

# **EVOLUTION OF THE CURRENCY HEDGING INSTRUMENTS IN EMERGING MARKETS, CASE OF MOROCCO: ARE EXOTIC OPTIONS SUITABLE IN TERMS OF PRICE AND RISK COVERAGE?**

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## **Abstract**

In this report, we will answer the problematic “how the currency hedging instruments have evolved in Morocco, and how the implementation of exotic options would be beneficial and advantageous in terms of price and risk coverage”. We will first analyze the different traditional financial instruments used in the Moroccan context. Afterwards, we will introduce the classical options present in Morocco from 2003. Subsequently, we will talk about the options of “second generation” also called exotic options. Thereafter, we will compare the classical options with the exotic ones thanks to the results of a simulation. The simulation consists of two cases, the import and export case. Then, we will conclude by showing why exotic options should be implemented in Morocco.

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**Keywords:** Emerging markets, Morocco, currency hedging instruments

## **Introduction**

The establishment of a foreign currency market in 1996 was indisputably a concrete demonstration of the integration of the Moroccan economy in the path of a financial globalization. The time when banks were limited to play a role of a “mailbox” between clients and central bank, by buying and selling currencies on the basis of an undifferentiated currency rate, is over.

Today, the Moroccan banks are equipped with trading rooms, authorized to carry out transactions for the purchase and sale of currencies, whose rates are now freely negotiable between parties.

In this new market, Moroccan exporters and importers are now able to negotiate preferential currency rate, and avoid the exchange risk by using new tools such as: the purchase/sale “spot” price, the purchase/sale on term known as “Forward”, as well as the options of first generation called “Vanilla”, introduced to the market in 2003. First designed as financial products for risk hedging, these options were finally reconverted into products of speculation, and seduced a large majority of customers.

However, classical options may be too costly regarding the specific needs of investors, and may even have an insignificant gain profiles compared to the expectations.

Thus, in order to limit the disadvantages of classical options, a new category of options, known as “options of second generation” or even “exotic options”, has emerged.

The aim of this study is to explain how the currency hedging instruments have evolved in Morocco, and how the implementation of exotic options would be beneficial and advantageous in terms of price and risk coverage.

## **Part I**

### **Presentation of the currency market**

Today, Morocco is more familiarized with the financial instruments present abroad. Indeed, in June 1996, the Exchange Office has liberalized the foreign exchange market in Morocco. Since, the national banks have the possibility to negotiate with their customers the transactions of import/export.

Bank Al Maghrib has opened this market by obliging banks to pay a commission of 2/1000, which has been negotiated to 1/1000 in 2007. This liberalization has facilitated the transactions and has allowed the banks to operate on the market. Regarding the risk coverage, two products or financial tools were available on the foreign exchange market. The first tool is the operation of exchange called the spot.

This means that the client prefer to buy or sell foreign currencies at the current value of the market without having any coverage regarding the risk. The second is the operation of change in the long term. This means that the customer prefers to avoid the risk by buying or selling a currency amount at a predetermined price fixed by the bank.

### **Exchange Products**

#### **The spot exchange**

The spot exchange is a classical exchange product used for several years by the Moroccan operators. It consists of the purchase or sale of foreign currency against the Moroccan dirham at a price called "spot", defined by the current price on the international exchange market. Based on market conditions, a spot transaction allows to directly fixing the sale or the purchase of a currency for a regulation or a delivery in two business days after the conclusion of the operation. In effect, the purchase of a currency on spot on day "J" will be concluded on day "J+2" following the transaction. These two business days allow the operator, which plays the role of intermediary between the Moroccan customer and the foreign customer, to send the ticket validation to the Back Office. Its role is to check if the change has been carried out at the appropriate rate and if the client has the necessary monetary resources to perform the transaction.

When these conditions are met, the transaction is carried out.

The spot exchange has several advantages:

- Take advantage of fluctuating market prices in real time through the trading Room.
- Benefit from listings, on request, of significant transactions.
- Reduce the level of risk in relation to potential adverse rate fluctuations.
- No disbursement on the initiation of the transaction.

However, a foreign spot exchange transaction has also some disadvantages:

- It does not allow you to benefit from a favorable evolution of the market.
- Oblige to fully undergo the market in case of favorable or unfavorable course evolution.

#### **The forward exchange**

The forward exchange is a classical exchange product more sophisticated than the spot exchange. It can set the purchase price or sale price of a currency for a transaction to be made in a future date. Thus, it is a way of hedging the foreign exchange risk by eliminating the uncertainty of the evolution of a currency compared to another.

Regarding the import, the forward exchange consists of buying a foreign currency amount at a specific date and price defined in day "J" to avoid a future appreciation of the foreign currency. The forward exchange rate is calculated as follow:

$$CT= CC*((1+t1*n/360) / (1+t2*n/360))$$

CC: Spot price

t1: Interest rates of the base currency

t2: Rate of interest of listed currency

n: Number of days

The trading room borrows the amount in local currency from the Monetary Desk at a specified rate, and sells the spot against a foreign currency at the interbank rate in a local or international bank under the most appropriate conditions. At maturity, the customer buys the currency at forward price, and the bank reimburses the amount previously borrowed. Thus, the bank benefits from foreign exchange gain as the difference between the spot price at which it sold, and the forward price at which the customer buys as well as the gain resulting from the difference between the rate of investment it collects and the borrowing rates it must pay.

In the case of export, the client wishes to sell currency on a date T at a price set on the D day, fearing a devaluation of the foreign currency. The bank borrows the foreign currency amount on the D day, and sells it against the local currency at spot price and at a specified rate. At maturity, the customer sells its currency to the bank; the bank pays the customer in local currency and repays the currency amount borrowed on D day. It, therefore, benefits from foreign exchange gain between the spot price at which it sold the currency and the forward price at which it bought the currency from the customer on date T.

## Part II

### Classical Options

Since 2005, classical options have been present in Morocco and investors are allowed to use them to treat their import/export transactions. However, only a minority of Moroccan companies uses these kinds of options and that's why a low transaction volume is recorded. Even if banks use them in order to hedge their currency risk, the most important operators are private Moroccan companies. In fact, they are the ones who mainly contribute to the economic development of the country. From 2005, these companies did not show a strong attraction toward classical options. Some of the companies know about them and use them, some know about them but are afraid of using them, and other don't even know about them. Personally, I think the problem is that companies that do not know about classical options are traditional ones that do not want to change their way of doing business. Another cause of the non-use of classical options may be the fact that with the 2008 financial crisis which is still present today, Moroccan investors don't want to take the risk and want to use what they call "traditional tools" to perform their import/export transactions while neglecting the potential profit they can make by using options. As a result, the Office des changes should maybe provide Moroccan investors with seminars about currency options in order to make them familiar with them and push the investors to show some risk-taking profile. However, if they still do not use them extensively, this could mean that they are waiting for the Moroccan economy to recover which is obviously linked with many other economies in the world.

### Strategies for Classical Options

#### Participatory Call

A participatory call is a mixture between plain vanilla call and forward exchange contracts. There are two possible scenarios in case of purchase of this option. The first scenario results in a spot price lower than the strike. The percentage of participatory call represents the share of the amount covered by the option. If this percentage is 60%, the holder of participatory call will be able to buy 60% of the global amount at the spot price, the remaining 40% to be purchased at strike price (above the spot for this scenario). The second

scenario is characterized by an unfavorable evolution of the market (spot price higher than strike). In this case, the operator is fully covered against a rise of the underlying. Thus, the option allows the user to purchase the full amount at the strike price and to take full advantage of the unfavorable market.

This strategy has several advantages but also disadvantages.

- **Advantages:**

- The percentage of participatory call allows you to profit in part from favorable market conditions, thereby reducing losses compared to Strike.
- Full coverage in the event of adverse market evolution.
- Level of premium reduced.

- **Disadvantages:**

- In case of a favorable market evolution (declining currency), the percentage of the total amount purchased at the strike represents an opportunity cost.

### **Call Spread**

The call spread is a strategy that is characterized by the purchase of a call option at the money and the sale of a call option out of the money; the two options have the same maturity. This allows reducing the losses and the gains of the operator, allowing him to establish a certain level of risk coverage.

- **Advantages:**

- Limited losses.
- Level of premium reduced.
- Allows you to profit from a favorable evolution of the underlying

- **Disadvantages:**

- Limited gains

### **PUT Spread**

The PUT spread is a strategy that is characterized by the purchase of a PUT option at the money and the sale of a PUT option out of the money, the two options having the same maturity. It allows a reduction of the losses as well as the gains of the operator, allowing him to establish a certain level of risk coverage.

The advantage of this strategy is to reduce the amount of the premium while enjoying the same gain realized with the dry purchase of a PUT option, this happening if the price of the underlying does not exceed the strike price of the sold PUT.

- **Advantages:**

- Limited losses.
- Reduced level of premium
- Enables profiting from a favorable evolution of the underlying.

- **Disadvantages:**

- Limited gains.

### **Tunnel (collar)**

The Tunnel is a strategy that concerns classical options. It consists of buying a currency option at the money while selling simultaneously another of the opposite sense out of the money. It allows total immunity from an unfavorable evolution all while relatively gaining from a profitable evolution. The profitability is limited by the intervals, also known as tunnels, in exchange for a reduced premium tending towards zero.

There exist two situations, the investor can buy a Call and sell a PUT out of the money, which corresponds to the import position. Thanks to this strategy, the investor benefits from a warranty on the highest rates at which he will eventually buy his currency

thanks to the acquisition of the Call option, but the minimum rate at which he will be able to purchase the latter via the sale of the PUT option is well defined.

If not, the investor can buy a PUT and sell a Call. In this case, the investor is an exporter.

**Example:** The case of importation - Tunnel on Dollar

Currency Pair: EUR/USD

Floor price (PUT): 1.35

Ceiling price (Call): 1.55

- If the price at maturity is 1.57, higher than the price ceiling, the importer exercise the Call and buys at the ceiling price of 1.55.
- If the price at maturity is 1.45, between the ceiling and floor price, the investor buys at the spot of 1.45.
- If the price at maturity is 1.32, lower than the floor price, the importer does not benefit from the favorable rate and must buy the currency at the strike price of the PUT that is at 1.35.
- **Advantages:**
  - Total assurance against an anticipated rise or fall of the currency.
  - Positive net revenue from a rise or fall of the currency up to the set limit.
  - A limited maximum rate of purchase.
  - Negligible premiums.
  - The ability to determine the level of the exercise price as well as the span of the Call.
- **Disadvantages:**
  - The opportunity cost in case of a fall of the currency below the strike of the PUT, or in case of a rise of the currency above the strike of the call.
  - The enterprise only gains partially from the favorable evolution of the currency.

### Exotic options

Recording a strong growth since the early eighties, the currency options market got enriched. In the early nineties, new products grouped under the generic term options of "second generation" or "exotic" options. Created specifically in order to meet the needs of end customers, these instruments developed rather slowly because they have little appeal as trading products (low standardization and thus reduced liquidity) and evaluation (pricing) and management (risk management) are complex. Despite this difficult start, some "Exotic" products - such as barrier options – recorded a growing success. The outstanding in portfolios of market makers are now important and coverage may, from time to time, have a significant impact on exchange markets, and subsequently, the level of premiums. The exotic options can be classified into two categories: Path Dependent and Non-Path Dependent.

### Path Dependent Options

As their name indicates, the path dependent options are options for which the payoff on maturity depends on the path taken by the rate of the underlying during the whole life of the option. This dependence can be strong as it is the case for Asian options, or weak for barrier options as an example. A strong "path dependence" is brought to fruition by the addition of a parameter that we must consider in addition to the price of the underlying at each instant T before maturity. For the case of Asian options, this parameter is the mean of the rates of the underlying up to maturity.

### Barrier Options

A barrier option is an exotic option that differs from a classical option by the addition of a parameter, which is the barrier. Once equaled or surpassed during the span of the option,

it can be activated or deactivated. In fact there exist two types of barriers, activating and deactivating. An option with an activating barrier is only exercised if during its life span the barrier is attained or surpassed by the underlying. An option with a deactivating barrier deactivates (the owner will no longer have the right to exercise it) once the rate of the underlying attains or surpasses a certain level before maturity. In both cases, the barrier is chosen by the buyer of the option in agreement with the seller. Different types of barrier options can be distinguished, each associated with a type of barrier: In or Out.

### **Knock Option**

**Knock-In Option:** this option has the particularity of having an activating barrier out of the money. For the case of a call for example, the barrier activates when the underlying price rises to a certain level, the inverse for a PUT.

**Knock-Out Option:** this option is identical to the knock-in option, the only difference being the nature of the barrier. The barrier is a deactivating one. As well for a Call the barrier deactivates when the underlying price falls to a certain level, the inverse for a PUT.

### **Kick Option**

**Kick in option:** This option is characterized by having an activating barrier in the money. For the Call, the activating barrier is situated above the spot and the strike. For the PUT, it will be located below the latter.

**Kick-out Option:** This option is identical to the kick-in option, the only difference being the nature of the barrier. It is a deactivating barrier. For the Kick-out Call, the deactivating barrier will be at the rise and the inverse for the PUT.

### **Double barrier options**

This kind of option is characterized by the presence of two barriers, an activating a deactivating barrier. As a result, the premium is strongly reduced. The advantage is that the owner can, if the activating barrier is attained, earn profit from the option while having paid an almost null premium. If the option is deactivated or if the activating barrier has not been attained, the owner will have lost the meager premium (almost zero) paid initially.

Thus, barrier options are less expensive than classical options without barriers. They were created to provide insurance without having the buyer paying a high premium. Thus, if the option is not activated, or if it is deactivated, the holder will lose the low initial premium paid. For the seller of the option, there's less risk that the holder exercises the option and therefore less risk of incurring losses, the barrier being a constraint.

### **Specific case of the purchase of a Call Kick-In option EUR USD:**

Nominal: EUR 1 million

Maturity: 3 months

Spot at maturity: 1.0400

Exercise Price: 1.0600

Activating barrier: 1.0900

Premium: 1.25% of the nominal

→ If at maturity the spot is greater than 1.0600 and if the spot hit 1.0900 during the life of the option, then the holder exercises the Call and buys EURs against USD at 1.0600. In all the opposite cases, the Call Kick-In option is not exercised at maturity.

### **Strategies using barrier options:**

Several strategies are derived from barrier options. An example is the Forward Plus. The Forward Plus is a synthetic forward adjusted at zero cost. The Forward Plus is the

purchase of a classical option, financed by the sale of a Kick-In option of the same exercise price:

- A buyer of foreign currency buys a Call and sells a PUT Kick-In.
- A seller of foreign currency buys a PUT and sells a Call Kick-In.

The rate proposed in the Forward Plus is slightly degraded compared to the purchase or sale price of a classical forward, but in return, the Forward Plus allows you to enjoy the upswing of the underlying exchange rate, provided that the barrier of the Kick-In option is not hit.

**Example:** Parameters of the Forward Plus:

Nominal value for both options: 1M EUR

Maturity rate common to both options: 3 months

Purchase of a EUR / USD Call

Exercise Price: 1.0460

Sale of a EUR / USD PUT:

Exercise Price: 1.0460

Activating Barrier: 0.9875

Spot: 1.0370 - term: 1.0370

- No premium paid, because the premium received on the sale of the Kick-In PUT finances the purchase of the Call
- If the barrier is touched during the life of the PUT Kick-In option, the client becomes the holder of a synthetic forward purchase at the price of 1.0460. So the client will buy at maturity 1M EUR at 1.0460
- If the barrier is never touched, the client is simply holder at maturity of a Call option with an exercise price of 1.0460, and will be free to deal at spot price otherwise.

### Summary of the situation at maturity

Exchange price at maturity	Spot < 1.046	Spot > 1.046
Barrier reached	1.04600	1.04600
Barrier never reached	Spot at maturity 0.9876	1.04600

#### - Advantages:

- No premium to be paid.
- Clients benefit from a portion of the improvement in the exchange rate, while ensuring a maximum ceiling price (purchase)/floor price (sale).

#### - Risks:

- The guaranteed price is slightly degraded compared to the classical forward rate.
- Lost profits from the difference between the spot at maturity and the guaranteed price.

### Asian Options

Asian options are characterized by a profit that depends on the average price of the underlying over a period of time before maturity. The profit is the difference between this average and the Strike.

There are also Asian options whose strike is nothing more than the average price of the underlying before maturity. Gains are represented by the difference between the closing price at maturity of the underlying and the strike price.

We also distinguish the flexible Asian options that allocate different weights to the observed prices and are widely used nowadays.

Asian options are mainly used in the commodities and exchange markets as they are considered as an alternative to hedging at a reduced price compared to classical options.

## Non-Path-Dependent Options

The price of these options does not depend on the path followed by the price of the underlying during the life of the option. We can distinguish several *Non-path-dependent options*, but we will focus on two of them: the binary options, and basket options.

### Binary Options

The binary option allows the buyer to receive a fixed amount of money if the price of the underlying reaches or surpasses the exercise price fixed beforehand. This is the type of option where the payoff is either a sum fixed in advance or nothing at all. Thus, it is called "binary option" because only two situations are possible: either the option ends in the money and the holder receives the amount fixed in advance, or the option ends out of the money and the holder gets nothing. A trader who thinks that the EUR / USD will close at a level above the current price of 1.3250 can buy a binary option (Call) to enjoy this rise. In contrast, if he thinks that the EUR / USD will finish below the level of 1.3250, he can buy a binary option (PUT) to enjoy the fall.

#### Example:

At 2 pm, the EUR / USD is at 1.3250. Therefore, the trader buys a binary option (call) for 100 € The option expires at 15 pm and provides a yield of 80% if the price ends above the exercise price. Therefore at 3pm, if the EUR / USD is above 1.3250 the holder receives the amount invested (€100) plus the 80% premium- €80. The profit is 80 € Conversely, if the price ends below 1.3250 then the trader loses his initial investment.

There are several types of binary options; the most important are listed below:

#### - The "High / Low" option:

The "High / Low" or "Up / Down" is the most popular option. This type of contract decides whether the underlying's price is above or below the original price when the option expires.

Example: An investor buys a "High / Low" option on the EUR / USD (predict a rise). The original price is 1.2550. The investor wins the contract if the closing price is above 1.2550.

#### - The one touch option:

The "One Touch" option is an option increasingly democratized in the industry of the binary option. This type of contract involves deciding whether the underlying price will reach a predefined value or not throughout the lifetime of the contract.

#### Example:

The investor buys a "one touch" option on the price of Gold. The original price is 1725. The targeted value is 1735. The investor wins the contract if the price hits the value 1735 throughout the lifetime of the option.

#### - The "all or nothing" option:

Also called "Cash or nothing", it entitles the holder to receive a fixed coupon determined in advance, if the option reaches maturity "in the money". Otherwise, the option premium is lost.

#### - Advantages:

- Certainty of the "pay-off": Unlike standard options for which the "pay-off" is random (since it is based on the final value of the underlying), the purchaser of a binary option is certain to receive an amount M (in case of favorable price evolution) or zero.
- Flexibility for the customer: In addition to the ability to choose the exercise price, the customer is free to determine the amount they wish to receive in the event of favorable evolution.



## **Binary options strategy**

### **Corridor option**

The corridor options consists of a series of binary options including, for each day between the transaction date and the maturity date, the purchase of a binary call and the selling of a binary call of a higher strike. This combination allows you to receive an amount proportional to the number of days during which the underlying will remain in the selected terminals. The purchaser of corridor options anticipates that the underlying will remain as long as possible within a "trading interval" during the life of the option.

### **Example**

The index is at 3000 points; a treasurer anticipates it will stay between 2750 and 3250 during the coming year. He buys a corridor option that will pay him an amount proportional to a 8.25% coupon, depending on the number of days during which the index will remain in the trading interval. The corridor option costs 3.87%. At the expiration of the option, we note that the index was quoted 300 times between 2750 and 3250. The treasurer of the option therefore receives a coupon of 6.78% (=  $300/365 * 8.25\%$ ).

*NB: When a customer decides to sell a standard binary option, he immediately receives a premium, but is exposed to unlimited losses if the evolution of the underlying is unfavorable. The sale of these options allows receiving instant bonuses while perfectly knowing the maximum loss.*

### **Current status of exotic options in Morocco**

"In Morocco, the introduction of currency options does not require a special euphoria. To start, their use is likely to remain limited to two local banks and some large groups. The predominance of foreign exchange transactions in euro (about 80% of transactions) is one of the reasons given by the bankers. In addition, the composition of the basket explains the relative stability of the dirham against the euro. The volatility of the EURO / MAD is relatively small comparing to that of the USD/MAD. Furthermore, the treatment of the options by banks requires a good organization of the activities and a control of processing operations. In addition, options require extensive preparation in terms of human resources, risk management and information systems. These products should be urgently developed because in the long term they will no longer be able to satisfy all customer needs" (M.Kably, L'Economiste). The development of these options will certainly lead to the implementation of exotic options in Morocco, which are products that protect from currency risk and which are more sophisticated than the classical options on currency. These exotic options are already present in several countries such as the United States, France ... Being more sophisticated than conventional options; they offer the possibility to make the client enjoy a favorable or unfavorable evolution by paying a small premium compared to that of the vanilla options. In Morocco, exotic options are still not present, but significant efforts are being made to learn and implement this kind of options. These options must first be understood by Moroccan operators. Since a minority of Moroccan companies use conventional options to hedge against currency risk, they will show no appetite for options to become familiar with the exotic. But this is not a problem; seminars will be held to show the mechanism of this kind of options.

### **Simulation**

#### **Case of import**

Nominal: 1M Euro

Deal Date: 05/15/13

Maturity: 07/15/13

Spot Price at 05/15/13: 11.0786 - 11.1550

Spot at maturity at 07/15/13: 11.1600

### Adaptable Currency exchange instruments:

- **Purchase at spot:**

The spot at purchase is the standard way to buy currency for an importer. Indeed, the Moroccan operator completely undergoes the market and does not want to hedge against the risk of appreciation of the foreign currency to buy. Thus, he will buy two days before the deadline the amount in euro at the market price called spot at 11.16. The client will thus pay  $1,000,000 * 11.16 = 11,160,000$  MAD.

- **Forward Purchase:**

The forward purchase is a simple technique to hedge against the risk of appreciation of the foreign currency for the Moroccan operator. The latter make a forward purchase when it predicts an upward anticipation of the foreign currency to buy.

The bank borrows the equivalent amount in dirham from the money Desk at an “Ask” rate of 3.25%, and sells it against the euro at a Bid rate of 0.02%. The formula for calculating the forward price is as follows:

Spot \*  $(1 + (\text{Rate MAD} * \text{NbD}) / 360) / (1 + (\text{Rate Eur} * \text{NbD}) / 360)$ . The forward rate is thus equal to:  $11.155 * (1.005417 / 1.000033) = 11.2151$ .

At maturity, the customer pays 11,215,100 MAD.

→ On July 15, the spot EURMAD course is 11.16. It is better than the forward price which is 11.2151. Thus, it would have been preferable for the importer to buy euro against the dirham in spot July 15. Therefore, the importer suffers from a loss of  $(11.2151 - 11.16) * 1,000,000 = 0.0551 * 1,000,000 = 55,100$  MAD.

- **Tunnel:**

The tunnel option is characterized by the purchase of a call and the simultaneous sale of a put. The upper bound represents the exercise price of the call, which is 11.241. The lower bound is the put exercise price which is 11.20.

The tunnel is a financial instrument that gives the user the opportunity to enjoy the favorable evolution of the market between two terminals (maximum price, minimum price). If the price is between these two limits, the operator buys currencies in spot-no option is exercised. If the price is above the exercise price of the call, the operator exercises its Call. If the price is below the exercise price of the put, the importer buys the strike of the put.

→ On July 15, the spot price is 11.16 EURMAD. Thus, the importer does not exercise his call. However, it will buy the currency at the exercise price of the put of 11.20. The importer will suffer a loss of  $(11.20 - 11.16) * 1,000,000 = 0.04 * 1,000,000 = 40,000$  MAD.

- **Classical option: buy a call EURUSD**

This option is characterized by the sale of a call EURMAD in the Moroccan operator. In our case, 0.74% is the price of this option compared to the initial amount. The amount in question is 1 million euro, so that the customer will pay the bank the equivalent MAD 7400 EUR in buying this call. The importer must then pay the premium of  $7,400 * 11.155 = 82,547$  MAD

- **Exotic option: buy a call to Knock → Kick-In**

A barrier option is an exotic option that differs from classical options. Indeed, one knock option is an option that activates when the price of the underlying reaches or exceeds a certain level called barrier before maturity. As soon as it touches this level, the option is activated and gives the right to the holder to exercise it. If the underlying does not touch the barrier, the operator is losing the premium initially paid. For the call to knock if the spot at maturity is greater than the strike and whether the spot hit the knock during the life of the option, then the holder exercises the Call and buys EUR against MAD during strike. In all cases the contrary, the Call is not exercised at maturity.

Strike = Spot = 11.155

Activating barrier = 11.20

Premium to pay = 61001.77 MAD

→ Throughout the maturity of the option, the current EURMAD hit and exceeded the knock. Thus, the option is enabled and gives the importer the right to exercise it.

→ On July 15, the EURMAD spot price is 11.16. The exercise price of the call is better than the spot on July 15. Therefore, the importer exercises the call and has a gain of  $11.16 - 11.155 = 0,005 * 1,000,000 = 5000$  MAD. However, its net profit is negative given the amount of the premium paid:  $5000 - 61001.77 = -56001.77$  MAD

### Interpretation of results

The best risk coverage here is to purchase the currency at the spot price at maturity. Other risk coverage instruments are also very interesting, but for this example, the currency prices are made in a way they cannot be beneficial for the operator. The instrument through which the loss is at its minimum is the tunnel followed by forward exchange contracts and by the exotic option and finally the classical option.

### Case of Export

The exporter receives in 2 months \$ 1,000,000. This means that he is selling dollars against the MAD in 2 months. Then, the bank buys dollars spot on Bid.

Amount to cover: USD 1M

Deal Date: 05/15/13

Maturity: 07/15/13

Spot price of 05/15/13: 8.51 - 8.56

Spot price at Maturity of 07/15/13: 8.54

### Case of Sale on Spot

In our situation, the sale at spot price corresponds to the case where the exporter sells for cash, two days before the deadline date of 15/07, an amount of \$ 1,000,000. The bank then buys the \$ at 8.54, and the exporter receives an amount of 8,540,000 MAD.

### Case of Forward Sale

The forward sale is for the exporter to receive at maturity on July 15, an amount of \$ 1,000,000, and simultaneously sell it to the bank against the Dirham. In time T, the bank borrows \$ at a rate of (ask) USD 1.25 and sells it up against the MAD at a rate (bid) MAD 3%. The forward rate is then: 8.5348.

At maturity, the exporter receives an amount of 8,534,800 MAD. When the forward price is higher than the spot due price the exporter benefits from it. However, when the forward price is less than the spot due price, the bank benefits.

**CAT = SPOT \* (1 + ((Tx MAD \* Nb Days)/36000) / 1 + ((Tx Currency \* Nb Days)/36000))**

→ On July 15, the price of 8.54 is slightly higher than the forward price. Thus, the exporter suffers from a loss because the forward price at which the transaction is carried out is lower and less advantageous than the spot during July 15. The value of the loss to the exporter is:  $(8.54 - 8.5348) * 1,000,000 = 5,200$  MAD

### Case of a Plain PUT Vanilla Option USD/MAD:

The bank sells a PUT to the exporter whose premium is 1.80% for an amount in foreign currency of: \$ 1,000,000 to convert to MAD.

Premium to pay by the exporter =  $1,000,000 * 1.80\% * 8.51 = 153\,180$  MAD

Spot of 05/15/13: 8.51

Strike of PUT: 8.51

Spot of 07/15/13: 8.54

→ The strike is below than the spot of July 15. Therefore, the exporter abandons his PUT and sells it at spot price. Thus, he received a total of 8.54 million.

The situation is not good for the exporter even If he sells his currencies at 8.54 because he loses the paid premium. The amount of the loss is measured by calculating the difference between the prices minus the premium paid.  $((8.54 - 8.51) * 1,000,000) - 153,180 = 123,180$  MAD

### Case of a Tunnel

For an exporter, the tunnel is to buy a PUT and sell a call.

The lower bound is: 8.5100 and corresponds to the exercise price of the PUT guaranteeing to the exporter a price floor. The upper bound is: 8.5500 and corresponds to the exercise price of the Call limiting the profitability of the exporter at the rise.

At maturity, if the price is between 8.51 and 8.55, the transaction is made at the spot price and no option is exercised. If the price is below 8.51, the exporter exercises his PUT, and the transaction is made at the exercise price 8.51. If the price is higher than 8.55, the bank exercises its Call and the transaction is performed at the exercise price at 8.55.

→ On July 15, at maturity, the course is 8.54 and is between the two boundaries 8.51 and 8.55. Therefore, no option is exercised and the transaction is made at a price of 8.54. The exporter sells his currency and receives an amount of 8,540,000 MAD.

### Case of an exotic option: a PUT deactivating barrier in the money → PUT kick out

An option PUT with a barrier differs slightly from a classical PUT option. Indeed, a PUT deactivating barrier option, as an example, has the same characteristics as a classical PUT, added to it a parameter that makes the option no longer valid if it affects a specific price. This price represents a deactivating barrier which, once reached, cancel the option. When the spot level of the underlying - USDMAD - reaches or crosses the barrier at any time during the life of the option, the PUT is automatically disabled and causes irretrievable loss of the amount invested in the PUT, whatever the future development of the underlying will be.

→ Premium to pay by the exporter =  $1,000,000 * 1.80\% * 8.51 = 29276.41$ MAD

Spot of 05/15/13: 8.51

Strike of PUT: 8.51

Spot at 07/15/13: 8.54

Deactivating barrier:  $8.51 * (1 - 0003) = 8.30$

→ The spot of July 15 did not reach the deactivating barrier of 8.30. Therefore, the option is available but will not be exercised by its holder (exporter) because the spot of July 15 is better than the strike of the PUT. Thus, the transaction will be carried out spot price of July 15: 8.54.

→ The exporter is winning in this situation since he could sell his currency at a higher price of 8.54 instead of 8.51. The amount of the gain is  $(8.54 - 8.51) * 1,000,000 = 30,000$ . He is, however, losing the premium: 29,276.41 MAD. The net gain is  $30,000 - 29,276.41 = 723.59$  MAD.

### Interpretation of Results

Using the analysis of simulation results of the case study above, we cannot draw any major conclusions because the situations and the results vary depending on economic

conditions and the price trend. However, we can deduce that from the point of view of options as a hedging instruments for exchange risk, these are quite expensive but exotic options are much more affordable and more attractive given the relatively low level of the premium they require to be paid compared to conventional options. In both cases, we opted for a barrier option (Call Kick-In to import, Put Out Kick-export), which are among the most commonly used options in international markets. Thanks to the pricer, we could price these two options by typing the actual data in the database. Therefore, we could get the option price with respect to strikes and barriers set. In this situation, the Put Kick-Out has been successful as it has achieved a positive gain in spite of the lost premium due to the option not being exercised. Unfortunately, the Kick-In Call has not allowed its holder to make gains. That being said, even if the exotic options are theoretically very attractive, they can be very risky. This explains why they are still not present in Morocco to be used by operators due to the risk-aversion philosophy of Moroccan investors.

### **Future of exotic options in Morocco**

This being said, the exotic options have a promising future in Morocco. Since conventional exchange options are no longer sufficient to meet the hedging of several Moroccan operators; moving towards exotic options remains the best solution. Although a minority of Moroccan companies still use traditional exchange options in their import-export financing, their volumes are still significant. Exotic options should therefore be liquid on the Moroccan exchange market because they offer important advantages for the operator. In favor of the operator of course, but the bank, the issuer of options, also benefits. Indeed, it receives a relatively low premium by issuing an option and can also benefit if the price of the underlying at maturity are in its favor. Thus, both parties can benefit. The only obstacle now is to show to the Exchange Office that the implementation of exotic options in Morocco would be a success. It is obvious that the development of currency options as a hedging tool is crucial for the expansion of our capital market and our financial solidity, and for the reinforcement of our local currency. However, since the Moroccan currency is characterized by a fixed regime (basket EURUSD), the Exchange Office believes that exotic options should be in the heart of a floating regime to ensure their liquidity and demand. However, a strong and stable economy is required for the adoption of a floating regime which is not really the case for Morocco. Thus, it is important to avoid high volatility of the national currency and to ensure economic stability. This is why the implementation of exotic options is time-consuming, and the Exchange Office does not want to rush. The benefits of exotic options are obvious but their adoption requires a certain economic stability and an appetite for risk-taking.

### **Conclusion**

At a time when competition is at its peak, the investor needs diversify increasingly contributing to the enrichment of the range of exotic options. However, if the benefits of these products are undeniable, their valuation and coverage is a real challenge.

The purpose of this project was to show how the implementation of exotic options in Morocco is advantageous to guarantee to investors a customized hedging. Indeed, throughout this report, I was able to distinguish between different hedging instruments, and it turned out that exotic options, compared to conventional options, are highly advantageous in terms of premium paid and received pay-off. However, buying these exotic options requires taking large risks. As we have seen in the simulation I performed, there must be some difference between the strike of the option and the underlying spot price to offset the premium and enjoy the option. Otherwise, a loss can be generated.

This being said, the implementation project of exotic options in Morocco should not be sidelined. Certainly, it requires time and a multitude of efforts since the exchange rate regime must move from a basket regime to a floating regime, which in turn requires a stable and a stronger economy. However, the benefits of its implementation are interesting.

A logical continuation of this work would be to focus on the analysis of the change from an exchange regime in Morocco into a floating regime.

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