.475	-0.995	-7.18	-6.7
$1030 \leq S_T \leq 1062.25$	5.525	8.75	3.81	3.81	**8.75**	**8.75**	-0.995	2.23	-6.7	-3.475
$1062.25 \leq S_T \leq 1100$	**8.75**	**12.525**	3.81	3.81	8.75	8.75	2.23	6.005	-3.457	0.3
$1100 \leq S_T \leq 1187.15$	**12.525**	**12.525**	3.81	12.525	8.75	8.75	6.005	6.005	0.3	9.015
$1187.15 \leq S_T \leq 1200$	12.525	12.525	**12.525**	**13.81**	8.75	8.75	6.005	6.005	9.015	10.3
$1200 \leq S_T \leq 1300$	12.525	12.525	**13.81**	**23.81**	8.75	18.75	6.005	6.005	10.3	20.3
$S_T \geq 1300$	12.525	12.525	**23.81**	**23.81**	18.75	18.75	6.005	6.005	20.3	20.3

Source: Own calculations

Table 10

COMPARISON OF SELECTED INVESTMENT CERTIFICATES IF BARRIER LEVEL 900 WAS BREACHED DURING THE MATURITY

Investment certificate	I_6		I_7		I_8		I_9		I_{10}	
Intervals of underlying price at the maturity date	Profit of the investor									
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
$S_T \leq 900$	**-90.67**	**-0.67**	-96.56	-6.56	-97.08	-7.08	-90.735	-0.735	-96.44	-6.44
$900 \leq S_T \leq 913.85$	**-0.67**	**0.715**	-6.56	-5.175	-7.08	-5.695	-0.735	0.65	-6.44	-5.055
$913.85 \leq S_T \leq 1025.2$	**0.715**	**11.85**	-5.175	5.96	-5.695	5.44	0.65	11.785	-5.055	6.08
$1025.2 \leq S_T \leq 1030$	**11.85**	**12.33**	5.96	6.44	5.44	5.92	11.785	12.265	6.08	6.56
$1030 \leq S_T \leq 1100$	**12.33**	**19.33**	6.44	13.44	5.92	12.92	12.265	19.265	6.56	13.56
$1100 \leq S_T \leq 1157.7$	**19.33**	**19.33**	13.44	19.21	12.92	18.69	19.265	19.265	13.56	19.33
$1157.7 \leq S_T \leq 1193.6$	19.33	19.33	19.21	22.8	18.69	22.28	19.265	19.265	**19.33**	**22.92**
$1193.6 \leq S_T \leq 1200$	19.33	19.33	22.8	23.44	22.28	22.92	19.265	19.265	**22.92**	**23.56**
$1200 \leq S_T \leq 1300$	19.33	19.33	23.44	33.44	22.92	32.92	19.265	19.265	**23.56**	**33.56**
$S_T \geq 1300$	19.33	19.33	33.44	33.44	32.92	32.92	19.265	19.265	**33.56**	**33.56**

Source: Own calculations

Table 11

COMPARISON OF SELECTED INVESTMENT CERTIFICATES IF BARRIER LEVEL 900 WAS NOT REACHED DURING THE MATURITY

Investment certificate	I_6		I_7		I_8		I_9		I_{10}	
Intervals of underlying price at the maturity date	Profit of the investor									
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
$900 \leq S_T \leq 913.85$	12.33	12.33	13.44	13.44	22.92	22.92	**22.92**	**24.305**	17.215	18.6
$913.85 \leq S_T \leq 1025.2$	12.33	12.33	13.44	13.44	**22.92**	**22.92**	11.785	22.92	6.08	17.215
$1025.2 \leq S_T \leq 1030$	12.33	12.33	13.44	13.44	**22.92**	**22.92**	11.785	12.265	6.08	6.56
$1030 \leq S_T \leq 1100$	12.33	19.33	13.44	13.44	**22.92**	**22.92**	12.265	19.265	6.56	13.56
$1100 \leq S_T \leq 1157.7$	19.33	19.33	13.44	19.21	**22.92**	**22.92**	19.265	19.265	13.56	19.33
$1157.7 \leq S_T \leq 1193.6$	19.33	19.33	19.21	22.8	**22.92**	**22.92**	19.265	19.265	19.33	22.92
$1193.6 \leq S_T \leq 1200$	19.33	19.33	22.8	23.44	22.92	22.92	19.265	19.265	**22.92**	**23.56**
$1200 \leq S_T \leq 1300$	19.33	19.33	23.44	33.44	22.92	32.92	19.265	19.265	**23.56**	**33.56**
$S_T \geq 1300$	19.33	19.33	33.44	33.44	32.92	32.92	19.265	19.265	**33.56**	**33.56**

Source: Own calculations

PRINCIPI ZASNIVANJA STRUKTURIRANIH FINANCIJSKIH PROIZVODA

Sažetak

U ovom se članku analiziraju inovativni financijski proizvodi iz područja izvedenica odnosno derivativa – (engl. capped bonus i capped twin-win certificates). Analiza pruža uvid u stvaranje ovih certifikata temeljem kombinacije tradicionalnih financijskih instrumenata i derivativnih proizvoda naročito tzv. egzotičnih opcija. Iskazane su također i formule njihovog cjenovnog vrednovanja. Izvedena analiza je robustna u odnosu na različite vrijednosne papire isključujući novčane dividende. Polazeći od teorijskih modela cjenovnog određivanja izvedeno je osamdeset certifikata oba tipa na Googleovim dionicama s različitim parametrima. Uvjet pod kojim se ostvaruje profit prvenstveno je tržišni. Radom je identificirana profitabilnost za investitora kao i dani dospijeća.

Ključne riječi: strukturirani financijski proizvodi, investicijski certifikati, derivativi – limitiran certifikat (capped bonus certificate, capped twin win certificate), predodređena cijena aktive (vanilla option pricing)