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ANALYSIS OF THE GKO/OFZ INTEREST RATES

Working paper #99/010

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The study was aimed at forecasting interest rates of the Russian government securities. The system of simultaneous equations was constructed, including as endogenous variables GKO interest rate, interest rate for Russian currency securities, Central Bank refinancing rate, and expected exchange rate.

The model's accuracy proved to be fairly high on historic data. It was found that 'market integration' was increasing over the period, and this growth accounts for 2/3 of the observed decline in the GKO interest rates from 1995 to 1997. Though the model provides good description of the interest rates before the financial crisis, its performance during the crisis period deserves further analysis.

Дворкович А. В, Гурвич Е. Т. Анализ процентных ставок ГКО/ОФЗ./ Препринт #/99/010.- М.: Российская экономическая школа, 1999.-26с.(Англ.)

Цель работы состояла в моделировании процентных ставок на рынке государственных ценных бумаг. Была построена система одновременных уравнений, включающая в качестве эндогенных переменных ставки ГКО, ставки по валютным государственным бумагам, ставки рефинансирования Центрального банка, и курсовые ожидания.

Модель продемонстрировала достаточно высокую точность при моделировании на исторических данных. Было установлено, что степень "интеграции в мировые рынки" в течение рассматриваемого периода росла, и что этот рост объясняет 2/3 наблюдавшегося в 1995-1997 гг. снижения процентных ставок на рынке ГКО/ОФЗ. Хотя модель хорошо описывает поведение процентных ставок до финансового кризиса, она требует совершенствования для того чтобы быть применимой в кризисный период.

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I. Introduction

Financial turmoil in the world and Russian financial markets at the end of 1997 and the beginning of 1998 has increased the importance of explanation for interest rate trends and the necessity of interest rate forecasts. Evidently, the fluctuations in interest rates have been closely connected to the increased integration of financial markets that played a role of the multiplier for positive and negative trends even if internal problems have not been substantial. Moreover, we face now the question whether the level of domestic interest rates prevailed in Russia in 1997 has been justified given internal economic and political risks, or the spread between external and domestic rates had to be significantly increased. Furthermore, we have to find now possible short- and medium-term measures of economic policy that can affect interest rate fluctuations given a high degree of globalization. Our model experiments shall contribute to searching answers to those important questions.

II. Discussion of the Model Appropriateness

A). Major Factors under Interest Rate Trends

Following the descriptive analysis, we have been able to identify major factors under the general trends of interest rates on Russian government securities observed from June 1994 to December 1997. Those include: exchange rate development and policy, political risks, the state of the Russian banking sector, the degree of integration into the world market, and evaluation of government securities by the world financial markets.

B). Relevance of the Model

The basic model that was taken as a starting point of our analysis can be described by the following system of equations **([1], [4]):**

$$i[t] = \psi * \theta * (i^{*}[t]+\delta^{e}[t]) + \psi * (1-\theta) * i[t-1] + (1-\psi) * (r[t]+\pi^{e}[t]) \quad (2.1)$$

$$\delta^{e}[t] = \delta[CA[t], IR[t], M[t], \pi^{e}[t], \delta^{a}[t], X[t]] \quad (2.2)$$

$$r[t] = r[M[t]/P[t], BD[t], T[t], Y[t]] \quad (2.3)$$

$$\pi^{e}[t] = \pi[M[t], W[t], \pi[t-1], \pi^{a}[t], \delta^{e}[t], Z[t]] \quad (2.4)$$

where i[t] is the nominal interest rate, i*(t) - dollar interest rate, $\delta^{e}[t]$ - expected depreciation of the domestic currency, r[t] - long-term real interest rate, reflecting macroeconomic environment, $\pi^{e}[t]$ - expected inflation, CA[t] - current account deficit/surplus, IR[t] - official international reserves, BD[t] - budget deficit, M[t] - money supply growth, $\pi^{a}[t]$ - expected inflation rate announced by the Government, $\delta^{a}[t]$ - announced exchange rate depreciation, P[t] - price level, T[t] - composite effective tax rate, W[t] - wage growth, X[t], Y[t], Z[t] - other factors, ψ - a parameter reflecting the degree of integration of the domestic economy into the world economy, θ - a parameter reflecting the degree of financial markets efficiency.

Our preliminary analysis described in the previous section provides a good argument that this model is in fact relevant in the explanation of interest rate development in the Russian government security markets.

1. Role of the integration into the world financial markets

We have found that before 1996 when the degree of integration of Russian financial markets into the world markets was low (as measured by the

participation of non-resident investors in government security markets), the correlation between GKO yields and exchange rate adjusted yields on MinFin bonds was close to zero (-0.09), while in 1996 and 1997 when the share of non-residents in GKO market fluctuated from 15 to 35 percent, the correlation is highly positive (0.80). If we consider the period from October 1996 (when the Russian credit rating was announced and the first Eurobonds were placed) the correlation is almost perfect (0.98).

2. Role of exchange rate expectations

The effect of exchange rate expectations on interest rate developments has been itself a function of the exchange rate policy conducted by the Central Bank. Before the middle of 1995 when the first exchange rate band was announced, the floating exchange rate played an almost deterministic role in interest rate expectations as speculations in the exchange rate market served as the only serious alternative for the government security market. The expectations of the exchange rate growth[1] are substantially correlated with corresponding GKO yields from May 1994 until May 1995 (0.57). This suggests either a direct effect of the exchange rate expectations (when currency is an alternative to GKO for investors), or indirect effect via inflationary expectations. Our model implies that the exchange rate expectations are reflected in inflationary expectations that in turn affect nominal interest rates.

After the announcement of the exchange rate band, the direct effect has gradually disappeared, and from 1996 the exchange rate expectations affect interest rates via the interest rate parity as the weight of the latter increased significantly from the

[1] We used the adaptive form of expectations rather than the exchange rate futures as the data on

beginning of 1996. This conclusion is supported both by the insignificant correlation between the exchange rate expectations from June 1995 to September 1997 (-0.07), and by the high correlation between GKO and MinFin bond yields.

C). Interpretation of the Interest Rates Development in Terms of the Model

The considerations about the role of integration and exchange rate expectations suggest that the model of interest rate determination described in the project proposal is indeed relevant and reasonable. On the one hand, it provides qualitative explanation of interest rate fluctuations over the entire period and over the two major sub-periods divided by a structural break in the middle of 1995.

Before June 1995, the model will highly weigh internal factors reflected in unstable exchange rate expectations. This relationship is built into the model as the second and the third part of equation (2.1), and equation (2.4), where inflationary expectations is a function of exchange rate expectations.

After June 1995, especially from the beginning of 1996, the model will place most of the weight on external factors reflected in world interest rates adjusted with stable exchange expectations. This relationship is built into the model as the first part of equation (2.1), and equation (2.2), where exchange rate expectations are related to the announced exchange rate regime.

Our analysis has shown also, that the model should incorporate the estimation of political risks that played a decisive role in the determination of interest rates during election campaigns. Our model will include this risks as the variable Y(t) in equation (2.3). Political risks raise a risk premium that should be incorporated into the real interest rate, and may affect as well the risk premium included into the dollar interest rate i*(t).

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the latter are still not complete.

III. Model Specification

We have given up estimation of inflation expectations and real interest rates, which appear in the initial model. It was decided to replace the term $(r[t]+\pi^e[t])$ with the nominal rate R_t, taking as R_t some interest rate, depending on "domestic" macroeconomic variables (like inflation, money supply, budget deficit, etc).

One of the key issues was the choice of the particular rate to be used as an indicator R_t. Several options were tried here: the Central Bank refinancing rate RCBR, the interbank overnight rate RIB, and average deposit rate RDEP. Each of them has its own salient features, affecting its possible role in the model. Say, the CBR depends to some extent on both macroeconomic variables and other interest rates, but it is essentially variable controlled by the monetary authorities. In this case R_t may be considered as an exogenous variable, set outside the model. Such version of the model is important from the viewpoint of possible implications of the Central Bank policy. A recent example of the situation when this issue was of crucial interest is presented by the period of the financial markets turmoil, when the CBR had to manipulate refinancing rate, exchange rates and impact on the GKO interest rates.

The major distinctions of the interest rates under consideration are as follows:

1. The Central Bank refinancing rate

- controlled by the CBR, so it can be used as a policy instrument;
- relative stability as compared to other rates; at the same time it can experience significant abrupt changes;
- specific relationship with GKO/OFZ rate (say, RCBR cannot be sustainably

kept at a lower level than the GKO/OFZ rate), putting limitations on its use as a policy instrument.

2. Interbank overnight rate

- high volatility;
- dependence on the major macroeconomic factors: short-term money demand and supply, state of the banking sector, etc;
- only implicit interdependence with the GKO/OFZ rate;
- 'objective' nature, as it is defined on the highly competitive market.

3. Deposit rate

- medium stability;
- link to such macroeconomic factors as demand for money and supply of savings;
- high correlation with GKO/OFZ rates, as the government security market is one of the main directions of investment.

The initial presentation of the model (2.1) - (2.4) incorporates the product of the key estimated parameters θ and ψ. But it can be modified to 'untie' this product making the model construction easier. The first equation of the model was represented as:

$$i[t] = \varphi_1 * (i^*[t]+\delta^e[t]) + \varphi_2 * i[t-1] + \varphi_3 * R[t]$$

Parameters φ_1 - φ_3 characterise then the impact of "international" interest rates, inertia in interest rates formation, and domestic macroeconomic situation correspondingly. In fact, if we suppose that $\varphi_1 + \varphi_2 + \varphi_3 = 1$, this is equivalent to the initial equation, with $\theta = \varphi_1 / (\varphi_1+\varphi_2)$, and $\psi = \varphi_1+\varphi_2$. Having estimated parameters φ_1 - φ_3, we can obtain thus the measures of 'market efficiency' and 'market integration'. Moreover, parameters φ_1 - φ_3 have by themselves even better

interpretation than ψ and θ, as contribution of each of the three components is characterised with its own parameter.

Whatever is the choice of the interest rate R_t, it is essential to take into account its bilateral link to the GKO rate i_t. To reflect this, a system of simultaneous equations was estimated that included four endogenous variables:

i_t - GKO/OFZ auction interest rate,

i^*_t - interest rates on Minfin bonds (denominated in US$), adjusted to the 6-month maturity,

δ^e_t - expectations of the US$ exchange rate in 6 month (translated into annual exchange rate growth),

R_t - one of the domestic interest rates.

The choice of i^*_t changes somewhat the underlying interpretation of the model. The first component in the equation (2.1) in the modified version is not just "international interest rate", but rather "interest rate of Russian securities in international markets". It incorporates thus both international interest rates (T_t) and international estimates of specific risks s_t associated to Russian securities.

The equations have been constructed in the following form:

$$i_t = \varphi_1 * (i^*_t + \delta^e_t) + \varphi_2 * i_{t-1} + (1 - \varphi_1 - \varphi_2) * R_t + c_{13} * D1 + c_{14} * D2 + c_{15} * D3,$$

$$R_t = r[R_{t-1}, i_t(i_{t-1}), \pi^{\grave{a}}_t, \delta^a_t, MS_t, B_t],$$

$$i^*_t = T_t + s[i^*_{t-1}, R_t, \pi^{\grave{a}}_t, \delta^a_t, IR_t]$$

$$\delta^e_t = \delta[MS_t, \pi^a_t, \delta^a_t, \delta^e_{t-1}, IR_t]$$

where D1, D2, D3 are dummies, allowing for the effect of the Presidential elections: D1=1 in the first months of the pre-elections period (March-April 1996)

and 0 otherwise, D2=1 in the point of maximum political risk in June 1996, D3=1 in July 1996, when the rates returned to their normal levels (the neccessity to incorporate the latter variable is caused by the use of lagged variable i_{t-1} in the first equation),

MS_t - some indicator of money supply. Several variables were tried as such indicator: real M2 value (M2 deflated by CPI); money supply growth rates (average for the last 3 or 6 months), without lag or lagged for 1 to 3 months; real money base; money base growth rate (averaged and lagged in the same way as M2),

B_t - some indicator of actual or potential scale of domestic borrowings. Again several variables were tried for this role, including: Federal budget deficit, real volume of GKO/OFZ placement; real receipts from placing GKO/OFZ; real net financing via GKO/OFZ market (in all cases "real" meant "deflated by CPI" or "expressed in % of GDP");

T_t - interest rate for the US 6-month treasury bills,

IR_t - gross international reserves of Russia (in US$ billion),

r, s, δ - linear functions characterising correspondingly dependence of the 'domestic' interest rate R_t, spread, and expected exchange rate growth on the factors defining them.

One of the hypothesis was that the measures of market 'integration', 'inertia', and 'macroeconomic dependency' are changing with time. To test it, in addition to the models where coefficients c_{11} - c_{13} were constant, models with variable coefficients of the form: a+b*t, a+b*log(t), a+b/t.

The observations comprised 28 months (July 1995 to October 1997). The choice of the initial point is explained by the structural break revealed in the previous

analysis since the introduction of the exchange rate corridor, while the end point was chosen basing on the stationarity analysis. Augmented Dickey-Fuller unit root test inititally implemented for the period July 1995-December 1997 failed to reject null hypothesis of non-stationarity for the series i^*_t . Applied for the truncated period July 1995-October 1997, this test made possible to reject non-stationarity for all endogenous variables. The necessity to cut the last two months of 1997 looks natural as they date to the period of world financial crisis.

Table 3.1. Augmented Dickey-Fuller Test

	ADF Test	**Critical value**	**Significance level**
$\mathbf{i_t}$	4.41	4.32	1%
$\mathbf{RCBR_t}$	2.44	1.95	5%
$\mathbf{i^*_t}$	4.37	4.34	1%
$\mathbf{\delta^e_t}$	2.05	1.95	5%

The system was estimated by the two-stage least squares procedure. The following model specification proved to be the best:

$$i_t = c_{11} * \log(t)*(i^*_t+\delta^e_t) + c_{12} * i_{t-1} + (1-c_{11}* \log(t) - c_{12}) * RCBR_t + c_{13} * D1 + c_{14} * D2 + c_{15} * D3, \quad (3.1)$$

$$RCBR_t = c_{21} * RCBR_{t-1} + c_{22} * i_t + c_{23} * \pi^a_t + c_{24} * \delta^a_t + c_{25} * borr_t, \quad (3.2)$$

$$i^*_t = T_t + c_{31} * i^*_{t-1} + c_{32} * RCBR_t , \quad (3.3)$$

$$\delta^e_t = c_{41} * \delta^e_{t-1} + c_{42} * \pi^a_t + c_{43} * IR_t, \quad (3.4)$$

where ‘borr’ denotes GKO/OFZ placement at constant prices (i.e. deflated by

CPI), while IR and RCBR, as mentioned above, are the international reserves and CBR refinancing rate correspondingly.

This system meets rank conditions of identification.

Significant serial correlation was revealed for the i^*_t variable. To deal with it the moving average technique was used, which eliminated autocorrelation.

The output for each equation estimation is presented below.

Equation 1.

$$i_t = 0.0689 * \log(t) * (i^*_t + \delta^e_t) + 0.789 * i_{t-1} + (1 - 0.0689 * \log(t) - 0.789) * RCBR_t +$$
$$(t=2.5) \qquad (t=10.5)$$
$$0.627 * D1 + 1.026 * D2 - 0.838 * D3$$
$$(t=5.3) \quad (t=6.4) \quad (t=4.8)$$

$R^2_{adj} = 0.957,\ F = 127.9,\ s = 0.145,\ DW = 1.56,\ Durbin\ h = 1.16.$

Equation 2.

$$RCBR_t = 0.874 * RCBR_{t-1} + 0.130 * i_t + 0.358 * \pi^a_t - 2.286 * \delta^a_t + 7.759e\text{-}06 * borr_t$$
$$(t=18.4) \quad (t=6.4) \quad (t=3.2) \quad (t=-3.8) \quad (t=2.9)$$

$R^2_{adj} = 0.995,\ F = 1208.3,\ s = 0.040,\ DW = 2.31,\ Durbin\ h = -0.80.$

Equation 3.

$i^*_t = T_t + 0.225 * i^*_{t-1} + 0.0535 * RCBR_t$,

(t=6.9) (t=14.1)

MA(1)=0.338,

$R^2_{adj} = 0.968$, F = 415.3, s = 0.007, DW = 2.06, Durbin h = -0.15.

Equation 4.

$\delta^e_t = 1.189 * \delta^e_{t-1} + 0.568 * \pi^a_t - 0.00467 * IR_t$,

(t=4.6) (t=9.2) (t= -3.3)

$R^2_{adj} = 0.870$, F = 87.6, s = 0.047, DW = 1.80.

Either constant, insreasing or decreasing with time terms were tried for coefficients φ_1 - φ_3. The best estimates were obtained when we used increasing (with diminishing rate) 'market integration degree' φ_1, constant 'degree of inertia' φ_2, and correspondingly decreasing 'macroeconomic dependence' φ_3. Calculated figures of these parameters as well as that for the parameters θ, ψ from the initial model (3.1)-(3.4) are presented below for the whole period under consideration.

Table 3.2. Estimated parameters of the interest rate performance.

	φ_1	φ_2	φ_3	θ	ψ
Jul-95	0.000	0.789	0.211	0%	79%
Aug-95	0.048	0.789	0.163	6%	84%
Sep-95	0.076	0.789	0.136	9%	86%
Oct-95	0.096	0.789	0.116	11%	88%
Nov-95	0.111	0.789	0.100	12%	90%
Dec-95	0.124	0.789	0.088	14%	91%

Jan-96	0.134	0.789	0.077	15%	92%
Feb-96	0.143	0.789	0.068	15%	93%
Mar-96	0.151	0.789	0.060	16%	94%
Apr-96	0.159	0.789	0.053	17%	95%
May-96	0.165	0.789	0.046	17%	95%
Jun-96	0.171	0.789	0.040	18%	96%
Jul-96	0.177	0.789	0.034	18%	97%
Aug-96	0.182	0.789	0.029	19%	97%
Sep-96	0.187	0.789	0.025	19%	98%
Oct-96	0.191	0.789	0.020	20%	98%
Nov-96	0.195	0.789	0.016	20%	98%
Dec-96	0.199	0.789	0.012	20%	99%
Jan-97	0.203	0.789	0.008	20%	99%
Feb-97	0.207	0.789	0.005	21%	100%
Mar-97	0.210	0.789	0.001	21%	100%
Apr-97	0.213	0.789	-0.002	21%	100%
May-97	0.216	0.789	-0.005	22%	100%
Jun-97	0.219	0.789	-0.008	22%	101%
Jul-97	0.222	0.789	-0.011	22%	101%
Aug-97	0.225	0.789	-0.013	22%	101%
Sep-97	0.227	0.789	-0.016	22%	102%
Oct-97	0.230	0.789	-0.018	23%	102%

IV. Simulation Model

To check roughly the quality of the model dynamic simulation was implemented. The first step was historic simulation for the period July 1995-October 1997.

Observed and fitted endogenous variables are presented at the graphs in the Appendix. Their comparison demonstrates relatively good match in the recent period. The accuracy of the simulation can be characterised with the figures in Table 4.1.

Table 4.1. Summary Statistics for Historic Simulation (July 1995-October

1997)

	GKO Rate (i_t)	CBR Rate (RCBR)	Currency Securities Rate (i^*_t)	Exchange Rate Expectations (δ^e_t)
Rms error	18.0%	15.4%	1.4%	4.4%
Rms % error	18.8%	17.6%	9.4%	23.5%
Simul. error	-2.9%	-8.5%	-0.5%	0.0%
Simul. % error	4.1%	-2.6%	-2.6%	2.9%
Theil U	8.1%	7.4%	5.1%	9.6%

The calculated parameters imply that market inertia degree was constant at the level of 79%. High level of the market inertia could be expected, taking into account relatively small volatility of interest rates in the period under consideration (correlation of the current to previous interest rate made up 0.87). The 'market integration' was increasing from 0 to 23% in October 1997, while macroeconomic dependency was declining from 21% in July 1995 to 0 in April 1997, and became even small negative by October 1997.

The latter fact from our viewpoint does not deserve special discussion, as the parameter magnitude does not differ significantly from zero. Increasing degree of market integration corresponds to the growing involvement of non-residents to Russian securities markets. Say, during 1997 the share of GKO/OFZ holdings by non-residents has risen from 17% to 28%.

In terms of the initial model, the 'market integration' degree θ is growing from 0 to 23%, while the 'market efficiency' is increasing from 79% to 100% plus.

Our model enables evaluation of the impact of the market integration with the world financial markets. This was carried out by comparing the results of the above *ex post* simulation with similar results under assumption of constant coefficients φ_1 - φ_3. It was found that in the latter case the GKO interest rate would decrease from 165.8% in October 1995 to 117.2% in October 1997. Under changing coefficients the October 1997 simulated rate amounts to 17.0%, and the observed rate made up 17.5%. This can have an interpretation that with constant market integration interest rate decline would make up only 33% of its actual fall. The rest 67% of the interest rate decrease can be attributed then to the market integration, which accounts thus to 2/3 of the observed decline. These conclusion confirms thus the widespead view that the reason for interest rates decrease was first of all non-residents involvement to the market, and gives it quantitative estimation.

Unexpected, as it may seem, conclusion from the model is that since mid-1997 "domestic" interest rate, reflecting macroeconomic situation, didn't affect GKO rates directly, as the weight φ_3 of this factor has fallen to zero. In terms of economic theory this result implies that Russia became by this time "small open economy". Analysis of GKO market at the micro-level supports the viewpoint that non-residents are dominating this market. Though they hold under 30% of the securities, non-residents manage to manipulate the whole market, sending "signals" on the alleged intention to leave it. According to the model, macroeconomic conditions still influence the GKO rates in 1997, but only through currency rate i* and exchange rate expectations δ^e_t.

The next step was *ex post* forecast for the period November 1997 - June 1998. The projected GKO interest rates, presented in the graph in the Appendix, amount to 11% in June. This complies entirely with the government forecast used in the Federal Budget for 1998, but evidently differs drastically from the actual rates in June, which made up 51% for the 6-months GKO.

We have to conclude thus that our model provides satisfactory description for the interest rates development before the financial crisis, but fails to explain market performance after crisis initiation.

V. Model Discussion and Interpretation

The modeling in the form of simultaneous equations has allowed to account for the inter-relation among various internal and external interest rates. The refinancing rate (as a base domestic rate) has fulfilled the role of connection between external and domestic yields on government securities. The justification for the inclusion of the refinancing rate into the external rate equation is determined by the structure of the latter. The external rate has been divided into two components: the base 6-month US Treasury rate and the spread reflecting a country risk. It is assumed that the changes in a country risk are implicitly included in the changes of refinancing rate. As the latter is endogenous in our model, the assumption seems to be well grounded.

Most of the model coefficient look logical and do not require special discussion. The main exception is the negative sign of the coefficient for the announced exchange rate growth in the refinance rate equation. We can suggest the following explanation. Facing low credibility of its announced policy, the Central Bank had to use higher refinancing rate to support projected reduction of exchange rate

growth. The Central Bank changes ex ante its refinance rate in accordance with announced exchange rate policy, while market rates develop mostly following the exchange rate expectations. If the latter differ substantially from the announcements, the Central Bank can be forced to change ex post its refinance rate in the opposite direction to change the market sentiment and persuade the market that the CBR will stick to the announced policy. We found negative correlation of the refinance rate with the difference of announced and expected future exchange rate, while the refinance rate was positively correlated with either announced or expected rates separately.

Ex post simulation revealed that the model fails to produce good description of interest rates performance in the period of world financial crisis. We face thus necessity to explain poor performance of our model since November 1997.

Model analysis evidences that primary source of model inadequacy is poor prediction of exchange rate expectations. Average futures quotations in June implied expected growth of exchange rate in the next 6 months by 32% in annual terms (and still more – over 50% - at the Chicago Stock Exchange), while the model predicted only 5.4% growth (quite close to the announced target, which made up 5%). Bias in the projections of other variables resulted from this error.

In reality exchange expectations have hiked due to joint impact of three major factors. First, deteriorated trade balance projections after decline in the world market commodity persuaded most investors that rouble became overvalued, and devaluation is thus forthcoming. Our estimates show that ruble still was undervalued at that time, though by far less than before.

As a result, international reserves of monetary authorities were depleting rapidly, in spite of extended foreign borrowing. Reserves were contracting parallel to

sustainable inability of the Government to raise tax revenues and evidenced high capital flight.

One of the factors we mentioned is incorporated to the model: equation for currency expectations includes value of international reserves. Actually observed decrease of international reserves in 1998 only insignificantly affects projected interest rates. The reason is various impact of the factor under consideration (as well as other factors) in the base period of the model estimation, when the macroeconomic situation was improving, and forecast period, when the situation has deteriorated. In particular, the international reserves value and government debt stock in 1995-1997 were by far less significant than in 1998.

The second reason is changed attitudes of investors to emerging markets (including Russia) with the initiation of the world financial crisis. Growing cautiousness in this period contrasted capital inflow during the previous year. The only difference in macroeconomic terms was higher burden of the debt servicing by both public and private sectors.

Third, the situation at the new stage was characterized by lack of confidence to the monetary authorities policy, resulting in quite different interpretation of the announced macroeconomic targets. This changes entirely investors attitudes and behavior. Say, if investors believe the announced targets are reasonable, their expectations are positively correlated to them. In case of lack of confidence, this correlation is likely to be negative, as from the viewpoint of investors, say, unrealistic exchange rate targets make devaluation more probable. ‘Credibility crisis’ was caused, on one hand, by inability of the Government to respond adequately to the challenge of the deteriorated financial conditions, and on the other hand, by lack of flexibility of the monetary authorities, which were reluctant

to adjust their targets and policies with regard to the changed environment.

We believe that models of the type used in our study are able to provide reasonable description of the interest rates only when expectations do not differ much from the announced targets. Otherwise one should build model of different type, characterizing effect of 'objective' factors on investors' sentiments. The evident policy implications is that the authorities have to pay much more attention to the intended or unintended signals sent to investors, and make efforts to send only confident signals.

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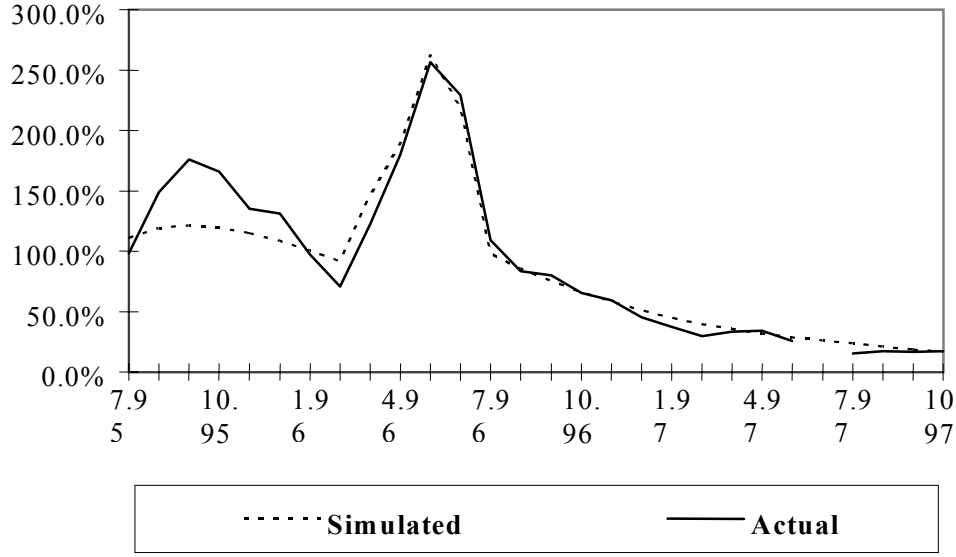
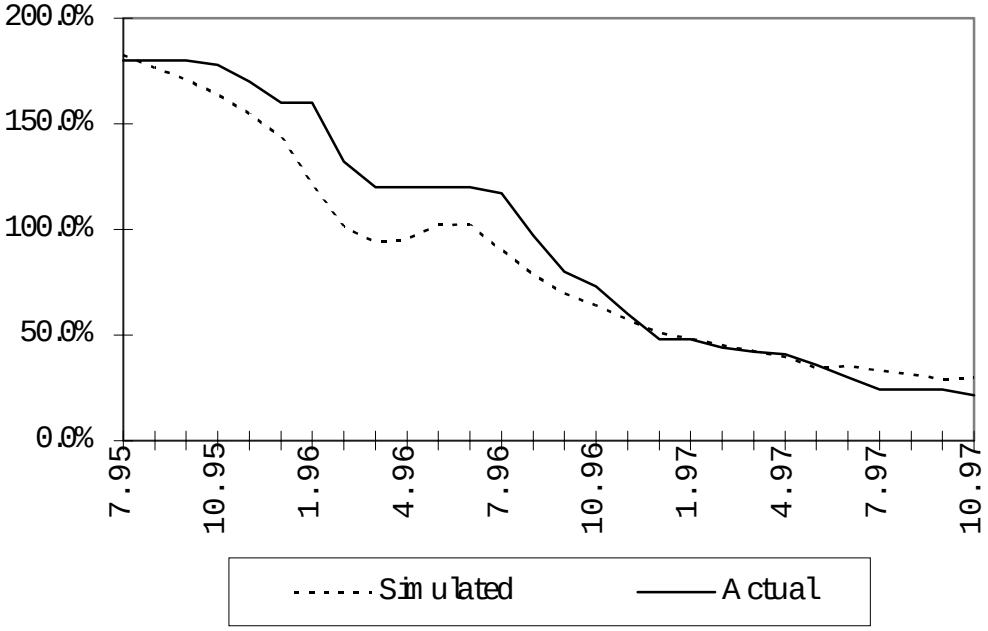
APPENDIX:

CHARTS

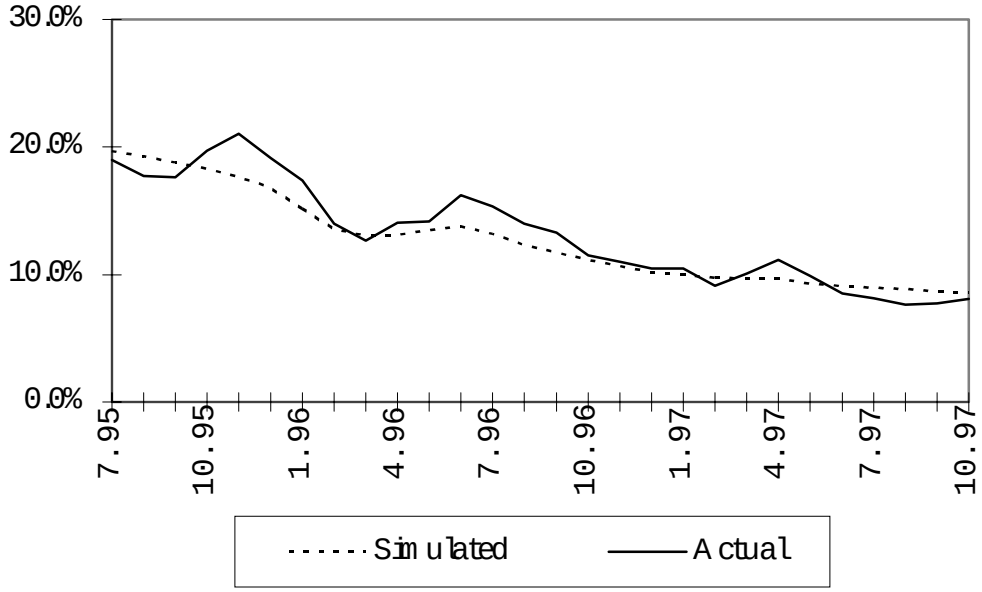
Actual and Simulated GKO Interest Rate (1995-1997)



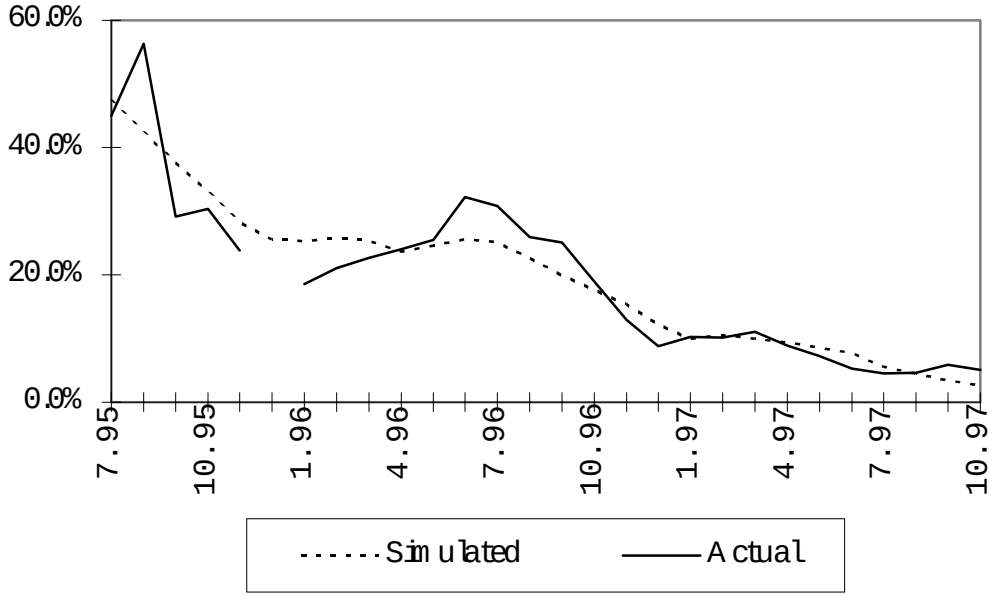
Actual and Simulated CBR Refinance Rate (1995-1997)

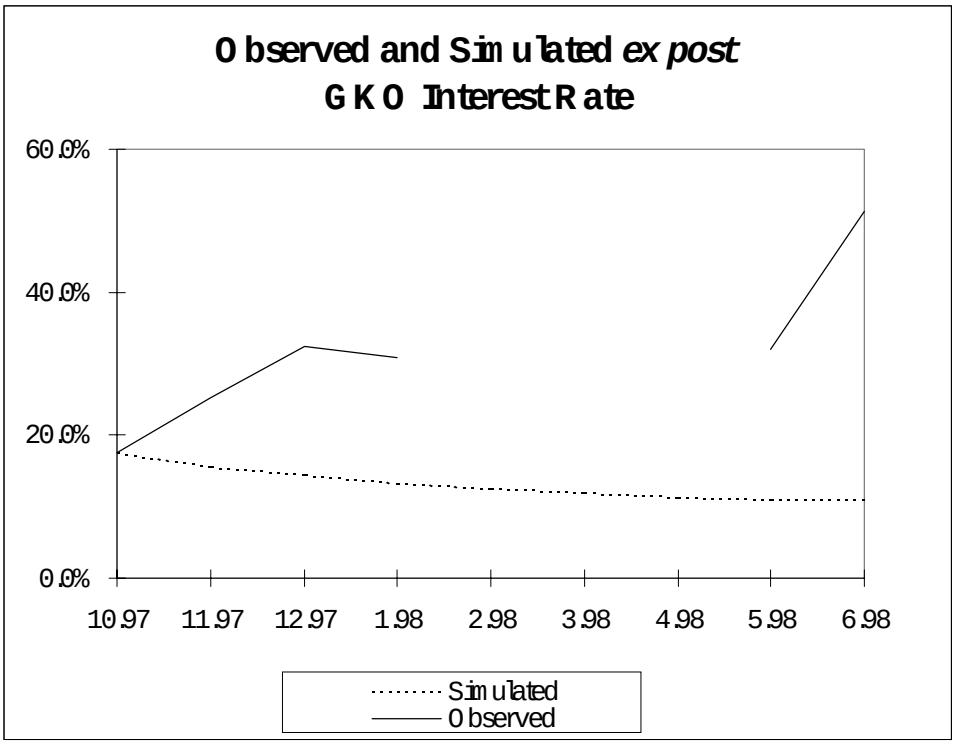


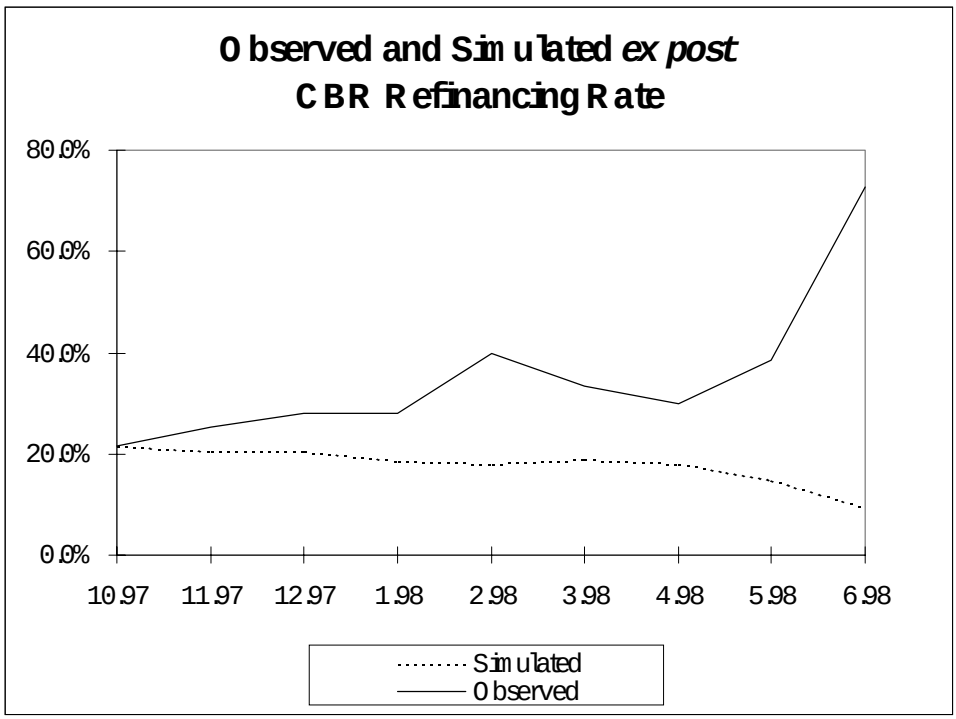
Actual and Simulated Min Fin Bonds Interest Rate (1995-1997)

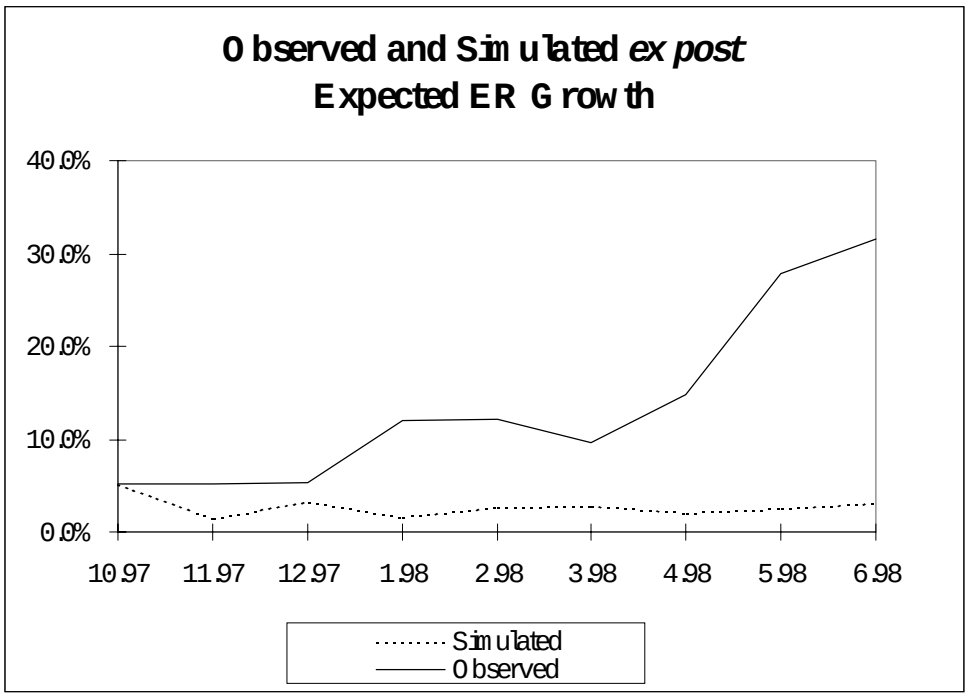


Actual and Simulated Expected ER Growth (next 6 mnth in annual terms)




Observed and Simulated *ex post*
GKO Interest Rate
60.0%
40.0%
20.0%
0.0%
10.97
11.97
12.97
1.98
2.98
3.98
4.98
5.98
6.98
Simulated
Observed


Observed and Simulated *ex post*
CBR Refinancing Rate
80.0%
60.0%
40.0%
20.0%
0.0%
10.97
11.97
12.97
1.98
2.98
3.98
4.98
5.98
6.98
Simulated
Observed


Observed and Simulated *ex post*
Expected ER Growth
40.0%
30.0%
20.0%
10.0%
0.0%
10.97
11.97
12.97
1.98
2.98
3.98
4.98
5.98
6.98
Simulated
Observed