Hedging foreign exchange risk with swaps and options in banks

التحوط من مخاطر الصرف الأجنبي في البنوك باستخدام عقود المبادلات والخيارات

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***Abstract*:**

The primary purpose of this article is to examine the importance of financial derivative instruments (options, swaps), and how they can be used to manage risk, exactly to hedging against currency risk in the commercial banks, we used the qualitative and quantitative methods to illustrate the role of options and The results confirm that hedging strategies, either with swaps or options yield better performance compared to unhedged strategy, the bank can guarantee a limits to their costs whatever the FX rates in market it twill pay defined amounts.

.**keyword**: foreign-exchange risk, exposure, currency swap, currency option, spot rate, strike price

JEL classification code : XN1, XN2

***ملخص*:**

يتمثل هدفنا الأساسي في هذا البحث في توضيح أهمية المشتقات المالية خصوصا المبادلة والخيارات في التحوط من مخاطر الصرف الأجنبي لدى البنوك التجارية، ولقد أكدت نتائج الدراسة بأن التحوط باستخدام عقود المبادلة والخيارات يمنح للبنوك فرصة اكثر للتحوط من خلال ضمان حد أدنى أو أقصى للتكاليف خاصة مهما تقلبت أسعار الصرف، فالبنوك سوف تدفع المبالغ المحددة مسبقا ضمن المشتقات المالية المدروسة.

الكلمات المفتاحية : سعر الصرف، مبادلات العملة، خيارات العملة، سعر التنفيذ، سعر الصرف في السوق.

تصنيف JEL : XN1، XN2

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1. Introduction :

banks engaging in international transactions (loans, buying and selling securities….) are likely to possess asset and liabilities denominated in variety of foreign currencies.

in the face of today's volatile financial market, the need for effective instruments to minimize that kind of exposure becomes the primary concern for bank's survival.

Although, derivatives have been utilized to the fullest in some giant banks to reduce significantly currency risks, these instruments are still new and unexploited for the Algerian banks. That's why derivatives are chosen in this research to analyze their usage and profit, **how do banks use financial derivatives : swaps and options to hedging a foreign exchange risk ?**

sub-questions:

- Whate are the different methods of risk bank management?
- How do banks use swaps to hedging a foreign exchange risk?
- How do banks use options to hedging a foreign exchange risk?

Hypotheses:

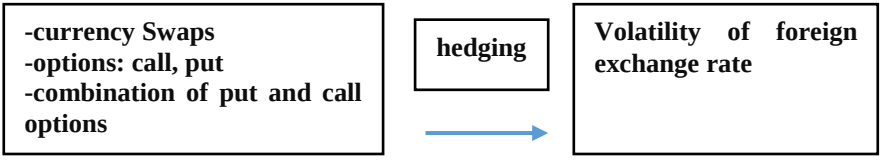
- The banks can reduce the risks by avoiding them.
- The swap is just as a trade instrument
- The option is just as a trade instrument

Objectives:

The primary purpose of this article is to examine the importance of financial derivative instruments (options, swaps) and how they can be used to manage risk, exactly to hedging against currency risk in the commercial banks

research model:

we try to study how banks use the swaps and options to hedging the foreign exchange risk



2. The different methods of banks risk management :

The risk management techniques or methods can be classified broadly as: (Utz, 2008, p139-140)

- **Accepting the risk:** concerning the accepting of risk, the risks with a minimum effect of the profit need no specific measures and under economic point of view, should be basically accepted.
- **Reduction of the risk** the bank can do this with the tight controls, for example if a customer want to take credit, and the responsible employee neglects to take financial standing information from the external commercial agency, credit losses can grow, in this case the control can be tighter and therefore more intensively for reducing risks .
- **Avoiding the risk :** a stop of offering structured financial products with high complexity to customer counts under the term of avoiding risks, and the bank management can prevent the risks, but same losing profit and as well losing customers if the supply of financial services will be reduced to much to them.
- **Transforming the risk:** in contrast of accept and avoid the risk, banks can take way some risks consciously, risk transformation is another possibility for banks whereby third parties do all risks related activities.
- **Mitigate the risk:** risk mitigation is linked to measures taken to convert unacceptable risks into acceptable risks. (HUANG, 2007)
- **Hedging the risk:** is a transfer of risk without buying insurance policies, with the possibility of scarfing profit. (بلعزوز، 2013، صفحة 51)

3. how do banks use swaps to hedging a foreign exchange risk:

Banks use swaps currency to decrease exposure to changes in exchange rate, if a bank has foreign operations, it can enter into a currency swap in order to more closely match its foreign currency revenues with payments on borrowings. Currency swaps also allow banks to effectively borrow in currencies most desirable to them. (AFFAIRS, 1994, p48). In a forex swap, the parties agree to swap

equivalent amounts of currency for a period and then re-swap them at the end of the period at an agreed swap rate. The swap rate and amount of currency is agreed between the parties in advance. Thus it is called a fixed rate swap. (chapter-13-hedging-foreign-exchange-risk, 2019)
Forex swaps are especially useful when dealing with countries that have exchange controls and/or volatile exchange rates.

For more explication, Suppose that **BADR Bank** , lends an European investor amount of 02 million euro, and he will pay after a year 2.5 million euro, and suppose that the credit risk is 0, the problem is the Algerian bank exposure to currency risk. The bank knows how much will be received in one year time in euro but not dinnar as the exchange rate changes daily, suppose too that, The currency spot rate is :100DA=1euro , The estimated spot rate in one year is 50DA=1euro
We can illustrate the swap's role in this table :

Table 1 :hedging with a currency swap

	Lending(1)	**Repayment (2)**
Without swap		
amount domestic currency	200 m DA	2.5m €=125 m DA
Loss/profit	**Loss:** 75m DA	
With swap(2-1)		
Buy 2m euro (swap)	200m DA	
-Repay the loan **-Swap back 2million euro** **-sell in foreign exchange market**		-2.5m euro: -2m €= 200m DA -0.5m €=25m DA
loss/profit	**profit**:25m DA	

4. how do a bank use the options to hedging the foreign exchange risk:

4.1.Definition:

An option gives the owner the right but not the obligation to buy or sell a specified quantity of a currency at a specified rate on or before a specified date.

In general there are two types of options : standard options and exotic options. The standard options also called(vanilla options) or just options, are the most basic option instruments. (RAMIREZ, 2015) . The are two types of options:

- Call option gives the holder the right to buy a certain quantity of currency at the exercise price at a specified time(stipulated date)
- Put option gives the holder the right to sell a certain quantity of currency at the exercise price at a stipulated date

The essential characteristics of a currency option for its owner are those of risk limitation and unlimited Profit potential, it is similar to an insurance policy, whereby instead of a householder paying a premium for insuring the house against a fire risk, a bank pays a premium to insure itself against adverse foreign exchange risk movement, this premium is paid upfront and is the bank's maximum cost. Exchange of currencies in the future may take place at the strike price(or exercise price) or if is more beneficial at prevailing exchange rate. (SHAMAH, 2004, p07)

4.2.Hedging with call and put options:

options could be used to hedge against currency risk, depending on the effect of fluctuation in exchange rate. For a bank who need to buy foreign currencies with local currencies, appreciation in foreign currencies would have negative impact to him. This is because more local currencies are needed in order to afford same amount of foreign

currencies. In other words, this bank has to pay more when foreign currencies appreciate. In order to hedge against foreign currency appreciation, the

bank would take long position in options: buy call option to lock the exchange rate that will be applied when they have to buy foreign currencies in the future. On the other hand, currency depreciation in foreign currencies tends to have negative effect on banks who need to sell foreign currency in exchange for local currencies. This is because less local currencies would receive out of same amount of foreign currencies when foreign currencies depreciate. To hedge against foreign currency depreciation, this bank would take long position in in put option to lock the rate they have to sell foreign currencies in exchange for local currencies in the future. (Cecilia Alvarado-Vargas, 2013, p12).

The bank decide to exercise the option or not depending on the payoffs, the payoffs are the net loss/profits from the option as shown in the following table :

Table 2 :the payoffs of options

Long position of	**Pay-off(loss/gain)**
Call option	Spot rate-(strike price+premium)
Put option	Strike price-(spot rate+premium)
Short position of	
Call option	Premium-(spot rate-strike price)
Put option	Premium-(strike price-spot rate)

Source : Thummuluri Siddaiah, 2009, p190-191.

Suppose a Algerian bank provided a loan to an European investor in the amount of 20000€, at current FX rate: 100DA=1€(1DA=0.01€), after one year the bank will receive the principal amount of the loan plus the interest, in the amount of 25000€. suppose the credit risk=0,

the bank wishes to hedge the currency exposure with traded options, it wishes to sell euros and buy dinars, consequently it will have to purchase a call option DA, suppose the current spot rate is: 100 DA= 1 € (1DA=0.1€), and the bank opts for a strike price of 0.01 €, suppose too the cost of this option is 10DA for 1€(0.1€-1DA), the cost for 25000€=250000DA as premium.

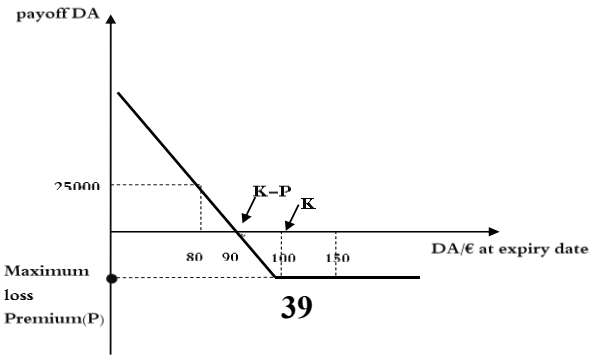
We analyze the profit and loss of the bank in many situations of spot current rate at expiry date of option:

Table3: the payoffs of the put option

Spot rate	100DA=1€	90DA=1€	150DA=1€	80DA=1€
Premium	250000DA	250000DA	250000DA	250000DA
Resulting from spot sale	2500000DA	2250000DA	3750000DA	2000000DA
Resulting from exercising the option	2500000 DA	2500000DA	2500000DA	2500000DA
Gain/loss from exercising the option	0	250000DA	1250000DA	500000
Net gain/net loss(payoff)	-250000DA	0	-1500000DA	250000DA
	Let the option lapse	/	**Let the option lapse**	**Exercise the option**

At any position, at any spot rate, the maximum of loss's bank is the premium, so according this example we can figure the payoffs as:

Figure(1): payoffs put currency option

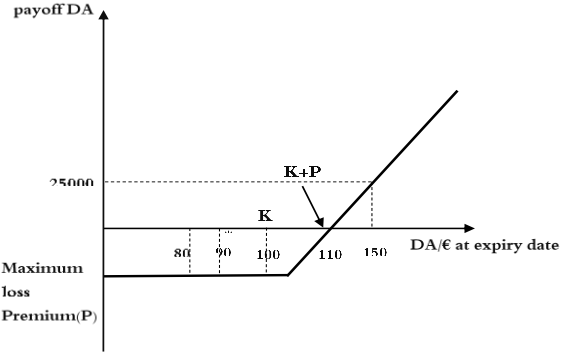


As can be observed, the bank incurs loss as a long as the spot rate is equivalent to or greater than the strike rate, the maximum loss of the bank is the premium.

As the spot rate falls and become lower than the strike rate minus the premium(K-P=90DA/€), the option yields a profit to the bank.

Suppose the opposite, the bank will pay to a bank or state…a FX amount of 25000€, it will buy a call option at the maturity, if we save the same data of the previous example the payoffs will be as showed in this figure:

Figure(2): payoffs of a currency call option



As long as the spot rate is less than or equivalent to the strike rate, the bank incurs a loss, which is equivalent at maximum to the premium, the bank can make a profit only when the spot rate exceeds the sum of the strike rate and premium K+P=110DA/1€, the spot rate over and above 110DA/1€ will yield an unlimited net profit to the bank.

so, options can be used to hedge both receivables and payables in foreign currency, when the bank buys a call option, it hedges the appreciation of a foreign currency through the determination of the maximum amount that it has to pay in home currency, and at the same time can benefit if the exchange rate ends up below the strike rate.

And if it buys a put option it hedge the depreciation of a foreign currency through determination of the minimum amount of domestic currency is received for foreign currency inflows.

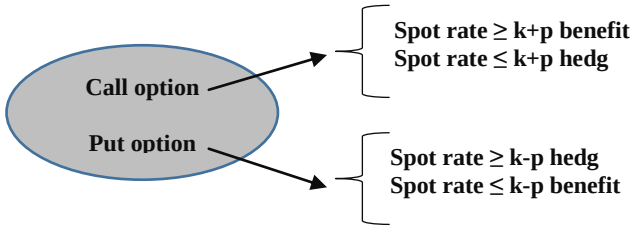


TABLE4: currency hedging with options

Currency Appreciation	**Currency Depreciation**
Long position in foreign currency call options	Long position in foreign currency put options

That's mean that the bank for hedging from the volatility in foreign exchange, he must be always acquires a long position: buy the option(call or put), in hedging he never sell call or put option(this is the short position) (Cecilia Alvarado-Vargas, 2013, p12), a written option can only be designated as hedging instrument in combination with a purchased option and under certain conditions, such us Spreads, Straddles, Strangles, and Exotic options like barrier, knock in, knock out options offer great opportunites to traders to hedge their transaction exposures. (siddaiah, 2009, p. 137)

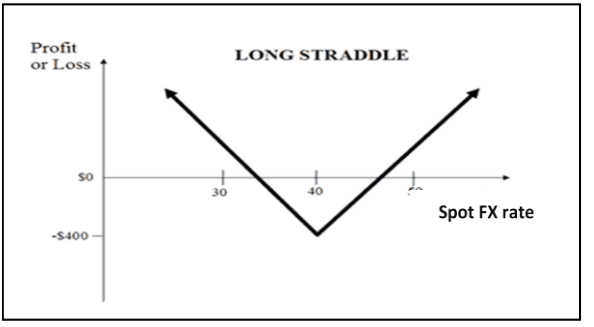
5. Option strategies:

Different combinations of options generate versatile strategies to be used in different market situations. This combinations are designated by different names such us tunnels, spreads, straddles, strangles and butterflies. These strategies are complex in nature, their impact in different market situations has to be analysed carefully, and the suitability of each strategy has to be determined before opting for any of these strategies. (KEVIN, 2009, P107)

5.1.Straddle strategy:

- **long position**: when the bank purchase a call and put option on the same underlying asset, with the same exercise price and for the same expiry date, in this case the bank is taking the view that there would be high volatility in exchange rates of the underlying currency.
- **short position**: when the bank sell a call and put option on the same underlying asset, with the same exercise price and for the same expiry date, in this case the bank takes the view that volatility in exchange rate would be low.

Figure(3): profit and loss(payoff) in straddle



SOURCE: OPTION STRADDLE, HTTPS://WWW.THEOPTIONSGUIDE.COM, VUE DECEMBRE2019.

This strategy provide a full participation in protection against market movement or increasing volatility, its maximum loss is the premium, even though it stay expensive product, and not suitable as directional hedge. (Wystup, 2017)

5.2.Strangle strategie:

A strangle is similar to a straddle, in opperations and positions, however in strangle the put and call used in combination will have a different strike prices. The long strangle holder will benefit from substantial movements in exchange rate in either direction, while the the short strangle holder will benefit when exchange rate move in a narrow range. (KEVIN, 2009, p110)

This strategy is cheaper than the straddle, even though it is expensive, and it is strong way to protection against highly volatile exchange rate or increasing volatility, but not suitable as directional hedge. (Wystup, 2017)

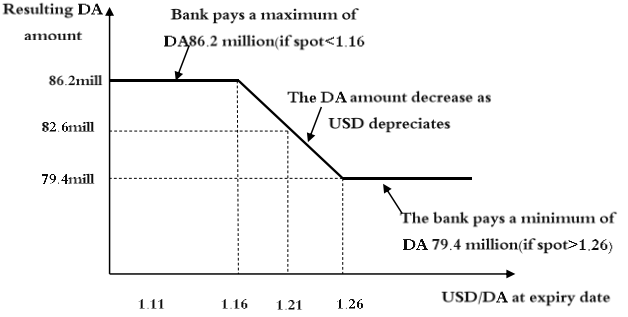
5.3. Strategy zero-cost tunnel :

With this strategy The bank buy an option and simultaneously sell the opposite option in order to avoid paying any premium. (RAMIREZ, 2015). The bank buy a call(put) option and sell put(call) option, at the same time. (عادل, 2016-2017, p196)

Suppose Algerian bank will pay 100 million dollars after one year, and it decides to hedge the FX risk(or FOreign Exchange=FOREX) arising from the highly expected purchase by buying put option at a strike price: 1.16 DA -1$, and simultaneously sell a call option at a strike price: 1.26DA=1$, at the same premium. Therefore the bank neither paid neither recieved a premium for the combination of the two options.

The purchased DA put limits the maximum DA amount to pay to 86.2 million DA, at the same time the sold DA call limits the minimum DA amount to 79.4 millionDA as shown in fugure( )

Figure(4): tunnel Resulting DA ammount

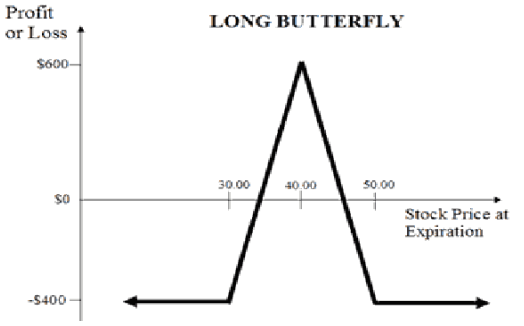


Source: Juan Ramirez, 2015.

5.4. Butterfly spread:

A butterfly spread involve buying an ATM straddle and selling call and put options of equal delta. A long butterfly strategy stands to make a limited profit if the spot rate at expiry is close to the straddle strike. (Jessica JAMES, 2015, p242).

Figure(5):profit and loss in long butterfly



Source: Uwe Wystup, 2017.

A butterfly spread can created as follows: (SIDDAIAH, 2011, p187)

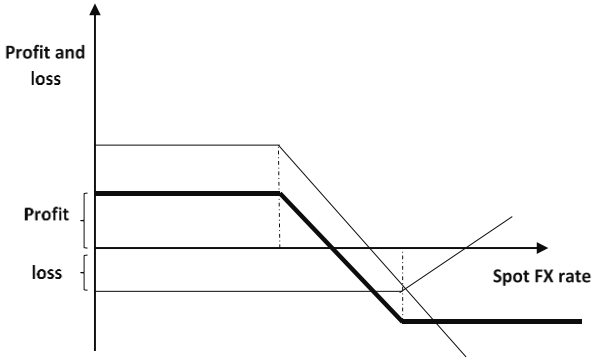
a. Buy call/put option with relatively low strike price.
b. Buy call/put option with relatively high strike price.
c. Sell two call/put options with strike price halfway between options a and b.

5.5. The Bear spread strategy:

limits the profit potential and downside risk for the bank, when it buys a call option with one strike price and sells a call option with another strike price. The strike price of the call option purchased is greater than the strike price of the call option sold. The bear spread can also be created with put options. One can buy put option with higher

strike price and sell a put option with a lower strike price. (SIDDAIAH, 2011, p187)

Figure(6) : payoff in Bear spread by call

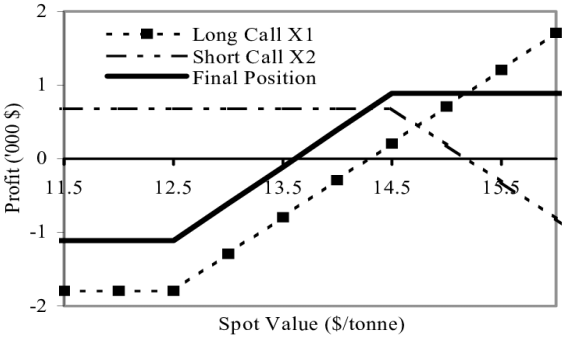


Source:.108:دانيا إبراهيم غيا، 2013، ص

5.6. The bull spread strategy:

it can limits the profits potential of a bank as well as the downside risk. This strategy according to which a bank buy a call option with a lower strike price and sell an other call option with higher strike price (SIDDAIAH, 2011, p187).

FIGURE(7):BULL SPREAD USING CALLS



Source: .107:دانيا إبراهيم غيا، 2013، ص

5.7. Other strategis:

There are many strategies which used in options:

- **Condor:** The combination of selling a strangle and buying a strangle, or selling a put and a call spread with strikes all being out of the money. (Rieunier, 2019)
- **Seagull:** A long seagull call strategy is a combination of a long call with a center strike, a short call with higher strike, and a short put with a lower strike. (Wystup, 2017)
- **Knock-in, Knock-out:** two types of barrier options, these are exotic options. Knock-out options terminate if spot rate at or beyond a barrier before expiration. Knock-in option is inactive but becomes active if spot rate at or beyond a barrier before expiration. (Twomey, 2011, p. 281)

6. Study Methodology :

The main objective of our research is we used to use the qualitative an quantitative metohds to investigate the usage of swaps and option to hedging FX risk in Banks,and answered the research questions. We used a Hypothetical examples to illustrate the role of each derivative concerned to hedging.

7. Study Results :

We reached the following results

- the banks can manage the risks by avoiding them, or reducing, transferring, mitigating or hedging.
- The results confirm that hedging strategies, either with swaps or options yield better performance compared to unhedged strategy.
- the swaps and options are trading and speculating instruments, but they are using as well as for hedging.
- if the bank is in a long position it hedges the risk of depreciation of FX with swap(by fixation of FX rate) but it losses the opportunity of profit if its expectations are wrong, and vice versa

- there are many types and options strategies, which their main principle is to fix a limits costs(premium of call and put option), and to cover options losses through other options gains (butterfly, straddles….etc.)

- the banks use the options or options strategies depending its position, objectives, and the option cost too, because there is a strategy more expensive than others.

8. Conclusion :

In their operations banks are particularly exposed to many types of market risks, as volatility of interest rates, prices of securities, and foreign exchange, And they are obliged to establish a comprehensive and reliable risk management system, using many ways and financial instruments to realizing the bank's objectives, the swaps and options provide an opportunity to make profits, as well as this they provide an opportunity to hedge the risks.

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