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Proposal of new outperformance certificates in agricultural market

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Abstract: The paper analyses new structured financial products in agricultural market with the aim to gain in the declining trends. There are presented the reverse outperformance and the capped reverse outperformance certificates from the point of view of their investors and provided detailed descriptions of the profit functions in the analytical form. It is shown that the payoff of these certificates is an engineered from a combination of the traditional financial instrument and derivative products, especially the vanilla options. Further, there are developed formulas for pricing of these certificates and specified the conditions under which the issuer is profitable in the primary market. Also the profitability for the individual investor at the future trade date is presented. Several certificates for these types of certificates associated with the soybean futures contracts are designed and compared with the best results for the investor. The presented approach is based on the soybean options contracts traded on the Chicago Board of Trade.

Key words: capped reverse outperformace certificate, commodity vanilla options, option pricing, reverse outperformace certificate

For the last years, the popularity of the investments into agricultural commodities has grown among the investors. The investors concentrate mainly on goods that can be internationally traded. The price of agricultural commodities does not depend only on the local conditions, but mainly on the situation within the largest producers. Also, the globalization has an influence on agricultural trade. Today, there is a number of different routes to the commodity markets, and some of these routes make it easy for even the average investor to participate. A popular way to invest in agricultural commodities is through structured products.

New modified outperformance certificates, i.e. the reverse outperformance and the capped reverse outperformance certificates belong to the group of modern structured products. In general, the structured products are known and become popular in the Asian and European market, less well in America. They are sold by commercial and investment banks, hedge funds and other entities. The financial crisis influenced extensively this segment. Although at present the volumes of the issued and offered structured products as well as the proportion of these products in the investors' portfolios are growing each year again, the investors are still worried about an unexpected market performance. Several studies (Benet et al. 2006; Chorafas 2006; Bluemke 2009) deal with this modern structured products.

Bluemke (2009) defines the structured products (referred as the structured investments) as financial assets, which consist of various elemental components, combined to generate a specific risk-return profile adapted to an investor's needs. It is a novel asset class which represents the alternative to a direct investment. Structured products are designed for each investor according to highly targeted investments tied to his/her propensity to risk, the return requirements and market expectations of the underlying asset development. The investment certificates creation for every market scenario introduces its explicit strength. These products are created through the process of financial engineering, i.e. by combining underlining (usually a share in a company, a basket of shares, an entire index or different types of commodities, etc.) with the derivatives, often the option component (the classic vanilla and/or exotic option). In fact, using the options has become increasingly popular over the recent time. The most direct way of investing into commodities is by going through the futures markets. In this paper, we focus mainly on the commodity options, also known as the futures options. A future contract is a standardized contract, which represents a commitment to make or take the delivery of a spe-

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cific quantity and quality of a given commodity in the future. Also, it is valid, that futures on commodities are also often easier and more convenient to trade than the commodities themselves.

Generally, futures options are the conditional contracts. By buying a call/put futures option, the buyer (holder) acquires the right (but not the obligation) to buy/sell a futures contract at the fixed strike price (exercise price) at the time of the expiration of the option (the European style) or at any time within a specified expiration period of the option (the American style). For this right, he/she must pay a so-called option premium to the call/put option seller (writer). Commodity options are non-deliverable, i.e. without the physical delivery of the commodity. Therefore, there is only the cash settlement of the contract. Futures and futures options are traded side by side in the same exchange. The new generation of options, the exotic options, are profiled during the option development. Barrier options are a widely used class of the exotic options. They have the second strike price, named the barrier, trigger, or out-strike. If only the value of the commodity at the expiration date is significant for the resulting profit profile, then the vanilla options are used for the investment certificates formation. On the other hand, if the value of the commodity until time to expiration is significant, then the exotic options are used. Barrier options are also used on hedging. Hedging introduces the management of the price risk which purpose is to protect against an unfavourable price movement. Hedging of the commodity risk management is investigated in the paper (Taušer and Čajka 2014a) and hedging of the weather risk in the paper (Taušer and Čajka 2014b). Hedging by the means of options strategies using barrier options is discussed in the works Rusnáková and Šoltés (2012), Šoltés and Rusnáková (2012, 2013). Detailed descriptions of the classic vanilla and exotic options exist in the literature – Kolb (1995), Šoltés (2002), Zhang (1998) and Hull (2012).

The aim of this paper is to provide an analysis of new modified outperformance certificates in the agricultural market, i.e. the reverse outperformance and the capped reverse outperformance certificates, which are suitable in declining markets. We explore how are applied the principles of financial engineering to the structured products creation. It is shown, that they are formed by using the vanilla options; specifically the American style of call and put options. There are presented pricing formulas to these types of investment certificates by using the option pricing models. It is found that the issuance of these certificates is profitable for the issuers in certain conditions. Then several certificates on the soybean futures with various parameters are designed and analysed followed by the investigation of their profitability. We focus on the application of investment certificates with the soybean futures as an underlying asset, but the results are robust for various types of commodities. The approach is based on the soybean option contracts traded on the Chicago Board of Trade. Our findings help to raise the ability of retail investors to understand these sophisticated products constructions.

CHARACTERISTICS AND CREATION OF NEW MODIFIED OUTPERFORMANCE CERTIFICATES

At present, the large commercial banks are constantly offering new modified investment certificates in the financial market. For example in the papers Hernandez et al. (2011), Šoltés (2011), Hernandez et al. (2012), Rusnáková and Younis (2012), Gordiaková and Younis (2013), Younis and Rusnáková (2014) the authors analyse the construction of various types of investment certificates using the vanilla and/or exotic options.

This paper is focused on the reverse outperformance and the capped reverse outperformance certificates. These products are mentioned in the work (Löhr and Cremers 2007), but a detailed analysis has not yet been provided. The classic outperformance certificate was investigated by Hernandez et al. (2013). Its modification, the sprint (speed or double chance) certificate, its issue and the basic characteristics of parameters is dealt in Šoltés (2010). Following the mentioned studies, we realize a more comprehensive analysis.

The presented modified outperformance certificate, i.e. the reverse outperformance certificate, belongs to the group of participation investment certificates and its modification (the capped reverse outperformance certificate) belongs to the group of the yield enhancement investment products. All these certificates enable investors to participate at disproportionately higher (in the case of the capped certificate up to the cap level) from the price decreases of the underlying asset (soybean futures in our case). This participation rate (or the leverage more than 100%) increases investor's chances of making a profit to the direct investment in the underlying asset. The disproportionate chance

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is not associated with a higher risk. On the other hand, in the case of all reverse certificates the investor can incur a total loss of the invested capital if the underlying price rises above twice of the underlying starting price. Therefore, these types are suitable mainly when the markets are only falling.

Reverse outperformance certificate is in contrast to the classic outperformance certificate. The product offers investors an interesting investment opportunity when the underlying price is expected to be strongly falling. For this product, there are offered three possible payoffs at the maturity. If the underlying price at the maturity date is lower than the starting price, the investor participates disproportionately due to the participation factor in the negative performance of the underlying. If the underlying price at the maturity date is equal or larger than the starting price, the investor participates inversely in the positive performance of the underlying based on the starting price. However, if the underlying price is larger than twice of the starting price of the underlying, the investor incurs a total loss of his/her invested capital.

Let be the profit function of the reverse outperformance certificate with the starting price S_0, the selling price at any time within a specified expiration period S_t, the multiplier p, the participation rate m, the time to maturity t, the maturity date (or the expiration date) T, the nominal value of the certificate NV, where $NV = pS_0$ and with the fair value of the certificate k_0 is:

$$P(S_t) = \begin{cases} pm(S_0 - S_t) + NV - k_0 & \text{if } S_{0\le t\le T} < S_0 \\ p(S_0 - S_t) + NV - k_0 & \text{if } S_0 \le S_{0\le t\le T} < 2S_0 \\ -k_0 & \text{if } S_{0\le t\le T} \ge 2S_0 \end{cases} \quad (1)$$

Capped reverse outperformance certificate (or reverse sprint certificate) is a modification of the reverse outperformance certificate with a limited disproportional participation in the declining underlying price up to the cap (the cap level is set below the starting price of the underlying). This type is suitable mainly when underlying price is slightly falling. In this case, the participation rate is higher than the participation rate of the reverse outperformance certificate due to the cap level. The profit function of the capped reverse outperformance certificate with the starting price S_0, the selling price at any time within a specified expiration period S_t, the cap level C, the multiplier p, the participation rate m, time to maturity t, the maturity date (or the expiration date) T, the nominal value of the certificate NV, where $NV = pS_0$ and with the fair value of the certificate k_0 is:

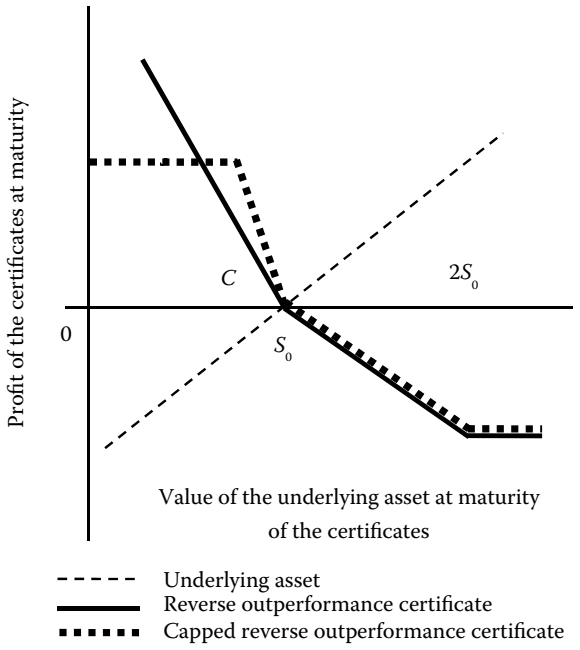

Figure 1. Profit functions of the modified outperformance certificates

Source: Own design

$$P(S_t) = \begin{cases} pm(S_0 - C) + NV - k_0 & \text{if } S_{0\le t\le T} \le C \\ pm(S_0 - S_t) + NV - k_0 & \text{if } C < S_{0\le t\le T} < S_0 \\ p(S_0 - S_t) + NV - k_0 & \text{if } S_0 \le S_{0\le t\le T} < 2S_0 \\ -k_0 & \text{if } S_{0\le t\le T} \ge 2S_0 \end{cases} \quad (2)$$

By assuming the characteristics and the profit function mentioned above, in the Figure 1 the investment strategy graphical representations of modified outperformance certificates suitable in declining markets at the maturity date are presented.

NATURE OF THE CREATION

Our question is how we can create these investment certificates. The profit of a **reverse outperformance certificate** (1) is equal to the profit from holding the following alternative portfolio:

a short position in the underlying asset with the starting price S_0, the selling price S_t, the multiplier p, time to maturity t, where $0 \le t \le T$ and the maturity date T

$$P_1(S_t) = p(S_0 - S_t) \quad (3)$$

a long position in the number of $(m - 1)$ put options on the underlying asset with the strike level referred

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to as the starting price S_0, the premium p_B for an option, the multiplier p and the time to maturity of the option t equals the time to maturity of the certificate t

$$P_2(S_t)=\begin{cases}-p(m-1)(S_t-S_0+p_B) & \text{if } S_{0\le t\le T}<S_0\\ -p(m-1)p_B & \text{if } S_{0\le t\le T}\ge S_0\end{cases} \quad (4)$$

a long position in the call options on the underlying asset with the strike level referred to as 2 the starting price $2S_0$, the premium c_B for an option, the multiplier p and the time to maturity of the option t equals the time to maturity of the certificate t

$$P_3(S_t)=\begin{cases}-pc_B & \text{if } S_{0\le t\le T}<2S_0\\ p(S_t-2S_0-c_B) & \text{if } S_{0\le t\le T}\ge 2S_0\end{cases} \quad (5)$$

The profit function at the future trade date t from the alternative investment portfolio expressed as the sum of the individual profit functions (3), (4) and (5) has the following form:

$$P(S_t)=\begin{cases}pm(S_0-S_t)-p(mp_B-p_B+c_B) & \text{if } S_{0\le t\le T}<S_0\\ p(S_0-S_t)-p(mp_B-p_B+c_B) & \text{if } S_0\le S_{0\le t\le T}<2S_0\\ -p(S_0+mp_B-p_B+c_B) & \text{if } S_{0\le t\le T}\ge 2S_0\end{cases} \quad (6)$$

If the fair value (the total cost) of the certificate

$$k_0 = p(S_0 + mp_B - p_B + c_B) \quad (7)$$

is met, then the profit function of the alternative portfolio (6) is identical to the profit function of the presented certificate (1). The issuer will be profitable at the issue date if any issue price of the reverse outperformance certificate B_0 is above the fair value of the certificate. The profit function for the issuer is

$$\Pi = B_0 - k_0 \quad (8)$$

Then the profitability is measured by the profit (Π) as a percentage of the fair value of the certificate (k_0), i.e.

$$profitability = \frac{\prod}{k_0}100\% = \frac{B_0-k_0}{k_0}100\% \quad (9)$$

The profit function of the **capped reverse outperformance certificate** (2) can be replicated as the profit from holding the alternative portfolio (3), (4), (5) and a short position in the number of m put options on the underlying asset with the lower strike level referred to as the cap level C, the premium p_S for an option, the multiplier p, the time to maturity of the option t equals the time to maturity of the certificate t

$$P_4(S_t)=\begin{cases}pm(S_t-C+p_S) & \text{if } S_{0\le t\le T}\le C\\ pmp_S & \text{if } S_{0\le t\le T}>C\end{cases} \quad (10)$$

If we want to create the capped reverse outperformance certificate with no initial costs, the further condition

$$mp_s = (m-1)p_B + c_B \quad (11)$$

would have to be met. Therefore, the option premium p_S should be sufficiently large. It is obvious that the option premium of the put option increases with increasing of the strike price. For that reason, if we require a higher multiplicity of profit, the cap level is nearer to the starting price.

The profit function from the alternative investment portfolio expressed as the sum of the individual profit functions (3), (4), (5) and (10) has the Equation (12).

Using the alternative investment (12), we have derived the profit function identical to the profit function of the capped reverse outperformance certificate (2) if the fair value of the certificate

$$k_0 = p(S_0 + m(p_B - p_S) - p_B + c_B) \quad (13)$$

is met. Any issue price B_0 of the capped reverse outperformance certificate above the fair value k_0:

$$B_0 > p(S_0 + m(p_B - p_S) - p_B + c_B) \quad (14)$$

is the gain to the certificate issuer. The profit function for the issuer is based on Equation (8) and his/her profitability on Equation (9).

With the capped reverse outperformance certificate, we can obtain the maximum profit $[m(S_0 - C)]$. Now we want to compare the profit from the capped reverse outperformance certificate with the simplest investment certificate, i.e. the reverse linear certificate which exactly replicates the inverse underlying asset development, therefore, we have to find the outperformance point (OP). The investment to this

$$P(S_t)=\begin{cases}pm(S_0-C)-p(m(p_B-p_S)-p_B+c_B) & \text{if } S_{0\le t\le T}\le C\\ pm(S_0-S_t)-p(m(p_B-p_S)-p_B+c_B) & \text{if } C<S_{0\le t\le T}<S_0\\ p(S_0-S_t)-p(m(p_B-p_S)-p_B+c_B) & \text{if } S_0\le S_{0\le t\le T}<2S_0\\ -p(S_0+m(p_B-p_S)-p_B+c_B) & \text{if } S_{0\le t\le T}\ge 2S_0\end{cases} \quad (12)$$

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Table 1. Construction of modified outperformance certificates suitable in declining markets

Reverse outperformance	Capped reverse outperformance
Short Underlying asset	Short Underlying asset
Long (m – 1) put	Short m put
Long call	Long (m – 1) put
	Long call

Source: Own design

certificate is profitable in comparison to the reverse linear certificate up to the outperformance point (OP) which is defined as

$$OP = mC - (m-1)S_0 \quad (15)$$

If the selling underlying price at the future trade date of the certificate S_t is lower than $mC-(m-1)S_0$, then the capped reverse outperformance certificate achieves a worse result than the reverse linear certificate on the same underlying asset.

The overview of the above certificates' construction is in the Table 1.

PRICING OF THE MODIFIED OUTPERFORMANCE CERTIFICATES

The fair value of the certificates can be calculated based on the value of the individual components, i.e. the value of an alternative portfolio as combination of an underlying asset position and positions in options. For example, Baule and Tallau (2011), Hernandez et al. (2013) deal with the problem of the valuation of the structured product. The fair value of the reverse outperformance certificate based on the value of the alternative portfolio is expressed by the Equation (7) and the fair value of the capped reverse outperformance certificate is expressed by (13).

Consequently, we need to obtain values of the vanilla positions. The theoretical price of the European vanilla call and the put option on the stocks without dividend is introduced in the work (Black and Scholes 1973). The modified Black-Scholes-Merton formula (Merton 1973) considers pricing of the options on stocks with dividends.

Black (1976) was the first who valuated the European futures options. The Black formula is similar to the Black-Scholes formula for valuing stock options except the spot price S of the underlying is replaced by a discounted futures price F. The model takes into consideration no financing costs related to a futures contract. These results give a lower option price than for a similar option on equity. The European call price c and the European put price p for a futures option are given by the equations:

$$c = e^{-rT}\left[F_0 N(d_1) - XN(d_2)\right] \quad (16)$$

$$p = e^{-rT}\left[XN(-d_2) - F_0 N(-d_1)\right] \quad (17)$$

where

$$d_1 = \frac{\ln\left(\frac{F_0}{X}\right) + \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}} \quad (18)$$

$$d_2 = \frac{\ln\left(\frac{F_0}{X}\right) - \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T} \quad (19)$$

$N(d_1)$ and $N(d_2)$ are the values of the standard normal cumulative distribution function. According to the Equations (16)–(19), the price of the call/put option is a function of the futures price of the underlying asset F, the strike price X, the constant implied volatility of returns of the underlying asset σ, the constant risk-free interest rate r and the time to maturity option T. Therefore, the change of some parameter has the influence to change the option price as well as the certificate price.

Options on futures are in practice mainly in the American style available from the CME Group (CME) and the Chicago Board Options Exchange (CBOE), where the options and futures trade. The American futures style option can be exercised early. Therefore, the prices of the American style options are higher than the prices of the European style options. The valuation of the American options on futures contracts is discussed in the work of Ramaswamy and Sundaresan (1985).

The implied volatility (σ) of the underlying asset returns is gained from Bloomberg and the risk-free rate of interest (r) is derived from the government bond yields (Bloomberg) having the term to maturity equal to the time of maturity of the certificate.

DESIGN OF NEW MODIFIED OUTPERFORMANCE CERTIFICATES

Let us assume that the investors (retail clients or large institutional investors) expect that the soybean

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Table 2. Soybean futures call and put option premiums ($/per bushel)

Call option premium	Strike	Put option premium
1.127	9.80	0.392
0.995	10.00	0.390
0.874	10.20	0.466
0.761	10.40	0.553
0.657	10.60	0.651
0.565	10.80	0.757
0.484	11.00	0.876
0.413	11.20	1.004
0.351	11.40	1.142
0.296	11.60	1.287
0.000	21.20	0.000

Source: CME Group

price is going to drop in the future (July 2015) but do not own the physical raw commodity. Investment certificates are one of the possibilities how to invest in commodities. Globalization connects all the markets, therefore, the issuers of new investment products use this fact. In our paper, we focus on the application of the investment certificates on the soybean futures, but the results are robust for various commodities.

In this section, we propose the reverse outperformance and capped reverse outperformance certificates on the soybean futures and perform the analysis of their profitability for to the investor at the future trade date *t*. The designed certificates being analysed and compared assume the soybean futures options prices quotes for July 2015 soybean contract traded on the Chicago Board of Trade (CBOT). The actual price from 9th December 2014 of the soybean futures is $10.60 per bushel. The option premiums for month July 2015 (expiration date 26th Jun 2015) soybean call and put options are in the Table 2. All data consist of the American style commodity options traded on the underlying futures contract and one soybean option contract size is 5000 bushels. For simplification, we consider the prices per bushel and assume the transaction cost of $0.

Table 3. Stylized data about new modified outperformance certificates

Key data	
Underlying asset	Soybean futures
Underlying price	$10.60/bushel
Issue date	9th December 2014
Expiration date	26th Jun 2015
Multiplier	1:10

Source: Own design

From the Bloomberg, we obtained the risk-free interest rates (0.14%) – the yields of the government bonds with a similar maturity as the options and the implied volatility (21.043%). The common stylized data about the certificates are in the Table 3.

We suppose that the issue price B_0 of the (capped) reverse outperformance certificates equals to the fair value k_0, i.e. the gain to the certificate issuer is zero.

Let us propose the reverse outperformance certificate. If we want to replicate the profit of the reverse outperformance certificate, we have to create a replicating portfolio as a combination of a short position in the soybean futures with the starting price $10.60 per bushel, a long position in the put option in the soybean futures with the strike level $10.60 per bushel, a leverage 200%, i.e. *m* equals 2, premium $0.651 per bushel for an option, maturity date 26th Jun 2015 and the long position in the call option in the soybean futures with the strike level $21.20 per bushel, premium $0 per bushel for an option, maturity date 26th Jun 2015. Then the profit function from the selling of the designed reverse outperformance certificate at the future trading date *t* based on (6) and the purchase price of this certificate k_0 based on (7) equals to $1.125 per bushel is represented by the following equation:

$$P(S_T) = \begin{cases} 2.055 - 0.2S_t & \text{if } S_{0\le t\le T} < 10.60 \\ 0.995 - 0.1S_t & \text{if } 10.60 \le S_{0\le t\le T} < 21.20 \\ -1.125 & \text{if } S_{0\le t\le T} \ge 21.20 \end{cases} \quad (20)$$

Let us propose the capped reverse outperformance certificate as a combination of a short position in the soybean futures with the starting price $10.60 per bushel, a short position in a greater amount of put option with the strike level equals the cap level $10.20 per bushel, the leverage 200%, i.e. *m* equals 2, premium $0.466 per bushel for an option, the maturity date 26th Jun 2015, a long position in a smaller amount of the put option in the soybeans futures with the strike level $10.60 per bushel, a leverage *m* equals 2, premium $0.651 per bushel for an option, maturity date 26th Jun 2015 and a long position in the call option in the soybean futures with strike level $21.20 per bushel, premium $0 per bushel for an option, maturity date 26th Jun 2015. The profit function from the selling of the proposed capped reverse outperformance cer-

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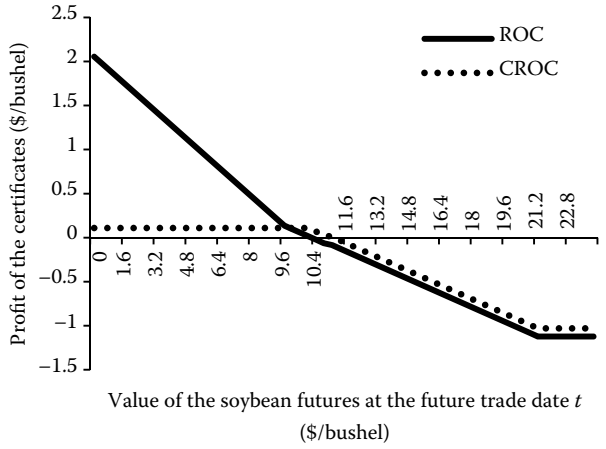

Figure 2. Profit from the proposed reverse outperformance and capped reverse outperformance certificate

Source: Own design

tificate at the future trade date t based on (12) and the purchase price of this certificate k_0 based on (13) equals to \$1.032 per bushel is as follows:

$$P(S_T) = \begin{cases} 0.108 & \text{if } S_{0\le t\le T} \le 10.20 \\ 2.148 - 0.2S_t & \text{if } 10.20 < S_{0\le t\le T} < 10.60 \\ 1.088 - 0.1S_t & \text{if } 10.60 \le S_{0\le t\le T} < 21.20 \\ -1.032 & \text{if } S_{0\le t\le T} \ge 21.20 \end{cases} \quad (21)$$

The comparison of profit from the proposed reverse outperformance (ROC) and the capped reverse outperformance (CROC) certificates on the soybean futures with the leverage 2 and the cap level \$10.20 per bushel depending on the soybean futures price's development at the future trade date t of the certificates is illustrated in the Figure 2. We compare the given investment certificates at the possible future scenarios of the soybean futures price's development and we give the recommendations for the potential investor. Figure 2 illustrates the results noted in the equations (20) and (21).

As it can be seen in the Figure 2, the reverse outperformance certificate makes a better profit for the investor if the soybean price is from the interval (0, 9.73) or the capped reverse outperformance certificate from the interval (9.73, 10.60) at the future trade date. As it was mentioned earlier, the starting price of soybean is \$10.60 per bushel. Therefore, the reverse outperformance certificate is suitable for an investor who expects only a strong decline in the soybean price and the capped reverse outperformance certificate in the case of a small decline. Otherwise, if the soybean price rises above the starting price \$10.60 per bushel, the investor makes a loss, but a lower loss is always in the case of the capped reverse outperformance certificate due to the lower purchase price. If the soybean price rises above \$21.20 per bushel, the investor makes a total loss of the invested capital at the future trade date for both certificates.

The cap level, leverage, multiplier and maturity date are specified at the time of issue. These parameters impact the investor's profit. Let us suppose various parameters, i.e. the 2 and 3, the cap level \$10.20 per bushel; \$10.00 per bushel and \$9.80 per bushel and let us calculate the potential investor's profit from the reverse outperformance and the capped reverse outperformance certificates on the soybean futures with the actual price \$10.60 per bushel and the issue date 9th December 2014. The relation between the issue profit change of the investor and parameters' change is detected using the proposed certificates but the results are generally valid considering the same change of the parameter. Data of the proposed

Table 4. Parameters of selected reverse outperformance (ROC) and capped reverse outperformance (CROC) certificates with the expiration date 26th Jun 2015 (\$/per bushel)

Denotation of investment certificate		Actual price S_0	Put option $p(S_0)$	Cap level (C)	Put option $p(C)$	Leverage (m)	Issue price
ROC	I_1	10.60	0.651	–	–	2	1.125
	I_2	10.60	0.651	–	–	3	1.190
CROC	I_3	10.60	0.651	10.20	0.466	2	1.032
	I_4	10.60	0.651	10.20	0.466	3	1.050
	I_5	10.60	0.651	10.00	0.390	2	1.047
	I_6	10.60	0.651	10.00	0.390	3	1.073
	I_7	10.60	0.651	9.80	0.322	2	1.061
	I_8	10.60	0.651	9.80	0.322	3	1.094

Source: Own design

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Table 5. Comparison of the investor's profit/loss (in $/bushel) of new outperformance certificates at the future trade date t

Intervals of the underlying price at future trade date	I_1		I_2		I_3		I_4		I_5		I_6		I_7		I_8	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
$S_t \leq 9.80$	0.095	2.055	0.110	3.050	0.108	0.108	0.130	0.130	0.133	0.133	0.167	0.167	0.159	0.159	0.206	0.206
$9.80 \leq S_t \leq 10.00$	0.055	0.095	0.050	0.110	0.108	0.108	0.130	0.130	0.133	0.133	0.167	0.167	0.119	0.159	0.146	0.206
$10.00 \leq S_t \leq 10.20$	0.015	0.055	–0.010	0.050	0.108	0.108	0.130	0.130	0.093	0.133	0.107	0.167	0.079	0.119	0.086	0.146
$10.20 \leq S_t \leq 10.60$	–0.065	0.015	–0.010	–0.130	0.028	0.108	0.010	0.130	0.013	0.093	–0.013	0.107	–0.001	0.079	–0.034	0.086
$10.60 \leq S_t \leq 21.20$	–0.065	–1.125	–0.130	–1.190	–1.032	0.028	–1.050	0.010	–1.047	0.013	–0.013	–1.073	–0.001	–1.061	–0.034	–1.094
$S_t \geq 21.20$	–1.125	–1.125	–1.190	–1.190	–1.032	–1.032	–1.050	–1.050	–1.047	–1.047	–1.073	–1.073	–1.061	–1.061	–1.094	–1.094

Source: own design

certificates with different parameters are summarized in the Table 4 and used for further analysis. In order to calculate the profit of the issuer, we also need the issue price (the fair value) of each certificate.

Let us look at the influence of two main parameters – the leverage m and in the case of the capped certificate, the cap level C on the reverse outperformance's price (I_1–I_2) and the capped reverse outperformance (I_3–I_8) certificates. Our results show a positive influence of the leverage m on the price of both certificates, i.e. the growth of the leverage m causes the growth of the issue price and vice versa. In the case of the cap level, there is a negative influence on the capped certificates issue price (I_3–I_5–I_7; I_4–I_6–I_8), i.e. if the cap level is nearer to the actual price S_0, the issue prices of the capped certificates are lower and vice versa, as we can see in the Table 4.

Finally, we evaluate the profitability analysis (the minimum (min) and maximum (max) profit/loss) of the reverse outperformance certificates (I_1–I_2) and the capped reverse outperformance certificates (I_3–I_8) for different parameters of the leverage and the cap level from the investor' point of view. The complete profitability analysis for the selected intervals of the price at the future trade date t is in the Table 5.

The results indicate that the reverse outperformance and the capped reverse outperformance certificates may generate the maximum profit. Although it appears that the reverse outperformance gives a higher maximum profit, in practice there is an improbability of falling soybean price at zero. If the soybean price at the future trade date drops below $9.734 per bushel, i.e. from the interval (0, 9.734), then the reverse outperformance certificate I_2 ensures the highest profit, but also a higher loss in the case of an unfavourable development from the interval (10.60, 21.20) in comparison to other certificates. If the soybean price at the future trade date is above $10.60 per bushel, then the loss of all certificates (I_1–I_8) increases proportionally with the growth of the soybean price, but the loss is limited by the purchase price of certificates.

Based on the performed analysis and comparison of certificates, we reach the following findings. If the investor expects a bigger decrease in the underlying price, he/she should choose the certificates without cap and with the higher leverage. If there is expected only a smaller decrease in the underlying price, then the capped reverse outperformance certificates are recommended. Further, we can conclude that the certificates with lower cap levels (further to the starting price) are more expensive in comparison

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to those having the higher cap level (nearer to the starting price). This is due to the fact that in the first case, the investor can participate longer on the decrease of the soybean price as in the second case. Therefore, it is important to select the certificate with the most appropriate parameters based on the investor's expectation of the underlying price development.

CONCLUSION

This paper oriented on the segment of modern structured products presents a proposal of new outperformance certificates in the agricultural market, i.e. the reverse outperformance and the capped reverse outperformance certificate. This segment has been gaining in popularity and is going through a continuous boom again. Structured products can provide an increased diversification for the client portfolios. Due to the inclusion of the derivative component, it gives the structured product itself the characteristics of a derivative. They allow the investor to maximise his/her portfolio return while keeping the risks under control.

The paper is based on the analytical approach of the profit functions of the certificates in the agricultural market. These profit functions have been replicated as a combination of the vanilla options together with the position in the underlying asset. We assume certain conditions for the alternative portfolios in order to show that the profit functions of these alternative investment opportunities are equal to the profit functions of the proposed certificates. The practical application, i.e. the presentation, analysis and comparison of these newly designed certificates has been performed on the agricultural commodity – the soybean futures. The analysis of profitability to the investor in the modified outperformance certificates has allowed to quantify the price intervals resulting in the profit or loss of the potential investor at the future trade date. We focus on the application of investment certificates with the soybean futures as an underlying asset, but the results are robust for various types of commodities.

This analysis was made with the objective to contribute to the intellectualization of an investor. From the methodological point of view, our analysis can serve as an inspiration for a further structured products formation using others types of options and underlying assets.

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