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CURRENCY QUASI–FORWARD FORMULAE WITH COSTLESS AND COSTLY ARBITRAGE*

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Abstract. *In this paper, we present simple formulae for evaluation of currency quasi-forward agreement. This type of forward agreement is frequently used amongst leading Serbian banks and their counterparties. It serves as a tool for hedging clients' exchange rate risk. Moreover, it could potentially contribute to bank profitability, especially if the rates are quoted at the very boundaries of the arbitrage band. Unfortunately, there is no publicly available database for quoted or arranged forward rates. However, if the database becomes available, for researchers a next step further is to test how much if any the actual forward rates are transacted on the line of theoretical foundation presented here.*

Key Words: *Serbian derivatives market, basis arbitrage, currency quasi-forward agreement; forward modeling*

INTRODUCTION

Serbian private derivative market has seen the biggest advance in introducing currency quasi-forward. This type of contract is a specific mix of typical terminal agreement (forward) and deposit contract. A typical, or classic forward, is a two-party agreement to exchange an asset at a specified future time for a predetermined price. In case of currency forward it means that neither party has to pay anything to the other before the specified future time, i.e. delivery date. Neither seller pays (delivers) foreign currency, nor buyer pays counter-value in domestic currency. A quasi, or "covered", forward assumes different payment schedule. A seller still delivers foreign currency at a specified future time, but a buyer pays at the signing of contract. The advance payment can be treated as a performance bond (cash collateral); at least it serves a similar role. Unlike the performance bond, which assures the payment, but payment comes independently, here the whole payment is done in advance. The contract offset a contractual party, that with a short position

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(agreed to *sell* the foreign currency on forward), which is regularly a bank, for counterparty risk. The other party (that with long forward position) agreed on paying full terminal price in advance.

In following sections, we are going to introduce basic evaluation principles to deliver formulae for currency quasi-forward. The approach is accomplished through a three-step procedure. Firstly, we introduced basic principles of basis arbitrage for classic forward agreement. Then we go to discuss peculiarities of quasi-forward. Finally, some of starting assumptions are relaxed in order to develop the case of costly arbitrage. The framework makes us able to analyze determinant of price setting policy in a multiple dealer forward market.

1. Basis Arbitrage

The difference between the current forward price and the spot (cash) price of an asset is known as basis. If equilibrium has been reached, the basis equals to so-called cost of carry, which is exactly what costs carrying the asset (to take possession of it) until maturity of forward contract. Some authors (Fabozzi et al. 2002, p. 546) renamed the same concept "net financing costs". In science of economy, this relation has been known for centuries. For instance, Keynes (1936, pp. 225–228) in his seminal work has used cost of carry concept to develop inter-temporal equilibrium in demand for money and other goods. In currency forward markets, the cost of carry is the difference between the interest cost of the domestic currency invested in a foreign currency and the interest earned on the foreign currency. The cost-of-carry relation can therefore be written as (Stoll and Whaley, 1993, p. 159):

$$F_T = S_t e^{(r_d - r_f)(T-t)} \tag{1}$$

Where F_T stands for forward exchange rate maturing at time T, S_t (spot) exchange rate for immediate delivery, r_d, and r_f are continuously compounded, riskless rate of interest in the domestic and foreign currency, respectively, and $T - t$ is the maturity of the forward contract. In international finance, the relation is well known as the interest rate parity relation (Aliber, 1973; Frenkel and Levich, 1975; Giddy, 1976).

Out-of-equilibrium basis differs from cost of carry, which could make some market participant play on equilibrating the market, to set up the strategy called basis arbitrage. At the same time, the strategy forces market to stay close to equilibrium. Therefore, the relation belongs to those economic regularities that are supported with so-called arbitrage mechanism. The arbitrage argument is often taken so strongly that many authors question the ability of forward rate to predict future spot rate (*cf.* Fama and Bliss, 1987, Fama, 2006). For the relation to hold it is necessary to have all the conditions met:

Assumptions:

i. Arbitragers can borrow or lend foreign currency risklessly at a compounded rate of interest, r_f, and in the same way they can borrow or lend local (domestic) currency at a compounded rate of interest r_d. Thus, they can borrow money at the same risk-free rate of interest as they can lend money;

ii. There are no taxes, nor any cost necessary to accomplish transactions. Thus, the arbitragers are subject to no transaction costs when they trade, and subject to the same tax rate on all net trading profits;

iii. The forward, spot exchange rate, and interest rates are independent on value of transactions;
iv. There is no costs related to gathering and processing of the relevant information;
v. When arbitrager sees an arbitrage opportunity, she or he is able to exploit it, so that she or he takes advantage of arbitrage opportunities as they occur.

If the forward exchange rate is different from the spot exchange rate for an amount above the cost of carry (interest deferential), arbitragers can buy the foreign currency and short forward contract on the foreign currency. If the rates differ on the opposite way, they can short the foreign currency and buy forward contracts on it. Here we just follow the simple arbitrage rule: buy what you think is cheaper (or less expensive), and sell what you think is more expensive. Then, you have just to wait for the exchange rates to return to their equilibrium relation, or to converge. All the positions are to be expressed in units of domestic currency, and evaluated as cash flow. Namely, cash inflows (e.g. in case of borrowing money) go with positive sign, while cash outflows (in case of repaying a loan) go with negative sign.

Let us first give a proof that forward rate could not be above the level given by the relation (1), therefore it must be equal or possibly below the relation. The proof is given in a way similar to that already seen in economics (*cf.* Stoll and Whaley, 1993, pp. 33–37). The starting point is so-called riskless basis arbitrage. If the forward price is too high, arbitragers will find it attractive to buy the foreign currency on spot and take a short position in a forward contract (Hull, 2003, p. 47). This is exactly what we show in the following table (1).

In order to start arbitrage arbitrager with no initial wealth should borrow the domestic currency in amount necessary to purchase one unit of foreign currency, which is then invested at the foreign riskless rate of interest. If the proceeds at maturity of the foreign investment are sold in the forward market, a return expressed in domestic currency can be guaranteed at time *T*.

Cash flow coming from all positions necessary to construct, or "put on" the arbitrage is presented in Table below (1). At time *t*, the arbitrager borrows domestic currency in amount enough to buy one unit of foreign currency on spot for S_t. The obtained foreign currency fund is invested at the certain rate of interest r_f. At the same time, arbitrager shorts a forward contract to sell foreign currency in $T - t$. When the forward contract matures at time *T*, the terminal value of invested foreign currency is $\widetilde{S}_T e^{r_f(T-t)}$, which is exactly the terminal value of foreign currency that the arbitrager should deliver to forward counterparty.

At time *T* foreign currency is sold for $F_T e^{r_f(T-t)}$. An amount $S_t e^{r_d(T-t)}$ is required to repay the domestic currency loan at maturity and the investor makes a profit if the proceed in domestic currency obtained for selling foreign currency on forward exceeds cash outflow coming from borrowed domestic currency.

Table 1. Arbitrage transactions for establishing the relation $F_T \leq S_t e^{(r_d - r_f)(T-t)}$

Position	Initial value (t)	Terminal value (T)
Borrow domestic currency	S_t	$-S_t e^{r_d(T-t)}$
Buy foreign currency on spot and invest risklessly	$-S_t$	$\widetilde{S}_T e^{r_f(T-t)}$
Sell forward contract	0	$(F_T - \widetilde{S}_T)e^{r_f(T-t)}$
Net portfolio value	0	$F_T e^{r_f(T-t)} - S_t e^{r_d(T-t)}$

When the portfolio is formed, the net investment cost equals zero, since the cost of acquiring the foreign currency is completely financed with riskless borrowing. Moreover, the forward position in Table (1) requires zero outlay and has a zero initial value. At the expiration of the forward contract, net terminal value of the portfolio does not depend on (uncertain) future spot exchange rate ($\widetilde{S}_T$), so it is currency risk-free. Moreover, since all the interest rates are also risk-free and known in advance (fixed by the terms of contract), there is no default or interest rate risk. Net portfolio terminal value cannot be positive; otherwise, costless arbitrage profits would be possible. The idea could be formalized as follows:

$$F_T e^{r_f(T-t)} - S_t e^{r_d(T-t)} \leq 0 \tag{2}$$

Therefore:

$$F_T \leq S_t e^{(r_d - r_f)(T-t)} \tag{3}$$

The relation (3) limits the amount by which the forward exchange rate can exceed the spot rate. Again, this limit results from the fact that it is always possible to acquire the foreign currency for future delivery by buying it today and holding it rather than by buying a forward contract. When reverse arbitrage is possible, as here is assumed, the equilibrium price relation is exactly as stated in starting equation (1).

Let us consider next reverse arbitrage. Suppose that the forward exchange rate is too low relative to spot exchange rate. An arbitrager can borrow foreign currency, sell it on spot, and invest the proceeds of domestic currency at r_d per annum for the period lasting $T - t$, and take a long position in underpriced forward contract. In the meantime (from moment t to T), the proceeds from invested domestic currency grow to $S_t e^{r_d(T-t)}$. Under the terms of the forward contract, an arbitrager pays $F_T e^{r_f(T-t)}$, takes delivery of the foreign currency whose spot terminal value is $\widetilde{S}_T e^{r_f(T-t)}$, and uses it to close out the short spot position, i.e. the amount, which she or he owes for borrowed foreign currency.

Cash flow coming from all position necessary to construct the arbitrage is presented in Table below (2). All the transaction matures at the same date in future (T). Firstly, arbitrager borrows foreign currency risklessly. By doing this, he gets a unit of foreign currency whose value expressed in units of domestic currency initially is S_t. The borrowing at time t requires cash outflow at time T, whose value depends on future spot foreign exchange rate ($\widetilde{S}_t$) and costs of borrowing (r_f). The foreign currency borrowed at time t is sold on spot and proceed in domestic currency is invested at rate r_d. At time T arbitragers will have at hands domestic currency in amount of $S_t e^{r_d(T-t)}$.

To be perfectly hedged, the arbitrager needs to have at disposal at time T amount of foreign currency equal to $-\widetilde{S}_t e^{r_f(T-t)}$. It will be provided by buying it on forward (third line Table 2). Buying foreign currency on forward does not require any initial outlay or produce any income. However, at time of expiration the long forward position will generate net cash flow that depends on eventual difference between (uncertain) future spot rate and agreed forward rate. Thus, terminal value of long forward position is $(\widetilde{S}_T - F_T)e^{r_f(T-t)}$.

Table 2. Arbitrage transactions for establishing the relation $F_T \geq S_t e^{(r_d - r_f)(T-t)}$

Position	Initial value (t)	Terminal value (T)
Borrow foreign currency	S_t	$-\widetilde{S}_t e^{r_f(T-t)}$
Sell foreign currency on spot and invest domestic currency risklessly	$-S_t$	$S_t e^{r_d(T-t)}$
Buy forward contract	0	$(\widetilde{S}_T - F_T)e^{r_f(T-t)}$
Net portfolio value	0	$S_t e^{r_d(T-t)} - F_T e^{r_f(T-t)}$

The same as previous case, this arbitrage portfolio is also riskless and demands no initial wealth, so that net portfolio value could not be positive. We conclude that the following condition must hold:

$$S_t e^{r_d(T-t)} - F_T e^{r_f(T-t)} \leq 0 \tag{4}$$

Therefore:

$$F_T \geq S_t e^{(r_d - r_f)(T-t)} \tag{5}$$

The only exchange rate that simultaneously satisfies both conditions (3 and 5) is the following forward rate:

$$F_T = S_t e^{(r_d - r_f)(T-t)} \tag{6}$$

This is competitive equilibrium outcome, assuming that investments both in domestic and foreign currency offer a riskless return, and that there is no default risk on the forward contract, borrowings in domestic and foreign currency. In other words, the absence of costless arbitrage opportunities in the marketplace ensures that forward exchange rate will be unequally related to relevant spot exchange rate.

2. Mechanism of Arbitrage with Currency Quasi–Forward

The arbitrage proof employed in previous case has to be modified for the case of currency quasi-forward. Supposing that:

vi. The participant with short forward position requires from the counterparty domestic money to be deposited.

The amount of money to be deposited equals to amount of foreign currency parties agreed to exchange, times forward price. Thus, forward transaction has to be fully covered by cash deposit. Hence the term "covered forward"; this stands as alternative one for "quasi" forward. This deposit serves the role of collateral and by assumption returns no income to depositor.

Therefore, arbitrage transaction differs in a way that arbitrager has to borrow additional domestic currency to assure counterparty (the one that takes short forward position) that the forward obligations are going to be met. Thus, it can borrow $F_{T,t}e^{r_f(T-t)}$ amount of domestic currency, where $F_{T,t}$ stands for quasi–forward exchange rate with maturity T, that generate a part of cash flow also at time t.

Additionally, cash flow that comes from quasi–forward differs from previous case (classic forward). A classic forward produced no cash flow for both parties in time of signing the contract. Here, the counterparty with long forward position makes his payment in time t, while counterparty with short forward position postpones his payment to other party to time T. The long quasi forward position gets terminal spot value of foreign currency bought on forward at time T, which is $\widetilde{S}_T e^{r_f(T-t)}$, and gives in return, at time t, domestic currency in amount of $F_{T,t}e^{r_f(T-t)}$.

Table 3. Arbitrage transactions for establishing the relation $F_{T,t} \geq S_t e^{-r_f(T-t)}$

Position	Initial value (t)	Terminal value (T)
Borrow foreign currency	S_t	$-\widetilde{S}_t e^{r_f(T-t)}$
Sell foreign currency on spot and invest domestic currency risklessly	$-S_t$	$S_t e^{r_d(T-t)}$
Buy forward contract	$-F_{T,t}e^{r_f(T-t)}$	$\widetilde{S}_T e^{r_f(T-t)}$
Borrow domestic currency	$F_{T,t}e^{r_f(T-t)}$	$-F_{T,t}e^{(r_d+r_f)(T-t)}$
Net portfolio value	0	$S_t e^{r_d(T-t)} - F_{T,t}e^{(r_d+r_f)(T-t)}$

Suming terminal values for all positions we get terminal net portfolio value, which by assumption can not be positive. Therefore:

$$S_t e^{r_d(T-t)} - F_{T,t}e^{(r_d+r_f)(T-t)} \leq 0 \tag{7}$$

$$F_{T,t} \geq S_t \left[\frac{e^{r_d(T-t)}}{e^{(r_d+r_f)(T-t)}} \right] \tag{8}$$

$$F_{T,t} \geq S_t e^{-r_f(T-t)} \tag{9}$$

In reverse arbitrage, the first leg of the arbitrage is buying foreign currency on spot and the second leg is selling foreign currency on forward. Now, the short forward position carries the arbitrage. The differences from previous case are as follows:

a) The arbitrager gets in advance domestic currency value of foreign currency agreed to sell on forward, and
b) Invests it at riskless rate of return r_d.

Table 4. Arbitrage transactions for establishing the relation $F_{T,t} \le S_t e^{-r_f(T-t)}$

Position	Initial value (t)	Terminal value (T)
Borrow domestic currency	S_t	$-S_t e^{r_d(T-t)}$
Buy foreign currency on spot and invest risklessly	$-S_t$	$\widetilde{S}_T e^{r_f(T-t)}$
Sell forward contract	$F_{T,t} e^{r_f(T-t)}$	$-\widetilde{S}_t e^{r_f(T-t)}$
Invest domestic currency taken in deposit	$-F_{T,t} e^{r_f(T-t)}$	$F_{T,t} e^{(r_d+r_f)(T-t)}$
Net portfolio value	0	$F_{T,t} e^{(r_d+r_f)(T-t)} - S_t e^{r_d(T-t)}$

As is true in previous cases, the net portfolio could not generate arbitrage profit, so the following rule must hold:

$$F_{T,t} e^{(r_d+r_f)(T-t)} - S_t e^{r_d(T-t)} \le 0 \tag{10}$$

$$F_{T,t} \le S_t \left[\frac{e^{r_d(T-t)}}{e^{(r_d+r_f)(T-t)}} \right] \tag{11}$$

$$F_{T,t} \le S_t e^{-r_f(T-t)} \tag{12}$$

Therefore, the only equation that sasifies both (9 and 12) conditions is the equilibrium currency quasi–forward formulae:

$$F_{T,t} = S_t e^{-r_f(T-t)} \tag{13}$$

Since the cost of carry rate is negative ($-r_f$), providing that payment of safety deposit returns no income to depositor, quasi-forward rate must always be below the relevant spot rate, so that there must be so-called forward discount. This case gives equilibrium currency quasi–forward formulae if all the assumptions (*i*–*vi*) are simultaneously satisfied. The first assumption (*i*) implies that both parties that are getting into forward exchange are risk-free entities. For example, it could be a case where both parties getting into forward exchange are AAA ranked borrowers, or, where we have a bank-to-bank quasi–forward. In the next section, we are going to substitute the first assumption, allowing the forward arranged between the parties, which are not both risk-free. The case is a good framework for analyzing bank-to-client quasi–forward.

3. Mechanism of Arbitrage with No Riskless Borrowing Opportunities

Consider the position of arbitrager who cannot borrow risklessly. In real world, many non-bank forward market participants are not able to borrow at the risk free rate. They are exposed to higher cost of carrying the arbitrage since in both arbitrage and reverse arbitrage they are supposed to lend and borrow, by new assumptions at the different rate, and practically with negative net return. Such an arbitrage is no more able to generate zero-profit outcome, and the quasi-forward formulae could not be expressed as an equation, but rather as specific inequality condition. In order to discuss limits of arbitrage in such real world conditions, we need to substitute the next two assumptions (*vii*, *viii*) for the first one (*i*):

vii. Arbitragers can lend risklessly at a relevant compounded rate of interest, but they cannot borrow risklessly;

viii. There is no possibility to borrow risk free investment (e.g. treasury bills); providing that the costs of borrowing will not be equal to return on go long in risk free investments.

Firstly, look at the first arbitrage. The arbitrager pays higher cost on borrowing foreign currency, as well as on borrowing domestic currency, which is now above the risk free rate for plausible default risk premium. By assumption, the cost of borrowing is equal to relevant bank lending (credit) rate, noted r_{fk} or r_{dk}, for foreign currency loans and domestic currency loans, respectively. Thus, it has to buy on forward more money than in case when riskless borrowing is allowed. Moreover, when investing domestic money he gets in return risk free interest rate, the same as in previous cases, while when borrowing the domestic money to put it in collateral he pays higher loan rate. This is why arbitrage is no more costless, since arbitragers of that kind are forced to pay excess levy expressed as the spread between bank lending and bank deposit rates.

Table 5. Arbitrage transactions for establishing the relation $F_{T,t} \geq S_t e^{[(r_d - r_{dk}) - r_{fk}](T-t)}$

Position	Initial value (t)	Terminal value (T)
Borrow foreign currency	S_t	$-\tilde{S}_t e^{r_{fk}(T-t)}$
Sell foreign currency on spot and invest domestic currency risklessly	$-S_t$	$S_t e^{r_d(T-t)}$
Buy forward contract	$-F_{T,t} e^{r_{fk}(T-t)}$	$\tilde{S}_T e^{r_{fk}(T-t)}$
Borrow domestic currency	$F_{T,t} e^{r_{fk}(T-t)}$	$-F_{T,t} e^{(r_{dk}+r_{fk})(T-t)}$
Net portfolio value	0	$S_t e^{r_d(T-t)} - F_{T,t} e^{(r_{dk}+r_{fk})(T-t)}$

$$S_t e^{r_d(T-t)} - F_{T,t} e^{(r_{dk}+r_{fk})(T-t)} \leq 0 \tag{14}$$

$$S_t e^{r_d(T-t)} \leq F_{T,t} e^{(r_{dk}+r_{fk})(T-t)} \tag{15}$$

$$F_{T,t} \geq S_t \left[\frac{e^{r_d(T-t)}}{e^{(r_{dk}+r_{fk})(T-t)}} \right] \tag{16}$$

$$F_{T,t} \geq S_t e^{[(r_d - r_{dk}) - r_{fk}](T-t)} \tag{17}$$

Table 6. Arbitrage transactions for establishing the relation $F_{T,t} \leq S_t e^{[(r_{dk}-r_d)-r_f](T-t)}$

Position	Initial value (t)	Terminal value (T)
Borrow domestic currency	S_t	$-S_t e^{r_{dk}(T-t)}$
Buy foreign currency on spot and invest risklessly	$-S_t$	$\widetilde{S}_T e^{r_f(T-t)}$
Sell forward contract	$F_{T,t} e^{r_f(T-t)}$	$-\widetilde{S}_t e^{r_f(T-t)}$
Invest domestic currency taken in deposit	$-F_{T,t} e^{r_f(T-t)}$	$F_{T,t} e^{(r_d+r_f)(T-t)}$
Net portfolio value	0	$F_{T,t} e^{(r_d+r_f)(T-t)} - S_t e^{r_{dk}(T-t)}$

$$F_{T,t} e^{(r_d+r_f)(T-t)} - S_t e^{r_{dk}(T-t)} \leq 0 \tag{18}$$

$$F_{T,t} \leq S_t \left[\frac{e^{r_{dk}(T-t)}}{e^{(r_d+r_f)(T-t)}} \right] \tag{19}$$

$$F_{T,t} \leq S_t e^{[(r_{dk}-r_d)-r_f](T-t)} \tag{20}$$

Simply, by integrating those two conditions (20 and 17) we get the following inequality:

$$S_t e^{[(r_{dk}-r_d)-r_f](T-t)} \geq F_{T,t} \geq S_t e^{[(r_d-r_{dk})-r_{fk}](T-t)} \tag{21}$$

Therefore, there is no an equilibrium forward exchange rate, but rather a continuum of rates inside a band with boundaries. Assuming the forward maturing exactly one year ahead, for the sake of simplicity, and rearranging the formulae further we get:

$$S_t e^{[(r_{dk}-r_d)-r_f]} \geq F_{T,t} \geq S_t e^{[(r_d-r_{dk})-r_{fk}]} \tag{22}$$

This expression (22) gives a band of quasi-forward exchange rates with boundaries determined by the cost of arbitrage. The arbitrager is going to make profit if the forward rate drops below the lower threshold, the same as she or he makes profit if the forward rate goes above the upper threshold. If the forward price drops below the lower threshold, arbitragers will find it attractive to sell the foreign currency on spot and take a long position in a forward contract. Similarly, the forward rate above the upper threshold will activate arbitragers to take short forward position and buy foreign currency on spot. Inside the band, profitable arbitrage opportunity disappears, and riskless borrower (a bank) is free to set the rates at the thresholds. Inequality condition gives the risk free borrower (e.g. a bank) a scope to quote bid and ask forward rate differently. Consequently, the upper threshold presents the highest rate a riskless borrower could quote for selling on forward (ask forward rate), while the lower threshold presents the lowest rate a riskless borrower could quote for buying on forward (bid or offer forward rate). Denoting lower boundary as $bF_{T,t}$, which stands for bid quasi–forward rate, and upper boundary as $aF_{T,t}$, which stands for ask quasi–forward rate we get:

$$aF_{T,t} \geq F_{T,t} \geq bF_{T,t} \tag{23}$$

The formulas above (22 and 23) are easily manipulated to give maximum bid-ask spread. While the bid-ask spread is frequently defined as the absolute difference between ask and bid price, it is often preferable to define it in proportional terms as a ratio of ask to bid price. Dividing upper threshold by lower threshold and subtracting spot rate from each side, equation for bid-ask spread, restated as ratio of selling forward rate to buying forward rate, can also be written as:

$$\frac{aF_{T,t}}{bF_{T,t}} = \frac{e^{[(r_{dk}-r_d)-r_f]}}{e^{[(r_d-r_{dk})-r_{fk}]}} \tag{24}$$

Opposite to equilibrium quasi–forward rate, established through costless arbitrage (13), which is always below the relevant spot rate (there is forward discount), which is also the case for bid quasi–forward rate, the ask quasi–forward rate could take either premium or discount over relevant spot rate. It will take premium if only the spread between domestic loan and deposit rate goes above foreign riskless rate. Otherwise, it will take discount.

Anyway, by further rearranging the equation above (24) we get an expression with explicit economic rationale:

$$\frac{aF_{T,t}}{bF_{T,t}} = e^{[2(r_{dk}-r_d)+(r_{fk}-r_f)]} \tag{25}$$

Hence, a bank could quote currency quasi-forward exchange rate with the bid-asked spread, which is by definition an estimation of total arbitrage costs. Providing that necessary conditions follow, that equilibrium bid-asked spread equals sum of doubled spread between domestic currency credit and deposit interest rate, and spread between foreign currency credit and deposit interest rate. Transaction costs that arbitrager as such has to be exposed to are completely composed from interest rate spreads.

Conclusion

In this paper we employ arbitrage mechanism to develop a model for currency quasi-forward, and a formulae for quasi-forward exchange rate. Firstly, we restated a proof for classic currency forward, then we discuss peculiarity of quasi-forward arbitrage mechanism. In the final step we have introduced some costs of doing the arbitrage. It is clear that this peculiar arbitrage costs put the margin above and below otherwise equilibrium forward rate.

For risky borrowers the bid–ask spread is acceptable because the better result is not available through arbitrage. From here follows that currency quasi-forward bid-ask spread depends on the same determinants as interest rate spread; the level of competition amongst dealers (banks), average credit quality of borrowers, and the other cost of intermediation. For banks bid-ask spread is a specific source of income that comes from intermediation on the forward currency market. For risky banks' clients, it is a burden that has to be taken for a convenience to approach the dealer market structure as they wish. This is the most relevant component of total cost of hedging exchange rate risk over a dealer forward market.

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FORMULA KVAZI–TERMINSKOG DEVIZNOG KURSA SA I BEZ TROŠKOVA ARBITRAŽE

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U radu na jednostavan način razvijamo formulu za evaluaciju valutnog kvazi forvard ugovora. Ovaj tip terminskog ugovora često koriste vodeće banke u Srbiji u odnosima sa svojim klijentima. Ugovor služi klijentima za zaštitu od deviznog rizika. Pored toga valutni kvazi forvard za banke može biti značajan izvor prihoda, naročito ako u politici cena banke, kao dileri, koriste mogućnost da postave kotaciju u skladu sa maksimumom koji im omogućava prostor za efikasno delovanje arbitraže. Na žalost, ne postoji javno dostupna baza podataka o kotacijama niti kursevima zabeleženim u transakcijama realizovanim sa nebankarskim klijentima. U narednim istraživanjima, ukoliko ovakve informacije budu dostupne, korisno bi bilo empirijski testirati u kojoj meri se kursevi realizovani u transakcijama formiraju u skladu sa teorijskim principima koje smo izložili u ovom radu.

Ključne reči: *tržište derivate u Republici Srbiji, terminska arbitraža, valutni kvazi forvard ugovor, model terminske cene.*