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Analysis of using options to the express certificates formation

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This article analyses the express certificates formation on the financial market. Express certificates are one type of modern structured products suitable for individual investors, the return of which is derived from the return of the underlying asset. There are detailed descriptions of these products with the aim of showing the nature of the express certificates formation. It is proved that the payoff of the express certificates is engineered from a combination of traditional financial instrument with the derivative products, especially vanilla and barrier options. Theoretical price of vanilla and barrier options are calculated through option pricing models. The main aim of this article is to provide an analysis of the express certificates formation on the shares (Daimler AG and Allianz SE) issued by Deutsche Bank AG. The objective of the analysis is to contribute to the intellectualisation of all investors.

Keywords: investment certificate; express certificate; vanilla option; barrier option; option pricing

JEL classification: G11; G13; G15; G24.

1. Introduction

Structured products, mainly investment certificates (one type of structured products), have become more popular and increasingly complex in recent years. They introduce new innovative investments, which offer new opportunities in the financial markets. Structured products are referred as a combination of individual financial instrument and derivatives, usually classic vanilla and/or exotic (mainly barrier) option. They are usually issued by banks (e.g. Deutsche Bank AG, Raiffeisen Centrobank, etc.) with varying features (as returns, risk profiles and terms) of an underlying asset (a financial instrument), which can be a share in a company, a basket of shares, an entire index, commodity or currency. Structured products are designed for every investor according to his/her requirements, i.e. risk-return profile, terms and market expectations of underlying price development. The advantage of the structured products is the limited maximum potential loss by the initial invested amount. Therefore every investor knows the potential risk and the return from the outset of his/her investment. Today several studies (Benet, Giannetti, & Pissaris, 2006; Bluemke, 2009; Chorafas, 2006) deal with these modern structured products.

These innovative instruments contain an option component, therefore are connected with the process of financial engineering. There are used as standard vanilla options, as well as the barrier options. The aim of this article is to provide an analysis of the

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express certificates on the shares (Daimler AG and Allianz SE) issued by Deutsche Bank AG. There is explored the application of the financial engineering principles to the investment certificates formation. It is shown that these products are formed by using the European style of down and knock-out put option, and the classic European vanilla call option, which is necessary to sell every year. There are analysed two express certificates (Express Certificate Daimler AG and Express Certificate Allianz SE) with demonstrated the nature of their formation for potential investors. Our approach is focused only on the application for investment certificates with the shares as the underlying asset, but the results are robust for various types of underlying assets as index, commodity, etc. The analysis will increase the ability of all investors to understand these sophisticated products constructions.

The methodology of this article is based on options, which are a significant part of the investment certificates. The profit functions of options, in our case classic vanilla and barrier options, are expressed in the analytical expression. There are used option pricing models for classic vanilla and barrier options. Through the presented approach of the analytical expression of classic vanilla and barrier options and calculated option prices we can explicitly prove the nature of the express certificates formation.

The article is organised on the follows sections. In section two, we introduce the characteristics of the express certificates. The third section introduces options in general and presents the option pricing models, which are used on investment certificates formation and we show the express certificates formation through options. In the fourth section we apply our results to real products on the market. The conclusions are summarised in the last section.

2. Characteristics of the express certificates

Today large commercial banks are constantly offering new modified investment certificates on the financial market, where every investor can find the best certificates according to his/her requirements. For example in the papers by Hernández, Lee, Liu, and Dai (2013), M. Šoltés (2010, 2012), V. Šoltés (2011), and Younis and Rusnáková (2014) the authors analyse and explain the various types of investment certificates formation.

Express certificates belong to the group of modern structured products. HypoVereinsbank issued the first express certificate in 2003. Express certificates are suitable for investors with expectations of stagnation or small increases. The advantage of all investment certificates is the liquidity, i.e. it is possible to sell them at any time at actual price on the stock exchange or OTC market. This product was investigated by Hernández, Tobler, and Brusa (2010). Following the previously mentioned studies we realise a more comprehensive analysis of the express certificates.

In contrast to the other types of investment certificates, we do not know how to determine the duration of the express certificates, except in terms of years. Normally, they are issued for a term of one to four years, but sometimes five years, where the underlying asset price is compared with the termination level (usually the starting value) in forthcoming years. If the underlying price is quoted at or above the current level in forthcoming years, the express certificate will be automatically redeemed prior to the maturity date at the pre-defined termination price (the investor will achieve the nominal value and an attractive yield). If the underlying price quotes under the termination level at the annual valuation date, the term of the certificate will be automatically extended by another year, and the potential annual termination price rises by X percentage points. The same procedure will happen in the second valuation date.

Every express certificate is characterised by parameters:

- Issue price (the nominal value) – the certificate price defined at issue.
- Annual valuation dates – dates on which certificate can be prematurely redeemed.
- Maturity date – a date when the certificate is mature.
- Termination level (the initial reference level) – 100% of the official closing price of the underlying asset at the initial valuation date.
- Redemption amount – fixed yield, it is the maximum yield, which the investor can receive from the express certificate at the annual valuation dates or the maturity date, in accordance with fulfilled issue conditions.
- Barrier (the security buffer) – level, which the underlying price must not be touched or undercut depends on the observation period (either during the time to maturity or at the maturity date). It is set below the underlying asset price at the issue date.

By assuming the characteristics mentioned above, the investment strategy graphical representations of the express certificates at the maturity date are presented in Figure 1.

We can see in Figure 1 the profit function that express certificates generate an opportunity of the premature redemption in one of the annual valuation dates (1–4) according to fulfilled conditions of issue. Express certificates are an alternative to a direct investment in the underlying asset and offer the investor a chance to earn an attractive yield in a short period of time with lower risk of loss. If the underlying price quote is under the termination level, but does not achieve the barrier level *B* at the maturity date, the investor receives his/her nominal value back. If the underlying price quotes is under the termination level in every annual valuation date (1–4) and is under the barrier level at maturity date, then the investor receives the redemption according to

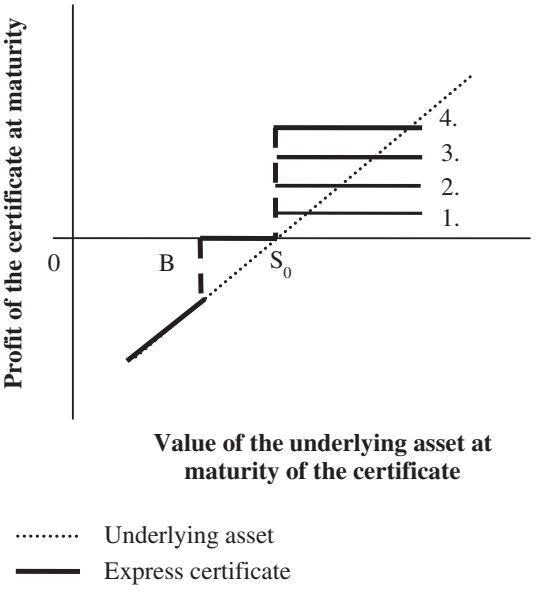

Figure 1. Profit function of the express certificate.
Source: Created by the authors according to Deutsche Bank AG.

the actual development of the underlying asset. On the other hand, there is the maximum annual yield, which the investor can receive from his/her investment.

At the maturity date of the express certificate may be three variants of the underlying price development:

- *Variant 1* – if the underlying price does not touch or cross the barrier level at the maturity date and is at or above the termination level $(B < S_0 \leq S_T)$, then the investor will generate the maximum yield.
- *Variant 2* – if the underlying price does not touch or cross the barrier level at the maturity date and is below the termination level $(B < S_T \leq S_0)$, then there is at least partial guarantee of investor′s investment in the amount of the nominal value.
- *Variant 3* – if the underlying price touches or crosses the barrier level at the maturity date $(S_T < B \leq S_0)$, then the investor generates the losses of the underlying asset at ratio 1:1, according to the actual underlying development. In this case, the redemption is affected and is equal to the performance of the underlying asset.

Due to their structure, the express certificates are suitable for conservative investors who are willing to forego unlimited participation of the attractive returns (if the underlying price is rising) in favour of a security buffer. We can create a stable portfolio through the express certificates with annual yields in the range of 6–10%. However, if we add some special investment opportunities to this portfolio, we have another alternative for the long-term dynamic portfolio construction.

3. Options suitable for the express certificates formation

Options are at the heart of the most investment certificates. The express certificates formation is connected with the classic vanilla options as well as the barrier options belonging to the exotic options. Therefore we briefly characterise these options.

Options belong among the conditional contracts. It means that the buyers and the sellers do not have the equal rights and obligations. The buyer (the holder) of the option has the right to buy (a purchase call) or to sell (a purchase put) and the seller (the writer) has the obligation to sell (a sale call) and to buy (a sale put) an underlying asset at a pre-specified time (the maturity date or the expiration date) at a pre-specified price (the strike price or the exercise price). The buyer pays a so-called option premium (i.e. the option price) to the seller for this right. The buyer can exercise his/her right either at the time of expiration of the option (European option) or at any time within a pre-specified expiration period of the option (American option).

Less known, but much more sophisticated options are the barrier options (one type of the exotic options). Barrier options are an alternative to the traditional vanilla options. Their option premiums are always cheaper in comparison to the vanilla option premiums, because we are not sure whether the option will have a value at the maturity date or expire as worthless. Also the barrier options can exist as buying (call) and selling (put) options.

Barrier options are characterised by the fact that except for the strike price they have another important price, a so-called barrier. It is a very important level, therefore if the underlying price, at any time (American style) or at the maturity date (European style), touches or crosses the barrier, the option is activated (referred as a knock-in option) or deactivated (referred as a knock-out option). The barrier can be placed above the

starting price (referred as an up and knock-in option or up and knock-out option) or below the starting price (referred as a down and knock-in option or down and knock-out option) at the time of the option issue. Consequently, they are connected with a necessary condition, which must be met, in order to the investor could exercise a barrier option. Otherwise the barrier option expires as worthless. There are altogether 16 basic option positions of the barrier options with one barrier. Detailed descriptions of the vanilla and the barrier options exist in the literature (Hull, 2012; Kolb, 1995; Zhang, 1998), but also Šoltés (2002). Options can also be used on hedging, where they introduce the management of price risk the purpose of which is to protect against unfavourable price movement. Hedging by means of options strategies using barrier options are discussed in the works Rusnáková and Šoltés (2012) and Šoltés and Rusnákova (2012, 2013).

One of the most important problems of the barrier options is their price specification and conditions under which this price will be based. It can be proved, the combination of the 'in' and 'out' barrier option price with the same underlying asset, the strike price, the maturity date and the barrier level is equal to the vanilla option price.

This article uses an approach based on the profit functions of the vanilla and the barrier options in the analytical expression, in order to prove the nature of the express certificates formation. In the formation of the express certificates we are going to use the selling of the vanilla call options and the buying of the down and knock-out put options.

The profit function of a short position in the call options on the underlying asset with the strike level X, the premium c_S for an option, the multiplier p, the price at the maturity date S_T and the time to maturity of the option t is

$$P(S_T) = \begin{cases} p * c_S & \text{if } \mathrm{S_T} < X, \\ -p * (S_T - X - c_S) & \text{if } \mathrm{S_T} \geq X. \end{cases} \tag{1}$$

And the profit function of a long position in the down and knock-out put options on the underlying with the strike level X, the barrier level B, the price at the maturity date S_T, the premium p_{BDO} for an option and the time to maturity of the option t is:

$$P(S_T) = \begin{cases} -p * p_{BDO} & \text{if } \min\limits_{0 \leq t \leq T}(S_t) \leq \mathrm{B}, \\ -p * (S_T - X + p_{BDO}) & \text{if } \min\limits_{0 \leq t \leq T}(S_t) > \mathrm{B} \wedge \mathrm{S_T} < X, \\ -p * p_{BDO} & \text{if } \min\limits_{0 \leq t \leq T}(S_t) > \mathrm{B} \wedge \mathrm{S_T} \geq X. \end{cases} \tag{2}$$

3.1. *Option pricing models*

Express certificate formation can be proved through option pricing models. Therefore we introduce theoretical models for option pricing. The basic model of option valuation is Black–Scholes model introduced in the work Black and Scholes (1973). This model assumes an ideal market conditions and is based on a certain assumptions. Therefore, if we consider European vanilla call option on the shares without dividend, then the theoretical price can be calculated using Black–Scholes formula in the form:

$$c = SN(d_1) - Xe^{-rT}N(d_2), \tag{3}$$

where

$$d_1 = \frac{\ln\frac{S}{X} + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}, \tag{4}$$

$$d_2 = d_1 - \sigma\sqrt{T} = \frac{\ln\frac{S}{X} + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}. \tag{5}$$

$N(d_1)$ and $N(d_2)$ are the values of the standard normal cumulative distribution function. The price of call/put option, according to the relation (3) – (5), is a function of the underlying spot price S, the strike price X, the implied volatility of the underlying σ, the risk-free interest rate r (derived from government bonds yields) and the time to maturity option T. The change of some parameter has the influence to change of option price.

Let us denote the underlying asset price at time t S_t, the underlying asset price at time t–1 S_{t-1}, number of observations N, the observation period t_s, then the implied volatility σ will be calculated according to the following relation (Ambrož, 2002):

$$\sigma = \sqrt{\frac{(\bar{X} - X_i)^2}{N-1}} * \sqrt{t_S}, \tag{6}$$

where

$$\bar{X} = \frac{\sum_{i=1}^{N} X_i}{N}, \tag{7}$$

$$X_i = \ln\frac{S_t}{S_{t-1}}. \tag{8}$$

The classical Black–Scholes approach does not directly suit barrier options, because the next factor, a barrier, influences on height of the option premium. Merton (1973) modified the Black–Scholes model and derived a first relationship to calculate the European down and knock-out call option price. Later Rubinstein and Reiner (1991) applied Black–Scholes–Merton formula on eight basic types of barrier options, and applied Haug (1998) on all 16 types.

Our approach is based on the theoretical price of standard European barrier options according to an analytical model by Haug (1998). Let us denote the put option p, the barrier level B, the strike price X, the actual underlying spot price S_0, compensation K, the risk-free interest rate r, the implied volatility σ and the time to maturity of the option t, then the theoretical down and knock-out put barrier option price p_{BDO} with the barrier lower than the strike price is calculated as:

$$P_{BDO(B\leq X)} = A - B + C - D + F \quad \eta = 1, \ = -1, \tag{9}$$

where

$$A = \varphi S_0 e^{-qt} N(\varphi x_1) - \varphi X e^{-rt} N(\varphi x_1 - \varphi\sigma\sqrt{t}), \tag{10}$$

$$B = \varphi S_0 e^{-qt} N(\varphi x_2) - \varphi X e^{-rt} N(\varphi x_2 - \varphi\sigma\sqrt{t}), \tag{11}$$

$$C = \varphi S_0 e^{-qt} (B/S_0)^{2(\mu+1)} N(\eta y_1) - \varphi X e^{-rt} (B/S_0)^{2\mu} N(\eta y_1 - \eta\sigma\sqrt{t}), \tag{12}$$

$$D = \varphi S_0 e^{-qt} (B/S_0)^{2(\mu+1)} N(\eta y_2) - \varphi X e^{-rt} (B/S_0)^{2\mu} N(\eta y_2 - \eta\sigma\sqrt{t}), \tag{13}$$

$$F = K\left[(B/S_0)^{\mu+\lambda} N(\eta z) + (B/S_0)^{\mu-\lambda} N(\eta z - 2\eta\lambda\sigma\sqrt{t})\right], \tag{14}$$

and

$$x_1 = \frac{\ln\left(\frac{S_0}{X}\right)}{\sigma\sqrt{t}} + (1+\mu)\sigma\sqrt{t}\ , \tag{15}$$

$$x_2 = \frac{\ln\left(\frac{S_0}{B}\right)}{\sigma\sqrt{t}} + (1+\mu)\sigma\sqrt{t}\ , \tag{16}$$

$$y_1 = \frac{\ln\left(\frac{B^2}{S_0 X}\right)}{\sigma\sqrt{t}} + (1+\mu)\sigma\sqrt{t}\ , \tag{17}$$

$$y_2 = \frac{\ln\left(\frac{B}{S_0}\right)}{\sigma\sqrt{t}} + (1+\mu)\sigma\sqrt{t}\ , \tag{18}$$

$$z = \frac{\ln\left(\frac{B}{S_0}\right)}{\sigma\sqrt{t}} + \lambda\sigma\sqrt{t}\ , \tag{19}$$

$$\mu = \frac{r - q + \frac{\sigma^2}{2}}{\sigma^2}\ , \tag{20}$$

$$\lambda = \sqrt{\mu^2 + \frac{2r}{\sigma^2}}\ . \tag{21}$$

All calculations of the vanilla and the barrier option prices were implemented in the statistical programme R. (Iacus, 2011)

4. Nature of the express certificates formation

The profit profile of the express certificates depends on the underlying asset development every annual valuation dates and exceeding/not exceeding the barrier level at the maturity date. Issuers of investment certificates purchase the options for the option premiums, where the barrier option premium is always cheaper than the vanilla option premium. These findings lead to the description of the following alternative investment strategy using the barrier option and the vanilla option.

If our assumptions are fulfilled, the alternative investment strategy has the same profit profile as the express certificate.

Let us suppose that we want to issue the express certificate on some underlying asset with the spot price at the time of issue S_0, the interest rate r_1 per year and the maturity date t years.

The profit profile of the alternative investment can be achieved:

- purchase of the underlying asset at S_0,
- purchase of the European down and knock-out put option with a strike price $RC_1 = S_0$, a barrier level defined in the express certificate and the expiration time identical with the expiration of the express certificate,
- sale of the European vanilla call option with a strike price $RC_1 = S_0$ and the one year expiration (the 1st valuation date).

Every investor (buyers of the investment certificate) has to pay the entry fee (a percentage of the issue price), which is together with dividends d_t (if they flow from the underlying asset) our profit.

Let us denote option premium for purchase of the barrier option p_{BDO}, option premium for the sale of the vanilla call option p_{1P}, the interest rate r and the annual tax rate d, then the sources from the option premiums and their interest must fulfil the following condition:

$$(p_{1P} - p_{BDO})(1 + r(1 - d)) \geq r_1 S_0. \tag{22}$$

If there is $S \geq S_0$ in the first valuation date, then the buyer of the vanilla call option with the strike price $RC_1 = S_0$ will want to purchase the underlying asset at S_0 and we, as the seller of the vanilla call option, will sell him the underlying asset at S_0. We will withdraw the sources and the interests fulfilled the condition (22) and pay the buyers of the express certificate $S_0 + r_1 S_0$ and the certificate ends life. Our liabilities are ended. The difference $(p_{1P} - p_{BDO})(1 + r(1 - d)) - r_1 S_0$. is our profit.

Our purchase of the down and knock-out put barrier option with the expiration date of the next t years is continuing.

If the underlying asset does not cross a barrier level and at the expiration time is $S_t < S_0$, then we will purchase the underlying asset at S_t and realise this option, i.e. we will sell the underlying asset at S_0. Our profit is the difference $S_0 - S_t$.

If the underlying asset crosses a barrier level and it is $S_t \geq S_0$ at the expiration date, we will let expire a barrier option.

If there is $S < S_0$ in the first valuation date, then the vanilla call option will expire and the buyer of the vanilla call option lets it expire.

We again sell the vanilla call option with $RC_2 = S_0$ with the one year expiration (the 2nd valuation date). We gain the option premium p_{2P}.

The next condition must be fulfilled:

$$((p_{1P} - p_{BDO})(1 + r(1 - d)) + p_{2P})(1 + r(1 - d)) \geq 2r_1 S_0. \tag{23}$$

We are analogously continuing as after the first valuation date. There can be two variations. If $S \geq S_0$, the express certificate is expired, then we will sell the buyer of the vanilla call option the underlying asset at S_0 and pay $S_0 + 2r_1 S_0$, i.e. $(1 + 2r_1)S_0$ per certificate. If $S < S_0$, we will again sell the vanilla call option and repeat the procedure until the maturity of the certificate.

In the case of the express certificate with a maturity t years it should be fulfilled the next condition:

$$\begin{aligned}(p_{1P} - p_{BDO})(1 + r(1 - d))^t + p_{2P}(1 + r(1 - d))^{t-1} + p_{3P}(1 + r(1 - d))^{t-2} + \ldots \\ + p_{tP}(1 + r(1 - d)) \geq t r_1 S_0 \,,\end{aligned} \tag{24}$$

and sources for interest.

If there is no early redemption, then three variants can occur at the maturity of the express certificate:

(a) If $S \geq S_0$, then the buyer of the vanilla call option implements his right and we must sell the underlying asset at S_0. Together with the interest from the selling of the vanilla call option fulfilled the condition (24), we will repay the buyer of the express certificate and let expire the buying of the barrier option.
(b) If $B < S < S_0$, the barrier level was not crossed, then we realise the down and knock-out put barrier option and sell the underlying asset at S_0. The sources from the selling of the vanilla call option are our profit.
(c) If $S \leq B < S_0$, the barrier level was crossed, then the express certificate is redeemed at price S and the investor incurs a loss.

5. Analysis of the real express certificates traded in the financial market

The German companies Daimler AG, one of the most successful automotive companies in the world, and Allianz SE, providing financial services with main focus on insurance, belong to the successful global companies in the world. Investors see the big investment opportunities, because the shares of these companies are becoming the underlying assets of different investment certificates.

One of the investment certificates types, which are offered currently in the financial market, are the Express Certificate Daimler AG with fixed Strikes and 60% Barrier (DE000DB2F8T2) and Express Certificate Allianz SE with fixed Strikes and 60% Barrier (DE000DB9ZGB6) issued by Deutsche Bank AG. These products allow the investors to generate express yield in one of the valuation days (if conditions are met specified at the issue), providing that the underlying asset price will be above 60% barrier at the maturity date. The underlying assets of the express certificates are the shares of Daimler AG and Allianz SE.

Both express certificates are issued at a term of five years (at least one and not more than five years) with key information presented in Table 1. More information is available at Deutsche Bank AG (http://www.at.x-markets.db.com).

Table 1. The basic characteristics of Express Certificate Daimler AG and Express Certificate Allianz SE.

ISIN	DE000DB2F8T2	DE000DB9ZGB6
Underlying asset	Daimler AG	Allianz SE
Issue date	29 September 2010	13 July 2011
Maturity date	23 September 2015	20 July 2016
Issue price	100 *EUR* + 1.5% Front-End Load*	100 *EUR* + 1.5% Front-End Load*
Annual valuation dates	16.9.2011 / 21.9.2012 / 20.9.2013 / 19.9.2014 / 18.9.2015	20.7.2012 / 19.7.2013 / 18.7.2014 / 17.7.2015 / 15.7.2016
Reference level	100.00 *EUR*	100.00 *EUR*
Initial reference level	100% (46.23 *EUR*)	100% (89.99 *EUR*)
Redemption amount	111.30 *EUR* / 122.60 *EUR* / 133.90 *EUR* / 145.20 *EUR* / 156.50 *EUR*	111.25 *EUR* / 122.50 *EUR* / 133.75 *EUR* / 145.00 *EUR* / 156.25 *EUR*
Barrier level	60% (27.74 *EUR*)	60% (53.99 *EUR*)

Note: *The client pays the front-end load (entry fee) to his bank.
Source: Created by the authors according to Deutsche Bank AG on 28/04/2013.

As shown in Table 1, the investor pays us 1.50% entry fee for the purchase of the express certificate. In addition, there are repaid dividends from these shares, which are together with entry fee to our full profit.

Express Certificate Daimler AG was issued on 29 September 2010 with the maturity date on 23 September 2015. The profit profile is assured an alternative investment:

- purchase of the underlying asset at 46.23 *EUR*,
- purchase of the down and knock-out put option with the strike price $RC_1 = S_0 = 46.23$ *EUR*, the barrier level 27.74 *EUR*, the expiration time 5 years, the volatility 0.49 and the risk-free interest rate 0.046,
- sale of the vanilla call option with $RC_1 = S_0 = 46.23\,EUR$, the one year expiration (the 1st valuation date), the volatility 0.4 and the risk-free interest rate 0.014.

Theoretical price of the down and knock-out put barrier option (according to Haug model) with the given parameters is 0.19 *EUR* and the vanilla call option (according to Black–Scholes model) is 7.57 *EUR*. At the same time we except annual interest rate (r) at the deposit 0.01 and the tax rate (d) 0.19.

The profit profile of this express certificate in the 1st valuation date fulfils the condition:

$$\begin{gathered}(7.57 - 0.19)(1 + 0.01(1 - 0.19)) \geq 0.113 * 46.23 \\ 7.44 \geq 5.22\end{gathered} \tag{25}$$

In the 1st valuation date (16.9.2011) is the underlying asset price $S_1(36.40\ EUR) < S_0(46.23\ EUR)$, the vanilla call option expires and with this express certificate is trading further.

We again sell the vanilla call option with $RC_2 = S_0 = 46.23\ EUR$, the one year expiration (the 2nd valuation date), the volatility 0.39 and the risk-free interest rate 0.026. We gain an option premium at 2.94 *EUR*. Interests together with the option premium fulfil the condition:

$$\begin{gathered}(7.44 + 2.94)(1 + 0.01(1 - 0.19)) \geq 2 * 0.113 * 46.23 \\ 10.46 \geq 10.45\end{gathered} \tag{26}$$

In the 2nd valuation date (21.9.2012) the underlying asset price is $S_2(40.20\ EUR) < S_0(46.23\ EUR)$, the vanilla call option expires and with this express certificate is trading further.

We again sell vanilla call option with $RC_3 = S_0 = 46.23\ EUR$, the one year expiration (the 3rd valuation date), the volatility 0.46 and the risk-free interest rate 0.017. We gain the option premium at 5.44 *EUR*. Interests together with the option premium are fulfilled the condition:

$$\begin{gathered}(10.46 + 5.44)(1 + 0.01(1 - 0.19)) \geq 3 * 0.113 * 46.23 \\ 16.03 \geq 15.67\end{gathered} \tag{27}$$

In the case of Express Certificate Daimler AG issued on 13 July 2011 with the maturity date of 20 July 2016, the profit profile is to assured an alternative investment:

- purchase of the underlying asset at 89.99 *EUR*,
- purchase of the down and knock-out put option with $RC_1 = S_0 = 89.99\,EUR$, the barrier level 53.99 *EUR*, the expiration time 5 years, the volatility 0.48 and the risk-free interest rate 0.046,
- sale of the vanilla call option with $RC_1 = S_0 = 89.99\,EUR$, the one year expiration (the 1st valuation date), the volatility 0.27 and the free interest rate 0.027.

Theoretical price of the down and knock-out put barrier option with the given parameters is 0.39 *EUR* and vanilla call option is 10.84 *EUR*. The profit profile of this express certificate fulfils the condition in the 1st valuation date:

$$\begin{gathered}(10.84 - 0.39)(1 + 0.01(1 - 0.19)) \geq 0.1125 * 89.99 \\ 10.53 \geq 10.12\end{gathered} \tag{28}$$

In the 1st valuation date (20.7.2012) is the underlying asset price $S_1(79.86\ EUR) < S_0(89.99\ EUR)$, the vanilla call option expires and with this express certificate is trading further.

We again sell the vanilla call option with $RC_2 = S_0 = 89.99\,EUR$, the one year expiration (the 2nd valuation date), the volatility 0.51 and the risk-free interest rate 0.017. We gain the option premium at 13.02 *EUR*. Interests together with the option premium fulfil the condition:

$$\begin{gathered}(10.53 + 13.02)(1 + 0.01(1 - 0.19)) \geq 2 * 0.1125 * 89.99 \\ 23.74 \geq 20.25\end{gathered} \tag{29}$$

These express certificates are not trading on the financial market now, because they were redeemed in 2013. Shares of Daimler AG on 20.9.2013 was at the level 57.82

EUR, i.e. $S_3(57.82\ EUR) > S_0(46.23\ EUR)$ and shares of Allianz SE on 19.7.2013 was at the level 117.65 *EUR*, i.e. $S_2(117.65\ EUR) > S_0(89.99\ EUR)$. In this case, investors earned 133.90 *EUR* from Express Certificate Daimler AG and 122.50 *EUR* from Express Certificate Allianz SE. Today every investor can find a lot of express certificates on various types of underlying assets in the market depends on his/her requirements.

6. Conclusion

In recent years the investors have the opportunities to invest in new sophisticated products, i.e. the investment certificates. Investment certificates are not too well known among the public in Slovakia, but in Europe they belong to a common investment instruments.

This article oriented on the segment of investment certificates presents the express certificates formation through options. These products are formed by combination of the underlying asset (a share in a company, a basket of shares, an entire index, a currency, or a commodity) and the option component on this underlying asset. Investment products offer the retail investor various risk-return profiles, the terms with the opportunity to benefit not only rising, but also stagnant and declining markets. Express certificates are suitable for conservative investors who except to profit from stagnation, respectively slightly growth on the financial market. These products generate the maximum yield with simultaneously security buffer in the case of unfavourable underlying asset development. Express certificates allow us early repayment if a certain conditions are fulfilled.

This article deals with the characteristic of the express certificates, their nature of the formation by issuer with the application on the real express certificates (Express Certificate Daimler AG and Express Certificate Allianz SE). There is presented an alternative investment using European vanilla and European barrier options. European vanilla and barrier option prices are calculated according to option pricing models with the aim to prove the nature of the express certificates formation. This analysis is made with the objective to contribute to the intellectualisation of all investors.

This approach is based on the profit functions for vanilla and barrier options in the analytical expression, which are significant part of every investment certificate. Therefore the methodology of this article is connected with the options and option pricing models. From the methodological point of view, our approach can serve as an inspiration for the further types of the investment certificates formation.

Disclosure statement

No potential conflict of interest was reported by the authors.

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