УДК 336.764.2

Khraban A., Kalynovskii O.

USE OF NON-DELIVERABLE FORWARDS TO HEDGE FOREIGN EXCHANGE RISKS

This article describes Non-Deliverable Forward (NDF) contracts as instruments to hedge FX exposure for the Ukrainian Government that has been issuing Eurobonds on a regular basis. Financial advantages of internal borrowing in UAH are carefully demonstrated as opposed to external borrowing during the recent years. The article shows how NDFs could have been used to hedge the FX exposure in Ukraine in 2006-9, briefly explains the mechanism of NDF contracts, and presents the intricacies of UAH NDF pricing in 2006–2011.

Keywords: Non-Deliverable Forward contracts (NDFs), hedging FX exposure, currency risks, derivative markets, Ukrainian public debt, non-convertible currency, settlement currency, prevailing spot (fixing) rate, NDF risk premium.

Introduction

This paper addresses in detail one of the main basic FOREX hedging instruments called Non-Deliverable Forward (NDF). From what we were able to conclude in the process of working on this paper, research in the field of NDFs is essentially non-existent (especially on UAH NDFs), so we believe that this paper will serve as a solid starting point for those interested in studying practical applications of NDFs for FX risk hedging.

This article was written thanks to the FINREP Financial Sector Development Project (www.finrep.kiev.ua) operated in Ukraine by FMI and Booz Allen Hamilton under the US Agency for International Development (USAID) that provides policy consulting to the NBU, Ministry of Finance, Deposit Guarantee Fund, State Property Fund, Securities and Stock Market National Commission, and other state and public institutions engaged in operations in the financial sector. Special thanks to the FINREP Chief of Party Dr. Robert Bond, Head of FINREP Public Debt Management Department Mr. Paul Roberty, and FINREP Senior Public Debt Expert Mr. Volodymyr Vysotskii.

Research Objective

The purpose of the paper is to introduce the logic of hedging with NDFs, briefly explain the mechanism of NDF contracts, and present the intricacies of UAH NDF pricing in 2006–2011. Our major contribution is introduction of the notion of the NDF risk premiums, and demonstration of the advantages that could have been taken by the Ukrainian Government if NDFs were actually used in 2006–2009 by the Ministry of Finance of Ukraine.

Ukrainian Sovereign Debt

The Ukrainian Ministry of Finance (MoF) faces high levels of foreign currency exposure when issuing sovereign debt denominated in foreign currencies. The influence of the world financial crisis on currency exchange rates has led to significantly higher real interest rates on the Ukrainian debt due to the devaluation of UAH in 2008–2009. In order to see that, consider 4 examples of the Ukrainian debt issued in different currencies (USD, EURO, CHF, and JPY) in 2005–2007 (stable pre-crisis years) and maturing after 2008, when UAH devalued from UAH 4.60 per USD to almost UAH 9.5 per USD. All the Eurobond issues had coupon payments due every 6 or 12 months. Assuming that the Ukrainian Government would purchase the necessary foreign currency at the NBU rate and pay the due coupon payments and obviously Eurobond face values at maturity (*note:* if the bond issue had not matured yet as of September 2011, we assumed that they were called back on the most recent coupon date we had exchange rate data on). Table 1 shows the Coupon Rates of the four Ukrainian Eurobond issues versus the FOREX-adjusted Coupon Rates for the same Eurobonds (all debt service payments are considered to be in UAH before being converted into the appropriate currency for making the debt service payments).

As can be seen from Table 1, the FOREX-adjusted Coupon Rate in UAH is 4–11 times higher than the Coupon Rate quoted in foreign currency, which makes such Eurobonds very expensive in comparison with borrowing on the internal market (see table 2 showing comparable OVDPs which were issued and then matured during the similar period of Eurobond issue and duration). At first

Table 1. **FOREX-adjusted Coupon Rate of Four Ukrainian Eurobond Issues**

Eurobond Issue Code	Currency of the Eurobond	Issue Date	Maturity Period	Coupon Rate in Foreign Currency	FOREX-adjusted Coupon Rate (or Average Accounting Annual Return) (*see Note 3*)
i	ii	iii	iv	v	vi
1. ISIN XS0305394941	USD	June 26, 2007	5 years	6.39 %	23.50 %
2. ISIN XS0278503080	CHF	September 15, 2006	3 years	3.50 %	36.46 %
3. ISIN XS0232329879	EURO	October 13, 2005	10 years	4.95 %	24.25 %
4. Private Placement	JPY	December 19, 2006	4 years	3.20 %	35.58 %

Note 1: source of data in columns iii-v: *REUTERS.*

Note 2: the numbers presented in column vi were computed by the authors.

Note 3: FOREX-adjusted Coupon Rate (FACR), or Average Accounting Annual Return (AAAR), was calculated using the following steps:

All payments (coupons + face value) denominated in UAH for every Eurobond were added together.

The differences between the amounts calculated in Step 1 and the amounts received by the Ukrainian Government on the issue date denominated in UAH were taken. The resulting amounts represent how much in UAH the Ukrainian Government ended up paying for the privilege of using the Eurobond money in absolute terms. We can call it the Total FOREX-adjusted Debt Servicing Cost (Total FADSC).

In order to calculate the average Annual FADSC, we divide the Total FADSC by the number of years the Eurobond had been outstanding before it matured (or assumed to be called back if the maturity has not been reached yet). This way we basically construct a comparable bond with equal coupon payments denominated in UAH. As discounting which is usually used in NPV and IRR calculations is rarely utilized by the MoF personnel, the concept of timing of cash flows (or time value of money concept) is not employed in our approach as we are basically interested in overall cost of the debt independently of the exact timing when the cash flows (debt servicing payments) will actually take place.

The Annual FADSC denominated in UAH is then divided by the amount in UAH received by the Ukrainian Government on the date of Eurobond issue to obtain FACR, or AAAR.

The resulting formula for FACR (or AAAR) is:

$$\mathrm{FACR\,(or\,AAAR)} = \frac{\frac{\{(\sum c + FV) - I\}}{n}}{I},$$

where ∑c– sum of all the coupon payments paid by the Ukrainian Government denominated in UAH; FV – Face Value of the Eurobond; I – the amount received by the Ukrainian Government on the issue date in UAH (if a Eurobond is discounted, then I < FV, otherwise I = FV; n – maturity period of the Eurobond in years.

This formula can be taken further using the terms introduced in the algorithm above:

$$\mathrm{FACR\,(or\,AAAR)} = \frac{\frac{\{\mathrm{Total\ FADSC} - I\}}{n}}{I} = \frac{\mathrm{Total}\frac{\mathrm{FADSC}}{n}}{I} = \frac{\mathrm{Annual\ FADSC}}{I}$$

Table 2. **Comparable OVDP Issues and Effective Spread between International and Domestic Borrowing**

Eurobond Number from Table 1	Domestic Borrowing Rate at Relevant Periods		Exceeding by Accounting Annual Return Rate in UAH of Relevant Domestic Borrowing Rate
vii	viii	ix	x
1	6.60 % 07.09.2007 3 years	13 % 03.24.2010 2 years	10.50 %
2	9.40% 10.26.2006 3 years		27.06 %
3	7.50 % 10.26.2005 3 years	12.50 % 09.01.2008 3 years	11.75 %
4	6.00 % 21.12.2006 3 years	19.50 % 1.12.2009 1 year	16.08 %

Note 1: the cost of outstanding Eurobonds was translated into UAH based on the exchange rate as of the last coupon payment date.

Note 2: the numbers presented in this table were computed by the authors.

glance, internal borrowings may seem to be more expensive if their Coupon Rates are compared in absolute terms, but a closer inspection, taking into account all the currency conversion risks, reveals that internal borrowings are much more attractive as they bear no FOREX exposure risks. Column x in table 2 demonstrates the magnitude of the spread between international and domestic borrowing with overwhelming advantages of domestic borrowing.

The recent Ukrainian Eurobond market lessons clearly advocate for the use of internal borrowing, although in some cases money cannot be raised at the local financial markets if MoF needs more money than available for borrowing at the domestic markets under current interest rates.

Under such circumstances, Ukraine would have to borrow internationally, although it should take all the necessary precautionary measures related to

hedging the FOREX exposure risks. Even though external borrowing seems to be cheaper than domestic borrowing at first glance (nominal interest rates for Eurobonds are usually much better than those for OVDPs), borrowing in other currencies is always very risky. When comparing external vs internal borrowing rates, the appropriate currency pair deposit interest rates have to be compared as well (for example, today USD deposits yield 9 %, while UAH deposits yield 16 %, which indicates that UAH is expected to lose more of its value than USD and is expected to be worth less against USD one year from now, so buying USD to pay back a Eurobond would turn out to be more costly than it may seem today).

Non-Deliverable Forwards and Their Use

A non-deliverable forward (NDF) is a cash-settled, short-term forward contract on a non-convertible currency. The currencies are not physically delivered, instead the contract is settled by calculating the difference between the agreed upon exchange rate and the spot rate at the time of settlement for an agreed upon notional amount of funds. One party in the agreement will make a payment to the other party on the basis of the profit or loss on the contract [1, p. 3].

NDFs are used in foreign exchange and commodities markets. They prevail in those countries where forward FOREX trading has been prohibited by the government to prevent exchange rate volatility. The NDF market is an over-the-counter market. Active NDF trading commenced in early 1990s. NDF markets were developed for emerging markets with very tight capital controls, where the currencies could not be delivered offshore (non-convertible currencies). Historically, most NDFs are cash settled in USD, although can be settled in EURO or CHF [5, p. 24–25]. No payment or account movement takes place in the non-convertible currency. Therefore, this emerging market currency with capital controls is non-deliverable. Usually NDFs are quoted to be from between one month to one year (1 month, 3 months, 6 months, 9 months, and 1 year), although some banks would quote up to two years upon request. NDFs require a special contract that meets the provisions of the internationally recognized International Swaps and Derivatives Association (ISDA). It is estimated that between 60 to 80 per cent of NDF trading is speculative [2, p. 5]. A typical NDF involves two counterparties with the profit or loss being adjusted on the contracted settlement date between them on the basis of the difference between the contracted NDF rate and the prevailing spot FX rates on an agreed notional amount.

The features/terms of an NDF include [4, p. 3]:

- the notional amount: This is the "face value" of the NDF, which is agreed between the two counterparties. It should be noted that there is never any intention to exchange the notional amounts in the two currencies.
- the fixing date: This is the day and time whereby the comparison between the NDF rate and the prevailing spot rate is made.
- the settlement (or delivery) date: This is the day when the difference is paid or received. Depending on the currencies dealt, the fixing date is one or two good business days before the settlement date.
- the contracted NDF rate: This is the rate agreed between the two counterparties on the transaction date, and is essentially the outright forward rate of the currencies dealt.
- the prevailing spot (fixing) rate: The fixing spot rate on the fixing date is usually provided by the central bank, and is commonly calculated by calling a number of dealers in the market for a quote at a specified time of day, and taking the average. The exact method of determining the fixing rate will be agreed when a trade is initiated, but most NDF markets have their own conventions (for example, two days before Settlement/Value date).

Since an NDF is a cash-settled instrument, the notional amount is never exchanged. The only exchange of cash flows that takes place is the difference between the NDF rate and the prevailing spot market rate that is determined on the fixing date and exchanged on the settlement date. Therefore, NDFs are “non-cash” products and are off the balance sheet. As the principal sums do not move, these instruments involve much lower counter-party risks.

NDFs are committed short-term instruments, and both counterparties are committed and are obliged to honor the deal, although either counterparty can cancel an existing contract by entering into another offsetting deal at the prevailing market rate. NDFs make it possible to hedge the FOREX risks irrespective of any currency control restrictions (for example, if it is not possible to hedge the currency with forwards). Trading in NDF market generally is done in offshore financial centers.

According to the terms of an NDF contract, if on the settlement date, the then-prevailing spot market exchange rate is greater (in foreign currency per dollar terms) than the previously agreed forward exchange rate, the holder of the contract who is long the emerging market currency must pay the holder of the other side of the contract the difference between the contracted forward price and the spot market rate. The contract is net-settled in US dollars based on the notional amount [2, p. 2].

Let us consider a numerical example to better understand the nature of NDFs. Suppose the MoF

needs to buy USD 50 million (*the notional amount*) in 3 months and 2 days (3 months is the *fixing date* and 3 months + 2 days is the *settlement (delivery) date*) to repay a Eurobond issue denominated in USD. The best quote from the banks offering NDFs is UAH 8.20 per USD (*the NDF contract rate*). The MoF wants to hedge its FOREX exposure with the NDFs offered by the bank. Under the terms of the contract, the contracted NDF rate is UAH 8.20 per USD. Today's prevailing spot rate is irrelevant for the purposes of calculation of profit/loss from this deal as we would only be interested in what happens to the prevailing spot rate on the fixing date. Three scenarios are possible (please refer to Figure 2):

1. Suppose, in 3 months on the fixing date, the prevailing spot rate S is higher than the contracted NDF rate F, that is S > F. For example, S = UAH 8.24 per USD. Therefore, the NDF served its purpose – it hedged the MoF FOREX exposure and now the bank owes the MoF the difference between S and F multiplied by the notional amount:

$$profit\ to\ the\ MoF = N \cdot \left(1 - \frac{F}{S}\right) =$$

$$= USD\ 50\ million \cdot \left(1 - \frac{8.20}{8.24}\right) = USD\ 0.2427\ million.$$

2. Under this scenario, on the fixing date the prevailing spot rate S is lower than the contracted NDF rate F, that is $S < F$. For example, S = UAH 8.17 per USD. In this case, the MoF hedge worked in the opposite direction and brought losses to the MoF:

$$loss\ to\ the\ MoF = N \cdot \left(1 - \frac{F}{S}\right) =$$

$$= USD\ 50\ million \cdot \left(1 - \frac{8.20}{8.17}\right) = (USD\ 0.1836\ million).$$

3. Obviously, one more scenario is possible under which S = F, and no money changes hands.

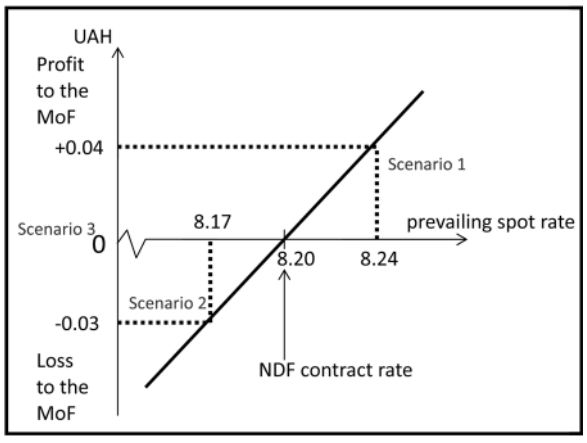

Figure 1. Pay-off diagram for the Ministry of Finance (short the UAH) (developed by the authors)

In either case, the result is equivalent to hedging with a conventional forward contract. Figure 2 demonstrates that he NDF arrangement is essentially equivalent to the situation under which the party that initially shorts the local currency buys USD from the bank at the contracted NDF rate on the fixing date and sells it back to the bank at the prevailing spot rate on the fixing date, and then pays/receives the difference on the notional amount on the settlement date. In the end, both cash flows in UAH cancel each other out, and USD cash flows are net-settled for the amount of the difference (Settlement Amount).

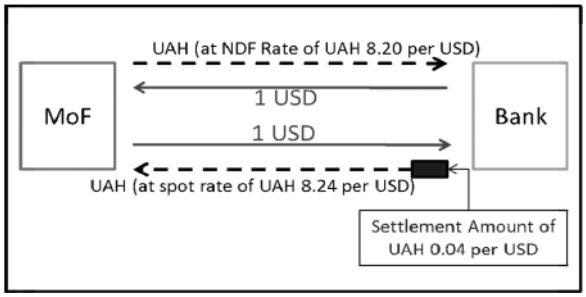

Figure 2. Underlying Mechanism of an NDF Contract in which MoF profited from the hedge (developed by the authors)

NDF Pricing

The costs of an NDF correspond to the interest differential between the two currencies. Non-convertible currencies often have very high interest rates that reflect anticipation of devaluation. Therefore, hedging in such countries is quite expensive. [5, p. 25].

The NDFs are generally used to hedge exposure or speculate on a move in a currency where local market authorities limit such activity. NDF prices can be a useful tool for market monitoring in that these prices reflect market expectations and supply and demand factors that cannot be fully manifested in onshore currency product prices in a country with capital controls. The difference between onshore currency forward prices, where they are available, and NDFs can increase in periods of heightened investor caution or concern over potential change in the exchange rate regime or a perceived increase in onshore country risk. Prices in the NDF market can be a useful informational tool for authorities and investors to gauge market expectations of potential pressures on an exchange rate regime going forward.

The pricing of most forward foreign exchange contracts is primarily based on the interest rate parity formula which determines equivalent returns over a set time period based on two currencies' interest rates and the current spot exchange rate. In addition to interest rate parity calculations, many other factors can affect pricing of forward contracts

such as trading flows, liquidity, and counterparty risk. NDF prices can also be affected by the perceived probability of changes in foreign exchange regime, speculative positioning, conditions in local onshore interest rate markets and the relationship between the offshore and onshore currency forward markets [3, p. 26]. When international investors have little access to a country's onshore interest rate markets or deposits in local currency, the NDF prices for that currency are based primarily on the expected future level of the spot exchange rate. For example, in the fall of 2003, NDF prices for the Chinese yuan declined to historic lows, primarily due to expectations that Chinese authorities would allow the yuan to appreciate against the dollar. Interest rate parity calculations generally do not affect NDF prices in Chinese yuan given that offshore investors have very limited access to onshore Chinese yuan interest rate products [2, p. 2].

The contract NDF rate is determined by banks taking into account several factors [6, p. 5]:

- inter-bank interest rates of the countries of the currency pair;
- the currency pair and the time zone the trade would take place in;
- the maturity date;
- inter-bank foreign exchange rates;
- the notional principal amount;
- market volatility;
- bank's margin.

There are no up-front out of pocket costs with an NDF. Once the non-deliverable currency, settlement currency and maturity date are nominated, the bank will determine the contract rate. While there are no up-front costs with NDFs, the banks usually still derive a financial benefit by incorporating a margin into the contract rate. This means that this rate will be different from the market rate prevailing at that time. Basically, the MoF would pay for the NDF by accepting the contract rate quoted by the bank.

NDF "Risk Premiums" in Ukraine in 2006–2011

As expected based on the international experience in NDF pricing, in 2006–2011, on average NDFs in Ukraine demonstrated expectations about the UAH/USD exchange rates in favour of USD (that is, on average USD was expected to appreciate, while UAH was expected to depreciate in value), as seen from the results of regression analysis based on the assumption that the contracted NDF rates are a function of the current spot exchange rate:

$$\text{Contracted NDF Rate} = f(\text{current spot exchange rate}).$$

Data for the period of 10/15/2006 through 08/28/2011 was used in regression analysis.

Basic regression of the form $Y = \boldsymbol{a}+\boldsymbol{b}*X1$ was employed, where Y – Contracted NDF Rate; X – Current Spot Exchange Rate; $\boldsymbol{a}$ – intercept (for our analysis, we assume that $\boldsymbol{a = 0}$ as in this setting a is meaningless); $\boldsymbol{b}$ – slope coefficient, or X1 coefficient.

The analysis yielded the results presented in Table 3.

Table 3. **Regression Results for 2006–2011**

Type of NDF	b	N = Number of Months	(b-1)/N
I	***ii***	***Iii***	***iv***
1-Mo NDF	1.017316	1	0.017316
3-Mo NDF	1.057774	3	0.019258
6-Mo NDF	1.093981	6	0.015663
9-Mo NDF	1.138654	9	0.015406
1-Yr NDF	1.167437	12	0.013953

Note: the numbers presented in this table were computed by the authors.

Explanation of the results:

Let us assume that the Ministry of Finance is willing to enter into a contract to short the UAH with a bank that holds a long position in the UAH. In this case, b can be interpreted as the "risk premium", as the bank holds a long position in the UAH, it quotes as high UAH/USD fixing rate as possible to

- minimize its currency exchange exposure;
- include its margin.

This rationale can be taken further to see how much on average banks "charge" the other side of the NDF contract holders for the privilege to hedge their currency exposure with NDFs on a monthly basis. Column *iv* shows that, depending on the duration of the NDF, Ministry of Finance would end up overpaying on average from 1.39 % per month (if 1-Year NDF is signed) to 1.92 % per month (if 3-Month NDF is signed). It turns out, that the "cheapest" 1-Year NDF contract obliged the party that held a long position in UAH to end up paying the premium of 1.39 % per month, which on average added up to 16.74% per year. Obviously, this premium would be much lower if Ukraine had not faced such wild exchange rate volatility in 2007–2009, as suggested by the analysis of the UAH/USD NDF contracts for October 2006 – April 2007 (UAH remained stable at the level of UAH 5.03 – 5.07 per USD):

Table 4. **Regression Results for the Ukrainian NDFs in October 2006– April 2007**

Type of NDF	b	N = Number of Months	(b-1)/N
i	***ii***	***iii***	***iv***
1-Mo NDF	0.999614	1	-0.00039
3-Mo NDF	1.003407	3	0.001136
6-Mo NDF	1.008565	6	0.001428
9-Mo NDF	1.015308	9	0.001701
1-Yr NDF	1.023383	12	0.001949

Note: the numbers presented in this table were computed by the authors.

It can be seen from the Table 4 that NDF contract holders who shorted the national currency in October 2006 – April 2007 paid the risk premium between 0.11 % and 0.19 % per month which obviously was much more affordable than in the following years.

Following the high currency exchange rate volatility period of May 2007 – December 2009, starting January 2010, the UAH/USD exchange rate remained relatively stable within the range of UAH 7.89 – 8.10 per USD. This stability calmed down the FOREX expectations which resulted in lower NDF risk premiums. As can be seen from the Table 5, between January 2010 and August 2011, monthly exchange rate risk premiums on average ranged between 0.54 % for 1-month NDFs and 0.65 % per month for 1-year NDFs.

Table 5. **Regression Results for the Ukrainian January 2010 – August 2011 NDFs**

Type of NDF	b	N = Number of Months	(b-1)/N
i	***ii***	***iii***	***iv***
1-Mo NDF	1.005461	1	0.00546
3-Mo NDF	1.018012	3	0.00600
6-Mo NDF	1.037635	6	0.00627
9-Mo NDF	1.058026	9	0.00645
1-Yr NDF	1.078305	12	0.00653

Note: the numbers presented in this table were computed by the authors.

Potential Benefits from Using UAH/USD NDFs in 2006–2009

Assuming that the MoF could use NDFs in 2006–2009 to hedge its FX risks, let us analyze the results of FX hedging with NDFs. Please refer to Charts 1–4 that plot the contracted NDF rates of 1-, 3-, 6-, 9-month, and 1-year UAH NDFs versus the prevailing spot rates on the fixing dates in 2006–2011. The prevailing spot rates are presented in blue color while the NDF rates are presented in other colors. The MoF would benefit from NDF contracts wherever the NDF rate is below the prevailing spot rate (wherever the color line is below the blue line). The opposite would be true for the situations where the color line is above the blue line.

1-Month NDFs performed very nicely between August and December 2008 when UAH/USD exchange rate increased from UAH 4.70 to UAH 9.50 per USD. After that, it was no longer the case, as the NDFs were rather overpriced. The same holds true for NDFs with longer durations, as demonstrated by Charts 2–4.

Chart 4 shows that the longer is the term of an NDF, the more expensive they become as there is more uncertainty involved which demands a higher risk premium. This result remotely resembles the bullwhip effect experienced in supply-chain

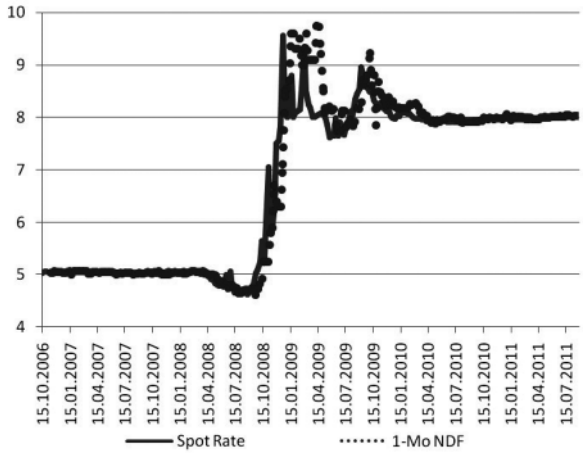

Chart 1. The Contracted NDF Rate for 1-Month UAH/USD NDFs vs Prevailing Spot Rate on the Fixing Date in 2006–2011

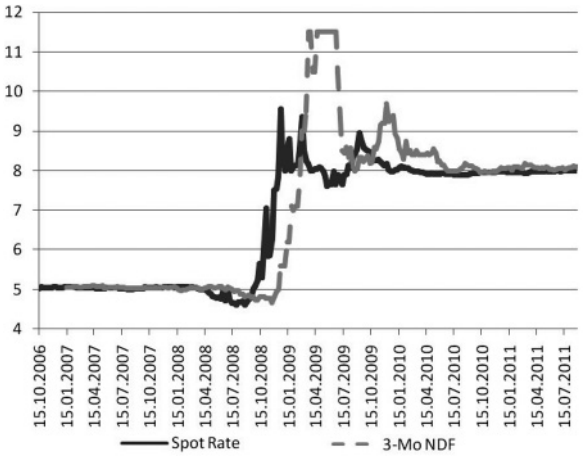

Chart 2. The Contracted NDF Rate for 3-Month UAH/USD NDFs vs Prevailing Spot Rate on the Fixing Date in 2006–2011

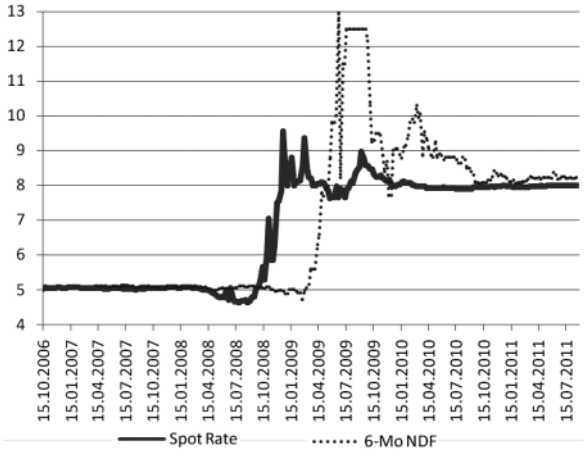

Chart 3. The Contracted NDF Rate for 6-Month UAH/USD NDFs vs Prevailing Spot Rate on the Fixing Date in 2006-2011

Table 6. **No Hedging vs. Hedging of Eurobond Coupon Payments in Q4, 2008**

Eurobond	Amount in USD	Annual Coupon	Coupon Date in Q4 2008	UAH/ USD Spot Rate	Scenario 1: Amount Paid in UAH with No Hedging	Contract 6-Mo UAH/USD NDF Rate	Scenario 2: Amount Paid in UAH if Hedged
XS0170177306	1,000,000,000	7.65 %	Dec 11, 2008	7.4743	285,891,975	4.99	190,867,500
XS0276053112	1,000,000,000	6.58 %	Nov 21, 2008	5.9988	197,360,520	5	164,500,000
XS0305394941	500,000,000	6.39 %	Dec 26, 2008	7.79	124,347,875	4.96	79,174,000
XS0330776617	700,000,000	6.75 %	Nov 14, 2008	5.7819	136,597,388	5.02	118,597,500
				Total	744,197,758		553,139,000

Note: the numbers presented in this table were computed by the authors.

management as it is also driven by expectations and is magnified as planning horizons become longer (The Bullwhip Effect (or Whiplash Effect) is an observed phenomenon in forecast-driven distribution channels. The concept has its roots in J Forrester's Industrial Dynamics (1961) and thus it is also known as the Forrester Effect. Since the oscillating demand magnification upstream a supply chain reminds someone of a cracking whip it became famous as the Bullwhip Effect).

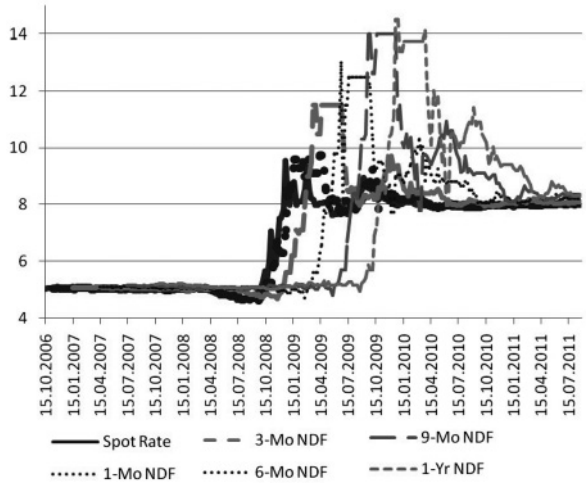

Chart 4. The Contracted NDF Rate for 1-Month, 3-Month, 6-Month, 9-Month, 1-Year UAH/USD NDFs vs Prevailing Spot Rate on the Fixing Date in 2006–2011

As an illustration of the effectiveness of NDFs, let us take 4 USD denominated Eurobonds that had their coupon payments due in Q4 of 2008 and examine the difference between two scenarios:

– Scenario 1: no hedging was done;
– Scenario 2: hedging with 6-month NDFs was performed.

The resulting analysis is presented in Table 6.

As seen from Table 6, the amount that was actually paid by the Ukrainian Government in UAH is 35 % higher than the amount that would be paid if the coupon payments were hedged with 6-month NDFs. Obviously, the Ukrainian Government would have to bear losses several periods before such a situation would occur but, as seen from the analysis presented above, in the time of low exchange rate volatility the NDF premiums tend to be rather low (between Oct 2006 and Apr 2007, the 6-month NDF monthly premium was only 0.14 % amounting to 1.712 % per year). Assuming 5 years of buying NDF contracts would be necessary to wait for a similar disaster to happen, 5*1.712 = 8.56 % would be spent by the NBU in NDF premiums as an insurance against the 35 % coupon payment increase, which is obviously worth it.

Conclusions

In 2008–2011, Ukraine overpaid around 30–35 % due to the lack of hedging FX exposure from Eurobond issues. As a result, it ended up paying 4–11 times the coupon rate in domestic currency than the rate which was initially intended. Due to the fact that Ukraine has heavy currency control mechanisms in place which restrict the currency positions of economic agents, we propose the use of non-deliverable forwards as the simplest tool to hedge the FX exposure for the MoF.

The key benefits of NDFs include:

- Protection: NDFs would provide the MoF with protection against unfavorable foreign exchange movements between the time MoF enters into an NDF and the maturity date. The MoF would exchange the uncertainty of exchange rate fluctuations for the certainty of an agreed cash flow.
- Managing Risk: as exchange restrictions in Ukraine do not allow physical delivery of currency, NDFs provide a means of mitigating foreign exchange risks.
- Flexibility: the maturity dates and the contract amounts can be tailored to meet particular requirements of the MoF.

Key Risks include:

- Opportunity loss: the MoF would forego any benefit of a favorable exchange rate movement between the time it enters into an NDF contract and the maturity date.
- Variation / Early termination: cancellations or adjustments may result in a cost to the MoF.
- Counterparty and operational risk: if the contracting party (the bank that offered an NDF) is unable to perform its obligations under the NDF, the MoF may be exposed to market exchange

rate fluctuations as if the MoF had not entered into an NDF. The contracting party's ability to fulfill its obligations would be linked to its financial well-being (credit or counterparty risk) and to the effectiveness of its internal systems, processes, and procedures (operational risk).

There are two possible outcomes at maturity of an NDF:

- If the contract rate is more favorable for the MoF than the prevailing spot (fixing) rate, the contracting party (the bank) will pay the MoF the difference in the settlement currency.
- If the contract rate is less favorable for the MoF than the prevailing spot rate, the MoF will pay the contracting party the difference in the settlement currency.

Even though NDFs seem to be rather "innocent", some countries with convertibility restrictions and heavy FX controls had to restrict NDF activity of their financial institutions in order to prevent FX volatility, although this could not stop the offshore NDF markets from operating.

NDF prices can be a useful market monitoring tool, reflecting market forces that cannot be manifested in onshore markets. Once a country moves to a more convertible exchange rate regime and onshore counterparties are permitted to transact in NDFs with international counterparties, NDF market liquidity can potentially contribute to liquidity and volume in onshore currency product markets. Once a currency becomes fully convertible, NDF markets tend to disappear. NDF markets can be seen as an intermediate tool in the progress of market development from limited to fuller capital convertibility.

Time series data demonstrate that Ukrainian Government could have greatly benefitted from using NDFs in 2008 when UAH/USD exchange rate jumped from UAH 4.60 to UAH 9.50 per USD and eventually settled to around UAH 7.90 per USD. NDFs are cheap if expectations of FX volatility are low; otherwise they tend to become prohibitively expensive.

UAH NDFs are offered by most international investment banks with Deutsche Bank, Citi Bank, VTB Bank, ING Bank being the major market makers. Local commercial banks do not offer NDFs to their clients, and refer all such inquires to the international investment banks. As long as there is differential treatment between residents and non-residents with regard to their operation in derivatives market, offshore UAH NDF market will continue to operate. It is definitely essential for sustenance of foreign investor's interest in the domestic economy. Activity in the NDF market needs to be closely monitored to keep track of the pressures on the Ukrainian currency as well as to prevent speculative attack on UAH during volatile conditions.

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Храбан А. М., Калиновський О. З.

ВИКОРИСТАННЯ БЕЗПОСТАВКОВИХ ФОРВАРДІВ ДЛЯ ХЕДЖУВАННЯ ВАЛЮТНИХ РИЗИКІВ

У статті описано форвардний контракт без поставки (NDF) як можливий інструмент для хеджування валютних ризиків українським урядом, який випускав єврооблігації на регулярній основі. Продемонстровано фінансові переваги позик на внутрішньому ринку в гривні, на відміну від зовнішніх запозичень, що здійснювалися протягом кількох останніх років. Показано, як NDF можна було б використовувати для хеджування валютних ризиків в Україні у 2006–2009 рр., коротко пояснює механізм роботи NDF контрактів, а також досліджує ціноутворення на гривневі NDF у 2006–2011 роках.

Ключові слова: форвардний контракт без поставки (NDF), хеджування валютних ризиків, ринки похідних фінансових інструментів (деривативів), неконвертовані валюти, валюта розрахунків, переважаючий на ринку спотовий курс, премія за ризик у NDF.

Матеріал надійшов 11.04.2012