The Three Sources of Risk Premia in Ukrainian Inter-bank Markets

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Abstract:

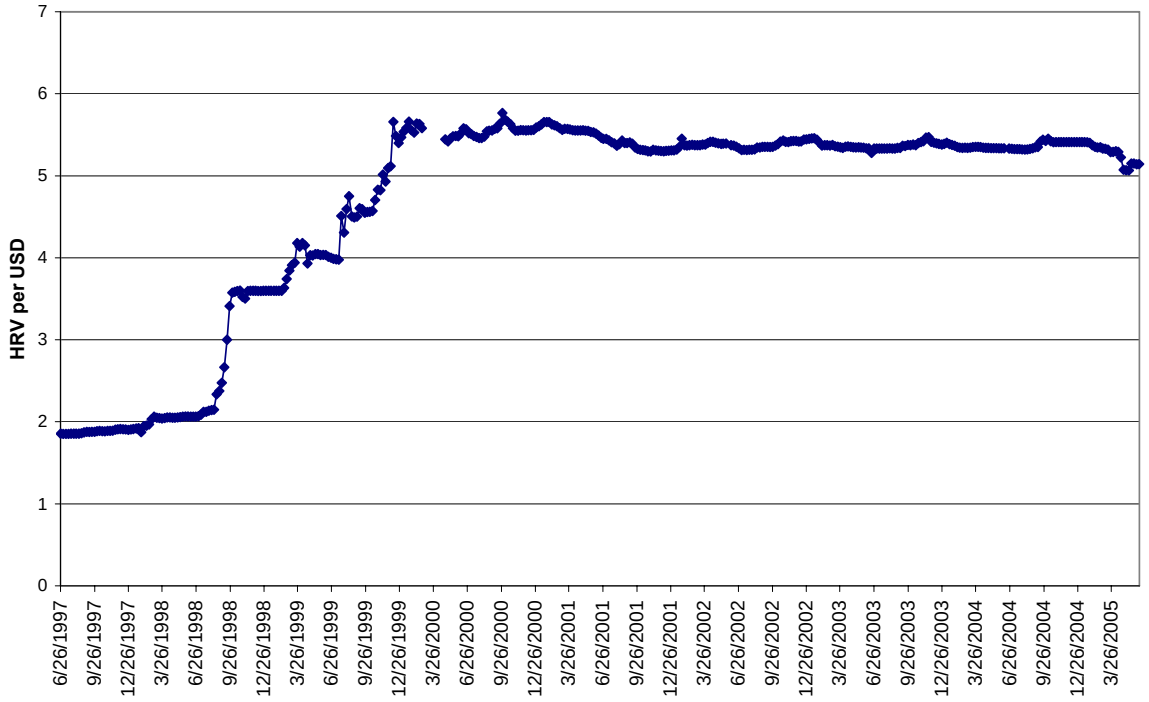
Despite its adoption of a nominal-anchor exchange-rate policy during the period 1999-2005, Ukrainian financial markets were subject to substantial premia in interest rates on inter-bank markets relative to what is observed in Euro credit markets. In this paper I demonstrate that there were three sources of this risk premium, and that these sources had different causes. Estimation using weekly data over the period 1999-2005 illustrates that the government's "nominal anchor" policy *vis à vis* the US dollar was effective at eliminating the risk of currency depreciation. However, other risks of convertibility and liquidity were either not addressed or exacerbated. Future monetary and financial-sector policy should be calibrated to address all three to avoid the financial crises that have affected other emerging economies.

JEL classifications: E43, F31, F36

I. Introduction.

Recent economic history for Ukraine can be dated from 17 August 1998 with the onset of the Russian financial crisis. The Russian crisis caused an economic crisis for Ukraine, as well as for the other economies of the former Soviet Union.[1] While the National Bank of Ukraine (NBU) initially defended the value of its currency, it soon thereafter adopted a more passive stance – and the nominal exchange rate depreciated strongly. As Figure 1 illustrates, the nominal exchange rate of the hryvnia to the US dollar depreciated from 1.86 in September 1997 to 5.66 in December 1999.

Figure 1: Hryvnia Exchange Rate



Source: National Bank of Ukraine

In May 1999 the Ukrainian legislature passed the "Law on the National Bank of Ukraine". In that law the NBU is given three main objectives (in decreasing order of

[1] See Conway (2001, chapter 10) for a detailed discussion of the implication of that crisis in three non-Russian FSU countries, including Ukraine.

importance): the stabilization of the Ukrainian monetary unit, the stability of the banking sector, and price stability.[2] The NBU chose to implement its objective through maintaining a near-fixed exchange rate with the US dollar. As Figure 1 illustrates, the period from the end of 1999 to June 2005 was one of remarkable stability in the exchange rate.[3]

This is seemingly a singularly successful application of the "nominal anchor" use of exchange rates.[4] Ukraine has enjoyed rapid export-led growth since its introduction. However, the stability in currency value has not worked through commonly expected channels. Commodity prices have not been brought into line with US prices, as would be suggested by the law of one price: while US inflation has remained at about 3 percent per annum, Ukrainian annual inflation has ranged from over 20 percent to -6 percent. Interest rates on interbank credits also have not converged with the rates observed on US dollar credits in European markets. There has been a large premium on interest rates in hryvnia-denominated (HRV) interbank credits relative to US dollar-denominated (USD) credits. Both interest rates differ significantly from the interest rates on the London interbank markets for credits of identical maturity. Figure 2 illustrates one such case: nominal annualized interest rates on 30-day interbank credits in Kyiv and London markets. Both HRV and USD interest-rate series are presented for Kyiv.[5]

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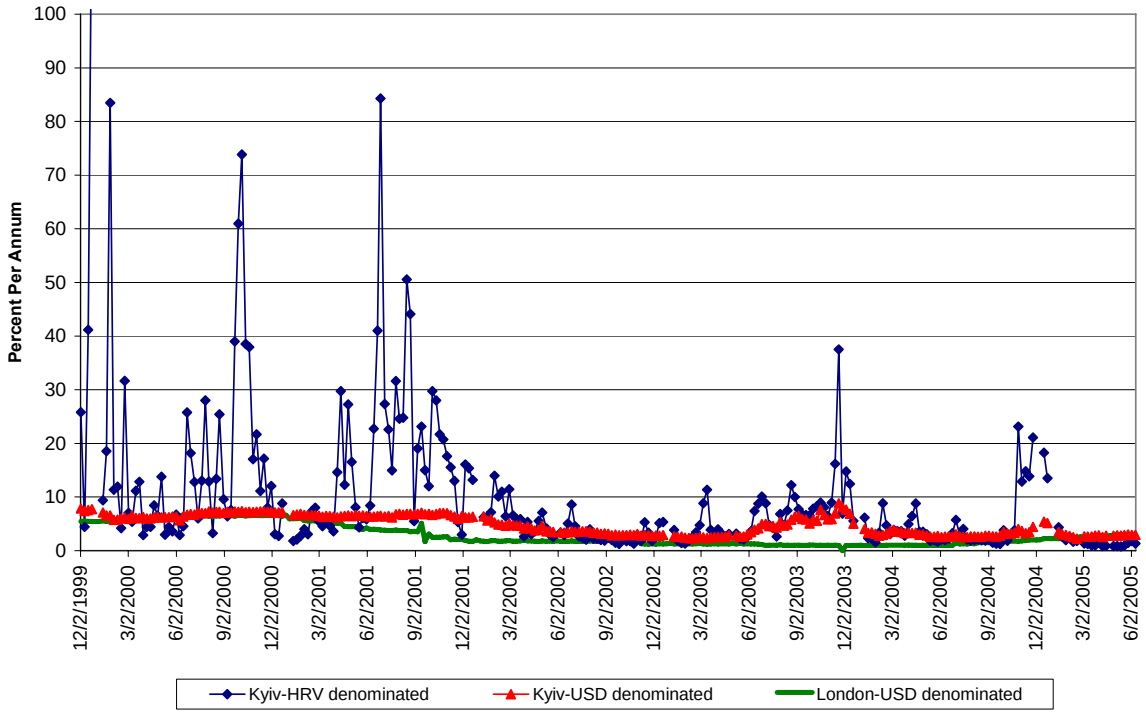
[2] Source: "The Law on the National Bank of Ukraine", approved in May 1999.

[3] The data illustrated here are the daily offered rate on private markets measured each Thursday. The rapid depreciation in the currency begins with the Russian financial crisis of 17 August 1998.

[4] Corden (1993) provides a nice explanation of the "nominal anchor" view of stabilization policy, and contrasts it with the "real targets" approach..

[5] While interbank rates are available from mid-1997 in hryvnia denomination and from early 1999 in US dollar denomination, Figure 2 illustrates only the period of stable exchange rates from end 1999 to mid 2005.

Figure 2: Interest Rates on Overnight Interbank Credit



Sources: National Bank of Ukraine and Datastream.

Despite the stability of the exchange rate, there is a great deal of variation evident in the hryvnia interest rate. The "Orange Revolution" of end-2004 is evident in the data, but from the financial-market perspective this was only the most recent cause for divergence of Kyiv-based interest rates from those available in the Euromarkets. There is also a persistent divergence in interest rates between USD interbank rates in Kyiv and in London. Similar divergences exist at all maturities of interbank credit.

I examine the macroeconomic consequences of the nominal anchor policy in Conway (2005). In this paper I investigate the rationales for continued divergence of interbank credit rates from those on the Euro credit market. I define three components of the interest rate premium. Only one of these – the currency premium -- is affected by the

use of the nominal anchor. The other two components are the products of imbalances between demand and supply in the domestic credit markets. The convertibility premium reflects an excess supply of HRV credit matched with an excess demand for USD credit. The liquidity premium reflects the excess demand for longer-maturity credits matched with an excess supply of shorter-maturity credits.

All three components of the premia indicate that Ukraine's financial markets are incompletely integrated in the Euro credit market. I conclude, however, that the nominal anchor policy alone is insufficient to foster more complete integration. I use regression analysis to identify the determinants of the three premia, and conclude that the convertibility and liquidity premia will continue so long as the mismatches in credit demands and supplies continue.

II. Integration of financial markets in transition economies: existing results.

The anomalies of the previous section are apparent examples of the violation of uncovered interest parity. This is not a new result: whether investigated as a forward discount bias or as a deviation of expected depreciation from ratio of interest factors, the systematic and sustained divergence of actual exchange rates and interest rates from covered interest parity has been demonstrated repeatedly in the past.[6] A number of alternative hypotheses have been considered. Froot and Frankel (1989) considered non-rationality of expectations and time-varying risk premia with specialist survey results used as an instrument for expectations in US dollar exchange rates. Canova and Ito (1991) construct a VAR-based exchange-rate expectation and test for the existence of a

[6] Hodrick (1988) has an excellent exposition and summary of results prior to that time, while Bekaert and Hodrick (2001) have a summary of more recent findings.

time-varying risk premium in the US dollar/yen exchange market. Black and Salemi (1993) use explicit optimization in portfolio-balance asset demand to construct an empirical search for time-varying risk premia in the US dollar-deutschemark exchange rate. This non-exhaustive list illustrates the unsettled nature of the analysis of that time. All three papers reject uncovered interest parity. Froot and Frankel (1989) also rejects the notion of a risk premium in favor of the non-rationality of expectations. Canova and Ito cannot reject a risk premium, but do reject one that varies systematically over time. Black and Salemi (1993) rejects the constancy of the risk premium in favor of a time-varying specification implied by the portfolio-balance theory. Bekaert and Hodrick (2001) reconsider the risk-premium tests for exchange rates between the US dollar, British pound and German Deutschemark for the period 1975-1997, with special attention to the small-sample properties of the estimators, and conclude that previous tests suffered from potential bias.

Tests of uncovered interest parity for developing countries are less often reported, in part because of the difficulty of obtaining matching financial-market data for these countries. Haque and Montiel (1991) modeled the actual developing-country interest rate as an average of the rate observed under uncovered parity and the one observed in financial autarky. They then estimated a "coefficient of financial integration" as the degree to which uncovered interest parity was in fact observed. Of fifteen developing countries between 1969 and 1987, for only five could the uncovered interest parity assumption be rejected. Flood and Rose (2001) investigate the deviations from uncovered interest parity for the 1990s in 13 industrial and 10 newly developing countries. They conclude "While UIP [uncovered interest parity] still does not work

well, it works better than it used to." (p. 2) It was especially effective, in fact, among those countries facing exchange-rate crises during that period.

Studies of uncovered interest parity for transition economies are relatively rare. On the theoretical side, McKinnon and Pill (1999) tie the deviations from uncovered interest parity to various sources of risk; they conclude that currency risks can lead banks to overborrowing in foreign currency. Empirical studies of financial markets have typically focused upon estimating the demand for money within a macroeconomic model; Starr (2005) and Oomes and Ohnsorge (2005) are examples for Russia, while Bilan (2005) considers similar issues in Ukraine. Despite the potential for uncovered interest parity, each of these studies treats the financial markets of the transition economy as being in financial autarky.

This paper investigates deviations from uncovered interest parity for Ukraine. It makes three important contributions:

- Uncovered interest parity is investigated through markets of inter-bank bid and offered rates of identical maturity and with exchange-rate changes measured precisely to the parity condition.
- The concept of the time-varying risk premium is made precise through specification of three sources of risk: the risk of depreciation (as is typically assumed), the risk of convertibility, and the risk of non-liquidity. A novel decomposition relates these primitive risks to the observed risk premium.
- The sources of each risk are estimated over the period late 1999-mid 2005. The time-varying nature of the risk premium is due in part to changing weights on these three risks, and in part to variations in the amplitude of each risk.

There is an important policy conclusion drawn from this analysis. The NBU policy of stable exchange rate with the US dollar was successful at eliminating depreciation risk. However, the two other sources of risk have persisted. The banking system's mismatch in borrowing and lending in US dollars is a continuing source of risk, and should be addressed before the financial integration consistent with uncovered interest parity will be observed.

III. The premia of the financial markets in Kyiv.

The interbank credit market in Kyiv facilitates trades in credits of six maturities (overnight, 7-day, 14-day, 30-day, 60-day and 90-day) in two currency denominations (HRV and USD). The data are available weekly, and are measured on the same day (Thursday) of each week. The "bid" and "offer" rate are both collected. The midpoint between bid and offer rates is defined as the relevant interest rate, while the difference of bid and offer divided by one plus the bid rate is defined as the spread in interbank credits. For comparison, bid and offer interest rates at the same maturities were collected for the London Interbank market and the Moscow Interbank market. For this study I examine overnight, 7-day, 30-day and 90-day interbank credits denominated in hryvnia and in US dollars.

The theory of international finance suggests two potential sources of arbitrage or speculative profit in linking the Kyiv and London markets. I denote interest rates using the following notation.

$\rho^{\$}_{mt}$: the international interest rate on a USD credit with maturity m at time t

$r^{\$}_{mt}$: the interest rate on a Ukrainian USD credit with maturity m at time t.

r^{H}_{mt}: the interest rate on a Ukrainian HRV credit with maturity m at time t.

These interest rates are potentially linked through arbitrage or through speculation based on the nominal anchor of stable exchange rate.

There is first of all the seeming arbitrage opportunity of trading in US dollar-denominated assets. In the absence of transactions costs, and for comparable credits, this implies that

$$(1+ \rho^{\$}_{mt}) = (1 + r^{\$}_{mt}) \qquad \text{for all m,t} \qquad (1)$$

There is secondly the opportunity to trade across currencies. In this case, uncovered interest parity implies

$$(1 + r^{\$}_{mt}) (e_{t+1}/e_t) = (1 + r^{H}_{mt}) \qquad \text{for all m,t} \qquad (2)$$

This is not an arbitrage opportunity, since the future exchange rate is unknown and there are no liquid forward markets. However, given the stability of the exchange rate over time, the risks attached to such transactions would appear to be small.

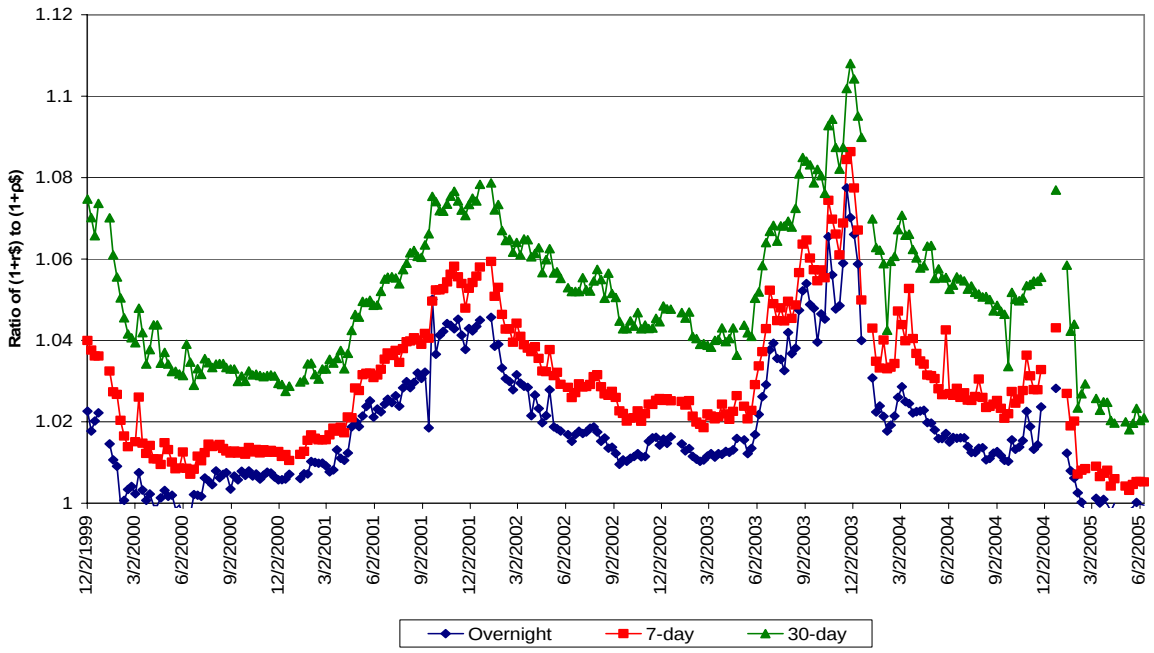
In Ukraine over this period, these parities were not observed. The divergence from (1) will be referred to as the convertibility premium, the divergence from (2) will be called the currency premium, and the mark-up of longer-maturity over shorter-maturity credit rates will be the liquidity premium.

Convertibility premium. The potential inability to transfer the proceeds of USD credits out of country leads to a convertibility premium v_{mt} in the parity defined by (1). Given this risk, those offering USD credits in the Ukrainian interbank market will demand a premium v_{mt} relative to the rate offered on Euro credit markets. This yields the expression (3).

$$v_{mt}(1+ \rho^{\$}_{mt}) = (1 + r^{\$}_{mt}) \qquad (3)$$

The v_{mt} for overnight, 7-day and 30-day USD-denominated deposits on the Kyiv interbank market are calculated relative to the equivalent-maturity rate on the London interbank market and are illustrated in Figure 3.[7]

Figure 3: Convertibility Premia in Ukraine



Source: author's calculation

[7] The mid-point of bid and offer rates is pictured for each maturity.

It is evident from this figure that there has been substantial variation in the convertibility premium. The premium v_{30t} falls from 1.07 at the end of 1999 to 1.03 by the beginning of 2001. It rises above 1.08 by the end of 2001, and then falls again to 1.03 by March 2003. It then reaches its peak for this period at the end of 2003 with a ratio of 1.11. It falls throughout 2004, but then spikes again during the Orange Revolution at the end of 2004, until finally falling to less than 1.02 during the first half of 2005.[8]

Currency premium. The currency premium is a wedge between the interest rates on USD and HRV credits of the same maturity offered in the same market. This is an extension of (2) above, with the observed wedge w_{mt} defined as in (4). One potential component of this wedge is the expected depreciation of the nominal exchange rate, while a second component may be the heightened risk of transacting in hryvnia in Ukraine.

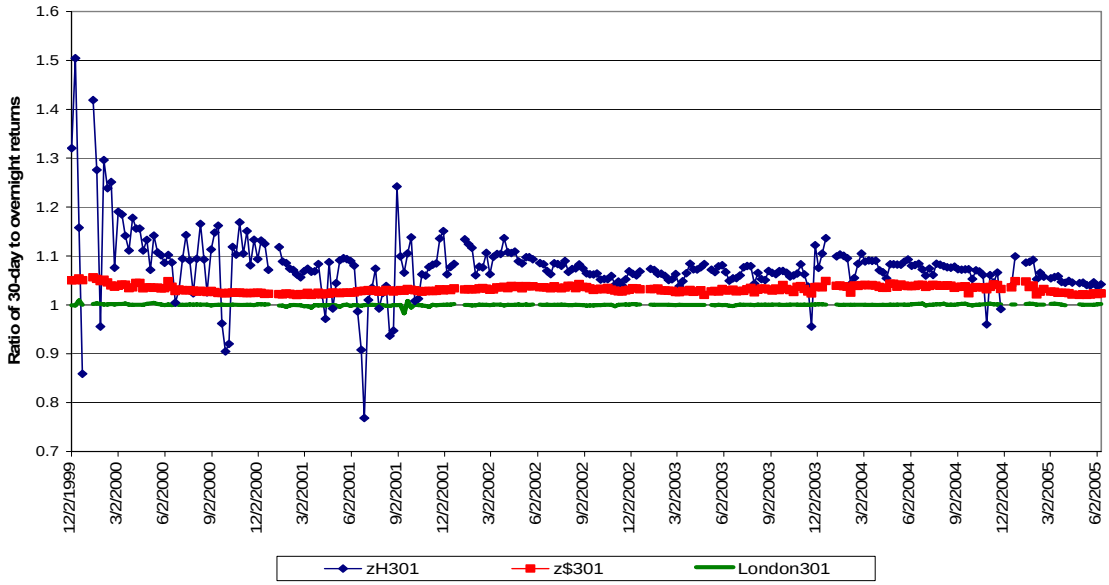
$$w_{mt} (1 + r^{\$}_{mt}) = (1 + r^{H}_{mt}) \qquad (4)$$

If expected exchange-rate depreciation were the only factor at play (if, for example, the actors had rational expectations and risk neutrality), then $w_{mt} = (e_{t+1}/e_t)$, and expected depreciation of the exchange rate leads to $w_{mt} > 1$. Figure 2 illustrates the difference in HRV and USD 30-day rates on the Kyiv interbank market, and it is clearly the case that w_{mt} is greatly in excess of one despite the stability of the nominal exchange rate. This

[8] This may give the impression that the financial markets were more troubled by events at the end of 2003 than by the Orange Revolution. We don't have direct evidence of this, since no interbank rates are reported for a number of weeks in late 2004. The absence of rates is itself striking evidence of upheaval.

could have been the effect of expected but unrealized depreciation against the US dollar, but may also reflect a risk attached to transacting in hryvnia.[9]

Figure 4: Term Structures in 30-day relative to Overnight Interbank Credits



Source: author's calculation

Liquidity premium. There is a liquidity premium evident in the Kyiv inter-bank markets that is not evident in the London market. This liquidity premium (z^{H}_{mnt}, $z^{\$}_{mnt}$) measures a term structure among inter-bank interest rates on credits of different maturities.

$$z^{\$}_{mnt}\,(1+r^{\$}_{mt}) = (1+r^{\$}_{nt}) \qquad \text{for } m<n \qquad (5a)$$

$$z^{H}_{mnt}\,(1+r^{H}_{mt}) = (1+r^{H}_{nt}) \qquad \text{for } m<n \qquad (5b)$$

This liquidity premium is illustrated in Figure 4 for the 30-day to overnight term structures. While the London markets register almost no term structure over this maturity, there is evidence of positive premia in both Kyiv credits.[10]

[9] The expected-but-unobserved depreciation explanation would be similar to the "peso problem" exposited for Mexico by Krasker (1980) and for the US by Lewis (1991).

The USD credits are characterized by a solid, relatively constant mark-up in the 30-day credits over the overnight credits, while the HRV credits indicate an even larger mark-up on average and a greater volatility in premium over this period.

Decomposing the premia evident in the Ukrainian data. I use the following identity to decompose the premia in the data.

$$(1+r^{H}_{mt}) = [(1+r^{H}_{mt})/(1+r^{\$}_{mt})]*[(1+r^{\$}_{mt})/(1+r^{\$}_{1t})]*[(1+r^{\$}_{1t})/(1+\rho^{\$}_{1t})]*(1+\rho^{\$}_{1t})$$
$$= w_{mt} * z^{\$}_{m1t} * v_{1t} * (1+\rho^{\$}_{1t}) \qquad (6)$$

This identity links the longer-maturity HRV rates with the overnight rate on the London credit market. The first three terms are the three premia defined above: the currency premium, the liquidity premium and the convertibility premium. The final term is the overnight rate on the London market.

Table 1 calculates on an annual basis the contribution of these four components to the mean value of $(1+r^{H}_{mt})$ for various maturities. Logarithms are taken of the components of (6), so that in the absence of rounding error the entries in each year for the second through fifth rows should sum to the entry in the first row.

When considered in annual averages, the evolution paths of the three premia are quite different. The currency premium w_{mt} is bid away over the years reported in the sample, until in 2005 the average premium on overnight credits is a discount. The liquidity premium $z^{\$}_{m1t}$ differs by maturity m, but remains roughly constant for the 7-day credits (at 0.01) and for the 30-day credits (at 0.03) while rising for the 90-day credits

[10] While the London inter-bank market exhibits term structure, the positive slope of the term structure only becomes evident for maturities longer than 90 days.

(from 0.04 to 0.08). The convertibility premium v_{1t} was near zero on average in 2000, but rose during the period 2001-2004 before falling once again to near zero in 2005. Finally, the rate of return on the Eurodollar market fell steadily over the period 2000-2004 before a small uptick in 2005.

Comparisons of the three premia in Table 1 indicate that the currency premium was the dominant component of the inter-bank rate in 1999. By 2001, though, the convertibility and liquidity premia taken together were more important determinants of the credit rates. In 2005, all three premia were eliminated on average for the overnight and 7-day maturities, while the liquidity premium remained relatively large for the 30-day maturity.

This decomposition provides a picture of the evolution of risk premia but doesn't identify the causes. In the next section I use regression analysis to uncover the determinants of these premia.

IV. Hypothesis testing: what caused these premia?

Theory suggests two simple (and extreme) theories for interest-rate determination in the Kyiv inter-bank market. The first is the complete integration theory: interest rates in Kyiv are related to those on the London credit market through the linkages specified in (1) and (2). In that case the convertibility and liquidity premia are zero, and the currency premium is equal to the expected depreciation of the hryvnia relative to the US dollar. The second is the theory that inter-bank interest rates are essentially random, with no systematic relation to risk, return or term structure. The evidence of Table 1 suggests that neither of these is valid, but a more formal test is necessary to confirm this conclusion.

The null hypothesis for the analysis that follows is the complete integration hypothesis, with convertibility and liquidity premia equal to zero and currency premium equal to expected depreciation plus a random zero-mean error. I identify four additional alternative hypotheses:

- Learning the reliability of the NBU's stable exchange-rate regime. This leads to gradual adjustment in inter-bank rates toward parity.
- Market-specific risks associated with the inter-bank markets in Kyiv.
- A premium proportional to exchange-rate depreciation.
- Shifts in monetary policy.
- Excess credit demands in the Kyiv markets leading to interest rate premia.

In the following part I construct measures of exchange-rate volatility, market-specific risks, learning and excess credit demand to introduce these alternative hypotheses. With those in hand I will test the importance of the various hypotheses in explaining each premium in turn.

Construction of risk- and policy-related explanatory variables. Testing these hypotheses requires explanatory variables that will proxy for the importance of these various forces in Ukrainian financial markets. These are grouped below into indicators of market risk, credit imbalances, and monetary policy.

1. Indicators of market risk. I use the spread observed in a financial market as an indicator of market-specific risk. The spread in the foreign-exchange or inter-bank credit markets is defined here as the difference in "bid" and "offer" rates as a percent of the revenue from the transaction. It is the source of profit for transactors. It is also, in times of uncertainty, an indicator of the risk involved in the transaction. Risk-averse

lenders (or sellers of foreign exchange) will increase their "offer" rate, while risk-averse borrowers (or purchasers of foreign exchange) will reduce their bid rate, when the transactions risk increases.

Figure 5 illustrates the evolution over time of three spreads in Kyiv markets: the exchange-rate spread, the spread on overnight hryvnia-denominated credits, and the spread on overnight US dollar-denominated credits. The exchange-rate spread and the USD credit spread begin and end in roughly the same place, with a decline over time from 4 percent to about 1 percent. The decline is consistent with a deepening of the Kyiv foreign-exchange and inter-bank markets, as competition reduces the spread observed. There is still room for further reductions, as is evident from the spread reported for the London overnight credits; that spread differs only marginally from zero. [11]

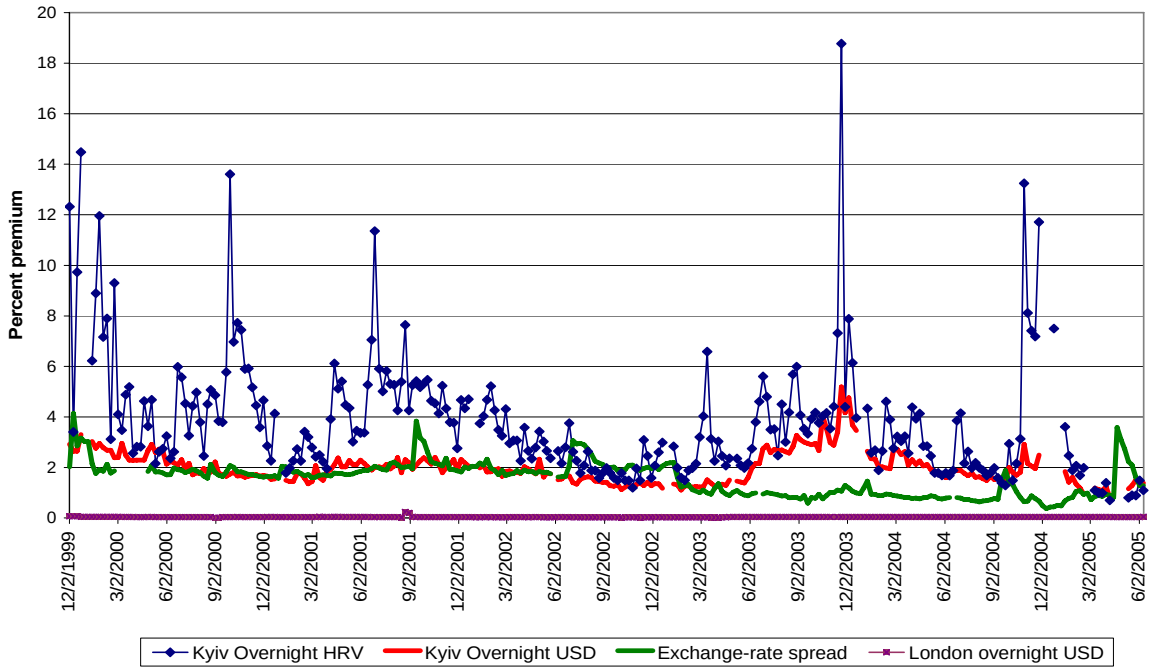
The exchange-rate spread has three peaks of about 4 percent.[12] The first occurs at the end of 1999 when exchange-rate stability was imposed, the second is observed in the days after 11 September 2001, and the third appears in April 2005 when the NBU abandoned strict exchange-rate stability with the US dollar. In between, there was an initial equilibrium spread of about 2 percent observed in 2000 and 2001, and a second equilibrium between 0.5 and 1 percent in 2003, 2004 and early 2005.

The spread on USD overnight credits takes a similar path in the years 2000 through 2002. [13] From early 2003 through early 2005, though, the two spreads diverge – the spread on interbank credit rises to about 5 percent in late 2003, and slowly falls back to about 1 percent in early 2005. The extreme volatility of the spread on HRV

[11] The bid-ask spread in the London overnight markets is general less than 0.1 percent. Its sole spike in the weekly series examined came on 9/13/2001, when the spread rose to 0.25 percent.
[12] The exchange rate spread is defined ("sell" rate – "buy" rate)*100/("buy" rate).
[13] The spread in the interbank credit markets is defined ("offer" rate – "bid" rate)/(1+ "bid" rate/100)

overnight credits disguises the fact that this series begins and ends just as the other two: beginning at about 4 percent at end-1999, and ending at about 1 percent in mid-2005. In between, though, its volatility is more striking than that in the other two series. It is a useful indicator of the perceived risk in the HRV credit markets.

Figure 5: Bid-ask Spreads in Overnight Interbank Credits and Exchange Rate



Source: author's calculation

I derive an aggregate measure of the risk associated with market j in period t (σ_{jt}) by deriving the principal component of the spreads observed in the overnight, 7-day and 30-day inter-bank transactions. The three markets considered are the Kyiv USD market (σ_{kt}), the Kyiv HRV market (σ_{ht}), and the London USD market (σ_{lt}). I also consider the standard deviation in the exchange rate (σ_{30t}) over the previous 30 days as an indicator of risk in the foreign-exchange market.[14] These risk measures are somewhat correlated with

[14] The spread in the foreign-exchange market was also considered, but provided no explanatory power when considered in tandem with σ_{30t}.

one another, as Table 2 illustrates, but identify different sources of risk to private financial transactions.

The spreads on the London credit markets as distilled in σ_{lt} indicate risks to the value of the US currency, and in fact the only sizeable increase in that spread occurred around 9/11/2001. The risk factor σ_{kt} measures banking-system specific risks of transactions in Ukraine: capital controls, opacity of commercial bank performance, and other features that increase the risk of non-repayment. The factor σ_{30t} measures the risk of exchange-rate fluctuations. The factor σ_{ht} combines the banking-system risk with the risk of NBU intervention into the credit markets. As Table 2 illustrates, there is a strong positive correlation (with coefficient 0.70) between risks in the two Kyiv markets. The correlation is also positive and large between σ_{ht} and σ_{30t}, reflecting the exchange-rate risk in the HRV markets. There is as well a positive correlation (of 0.36 or 0.37) between the risk associated with holding USD credits in the London market and the three Kyiv-based risk factors.

The risk-aversion hypothesis states that the premium demanded in interest rate will be increasing in risks associated with those markets. Thus, currency risk should be increasing in σ_{ht} and σ_{30t}, while declining in σ_{lt} and σ_{kt}. Convertibility risk should be increasing in σ_{kt} and declining in σ_{lt}, while independent of σ_{ht} and σ_{30t}. Liquidity risk in the Kyiv USD market should be increasing in σ_{kt} and should be independent of the other risk factors.

The market-based risk indicators σ_{ht} and σ_{kt} may depend upon monetary policy interventions. To separate market-based risk from policy risk in what follows, I regress σ_{ht} and σ_{kt} on year-specific dummy variables and monetary policy variables. The

residuals from those regressions are defined $\hat{s}_{ht}$ and $\hat{s}_{kt}$ and are independent of policy shocks. The regressions from which these variables are created are given in Table A1 in Annex.

2. Credit imbalance indicators. Commercial banks act as intermediaries on the financial markets: they accept deposits and extend credits. In Ukraine, both depositors and creditors have a choice of denomination in their transactions. Table 3 illustrates the magnitude and denomination of both "credits to the economy" and "deposits of enterprises, institutions and households" in the commercial banking system.[15]

The first set of columns describes credits granted by commercial banks. The share of HRV credits is declining over time, from 74 percent in 1995 down to 48 percent at the end of 1999 and rising slightly to 58 percent at end-June 2005.[16] The second set of columns presents the liabilities of the commercial banks; there, the share of HRV liabilities remains fairly steady throughout, ending in 2005 at 66 percent.

Two features stand out in this table. First, there has been remarkable growth in the financial intermediation of the economy, with both credits and liabilities of commercial banks growing rapidly. Second, the deposits denominated in foreign currency have not kept up with the credits extended in foreign currency. If the commercial banks are unable to meet their excess demands on the international markets, the relative shortage of USD funds could generate a premium.

For the purposes of this study, I will summarize the excess demand for credits in Kyiv in three variables. The variable xc_t is the excess demand for total credit in period

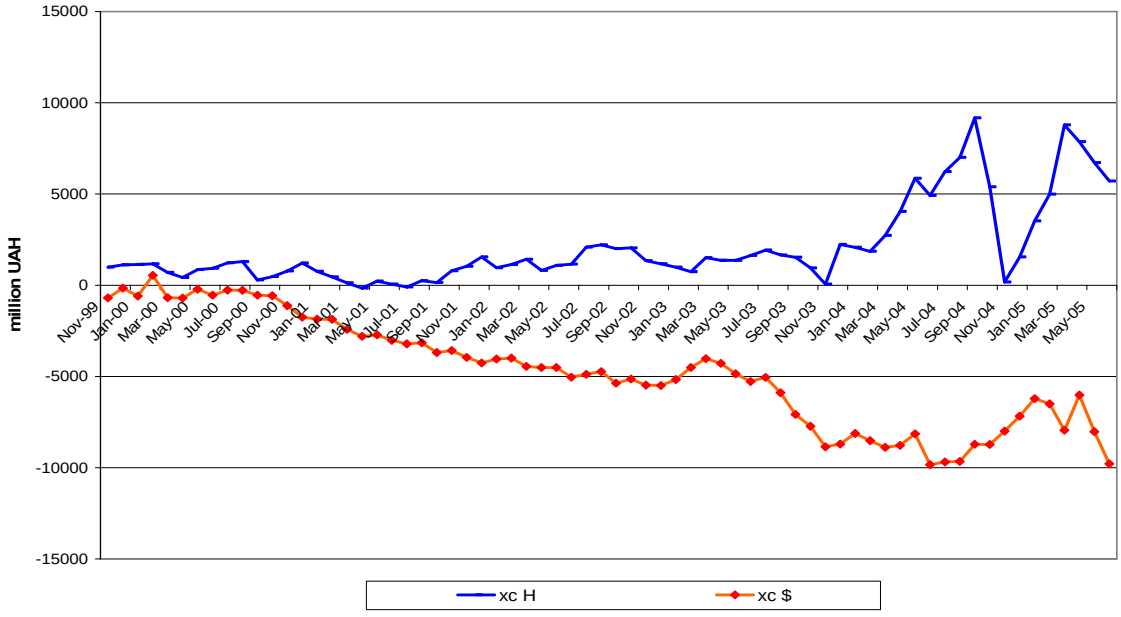
[15] These credits exclude "net credit to the government" from commercial banks. This was a relatively small amount throughout the period studied.

[16] Decomposition of credits into short-term (less than or equal to one year maturity) and long-term (greater than one-year maturity) illustrates that short-term credits remain predominantly HRV while long-term credits are nearly 50 percent USD.

t.[17] The variable $xc^{\$}_t$ is the excess demand for USD credits in period t, and xc^{H}_t is the excess demand for HRV credits in period t.

Figure 6 illustrates the excess supplies (deposits minus credits) to commercial banks for HRV and USD instruments at a monthly frequency. There is a sustained excess demand for USD credits in the commercial banking system – more USD credits are issued than USD deposits are received. There is also a sustained excess supply of HRV credits, with deposits in general exceeding demands for HRV credits. The net effect of the two is that of excess demand for credits. While there was an excess supply of credits overall prior to September 2000; only in October 2004 and March-April 2005 was the excess supply of credit observed again. The credit imbalance hypothesis suggests that the convertibility premium will be increasing in excess demand for USD credit.

Figure 11: Excess Supply of Funds to Commercial Banks



Source: National Bank of Ukraine

[17] This is measured as a percentage of deposits. If total credits of commercial banks are denoted cr_t and total deposits are dep_t, then $xc_t = (cr_t - dep_t)/dep_t$. The HRV and USD components are defined analogously.

3. Monetary policy stance. If risks and market distortions have introduced a separation between Ukrainian and foreign markets, then there will be scope for independent credit policy despite the maintenance of the fixed exchange rate.[18] Two variables are introduced to proxy for credit stance: the discount rate and the Lombard-discount channel. The discount (r_{dt}) and Lombard (r_{Lt}) rates in Ukraine play similar roles to those in other European banks. The discount rate is the lowest rate at which banks can borrow from the NBU, and is often below the market rate. Bank-level quotas for borrowing at that rate are set by the NBU. The Lombard rate is charged on emergency loans from the NBU to banks. No quota is placed on its use, and it thus should serve as an upper bound on market overnight interest rates. These two rates are set by NBU officials at periodic meetings. The Lombard/discount channel (L_t) is $L_t = (r_L - r_d)/(1+r_d/100)$ and is an indicator of interest-rate volatility acceptable to the NBU.

The monetary-policy hypothesis suggests that central-bank intervention to tighten the monetary policy will raise the currency premium. The convertibility and liquidity premia will not be directly affected by monetary policy. However, to the extent that monetary policy reduces the credit imbalance is will reduce the convertibility premium as well. To the extent that monetary policy intervenes in the overnight credit market, tightening should drive up USD overnight rates and reduce the liquidity premium.

What determines the currency premium? Table 4 reports regression analysis to identify the sources of the currency premium for various maturities of inter-bank credits. There are five sets of explanatory variables: the year-specific dummies modeling the learning process about the NBU commitment to the stable exchange rate,

[18] Bilan (2005) concludes just this – her "liquidity effect" is a measure of the degree to which monetary policy, ceteris paribus, can affect the interest rate. Her analysis is limited by an absence of variables indicating international parities – either exchange rate or foreign interest rate.

the actual exchange-rate depreciation observed over the relevant time horizon (in theory, the coefficient on this variable should be 1), the risk factors in the three inter-bank markets, two indicators of NBU monetary policy, and the excess-credit indicators.[19]

The intercept in each column represents the average currency premium in 2005, controlling for the other factors, and the year-specific dummy variables indicate the deviation of the average premium in that year from the one observed in 2005. The year-specific effects tell the story of Table 1: the currency premium has a component uncorrelated with other explanatory variables that declines rapidly between 1999 and 2002. This decline is consistent with the hypothesis that private actors initially built in a risk premium associated with the NBU commitment to exchange-rate stability. Controlling for other factors, the learning effect reduced w_{mt} in each year from 19990 to 2002. From that year on there were no further gains associated with this learning.

The uncovered interest parity theory of (2) suggests that exchange-rate depreciation will be positively correlated one for one with the w_{mt}. Instead, the estimation results indicate that, ceteris paribus, exchange-rate depreciation is negatively though insignificantly related to the currency premium. This negative effect is not significantly different from zero, but is significantly different from 1.[20]

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[19] In creating the relevant depreciation rate e_{t+m}/e_t, it is necessary to adjust for the fact that the interest rates quoted by the market are annualized. To do so I first calculate the actual depreciation over the maturity of the credit: one, seven, 30 or 90 days respectively. I then scale this depreciation rate up by 360, 52, 12 or 4 respectively to represent the annualized equivalent of the actual depreciation observed over this maturity.

[20] Under the rational expectations assumption, the actual depreciation of the exchange rate is equal to the expected depreciation plus a random error. This potentially introduces an errors-in-variables bias to the estimation reported in Table 2. To check whether this bias is generating the anomalous results I check the reverse regression $(e_{t+m}/e_t) = a + b*w_{mt.} + \varepsilon_{mt}$ The relation (2) with rational expectations predicts that b will be unity. In fact,

b (overnight) = -0.73 b (7-day) = 0.11
b (30 day) = 0.19 b (90 day) = -0.10

The last three of these are insignificantly different from zero at the 95 percent level of confidence, while the first is the wrong sign and significantly different from zero. While the coefficient of Table 2 may include some errors-in-variables bias, the general rejection of uncovered interest parity is evident in these

The risk factors ($\hat{s}_{ht}$, $\hat{s}_{kt}$, σ_{30t}) enter significantly, and in the anticipated direction, in these regressions.[21] Exchange-rate risk drives up the currency premium at all maturities: for example, in the 30-day credits the coefficient is 3.70. An increase in banking-sector risk $\hat{s}_{kt}$ causes w_{mt} to fall, as the denominator rises by more than the numerator. The NBU intervention risk $\hat{s}_{ht}$ has an independent positive effect on the currency premium (coefficient 0.05 for 30-day credits). These effects are observed in all four maturities considered. The impacts of both credit-market specific risks declined in size as the maturity considered increased.

The currency premium does not respond significantly to the excess demand for credit in the two markets, although the signs of the coefficients in shorter maturities are consistent with a "deposit boom" story. As excess demand for USD credit rises, for example, the interest rate on USD credits should rise and w_{mt} should fall.

Government policy has had a significant impact on the currency premium, although in the opposite direction to expected. Other things equal, a rise in the discount rate (i.e., tightening monetary policy) lowers significantly the currency premium in the shorter-maturity credits. Increasing the Lombard-discount rate channel tends to increase the currency premium in the shorter maturities, though not often significantly, while it reduces the premium in the 90-day maturity.

Given these results, I can summarize the hypothesis tests as follows. First, there is no evidence of uncovered interest parity as an arbitrage outcome once other factors are controlled for. There is significant evidence of a learning effect associated with the

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regressions as well. This negative sign is found in many tests of uncovered interest parity: see Flood and Rose (2001).

[21] I also included $\hat{s}_{lt}$, the principal component from the spreads in the London market, but it proved to be never significant.

stable exchange-rate policy. There is also evidence of response to market-specific risk premia emanating from the HRV, USD and foreign-exchange markets.

What causes the convertibility premium? In Table 5 I investigate the sources of the convertibility premium. The convertibility premium v_{mt} is regressed on a similar set of risk indicators, though in this case neither the London market risk ($\hat{s}_{lt}$) or the foreign-exchange risk (σ_{30t}) were significant contributors to any of the regressions. The regressions explain between 84 and 90 percent of the variation in this convertibility premium.

There is some reduction in the convertibility premium over time, but that effect is less pronounced than in the currency premium. The premium dropped from .08 to .03 between 1999 and 2000, but in subsequent years the premium rose again. There is an abrupt drop in 2005 to the levels indicated in the intercept.

Both banking-system risk and NBU intervention risk contribute positively and significantly to the convertibility premium. A one standard-deviation increase in banking-system risk raises the convertibility premium by between 0.009 and 0.015. The one standard-deviation increase in NBU intervention risk raises the short-term convertibility premium, but by only 0.002.

NBU use of the discount rate and Lombard-discount channel is seldom a significant determinant of the convertibility premium. This is expected, since monetary policy occurs in the hryvnia-denominated markets while the convertibility premium compares two US dollar-denominated markets.

Excess demand for USD credit is a significant factor in the determinant of the convertibility premium. A one percent increase in excess demand leads to from 0.04 to

0.06 increase in the convertibility premium. Other forms of excess credit demand entered insignificantly and so were excluded from this specification.

The sources of the convertibility premium then are different from those of the currency premium. Increased market-specific risks in the two credit markets lead to increased convertibility premium, but exchange-rate risk has no significant effect. Monetary policy use of the discount rate has little effect – but does reduce the premium in the overnight market as we would expect. Finally, the excess demand for credit was an important support for the convertibility premium.

What caused the liquidity premium? Table 6 illustrates the sources of the liquidity premium. The pattern of year-specific dummy variables indicates that the term structure in the US dollar-credit market became somewhat steeper on average between 1999 and 2004. Of the risk factors identified in this paper only the indicator of banking-system risk ($\hat{s}_{kt}$) enters significantly, with increases in risk increasing the premium at all maturities – increased banking-system risk leads to a demand for larger risk premia at longer maturities. The indicators of excess credit demand enter significantly: excess demand for HRV credit causes a reduction in the premium, while excess demand for USD credits cause an increase in the premium. This is probably due to an asymmetry in the average maturity of credit demands with USD credits typically of longer maturity than HRV credits.

Increases in the discount rate are associated with larger liquidity premia.[22] Increasing the discount-Lombard channel have positive effects on the liquidity premium for the 7-day and 30-day maturities, but a negative effect at the 90-day maturity.

V. Conclusions and prognoses.

The nominal anchor for the Ukrainian currency introduced in 1999 was quite successful in reducing exchange-rate variability *vis à vis* the US dollar. It also coincided with a pronounced reduction in interest rates on HRV inter-bank credits of all maturities between overnight and 90-day. To the extent that this reduction represents the removal of a risk premium in that market, credit allocations will be more efficient.

The nominal-anchor policy was paradoxically less effective at ensuring that interest rates on USD inter-bank credits in Ukraine were brought into equality with interest rates on USD inter-bank credits on the Eurocredit market. Further, its lack of success in this increased as the maturity of the inter-bank credit increased.

This paper demonstrates through the decomposition of interest-rate differences between the Kyiv credit markets and the London credit markets that this interest-rate reduction did not rely upon the quasi-arbitrage pressure of uncovered interest parity, but rather upon the maintenance of an excess supply of HRV credits and excess demand for USD credits. While this eliminated the currency premium, it perpetuated the convertibility and liquidity premia.

The prognosis for the inter-bank credit markets in Ukraine is somewhat pessimistic. While the currency premium has largely disappeared, there is the probability

[22] This impact of the discount rate is due to the positive association of its increase with increased market risk. When the market-risk effect is excluded, the discount rate has an insignificant impact on the liquidity premium.

of partial return in the near term. The reduction in exchange-rate volatility σ_{30t} was a significant contributor to the elimination of this premium. With the recent decision to relax the definition of stability of the hryvnia in terms of US dollars, this volatility will rise and will ceteris paribus increase the currency premium.

The convertibility premium defined in the overnight market had also disappeared by mid-2005, but this disappearance is less likely to continue. The reduction in financial-system risk and in NBU intervention risk observed in 2005 may well continue, but this premium also depended positively and significantly on the excess demand for USD credits by the commercial banks. So long as this excess demand continues, there will be upward pressure on this premium. The NBU can counter this pressure in the overnight market by raising the discount rate, as this contributes significantly to a reduction in the premium.

The liquidity premium observed in the term structure of USD credits has remained roughly constant in the Kyiv markets from 1999 to 2005. Since the other premia have declined in magnitude, this makes the liquidity premium a relatively more important component. While reduction in banking-system risk has had the expected and significant effect in reducing this premium, the pattern of excess demand for credit serves to sustain the liquidity premium. The excess demand for USD credits places upward pressure on this premium, as does the excess supply of HRV credits. This premium will thus continue while the excess demand in USD credits continues.

The Ukrainian situation in 2005 shares some characteristics with the "moral hazard" outcome described by McKinnon and Pill (2000). While the currency premium has been eliminated, the risk premium (what the authors call the "super premium")

remains in the form of liquidity and convertibility premia. These are positively related to the excess demand for USD credits as defined in this paper. McKinnon and Pill (2000) recognize the excess demand for USD credits by its flip side: the "overborrowing" of the banking system from international lenders. Duenwald et al. (2005) raises this red flag as well in speaking of the "credit boom" in Ukraine. In Conway (2005) I point out that the credit boom has in fact been fueled by a larger "saving boom", but that there is a mismatch in currencies between saving and investment. In this study, the mismatch is evidenced by the excess demand for USD credits.

While the "nominal anchor" policy has been effective in reducing currency depreciation risk, it has not been sufficient by itself to attain complete integration of inter-bank markets. The NBU should take into consideration all three types of risk in devising its monetary and financial policy. Through use of the discount-Lombard channel and regulation of banking system borrowing in concert with its nominal anchor, it can maintain the convergence in inter-bank interest rates with those in the European credit markets that it had achieved by mid-2005.

Annex: The Policy Content of Market Risk.

This regression was the basis for the calculation of the measures of market risk independent of policy used in the text. The residuals from this regression were defined $\hat{s}_i$ for i=h,k,l and were used in the regressions in the text.

Table A1: **The Policy Content of Market Risk**			
	σ_{ht}	σ_{kt}	σ_{lt}
Intercept	**-1.66**	**-2.20**	-0.16
	(0.28)	(0.28)	(0.29)
$\ln(1+r_{dt})$	**4.94**	**7.21**	1.27
	(2.28)	(2.27)	(2.38)
L_t	6.45	9.15	-7.97
	(5.01)	(4.98)	(5.22)
d99	**2.96**	1.38	**3.15**
	(0.76)	(0.76)	(0.80)
d00	0.77	0.58	0.54
	(0.44)	(0.44)	(0.42)
d01	**0.79**	**0.69**	**0.84**
	(0.30)	(0.30)	(0.31)
d02	**0.64**	**0.78**	**-0.50**
	(0.24)	(0.24)	(0.25)
d03	**1.30**	**2.01**	-0.25
	(0.24)	(0.24)	(0.25)
d04	**0.96**	**1.43**	0.19
	(0.22)	(0.21)	(0.22)
R^2	0.41	0.42	0.36
N	255	255	255

Standard errors in parentheses.
Figures in bold are significantly different from zero at the 95 percent confidence level.

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Table 1: Decomposition of the HRV Interbank Rate

mean annual values

	2000	**2001**	**2002**	**2003**	**2004**	**2005**
30-day credits						
$\log(1+r^{H}_{30t})$	**0.25**	**0.20**	**0.12**	**0.13**	**0.12**	**0.07**
$\log(w_{30t})$	0.15	0.11	0.05	0.05	0.05	0.01
$\log(z^{\$}_{301t})$	0.03	0.03	0.03	0.03	0.04	0.03
$\log(v_{1t})$	0.00	0.02	0.02	0.03	0.02	0.00
$\log(1+\rho_{1t})$	0.06	0.04	0.02	0.02	0.01	0.03
90-day credits						
$\log(1+r^{H}_{90t})$	**0.29**	**0.22**	**0.15**	**0.15**	**0.16**	n.a.
$\log(w_{90t})$	0.19	0.10	0.06	0.05	0.04	n.a.
$\log(z^{\$}_{901t})$	0.04	0.04	0.06	0.05	0.08	n.a.
$\log(v_{1t})$	0.00	0.02	0.02	0.03	0.02	n.a.
$\log(1+\rho_{1t})$	0.06	0.04	0.02	0.02	0.01	n.a.
7-day credits						
$\log(1+r^{H}_{7t})$	**0.17**	**0.17**	**0.06**	**0.09**	**0.07**	**0.03**
$\log(w_{7t})$	0.10	0.09	0.01	0.03	0.03	0.00
$\log(z^{\$}_{71t})$	0.01	0.01	0.01	0.01	0.01	0.01
$\log(v_{1t})$	0.00	0.02	0.02	0.03	0.02	0.00
$\log(1+\rho_{1t})$	0.06	0.04	0.02	0.02	0.01	0.03
Overnight credits						
$\log(1+r^{H}_{1t})$	**0.14**	**0.15**	**0.04**	**0.07**	**0.05**	**0.02**
$\log(w_{1t})$	0.08	0.08	0.00	0.02	0.02	-0.01
$\log(v_{1t})$	0.00	0.02	0.02	0.03	0.02	0.00
$\log(1+\rho_{1t})$	0.06	0.04	0.02	0.02	0.01	0.03

Source: author's calculations. There is no term structure to overnight credits, so $z^{\$}_{11t}$ is undefined.
n.a.: only 3 observations are available for the 90-day credits in 2005.

Table 2: Correlations among Risk Factors

	σ_{ht}	σ_{kt}	σ_{lt}	σ_{30t}
σ_{ht}	1.0	0.70	0.37	0.47
σ_{kt}	0.70	1.0	0.37	0.27
σ_{lt}	0.37	0.37	1.0	0.36
σ_{30t}	0.47	0.27	0.36	1.0

Author's calculation

Table 3: Total Credits and Deposits of the Commercial Banks

	Credits			**Deposits**		
	Value	HRV share	Foreign share	Value	HRV share	Foreign share
1995	4078	0.74	0.26	4287	0.63	0.39
1996	5452	0.75	0.25	5145	0.69	0.31
1997	7295	0.71	0.29	6357	0.74	0.26
1998	8873	0.58	0.42	8278	0.60	0.40
1999	11787	0.48	0.52	12156	0.56	0.44
2000	19574	0.54	0.46	18739	0.62	0.38
2001	28373	0.56	0.44	25674	0.68	0.32
2002	42035	0.58	0.42	37715	0.62	0.38
2003	67835	0.58	0.42	61617	0.68	0.32
2004	91769	0.59	0.41	82959	0.64	0.36
2005 *	108742	0.58	0.42	104674	0.66	0.34

* end June

Source: National Bank of Ukraine

Table 4: Sources of the Currency Premium				
	w_{1t}	w_{7t}	w_{30t}	w_{90t}
Intercept	0.001	-0.005	-0.03	0.06
	(0.04)	(0.03)	(0.03)	(0.06)
e_{t+m}/e_t	-0.001	-0.007	-0.009	-0.01
	(0.007)	(0.007)	(0.02)	(0.06)
$\hat{s}_{ht}$	**0.09**	**0.09**	**0.052**	**0.03**
	(0.006)	(0.005)	(0.004)	(0.004)
$\hat{s}_{kt}$	**-0.03**	**-0.03**	**-0.012**	-0.006
	(0.006)	(0.004)	(0.003)	(0.004)
σ_{30t}	**8.11**	**5.73**	**3.90**	**6.34**
	(1.31)	(0.98)	(0.77)	(1.23)
$\ln(1+r_{dt})$	**-0.58**	**-0.28**	0.16	0.18
	(0.19)	(0.14)	(0.11)	(0.15)
L_t	**0.77**	0.54	0.06	**-0.47**
	(0.38)	(0.28)	(0.23)	(0.24)
xc_t	0.20	0.18	0.06	0.07
	(0.13)	(0.10)	(0.08)	(0.09)
$xc^{\$}_t$	-0.26	-0.17	0.04	0.01
	(0.15)	(0.11)	(0.09)	(0.11)
d99	**0.27**	**0.35**	**0.27**	
	(0.06)	(0.05)	(0.04)	
d00	**0.19**	**0.16**	**0.12**	**0.09**
	(0.03)	(0.02)	(0.02)	(0.04)
d01	**0.18**	**0.14**	**0.07**	0.01
	(0.03)	(0.02)	(0.02)	(0.03)
d02	**0.08**	**0.05**	0.02	-0.05
	(0.03)	(0.02)	(0.02)	(0.03)
d03	**0.07**	**0.06**	**0.04**	-0.04
	(0.02)	(0.02)	(0.01)	(0.03)
d04	**0.07**	**0.06**	**0.03**	-0.03
	(0.02)	(0.01)	(0.01)	(0.03)
R^2	0.72	0.82	0.84	0.80
N	253	253	246	214

Standard errors in parentheses.
Figures in bold are significantly different from zero at the 95 percent confidence level.

Table 5: Sources of the Convertibility Premium				
	$\mathbf{v_{1t}}$	$\mathbf{v_{7t}}$	$\mathbf{v_{30t}}$	$\mathbf{v_{90t}}$
Intercept	-0.003	0.006	**0.02**	**0.03**
	(0.004)	(0.004)	(0.004)	(0.01)
$\hat{s}_{ht}$	**0.002**	**0.002**	0.001	0.001
	(0.0006)	(0.0006)	(0.0006)	(0.001)
$\hat{s}_{kt}$	**0.009**	**0.013**	**0.015**	**0.014**
	(0.001)	(0.0006)	(0.0006)	(0.001)
$\ln(1+r_{dt})$	**-0.05**	-0.000	0.03	0.04
	(0.02)	(0.02)	(0.02)	(0.03)
L_t	-0.02	0.005	0.07	**-0.18**
	(0.04)	(0.04)	(0.04)	(0.07)
$xc^{\$}_t$	**0.04**	**0.05**	**0.06**	**0.06**
	(0.01)	(0.008)	(0.008)	(0.01)
d99	**0.04**	**0.05**	**0.05**	**0.08**
	(0.006)	(0.006)	(0.006)	(0.01)
d00	**0.02**	**0.02**	**0.02**	**0.03**
	(0.004)	(0.004)	(0.003)	(0.01)
d01	**0.02**	**0.02**	**0.02**	**0.04**
	(0.003)	(0.003)	(0.003)	(0.01)
d02	**0.01**	**0.01**	**0.01**	**0.04**
	(0.002)	(0.002)	(0.002)	(0.01)
d03	**0.02**	**0.03**	**0.03**	**0.06**
	(0.002)	(0.002)	(0.002)	(0.01)
d04	**0.01**	**0.02**	**0.02**	**0.09**
	(0.002)	(0.002)	(0.002)	(0.01)
R^2	0.84	0.88	0.90	0.86
N	255	255	255	225

Standard errors in parentheses.
Figures in bold are significantly different from zero at the 95 percent confidence level.

Table 6: Sources of Liquidity Premium			
	$z^{\$}_{71t}$	$z^{\$}_{301t}$	$z^{\$}_{901t}$
Intercept	0.001	**0.013**	**0.03**
	(0.002)	(0.002)	(0.01)
$\hat{s}_{ht}$	-0.0002	-0.0005	-0.0007
	(0.0003)	(0.0004)	(0.001)
$\hat{s}_{kt}$	**0.0014**	**0.003**	**0.002**
	(0.0003)	(0.0004)	(0.001)
$\ln(1+r_{dt})$	**0.03**	**0.05**	**0.07**
	(0.01)	(0.01)	(0.03)
L_t	0.03	**0.09**	-0.11
	(0.02)	(0.03)	(0.07)
xc^{H}_{t}	**-0.02**	**-0.03**	-0.003
	(0.006)	(0.01)	(0.02)
$xc^{\$}_{t}$	**0.008**	**0.02**	0.01
	(0.004)	(0.006)	(0.01)
d99	0.002	**0.01**	**0.03**
	(0.003)	(0.004)	(0.01)
d00	-0.003	-0.001	**0.01**
	(0.002)	(0.002)	(0.01)
d01	-0.002	**-0.005**	0.01
	(0.002)	(0.002)	(0.01)
d02	0.002	**0.005**	**0.02**
	(0.001)	(0.002)	(0.007)
d03	**0.004**	**0.006**	**0.03**
	(0.001)	(0.002)	(0.01)
d04	**0.006**	**0.010**	**0.07**
	(0.001)	(0.001)	(0.006)
R^2	0.45	0.62	0.79
N	255	255	225

Standard errors in parentheses.
Figures in bold are significantly different from zero at the 95 percent confidence level.