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INVESTING BASED ON AGRICULTURAL STRUCTURED PRODUCTS

The paper deals with investing in agriculture based on structured products, which gains an important position in international investment for both institutional and retail investors. The aim of the paper is to present the proposal of two new types of investment certificates, i.e. Twin-Win Outperformance certificates and Capped Twin-Win Outperformance certificates, which belong to the segment of partially guaranteed investment tools due to a security buffer. The advantage the proposed certificates lies in the combination of the features of two certificates into one product. The certificates are described in an analytical form of the profit functions which are derived based on two components, i.e. the underlying asset and the derivative (used European call options and down and knock-out put barrier options) on its underlying asset. The pricing formulas are developed with a specification of the issue price sensitivity on changes in different input parameters. Opportunities to invest in these proposed certificates are being demonstrated in the agricultural market, i.e. Teucrium Corn Fund ETF, where various variants of these certificates are created based on different level of included parameters. The best results are performed with the objective to increasing of the intellectualization of all potential investors in investing to agriculture using corn futures.

Keywords: *Agricultural commodity, structured product, investment certificate, vanilla option, barrier option, corn futures*

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1. INTRODUCTION

Investing in the agricultural sector can provide numerous benefits. The prices of commodities tend to move in opposition to stocks therefore they are one way how to diversify a portfolio beyond traditional securities. Active direct trading in the commodity market was very complicated for ordinary people, so today there are investment opportunities that are also available to retail clients, such as mutual funds, or new instruments such as derivatives and structured products. In the agricultural sector, grains can be very volatile during the summer months or during any period of weather-related transitions. Several studies deal with this issue such as (Rondinone & Thomasz 2016) who test the sensitivity of agricultural commodities (soybeans and corn) against shocks in the interest rate. For example, weather derivatives in the agricultural sector can be used to hedge their purchasing or selling price of the commodities in the case of a change in temperature (Bobriková, 2016).

For investors interested in the agricultural sector, population growth combined with limited agricultural supply can provide profit opportunities from rising agricultural commodity prices. There are several ways how to invest in agriculture such as buying ETF's exposed to futures, futures, stock tracking ETF's, individual stocks, structured products or invest directly (Balarie, 2007). For example, Lohiya (2019) deals with the trade on agricultural derivatives markets with the aim to explain and develop comprehensively the portfolio management techniques while trading volatility as an asset class in agricultural markets. Some authors compare structured products to gambling (such as Abreu and Mendes (2018)) and examine the actual trading behaviour of investors to the structured retail products (such as Breuer and Perst, (2007); Das and Statman (2013)).

Structured product consists of packaging basic asset together with derivatives. Manufacturers, i.e. structurers, i.e. issuers are usually banks. Structured products can be designed so that such client, i.e. investor in these products, can take positions according to its views in a convenient way. Any payoff structure desired by an investor can be constructed through financial engineering. The payoff of a structured product linked to the performance of an option or other derivative instrument on some underlying asset (to be referred to as UA henceforth). The UA can be any of the following as a stock, a commodity, an index, an interest rate or a combination of any of mentioned. The advantage of structured products is in the ability to profit from the upside, stagnant or downside performance of UA at the future date (i.e. maturity date or delivery date) depending on the features of the investment and their use in international scale. Therefore, there can be created different risk and return profiles of given products for investors based on their preference of risk propensity at the prevailing market conditions. More informa-

tion about structured products can be found in several studies such as (Bluemke, 2009) or (Knop, 2007).

According to Bloomberg, the total structured product market accounted for over \$7 trillion in invested assets. In an environment of tighter credit conditions, very low interest rates, and elevated equity volatility, institutional and retail investors are searching for products that deliver dependable yield while also providing features such as capital protection, leverage, reduced portfolio risk exposures, and access to new markets and diverse asset classes. Global usage is extremely country specific and has to do with the needs of the local client base, which will be based on the state of the interest rate market, the currency market and the equity market. Structured products find their most advanced usage in Europe, Singapore and Hong Kong. When we look at the USA, structured products usage is not quite as advanced as it is in Europe and APAC. In the USA there is the fixed income market much bigger than the equity market. But about 80% of structured products are based in equities. This means there is a lot of room for the market to grow in the USA.

Investment certificates build in the views held by the clients represent the biggest part of structured products and offer investors a wide range of investment options in various types of assets. Index, guaranteed (Gordíaková & Younis, 2013), bonus (Younis & Rusnáková, 2014), discount (Entrop & Fischer & McKenzie & Wilkens & Winkler, 2016), express (Hernández & Tobler & Brusa, 2010), outperformance (Hernández & Lee & Liu & Dai, 2013; Harčariková, 2015) or leverage (Entrop & Scholz & Wilkens, 2009; Rossetto & Bommel, 2009) certificates are gaining more and more popularity, even among small investors, as evidenced by the ever-increasing number of issues, as well as the volume of trades in these securities.

On the basis of the existing studies mentioned above, we will proceed to the proposal of new modifications of investment certificates specifically Twin-Win Outperformance and Capped Twin-Win Outperformance certificates, in the agricultural market and to demonstrate the nature of these products' design through the financial engineering using option strategies. Our proposal of certificates combines two advantages into one product, i.e. the investor can earn disproportionately in the case of the upside participation of UA based on the use of leverage (feature of Outperformance certificates), but can also earn in the case of downside participation of UA price in the ratio of 1:1, unless the barrier level has been broken (feature of Twin-Win certificates). After breaking the barrier level during the maturity period, this protection is deactivated, then the investor participates in the loss when the price of UA falls. In the case of capped certificates, i.e. Capped Twin-Win Outperformance certificates, the investor has limited profit only up to the cap level.

Application is showed on Teucrium Corn Fund ETF with the demonstration of pricing formulas and the discovery of factors which influence on the issue price.

Our research can provide an inspiration of the design of additional types of these products for international issuers. These findings should also help investors with an understanding of the nature of these products. Application of these certificates is possible for various financial asset classes, such as a basket of shares, indexes or foreign currency, the use of which may be widened in the scientific area, market practitioners, issuers and investors. Structured products offer enhancement returns but their payoff often involve complex option positions and clients may not have knowledge such risk they handle. Therefore, clients who decide to invest in structured products must first consider whether this tool meets their knowledge and experience, investment goals and investment horizon.

2. METHODOLOGY AND DATA

The creation of structured products is based on the combination of UA and derivative tool, mainly options and different option strategies. Options form an important basis for any structured products. Due to this fact, the methodology of the paper is based on these instruments.

Options belong to the conditional contracts with the possibility of buying or selling an underlying asset between two parties. The option buyer (or holder) buys the right (not obligation) to buy/sell an underlying asset at the fixed strike price (or exercise price) at the expiry date (or maturity date) of option (European style) or at any time within a specified expiration period of option (American style). For this right, the option buyer must pay option premium to the call/put option seller (or writer). In this case, there is no physical delivery of an underlying asset but only cash settlement of the contract (Kolb & Overdahl, 2003).

Barrier options are one type of exotic options which are similar to standard vanilla options with vital differences. According to Hull (2015) a barrier option's payoff depends on two price levels, i.e. the strike price and the barrier level. The barrier level can be set UP or DOWN of the actual spot price and can be activated if the barrier level is reached (IN) or not reached (OUT), also valid for call/put option. The use of selected options in structured products creation depends on two factors. If the value of an underlying asset at the maturity date is significant for the resulting profit profile, then the use of vanilla options is needed or if the value of an underlying asset until time to maturity date is significant, then the use of exotic options (mainly barrier options) are needed.

In general commodities are bought and sold through standardized futures contracts on several exchanges. The best known and oldest exchange is the Chicago

Board of Trade (CBOT), where traders can buy futures on common agricultural commodities such as wheat, corn, oats, rice, soybeans and more. According to Jil-ek (2010) futures contract is a standardized legal agreement to buy or sell a standardized asset at a predetermined price at a specified time in the future between two parties through a futures exchange. Futures contracts allow traders to buy and sell commodities without the need for storage, allowing speculators to be part of the market. For example, corn futures contracts are traded in bushels (standardized quantity as 5,000 bushels). Commodities typically behave differently than other asset classes and can help enhance portfolio diversification. Purankar and Singh (2017) explore whether the inclusion of agriculture commodity futures contracts can provide higher degree of portfolio diversification in the short and long-term relationship.

This paper deals with the construction of 2 types investment certificates, i.e. Twin-Win Outperformance (referred as TWO) and Capped Twin-Win Outperformance (referred as CTWO) using the analytical expression of the profit functions of classic vanilla call and barrier down and knock-out put options. The fair value of the investment certificate is calculated based on individual components of an alternative portfolio, i.e. the underlying asset and options.

The analytical expression of the profit function of the alternative portfolio for Twin-Win Outperformance certificate is created by a combination:

- buying of the UA, where S_T is the spot price at the maturity trade date T and S_0 is the spot price at the initial date:

$$P_1(S_T) = S_T - S_0, \quad (1)$$

- buying 2 down and knock-out put options with the strike price S_0 , lower barrier D and option premium p_{1BDO} is

$$P_2(S_T) = \begin{cases} -2p_{1BDO} & \text{if } \min_{0 \leq t \leq T}(S_t) \leq D \wedge S_T < S_0, \\ -2(S_T - S_0 + p_{1BDO}) & \text{if } \min_{0 \leq t \leq T}(S_t) > D \wedge S_T < S_0, \\ -2p_{1BDO} & \text{if } S_T \geq S_0, \end{cases} \quad (2)$$

- and by buying $(m-1)$ of call options with the strike price S_0 and option premium c_{2B} , where m is the participation factor:

$$P_3(S_T) = \begin{cases} -(m-1)c_{2B} & \text{if } S_T < S_0, \\ (m-1)(S_T - S_0 - c_{2B}) & \text{if } S_T \geq S_0. \end{cases} \quad (3)$$

Then profit function of Twin-Win Outperformance certificate based on the combination (1), (2) and (3) is:

$$P(S_T) = \begin{cases} S_T - S_0 - 2p_{1BDO} - (m-1)c_{2B} & \text{if } \min_{0 \leq t \leq T}(S_t) \leq D \wedge S_T < S_0, \\ -S_T + S_0 - p_{1BDO} + (m-1)c_{2B} & \text{if } \min_{0 \leq t \leq T}(S_t) > D \wedge S_T < S_0, \\ m(S_T - S_0) + S_0 - S_0 - 2p_{1BDO} - (m-1)c_{2B} & \text{if } S_T \geq S_0. \end{cases} \quad (4)$$

After that the fair (or purchasing) price of TWO is:

$$S_0 + 2p_{1BDO} + (m-1)c_{2B}. \quad (5)$$

The second certificate, i.e. Capped Twin-Win Outperformance certificate, is created by a combination (1), (2), (3) and

- by selling m of call options with the strike price C (cap level) and option premium c_{3S} is

$$P_3(S_T) = \begin{cases} mc_{3S} & \text{if } S_T < C, \\ -m(S_T - C - c_{3S}) & \text{if } S_T \geq C. \end{cases} \quad (6)$$

Then profit function of Capped Twin-Win Outperformance certificate based on the combination (1), (2), (3) and (6) is:

$$P(S_T) = \begin{cases} S_T - S_0 - 2p_{1BDO} - (m-1)c_{2B} + mc_{3S} & \text{if } \min_{0 \leq t \leq T}(S_t) \leq D \wedge S_T < S_0, \\ -S_T + S_0 - 2p_{1BDO} - (m-1)c_{2B} + mc_{3S} & \text{if } \min_{0 \leq t \leq T}(S_t) > D \wedge S_T < S_0, \\ m(S_T - S_0) + S_0 - S_0 - 2p_{1BDO} - (m-1)c_{2B} + mc_{3S} & \text{if } S_0 \leq S_T < C. \\ m(C - S_0) + S_0 - S_0 - 2p_{1BDO} - (m-1)c_{2B} + mc_{3S} & \text{if } S_T \geq C. \end{cases} \quad (7)$$

After that the fair (or purchasing) price of CTWO is:

$$S_0 + 2p_{1BDO} + (m-1)c_{2B} - mc_{3S} \quad (8)$$

Any issue price of the designed certificate above the fair value (purchasing price) is the gain to the certificate issuer.

The valuation of structured products is discussed by many authors such as Henderson and Pearson (2011) or Wilkens, Erner & Roder (2003). Specific the bonus certificates pricing is investigated by Baule and Tallau (2011) and the out-performance certificates pricing is introduced by Hernandez et al. (2013). On the

other hand, Wilkens and Stoimenov (2007) have described the empirical analysis of long and short index certificates pricing in the German market.

The valuation of investment certificate is based on valuation of the individual tools of the given product, mainly based on options pricing models. Our designed certificates, i.e. TWO and CTWO certificates, are evaluated using the relation of (5) and (8).

Theoretical prices of European vanilla call and put options on the stocks without dividends are introduced by Black and Scholes (1973) and on the stocks with dividends by Merton (1973). Later Black (1976) derived relation for European futures options with the possibility of application on all commodities. Barrier options represent the modification of vanilla option due to next factor, i.e. barrier level. Barrier options are traded on the OTC markets which are not publicly available. In this case Merton (1973) modified Black-Scholes model valid for European down and knock-out call option price, Rubinstein and Reiner (1991) applied on 8 basic types of barrier options and Haug (1997) on all 16 types of standard European barrier options. Also, Rich (1994) derived a mathematical structure of barrier options value.

Factors that can affect the pricing of an option component include expected dividends of UA, correlation of UAs if there are more than one, time to expiration, market interest rates, the option's strike price and the implied volatility of UA. For the aims of our analysis, there are used real vanilla options data. Barrier options prices are calculated with the implementation in statistical program R.

In this paper we focus mainly on options, i.e. vanilla and barrier options on ETF's corn futures contracts used on structured products creation. The proposed certificates are applied indirectly to the agricultural commodity, i.e. the Teucrium Corn Fund ETF (CORN) with the issue date 1st June 2020 at actual issue price USD 12.04. The Teucrium Corn Fund ETF (CORN) provides investors an easy way to gain on the price of corn futures. Corn is one of the most important agricultural commodities, used throughout the global economy. This fund is designed to provide investors with a cost-effective means to gain price exposure to the corn market for future delivery and its shares are traded on the NYSE Arca stock exchange. The common stylized data about the proposed certificates we can see in the Table 1.

Table 1:

KEY INFORMATION ABOUT DESIGNED CERTIFICATES.

Underlying asset	Issue date	Issue price	Maturity date	Multiplier	Historical volatility	Dividends
Teucrium Corn Fund (CORN)	1st June 2020	12.04 USD	21st January 2022	1:1	16.78%	-

Source: processed based on data from Yahoo Finance (2020)

There are used real traded European vanilla options on CORN gained from Yahoo Finance (2020). Due to the trading of barrier options on OTC markets, we proceeded to the calculations of barrier options, in our case of down and knock-out put options. There are necessary data about the strike prices, the barrier levels, the cap levels, the leverages, the expiration period (1.64 year), the risk-free interest rate (based on the yield of government bond, level of 0.17%) and the historical volatility (level of 16.78%). Parameters as the barrier level, the cap level and the leverage are selected by the author and specified at the issue time. Due to simplifications, we assume transactions cost of USD 0 and the issuer's profit is zero, i.e. theoretical issue price is equal the purchased price of given certificates.

3. RESULTS AND DISCUSSION

Proposed certificates have a barrier (referred as B), set at the level USD 6; USD 8 and USD 10, while the monitoring of barrier is continuous during the whole time up to maturity date 21st January 2022. Leverage (referred as m) is considered at the level of 2 and 3. In the case of Capped Outperformance Twin-Win certificate, the cap (referred as C) is set at the level of USD 15; USD 18 and USD 20.

These parameters impact on issue price and the investor's profit. We consider the purchase of 1 certificate. Data of all designed certificates with considered parameters are summarized in Table 2.

Table 2:

PARAMETERS OF SELECTED TWO AND CTWO CERTIFICATES
IN USD PRE 1 CERTIFICATE) WITH THE MATURITY DATE
21ST JANUARY 2022.

Denotation of investment certificate	Barrier	Actual price	Put barrier option	Call option	Cap level	Call option	Lever- age	Issue price
	B	S_0	$P_{DO}(S_0)$	$c(S_0)$	C	$c(C)$	m	k_0
TWO_1	6	12.04	1.002	1.90	-	-	2	15.04
TWO_2	6	12.04	1.002	1.90	-	-	3	16.04
TWO_3	8	12.04	0.783	1.90	-	-	2	14.61
TWO_4	8	12.04	0.783	1.90	-	-	3	15.61
TWO_5	10	12.04	0.120	1.90	-	-	2	13.28
TWO_6	10	12.04	0.120	1.90	-	-	3	14.28
CTWO_1	6	12.04	1.002	1.90	15	0.89	2	12.79
CTWO_2	6	12.04	1.002	1.90	18	0.70	2	13.17
CTWO_3	6	12.04	1.002	1.90	20	0.55	2	13.47
CTWO_4	6	12.04	1.002	1.90	15	0.89	3	12.43
CTWO_5	6	12.04	1.002	1.90	18	0.70	3	13.00
CTWO_6	6	12.04	1.002	1.90	20	0.55	3	13.45
CTWO_7	8	12.04	0.783	1.90	15	0.89	2	12.35
CTWO_8	8	12.04	0.783	1.90	18	0.70	2	12.73
CTWO_9	8	12.04	0.783	1.90	20	0.55	2	13.03
CTWO_10	8	12.04	0.783	1.90	15	0.89	3	11.99
CTWO_11	8	12.04	0.783	1.90	18	0.70	3	12.56
CTWO_12	8	12.04	0.783	1.90	20	0.55	3	13.01
CTWO_13	10	12.04	0.120	1.90	15	0.89	2	11.03
CTWO_14	10	12.04	0.120	1.90	18	0.70	2	11.41
CTWO_15	10	12.04	0.120	1.90	20	0.55	2	11.71
CTWO_16	10	12.04	0.120	1.90	15	0.89	3	10.66
CTWO_17	10	12.04	0.120	1.90	18	0.70	3	11.23
CTWO_18	10	12.04	0.120	1.90	20	0.55	3	11.68

Source: own research

Based on the results from Table 2, there is possible to determine parameters which influence on the issue price of designed certificates. There was identified parameters as the barrier level B , the leverage m and the cap level C (valid for capped certificates). Our results indicate negative relationship of the barrier level (variants

TWO_1-TWO_3; CTWO_1-CTWO_7) on the certificates issue price, i.e. the higher the barrier level (closer to the actual spot price S_0) is, the lower the issue price is and vice versa. The cap level (variants CTWO_1-CTWO_2-CTWO_3) and also the leverage (variants TWO_1-TWO_2; CTWO_1-CTWO_4) influence positive on the issue price of the certificates if other parameters remain unchanged. The higher the cap level or the leverage is, the higher the issue price is and vice versa.

For illustration we consider designed certificates with the barrier level USD 8 and 10, the leverage 2 and 3 and for capped certificate, the cap level is USD 15 and 20. The profit profile of TWO is based on the relation (4) and CTWO on relation (7) where different scenarios of UA price development at the maturity date are considered. We compare these certificates with linear certificate (referred as LC henceforth) while the results of illustrated certificates are showed in Table 3 and Table 4.

Table 3:

THE PROFIT PROFILE OF SELECTED DESIGNED TWO AND LC
 AT THE MATURITY DATE (21STJANUARY 2022).

Scenarios of UA price development at the maturity date	LC	TWO_3	TWO_4	TWO_5
$if \min(S_T) < 8 \wedge S_T < 12.04$	$S_T - 12.04$	$S_T - 15.51$	$S_T - 17.41$	-
$if \min(S_T) > 8 \wedge S_T < 12.04$	$S_T - 12.04$	$- S_T + 8.57$	$- S_T + 6.67$	-
$if \min(S_T) < 10 \wedge S_T < 12.04$	$S_T - 12.04$	-	-	$S_T - 14.18$
$if \min(S_T) > 10 \wedge S_T < 12.04$	$S_T - 12.04$	-	-	$- S_T + 9.90$
$if S_T > 12.04$	$S_T - 12.04$	$2S_T - 27.55$	$3S_T - 41.49$	$2S_T - 26.22$

Source: own research

Table 4:

THE PROFIT PROFILE OF SELECTED DESIGNED CTWO
AT THE MATURITY DATE (21ST JANUARY 2022).

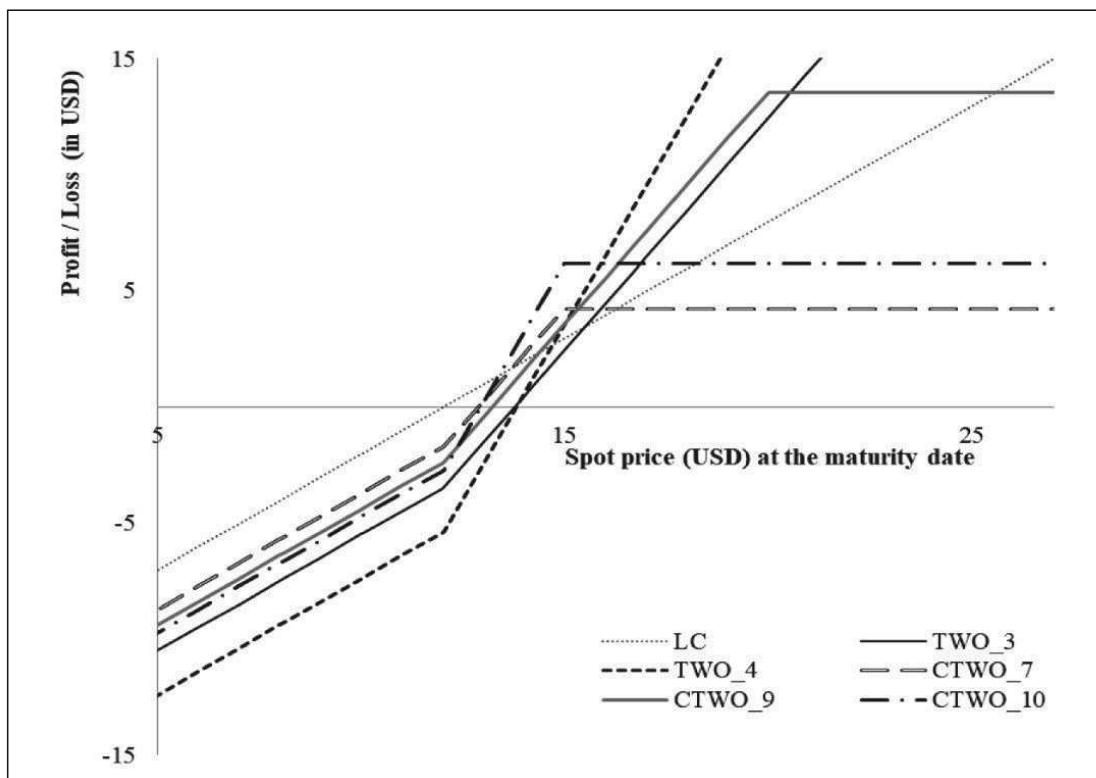
Scenarios of UA price development at the maturity date	CTWO_7	CTWO_9	CTWO_10	CTWO_13
$if \min(S_T) < 8 \wedge S_T < 12.04$	$S_T - 13.73$	$S_T - 14.41$	$S_T - 14.47$	-
$if \min(S_T) > 8 \wedge S_T < 12.04$	$-S_T + 10.35$	$-S_T + 9.67$	$-S_T + 9.34$	-
$if \min(S_T) < 10 \wedge S_T < 12.04$	-	-	-	$S_T - 12.40$
$if \min(S_T) > 10 \wedge S_T < 12.04$	-	-	-	$-S_T + 11.68$
$if 12.04 < S_T < 15$	$2S_T - 25.77$	-	$3S_T - 38.82$	$2S_T - 24.44$
$if S_T > 15$	4.23	-	6.18	5.56
$if 12.04 < S_T < 20$	-	$2S_T - 26.45$	-	-
$if S_T > 20$	-	13.55	-	-

Source: own research

For easier expression of the results from Table 3 and 4, the graphical comparison of designed certificates is illustrated in Figure 1 for the case of the barrier level is reached and in Figure 2 for the case of the barrier level is not reached. Only chosen certificates from Table 3 and 4. are presented graphically.

Figure 1:

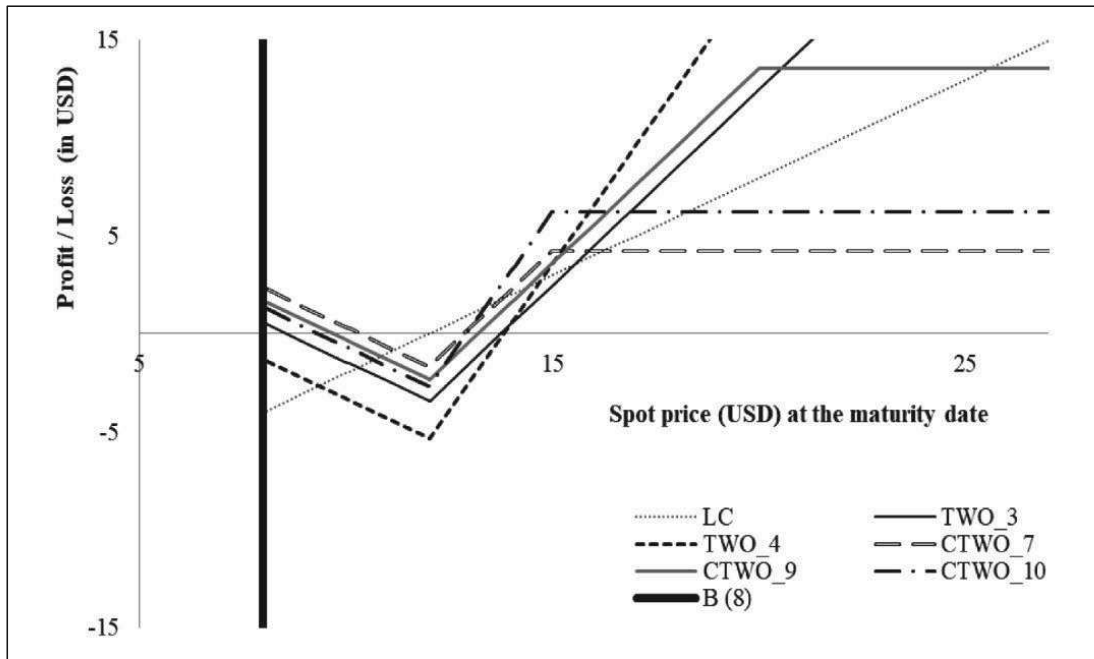
PROFIT/LOSS (IN USD PER 1 CERTIFICATE) FROM THE PROPOSED TWO, CTWO AND LC AT THE MATURITY DATE IF THE BARRIER LEVEL IS REACHED DURING TIME TO MATURITY.



Source: Own design

Figure 2:

PROFIT/LOSS (IN USD PER 1 CERTIFICATE) FROM THE PROPOSED TWO, CTWO AND LC AT THE MATURITY DATE IF THE BARRIER LEVEL IS NOT REACHED DURING TIME TO MATURITY.



Source: Own design

The results show that the profit, resp. the loss from our designed certificates depends on the development of CORN at the maturity date, as well as during the whole observed period. Maximum loss is limited by the purchasing price of given certificate. It is important to observe whether the barrier level has been crossed or not during the maturity period. The results from Figure 1 and 2 indicate if the barrier level is reached during time to maturity (the security buffer is cancelled) and the CORN price at the maturity date is under USD 13.39, i.e. from the interval USD (0; 13.39), then LC ensures the lowest loss up to the CORN price USD 12.04. From this level of price LC is profitable. CTWO₁₀ certificate ensures higher profit for the CORN price interval USD (13.39; 15.89), but this certificate is limited by maximum profit in the amount of USD 6.18 per certificate. On the other hand, if the CORN price is from interval USD (15.89; ∞) at the maturity date, TWO₄ certificate appears as the better certificate for investors because the profit from this certificate will grow 3 times compared to LC development (it is valid if the

CORN price rises, so the profit will rise). However, if the barrier level (USD 8) has not been crossed during time to maturity and CORN price drops under the level of USD 11.2, i.e. interval USD (8; 11.2), then CTWO_7 certificate ensures the profit that is declining to the level of USD 10.35, then the loss will grow to the level of USD 11.2. If the CORN price is in interval of USD (11.2; 13.39), then LC is better variant for investment, otherwise CTWO_10 is better in interval of USD (13.39; 15.89). In the case, if CORN price rises significant above USD 15.89, TWO_4 certificate is the best variant for investment due to higher leverage.

For certificates without a cap and with different levels of barrier level is valid, if there is a sharp drop below the barrier level and the CORN price is in the range of USD (0; 14.18) at maturity date, LC is the best option because ensures the lowest loss up to the level of USD 12.04. From this level it will provide us with a profit. The loss from investing in our designed certificates will increase with a decrease in the CORN price. Subsequently, in the case of an increase in the CORN price, i.e. interval USD (14.18; 15.27), TWO_5 (the barrier level is closer to S_0) is the best certificate and TWO_4 (the higher leverage) is the best variant, if the CORN price is above USD 15.27, whose profit will increase 3 times as LC. The most ideal situation is, if the barrier level is not exceeded and the CORN price drops but is above the level of the given barrier level, then the proposed certificates are better than LC, valid for TWO_3 USD (8; 10.31), TWO_4 USD (8; 9.36) and for TWO_5 USD (10; 10.97). Conversely, TWO_3 USD (15.51; ∞), TWO_4 USD (14.72; ∞) and TWO_5 USD (14.18; ∞) certificates are better than LC for the case of the CORN price increase.

Our results indicate that cap certificates appear as a better opportunity to invest, but only if we do not expect a strong drop below the barrier level and at the same time strong rise above the cap level, which represents the achievement of the maximum profit. If the barrier level is exceeded during the maturity period and the CORN price drops, i.e. the level of USD (0; 13.39), LC brings us the smallest loss. CTWO_10 certificate is more profitable in the range of USD (13.39; 16.32) and with a strong rise of CORN price, i.e. above USD 16.32 is the best investing in the CTWO_9 certificate. On the other hand, if the barrier is not exceeded, then the proposed cap certificates are profitable compared to LC in cases of namely CTWO_7 certificate for level of USD (8; 11.20) and level of USD (13.73; ∞), for CTWO_9 certificate levels of USD (8; 10.86) and USD (14.41; ∞), for CTWO_10 certificate levels of USD (8; 10.69) and USD (13.39; ∞) and for CTWO_13 certificate levels of USD (10; 11.86) and USD (12.40; ∞). In the case of a slight decrease, CTWO_7 is the most ideal certificate, but only up to the level of USD 11.20, where it is followed by LC in the range of USD (11.20; 13.39). CTWO_10 certificate is more profitable for the strong rise of the CORN price, i.e. in the range of USD (13.39; 16.32). CTWO_9 certificate is better for the range of USD (16.32; 25.59),

which reaches the maximum profit at the level of USD 13.55. And even with the more than double increase of the CORN price (i.e. above USD 25.59), LC has a higher profit than all designed certificates.

In this part the evaluation of the profitability analysis is presented from investor's point of view. We consider with some level of the percentage change of CORN price at the maturity date (21st January 2022) in comparison to the actual spot price S_0 . Table 5 shows the findings of the best certificate for potential investors according to their expectations valid only for selected proposed certificates. Results indicate that if the CORN price is at the level of the actual spot price 0% (USD 12.04), investors make a loss from proposed certificates (the highest loss from the holding of TWO_3 certificate). Due to the security buffer (barrier level) the issue price of proposed certificates is higher. In the case of slightly drop only CTWO certificates are profitable which is associated with lower costs for their creation. These new certificates appear as a profitable investment, however it is not always true. The choice of certificates depends on the right positioning of the parameters as barrier level, leverage and cap level. In this case investor makes a profit if CORN price drops about 5% – 15% from the actual price (valid for CTWO_13 certificate) and 15% – 30% from the actual price (valid for CTWO_7 certificate) or if CORN price increases more than 5% from the actual price (valid for CTWO_13 certificate), 10% from the actual price (valid for CTWO_7 certificate) and 15% from the actual price (valid for TWO_3 certificate). In general, there is valid that maximum loss is limited by the certificate's purchase price and for cap certificates is limited maximum profit by the cap level.

Table 5:

COMPARISON OF THE INVESTOR'S P/L (IN USD/PER 1 CERTIFICATE)
 OF NEW TWO AND CTWO CERTIFICATES ON DIFFERENT
 PERCENTAGE CHANGES OF CORN AT THE MATURITY DATE
 21ST JANUARY 2022.

% change of CORN in comparison to actual price	TWO_3		CTWO_7		CTWO_13		LC (P/L in USD)
	P/L (in USD) if <i>B</i> is reached	P/L (in USD) if <i>B</i> is not reached	P/L (in USD) if <i>B</i> is reached	P/L (in USD) if <i>B</i> is not reached	P/L (in USD) if <i>B</i> is reached	P/L (in USD) if <i>B</i> is not reached	
-50%	-9.49	-	-7.71	-	-6.38	-	-6.02
-30%	-7.08	0.15	-5.30	1.93	-3.97	-	-3.61
-15%	-5.27	-1.66	-3.49	0.12	-2.17	1.45	-1.81
-10%	-4.67	-2.26	-2.89	-0.48	-1.56	0.84	-1.20
-5%	-4.07	-2.86	-2.29	-1.08	-0.96	0.24	-0.60
0%	-3.47	-3.47	-1.69	-1.69	-0.36	-0.36	0.00
5%	-2.26	-2.26	-0.48	-0.48	0.84	0.84	0.60
10%	-1.06	-1.06	0.72	0.72	2.05	2.05	1.20
15%	0.15	0.15	1.93	1.93	3.25	3.25	1.81
30%	3.76	3.76	4.23	4.23	5.56	5.56	3.61
50%	8.57	8.57	4.23	4.23	5.56	5.56	6.02
70%	13.39	13.39	4.23	4.23	5.56	5.56	8.43

Notes: TWO Twin-Win Outperformance certificate, CTWO capped Capped Twin-Win Outperformance, LC Linear Certificate, P/L profit/loss, *B* barrier level

Source: own research

According to the results of our analysis based on the comparison of proposed Twin-Win Outperformance certificates, the following findings are presented. All our proposed certificates are designed so that the investor earns only in a situation of a slight decline up to the barrier level and at the same time if the CORN price will increase slightly in the future (valid for cap certificates) or growth will be unlimited (valid for certificates without a cap level). The proposed certificates are associated with higher costs in their creation, which is due to the security buffer on their specific payoff profile (based on the purchase of options). When investing in certificates, everything depends on the expectations of investors. If there is expected rapid growth in the CORN price, but not excluded slow drop up to the barrier level, then investor should choose certificates without the cap level

and with the higher level of the leverage. If investors predict only slight growth in the CORN price, but do not expect achievement of the barrier level, then the certificates with cap level are recommended for the investor. If the barrier level is reached during time to maturity and the CORN price moves around the actual spot price of CORN (S_0), then LC is the best opportunity for investment due to the lower purchase price.

Conclusions of our analysis indicate, that presented selected certificates will be profitable, if the CORN price increases above level of USD 13.77 (TWO_3), USD 13.83 (TWO_4), and USD 13.11 (TWO_5). TWO_3 certificate will also be profitable, if the CORN price falls slightly but does not reach the barrier level, i.e. level of USD (8; 8.57). In the case of different barrier levels, there are better certificates with a higher barrier level, i.e. set closer to S_0 , which will bring us a higher profit compared to a certificate with the same parameters, but the lower barrier level. Also, the loss will be lower in this case. Even in this case, the cap certificates are more profitable, if the barrier level is higher (set closer to S_0), also at the same time a higher cap level (set further to S_0), due to the longer period contributing to the rise in the CORN price. If we expect only a slight decrease, then the most profitable certificate is CTWO_13. Generally, the most important role in investor's choice is based on the selection of investment certificates based on the appropriate parameters and expectations of the future UA's price development.

4. CONCLUSION

The segment of structured products gains in popularity on international markets in the field of investing in various types of underlying assets. Due to derivative component, the structured products can also have specific profit profile with the possibility of investing in each segment in the market.

The aim of the paper was to propose two new investment certificates – Twin-Win Outperformance certificates and Capped Twin-Win Outperformance certificates and to make the application in agricultural market. Twin-Win Outperformance certificates enable to profit unlimited and Capped Twin-Win Outperformance certificates limited in the case of the increasing of the underlying asset's price. Both proposed certificates can profit in the case of the underlying asset's price drop only up to the barrier level. The nature of these products' creation was based on the option strategies, i.e. the combination of the vanilla (real traded in the market) and barrier (processed based on Haug option pricing model in statistical program R) European style of options together with the underlying asset. Further, there was showed different variants of these proposed certificates according to the

choice of suitable input parameters, such as the barrier level, the leverage, and the cap level, which influence on the issue price of given certificates.

Our empirical approach was applied in agricultural market, i.e. Teucrium Corn Fund ETF (CORN), where presentation, analysis and comparison of these proposed certificates were performed. The analysis of the profitability to the investor in proposed certificates had allowed to quantify CORN price intervals resulting in profit or loss of potential investor at the maturity date. The proposed Twin-Win Outperformance and Capped Twin-Win Outperformance certificates can be added to the investor's portfolio.

The research was made with the objective to contribute to the knowledge of the investors in the field of structured products. Also, our paper provides insight into the design, payoff and pricing of Twin-Win Outperformance certificates and Capped Twin-Win Outperformance certificates. Based on the methodological aspect, our research can be provided as an inspiration for the issuers within the manufacture process of the another types of the investment based on option positions or different types of the underlying assets (currencies, indices, exchange rate, etc.).

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ULAGANJE TEMELJENO NA POLJOPRIVREDNIM STRUKTURIRANIM PROIZVODIMA

Sažetak

Rad se bavi ulaganjima u poljoprivredu temeljeno na strukturiranim proizvodima, koje zauzima važno mjesto u međunarodnom ulaganju kako za institucionalne tako i za male ulagače. Cilj rada je prikazati prijedlog dvije nove vrste investicijskih certifikata, primjerice *Twin-Win Outperformance* certifikata i *Capped Twin-Win Outperformance* certifikata, koji zbog svog ugrađenog sigurnosnog elementa spadaju u segment djelomično zajamčenih investicijskih alata. Prednost predloženih certifikata leži u kombinaciji značajki dvaju certifikata u jedan proizvod. Certifikati su opisani u analitičkom obliku profitnih funkcija koje su izvedene na temelju dviju komponenti, tj. temeljne imovine i izvedenice (korištene europske *call* opcije i *down* i *knock-out put barrier* opcije) na temeljnoj imovini. Formule za određivanje cijene razvijene su uz specifikaciju osjetljivosti cijene izdanja na promjene različitih ulaznih parametara. Mogućnosti ulaganja u ove predložene certifikate pokazuju se na poljoprivrednom tržištu, tj. *Teucrium Corn Fund* (ETF), gdje se kreiraju različite varijante ovih certifikata na temelju različite razine uključenih parametara. Najbolji rezultati ostvaruju se s ciljem povećanja intelektualiziranosti svih potencijalnih ulagača u ulaganje u poljoprivredu korištenjem ročnica na kukuruz.

Ključne riječi: poljoprivredna roba, strukturirani proizvod, investicijski certifikat, standardne opcije, opcija s ograničenjem, ročnice na kukuruz