Simple foreign currency option Hedge strategies

A comparison of Option contracts versus Forward contracts

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Abstract:

Date: 28 May, 2010

University: Mälardalen University, Västerås Campus, Sweden

Course: Bachelor thesis in Economics (15ETCS)

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Title: Simple foreign currency option hedge strategies,
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Problem: The use of currency options has been grown widely during the latest years. This paper tries to answer whether hedge strategies using currency options are superior to forward exchange contracts or not.

Method: To answer this question a model was decided to compare payoff of a currency option hedge along the different strategies it can take to pay off the same hedge using forward contracts.

Conclusion: Conclusion is that comparing a single call or put option with single long or short forward contract, small changes in the foreign currency forwards can do better than options because of the option premium but if the changes can cover the premium

Keywords: Currency options, forward exchange rate, option hedging strategies
ACKNOWLEDGEMENT

We are heartily thankful to our supervisor, Christos Papahristodoulou, whose encouragement, guidance and support from the initial to the final level enabled us to develop an understanding of the subject.

Lastly, we offer our regards and blessings to all of those who supported us in any respect during the completion of the project.

Alireza Arabi

Maziar Saei
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1 INTRODUCTION

1.1 BACKGROUND
Being students of analytical finance and going through courses like investment theory and corporate finance gives us the spark about the topic. We came across hedging during our courses and while we were searching for a suitable topic for our thesis, currency hedging grabbed our attention and reading more about it made us interested in currency risk management and we began our work.

The foreign currency market is claimed to be one of the largest financial markets during the last decade. (Keith, P.2005). A survey provided by Riksbanken (9 October, 2001) shows that use of financial derivatives linked to exchange rates have more than doubled. The main reason of such an activity is to be more involved in hedging different types of foreign currency risk exposure and protecting from loss in value denominated in a foreign currency other than the domestic.

As we were studying different books and articles we notice that options were not commonly used. Currency options were used mostly by giant companies while smaller companies preferred to rely more on forward contracts than options, the reason being that options are risky and very expensive. This was very surprising, because in theory options comparing to other financial instruments shouldn’t have such a bad reputation. We started to wonder if this is true or if it is just rumors?

1.2 MARKET AND MARKET PARTICIPANTS
In this paper we will approach two general targets; commercial banks and medium size companies involved in international trades. The market is an over the counter market. “Over
the counter means nothing than direct between counterparties or in the private interbank market.”

1.2.1 BANKS
In this paper by the term bank we mean major commercial banks which work with medium size companies or corporate customers in Sweden. A good example can be Nordea and Svenska Handelsbanken. The medium size companies or corporations, approach the foreign exchange market through banks. The Bank actually works as market representative for them when trading with currency derivatives. For this reason a standardized agreement is signed between the bank and the company customer. The agreement contains specifications for standard conditions and will work as a basis for further trades between the bank and the company. It contains terms like the limits of the credit line extended to the company. Banks make many different types of trades daily, both for themselves and their customers, and have to manage portfolios in most currencies. They have currency desks working around the clock at different locations in the world.

1.2.2 COMPANIES
In this paper with the term company we mean medium-sized Swedish businesses that trade internationally. Their business involves several deals a month and banks are used when the deals are large enough to be of interest. These companies understand the risk of foreign currency movements and consider hedging strategies to protect themselves against exposure to these risks. The choice of strategy will depend on the type of business activity of each individual company, but they might not yet be ready for advanced positions which require continuous monitoring and hedge rebalancing. The hedge purposes, for this type of

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1 Hicks, A, 2000, Managing currency risk using foreign exchange option.
companies are mostly to hedge for payments of goods. Companies would typically trade with the bank where they have credit lines, because of their limited economic resources that makes it difficult to open credit lines with many banks at the same time. In this paper we don’t have the aim to approach very large international companies because they have treasury departments which are very complex and complicated and sometimes they are even larger than the currency departments of banks. They often deal with several international financial institutions at a time, like what banks do and use strategies further more advanced than the hedge searched in this paper.

1.2.3 Over the Counter Market

In Sweden usually currency derivative trades are over the counter deals. A deal between a medium size company and their counterparty is done through interbank. A financial officer from a company contacts the company’s personal bank representative. The contract is usually done via a phone call. The company’s officer asks for the desired type of derivative that he wants to purchase or sell, time period, and other specifications wanted for the contract. The banks representative contacts his local trading desk and normally gets the price quickly. If it is an uncommon currency then the local trade desk might have to make further contacts and ask for the positions that they are allowed to enter and their costs. They will get the price according to current market levels. Sometimes there might be differences between the market conditions and the conditions which are offered. This can be because the bank might already have a position which it wishes to decrease and they are willing to offer better than market conditions or similarly in the opposite way. They have a high demand for a certain type of hedge and can therefore increase their margins to reduce risk. If they are dealing with a forward contract, they will talk about spread. Spread is the
difference between the banks bid and asking prices. Normally the spread for a small euro contract is about four hundred points or if it’s Swedish is hundreds of an öre. Öre is one hundredth of a krona. The larger the contract, the thinner is the spread. The company might have to take larger spreads if their trades are relatively small. If they are dealing with options, the bank will offer the strike price and volatility, and after the companies agreement the deal will be closed and paper copies of contract will be sent out as confirmation that the deal has been closed. The reason behind this will become clearer in the next chapters where we will explain about pricing of the options. We have to recall that obtaining option contracts is not free.

1.3 TYPES OF CONTRACTS:
There are three types of contract used in foreign exchange market for trading foreign currency which are relevant to our paper:

1.3.1 SPOT CONTRACTS
Spot contract is an agreement for immediate sale and delivery of spot commodity such as currency at the current spot price and delivery take place in two business days.

1.3.2 FORWARD CONTRACTS
A forward contract is an agreement between two counterparties to exchange (sell/buy) a specified amount of a foreign currency at a fixed future date and predetermined price.

One side of the parties will be on a long position which means agrees to buy specified amount of a foreign currency at the fixed future date for the specified future price and the other party will be on a short position which agrees to sell the specified amount of a foreign currency at the fixed future date for the specified price.
1.3.3 **Option Contracts**

Options are contracts that give the right to holder to buy or sell an asset at the expiration date with predetermined delivery price but there is no obligation for the holder to exercise the option. The only obligation here is that to enter the contract, the investor or trader has to pay a premium amount. Options are classified into two basic types, call options and put options.

Options are in two styles, European and American. Most of currency options are European style; it means options can only be exercised at the expiration date or at the maturity. An American option is not our interest here in this paper because they can be exercised any time before the maturity. Option contract can be traded on exchange traded markets which are standardized in terms of size, strike, price and maturity or it can be traded in over the counter market where it can be agreed upon customers’ needs.

There is one clear benefit to an option contract hedge compared to a forward contract when hedge is needed in a business transaction like sale of goods. Options may be used in the same way as forward contracts to hedge for foreign exchange risk in a trade. Still, there is an important difference in the type of cover obtained. Forwards protect the financial risk only, not the commercial risk. Commercial risk, is the risk that debtor will be unable to pay its debts because of business events such as bankruptcy.\(^2\)

Options protect against the actual commercial risk, protecting the downside while retaining the benefits of any upside movement in the exchange rate. For example if company X has to pay its invoice in foreign currency to company Y, with a depreciation of the foreign currency, company X with a long position in a forward would still have to pay the exchange rate stated

in the forward contract. But a competitor who uses an option hedge or do not hedge at all could buy the currency much cheaper and gain more from an otherwise identical deal³.

1.4 PROBLEM DISCUSSION
As we found out that most companies other than giant ones rely on forwards to hedge their foreign currency exposure risk, a question raised in our mind how these companies differ from the giant ones. The difference is the way they look at hedging and purpose of their hedge.

Larger companies use derivatives to manage financial risk, while smaller companies use derivatives mainly to hedge cash flows from transactions for example like importing a good and have to pay the payment in cash. The larger the firm the higher degree of financial activity they have. The small companies or medium size corporations are usually concern with the unfavorable exchange rate movements and thus hedge each payment so they can ensure a profit in each deal. Their main aim is to avoid loss and they do not want to speculate and not interested to make profit from hedging. For them hedge is a cost and their policy is to try to minimize this cost as much as is possible.

This can explain very much why they often chose forwards as their hedging instrument, considering the fact that forward contracts are free to enter and there is no fee or premium like options to obtain them. We can say the cost of forward contracts is a hidden cost in the spread that the banks use when dealing. Considering the spread, size of a forward contract can either be very large or small, so companies might be forced to enter bigger or smaller contracts than they are looking for. While in case of options it is very easy to measure the cost and in the worst scenario it is to pay up in advance (option premium). So why should

any rational mind buy an option to hedge currency risk exposure whereas forward contract can be obtained for free?

Here comes another factor to be noticed and that is risk. What is risk? There are different answers to this question. Going back to the forward contract, the exact amount to be paid is specified without considering the credit risk thus the contract itself virtually is risk free. On the other hand, options are risky because the outcome is unknown. The amount to be paid depend on if the option will be exercised or not and hence options are more risky. In finance a common definition of risk is that risk is the standard deviation of return on total investment. Thus to compare an option contract with a forward contract a total expected return of their payoff should be consider. Otherwise forwards are risk free as they lock in a future price and any movements in foreign currency has no risk. In other words the standard deviation is simply zero. Therefore, it is better to consider total payoff of both contracts for a better comparison.

These set of questions and answers sets us towards our main problem, how would simple call option performance compare to forward contracts historically? We were surprised when we found out there was not such research to find.

1.5 Outline

Figure 1.1 shows an image of outline of the paper as a whole. In the introduction, we provided a brief background to our topic and the problem area of the paper. We will try to make a clear picture of the purpose of the paper and main problem area. In the second chapter we will describe the theories used further in our analysis. The third chapter contains the methods used for the research. The analysis chapter is the analysis conducted and our findings. The final chapter we will contain the conclusion.
1.6 PURPOSE STATEMENT

The purpose of this paper is to provide facts for expanding of currency options. This will be done through introducing hedging strategies and comparing the results of a forward contract used to hedge currency by the results of option contracts used to hedge currency risk. We hope by this simple strategy we can find facts to support our thinking that the option position is more flexible, advantageous and convenience to use for hedging currency risk.

2 THEORETICAL AREA

In this part our goal is to provide and explain the theories which are relevant to this paper in order to have academic support for the analysis we provide in the next chapter.

2.1 EXCHANGE RATES

Today international trade plays a big role in any economy. No economy operates on its own and ignores the economic events and effects around it. Countries trade and have financial relations with each other to obtain goods and services which they cannot produce by themselves because of existing lower costs in other regions and this concerns large transactions in different currencies and this direction of trade between countries depends
on exchange rates. Exchange rates are price of one country’s currency in terms of another country’s currency. Therefore the way they are determined can be very important (fix exchange rate and floating exchange rate system). A quick review in 1971, about how international monetary system determines the exchange rates, we can notice till 1971 that most countries agreed to a fixed exchange rate system, wherein a currency’s value is matched to the value of another single currency or to a basket of their currencies; or to another measure of value such as gold called the Bretton wood system where dollar was tighten to gold and other currencies to dollar. In 1973 the Bretton wood system broke down and they gave up the fix exchange rate system and began to determine the exchange rate by unregulated forces of supply and demand and this new system called flexible exchange rate system. In the short run exchange rate are not constant. In the long run they approach levels determined by purchase power parity or the law of one price. It says if the costs of transportation and transaction costs are small the price of the same good in different countries should be roughly the same when they express in same currency.⁴

2.2 FORWARDS
Here in three sections the procedure of calculating forward exchange rate will be explained.

2.2.1 INTEREST RATE PARITY THEOREM
It is good to understand the interest parity theorem before forward pricing calculations. Base on the concept of purchase power parity, this theorem is a none-arbitrage theorem that states that in the floating exchange rate system between two countries the nominal

interest rate must be the same. Otherwise there will be arbitrage opportunity; which you can borrow money from the country with lowers interest rate and invests in the country with a higher interest rate and gain where in reality this is not possible.

2.2.2 CALCULATING FORWARD PRICE
To calculate forward price it will be easy to understand it needs the interest rate of the two countries and current exchange rate and then it can be calculated from the following:

\[ F = S_0 e^{(r_d - r_f)T} \]

If \( r_d = r_f \) \( \rightarrow F = S_0 \); if \( r_d \neq r_f \) \( \rightarrow F \neq S_0 \)

F is the value of the forward rate, S is the current exchange rate, rd is the domestic interest rate, rf is the foreign interest rate and T is the time to maturity.

2.2.3 PAY OFF STRUCTURE
Forward hedge might be seen as a risk free hedge as it’s free to enter, the payments and receivables of the contract are known, but still it can create both positive and negative payoff. This is because there is an obligation to holder of the forward contract to exercise the contract at the maturity. If holder of the forward contract is on the long position and if at the maturity the delivery price of the forward contract is less than spot price of the market, there is a positive payoff. On the other hand if at the maturity, spot price of the market depreciates against the exercise price of the contract, company is obligated to buy the foreign currency at higher rate and therefore gets a negative payoff. The pay off from a long forward contract is: \( S_t - k \)

\( S_t \) is the spot rate at the maturity and \( K \) is the delivery price. The pay off diagram is illustrated in figure 1.
2.3 OPTIONS

Here in this section we will explain more deeply about currency option and its characteristics and will introduce briefly how to price an option. Pricing of options is a complex area and can go deep into mathematics. Here we try to avoid the deep mathematical calculations and bring up a bright idea about option pricing and will discuss one of the most important elements.

2.3.1 OPTION CHARACTERISTICS

Currency options like any other options, offers chances for investment and pose a risk to investors as result of interchange in the value of the foreign currency. Options on equity securities are priced in relation to the price of the underlying security. Thus can be considered dollar-dominated currency option where prices generally depend on the American dollar value of the underlying foreign currency and similarly for the cross-rate currency options will be on the relative values of the underlying currency and the trading currency.

Figure 1 Payoff diagram of long forward contract
This relationship between underlying currency to the trading currency and the prices of options on that underlying foreign currency can be generally consider as follows:

1. If the value of an underlying foreign currency increases in relation with the trading currency, call premiums of the option will generally increase in value and put premiums will decrease.

2. If the value of an underlying foreign currency decreases in relation with the trading currency, call premiums will generally decrease and put premiums will increase.

To understand the currency option characteristic, needs to learn the terminology for options:

- **Call option**: an option to buy the underlying asset (foreign currency)
- **Put option**: an option to sell the underlying asset (foreign currency)
- **Strike price/exercise price**: the price at which the foreign currency may be bought or sold
- **In the money**: call option - exercise price less than spot price; Put option - exercise price more than spot price
- **Out of the money**: call option – exercise price more than spot price ; put option-exercise price less than spot price
- **At the money**: exercise price equal to spot price
- **Writing an option**: selling a put or call option, the opposite to buying a call or put option
- **Premium**: The cost of the option to holder.
Assuming using foreign currency option, if for example an importer company wishes to buy foreign currency which they have to pay for the invoice in the future at maximum price fixed now, it buys a call option or longs on call.

**Long Call option:**

- Maximum price to be paid for the foreign currency is the strike price.
- If strike price is lower than the spot price, then exercise the option (in the money).
- If strike price is higher than spot price then let option lapse and buy at spot (out of the money).
- Cost either way is the option premium.

Loss on a call option is limited to the premium paid to purchase the call option and potential profit is unlimited. Profit can be calculated as Spot price - Exercise price - premium.

![Figure 2 payoff diagrams for long call](image)

price fixed now, it buys a put option or long on a put.

- Minimum receipt obtained for sale of share is the strike price;
• If strike price higher than spot price then exercise the option (in the money);
• If strike price lower than spot price then let option lapse and buy at spot (out of the money).
• Cost either way is the option premium

Loss on a put option is limited to the premium paid to purchase the put option and potential profit is unlimited. Profit can be calculated as Exercise price - Spot price - premium. The pay off diagram for a long on put option will be:

Notice that the gain/loss for the buyer of an option is the loss/gain for the seller or writer of the option.

2.3.2 The Black and Scholes Option Pricing Formula
The formula is derived by Fischer Black and Myron Scholes and is one of the most famous theories in option pricing. The formula is widely used for pricing European style options. It calculates the price or premium of the option to buy or sell a foreign currency at some specified time in future. The discussion behind how the formula is derived is beyond of our paper. Formula after being adopted to value a currency call option, \( c \), is:

\[
\begin{align*}
\end{align*}
\]
higher than the volatility applied to options near the money, the volatility smile occurs. This means as volatility increases the price of option increases and so when the volatility decreases the price of option decreases.

2.3.4 Put-call Parity

It is the direct relation between price of puts and calls. Put call parity explains that at any time before the maturity, the price of a European put and a European call, with the same exercise price and the same expiration must be same as the difference between the present value of the exercise price and the present value of the deliverable quantity of foreign currency.

\[ p + s_0 = c + ke^{-rt} \]

The idea is simply to understanding put call parity is to realize that a long call, together with a short put, in effect is the same as forward foreign currency contract, assuming strike price, amounts and maturity dates are the same. This is because at the maturity if put option is in the money, option would be exercised, that means deliver foreign currency and receive domestic currency. Same would happen at the maturity, short call is in the money, the call option would be exercised and holder of the call would be obligated to deliver foreign exchange and receive. Thus it can be said:

Long forward ≈ Long call + Short put

It should be noticed that this holds only for European options of the same strike price.

2.3.5 Comparing Payoff Structure of Option and Forward
Figure 4 illustrates a long forward contract and long call option contract. We know the holder of call option has the right to exercise the option but there is no obligation. Consider company X has to make payments to company Y in foreign currency. For example a Swedish company has to pay in American dollar for its trade (long USD/ short SEK). If the exchange rate (Dollar/SEK) at maturity is higher than the strike price the long call option holder will exercise the contract. The more the exchange rate increases at the maturity, the higher payoff from the option. If the exchange rate is lower than strike price then they prefer not to exercise the contract. Since they have already paid the premium, the payoff is equal to pay off from buying at the spot price or forward rate less than the option premium amount. However the long forward position has a symmetric payoff. If the foreign exchange rate at the time to maturity appreciates its value and is higher than the delivery price, there is positive pay off and if the foreign exchange rate falls in the value at the maturity less than the delivery price there will be negative payoff. As you can see in figure 2.6 if changes in foreign currency rate are not significant, the long forward is in better position than the option and for larger changes, it’s in the other way. This is a good point to consider if the currency pair that the company is going to hedge is significantly volatile in the time period, hedge is needed or not.

![Payoff Diagram](image)

**FIGURE 4 PAY OFF DIAGRAM OF A LONG FORWARD AND LONG CALL OPTION**

### 2.3.6 Breakeven

Alireza Arabi & Maziar saei
Break even is the price at which the option is equal to the gain acquired by exercising the option. For call option, breakeven is addition of its premium to its strike price. And for a put option, it is subtraction of its strike price from the premium. Therefore at the maturity if call option is exercised, the foreign exchange rate should be greater than the breakeven to make the option having a positive pay off and can be compared to the forward rate of a forward contract, that’s what a company must pay in total for each unit of the foreign currency according to the contract.

3 RESEARCH METHOD
In this chapter we will introduce simple hedge strategies a company can take to manage the exposure exchange rate risk in the market and compare the payoff result with the payoff of the same hedge through forwards.

3.1. SIMPLE CALL AND PUTS

Call and put options individually have limited loss profile risk and unlimited potential reward in different directions and thus can be used to hedge against adverse exchange rate exposure. The long call can protect against a rise in the foreign currency and the long put can protect against a fall.

Consider a Swedish importer of materials priced in USD, has a projected need to buy $1,000,000 in one month from now and at the money option (SEK/USD 1/0.1500 strike) is priced $20,000 at 2% of face value = SEK 133,333. Option contract has 100 units. The Swedish importer would have a Foreign exchange risk if dollar become stronger against the krona. In the following table we consider spot range of $0.1300-0.1680 at expiry and will check the result of different hedging strategies that the firm could have done. The result
given in table 1 shows that at expiry over spot range of $0.1300-0.1680, if the company decides not to hedge, the highest cost is SEK 7692307 at $0.1300 and the best possible, which is the lowest cost for the company is SEK 5952380 at $0.1680. Noticing such small changes on the exchange rate gives the difference of SEK 1739927. Thus it’s a strong gamble for the company to choose not to hedge as can be seen.

The next scenario is to use long forward USD (Short SEK) at the forward rate of $0.1500 present spot rates, which locks in the cost of SEK 6,666,666. As it can be seen under this category whether SEK is going to be stronger or weaker, the cost locks. We consider that when SEK is stronger than USD, the Swedish company is going under loss comparing to the spot price at the expiry. Another scenario company considers option contracts as its hedging strategy. In this case the company can long a put option SEK 6,666,666 (USD 1000000 call) with cost of premium SEK 133,333. As you can check in table 1, this option can protect the Swedish company from the depreciation of value of SEK/USD. In any case the cost for the company here is the option premium. So it is important to notice if the cost of the option premium is reasonable for the hedge or not.

The last scenario is to sell SEK Call option (USD Put), in this strategy as you can see if SEK/USD becomes stronger, comparing to forward strategy locks in SEK 6533426 meaning the only factor in favor of the hedge is its premium and suffers for any rates below 0.1500.

Check table 1 in the next page.
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<td>5952380</td>
<td>6666666</td>
<td>6085713</td>
<td>6533426</td>
</tr>
</tbody>
</table>
3.2 The Risk Reversal

The risk reversal is a directional option combination designed to offset the exposure of foreign exchange risk. This strategy has several names, originally known as cylinder and also known as collar. The basic idea behind this strategy is to buy a call option and sell a put option together or vice versa. The purpose of selling a put is that premium received offsets the cost of buying the call option. From put call parity we know that buying a call option and selling a put option with the same strike prices has synthetic foreign exchange position. The hedger usually use out of the money options here. The reason behind is the option price, they simply are cheaper and as we said earlier companies are always looking for ways which they can reduce their costs.

For example consider the Swedish importer in the previous case that has to pay in USD. If the krona gets stronger against USD, it will decrease the transaction cost for Swedish company and if the krona gets weaker against USD, the transaction cost will increase. So hedging is suggested. Assuming in May 13 2010, the current spot rate of SEK/USD is 0.131413 and one month SEK LIBOR interest rate is 0.46250 %, one month USD LIBOR interest rate is 0.33813% and current volatility of SEK/USD is 16.18%. Buying a SEK put option (USD call) can protect the company from decreasing value of SEK at premium cost 0.197 USD for an option. This expense can be too high for the company to do the hedging while it can do the same hedging by buying USD through a forward contract at no cost in foreign exchange market.

A good strategy can be risk reversal here. The Company can buy a SEK put (USD call) option at strike price of $0.129443 to gain the guaranteed minimum level of protection and at the same time sells SEK call (USD put) at the strike $0.13338 where the income from the
premium will be equal to the put premium payment. This would be a zero cost strategy for the company protects from the rates below $0.129443 and benefits from rises in SEK to the higher level of sold call strike $0.133383. The payout diagram for this strategy would be like:

![Diagram](attachment:Figure5.png)

FIGURE 5 PAYOFF DIAGRAM OF RISK REVERSAL

In the risk reversal, there is wide range of strike price which can be chosen as long as the two option premiums are equal. This depends on the risk tolerance of the hedger. The lower the strike price of the put the higher the strike of the call. If the strike price is closed to each other, the user will be at the forward foreign exchange rate and would achieve zero cost strategy, a synthetic\(^6\) foreign exchange forward through put call parity. Hedger also can have wider range of strike price and this result out of the money options and cheaper option premiums.

### 3.3 Currency Spreads:

There is variety of different spreads that exist which can be used to hedge foreign currency exposure from the foreign currency market. In the next two sections, we will explain two of the most popular types of currency spreads which are bull spreads and bear spreads. Bull

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\(^6\) In finance, a synthetic position is a way to create the payoff of a financial instrument using other financial instruments.
spreads are useful when a foreign currency is expected to rise in value and bear spreads are useful when foreign currency are expected to fall in value.

3.3.1 Bull Spread with Call Option

Bull spread is created by buying a call option for a particular currency pair and selling a call option for the same currency pair. The long call option has a strike price below the spot rate and the short call option has a strike price above the spot rate. The maturity for both options is the same. With bull spread, the hedger has the expectations that forward exchange rate will increase.

Assume two call options on SEK/USD are available; the first option has a strike price of $0.1500 and premium of $0.018 while the second option has strike price of $0.1600 and premium of $0.014. An option contract on krona consists of 10,000 units (1 unit=100 USD) and current spot rate is 0.152 USD. Consider the following:

1. The value of SEK/USD rises to $0.1550 at the maturity. The current spot price lies between the two strike prices. The hedger exercises the long call option which has been bought for $0.014 and gains the difference. The short option expires at the maturity because the strike price is above the spot price and the hedger had received the premium.

| TABLE 2 CASH FLOW OF THE HEDGE PORTFOLIO FROM EXAMPLE 1 |
|---------------------------------|-----------------|-----------------|
| Selling price of SEK           | + $ 0.155       | + $15,500=(10,0000*0.135) |
| -purchase price of SEK         | - $ 0.15        | - $15,000=(10,0000*0.13) |
| -Premium paid for call option  | - $ 0.018       | - $1,800=(10,0000*0.018) |
| +premium received for call option | +$ 0.014     | +$1,400=(10,0000*0.014) |
| = net profit                   | $ 0.001         | $100            |
Notice here the hedger would have faced a net loss of $0.155 - $0.018 - $0.16 = $0.023 if he had just chosen to buy only the first call option and he avoided the loss by selling the second call option and receiving $0.014 premium.

2. The value SEK USD rises to $0.17 at the maturity, a value higher than the exercise price of two options. Here the hedger will exercise the long call option but the short put option will also be exercised by its holder. So the following cash flow would happen:

**TABLE 3 CASH FLOW FOR BULL SPREAD HEDGING STRATEGY FROM EXAMPLE 2**

<table>
<thead>
<tr>
<th></th>
<th>Per unit</th>
<th>Per contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling price of SEK</td>
<td>$0.17</td>
<td>+$17000=(10,000*0.17)</td>
</tr>
<tr>
<td>- purchase price of SEK</td>
<td>$0.15</td>
<td>-$15000=(10,000*0.13)</td>
</tr>
<tr>
<td>- Premium paid for call option</td>
<td>$0.018</td>
<td>-$1800=(10,000*0.018)</td>
</tr>
<tr>
<td>+ selling price of SEK</td>
<td>$0.16</td>
<td>+$16000=(10,000*0.14)</td>
</tr>
<tr>
<td>- Purchase price of SEK</td>
<td>$0.17</td>
<td>-$17000=(10,000*0.17)</td>
</tr>
<tr>
<td>+ premium received for call option</td>
<td>$0.014</td>
<td>+$1400=(10,000*0.014)</td>
</tr>
<tr>
<td>= net profit</td>
<td>$0.006</td>
<td>+$600=(10,000*0.006)</td>
</tr>
</tbody>
</table>

The point here is to understand that this strategy has limited reward and loss for the hedger. We are saying here reward because we are looking at all the strategies here in this paper as a purpose of hedge and hedging is to protect and reduce the risk not to speculate and gain profit. As it can be noticed the hedger will have to sell the USD purchased here from exercising the first call option at the current spot price and again buy USD at spot price so he can pay for the short option being exercised by its holder. Therefore the gain from the long call option will offset the loss from short put. Therefore there is no chance for the
hedger to expect higher reward on his strategy even if the value of the spot price increases higher at the maturity.

3. The value of SEK/USD falls to $0.14 at the maturity. The current spot price is below both exercise prices therefore neither of the call options will be exercised and both will expire at the maturity and net profit/loss will be limited to the option premiums. As in our example the hedger will face a loss because premium he had paid for call option is greater than the premium he received for short call and it is important to notice he was not successful to hedge because the company will still have to buy the foreign currency at the current spot price.

Net profit = $-0.018*100000 + $0.014*100000 = -$400

![Figure 6 payoff diagram currency bull spread call option from example 1](image)

### 3.3.2 Bull Spread with Put Option

As we said bull spread can be created either by call or put option. A bull spread with a put option can achieve similarly by buying a put option with a lower strike price and selling a put option by higher strike price on the same underlying currency pair and same maturity.

### 3.3.3 Bear Spread
Bear spread can be assumed to take opposite side compared to the bull spread. The hedger using bear spread can use either call option or put option as in bull spread. The bear spread with call option is when the hedger sells a call option for underlying currency pair and at the same time buys a call option for the same currency pair with higher exercise price. The hedger expects a fall in the forward rate of that particular currency pair here at the maturity.

In the previous example considering there is an expectation that SEK/USD will fall in value. The bear spread hedge strategy is to short call option with strike price of $0.15 premium $0.018 and long call option with strike price of $0.16, premium $0.014. The following table shows the payoff for the strategy at different spot rates:

**TABLE 4 PAY OFF FROM BEAR SPREAD HEDGING STRATEGY WITH CALL OPTION**

<table>
<thead>
<tr>
<th>Payoff SEK/USD at options expiration per unit</th>
<th>$ 0.14</th>
<th>$ 0.15</th>
<th>$ 0.155</th>
<th>$ 0.16</th>
<th>$ 0.17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sell call</td>
<td>+$0.018</td>
<td>+$0.018</td>
<td>+ $0.013</td>
<td>$0.008</td>
<td>-$0.022</td>
</tr>
<tr>
<td>Buy a call</td>
<td>-$0.014</td>
<td>-$0.014</td>
<td>-$0.014</td>
<td>-$0.014</td>
<td>+ $0.016</td>
</tr>
<tr>
<td>Net profit</td>
<td>+$0.004</td>
<td>+$0.004</td>
<td>-$0.001</td>
<td>-$0.006</td>
<td>-$0.006</td>
</tr>
</tbody>
</table>

![Figure 7 payoff diagram Bear spread call option](image-url)
We can notice that the payoff diagram of bear spread for call option is the mirror image of the payoff diagram for the bull spread for the call option. The maximum payoff as it can be seen is limited to the difference between the premiums of two call options $0.018 - $0.014 = $0.004 and maximum loss of the strategy is limited to difference between the strike price plus the difference between two premiums $0.15 - $0.16 + $0.018 - $0.014 = -$0.006. Hence it can be concluded from the above that bull spread has limited loss and reward for the hedger.

Comparing bear spread to bull spread we can say that it depends on the hedger risk situation. If the exposure risk of the forward rate is to fall in value and he wants to gain protection from that, bear spread can be the choice and if the risk is rising in forward rate, bull spread can be the choice. If the hedger uses bear spread with put option, comparing the call option is that if the value of the underlying currency falls dramatically at the maturity the loss is significant although it's limited.

4 ANALYSIS
As we said in previous chapters the aim of our research method is to compare the payoff of a forward contract against the option contract through the simple hedging strategies. Figure 8 shows the graphical comparison of four different currency option strategies against forwards.

The figure shows the pay off of long put currency option against long forward. The maximum potential loss for the option contract is the premium and for the same hedge strategy with forwards it’s unlimited. It should be noticed that for small changes in foreign currency, forward contract is better (recall breakeven point). In other combined option zero
cost strategies it can be noticed that the potential loss is limited compared to the forward contract.

Figure 8) graphical comparison of four different currency option strategies against forwards.

5 CONCLUSION
In this paper we tried to understand if option contract are less risky for hedging strategies than forward contracts. Our method was to compare the payoff of a simple currency option strategy against the forward contract for the same currency. First of all we understood there is no certainty to forecast the expected gain or loss for the payoff of the hedge portfolio. The reason can be explained due to the movement of the foreign currency at the maturity. In the short run there are many factors that influence the change in the foreign currency and in the long run factors such as interest rate parity and law of one price. Therefore to answer the question about how much they vary is out of this paper limits. The most important factor we found out was that during the time period the hedge needs to take
place, the choice of using option or forward contract, should be dependent on changes in foreign currency to cover the option premium and also in which direction so that option contract can outperform the forward. This was important in directional zero cost hedge strategies using currency options, we also noticed that due to the volatility of the exchange rates option can have different prices or different premiums, which can help the hedger to achieve zero cost hedging strategies by choosing better premiums.

Our conclusion is that comparing a single call or put option with single long or short forward contract, small changes in the foreign currency forwards can do better than options because of the option premium but if the changes can cover the premium, the premium paid can be considered as insurance. It is true that forwards are risk free because they are locked in the price and free to enter, but we illustrated also that it is possible with option to make a zero cost hedge portfolio and gain the benefits of using an option contract.
6 REFERENCES: