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Some Theoretical and Practical Uses of Forward/Futures Rate Agreements

Ileana Nicula, Crina Raluca Bucur

Christian University "Dimitrie Cantemir", Unirii Drive 176, Bucharest
e-mail: ileana_n2002@yahoo.com; ralucacrinapetrescu@yahoo.com

Abstract

On the money market the movements in the interest rates can bring gains and losses, both for nonfinancial and financial entities, which carry in their balance sheets assets or/and liabilities sensitive to the interest rates. Hereby there were developed many techniques to cover interest rate exposure, as well as other risks. The paper presents a short term derivative, Forward/Futures Rate Agreement (FRA), designated to hedge interest rate risk as a microhedging instrument. Thus the paper describes the theoretical framework, schemes and formulas, the practical uses of FRA contracts and their risks. The paper compares microhedging and macrohedging techniques, stressing on the differences. Concerning the Romanian Banking System, we took a look on a large financial group, Erste, in order to identify the degree to which the macro and micro hedging (especially interest rate contracts) are used (at group level and at BCR Romania level).

Key words: *hedging, micro and macrohedging, Forward/Futures interest rate, FRA strip*

JEL Classification: *G21*

Introduction

A forward or futures rate agreement (FRA) is a contract "between two parties wishing to protect themselves against a future movement in interest rates" (Banking Terminology, American Bankers Association, third edition).

Technically FRA is an OTC (over the counter) agreement in the money market for cash payment based on two interest rates: a *spot rate* (named the reference rate) and a *specified forward rate*. When there is a difference between them, a discounted cash flow is settled between the two counterparts. The counterparts are *the buyer* and *the seller* of the contract. Generally speaking, such a technique has the following purposes:

- to protect the buyer (in his borrower capacity) against the interest rate increasing, by guaranteeing the interest rate future;
- to protect the seller (in his investor capacity) against interest rate decreasing, by guaranteeing the interest rate future (and the assets of the portfolio are protected from diminishing their value).

If the spot rate is greater than the agreed rate, the seller pays the buyer the difference according to Formula 1 (cash flow has positive value).

If the spot rate is lower than the agreed rate, the buyer pays the seller the difference according to Formula 1 (cash flow has negative value).

On the money market, FRAs are different from other money market instruments, as the buyer of the contract is in fact the "borrower", even if this party does not borrow any money and its counterpart does not lend. Concerning the other money market instruments (certificates of deposit, repo contracts, as well as interest rate futures) the buyer is the lender of the funds. The notional principal amount is a theoretical sum on which Formula 1 or 2 are applied and the cash flow moving from a party to the other is computed.

Usually the payment takes place on the settlement date specified in the FRA agreement. A FRA agreement is presented as $(T_S \times T_L)$FRA or $(T_S \text{ v } T_L)$FRA, where T_S is the start of the contract and T_L is the end of the contract, the difference being the spot rate reference (for instance three or six-month interest rates on the money markets). For instance in (6×9)FRA, the counterparts agree at T_0 moment to use a three-month interest rate as the reference (9-6) and the settlement will take place in six months (settlement date) against the specified interest rate.

Usually FRAs are standard contracts denominated in different currencies, the notional principal, the maturities and the periods being customised. The British Bankers' Association (BBA) developed standards for FRAs called *Forward Rate Agreements of BBA terms*, used on a large scale by brokers and dealers.

Theoretical Framework for FRA Value and Forward/Futures Interest Rate

There is a specific terminology on the FRA market as follows:

- notional principal amount – the sum on which the two interest rates are applied (P);
- trade date – the date when the FRA is traded (see no. 1 on the Figure 1);
- fixing date – the date when the *reference interest rate* is computed in order to compare to FRA rate (see no. 2 on the Figure 1). It is usually two business day before settlement date;
- settlement date – the date used for computing purpose (T_S) (see no. 3 on the Figure 1);
- reference rate – the interest rate used in Formula 1 or 2, usually the LIBOR, EURIBOR[1] rates on the fixing date for the period specified in the FRA;
- maturity date – the date when the contract expires (T_L) (see no. 4 on the Figure 1);
- contract period – the time between the settlement date and maturity date (T_L - T_S);
- settlement sum or FRA value – the difference computed according to Formula 1 or 2, paid by a party to the other party.

There are defined two periods of months in FRA contracts: the shorter one T_S – no. 3 in Figure 1 - (say three months from now) and the longer one T_L- no. 4 in Figure 1 - (say nine months from the T_S). For these periods there are two interest rates: R_{Ref} and R_{FRA}.

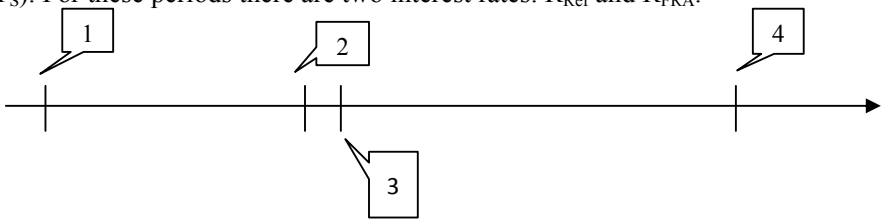

Fig. 1. FRA timing

Source: Conceived by the authors

[1] LIBOR = London Interbank Offered Rate; EURIBOR = Euro Interbank Offered Rate; reference rates for Eurocurrencies

Thus FRA pricing means a payment made at settlement date computed as follows:

$$Settlement\ sum = P \times (R_{Ref} - R_{FRA}) \times (t_L - t_S) \times e^{-R_{Ref}(T_S - t)} \quad (1)$$

where:

P = notional principal amount
R_{Ref} = reference interest rate
R_{FRA} = FRA interest rate
t_L-t_S = number of days in the contract period [T_L- T_S] based on 360 or 365 day count convention
t = settlement date when the interest rate is R_{Ref} (t = 0)
$R_{Ref} – R_{FRA}$ is the interest differential.

Formula 1 can be approximated by:

$$Settlement\ sum = \frac{(R_{Ref} - R_{FRA}) \times P \times (t_L - t_S)}{1 + \left[R_{Ref} \times (t_L - t_S)\right]} \quad (2)$$

The numerator is in fact the difference between the spot rate at settlement moment (R_{Ref}) and the forward rate (agreed rate) on the contract period. The denominator is the discounted factor, as the cash moves at the beginning of the contract (see Figure 1).

The computation of the *forward interest rate* is based on the forward principles, using a very simple approach. An investor has two alternatives: an investment in T_S months using an interest rate of R_{Min} and an investment in T_L months using R_{Max}, where $T_S < T_L$, T_L is maximum one year and $R_{Min} < R_{Max}$. The restriction on T_L is feasible, as FRAs are short term agreements, even if in some cases there are possible contracts longer than one year (but there is another formula for forward interest rate, not Formula 3).

In order to have easily access to the money, the investor decides to invest first for T_S months and then to extend for another period, until T_L. The problem is to find an interest rate for the extended period, so the yield on the investment to be R_{Max} on the whole period. This breakeven rate is called the *interest rate gap* and approximates the forward rate.

$$(1 + R_{Max} \times t_L) = (1 + R_{Min} \times t_S) \times (1 + R_{FRA} \times t_{FRA}) \quad (3)$$

where:

t_L – the time period from the dealing (t_0) to the maturity date;
t_S – the time period from the dealing (t_0) to the settlement date;
t_{FRA} – FRA contract period;
R_{FRA} – forward rate interest rate.

Replacing the *t* symbols from (Formula 3) with the number of days within the periods (*n*), formula 3 becomes:

$$(1 + R_L \times n_L) = (1 + R_S \times n_S) \times (1 + R_{FRA} \times n_{FRA}) \quad (4)$$

where:

R_L – the interest rate for the longer period T_L;
R_S – the interest rate for the shorter period T_S;
n_S – number of days from the trade date to the settlement date;
n_L – number of days from the trade date to the maturity date; 360 or 365 days count;
n_{FRA} – forward gap in number of days (equal to the contract period ($T_L – T_S$)).

Rearranging Formula 4, R_{FRA} is:

$$R_{FRA} = \frac{R_L \times n_L - R_S \times n_S}{n_{FRA}(1 + \frac{n_S}{B})} \quad (5)$$

where B is 360 or 365 days count base.

From the cost point of view the initial cost of a FRA contract is zero, as no cash flows are exchanged between the counterparts (except the fees).

Trading, Using and FRAs Risks

FRAs are used as hedging instruments against the interest rate movements, allowing locking in an interest rate for a future period of time. Thus the participants can extend the liabilities or assets maturities.

Entering into a FRA today for an interest rate which is effective in the future, the participants (banks and other companies) hedge their interest rate exposures, as well as speculate on the future interest rates.

If a financial institution has no easy access to funds with maturities beyond six months and carries in its balance sheet long-term loans, it should buy a (6×12)FRA and in this way to match assets and liabilities maturities from the point of view of interest movements, hedging/covering interest rate risk. The financial institution uses a deterministic approach, knowing at t_0 the cost of the funds beyond the six months. The counterpart (seller) can lengthen the maturity profile of its assets by determining at t_0 the yield on the future investment. FRAs can be seen as a "forward-starting loan, but with no exchange of principal, so that only the difference in interest rates is traded[2]".

If an entity borrows every three months at a prevailing *3-months LIBOR + margin* and estimates that the interest rate will rise in T_S months from now, it buys a (Ts × (Ts+3))FRA before the next credit rollover for fixing the interest rate. The Figure 2 illustrates the above situation.

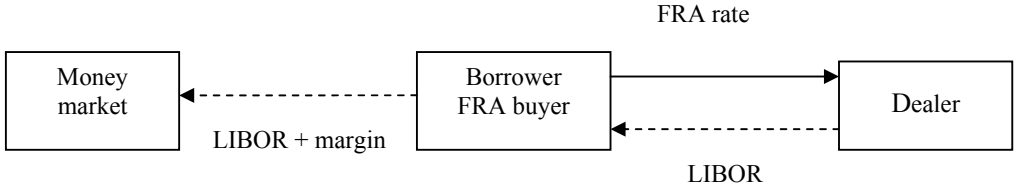

Fig. 2. FRA counterparts

Source: Conceived by the authors

Thus the credit cost is as follows:

entity pays:	-(LIBOR + margin)	to the lending bank
entity pays:	-(FRA rate)	to the FRA counterpart
entity receives:	+(LIBOR)	From the FRA counterpart
net cost	FRA rate + margin	

[2] Teasdale, A., *Learning curve - Forward Rate Agreements*, available at www.yieldcurve.com/../FRAs, 2004, [accessed on 18 Apr. 2012]

If an entity which generates substantial cash from its activity wants to protect its deposits from the interest rate decreasing, it sells a customised FRA in order to keep the investment return. The Figure 3 illustrates the above situation.

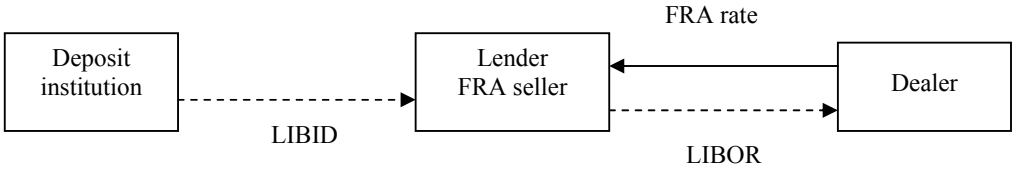

Fig. 3. FRA counterparts

Source: Conceived by the authors

Thus the return of the investment is as follows:

company receives:	+(LIBID[3])	from deposit
company receives:	+(FRA rate)	from the FRA counterparty
company pays:	-(LIBOR)	to the FRA counterparty
net return	FRA rate – (LIBOR – LIBID)	

Practically the both entities should use a series of FRA contracts to cover the all periods in which they are in the above positions. Such strategies are called *FRA strip* and the objective is to designate synthetic loans or/and deposits to hedge the positions, transforming a short term contract (as FRAs are) into a longer term one.

FRAs can be bought or sell in order to speculate on the interest rate movements. If an entity estimates that the rate rises, it buys FRA. But if the expectation is that the rate falls, it sells FRA. Therefore if the expectations are right, the speculator gains from the differential.

The market risk measured by sensitivity ratios is the same for FRAs as for the short debt instruments and the liquidity risk is quite low, as FRAs markets are highly liquid (in a normal economic environment). The liquidity risk in FRAs means the probability that one party cannot close its position.

Concerning the credit risk of FRAs, it always exists and higher than for Futures contracts. For FRAs credit risk means the probability that a party fails to pay the settlement amount, so it is in a default position. The loss of the counterpart is limited to the differential, not to the entire amount (principal).

Measuring FRAs credit risk exposure is to estimate the counterparty credit risk (on statistical basis).

Macro and Microhedging

FRAs contracts can be seen as powerful instruments for specific transactions and the hedging in such cases are known as *microhedging*. In such a technique, financial institutions should enter into Futures or Forward contracts whose underlying assets could cover as completely as possible specific assets or liabilities risks. Thus the risky positions are hedged individually item by item.

In order to apply microhedging in interest rate sensitivity, an entity should analyse its position (interest rate position), should estimate the future cash flows related to its operations, should analyse which technique is suitable (in term of risks, expertise, complexity, time) and monitor the market parameters during the hedging.

[3] LIBID = London Interbank Bid Rate

Macrohedging, on the other hand, allows the duration gap hedging for extensive part(s) of the balance sheet. The use is also related to the relations between assets and/or liabilities, offsetting important portfolios of assets and liabilities. Transforming the interest rate sensitivity "into insensitivity is conceived of in terms of controlling the gap or in terms of spread management"[4].

The dynamic nature of the assets and liabilities duration imposes the use of *macrohedging* technique (for instance the interest rate swaps).

Interest Rate Hedging at ERSTE Group

There are some difficulties to find into the banks financial statements *exactly* the structures of each and every derivative. The working paper has analysed one of the biggest financial institution, with an important market share in our country, namely Erste Group (BCR Romania owns 20.1% of net assets and 18.1% of equity, 19% of retail loans, 23% of retail deposits – of all credit institutions operating in Romania - according to the Annual Report of NBR, 2011).

As Erste Group presents, the derivatives used "include manly interest rate swaps, futures, forward rate agreements, interest rate options, currency swaps and currency options as well as credit default swaps." (Erste Group Annual Report)

The Table 1 presents *only* the interest rate derivatives positions and the total amounts.

Table 1. Interest rate derivatives

mill. Euro	***Notional amount 2011***	***Notional amount 2010***
Derivatives held for trading		
Interest forward rate agreement	31,903	106,122
Interest rate futures	9	643
Total derivatives held for trading	**363,449**	**460,263**
Fair value hedges		
Interest rate contracts	15,484	18,153
Total fair value hedges	**16,087**	**18,469**
Cash flow hedge		
Interest rate contracts	4,633	6,378
Total	**5,926**	**6,878**
Other derivatives		
Interest rate contracts	31,173	32,071
Total other derivatives	**43,722**	**50,665**
TOTAL DERIVATIVES	**429,184**	**536,275**

Source Erste Group Annual Report 2011

Except derivatives held for trading, *interest rate contracts* represent the main derivative instruments held by Erste Group, as follows:

- 96.25% (2011) and 98.29% (2010) for fair value;
- 78.18% (2011) and 92.73% (2010) for cash flow;
- 71.30% (2011) and 63.30% (2010) other derivatives.

Note that the interest rate contracts represent the main instruments used by Erste Group to hedge the fair value (first position) and cash flows (second position).

Fair value hedges represent a way to mitigate the market risk for the various financial instruments held by a financial institution.

[4] Robert W. Kolb, Stephen G. Timme, Gerald D. Gay, *Macro versus Micro Futures Hedges at Commercial Banks*, Journal of Futures Markets, vol. 4, issue 1, Spring 1984, pp.47-48

Cash flow hedges represent a way to reduce adverse conditions which could have impact on financial institution cash flows (for locking in the net interest income).

Generally speaking the *Net Interest Income* position captures the gain and loss on the hedging instrument, for both cash and fair value hedges.

According to the Erste Group "a hedge is expected to be highly effective if the changes in the fair value or cash flow attributable to the hedged risk during the period for which hedge is designated are expected to offset the fair value changes of the hedging instrument in a range of 80% to 125%". (Erste Group Annual Report 2011)

Anyhow the derivatives notional amount has been decreasing within the two years (2010 and 2011). According to IFRS 39 (implemented to define *recognition*, *derecognition* and *evaluation* of the financial instruments) "any asset should be recorded either (1) loans & receivables originated in the reporting entity, or (2) held to maturity, (3) held for transaction and (4) available for sale"[5]. IFRS 39 also has established the classification and reclassification of the financial assets and liabilities, "for banks to be hindered in developing their creativity generating uncontrollable risks"[6]. In this respect the data presented by Erste Group for 2011 and 2010 are illustrated in Table 2.

Table 2. Financial instruments per category according to IAS 39

mill. Euro	***2011***	***2010***
Assets		
Derivatives designated as hedging instruments	1,813	1,705
Derivatives designated for trading	9,118	6,803
TOTAL	**10,931**	**8,508**
% for hedging purpose	16.59%	20.04%
Liabilities		
Derivatives designated as hedging instruments	599	880
Derivatives designated for trading	8,738	7,519
TOTAL	**9,337**	**8,399**
% for hedging purpose	6.42%	10.48%

Source Erste Group Annual Report 2011

Taking into account that the main derivatives held by the financial institution are those for interest rate, we can argue that an important part of Erste hedging is performed for mitigating the *interest rate sensitivity* and the other part for trading.

Concerning BCR Romania, there are only interest rate swaps as hedging instruments in the last two years (2011 and 2010). The main aim (as stated in the Financial Statements[7]) is to cover the interest rate risk by changing the interest cash flows for deposits, computed using ROBOR[8] index, with the fix interest rate from currency interest rate swap operations.

A survey of several smaller banks in Romania (OTP, Garanti) pointed out that interest rate sensitivity is hedged manly by swaps.

To sum up, as expected the financial institutions manage the risk through derivatives mainly by macrohedging techniques.

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[5] www.iasplus.com, www.eycom.ch, www.ifac.org

[6] Ileana Nicula, *Some practical aspects concerning IAS 39 implementation in banks transactions*, in Proceedings of International Conference Eco-Trend 2010, VIIth Edition, "Economy and Globalization", Constantin Brancusi University, Tg. Jiu, 26-28 Nov.2010, pp. 504-510

[7] BCR, *Financial Statements*, available at www.bcr.ro/ro/investitori/aga/situatii-financiare-2011, [accessed on 20 Oct. 2012]

[8] ROBOR = Romanian Interbank Offered Rate

Conclusions

Trading FRAs is an important activity of investment and commercial banks, from double folded point of view: as market makers (in order to gain from the buying and selling transactions spread) and end users (in order to hedge interest risk).

The most active markets are London, New York, and the major European financial centres. There are listed the quotes for standard FRA maturities in the main financial newspapers and on different sources (as Bloomberg, Financial Times).

Below there is an extract from Financial Times (interest rates and currency agreements):

Oct. 25 2012		Open	Sett	Change	High	Low	Est. vol	Open int
Euribor 3m*	Dec	99.81	99.81	-	99.81	99.80	80,913	509,756
Euribor 3m*	Mar	99.80	99.80	-0.01	99.81	99.79	74,132	496,754
Euribor 3m*	Jun	99.78	99.77	-0.01	99.78	99.76	81,957	436,141
.....								
Sterling 3m*	Jun	99.51	99.49	-0.02	99.51	99.48	26,066	278,500
Sterling 3m*	Sep	99.50	99.48	-0.02	99.51	99.47	27,057	300,302
Eurodollar 3m†	Dec	99.680	99.68	-	99.680	99.670	55,000	942,609
Eurodollar 3m†	Mar	99.670	99.67	-	99.675	99.665	40,928	798,190
.....								
Euroyen 3m‡‡	Jun	99.725	99.720	-0.005	99.730	99.715	4,246	97,866
Euroyen 3m‡‡	Sep	99.740	99.735	-0.005	99.740	99.730	2,926	43,998

Source Financial Times[9]

Also nonfinancial entities enter into FRAs agreements in order to hedge their positions.

Using derivative instruments as FRAs to reduce interest rate risk implies a depth knowledge and expertise within the domain, as there are very complex transactions, which carry an unknown level of danger, if they are incorrectly performed. The entities should undertake the derivative activities only if the board and senior management are fully aware of the potential risks and know in depth the underlying strategies. In fact different regulators from all over the world have been established guidelines regarding sound practices for managing interest rate risks. Among them it can be mentioned Basel Committee on Banking Supervision, FDIC (Federal Deposit Insurance Corporation), OCC (Office of the Comptroller of the Currency) and so on. Especially the financial institutions should comply with the issued regulations in this matter, among them being: "raise additional capital, reduce the interest rate risk exposure, strengthen the expertise and improve the models as well as the measurement systems..." (Basel Committee on Banking Supervision).

National Bank of Romania periodically issues strict rules concerning the derivatives use as hedging techniques to discourage banks to use them for speculative purposes and to take oversized risks.

Moreover, IFRS implementation allows financial institutions to classify and measure adequately their assets in order to disclose the risks carried in their balance sheets. IFRS 9 will replace IFRS 39, so the assets should be *(a) debt instrument*, *(b) equity investment* or *(c) derivative*. According to IFRS 9 guide, "all derivatives are measured at fair value through profit or loss, unless they qualify and are designated for *hedge purposes*. Off balance sheets items (as derivatives) are very sensitive to market conditions and the best practise is to use fair value

[9] Financial Times, available at www.markets.ft.com/Research/markets/DataArchive, [accessed on 31 Oct. 2012]

option"[10]. Thus any slight modification which could induce a potential loss is capture through profit or loss account and the misleading figures would not longer be used to make up the financial statements.

The hedging strategies depend upon a lot of variables and can be performed not only using off balance sheet instruments, but also on balance sheet instruments.

Loss (2012) analysing hedging strategies in the context of financial constraints and imperfect competition has concluded "thus, hedging (which is related to the use of off-balance sheet instruments) and capital structure (which is related to the use of on-balance-sheet instruments) are interrelated. Moreover, financial constraints are not only exogenous and a firm's capital structure can exacerbate or alleviate the financial constraints it faces (for instance by increasing or decreasing conflicts of interest between shareholders and debtholders). Therefore, the optimal hedging strategy of a firm depends on its capital structure and vice versa".

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Aspecte teoretice şi practice ale utilizării contractelor FRA

Rezumat

Modificările ratelor dobânzilor pe piaţa monetară pot aduce câştiguri sau pierderi, atât pentru companiile financiare cât şi pentru cele non-financiare care deţin în bilanţurile lor active şi/sau pasive

[10] KPMG, *First impression: IFRS 9 Financial Instruments*, Dec. 2008

senzitive la ratele dobânzii. Ca urmare s-au pus la punct mai multe tehnici de acoperire a expunerii la riscul de rată a dobânzii, ca şi a altor riscuri. Lucrarea prezintă un instrument derivativ pe termen scurt şi anume contractele Forward/Futures pe rata dobânzii (prescurtat FRA), proiectate pentru acoperirea riscului de rată a dobânzii, instrumente din categoria microhedgingului. Lucrarea prezintă cadrul teoretic, scheme şi formule, utilizări practice ale contractelor FRA şi riscurile aferente acestora. De asemenea, lucrarea face o comparaţie între tehnicile de micro şi macrohedging, accentuând asupra diferenţelor. În ceea ce priveşte sistemul bancar românesc, am analizat un grup bancar mare, Grupul Erste, pentru a identifica gradul de utilizare a macro şi respectiv microhedgingul (în special contractele pe rata dobânzii), la nivel de grup şi la nivelul BCR România.