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A COMPARATIVE STUDY OF STRATEGIES SUITABLE FOR HEDGING THE FOREIGN EXCHANGE RATE RISK OF A BIG COMPANY

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ABSTRACT

As a result of the internationalization of the economy, foreign exchange transactions and, in this context, risks related to changes in foreign exchange rates appear in the lives of more and more businesses. Ignoring these risks or managing them inappropriately can also impair the company's ability to generate income, and even cause serious - in some cases unsolvable - liquidity disturbances. In our study, starting from the example of a large domestic company, we examined different strategies for hedging foreign exchange exposure. Due to length limits, we did not have the opportunity to present all possible strategies, but in relation to the hedging strategies we examined, we tried to reveal their possible advantages, dangers, and cost implications. We did all this in order to find the optimal hedging strategy/strategies for the company. During our investigation, we requested offers from 6 financial institutions. The level of the exchange rate to be protected was set at EUR/HUF 410.00. We found that, in the current market conditions, out of the four transactions we examined, three transactions (the forward, the zero-cost collar strategy and the participating forward) can be supported from the company's point of view.

JEL codes: G32, G17

Keywords: foreign exchange rate risk, foreign exchange forward transaction, plain vanilla transaction, zero-cost collar strategy, participating forward, profit-loss function

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1 INTRODUCTION

The last few years have triggered a series of economic shocks due to the pandemic and then the war that broke out in February 2022, which created an extremely volatile market environment. In a volatile market environment, plannability, which can be influenced by many external factors, becomes of primary importance for businesses. One of the most significant risks is currency risk. Currency risk includes:

- transaction risk, i.e. the price-based effect of exchange rate changes on foreign receivables and payables;
- economic or business risk related to the impact of exchange rate changes; and
- the revaluation or exchange risk that arises when the bank's foreign currency positions are revalued in domestic currency (*Van Greuning–Brajovic Bratanovic*, 2020).

Among these risks - from the point of view of our study - one of the most significant is the foreign exchange rate risk. Understanding how currency fluctuations can affect a company's performance is a complex task.

In a macroeconomic approach, the change of exchange rates is primarily determined by the change of the given country's export-import balance and its balance supplemented by income (i.e., the current account balance). In case of a negative balance, the deficit must be financed by a kind of capital flow. The economy is forced to raise funds (*Bélyácz*, 2013).

Permanently negative current account balances can typically be financed by working capital or debt-type investments. In order for the financing to be realized, it is primarily necessary for the given currency to have a high capital-attracting capacity, and this can be achieved by making investments in the given currency attractive to investors. This can be reach principally with a higher yield. Therefore, a currency can become attractive to investors if it exceeds the level of return available for other currencies with a similar risk, and for the given investor, the excess return available compensates for the risks arising in connection with the investment (K&H Treasury market risk management guide, 2015).

In the case of a given country, the main indicator of risk is represented by the CDS (Credit Default Swap) value of the given country. CDS, in short, credit default swap, can be considered as insurance against the insolvency of a country. It is of great importance for international investors, as it helps them distinguish risky countries from less risky countries. Due to CDS, they can predict the risk of a given country not being able to repay its public debt. The higher this value, the riskier the given country (*Brealey–Myers*, 2011).

Examining the effect of exchange rates from a microeconomic point of view, exchange rate fluctuations have a significant impact on the sales revenue and profitability of companies. If a company does not protect itself against the volatility of exchange rates, it is exposed to this risk and, in certain cases, not only its profitability, but even the future of the company may be at stake (*Collins*, 1999). Filtering out currency exchange movements that distort the company's earnings is a significant challenge for financial professionals (www.pwc.com).

Foreign exchange rate risk occurs in companies whose revenue or expenses are realized in a currency other than HUF, or whose HUF-based revenue/expenses are determined depending on another currency, and which have foreign currency loans, or pay or receive dividends in other currencies (*Bleuel*, 2008).

We can speak of an open foreign currency position if a given company carries out an activity in connection with which its foreign currency exposure arises. Depending on whether it is hedged, this currency exposure can be either open (unhedged), or hedged. In the case of hedged currency exposure, there is revenue behind the payment, and against the revenue, we can find a payment in the liquidity plan at approximately the same time, in the same period, in a similar amount within the same currency, or the exposure has already been hedged with a transaction (*Reichardt*, 1997).

Measuring and managing exposure to exchange rate risk is important to reduce companies' vulnerability to significant exchange rate movements that can adversely affect profit margins and asset values (*Papaioannu*, 2006).

In an open economy like Hungary's, sooner or later every business is faced with exchange rate risk. Since exchange rate fluctuations can significantly affect goodwill and profitability, the company's senior management must pay extra attention to the management of exchange rate risk.

Exchange rate risk related to companies' foreign exchange transactions can be handled professionally and unprofessionally, but ignoring the supervision of exchange rates can have serious consequences (*DeRosa*, 2006).

Unprofessional exchange risk management can cause a foreign exchange loss of HUF 50–100 million (minus 1-2 percent) per year for a company with export revenues of HUF five billion, while the treasurer of a company that manages exchange rate risk in a professional manner realises exchange gains of HUF fifty million from banking transactions every year (plus 1 percent) (*Jenei*, 2020).

Foreign exchange hedging strategies involve the elimination or reduction of this risk and require an understanding of how exchange rate risk can affect the operations of economic operators and techniques to manage the resulting risk effects (*Barton*, *Shenkir* and *Walker*, 2002).

The majority of companies think along conservative risk management principles, with the goal of eliminating exchange rate risk. The most prudent approach is if the internal regulations state that all exchange rate risks shall be eliminated immediately as soon as they arise. The attitude which prohibits the assumption of new risks, but allows flexibility in the timing of the closing of foreign currency positions arising in the course of normal business activity, and does not prescribe the obligation of immediate closing is slightly more permissive than the aforementioned approach.

How can a specific currency risk be hedged? Basically, the solutions can be classified into two groups: the so-called **natural hedge** or the use of **financial instruments**. Natural hedging can be, for example, when my purchases and sales are matched in terms of currency risk, in the same currency, thereby creating two opposite currency risks for the same period, which neutralize each other. In such a case, the company has foreign exchange transactions, but does not have an open position yet (*Coyle*, 2020; *Henderson*, 2006).

In the case of derivative instruments, a treasury pursuing a conservative exchange rate hedging policy can only enter into currency spot and forward transactions, or possibly standard currency option transactions. The more complex and exotic product we want to use, the more speculative elements will be in the hedging and the more uncertain the final outcome will be. That is why it is important to define the operational risk manager's scope (*Szabó*, 2022).

Whether a company hedges its open currency position, as well as with what instruments and to what extent, shall always be laid down in the internal regulations of the given company, taking into account the company's willingness to take risks. Based on their willingness to take risks, market participants can be classified into three groups:

- Risk averse: "Businesses that follow risk-averse behaviour strive to completely eliminate risks and dangers in connection with their business goals and actions."
- Risk-reducing: "Following a risk reduction strategy means that the company faces the emerging risks and takes the necessary measures in order to mitigate and prevent possible damage." (*Szőrös–Kresalek*, 2010)
- Risk-sharing or risk-transferring: a company exhibits risk-neutral behaviour if these risks do not play a prominent role in the life of the company, either because the company occupies such a strong position in the given market, or the risks are so small that they do not affect the company's result perceptibly (Szőrös–Kresalek, 2010).

2 MATERIAL AND METHOD

We would like to present the management of foreign exchange rate risks through the example of a large company, which clearly illustrates the effects, risks, advantages and value of hedging strategies.

As far as the core activity of the large company in our example is concerned, the company primarily deals with the manufacturing of products for the commodity market. In connection with the company's activities, a significant part of the raw materials and auxiliary materials required for product manufacturing is procured from abroad. The manufactured products are typically sold in Hungary, in the domestic market, therefore a significant part of the sales revenue is realized in HUF. Considering that in the case of the company, we are talking about foreign procurement (given in euros), payment positions (payments) in euros arise against mostly revenues in HUF.

Examining the company's liquidity plans, it is clear that, as a result of the company's activities, a significant euro short position is created against the forint's long position (purchases and payments are made in euros, but the company's revenue is realized in forints). In order to hedge its open currency position, the company needs to buy euros from forints, therefore it has to sell forints and buy euros. As a result, the company can hedge its exposure with a EUR/HUF sell transaction, thereby protecting itself against unfavourable movements in the EUR/HUF exchange rate.

By means of the transactions, our company is able to eliminate the possible exchange rate losses that may be suffered in connection with individual exchange rate movements. In addition, the hedged positions contribute to the fact that the exchange rate level for the realization of the transaction can be determined well in advance, therefore due to the hedge, we can get an accurate point of reference for planning and calculation of costs.

Based on the analysis of the liquidity plan for Q3 of 2022, it can be established on the euro side that a short position of EUR 10 million will emerge in connection with the operation of the company.

With regard to the fact that our company does not have any kind of revolving credit facility, without intervention the company is forced to face a collateral shortfall on the euro side.

Another important piece of information is the fact that the company aims to protect a predetermined exchange rate level (the planned exchange rate included in its business plan), so that the company should not be forced to suffer a loss compared to the planned exchange rate / target exchange rate due to foreign currency

exposure, and this financial loss should not negatively affect the realization of its plans. The level of the exchange rate to be hedged was set at EUR/HUF 410.00.

In the next part of our study, we present banking instruments that can be used to manage the risks arising from the volatility of the foreign exchange rate in connection with the aforementioned open foreign exchange position and the foreign currency exposures of the large company in the example, and we detail the advantages, risks, and possible outcomes related to these transactions. Hereunder, we examine the following transaction types: foreign exchange forward transaction, plain vanilla option, participating forward transaction, zero-cost collar.

Request for data required for the development of a hedging strategy:

In order to hedge the open currency exposure, our company requested offers from its banks for the four transactions according to the request for proposal below. In order to get an accurate market picture of coverage options and exchange rates, it is worth sending the request for data to as many, if possible, all banks of the company.

Table 1
Data request for banks

	Amount (in M EUR)	Type	Pair	Side	Delivery	Spot ref.	Swap	Rate
Bank name	10.000	FWD	EURHUF	buy	01/09/2022			

	Amount (in M EUR)	Type	Pair	Ref.	Type	Expiry	Delivery	Price (in %)
Bank name	10.000	LC	EURHUF	ATMF @ 402.30	European	30/08/2022	01/09/2022	

	Amount (in M EUR)	Type	Pair	Side	Expiry	Delivery	Spot ref.	Swap	Rate
Bank name	10.000	Part FWD	EURHUF	buy	30/08/2022	01/09/2022			

	Amount (in M EUR)	Type	Pair	Expiry	Delivery	SP	LC
Bank name	10.000	ZCC	EURHUF	30/08/2022	01/09/2022		410.00

Source: own editing based on the data received from the banks

In order to price the hedging by the banks, the exact parameters of the hedging transactions must be specified. The information required to be provided by the banks is indicated by the grey cells. In the case of a forward (forward, hereinafter referred to as: FWD) transaction, the amount, the currency pair, the direction of the transaction and the maturity date are essential data for banks. In the case of an FWD, it is important to know the spot reference data, as the starting basis of the foreign exchange forward transaction, as well as the swap points, which show the pricing of each bank. The forward price is the sum of the latter two figures.

When hedging with an option transaction, in addition to the data used for the FWD transaction, it is important to specify the type of transaction for pricing, in

our case: buying the right to buy (Long Call – LC), based on which the bank can identify the nature of the hedging. In our case, we want to buy a right (to buy) in exchange for an option premium at the level of the forward exchange rate (this is the so-called „at the money forward" – i.e. ATMF). When pricing the LC option, the fact that we want to buy a European option (i.e. the creation of the right contained in the option transaction is only examined at the specified maturity) carries additional important information for the bank.

In the case of the participating FWD strategy, it is necessary to start off the same data and we would like to receive in the same data from the bank as in the case of the FWD transaction, however, due to the nature of the transaction (a right of 50% in our case) and the resulting pricing methodology, we should receive different data.

In the case of the fourth and last examined transaction type – the zero-cost collar (ZCC) – we can speak of a complex option transaction, where two opposite option transactions are concluded (we buy one option and write a call option right, therefore we sell), so that the premiums of the two options should be the same, thus creating a zero-cost option transaction. In this case, we look for the level of the option right that we have written (Short Call – SC), where the level of the premium is the same as the level of the option premium of the right we want to buy (LC). The level of the option right we bought (LC) must be matched to the level we want to protect (EUR/HUF 410.00).

When developing the hedging strategy, we requested offers from six banks for each type of transaction. This relatively large number of offers can ensure that our company gets an accurate picture of market levels and exchange rates. If we only request a bid from one or a maximum of two banks, we may even get a distorted picture compared to the current levels and bids in the market.

The Bloomberg/Reuters interface can also serve as an additional indication of market levels, where real and current spot market rates can be easily monitored and checked.

3 ANALYSIS OF CURRENT MARKET LEVELS WHEN EXAMINING THE HEDGING STRATEGY

In connection with the development of hedging for the risk strategy arising from the volatility of foreign exchange rates, the first step is to examine the current market rates. By means of the Bloomberg/Reuters interface, the change in the EUR/HUF exchange rate for approximately the past year was retrieved, which is shown in *Figure 1*. In relation to the foreign exchange rates of the past year, it can be said that the exchange rate levels were scattered between EUR/HUF 347.00

and 398.50, which corresponded to a range of HUF 51.50, 12.92% in the examined period. In terms of one year, this exchange rate fluctuation can be called very significant. The forint has weakened a lot during this time. *Figure 1* clearly shows the weakening of the forint caused by the Russian-Ukrainian conflict since the end of February.

Based on the Bloomberg report retrieved when examining the possibility of the hedging strategy, it can be said that the average spot exchange rate in the market at the time of the query (1 June 2022) was EUR/HUF 396.00, which was HUF 14.00 more favourable per euro than the EUR/HUF 410.00 exchange rate level to be hedged.

Figure 1
EUR/HUF Table 15.06.2021 – 10.06.2022

Source: Bloomberg „EURHUF" Table

3.1 Presentation and analysis of foreign exchange rate hedging strategies

In the case of spot transactions, the parties are obliged to settle with each other already on the day T + 2, or on the day when the transaction is concluded, i.e. the two currencies participating in the transaction are already mandatorily exchanged between the parties (therefore the CF effect already arises). Based on our company's liquidity plans, the necessary hedge is not available when creating the hedging strategy, therefore the company cannot hedge its open position by means of these transactions, which is why the exchange rate risk management with the above-mentioned two strategies was rejected.

The possibility of hedging with a spot transaction at the maturity date of the open position (01.09.2022) was also rejected, because the purpose of the hedging strategy is to secure the desired exchange rate, i.e. to close the transaction. Hedging upon maturity involves leaving the transaction open until the maturity date.

3.2 Foreign exchange forward transaction

In contrast to the prompt and spot transactions detailed earlier, we have the opportunity to conclude a forward transaction precisely adjusted to the day on which the currency demand arises, therefore, in contrast to spot and prompt transactions, the hedge must only be available to the parties at the maturity date of the concluded forward transaction. After checking the company's liquidity plan, we can establish that it is possible to conclude a forward transaction, since the forint hedge is available upon maturity due to the revenues.

Our company received the following forward EUR/HUF buy offers (examining the direction of hedging from the company's side) from its banks, with a maturity date of 1 September 2022:

Table 2
Bank offers requested in connection with the FWD transaction

	Amount (in M EUR)	Type	Pair	Side	Lejárat	Spot ref.	Swap	Rate
Bank 1	10.000	FWD	EURHUF	buy	01/09/2022	396.00	635.00	402.35
Bank 2	10.000	FWD	EURHUF	buy	01/09/2022	396.04	676.00	402.80
Bank 3	10.000	FWD	EURHUF	buy	01/09/2022	396.00	630.00	402.30
Bank 4	10.000	FWD	EURHUF	buy	01/09/2022	396.10	662.00	402.72
Bank 5	10.000	FWD	EURHUF	buy	01/09/2022	**396.15**	797.00	**404.12**
Bank 6	10.000	FWD	EURHUF	buy	01/09/2022	396.09	692.00	403.010

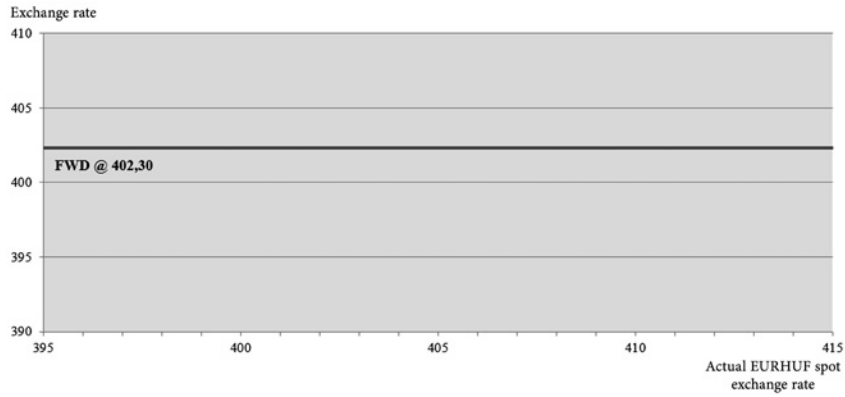
Source: own editing based on the offers received from the banks

After examining the offers received from the six banks, Bank 3 gave the most favourable offer at a level of EUR/HUF 402.30 to hedge the exposure EUR 10 million. The highest offer, expressed in forints, provides hedging at a level higher by HUF 18.2 million than the most favourable level of EUR/HUF 402.30. The quotations of Bank 3 and Bank 1 were based on the lowest reference spot quotation, while the highest value was given by Bank 5 in this case, as well. Bank 6 quoted with the lowest margin, however, due to the average spot reference level, it could not „beat" its competitors with its price.

The exchange rate level given by Bank 3 means that our company is protected at EUR/HUF 402.30 in the event of a transaction, therefore the cost calculated in HUF to hedge the EUR 10 million exposure amounts to a total of HUF 4.023 billion. This level provides protection at a level which is lower by 7.70 forints than the target rate per euro (in terms of the total exposure, this corresponds to a level lower by 77 million forints).

Similar to the spot transaction, the forward transaction is also a mandatory transaction, therefore both parties shall fulfil their obligations during the transaction. This means that regardless of the exchange rate levels on the market at maturity, both parties shall ensure the smooth implementation of currency exchanges between the parties. As a result, at any current spot market level, the transaction will be realized at the level of EUR/HUF 402.30 included in the bank's offer, which is shown in *Figure 2*.

Figure 2
The exchange rate values of FWD
reflected by the spot market exchange rates valid at maturity



Source: own editing

In *Figure 2*, the vertical axis shows the values of the FWD transaction for each market spot exchange rate (moving along the horizontal axis). The figure clearly illustrates that, due to the mandatory nature of the transaction, the price of the concluded FWD transaction cannot be affected by market processes, i.e. at any spot EUR/HUF exchange rate, the transaction is concluded at the level of 402.30 at maturity. In view of the above, the following statement is true: despite movements in the exchange rate into unfavourable direction, the FWD strategy protects against possible losses, but does not allow participation in favourable market movements.

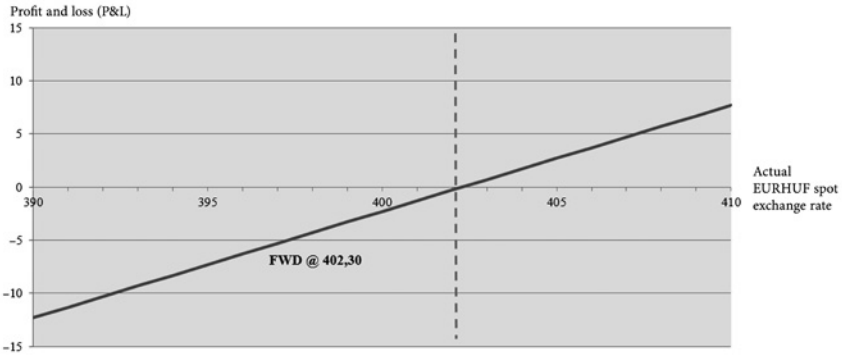
With the foreign exchange forward transaction, the exchange rate of the transaction is a known and guaranteed factor, therefore, in our case, all the costs related to the purchase of foreign currency are known in advance. During planning, the company is able to calculate with this factor, and the exchange rate level at which the necessary amount of foreign currency is purchased is guaranteed to us in advance at the level of EUR/HUF 402.30.

Figure 3 shows the P&L function of the FWD transaction, which can be used to determine the MtM (Marked to Market) value of the transaction at any time. The vertical axis indicates the profit or loss achieved on the transaction for the given spot market exchange rate value. Based on this, it can be concluded that if the current spot market rate is EUR/HUF 402.30, then the current MtM value is exactly zero, i.e. neither loss nor profit is generated on the transaction compared to the market level.

If the spot price is lower than the level of 402.30 at the time of the investigation, our company is forced to record a loss, because if the position had not been hedged with the FWD transaction, the company would be able to hedge its open exposure cheaper in the market at the current level. Assuming a current spot level of EUR/HUF 400.30, this means a loss of HUF 2 per euro, i.e. a loss of HUF 20 million is possible based on the example, in terms of the full exposure. Every decrease of HUF 1 in the exchange rate below the level of EUR/HUF 402.30 causes an additional loss of HUF 1 per euro (calculated for the total exposure of HUF 10 million). If this scenario comes true, our company's foreign exchange rate expectations were not correct, the exchange rate level moved in an unfavourable direction for the company.

The MtM value is positive, therefore the company makes a profit with the transaction if the current exchange rate is above EUR/HUF 402.30 at the time of the investigation or at maturity. In this case, if the hedging exchange rate level is exceeded by the exchange rate value, for each 1HUF increase (weakening forint or strengthening euro), a profit of HUF 10 million is generated on the exposure compared to the market level. This means that the EUR/HUF exchange rate changed in accordance with the company's expectations, the company hedged its short currency position properly, and its hedging strategy was well-formed, because the company protected itself against unfavourable movements and realized a profit against the market on the transaction.

Figure 3
The profit-loss function of the FWD transaction in the context of the spot price valid at maturity



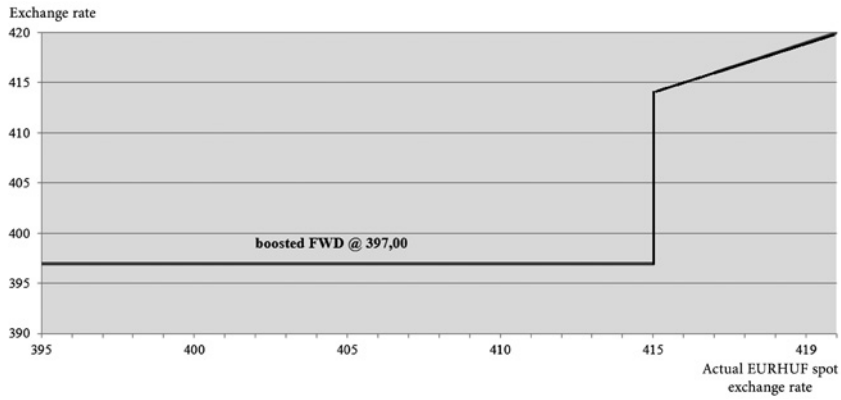
Source: own editing

As an additional option, we also examined the possibility of transforming the forward transaction so that the basic FWD transaction is supplemented with a knock out (KO) level, as a result of which the forward price can be made more favourable. In the case of the above transaction, an additional exchange rate level (KO level) above the exchange rate to be protected is determined, thereby our company may face two scenarios regarding the outcome of the transaction: i) as long as the market spot rate does not reach the KO level at maturity, the currency exchange between the parties is settled at a (boosted – more favourable, boosted) forward price, but ii) if the spot market level reaches or exceeds the KO level, our forward transaction is terminated (knocked out) and the exposure becomes open again. From our point of view, the main risk of the transaction is that, in the latter case, our company will be forced to purchase euros again at the market level, which will certainly be higher than the set target rate of exchange, but until the KO level is reached, the forward transaction will be realized at a level that is more favourable level for us.

For the EUR/HUF 415.00 KO level, the EUR/HUF 397.00 forward price was the best bank offer. In this case, up to EUR/HUF 415.00, our company will receive euros at a forward price of EUR/HUF 397.00, while above EUR/HUF 415.00 spot, the transaction will be terminated and above EUR/HUF 415.00 we will be forced to purchase euros.

Figure 4 shows the effect of reaching the KO level: if the spot market level reaches the KO level (EUR/HUF 415.00), the deal will be terminated and our company will be forced to purchase euros again at market levels.

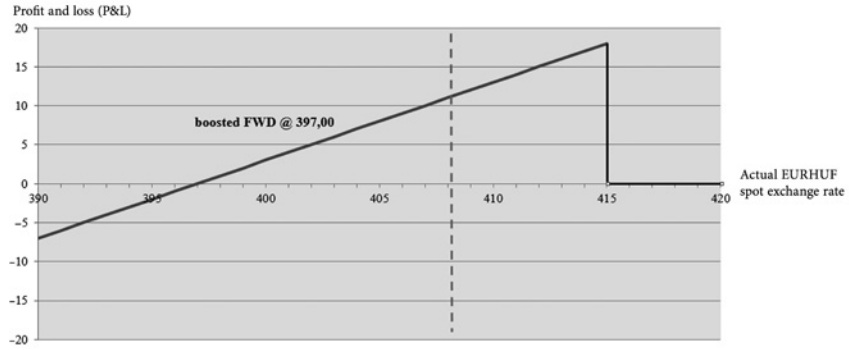
Figure 4
The exchange rate values of the boosted FWD reflected by the spot market exchange rates valid at maturity



Source: own editing

The profit-loss function of the boosted FWD transaction also reflects our statement above, according to which the MtM value will continuously increase our profit against the market above EUR/HUF 397.00 until reaching the KO level, however, upon reaching EUR/HUF 415.00 (KO level), the MtM value will drop to zero. The MtM here will be zero, however only against the market spot rate, but from then on, our company will be forced to purchase the necessary euros in the market at levels above EUR/HUF 415.00, which, on the one hand, will cause a loss to FWD , and on the other hand, exchange rates above the target rate will be realised.

Figure 5
The profit-loss function of the boosted FWD transaction in the context of the spot price valid at maturity



Source: own editing

As a second possibility, we examined what would happen if our company wanted to enter into a forward transaction involving the EUR/HUF 435.00 KO level. In this case, the (boosted) FWD transaction could have been concluded at EUR/HUF 401.00. In the latter facility, when the strategy was created, it allowed a volatility of HUF 25 (6.31%) above the target rate of exchange and HUF 39 (9.85%) above the current spot price (on the side of the weakening forint) until the knock-out level was reached. The strategy provides an opportunity to buy euros at a level that is HUF 9 lower than the target rate (HUF 90 million for the entire transaction) and HUF 1.30 lower than the normal forward rate (total hedging cost HUF 13 million).

3.3 Plain vanilla option

When concluding a plain vanilla options transaction, one party sells (or buys) an option obligation to (from) the other party, while the other party in the transaction buys (or sells) an option right against the other party. In this case, the party writing the option receives an option fee (premium), while the buyer of the option pays an option premium to the issuing party, regardless of whether the party holding the option right will exercise it (in the future), i.e. whether the transaction is called or not . In all cases, the option premium shall be paid upon conclusion of the transaction. If the buyer of the option right asserts his right – i.e. exercises their option right – the other party will always have an obligation written in the option.

Since the origination of the option right is determined in every case in such a way that the buyer of the option wants to protect themselves from levels that are less favourable than that, it can be definitely stated that if the buyer does not have the right to exercise the option, the net price of the transaction will always be more favourable than the target rate of exchange.

Considering that in our case the open foreign currency position of our company is short, i.e. foreign currency purchase is necessary, we will therefore further examine only the long call (LC) transaction type, since our company is only able to hedge its position with this type of transaction (it acquires the right to purchase, in the case of exchange rates above a certain level in the market, the required amount of foreign currency at the strike price, regardless of market levels).

In the case of a European-type option, the strike price is examined against the spot market levels valid at maturity only at maturity, while in the case of an American-type option, the exchange rate is examined during the entire term, i.e. in the period from the conclusion of the option to its maturity. Since the bank

has a significantly higher risk in the second case, the option premium is more expensive, i.e. higher.

As the most cost-effective strategy is an important factor for our company, we decided to further investigate the generally lower-cost European-style option strategy.

In accordance with the data request form of the option strategy, our company is looking for an option premium rate that provides it with a European-style call right (LC) with a given maturity (30/08/2022) and for a given amount (EUR 10 million) at the level of the ATMF (i.e. the forward price).

In connection with the data request for the purchase of the long call (LC), the banks gave offers as summarized in *Table 3*. The most unfavourable offer was given by Bank 3 at the level of 2.82%, while the most favourable offer came from Bank 1 at the level of 2.73%. The 2.73% option premium shall be understood and calculated for the total transaction value, i.e. the premium level of the ATMF LC intended to be tied to a liability of 10 million euros means a cost of 0.273 million euros (~110 million forints). There is a total difference of 90,000 euros between the premium of the best and the worst offers (this amounts to ~ HUF 36 million). In the case of our company, the premium fee of more than HUF 110 million means that this cost increases the EURHUF exchange rate per one euro by HUF 11.00, i.e. actual protection – including the level of the strike price (402.30) and the premium projected per euro cost (11.00) – can be realized at a total level of EURHUF 413.30, which is HUF 110 million higher than the option for forward currency purchase.

Table 3
Bank offers requested in connection with the LC transaction

	Amount (in M EUR)	Type	Pair	Ref.	Type	Expiry	Delivery	Price (in %)
Bank 1	10.000	LC	EURHUF	ATMF @ 402.30	European	30/08/2022	01/09/2022	**2.73**
Bank 2	10.000	LC	EURHUF	ATMF @ 402.30	European	30/08/2022	01/09/2022	2.79
Bank 3	10.000	LC	EURHUF	ATMF @ 402.30	European	30/08/2022	01/09/2022	**2.82**
Bank 4	10.000	LC	EURHUF	ATMF @ 402.30	European	30/08/2022	01/09/2022	2.735
Bank 5	10.000	LC	EURHUF	ATMF @ 402.30	European	30/08/2022	01/09/2022	2.75
Bank 6	10.000	LC	EURHUF	ATMF @ 402.30	European	30/08/2022	01/09/2022	2.80

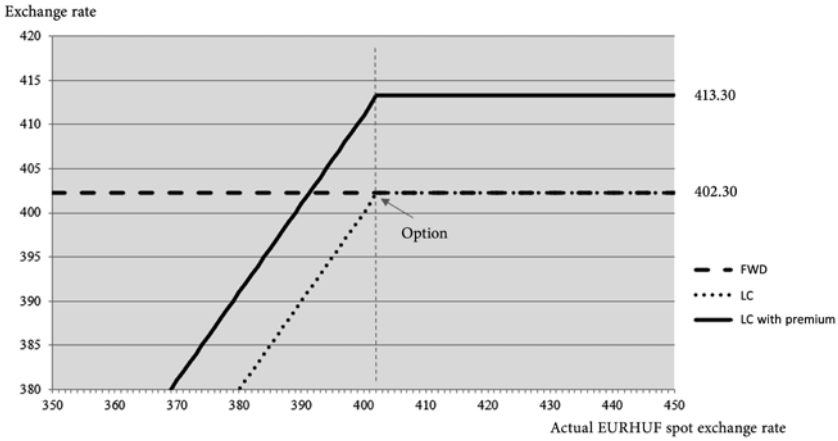
Source: own editing

On the basis of the requested best bank offer, the exchange values of the plain vanilla transaction are represented in *Figure 6* in the light of the spot market exchange rates due at maturity. The vertical axis shows the values the price of a

simple option transaction can take for each market spot exchange rate (moving along the horizontal axis).

The characteristic of the LC transaction is that as long as the transaction takes place in the market (in our case, the purchase of euros), the party with the option right does not exercise and shall not be entitled to exercise their the option right. Based on the above, until the market exchange rate reaches EUR/HUF 402.30, our company can hedge at current market level. If the market level reaches or exceeds the EUR/HUF 402.30 level at the expiry date, the rights included in the option can be exercised, i.e. in the case of any market rate above the 402.30 exchange rate level, our company has the opportunity to buy euros against forints at the 402.30 level. If we also take into account the premium per euro paid when buying the option and interpret it in a gross way (examining the entire exchange rate paid for one euro), the actual protection is realized at EUR/HUF 413.30 (above the target rate of exchange!) as shown in the figure.

Figure 6
The exchange rate values of the plain vanilla transaction reflected by the spot market exchange rate due at maturity

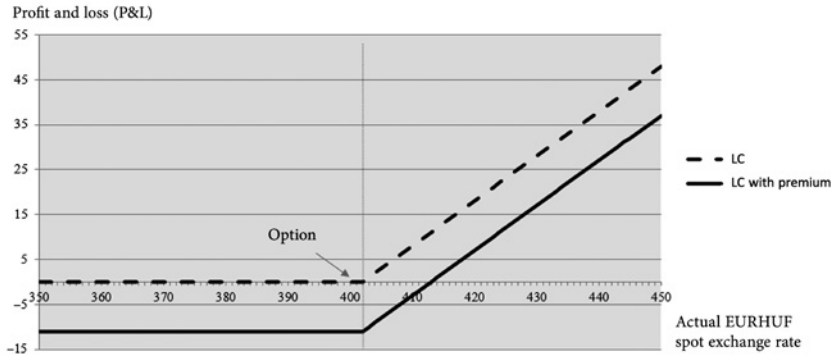


Source: own editing

Figure 7 shows the P&L function of the plain vanilla deal (vertical axis) for the current market rates shown on the horizontal axis, which can be used to determine the MtM value of the transaction at any time/date. Based on the profit-loss function of the simple option transaction, it can be said that as long as our company does not exercise its option right, it makes neither a profit nor a loss on the transaction compared to the market levels (it cannot, since the euro is purchased

in the market). If the company is able to assert its right included in the option at maturity (in the event that the exchange rate exceeds EUR/HUF 402.30 at maturity), the hedge will turn into profit. Every HUF 1 increase in the spot exchange rate at maturity results in a profit of HUF 1 per euro, i.e. HUF 10 million in relation to the total transaction amount of EUR 10 million. From the point of view of our company, the effect of the option premium pushes the profit-loss function in the direction of loss by HUF 11 per euro, i.e. the strategy actually turns into profit above EUR/HUF 413.30.

Figure 7
The profit-loss function of the plain vanilla transaction in the context of the spot price valid at maturity



Source: own editing

In view of the above, the possibility of whether there is an LC level where the total value of the call rate and the premium per one euro does not exceed EUR/HUF 410.00 was examined. Since the strike price of EUR/HUF 402.30 and the current spot market exchange rate (EUR/HUF 396.00) at the time of the development of the hedging strategy were very close (within 1.6%). Consequently, there was practically no exchange rate level available in the market at which it would have been possible to achieve the above correlation, because for this an in-the-money (ITM), i.e. a (profitable) option with an intrinsic value at the time of the conclusion, would have had to be entered into. Taking into account the impact of the premium per euro received at the ATMF (11 forints per euro), the target rate of exchange of EUR/HUF 410.00 could have been protected at a strike price of EUR/HUF 399.00. Considering that the more ITM an option is, the higher the premium will be, therefore the more we lower our strike price, the more option premium will be added. As a result, the HUF exchange rate will not be able to

strengthen below the EUR/HUF 410.00 level, therefore we can state that the designated target rate of exchange cannot be hedged with an option right.

Both in *Figures 6* and *7*, we can observe the previously mentioned paradox related to option transactions, that the company is in a favourable position if it does not have to call the option from its bank, despite the fact that the option premium was already paid when the transaction was concluded, as in this way, euros can be purchased at a level even lower than the strike price.

If we set the strike price of our purchased option to EUR/HUF 410.00, we would only be able to hedge the option transaction at the level of the target rate of exchange by examining the option transaction on its own, because a EUR/HUF 410.00 LC option creates a premium worth 2.09% (HUF 8.56), therefore overall protection is created at EUR/HUF 418.56, with which the target rate of exchange cannot be protected as a whole.

3.4 Zero cost option

In the case of a zero-cost option, two options are interpreted in the same direction (sell or buy) within a transaction. Concerning one „leg" of the transaction, we buy a right, while in the case of the other „leg" of the transaction, we will have an obligation (we sell a right). Given that in the case of this strategy, two option transactions are defined with the same maturity, amount and direction, we must speak of a complex option strategy.

In connection with the two options, it can be stated that since in the case of both „legs" one party will have the right to sell or buy, the exchange rate of the transaction concluded with the option cannot exceed these two extreme values, i.e. these two exchange rate values will be the maximum or minimum (exchange rate) output of the transaction. As a result, the zero-cost option strategy is also called a collar transaction, hence the English name Zero Cost Collar (ZCC).

The zero-cost collar option hedging strategy is a cost-free strategy from the point of view of both parties concluding the transaction (bank and client), because it consists of two option transactions in opposite directions (plain vanilla), so that the premiums of each option transaction are the same. In view of the above, the cost-freeness of the zero-cost collar transaction results from the fact that during the pricing, the right specified (written) by us (at a fixed exchange rate in this case) is accompanied by an option obligation (sold right) in the opposite direction for this right (exchange rate level), where the paid and the received option premiums are the same.

Since our company wants to protect itself from being forced to buy euros at levels above the target rate of exchange (EUR/HUF 410.00), we have set the long call

(LC) at the level of 410.00 – protecting the target rate. In the data request form, this level was referred to as the LC exchange rate (upper threshold level), for which the bank had to determine the lower threshold level (SP) where the premium of the two options is the same at the given (same) maturity.

Table 4 shows the offers given by the banks regarding the ZCC transaction. The best SP offer for the LC of EUR/HUF 410.00 (where the band is the widest – this way we have the opportunity to create the greatest room for manoeuvre while protecting the target rate of exchange) was given by Bank 2 with a level of EUR/HUF 398.00. The narrowest room for manoeuvre can be seen in the case of Bank 6, where the strategy protects against volatility of only HUF 10.00 per euro.

Table 4
Bank offers requested in connection with the ZCC transaction

	Amount (in M EUR)	Type	Pair	Expiry	Delivery	LC	SP
Bank 1	10.000	ZCC	EURHUF	30/08/2022	01/09/2022	410.00	398.12
Bank 2	10.000	ZCC	EURHUF	30/08/2022	01/09/2022	410.00	**398.00**
Bank 3	10.000	ZCC	EURHUF	30/08/2022	01/09/2022	410.00	398.355
Bank 4	10.000	ZCC	EURHUF	30/08/2022	01/09/2022	410.00	398.58
Bank 5	10.000	ZCC	EURHUF	30/08/2022	01/09/2022	410.00	399.10
Bank 6	10.000	ZCC	EURHUF	30/08/2022	01/09/2022	410.00	**400.00**

Source: own editing

Figure 8 illustrates the possible outcomes of the ZCC transaction:

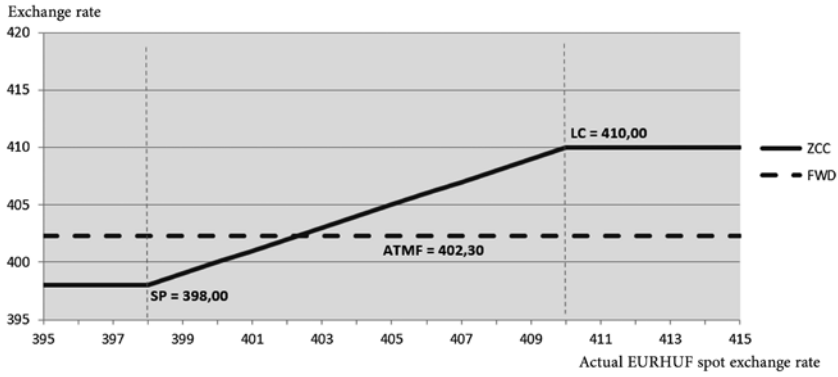
– If the spot exchange rate at maturity is above EUR/HUF 410.00, our company has the right to buy at the LC exchange rate (EUR/HUF 410.00 level). In the case of spot levels above the LC, the target exchange rate is protected, therefore there is no exchange rate loss against the target rate of exchange. With its weakening, the forint generates an exchange rate gain of one forint per euro for each movement by one forint in the EUR/HUF exchange rate compared to the spot exchange rate.
– If the spot exchange rate at maturity is between EUR/HUF 398.00 (SP) and 410.00 (LC), our company has neither the right nor the obligation to buy. The euro purchase transaction takes place in the market, at the spot exchange rate. Since the spot exchange rate in this case is definitely less than or equal to the target rate of exchange, no exchange rate loss can occur compared to either the target exchange rate, or the market levels, since settlement/transaction takes place at the spot exchange rate itself.

– If the spot exchange rate at maturity is below EUR/HUF 398.00, our company has a purchase obligation at the SP exchange rate (EUR/HUF 398.00 level). Below the short put level, the planned exchange rate is protected, there is no exchange rate loss against the target exchange rate, however, with the strengthening of the HUF, for each movement by one forint in the EUR/HUF exchange rate compared to the spot exchange rate, an exchange rate loss of one forint per euro occurs per EUR.

Figure 8 shows the reason why this strategy is called collar strategy: the exchange rate of the transaction cannot be higher than the exchange rate of the LC, and in the case of any spot market exchange rates below the exchange rate of the SP, the currency exchange will be carried out at least at the exchange rate of the SP. In the case of exchange rates above the call, our company exercises its right to buy, while in the case of exchange rates lower than the put, the bank exercises its right to sell, which in the case of our company will mean a purchase obligation.

The most favourable outcome for the company is (despite the fact that the MtM of the transaction is zero in this case) if the EUR/HUF market spot rate at maturity is 398.00, because in this case the purchase of the euro is realized at the lowest rate and our company does not have to suffer a loss compared to realisation at market levels.

Figure 8
The exchange rate values of the ZCC transaction reflected by the spot market exchange rates valid at the time of maturity

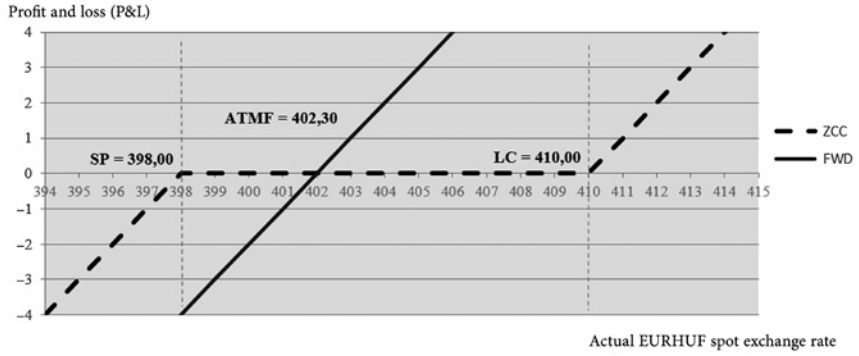


Source: own editing

Based on the profit-loss function of the ZCC transaction (Figure 9), it can be established that in the case of spot market levels between the SP and LC exchange rates, neither loss, nor profit arises, because between these two exchange rates,

neither party has a right that it can enforce against the other party. In the case of exchange rates lower than the SP value, loss is generated for the company in relation to the spot market rate at the time of maturity, while in the case of values above the LC, profit is generated.

Figure 9
The profit-loss function of the ZCC transaction in the context of the spot price valid at maturity



Source: own editing

A characteristic of the ZCC transaction is that the possible exchange rate values of the ZCC compared to the spot exchange rate at maturity, as well as the graph of the P&L function of the transaction, are the same as the separately drawn graphs of the SP and LC simple option transactions. The first half of the two graphs presented in the case of the ZCC transaction correspond exactly to individual graphs of the SP option, while the other half corresponds exactly to the identical graphs of the LC, so that the effects of the premium of the two options are on opposite sides. When examined separately, it improves the outcome of the transaction per euro in the case of SP (premium received), while in the case of LC (paid premium) it worsens the outcome. This also confirms the claim that the ZCC can consist of two opposing simple options, therefore their premiums extinguish each other.

From the perspective of hedging and the exchange rate to be hedged, when the hedging strategy was created, the ATMF exchange rate was very close to the exchange rate to be hedged. The SP exchange rate of LC EUR/HUF 410.00 was only HUF 4.30 away (this allows only 1.10% volatility), which squeezes the exchange rate of the possible outcome of the transaction into a very narrow band. This means that, from the company's point of view, the distance between the ATMF exchange rate and the purchase obligation exchange rate is 4.30 forints (398.00 vs. 402.30), i.e. the strategy allows for a 4.30 forint gain without creating a purchase

obligation, compared to the FWD strategy. This can be said to be favourable from the point of view that, compared to the FWD, our company can obtain the necessary euros at a level better by 4.30 forints, i.e. 43 million forints, in the case of the most favourable outcome. However, in the case of spot market rates below EUR/HUF 398.00, the company will be forced to record a loss against the market.

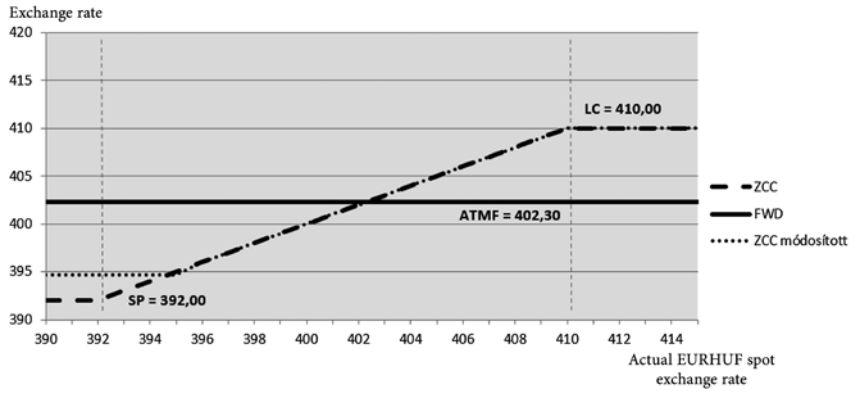
Extending the band of the collar to a wider range (moving the level at which the obligation arises further from the ATMF level) would, based on the logic detailed above, be only possible (the premium of the two options would be equal) if the LC exchange rate were raised to EUR/HUF 410.00. However, this would mean that the target exchange rate could not be protected, thereby the hedging strategy would become meaningless.

Due to the above, the restructuring of the ZCC strategy was examined as an additional option during the formation of the hedging strategy in order to enable favourable exchange rate movements in a wider range. Given that the level of LC cannot be set at a higher exchange rate due to the target rate of exchange, the possibility arose that the zero-cost option would be transformed into a complex strategy with a similar composition but with an option premium. With this, the price of the SP can be lowered (from EUR/HUF 398.00 to 392.00), but then – since the premium of the two options will no longer be the same – our company will be obliged to pay the option premium. Although the premium of this option will not be equal to the level of the premium of the plain vanilla option (because there is also a received premium against it, which covers the costs to a certain extent, represents compensation against the premium to be paid). Yet it would still have entailed a significant cost based on the banks' offer. The most favourable bank offer for LC 410.00 and SP 392.00 collar was 0.68%. In addition to the fact that this offer would still have provided protection in a very narrow band (a band of only HUF 18, i.e. 4.55%) band, given the current volatility, it had a very significant cost implication. The expected total cost of the strategy (premium) amounts to 68 thousand euros, 27.2 million forints in this case.

In accordance with the above, the image of the ZCC hedging transaction for the current spot market exchange rate will look like in *Figure 10*: in the case of levels below EUR/HUF 392.00, our company has a purchase obligation at the level of EUR/HUF 392.00, and in the case of levels above EUR/HUF 410.00, our company can exercise its long call at the level of EUR/HUF 410.00. In the case of spot market exchange rates between LC and SP, since neither party has any rights or obligations, the settlement takes place at the current market levels.

Taking into account the effect of the premium, the collar strategy can be realized with EUR/HUF 394.67 SP and EUR/HUF 412.67 LC options, i.e. in case of a call at the spot market price of EUR/HUF 410.00, it provides protection by HUF 2.67 above the target rate of exchange.

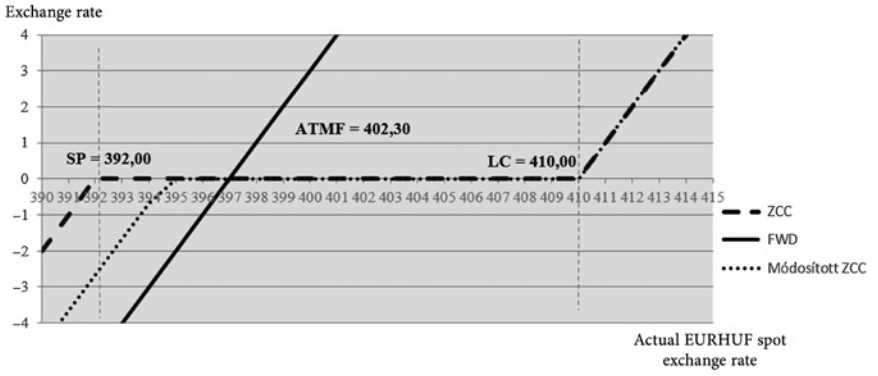
Figure 10
The exchange rate values of the modified ZCC transaction reflected by the spot market exchange rates valid at the time of maturity



Source: own editing

In the case of the modified ZCC transaction, according to Figure 11, our company incurs a loss at spot exchange rates below EUR/HUF 392.00, while at market levels above EUR/HUF 410.00, a profit arises due to the exercise of the long call. *Between the two levels of the ZCC strike price, neither party incurs a loss nor a profit compared to the market levels.*

Figure 11
The profit-loss function of the ZCC transaction in the context of the spot price valid at maturity



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3.5 Participating forward

The participating forward is a combination of the features of an option and a forward transaction. In general, we can say that a participating forward transaction is a complex option product in the nature of a forward contract, in the case of which we acquire the right to exchange one currency for another currency at a given exchange rate at a later date. If at a later date the market exchange rate is less favourable than the participating forward exchange rate, the entire agreed amount of currency will be converted, while if the market exchange rate is more favourable than the participating forward strike price, only half of the pre-agreed amount shall be compulsorily converted at the strike price. The remaining amount of foreign currency can be converted at the given market rate, i.e. the transaction allows you to share in the favourable market effects with the remaining portion of the total amount.

A participating FWD deal is very similar to a ZCC deal. In the case of the participating FWD, we can notice so many differences compared to a ZCC deal that the two extreme exchange rate values of the transaction (the put and call exchange rates) are determined not at different exchange rates, but at the same exchange rate value. However, we may rightly ask how the participating FWD transaction can be a cost-free transaction, if the levels of the right and the obligation included in the transaction are not separated, so that, in the case of our company, the right applies to the full amount, while the obligation only applies to a maximum of 50% of the total exposure. The answer is quite simple: when preparing the offer, the bank prices the risk that the transaction bears (the risk of the call) and it is to be paid by our company, as a client, not through the option premium, but the bank will determine the strike rate in such a way that it covers the inherent risks/riskiness of the transaction and the associated costs (over and above the cost of margin, operating costs and profit) against a FWD transaction. For the customer, this surplus appears in a strike price that is less favourable than the forward price.

Table 4 also proves our above statement. Among the six banks, the most favourable offer was given by Bank 3 with an offer of EUR/HUF 409.70. The exchange rate of the participating FWD transaction reflects the difference in pricing compared to FWD. For the forward period, we have the opportunity to conclude a transaction at the level of EUR/HUF 402.30, while our company can conclude a transaction at the level of EUR/HUF 409.70 with a participating forward transaction. The difference is HUF 7.40 per euro, which means that the strategy provides full protection at a HUF 74 million higher level (cost of full hedging: HUF 4.097 billion).

In the case of the requested bank offers, we can determine that the best rate of participating FWD is also very close to our target rate of EUR/HUF 410.00. With

the offer given by Bank 5, the hedgability of our target exchange rate is already in jeopardy.

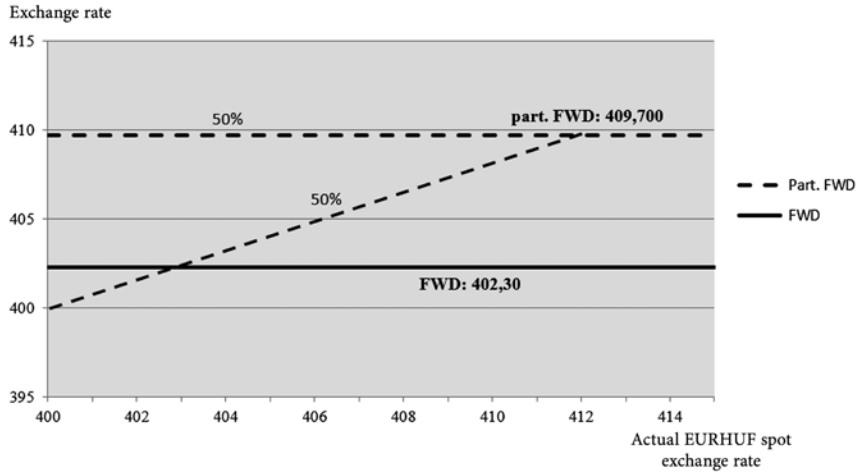
Table 5
Bank offers requested in connection with the participating FWD transaction

	Amount (in M EUR)	Type	Pair	Side	Expiry	Delivery	Spot ref.	SWAP	Rate
Bank 1	10.000	Part. FWD	EURHUF	buy	30/08/2022	01/09/2022	**396.00**	1 395.00	409.95
Bank 2	10.000	Part. FWD	EURHUF	buy	30/08/2022	01/09/2022	396.04	1 376.00	409.80
Bank 3	10.000	Part. FWD	EURHUF	buy	30/08/2022	01/09/2022	**396.00**	1 370.00	**409.70**
Bank4	10.000	Part. FWD	EURHUF	buy	30/08/2022	01/09/2022	396.10	1 375.50	409.855
Bank 5	10.000	Part. FWD	EURHUF	buy	30/08/2022	01/09/2022	**396.15**	1 404.00	**410.19**
Bank 6	10.000	Part. FWD	EURHUF	buy	30/08/2022	01/09/2022	396.09	1 383.00	409.92

Source: own editing

Considering that – as it is mentioned in the name of the participating forward transaction – we can talk about forward hedging to a certain extent, i.e. the transaction price is independent of the current market spot rates (see *Figure 12*). Regardless of what exchange rates develop in the market, our company will be able to buy euros at EUR/HUF 409.70. However, the exchange rates of the transaction need to be further investigated here. If the market exchange rate at maturity is above EUR/HUF 409.70, our company has the right (LC) to buy EUR 10 million at the level of 409.70, but if the exchange rate is below this level, only half of the total amount (liability) must be converted to euros (SP) at this level, while the remaining 5 million euros can be purchased on the market (i.e. at a more favourable level).

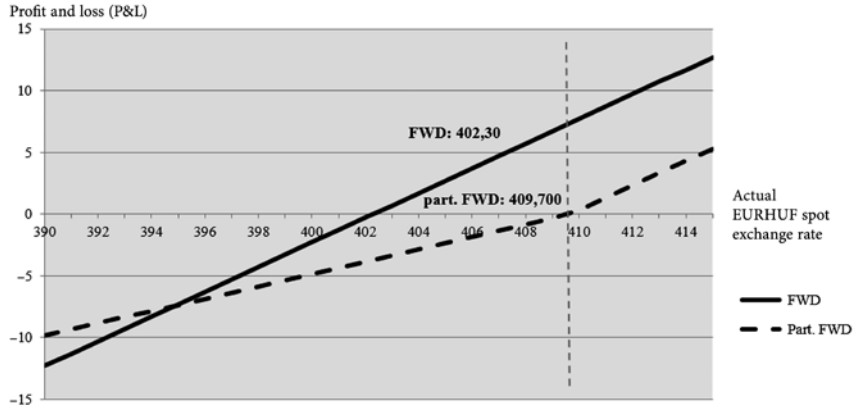
Figure 12
The exchange rate values of the participating FWD transaction reflected by the spot market exchange rates valid at the time of maturity



Source: own editing

The profit-loss function presented in *Figure 13* can also be used to clearly perceive the enforcement of rights and obligations in connection with the transaction. In the case of levels above the EUR/HUF 409.70 level, our company has the right to purchase the entire amount at the EUR/HUF 409.70 level, therefore each EUR/HUF exchange rate level one forint higher than the strike price generates a profit of one forint per euro against the market. Below EUR/HUF 409.70, the function is half as steep as the plain FWD, because in the case of levels below 409.70, our company is only obliged to buy euros for half of the total amount at 409.70, while for the remaining 5 million euros, procurement takes place in the market. As a result, the appreciation of HUF by one forint below EUR/HUF 409.70 causes a loss of 0.5 forints (calculated for a total exposure of HUF 5 million) compared to if you did not hedge your open position and bought the required currency at maturity.

Figure 13
The profit-loss function of the participating FWD transaction in the context of the spot price valid at maturity



Source: own editing

On the basis of *Figure 13*, we can see that although the strategy offers a higher level of protection compared to FWD (but the target rate of exchange still remains protected), however, in the event of further strengthening of the HUF below the level of EUR/HUF 409.70, we can benefit from favourable exchange rates partially (by half of the total transaction value), i.e. we will have the opportunity to buy 5 million euros at 409.70 and another 5 million euros at the current market rate. In our case, if the exchange rate of the forint strengthens below EUR/HUF 395.00 against the euro, the company is already in a more favourable position than in the case of FWD, because the relationship between the loss function of the two transactions then turns in favour of the participating FWD (the loss suffered due to the transaction is already lower). Above EUR/HUF 395.00, however, we are better off with the FWD transaction.

4 CONCLUSIONS

Through the example of a large company, we examined the options for hedging its open foreign exchange rate exposure, with which the company can effectively manage the exchange rate risk arising in connection with its open position of 10 million euros in the Q3 period of 2022. **In the case of individual hedging transactions, we analysed and examined the incurred costs, benefits and risks, in order to hedge the exposure with the optimal hedging strategy that provides**

the greatest security and the least cost. For this analysis, we primarily used and examined the so-called graphs showing „profit and loss" values and strike rates valid at maturity. During the analyses, we drew the following conclusions for each strategy:

Prompt and spot transactions

With prompt and spot transactions, our company would be able to hedge its exchange rate risk at significantly more favourable exchange rates compared to the target exchange rate, therefore the examined transactions can be said to be the most favourable on the cost side overall.

Despite the above, we rejected the possibility of hedging with both a prompt and a spot transaction, as they impose a payment obligation on the company for the value of the entire transaction upon conclusion of the transaction (prompt transaction) or 2 working days after the conclusion of the transaction (spot transaction). Based on the company's liquidity plan, the HUF hedging was not available at the value dates, therefore the company would not have been able to meet its payment obligations related to the transaction.

Future hedging (forward transaction)

Hedging with a forward exchange rate agreement is favourable for the company on both the cost side and the hedging side. Compared to the target exchange rate, it provides protection against unfavourable exchange rate movements at a level 7.70 forints lower, which means a cost advantage of 77 million forints, therefore we considered hedging with a forward transaction to be supportable in the current market environment.

In the case of the FWD transaction boosted with the knock out level of EUR/HUF 415.00, the forward exchange rate improves to EUR/HUF 397.00, while in the case of the knock out level of EUR/HUF 435.00, it improves to EUR/HUF 401.00, which also proves to be a good alternative for the hedging strategy during its formation.

Plain vanilla option

In the case of hedging with the plain vanilla option, taking into account the effect of the option premium, the strategy does not allow the target rate of exchange to be protected, since the effect of the premium raises the total price of the transaction above the target rate of exchange by HUF 3.30, which, calculated for the total exposure of EUR 10 million, represents an additional cost of HUF 33 million compared to the planned cost. Due to the above, we rejected the possibility of hedging

with a plain vanilla transaction under the current market conditions and in the context of the target rate of exchange.

Zero cost collar

In our case, the zero-cost collar strategy provides little room for manoeuvre, because when examining the exchange rate to be hedged, when the hedging strategy was created, the ATMF exchange rate was very close to the exchange rate to be protected. The exchange rate of the purchase obligation corresponding to EUR/HUF 410.00 of the long call was HUF 7.70 apart (this allows only 1.94% volatility), which limits the possible outcome of the transaction to a very narrow range.

Despite everything, we consider hedging with the transaction to be supportable, because the most unfavourable outcome is the same as the target rate of exchange, i.e. the company does not suffer a loss compared to the target rate of exchange, but this strategy imposes an obligation on the company at a level lower by 4.30 fillérs per euro compared to FWD, which means a HUF 43 million advantage in the case of the most favourable outcome.

In exchange for the 0.68% premium, the exchange rate of the put can be reduced to EUR/HUF 392.00 under the market conditions prevailing at the time of the strategy's creation.

Participating forward

The participating forward transaction combines the advantages of option transactions and the forward exchange rate agreement at the level of EUR/HUF 409.70 (and below the target price), therefore it provides a high degree of protection in the event of an increase in the EUR/HUF exchange rate and allows you to share in 50% of the total amount from favourable market movements in the event of a decrease in the EUR/HUF exchange rate. In our view, the strategy can be supported – albeit to a limited extent – with the fact that an advantage over the FWD strategy can only be seen at levels below EUR/HUF 395.00.

In summary, it can be said that out of the four examined transactions, three transactions (the forward transaction, the zero-cost collar strategy and the participating forward transaction) were identified as meeting the requirements set by the company, and that these transactions provide a high degree of security in the event of possible fluctuations in the interbank foreign exchange market in case of exchange rate changes, taking into account the costs.

Table 6
Comparative table of the examined transactions

Type of hedging	Rate	Amount of hedge	Target rate	Difference (HUF/EUR)
FWD	402.30	4 023 000 000	410.00	7.70
Boosted FWD (KO @ 415)	397	3 970 000 000	410.00	13.00
Boosted FWD (KO @ 415)	401	4 010 000 000	410.00	9.00
Plain vanilla option LC @ 410.00	413.30 *	4133000000	410.00	**–3.30**
Zero cost collar max	410	4 100 000 000	410.00	0.00
Zero cost collar min	398	3 980 000 000	410.00	12.00
Collar max	412.67 *	4 126 700 000	410.00	**–2.67**
Collar min	394.67 *	3 946 700 000	410.00	15.33
Part. FWD	409.7	4 097 000 000	410.00	0.30

Note: *with premium
Source: own editing

REFERENCES

Barton, T. L. –Shenkir, W.G. – Walker, P. L. (2002): *Making Enterprise Risk Management Pay Off: How Leading Companies Implement Risk Management.* Brookfield, Connecticut: Fei Research Foundation.

Bélyácz I. (2013): *A befektetések és a tőkepiac* [Investments and the Capital Market]. Budapest: Akadémiai Kiadó.

Bleuel, H. H. (2008): *Ein Analyseraster zur Bestimmung langfristiger Wechselkursrisiken von Unternehmen dargestellt am Beispiel der US-Dollar-Abwertung.* Forschungsberichte des Fachbereichs Wirtschaft der Fachhochschule, Düsseldorf Ausgabe.

Brealey, R. A. – Myers, S. C.:(2011): *Modern vállalati pénzügyek* [Principles of Corporate Finance]. Budapest: Panem Könyvkiadó.

Collins, M. J. (1999): *Cashflow- és likviditásmenedzsment* [Cash flow and Liquidity Management]. Budapest: Co-Nex Könyvkiadó Kft.

Coyle, B. (2000): *Currency Risk Management: Hedging Currency Exposures.* Financial Risk Management, revised ed. London: Financial World Publishing.

DeRosa, D. F. (1998): *Currency Derivatives: Pricing Theory, Exotic Options, and Hedging Applications.* Finacial Engineering. Hoboken (New Jersey): Wiley.

Henderson, C. (2006): *Currency Strategy: The Practitioner's Guide to Currency Investing, Hedging and Forecasting.* 2nd ed.: Wiley Finance.

Jenei Zs. (2020): Hajózni muszáj. Devizaárfolyam-kockázatot kezelni kötelező! [You must navigate. You have to manage foreign exchange rate risks!], https://www.vg.hu/velemeny/2020/03/hajozni-muszaj-devizaarfolyam-kockazatot-kezelni-kotelezo-2) (downloaded on: 06.06.2022.).

K&H (2015): *Treasury piaci kockázatkezelési kézikönyv* [K&H Treasury Market Risk Management Guide, 2015]. Budapest: K&H Bank.

Murphy, J. J. (2015): *Technical Analysis of the Financial Markets: A Comprehensive Guide to Trading Methods and Applications.* New York Institute of Finance.

Papaioannu M. G. (2006): Exchange Rate Risk Measurement and Management: Issues and Approaches for Firms. IMF Working Papers. https://doi.org/10.5089/9781451865158.001.

Reichardt I. (1997): *Devizaügyletek* [Exchange Transactions]. Budapest: Nemzetközi Bankárképző Központ [International Training Center for Bankers Ltd.].

Szabó F. (2022): Árfolyamkockázat-kezelés [Exchange rate risk management]. https://www.horvath-partners.com/hu/media-center/cikkek/arfolyamkockazat-kezeles (downloaded on: 24.05.2022.).

PwC (é. n.): Devizakockázat-kezelés [Currency risk management]. https://www.pwc.com/hu/hu/szolgaltatasok/konyvvizsgalat/treasury_tanacsadas/devizakockazat_kezeles.html (downloaded on 18.05.2022).

Szőrös K. – Kresalek P. (2010): *Üzleti tervezés* [Business Planning]. Budapest: Budapesti Gazdasági Főiskola.

Van Greuning, H. – Brajovic Bratanovic, S. (2020): *Analyzing Banking Risk: A Framework for Assessing Corporate Governance and Risk Management*. https://elibrary.worldbank.org/doi/abs/10.1596/978-1-4648-1446-4.