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An Econometric Analysis of the Banking Crises in Russia and Ukraine

by

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Abstract

The main of this paper is to determine the factors which triggered the 1998 credit crises in Russia and Ukraine. We use two alternative regression analyses. With a simple OLS model we investigate which factors describe the development of the ratio Domestic Credit/GDP, while in a Logit model we investigate which factors explains a Credit Crisis variable of our construction. Concerning Russia, our analysis stresses the importance of factors such as Public Balance/GDP ratio and M2/Gross International Reserves ratio: this is consistent with the theory of government inability in managing public debt as a source of the crisis. Concerning Ukraine, the effect of real shocks and the explosion of credit can be considered the key variable to explain the period of financial distress experienced by this country. The final interesting consideration is that the results of our analysis are consistent with the contagion hypothesis.

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1. Introduction

Financial turmoil and crises in the 1990s, followed by the Argentinean crisis in 2001 revitalised interest in researching on credit crises. The topic has attracted a vast interest in the profession and a huge body of literature is available. On the one hand, various theories have been developed (see for instance Dooley (2000)) to explain how credit crises develop, what are the factors determining them, what policies can be adopted to prevent them. On the other hand, a huge body of empirical literature has been developed focusing on determining the factors of crisis and also in exploring their specific dynamics (see for instance Demirgüç-Kunt and Detragiache (1998)).

This paper reports the results from investigating the factors which fostered the development of the credit crisis in Russia and Ukraine in 1998.

We focus on the 1998 crisis in Russia and Ukraine for several reasons. The development of the crisis in these two countries showed different dynamics though the two crises are somewhere connected. This has some implication for testing for the presence of contagion mechanisms, as recently pointed out for instance in a different context by Forbes and Rigobon, (2002), and by Berger and Wolfram (2002) for currency crisis. Further, the Ukrainian crisis though occurred in a period of financial distress nevertheless never exploded as in the case of Russia. This thus allows us to consider in our analysis the case of a "quasi crisis", no very much pursued in the literature.

We apply two alternative econometric analyses. First, we run simple OLS to model the factors that better explain the development of the ratio Domestic Credit/GDP, the most widely used indicator that the literature suggest to capture the development of a credit crisis. Second, we integrate our analysis with a logit model on a "quasi credit crisis" variable that we constructed. This analysis allows us to integrate evidence from both models, in order to give a comprehensive view of the problem and a better interpretation of the stylised facts.

This paper is organized as follows. Section 2 reviews the literature on the analysis of credit crises factors and dynamics, and a summary of the stylised facts which lead to the Russian and Ukrainian crises is provided. Section 3 describes the model, the data sets and reports

the empirical results. Section 4 summarizes the main findings of this research. A final Appendix reports a detailed description of the variables employed.

2. Short review of literature and stylised facts

2.1 Short review of literature

The Argentina's crisis in 2002 and its consequences are the main events that drew our attention to the field of banking crises. The main goal of this paper is to understand at least the most important dynamics that lead economies to this kind of phenomenon/crises.

There are plenty of contributions on banking credit crises, and many authors have contributed to the literature in this field. A first strand of research focuses on the selection of factors that played an important role in the erupting of crises. Demirgüç-Kunt and Detragiache (1998), for instance, use a multivariate Logit model to study the factors associated with the emergence of systemic banking crises in a large sample of developed and developing countries in 1980-94. Their main findings suggest that crises tend to develop when the macroeconomic environment is weak: low growth and high inflation seem to be the factors that play the main part in it. Moreover, there is evidence that when high real interest rates are observed, systemic banking crises are more frequent. Also balance of payment crises, deposit insurance scheme and weak low enforcement has played a role.

Several papers focus on transition economies. Mishkin (2000) proposes a framework to study banking crises, based on asymmetric information and suggestions to prevent these phenomena. A comprehensive econometric approach is proposed in Eichengreen and Arteta (2000): they try to find a minimum consensus concerning factors generally involved in transition economy crises. In particular they select a crisis list presented by Caprio and Klingebiel (1999) that includes crisis episodes from 1975 to 1997; then they run Probit regressions, including regressors which refer to the crisis factors usually discussed in the literature. Their main findings are that among macroeconomic variables, the most correlated to bank crises are domestic credit growth and low banking reserves. Among external factors, interest rate and growth rate in developed countries play an important role.

Among the others, internal financial liberalization results significant, while no evidence is found about the role of exchange regime, deposit insurance and institution quality.

Ecoch, Gulde and Hardy (2002) report results from three important experiences in transition economies: Bulgaria, Lithuania and Mongolia, which suffered severe banking crises that had to be resolved before growth could resume. The article describe the macroeconomics and institutional failings that led to these crises, and draws parallels with the causes of banking crisis in industrial and developing countries. Resolving the crisis proved technically and politically difficult, and setbacks occurred. Successful resolution required the implementation of a comprehensive and decisive strategy.

The fourth paper concerning transition economies is Mertens and Urga (2001), which evaluates the current development of the Ukrainian banking system. The authors focus on cost and profit efficiency and scale and scope economies for 79 from 168 Ukrainian commercial banks in 1998. Their main finding is that there is evidence that small banks operate more efficiently in cost terms but are less efficient in profit terms. Furthermore, there is a substantial difference in scale economies between small and large banks. Large banks show significant diseconomies of scale while small ones show significant scale economies. This result could suggest that current technology in the financial sector does not allow efficient growth and concentration on the financial sector in Ukraine.

While the papers we have introduced so far involve a comprehensive studies of all the factors involved in banking crisis, in the literature many other works stress particular factors which may have triggered crises. Demirgüç-Kunt and Detragiache (2000) analyze a panel data of 61 countries during 1980-97 to find some definitive evidence about the role of deposit insurance. The paper concludes that explicit deposit insurance tends to be detrimental to bank stability, in particular where bank interest rates are deregulated and the institutional environment is weak. Moreover, the adverse impact of deposit insurance on bank stability tends to be stronger when depositors are offered an extensive coverage, when the scheme is funded and when it is run by the government rather than by the private sector.

Detragiache and Spilimbergo (2001) studied the role of another debated factor, which is country liquidity. The authors studied a large panel of countries, finding that less liquid countries are most likely to default on their external debt. Specifically, for given total

external debt, the probability of a developing crisis increases with the proportion of short-term debt and debt service coming due and decreases with foreign exchange reserves. This correlation, however, is consistent with a standard model of optimal default and need not be ascribed to self-fulfilling creditor runs. Besides, the correlation with short-term debt appears to be driven by joint endogeneity.

Another interesting contribute is Falcetti and Tudela (2001), that instead of focusing on a particular factor, focused on a particular kind of crisis. In this article the authors study episodes when a balance of payment crisis follows a banking crisis within 48 months, events described in the literature as twin crises. The main objectives of the articles are two: individuate common factors to twin crises and try to find evidence of a causality relation between banking and balance of payment crises. Western country interest rates, inflation rates and exchange rate devaluation seem to be the most important common factors, but specific components also play an important part. Concerning the causality direction, the authors find evidence of balance of payment crises boosting credit crises only reducing the sample to the Nineties. Then they conclude that, because of the present market integration, credit and currency crises seem to be tightly connected; in the last decades we are observing a diachronic development of crises, which seem to be anyway directed mainly by common factors.

A second group of interesting papers concentrate on credit crises because these are very interesting "moments of research": in this sense they focus on particular dynamics, instead of factors, that cannot be observed but when a crisis is erupting or has just erupted.

Demirgüç-Kunt, Detragiache and Gupta (2000), using aggregate and bank level data for several countries, study what happens to the banking system in the aftermath of a banking crisis. Contemporary crises are not accompanied by declines in aggregate bank deposits, and credit does not fall relative to output, although the growth of both deposits and credit slows down substantially. Output recovery begins in the second year after the crisis and is not led by a recovery in credit growth. All the banks, including the strongest ones, reallocate their asset portfolio avoiding loans.

Another paper concentrating on crisis dynamics is Merrick (2001). The author extracts both the implied default recovery ratio and the risk-neutral default probability term structure for

Russian Federation and Republic of Argentina US dollar Eurobonds during 1998's Russian GKO default crisis. This crisis provides a unique window into the impact of changing default probabilities and recovery ratio assumptions on credit-sensitive sovereign bond prices. For the Russian Eurobonds, the sample paths suggest a two-phase crisis revaluation. Shifts in default probabilities account for most of the initial price collapse. Marked decreases in the implied default recovery ratio dominate the second phase. Investors never cut their recovery value assumptions for Argentine debt.

A third important contribution is Eichengreen, Rose and Wyplosz (1997), which face the theme of contagion in currency crises. According to this paper, speculative attacks tend to be temporally correlated; consequently, currency crises appear to pass "contagiously" from one country to another. Using thirty years of panel data from twenty industrialized countries, the paper found evidence of contagion. Contagion appears to spread more easily to countries that are closely tied by international trade linkages than to countries in similar macroeconomic circumstances.

Concerning the role of economic interdependence in the spreading of currency crises, a recent contribution by Berger and Wagner (2002) must be mentioned: the authors analyze how the mutual dependence of private sector expectations in different countries influences the stability of fixed exchange rate regimes. The crisis probabilities of countries trading with one another are interdependent because wage setters react to an imminent loss of international competitiveness stemming from an increase in the crisis probability of a trading partner. If a currency crisis in one country is perceived to be increasingly likely, the probability of devaluation of its trading partners currencies to restore their international competitiveness rises as well. Thus not only actual devaluations but also an increasing crisis probability may trigger currency crises elsewhere. The authors show that not only fundamental weaknesses but also spontaneous shifts in market sentiment may play a role in precipitating currency crisis.

2.2 Stylised facts: Russian and Ukrainian economic

We provide at this point a stylised report of what happened in the Russian and Ukrainian economic background in the years preceding the crisis. This session follows a contribution by Hanson (1999) for the Russian case, and a paper by Chaban (1999) for the Ukrainian one.

The Russian financial crisis began in May 1998. A long decline in production preceded it. It had its immediate origin in a flight of investors from the Russian Treasury bill market, because they feared rouble devaluation and a default on domestic debt service. There were plenty of reasons to be worried, since Russia had failed, in many respects, to carry out the liberalisation and stabilisation policies successfully implemented by other ex-communist countries. But where can be found the origin of this dependence on Treasury bill market? The explanation is not completely new: a political inability to put up expenditure constraints has the consequence of boosting debt to unbearable levels. The Russian failure cannot be considered unusual amongst the twenty-six former communist countries of Europe and Central Asia: until 1998 only some of them had made a successful economic transition, and Russia could simply be considered the most important one of those that had not.

Anyway, by September 1998, when Primakov was approved as Prime Minister, successive governments had already failed to bring Russian public finances into a state compatible with continuing stability. The reduction of inflation and money-supply growth were obtained with debatable operations: state spending remained around 40% of official GDP and revenue could not match it; non-viable enterprises were not forced to close or restructure; payments arrears and the use of money-surrogates continued to grow. The definitive shock consisted in a large fall in world energy prices, compounded to the effects of the incomplete reform. These circumstances made it impossible to contain the growth of government debt, because no further fiscal contribution could be asked to energy producers. Moreover, the presence of many foreign investors in the Russian Treasury bill market facilitated a panic in the market. This panic effect showed up while Russia was following the stabilisation programme proposed by the IMF: this plan requested advanced

transparency modalities, which were scarcely effective in that case, since investors showed the same diligence as in colonising as in abandoning the emerging market.
The credibility of government, central bank and commercial banks was severely damaged. Parliamentary and presidential elections were not too close, and because of the presence of a traditionalist government, the resumption of serious reform before 2001 was very unlikely. Western country policy-makers could play a very important role: a common view suggested rejecting further aid requests from a country whose political elite had always wasted; but they took the view that Russia was still militarily and politically too strong to be left unaided. But taking this view meant transferring the process of negotiating aid from the IMF to a more appropriate organisation as the G-7.
The scheme proposed reflect a very common dynamic: inadequate balance constraints provoke a dramatic increase in public debt; interest rates grow up very quickly; huge capital flows from abroad enter the market very quickly, but they menace future balance of payment crises, at the moment of their outflow. The objective of this work is trying to analyse how this phenomena affected the banking sector in a crisis contest.

Ukrainian recent history is slightly different, since it actually never experienced a trued crisis of banking system in its recent history, but it is possible to say that there were a few periods of financial turbulence. Two most serious episodes which put under pressure the financial system are collapse of T-Bills market in 1998 as a consequence of banking crisis and crash of the bank 'Ukraine' in 2001.
Since its independence, Ukraine had always had a deficit in its public balance sheet, even if some positive dynamics in its fiscal policy could be observed.
From a fiscal viewpoint, what should be the behaviour of a transition country? The Ukrainian government should have used public debt mainly to carry on economic restructuring and necessary reforms for a country that is planning to join free markets; otherwise it could have risked borrowing money just to pay interest.
Actually, before 1996, public debt was financed mainly issuing new money and retarding payments, and as a consequence hyperinflation periods are observed. Later, at the end of 1995, the government approved a new set of reforms with which it changed the method to

cover public balance sheet debt. By instituting a Treasury bill market and a regime of managed floating for the exchange rate with an oscillation band, it started borrowing money on the markets to cover debt. The objectives of this reform were reducing expected inflation in order to draw the attention of foreign investors. Unfortunately improvements were coming very slowly: the interest rate on Treasury bill market was 143% in 1995, 102% in 1996 and 43% in 1997. With those levels of interest rates, it is understandable how even small public debt is not bearable.

The decline in interest rates was, anyway, encouraging, and it helped improve the institution credibility. Something went wrong in September 1997, when contemporary events co-operate in boosting the collapse of the Treasury bill market: the Asian crisis, the devaluation of the hryvnia and the IMF refusal for further support to Ukraine. A huge outflow of money was the immediate consequence. The National Bank of Ukraine (NBU) started losing its reserves and became the first buyer of Treasury bills. A restrictive monetary police was carried on to avoid the collapse, but it only retarded the effects.

In September 1998, after the Russian crisis explosion, the NBU introduced a new oscillation band and after few months removed it completely. Serious administrative restrictions were imposed on banks and financial market operations: e.g. reserve requirements were substantially raised, the procedure of buying foreign currency for resident firms was made as difficult as possible, and several kinds of operations on currency market such as forwards and futures were abandoned. These measures reduced the quantitative indicators of crisis, as inflation rate or devaluation, but had other negative effects on economy.

The Russian crisis combined with other pre-existing difficulties, and only because of the serious actions in the banking sector, a system default was avoided. Actually banks were forced to convert Treasury bills in bonds with longer maturity. This saved the interests of the economic system, but had as a consequence a sub-capitalisation and a deficiency in reserves for the bank system.

Second episode which could produce serious consequences for the health of Ukrainian banking system was initiated by the bankruptcy of one of the largest Ukrainian commercial bank, 'Ukraine' (former 'Ukragroprombank'), in 2001. Mainly oriented on agricultural

sector it held huge portfolio of Ukrainian T-Bills and had large proportion of non-performing loans to agricultural producers which as a result lead to problems with liquidity and then to bankruptcy. Serious consequences to the banking system were avoided by NBU rescue operation.

3. Empirical Analysis: Model, data, and empirical results

3.1 The model

The analysis of Russian and Ukrainian data is proposed with two models: OLS regressions and Logit regressions.

The choice of carrying out a double analysis is based on the need to compare and integrate results from two models which present complementary strength points and drawbacks. Actually, the literature introduced in section 2 generally employs Logit regressions on a dummy variable taking value 1 in correspondence of credit crises, but unfortunately two problems arise in this context.

First, concerning Russian and Ukrainian data, only one episode of crisis can be easily individuated: then it was necessary extending the analysis to "quasi crisis" situation. This involves a definition of crisis original in the literature, and allows us to extend the interest of this analysis also to periods in which crises were not yet exploded, but the economic data were indicating that some the situation was nearly critical. The definition of a "quasi crisis" variable is one of the central topics of this research, and it is discussed in the following session, where the different variables employed in the model are presented.

Second, Logit estimation is not very robust because of the shortness of the series.

Therefore we decided to add a simple OLS analysis to integrate the results: in this case, the dependent variable is the Total credit issued by the bank system in a period. The reliability of this variable is someway discussed in the literature: in particular Eichengreen and Arteta (2000) consider it a poor measure of crisis. It must be noticed that the extent of their work was wider, and here we need in particular a proxy of banking system wealth, to integrate Logit results. Consequently we propose this regression, knowing that the single analysis

can have some limits, but considering it a good way to look for initial evidences of crisis factors.

Concluding, two are the models that are going to be regressed in this paper: the first is an OLS model, and the second a Logit one. Considering them singularly, the analysis has some limits, but the intent of this research is to look for some evidences that can be confirmed by both the methods.

The OLS model estimated is the following one:

$$Cr_i = \alpha_i + \sum_{j=1}^{k} \beta_{ij} X_{ij} + \varepsilon_i \qquad i=1,\ldots,T \tag{3.1}$$

where: Cr_i is the Domestic Credit/GDP ratio, used as a dependent variable;

α_i

α_i is the value of the constant in the model;

β_{ij} is the coefficient of the *j* regressor in the model at *i* time;

X_{ij} is the value of the *j* regressor in the model at *i* time; the regressors included in the model are the following:

1) GDP pro-capita rate of growth %;
2) Short-term real interest rate %;
3) Trade balance/GDP %;
4) Public balance/GDP %;
5) M2/Gross International Reserves %;
6) Gross International Reserves/Monthly Import %;
7) Inflation %;
8) Exchange rate devaluation %;
9) Short-term real borrowing interest rate %;
10) Short-term real lending interest rate %;
11) Domestic credit rate of growth %;
12) Deposits/GDP %;

13) Banking liquid reserves/Banking total assets %;

ε_i is a white noise process.

Since many are the variables involved in the models, and several of them seem to be collinear, it is absolutely reasonable that some of the coefficients can be statistically insignificant. The typical econometric approach consists in beginning the analysis from the most general model, then reducing the model to a more parsimonious one reducing the non significant variables. For this reason the model is proposed in several phases:

- in the first step a comprehensive model, including all the variables with an adequate numbers of lags, is estimated;
- with a t-test, the variables not statistically significant are selected; with an F-test a joint non-significance is verified before proceeding to the reduction;
- a more parsimonious model is estimated, until all the variables included are significant, and then conclusions are drawn;
- concerning the last regression, all the relevant test, in particular specification and misspecification ones are calculated in order to evaluate the goodness of fit. The analysis is integrated with some graphics, giving further information about the fit. Then comments follow.

The second regression estimated is the following Logit model:

$$\log\frac{P_i}{1-P_i} = \alpha_i + \sum_{j=1}^{k} \beta_{ij} X_{ij} + \varepsilon_i \qquad i=1,\ldots,T \tag{3.2}$$

α_i

where: $\log\frac{P_i}{1-P_i}$ is the odds for the event "a crisis in time *i*";

α_i is the value of the constant in the model;

β_{ij} is the coefficient of the *j* regressor in the model at *i* time;

X_{ij} is the value of the *j* regressor in the model at *i* time; the regressors included in the model are the following:

1) GDP pro-capita rate of growth %;
2) Short-term real interest rate %;
3) Trade balance/GDP %;
4) Public balance/GDP %;
5) M2/Gross International Reserves %;
6) Gross International Reserves/Monthly Import %;
7) Inflation %;
8) Exchange rate devaluation %;
9) Short-term real borrowing interest rate %;
10) Short-term real lending interest rate %;
11) Domestic credit rate of growth %;
12) Deposits/GDP %;
13) Banking liquid reserves/Banking total assets %;

ε_i is a white noise process.

Since both for Russia and for Ukraine, the estimation of this model extended to all the variables did not give a positive outcome, several experiments were carried on.

In the Russian analysis, results from three experiments are provided:

- in the first experiments, we estimated a Logit model where only the variables significant in the general regression are included;
- in the second one, we estimated a Logit model where only the variables significant in the OLS final regression are included;
- in the third one, we estimated two models, the first with the only macroeconomic variable and the second with only the banking ones; then we put the significant variables in a third model that is commented.

Concerning the Ukrainian analysis, the general Logit regression is clearly affected by an over-parameterisation problem, owed to the shortness of the series available. Consequently only a further experiment is proposed, where each single variable is included in the model, evaluating its effect on "quasi crisis" odds.

Also for the Logit models outcomes from several tests are reported. We would like to underline that, in particular for the Ukrainian case, since the robustness of the models is in discussion, the results might be considered just as indications to integrate OLS results.

3.2 The data sets

This paragraph is to describe the two sets of data collected and to motivate the decisions that led to the realisation of these sets.

The research was carried out taking into consideration the objectives of this paper: the analysis of a credit crisis, of its macroeconomic and banking factors; moreover the hypothesis of contagion is taken into consideration, and we are looking for some possible evidences.

The collection was conditioned by the limited availability of public and reliable data: if these are published for most of the countries, actually it is difficult to collect long series with the necessary frequency to carry out a good empirical analysis.

The main sources that allowed the building of the data set we are going to analyse are the following:

a) Bank of Russia: www.cbr.ru
b) The Stockholm School of Economics: www.hhs.se
c) UEPLAC: www.ueplac.kiev.ua
d) Bulletin of The National Bank of Ukraine

Data collected for this research are monthly for the Russian data set and quarterly for the Ukrainian one. In order to use series with the same length, we were forced to reduce them: Russian series are from January 1997 until June 2002; Ukrainian ones are from the first quarter of 1997 to the last of 2001.

The variables included in the two data sets have been selected considering the former literature presented in the previous paragraph. In particular three contributions are relevant:

1) Eichengreen and Arteta (2000)
2) Demirgüç-Kunt and Detragiache (1998)
3) Demirgüç-Kunt, Detragiache and Gupta (2000)

The selection then founds its fundament in the above-mentioned literature, but it also presents some original points. First of all, it considers two transition countries, one of which experienced a serious crisis with consequences on the second. Moreover, the methodology approach is double, since the variables are included both in an OLS and a Logit model, then two crisis variables had to be defined.

Both the Russian and the Ukrainian data sets contain the same variables, which are shortly presented as follows. A detailed description is provided in the appendix.
The variables are divided in three groups: crisis dependent variables, macroeconomic regressors and banking regressors.

a) Crisis variable

   The definition of a crisis variable is one of the most controversial point in the former literature concerning banking crises. The most common definitions utilize some indicators and some critical values to identify crisis periods. A particular consensus aroused concerning a definition that considers:

   - the ratio of non-performing assets to total assets in the banking system;
   - the cost of the rescue operations;
   - banking sector problems that resulted in a large scale nationalisation of banks;
   - extensive bank runs that took place or emerging measures such as deposit freezes, prolonged bank holidays, or generalised deposit guarantees that were enacted by the government in response to the crisis.

   In the analysis we propose, a methodology problem is risen by the fact that one only crisis is analysed, and it is not enough to build a dummy variable and regress it in a

Logit model. As previously said, an OLS model has thus been included, and the Logit analysis also takes care of "quasi crisis" episodes.

As a consequence, two are the crisis variables included in the data sets.

The first variable is needed to run the OLS regressions. This variable should be a quantitative proxy of banking wealth, and looking through the literature, the most indicated one is Total Credit Issued by the banking system. The use of this variable was also contested in the literature, namely in Eichengreen and Arteta (2000), where it is considered a poor measure of crisis presence. Actually their paper consider a big number of countries, where because of structural and dimensional differences, the Total Credit could really be considered a scarcely representative variable. But considering Russia and Ukraine only, and focusing on a short period of time, the problem is different, and the choice of this variable does not look meaningless.

From such a point of view it is also possible to consider alternative choices for crisis variable, namely:

- domestic credit issued by commercial banks: while total domestic credit includes operations of the Central Bank, this variable represents only commercial banks activity and in some circumstances could be viewed as more precise measure of banking system health.
- rate of growth of commercial banks deposits: this variable is an indirect indicator of the health of banking system which focuses on credibility of banking sector (as a variant, cash-deposit ratio could also be proposed);
- rate of growth of commercial banks' capital: this variable is often used by central banks both in Russia and in Ukraine as one of the most important indicator of the development of banking system. Crisis (or 'near-the-crisis') events usually have decline in banks' capital as a direct consequence.
- inter-bank credit rate: this could be considered as a sensible indicator of liquidity problems within a banking system.

A second crisis variable is needed to run the Logit regressions. As previously said, Logit regressions are very common in previous literature about credit crisis, but in this

case a methodology problem arises, because we are considering one only crisis event, and a series of financial turbulence that preceded and followed it. As a consequence, in this paper we propose an analysis extended to "quasi crisis" situations: we are not just considering less restrictive borders to define a crisis, but we are also taking into considerations new variables, in order to focus the attention on the banking aspects of these events. Amongst the variables collected, some can be considered good to prepare a dummy variable: after a first statistical analysis, critical values have been selected, and with outlier values, the "quasi crisis" variable has been built up.

The series that have been used to do this are the following:

1) Total domestic credit;
2) Ratio of revoked licence to total banking license (specific data were available for Russia, while a proxy has been used for Ukrainian data, considering a variable called "banks without licence")

Graphic analysis – Russia

Domestic credit / GDP

In the OLS analysis, the variable chosen as a proxy of credit crisis is the Domestic Credit to GDP ratio.

[Insert somewhere here Figure 1]

The most interesting aspect is that the domestic credit ratio to GDP falls under 60% in the August 1998, universally considered as the beginning of the crisis. This allows us to consider this a good representation of the financial turbulence.

Before this date, the course of the ratio is not constant: the ratio grows till February, then it starts a constant fall; in both the case, movements are never dramatic until the explosion of the crisis in August.

Dummy variable: "Quasi crisis"

The dummy variable for Russia is prepared according to this definition:

$$Quasi\,crisis_R = 1 \;\; if \;\; Domestic\,Credit / GDP < 50\%$$

$$\vee$$

$$Bank\,liquidations\,and\;\; failures / Number\,of\;\; credit\,institutions > 1\%$$

$$0 \;\; otherwise$$

The dummy variable presents 15 observations of "quasi crisis".

The Domestic Credit / GDP ratio was discussed above. The indicator of banking disease has been built up, for the Russia, as Bank liquidations and failures to Number of credit institutions ratio.

[Insert somewhere here Figure 2]

The graphic does not have a monotonic course during the period considered. It presents, in particular, some peaks in correspondence of 2000 and beginning of 2001, probably due to the consequences of the dynamics that were bringing back the system to an equilibrium situation.

Graphic analysis – Ukraine

Domestic credit / GDP

As such as for the Russian analysis, in the OLS regression the Domestic Credit to GDP ratio is used as a proxy for banking diseases. The following graph shows the course of this ratio on the considered period.

[Insert somewhere here Figure 3]

The ratio level is low during all 1997, while it shows an important increase during 1998. From this point its course is quite stable until 2001, presenting a slight rise at the end of the year. The impact of the Russian crisis does not look to be dramatically

important, but after 1997 the series gets the lowest point in the last quarter of 1998. Obviously this datum is not enough to testify a contagion, but can be considered as a first indication about the interaction between these two countries.

Dummy variable: "quasi crisis"

The dummy variable is built up according to this definition:

$$Quasi\,crisis_{UK} = 1 \; if \; Domestic\,Credit / GDP < 80\%$$
$$\vee$$
$$Banks\,without\,licence / Number\,of\,banking\,institutions > 80\%$$

$$0 \; otherwise$$

The dummy variable contains 9 observations of "quasi crisis".

It must be observed that different critical values were chosen in this case, in order to choose the observation with a "1" value.

The Domestic Credit to GDP ratio has been commented above, while the indicator of banking disease is shown in the graphic below.

[Insert somewhere here Figure 4]

This graphic is not giving new information about banking stress, because the only relevant feature is that the series has constantly gone down in the considered period.

b) Macroeconomic regressors

The following macroeconomic variables were calculated and used as regressors in both OLS and Logit analysis:

1) GDP growth rate %;
2) Short-term Real Refinancing Rate %;
3) Trade Balance/GDP %;

4) Public balance/GDP %;
5) M2/Gross International Reserves %;
6) Gross International Reserves/Import %;
7) Inflation %;
8) Change in Exchange rates %.

c) Banking regressors

The following banking variables were calculated and used as regressors in both OLS and Logit analysis:

1) Real borrowing interest rate %;
2) Real lending interest rate %;
3) Domestic credit growth rate %;
4) Deposits/GDP %;
5) Change in Banking reserves %.

d) Excluded regressors

In the short survey proposed in the first paragraph, the important role of institutional factors was underlined, since it is considered as one of the most important factors of banking crisis. Nevertheless, none of the variables included in the models is used to investigate in this direction, and this choice must be motivated.

Concerning the most important aspects (exchange rate regime, financial liberalisation, supervision quality and so on) it must be noticed that no important changes can be observed between 1995 and 2002. Therefore, referring to the short period considered in this paper, institutional factors could not be considered the factors that changed the situation in the short term. An analysis extended also to institutional factors could be a very interesting objective for a further study, which could consider a longer period of time.

Concerning deposit insurance, no explicit mechanism was applied neither in Russia or Ukraine, but for two exceptions: Sberbank in Russia and Oshchadbank in Ukraine, which allow only for assured deposits. The existence of these exceptions does not affect

the results of my analysis, which considers the systems as whole, and does not focus on its components.

3.3 Empirical results

3.3.1 Russian analysis – OLS

The first model we are going to consider is an OLS regression where all the variables are included with three lags. Attention must be drawn on two aspects:

1) Since data are monthly, the number of lags to consider initially could be even higher; unfortunately the series are quite short, and in order not to reduce the estimation significance, the number of lags ought not to be high. Anyway the dynamic of the model is not very likely to be affected by the missing lags, since the misspecification tests perform very well;
2) This first analysis, in which such a high number of regressors are included, is just the first step of a reduction process that will lead to the specification of the model we are going to comment.

The reduction technique is applied as described in section 3.1. The intermediate results and the exclusion tests are provided in table 1 to 3. Table 4 reports the results of this last model.

[Insert somewhere Tables 1-5]

All the specification tests concerning this last regression are calculated and shown in Tables 5 and 6, while the graphic analysis of the residuals is provided in Figure 5.

These tests deserve some further comment. The R^2 value is good, very close to 1, and can be considered as a good capacity of the model in estimating the path followed by the independent variable Domestic Credit/GDP.

At the same time, the value of DW is close to 2, indicating a low probability of serial correlation in the error term. Moreover, the two following incorrect-specification tests,

which verify the absence of serial auto-correlation and of conditional heteroschedastic auto-correlation, give positive outcomes. The hetero test confirms the omoschedasticity of the error term, and the Reset test is good evidence that the choice of the functional form is correct. The only negative indication is the Normality test, because the hypothesis of normal distribution in the error term is rejected.

Also the results reported in the stability test tables are good: all the variable coefficients are robust at a 5% or lower levels.

After giving an evaluation about the quality of the estimation, we can turn to the estimation results. Since the independent variable used refers to the deposit dimension, positive coefficients reflect variable trends in the same direction of deposit dimension, and vice versa. Amongst the significant variables, it is important to underline the presence of a lagged value of the independent variable, which refers to the auto-regressive component in the model. Amongst the real variables, several are the significant ones: in particular, some of the factors whose role was drawn under attention in the first paragraph of this article result to be robustly significant, and then deserve particular comments. The Public Balance results to be significant with a positive coefficient, individuating a negative relation between public deficits and banking activity. Also the M2/Gross International Reserves ratio coefficient is very robust, and important conclusions can be done considering it. In the previous literature, this variable is considered to be a good indicator of vulnerability to balance of payment crisis, and referring to what has been said concerning the development of Russian crisis, the presence of this coefficient should be considered very important.

The effect of real shocks has been signalised by real refinancing rate coefficient, that is positive, and which trend is consequently correlated with the dependent variable. Among the other macroeconomic factors, inflation also seem to play a relevant role; the Trade Balance/GDP-ratio coefficient is significant, but with a negative coefficient. The change in exchange rate coefficients are significant, both concerning present and lagged values, but with different signs: this means that the banking activity is surely influenced by exchange market turbulence, but it does not give me a robust indication concerning the sign of the relationship.

Concerning banking variables, the presence of Credit growth and Deposit/GDP among the significant variables is quite a waited result. We have to underline, however, that in other empirical works the growth has often been related to following crisis episodes, and consequently this result may be considered interesting. Lastly, also the Real lending rate coefficient results significant, obviously with a negative sign.

Russian analysis – Logit

In a first model (see Table 7), a Logit regression, in which all the macroeconomic and banking variables are included, is estimated. The results are not very satisfactory, because none of the coefficients is significant: it is clear that the short length of the series causes some over-parameterisation problems.

In order to obtain, anyway, some indications from this model, three experiments were run.

In the first experiment, only variable which were significant at a 30% level in the previous regression were included (see Tables 8 and 9).

In the second experiment we run a regression where we included the only variables significant in the latest OLS experiment (see Tables 10 and 11).

The third experiment consists in running two different regressions. In the first one, only macroeconomic variables are included. In a second regression, only banking variables are included. Then, significant variables in these two regressions (see Tables 12 and 13) are selected, and put together in a third regression, which results are shown in the Table 14, and tests reported in Table 16

These experiments allow us to draw some conclusions. We have to underline that the dependent variable in these equations is the dummy "quasi crisis": as a consequence, positive coefficients are synonyms of factors of crisis, and vice versa. Moreover, we remind that because of the particular interpretation of Logit coefficients, but on derivatives shown in Table 16. Concerning the results obtained from the first experiment, the only significant results are that GDP growth and the M2/Gross International Reserves are relevant. The second experiment confirms the indication about M2/Gross International Reserves and also

individuates Deposits/GDP as significant. Lastly, in the third exercise the GDP growth rate and the Real Lending rate are the variable whose t-test are accepted.
Summarising the results, the outcomes that should be considered as the most important in this Logit analysis are the ones which are repeated, or confirming OLS results. In this sense, the most important indication is relative to the M2/Gross International Reserves ratio, which captures the effect of balance of payment effects: this confirms what was said in the paragraph which reports the stylised facts about Russian crisis.
Further confirmations of OLS results refer to the presence, among the experiment outcomes, of Real lending rate and of Deposits/GDP: this testimony that this variables present particular dynamics in correspondence of credit crises. A novelty in these results is the role of GDP growth rate, which was not significant in the OLS regression.

Ukrainian analysis – OLS

The analysis of the Ukrainian experience is carried out applying the same reduction technique used for Russia. Because of the shorter series employed, we are not adding lagged variable, but for dependent variable. The misspecification test results confirm that the dynamic of the model is captured by this variable. Model selection is reported in Tables 16 and 17, while Table 18 report the most parsimonious model. Test results are provided in Tables19 and 20. A graphic analysis of residuals is shown in Figure 6.

[Insert somewhere here Tables 18]

Concerning the technical analysis, as it was for the Russian analysis, the outcomes of the tests are really comforting. R^2 is very close to 1, describing a model which ability to estimate the variance of real data is very good and ass we could expect, the F-test reject the null hypothesis. The DW test gives a good result, verifying a scarce serial correlation in the error terms. This indication is confirmed by the two following results, given by the AR and the ARCH tests. Also the normality, the hetero, the reset and the stability tests give good indications about the quality of fitting.

An important indication can be done considering the nature of the variables that are relevant in the model: the lagged dependent variable and the Credit growth rate are the two variables that naturally explain the trend of the dependent variable, which in the OLS regression is the Domestic Credit to GDP ratio. As a consequence, an increase in one of the factors with a positive coefficient is a signal of an improvement in the banking activity; a decrease in one of these same factors corresponds to a period of difficult activity. We have to work in the opposite direction for factors with a negative coefficient. After this necessary introduction, it is possible to comment the estimated coefficients.

Reading through Table 18 we notice, first of all, the importance of the auto-regressive behaviour of the dependent variable, mainly explained by its lagged value. Moreover, the Credit growth rate has a positive coefficient.

This allows us to individuate a first difference between this case and the Russian one: here these variables are enough to explain the trend, while in the Russian case, many other factors were individuated. Moreover, it is important to consider that these two factors were introduced in the model because of an economic fundament, and in function of this their role should be interpreted. The Domestic Credit growth rate allows us to verify that crisis often happen together with exploding credit dynamics, and its lagged value should catch the former year effect. Another important comment should be done: if these rates describe the phases of development and implosion of the banking system, it can be argued that other ones may be the causes of these factors. Observing the graph concerning the regression fitting, it is possible to note that the model does not describe in a very effective way the trend in correspondence of the end of 1998 and beginning of 1999. This could be an indication, but nothing more than this, that external factors should have been considered in this analysis, and contagion is a good theory to explain this dynamic. Unfortunately the data set incompatibility did not allow us to propose a comprehensive analysis of external factors which still is one of the most important topics to study in further works.

The following Logit analysis could be really useful, in this case, to individuate some more evidence about crisis factors.

Ukrainian analysis – Logit

The former conclusions leave rooms for further analysis, and the Logit model could be a good instrument to individuate new factors. Unfortunately the limitations in data availability severely affected the effectiveness of this analysis.

In a first regression (see Table 21) all the variables are included. The results are really disappointing, since none of the variable included in the model is statistically significant and an analysis similar to the one proposed for the Russian crisis is not adequate.

In this exercise the data set limitations affect completely the significance of the Logit model, which particularly suffers because of the number of parameters and because of the shortness of the series.

We therefore provide an alternative analysis by regressing the dependent variable Quasi crisis in models containing one only regressor at a time.. The results obtained, even if not so robust, look interesting: in particular the Deposits/GDP ratio and Change in banking reserves are significant among the banking factors, while the Public Balance to GDP ratio and M2 to Gross International reserves are the significant macroeconomic factors. The results are reported in Table 22.

The most important indication emerging from the Logit analysis is that, among the macroeconomic variables, the ones that had the most important role in the developing of financial turbulence in Ukraine were the public deficit and the vulnerability to balance of payment shocks. The negative sign of the coefficients reflects the reasonable sign of the relation: when the public balance and the balance of payment get worse, the probability of experiencing credit crisis increase substantially.

These results must be considered carefully, anyway, since the way they were obtained must be considered really experimental.

4. Summary of results

The main results of our analysis can be summarised as follows.

We report empirical results from OLS and Logit regressions. *OLS regressions give very interesting results, although a limitation of this kind of study is relative to the use of a dependent variable whose reliability as indicator of crisis may be doubtful. The logit analysis instead, though affected by the shortness of the series, allowed us to extend the analysis to the "quasi crisis" episodes, and this is an important point of our work.*

Concerning Russia, the general consensus is that the crises erupted because of the inability of political authorities in putting some brakes to the public debt explosion. In our analysis, the Public balances to GDP ratio results relevant in the OLS regressions. This confirms that the devastating effects caused by the public deficit on the Russian real economy had an impact also on the banking sector, through variables that act as transmission mechanisms.

The 1998 public debt increase caused a sharp increase in interest rates, which allowed the country to collect huge cash flows from abroad, through the GKO Treasury bill market. However, these flows late became the weakness point: when foreign investors started withdrawing their investments, fearing a prompt Rouble devaluation, they left the country exposed to a devastating money haemorrhage.

These are the channels that seriously affected the banking economy and activity, and they were clearly captured in our regressions by the M2 to Gross International Reserves ratio coefficient, an indicator of vulnerability to balance of payment crises.

Moreover inflation played a role and its effect on banking activity is shown in both the analyses. High and variable nominal interest rates, combined with hyperinflation periods, affected the maturity transformation, that is one of the main banking activities. This can explain why real interest rates are so significant in all our experiments.

The banking variable that was mostly affected by these dynamics is the real lending rate, whose course results significant in both analyses.

In sum, for Russia, it must be stressed how the main part of the decisive factors was caught by the regressions, and the results are robust in both OLS and logit estimations. As already mentioned, a limitation of the analysis is implicit in the definition of the dependent variable, that is more likely to represent the banking dimension and welfare than its crisis inclination. Further development of this work will be particularly careful to this aspect, as soon as wider data are available.

In Ukraine, conditions which led to crisis are more complicated. It is quite well known that Ukraine, even if experiencing a period of financial turbulence, was never involved with such a credit crush as Russia, neither did the country nor the banking system get insolvent.
Without any doubt, the origin of the financial disease is similar to the Russian case, and can be considered at the basis of every crisis in transition economy. The public balances, since Ukraine got independent, had always been in red. The original aspect of this crisis is that, on the contrary of the Russian case, deficit was covered by printing money, causing a strong hyper-inflation phenomenon. The situation ameliorated between 1996 and 1997, because of the strong interventions from the political/fiscal authorities, plus the international events which occurred between 1997 and 1998 determined a sharp fall in Treasury bills and money demands. A very important role was played by the Asian crisis, the International Monetary Found refusal to support Ukraine, and the money demand growth because of arrears payments.
In order to avoid the financial crash, the authorities decided to rely on the banking system, forcing banks to convert Treasury bills into long term bonds. This actually avoided the crash, but left to the banking system the uncomfortable legacy of under-capitalisation.
These effects are clearly captured in our regressions by the statistically significant coefficients associated the Public balances to GDP ratio and the M2 to Gross International Reserves ratio. Amongst the banking variables, the logit regression gives a clear indication about the impact of the change in reserves and the level of deposits, drawing attention on the system liquidity. However further analysis is needed in this direction.
Moreover, the banking activity trend seems to be explained by the course of Domestic Credit: the effect of real shocks and the explosion of credit then can be considered the key factors to explain the banking activity in Ukraine.
Our results call for further investigation in particular to better consider the channels through which the role that external factors may have played, and contagion hypotheses may then be directly incorporate into the model. We leave this to future research.

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Appendix: Detailed description of data

While a description of the sources, and a full explanation of the reasons why the crisis variables were chosen are provided in the section 3.3, this appendix is to complete the data information, giving details about how the variables were built, and why these one were chosen in the literature to study credit crises.

The appendix is composed by two paragraphs, in which macroeconomic and banking variables are discussed.

A1. Macroeconomic regressors

1) GDP growth rate %

   This series is calculated with this formula:

$$\left[\log(GDP)_t - \log(GDP)_{t-1}\right] * 100 \qquad \text{(A1.1)}$$

   where: *GDP* is the Gross Domestic Product at the time *t*.

   This variable is included in the models because of a theory, confirmed by several empirical analysis[1], saying that a low growth rate increase the probability of credit crises. Actually negative phases of the production cycle produce real shocks which impact cannot be reduced by the classic bank risk management.

2) Short-term Real Refinancing Rate %

   Among all the interest rate, in the literature the short-term real interest rate seems to be the most used. In order to calculate this series, this formula was used:

$$r = \frac{i - \pi}{1 + \pi} \qquad \text{(A1.2)}$$

   where: r is the real interest rate,

   i is the nominal interest rate,

π is the inflation rate.

The real interest rate is included in the models because it catches macroeconomic shocks effect hitting banking activity: in fact this rate growth is one of the most studied factors associated with the emerging of banking panics[2]. This dynamics can change the economical conditions for a bank, without any difference in the deposit management: since the assets side of a bank balance sheet is usually composed by medium-long-term lending at a fixed rate, the return rate cannot be adjusted quickly, while new deposit rate must be raised in the short term.

Another reason why this variable is chosen is that it catches the effects of a financial liberalization process[3] increasing banking risk.

3) Trade Balance/GDP %

This series is simply calculated as the percent trade balance ratio to GDP.

This variable is introduced to measure the effect of the trade balance on credit crisis. This probably shows how much a country depends on its relations with other countries. If a country is a creditor of foreign subjects, the national operators bear a greater default risk, with possible negative effects on banking activity.

4) Public Balance/GDP %

This series is calculated as the percent public balance to GDP ratio.

This variable is included in the models for two main reasons:

1) First, if the government has to obtain funds, it often postpone the measure needed to enforce balance sheets, and initial problems may grow and become systemic crisis. As a consequence "authorities don't intervene in the banking sector because this would show to everyone the problems and would increase

[1] See Eichengreen and Arteta (1997) and others.
[2] See Mishkin (1996) for a theoretical explanation and an empirical analysis.

the costs. The typical justification for this behaviour is that there is no money in the budget or the fiscal situation is to week to allow the government to solve sector problems"[4]. Moreover, even if the authority were ready to intervene, nevertheless the budget difficulties, different expectation may raise among the public, causing panics and self-fulfilling crises.

2) Second, difficulties in managing public debt may be a serious limit for financial liberalization projects[5].

5) M2/Gross International Reserves %

This series is calculated as the percent M2 to Gross International Reserved ratio. M2 is an aggregate which comprehends money, banking accounts (M1) and saving deposits and assimilate values.

This variable is included in order to verify whether banking systemic crisis are caused by a sudden cash outflow from a country. In the literature it is shown how this variable is a good indicator of vulnerability to balance of payment crises[6].

6) Gross International Reserves/Import %

This series is obtained as the percent Gross International Reserves to Import ratio, where import refers to the frequency of data.

In order to interpret this ratio we have to consider that, import being the same, this indicator grows when reserves are big, vice versa it decreases; reserves being the same, this indicators grows when imports are low and vice versa. Therefore this is an indicator of the international reserves adequacy, which effect is discussed in the literature.

[3] See Galbis (1993) fo an empirical analysis.
[4] Quoted from Lindgreen, Garcia and Saal (1996), pag. 166.
[5] See McKinnon (1991) for a theoretical explanation and an empirical analysis.
[6] See Calvo (1996) for a theoretical explanation and an empirical analysis.

7) Inflation

In this paper we have chosen to calculate the inflation as the percent increase of the Consumer Price Index. Thus this formula was used:

$$\pi = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} * 100 \qquad \text{(A1.3)}$$

where: π is the inflation rate calculated as the percent increase of the consumer price index;
CPI is the consumer price index.

There are several reasons why the inflation rate can have an effect on credit crisis probability, since this variable can be considered a proxy of macroeconomic mismanagement, whit adverse effects on the economy and on the banking activities through different paths. The most used explanation in the literature is that high and variable nominal interest rates make the maturity management more difficult and risky for all the banking operators.

8) Change in Exchange rates %

This series is calculated as the variation rate of the exchange rates between American dollar and the domestic currency. This formula is applied:

$$\left[\log(e)_t - \log(e)_{t-1}\right] * 100 \qquad \text{(A1.4)}$$

where: e is the exchange rate between American dollar and the domestic currency.

This variable is introduced to test the hypothesis that banking crises are led by the effects of exchange rate volatility.

A2. Banking regressors

1) Real borrowing interest rate %

Several series concerning borrowing rates were available, but since most of them were not complete, it was not possible to build up an average indicator. Therefore, among the available series, we have chosen data referring to low-term deposits in the domestic currency, in order to consider the most common interest rate. The following formula was applied to calculate real values:

$$r_d = \frac{i_d - \pi}{1 + \pi} \qquad \text{(A1.5)}$$

where: r_d is the real borrowing interest rate;

i_d is the nominal borrowing interest rate;

π is the inflation rate.

While the real term refinancing rate is included in the model to catch real shock effects, this variable is intended to catch the effect of the short term liabilities management on banking activity.

2) Real lending interest rate %

According to the former case, among all the available lending rate we have chosen the short term one. The same formula is applied to calculate real values:

$$r_l = \frac{i_l - \pi}{1 + \pi} \qquad \text{(A1.6)}$$

where: r_l is the real lending interest rate;

i_l is the nominal lending interest rate;

π is the inflation rate.

This variable is included to catch the effect of the asset management on the banking activity.

3) Domestic credit growth rate %

This formula is applied to calculate this series:

$$\left[\log(TotCr)_t - \log(TotCr)_{t-1}\right] * 100 \qquad \text{(A1.7)}$$

where: *TotCr* is the total amount of money the banking sector lends in a certain period of time.

In the literature dynamics concerning banking crisis are often linked with former credit growth periods. Including this variable is important to investigate in this direction. Since the effect of this variable is relevant after some years, it is important to insert in the model several lags.

4) Deposits/GDP %

This series is calculated as the percent Deposit to GDP ratio.

This variable is observed because in the theoretical literature banking runs often precede banking crisis. Since some objections is raised[7] by other authors, this analysis may lead to interesting conclusions.

5) Change in banking reserves %

This formula was used to calculate this series:

$$\left[\log(Ris)_t - \log(Ris)_{t-1}\right] * 100$$

where: *Ris* is the amount of banking reserves at time t.

[7] See Demirgüç-Kunt, Detragiache and Gupta (2000) in particular.

This variable is included in the model because the macroeconomic difficulties can lead to a banking crisis if the system is not liquid. This variable is considered to be, in the literature, the best indicator to catch the effect of liquidity of banking crises.

Tables

Russian analysis – OLS

Table 1 Regressing DomesticCreditGDP(%) by OLS(1)

(Russian data set 01/1997-06/2002, all the variables with three lags)

Variable	Coefficient	Std Error	t-value	t-prob	Part R^2
DomesticCredit/GDP(%)_1	0.380	0.163	2.330	0.053	0.437
DomesticCredit/GDP(%)_2	-0.108	0.230	-0.468	0.654	0.030
DomesticCredit/GDP(%)_3	0.470	0.199	2.360	0.050	0.444
Constant	189780.000	18.290	1.040	0.334	0.133
GDPgrowth(%)	-0.948	0.325	-2.910	0.023	0.548
GDPgrowth(%)_1	-0.450	0.370	-1.220	0.263	0.175
GDPgrowth(%)_2	-0.868	0.354	-2.450	0.044	0.462
GDPgrowth(%)_3	-0.915	0.218	-4.190	0.004	0.715
RealRef.Rate(%pa)	0.063	0.098	0.642	0.541	0.056
RealRef.Rate(%pa)_1	0.209	0.181	1.160	0.284	0.161
RealRef.Rate(%pa)_2	0.499	0.140	3.560	0.009	0.644
RealRef.Rate(%pa)_3	0.135	0.131	1.030	0.336	0.132
TradeBalance/GDP(%)	0.024	0.142	0.170	0.870	0.004
TradeBalance/GDP(%)_1	-0.425	0.191	-2.220	0.061	0.414
TradeBalance/GDP(%)_2	-0.019	0.135	-0.141	0.892	0.003
TradeBalance/GDP(%)_3	-0.214	0.211	-1.020	0.342	0.129
PublicBalance/GDP(%)	0.406	0.133	3.070	0.018	0.573
PublicBalance/GDP(%)_1	0.076	0.191	0.397	0.703	0.022
PublicBalance/GDP(%)_2	0.173	0.195	0.886	0.405	0.101
PublicBalance/GDP(%)_3	-0.317	0.117	-2.710	0.030	0.513
M2/GrIntRes.(%)	-0.034	0.032	-1.080	0.315	0.143

M2/GrIntRes.(%)_1	0.083	0.038	2.160	0.068	0.400
M2/GrIntRes.(%)_2	-0.221	0.053	-4.150	0.004	0.711
M2/GrIntRes.(%)_3	0.054	0.035	1.540	0.167	0.254
GrIntRes./MImport.(%)	-0.004	0.013	-0.290	0.780	0.012
GrIntRes./MImport.(%)_1	0.014	0.011	1.350	0.218	0.208
GrIntRes./MImport.(%)_2	0.011	0.010	1.080	0.318	0.142
GrIntRes./MImport.(%)_3	-0.012	0.010	-1.260	0.248	0.185
Inflation(%pa)	0.006	0.006	1.040	0.335	0.133
Inflation(%pa)_1	0.035	0.008	4.500	0.003	0.743
Inflation(%pa)_2	0.010	0.005	1.870	0.103	0.334
Inflation(%pa)_3	0.025	0.005	4.530	0.003	0.746
ExchRateVariation(%)	140485.000	0.778	1.810	0.114	0.318
ExchRateVariation(%)_1	-365428.000	1258.000	-2.900	0.023	0.547
ExchRateVariation(%)_2	-0.875	0.824	-1.060	0.323	0.139
ExchRateVariation(%)_3	-314796.000	0.848	-3.710	0.008	0.663
RealBorrowingRate(%pa)	0.412	0.285	1.450	0.191	0.230
RealBorrowingRate(%pa)_1	-0.660	0.261	-2.530	0.039	0.477
RealBorrowingRate(%pa)_2	0.032	0.292	0.110	0.916	0.002
RealBorrowingRate(%pa)_3	0.006	0.260	0.024	0.982	0.000
RealLendingRate(%pa)	-0.194	0.205	-0.948	0.375	0.114
RealLendingRate(%pa)_1	0.319	0.223	1.430	0.197	0.225
RealLendingRate(%pa)_2	-0.542	0.255	-2.120	0.072	0.391
RealLendingRate(%pa)_3	-0.029	0.216	-0.136	0.895	0.003
Creditgrowth(%)	345094.000	0.423	8.160	0.000	0.905
Creditgrowth(%)_1	361069.000	0.695	5.190	0.001	0.794
Creditgrowth(%)_2	0.796	0.707	1.120	0.298	0.153
Creditgrowth(%)_3	0.730	0.518	1.410	0.202	0.221
Deposits/GDP(%)	127625.000	0.159	8.050	0.000	0.903
Deposits/GDP(%)_1	-0.355	0.327	-1.080	0.314	0.144

Deposits/GDP(%)_2	-0.263	0.452	-0.582	0.579	0.046
Deposits/GDP(%)_3	-0.172	0.323	-0.532	0.611	0.039
BankRes.Variation(%)	-0.540	0.165	-3.270	0.014	0.605
BankRes.Variation(%)_1	-0.056	0.211	-0.264	0.799	0.010
BankRes.Variation(%)_2	-0.018	0.172	-0.103	0.921	0.002
BankRes.Variation(%)_3	0.432	0.150	2.890	0.023	0.544

Table 1 F-test on excluded variables in regression OLS(1)

F(27,7)	3.377 [0.051]

Table 2 Regressing DomesticCreditGDP(%) by OLS(2)

(Russian data set 01/1997-06/2002, all the significant variables in OLS(1))

Variable	**Coefficient**	**Std Error**	**t-value**	**t-prob**	**Part R^2**
DomesticCreditGDP(%)_1	0.749	0.049	15.300	0.000	0.873
DomesticCreditGDP(%)_3	0.022	0.025	0.867	0.392	0.022
Constant	545222.000	5722.000	0.953	0.347	0.026
GDPgrowth(%)	0.062	0.269	0.229	0.820	0.002
GDPgrowth(%)_2	-0.159	0.127	-1.250	0.219	0.044
GDPgrowth(%)_3	-0.103	0.109	-0.940	0.354	0.025
RealRef.Rate(%pa)_2	0.526	0.097	5.410	0.000	0.463
TradeBalance/GDP(%)_1	-0.263	0.069	-3.800	0.001	0.298
PublicBalance/GDP(%)	0.493	0.123	4.000	0.000	0.320
PublicBalance/GDP(%)_3	-0.310	0.116	-2.670	0.011	0.174
M2/GrIntRes.(%)_1	0.012	0.024	0.510	0.613	0.008
M2/GrIntRes.(%)_2	-0.084	0.029	-2.910	0.006	0.199
Inflation(%pa)_1	0.020	0.004	4.950	0.000	0.419
Inflation(%pa)_2	0.005	0.002	2.880	0.007	0.196
Inflation(%pa)_3	0.011	0.004	2.990	0.005	0.208

ExchRateVariation(%)	165883.000	0.302	5.490	0.000	0.470
ExchRateVariation(%)_1	-238956.000	0.640	-3.730	0.001	0.291
ExchRateVariation(%)_3	-170472.000	0.536	-3.180	0.003	0.229
RealBorrowingRate(%pa)	0.167	0.138	1.210	0.235	0.041
RealBorrowingRate(%pa)_1	-0.105	0.083	-1.270	0.213	0.045
RealLendingRate(%pa)	0.023	0.093	0.243	0.809	0.002
RealLendingRate(%pa)_2	-0.373	0.087	-4.270	0.000	0.349
Creditgrowth(%)	318957.000	0.330	9.660	0.000	0.733
Creditgrowth(%)_1	108781.000	0.403	2.700	0.011	0.177
Creditgrowth(%)_3	0.659	0.329	2.010	0.053	0.106
Deposits/GDP(%)	165590.000	0.131	12.600	0.000	0.824
Deposits/GDP(%)_1	-117766.000	0.157	-7.530	0.000	0.625
BankRes.Variation(%)	-0.280	0.153	-1.840	0.075	0.090
BankRes.Variation(%)_3	-0.024	0.132	-0.179	0.859	0.001

Table 3 F-test on excluded variables in regression OLS(2)

F(10,34)	1.005 [0.460]

Table 4 Regressing DomesticCreditGDP(%) by OLS(3)

(Russian data set 01/1997-06/2002, all the significant variables in OLS(2))

Variable	**Coefficient**	**Std Error**	**t-value**	**t-prob**	**Part R^2**
DomesticCreditGDP(%)_1	0.810	0.040	20.500	0.000	0.905
Constant	0.548	4203.000	0.130	0.897	0.000
RealRef.Rate(%pa)_2	0.424	0.085	5.010	0.000	0.363
TradeBalance/GDP(%)_1	-0.258	0.054	-4.760	0.000	0.340
PublicBalance/GDP(%)	0.437	0.102	4.300	0.000	0.296
PublicBalance/GDP(%)_3	-0.173	0.092	-1.870	0.068	0.074
M2/GrIntRes.(%)_2	-0.043	0.016	-2.740	0.009	0.146

Inflation(%pa)_1	0.023	0.003	6.830	0.000	0.515
Inflation(%pa)_2	0.003	0.001	2.030	0.048	0.086
Inflation(%pa)_3	0.009	0.003	3.020	0.004	0.172
ExchRateVariation(%)	137990.000	0.229	6.030	0.000	0.453
ExchRateVariation(%)_1	-295046.000	0.523	-5.650	0.000	0.420
ExchRateVariation(%)_3	-147736.000	0.430	-3.430	0.001	0.211
RealLendingRate(%pa)_2	-0.331	0.075	-4.440	0.000	0.309
Creditgrowth(%)	331247.000	0.284	11.700	0.000	0.756
Creditgrowth(%)_1	0.719	0.273	2.630	0.012	0.136
Creditgrowth(%)_3	0.379	0.243	1.560	0.127	0.052
Deposits/GDP(%)	162439.000	0.052	31.500	0.000	0.957
Deposits/GDP(%)_1	-121680.000	0.082	-14.800	0.000	0.833

Table 5 Values and tests of OLS(3) DomesticCreditGDP(%) regression

(Russian data set 01/1997-06/2002, all the significant variables in OLS(2))

Sigma	2.450
RSS	264.000
R^2	0.999
F(12,50)	3137 [0.000]**
Log-likelihood	-134.527
DW	1.740
AR 1-4 test: F(4,40)	1.503 [0.220]
ARCH 1-4 test: F(4,36)	0.103 [0.981]
Normality test: Chi^2(2)	9.6753 [0.008]**
Hetero test: F(36,7)	0.165 [0.999]
RESET test: F(1,43)	1.688 [0.201]

Table 6 Stability test on OLS(3) DomesticCreditGDP(%) regression parameters

(Russian data set 01/1997-06/2002, all the significant variables in OLS(2))

DomesticCreditGDP(%)_1	0.060
Constant	0.045
RealRef.Rate(%pa)_2	0.143
TradeBalance/GDP(%)_1	0.047
PublicBalance/GDP(%)	0.043
PublicBalance/GDP(%)_3	0.153
M2/GrIntRes.(%)_2	0.031
Inflation(%pa)_1	0.047
Inflation(%pa)_2	0.045
Inflation(%pa)_3	0.029
ExchRateVariation(%)	0.084
ExchRateVariation(%)_1	0.089
ExchRateVariation(%)_3	0.042
RealLendingRate(%pa)_2	0.116
Creditgrowth(%)	0.084
Creditgrowth(%)_1	0.116
Creditgrowth(%)_3	0.579*
Deposits/GDP(%)	0.049
Deposits/GDP(%)_1	0.052

Russian analysis - Logit

Table 7 Regressing Quasi crisi by Logit (1)

(Russian data set 01/1997-06/2002, all the variables)

Variable	Coefficient	Std Error	t-value	t-prob
Constant	-770044.000	141.100	-0.546	0.588
GDPgrowth(%)	478944.000	4222.000	1.130	0.262
RealRef.Rate(%pa)	185033.000	1897.000	0.975	0.334
TradeBalance/GDP(%)	145573.000	1725.000	0.844	0.403
PublicBalance/GDP(%)	-199504.000	2106.000	-0.948	0.348
M2/GrIntRes.(%)	-0.608	0.514	-1.180	0.243
GrIntRes./MImport.(%)	0.082	0.093	0.884	0.381
Inflation(%pa)	0.028	0.325	0.087	0.931
ExchRateVariation(%)	255426.000	3285.000	0.778	0.440
RealBorrowingRate(%pa)	-794572.000	6941.000	-1.140	0.258
RealLendingRate(%pa)	410363.000	3566.000	1.150	0.255
Creditgrowth(%)	0.396	2979.000	0.133	0.895
Deposits/GDP(%)	-0.266	0.242	-1.100	0.277
BankRes.Variation(%)	0.361	1113.000	0.324	0.747

1st Experiment: variables significant at 30%

Table 8 Regressing Quasi crisi by Logit(2)

(Russian data set 01/1997-06/2002, only significant variables at 30% in Logit(1))

Variable	Coefficient	Std Error	t-value	t-prob
Constant	135844.000	7910.000	1.720	0.091
GDPgrowth(%)	0.420	0.213	1.970	0.053
M2/GrIntRes.(%)	-0.121	0.067	-1.800	0.077
RealBorrowingRate(%pa)	-0.520	0.415	-1.250	0.215
RealLendingRate(%pa)	0.279	0.313	0.893	0.376
Deposits/GDP(%)	-0.042	0.029	-1.460	0.149

Table 9 Values and tests regressing DomesticCreditGDP(%) by Logit(2)

(Russian data set 01/1997-06/2002, only significant variables at 30% in Logit(1))

Probability of 0	0.773
Probability of 1	0.228
Test χ^2	38.067 [0.000]**
$\partial P/\partial GDPgrowth$	0.074
$\partial P/\partial(M2/GrIntReserves)$	-0.021

2nd Experiment: variables significant in the OLS regression

Table 10 Regressing Quasi crisi by Logit (3)

(Russian data set 01/1997-06/2002, only significant variables at 10% in OLS(3))

Variable	**Coefficient**	**Std Error**	**t-value**	**t-prob**
Constant	130701.000	7525.000	1.740	0.088
RealRef.Rate(%pa)	0.183	0.140	1.310	0.197
TradeBalance/GDP(%)	0.107	0.070	1.540	0.130
PublicBalance/GDP(%)	-0.174	0.141	-1.230	0.222
M2/GrIntRes.(%)	-0.063	0.036	-1.730	0.089
Inflation(%pa)	0.032	0.068	0.471	0.640
ExchRateVariation(%)	-0.270	0.815	-0.331	0.742
RealLendingRate(%pa)	-0.153	0.126	-1.210	0.231
Creditgrowth(%)	-0.100	0.488	-0.205	0.838
Deposits/GDP(%)	-0.063	0.034	-1.850	0.070

Table 11 Values and tests regressing DomesticCreditGDP(%) by Logit (3)

(Russian data set 01/1997-06/2002, only significant variables at 10% in OLS(3))

Probability of 0	0.773
Probability of 1	0.228

Test χ^2	37.377 [0.000]**
$\partial P/\partial(M2/GrInt\,\mathrm{Re}serves)$	-0.011
$\partial P/\partial(Deposits/GDP)$	-0.011

3rd Experiment: independent analysis of macroeconomic and banking variables

Table 12 Regressing Quasi crisi by Logit (4)

(Russian data set 01/1997-06/2002, only macroeconomic variables)

Variable	Coefficient	Std Error	t-value	t-prob
Constant	127133.000	15.720	0.809	0.422
GDPgrowth(%)	0.779	0.395	1.970	0.053
RealRef.Rate(%pa)	0.153	0.155	0.991	0.326
TradeBalance/GDP(%)	0.208	0.124	1.670	0.099
PublicBalance/GDP(%)	-0.347	0.211	-1.650	0.105
M2/GrIntRes.(%)	-0.140	0.077	-1.810	0.076
GrIntRes./MImport.(%)	-0.006	0.008	-0.716	0.477
Inflation(%pa)	0.234	0.143	1.640	0.106
ExchRateVariation(%)	-0.802	1007.000	-0.796	0.429

Table 13 Regressing Quasi crisi by Logit (5)

(Russian data set 01/1997-06/2002, only banking variables)

Variable	Coefficient	Std Error	t-value	t-prob
Constant	128756.000	2838.000	0.454	0.652
RealBorrowingRate(%pa)	0.155	0.145	1.070	0.289
RealLendingRate(%pa)	-0.237	0.134	-1.770	0.082
Creditgrowth(%)	0.287	0.270	1.070	0.291
Deposits/GDP(%)	-0.012	0.015	-0.845	0.402
BankRes.Variation(%)	0.147	0.114	1.290	0.201

Table 14 **Regressing Quasi crisi by Logit (6)**

(Russian data set 01/1997-06/2002, only significant variables in (4) e (5))

Variable	**Coefficient**	**Std Error**	**t-value**	**t-prob**
Constant	-140871.000	3683.000	-0.382	0.703
GDPgrowth(%)	0.414	0.189	2.200	0.032
TradeBalance/GDP(%)	0.056	0.057	0.974	0.334
M2/GrIntRes.(%)	-0.011	0.016	-0.679	0.499
RealLendingRate(%pa)	-0.156	0.055	-2.840	0.006

Table 15 **Values and tests regressing DomesticCreditGDP(%) by Logit (6)**

(Russian data set 01/1997-06/2002, only significant variables in (4) e (5))

Probability of 0	0.773
Probability of 1	0.227
Test χ^2	33.772 [0.0000]**
$\partial P/\partial GDPgrowth$	0.073
$\partial P/\partial \mathrm{Re}\, alLendingRate$	-0.028

Ukrainian analysis – OLS

Table 16 **Regressing DomesticCreditGDP(%) by OLS(1)**

(Ukrainian data set 01/1997-12/2001, all the variables)

Variable	**Coefficient**	**Std Error**	**t-value**	**t-prob**	**Part** R^2
DomesticCreditGDP(%)_1	0.873	0.285	3.060	0.038	0.701
Constant	137348.000	11.860	1.160	0.311	0.251

GDPgrowth(%)	-0.817	0.225	-3.630	0.022	0.767
RealRef.Rate(%pa)	0.236	0.202	1.170	0.308	0.254
TradeBalance/GDP(%)	0.602	0.746	0.806	0.465	0.140
PublicBalance/GDP(%)	-0.087	0.359	-0.242	0.820	0.015
M2/GrIntRes.(%)	-0.014	0.010	-1.410	0.232	0.331
GrIntRes./Import3M(%)	-0.013	0.026	-0.510	0.637	0.061
Inflation(%pa)	0.086	0.208	0.415	0.700	0.041
ExchRateVariation(%)	-0.641	0.413	-1.550	0.195	0.376
RealBorrowingRate(%pa)	0.125	0.799	0.157	0.883	0.006
RealLendingRate(%pa)	-0.333	0.575	-0.579	0.594	0.077
Creditgrowth(%)	0.192	0.090	2.130	0.100	0.531
Deposits/GDP(%)	0.166	0.395	0.421	0.696	0.042
BankRes.Variation(%)	-0.192	0.124	-1.540	0.198	0.373

Table 17 **F-test on excluded variables in regression OLS(1)**

F(11,4)	0.769 [0.671]

Table 18 **Regressing DomesticCreditGDP(%) by OLS(2)**

(Ukrainian data set 01/1997-12/2001, only significant variables at 10% in OLS(1))

Variable	**Coefficient**	**Std Error**	**t-value**	**t-prob**	**Part R^2**
DomesticCreditGDP(%)_1	0.990	0.041	24.000	0.000	0.975
Constant	216426.000	1524.000	1.420	0.176	0.119
GDPgrowth(%)	-0.808	0.074	-10.900	0.000	0.887
Creditgrowth(%)	0.335	0.052	6.500	0.000	0.738

Table 19 **Values and tests regressing DomesticCreditGDP(%) by OLS(2)**

(Ukrainian data set 01/1997-12/2001, only significant variables at 10% in OLS(1))

Sigma	2.003

RSS	60.177
R^2	0.979
F(4,15)	232.400 [0.000]**
Log-likelihood	-37.912
DW	2.130
AR 1-2 test: F(2,13)	0.137 [0.873]
ARCH 1-2 test: F(2,11)	0.073 [0.930]
Normality test: Chi^2(2)	0.188 [0.910]
hetero test: F(6,8)	0.488 [0.801]
RESET test: F(1,14)	2.858 [0.113]

Table 20 Stability test on OLS(2) DomesticCreditGDP(%) regression parameters

(Ukrainian data set 01/1997-12/2001, all the significant variables at 10% in OLS(1))

DomesticCreditGDP(%)_1	0.150
Constant	0.159
GDPgrowth(%)	0.394
Creditgrowth(%)	0.108

Ukrainian analysis - Logit

Table 21 Regressing Quasi crisi by Logit (1)

(Ukrainian data set 01/1997-12/2001, all the variables)

Variable	Coefficient	Std Error	t-value	t-prob
Constant	-198.254	2.488e+008	-0.000	1.000
GDPgrowth(%)	3.774	1.940e+009	0.000	1.000
RealRef.Rate(%pa)	-1.159	2.675e+008	-0.000	1.000
TradeBalance/GDP(%)	-12.686	1.331e+009	-0.000	1.000

PublicBalance/GDP(%)	-6.318	2.312e+009	-0.000	1.000
M2/GrIntRes.(%)	0.142	7.983e+007	0.000	1.000
GrIntRes./Import3M(%)	1.049	2.404e+008	0.000	1.000
Inflation(%pa)	1.905	1.403e+009	0.000	1.000
ExchRateVariation(%)	-1.573	4.321e+009	-0.000	1.000
RealBorrowingRate(%pa)	-10.907	2.632e+008	-0.000	1.000
RealLendingRate(%pa)	9.578	5.701e+008	0.000	1.000
Creditgrowth(%)	0.435	7.629e+008	0.000	1.000
Deposits/GDP(%)	-8.484	2.501e+009	-0.000	1.000
BankRes.Variation(%)	0.736	5.157e+008	0.000	1.000

Models containing one only variable

Table 22a Regressing Quasi crisi by Logit (2)

(Ukrainian data set 01/1997-12/2001, only one regressor)

Variable	Coefficient	Std Error	t-value	t-prob
Constant	-0.757	0.582	-1.300	0.210
PublicBalance/GDP(%)	-0.326	0.177	-1.840	0.082

Table 3.23b Regressing Quasi crisi by Logit (2)

(Ukrainian data set 01/1997-12/2001, only one regressor)

Variable	Coefficient	Std Error	t-value	t-prob
Constant	4.093	2.028	2.020	0.059
M2/GrossIntRes(%)	-0.011	0.005	-2.100	0.050

Table 24c Regressing Quasi crisi by Logit (2)

(Ukrainian data set 01/1997-12/2001, only one regressor)

Variable	Coefficient	Std Error	t-value	t-prob
Constant	6.070	3.144	1.930	0.069
Deposits/GDP(%)	-0.187	0.095	-1.980	0.064

Table 3.25d Regressing Quasi crisi by Logit (2)

(Ukrainian data set 01/1997-12/2001, only one regressor)

Variable	Coefficient	Std Error	t-value	t-prob
Constant	0.431	0.595	0.726	0.477
BankingResVariation(%)	-0.168	0.086	-1.950	0.068

Figures

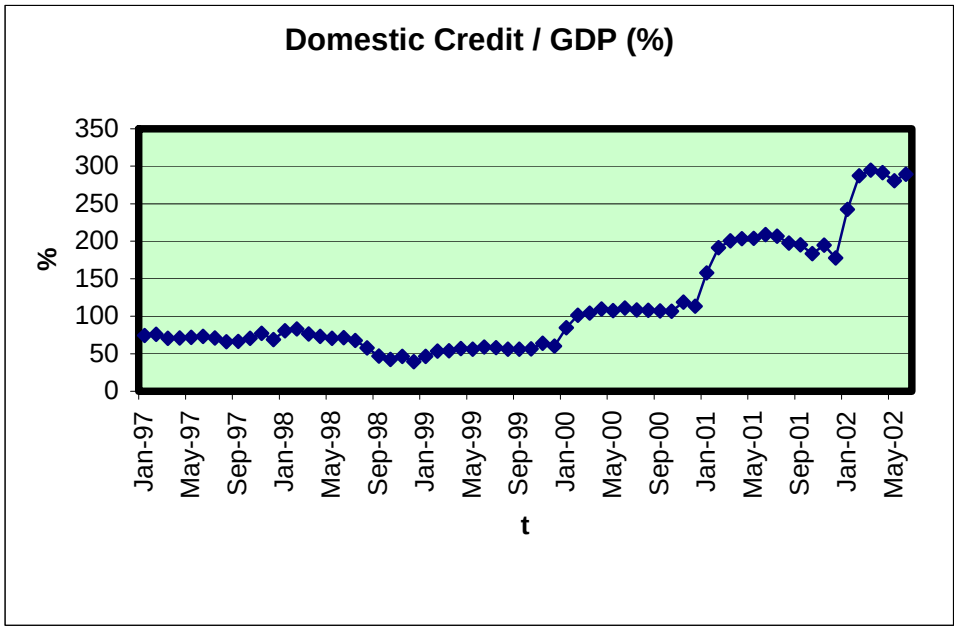

Figure 1 **Russian data set: Domestic Credit / GDP (%)**

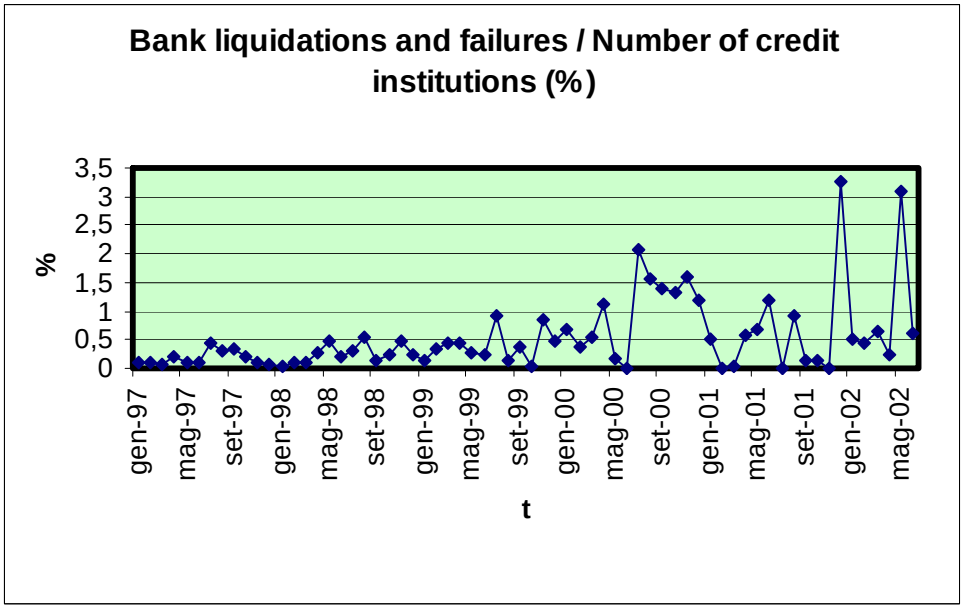

Figure 2 **Russian data set: Bank liquidations and failures / Number of credit institutions (%)**

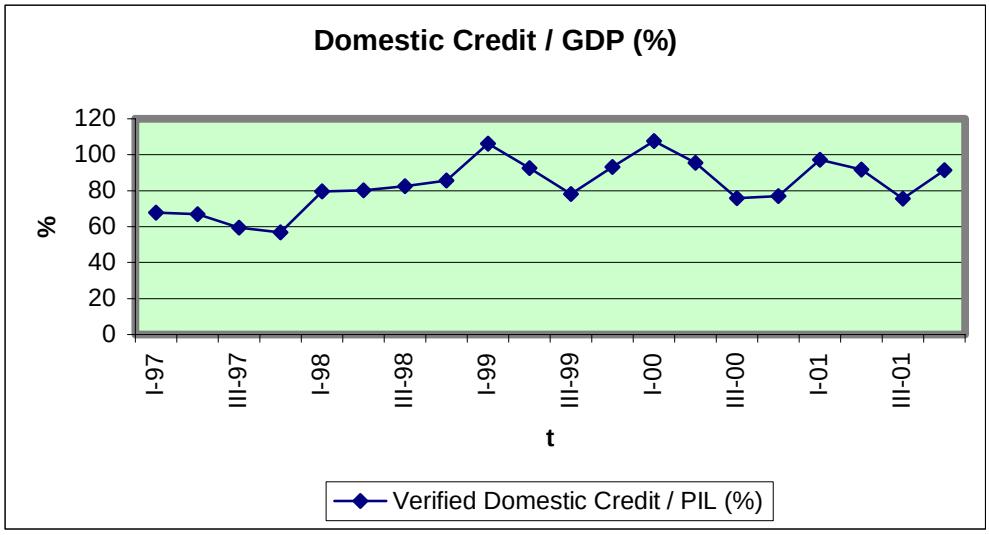

Figure 3 **Ukraina data set: Domestic Credit / GDP (%)**

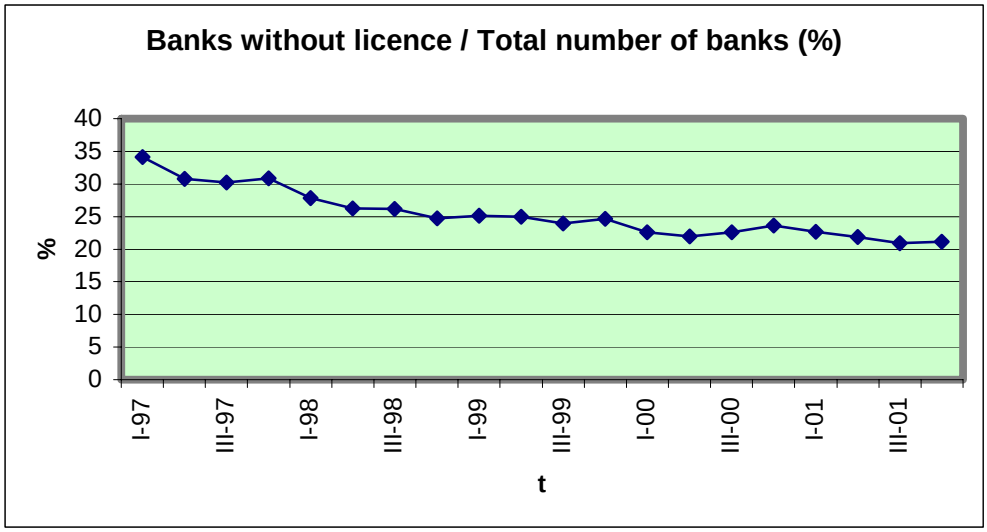

Figure 4 **Dataset Ucraina: Banche senza licenza / Totale banche (%)**

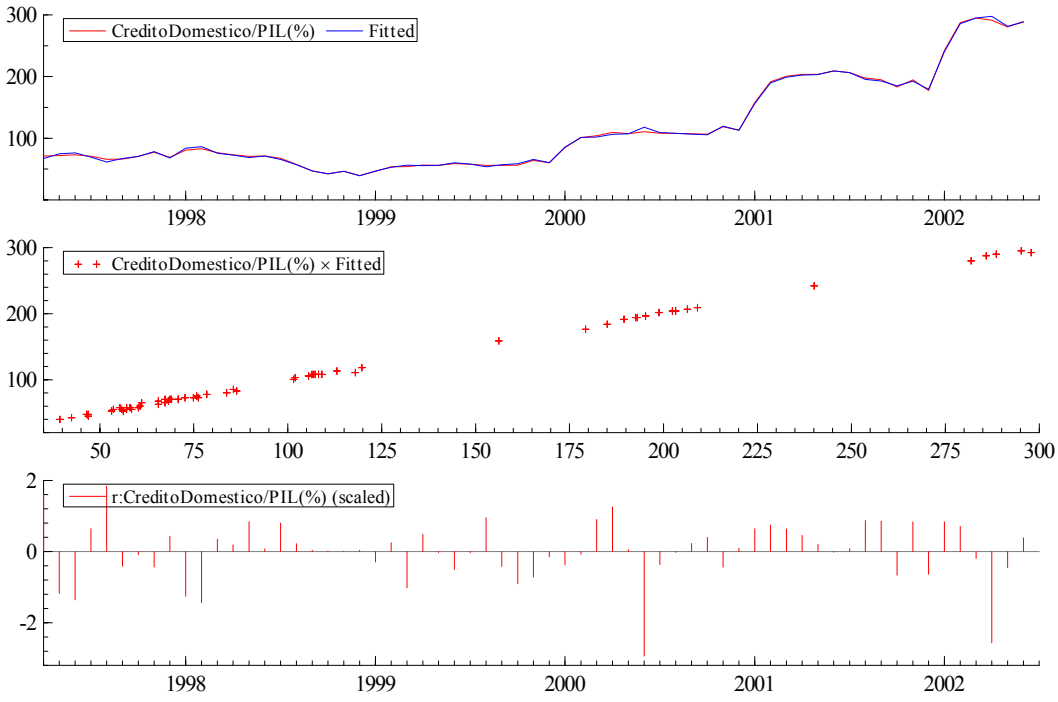

Figure 5 **Test on estimation fitting: regressing OLS(3) on Russian data set.**

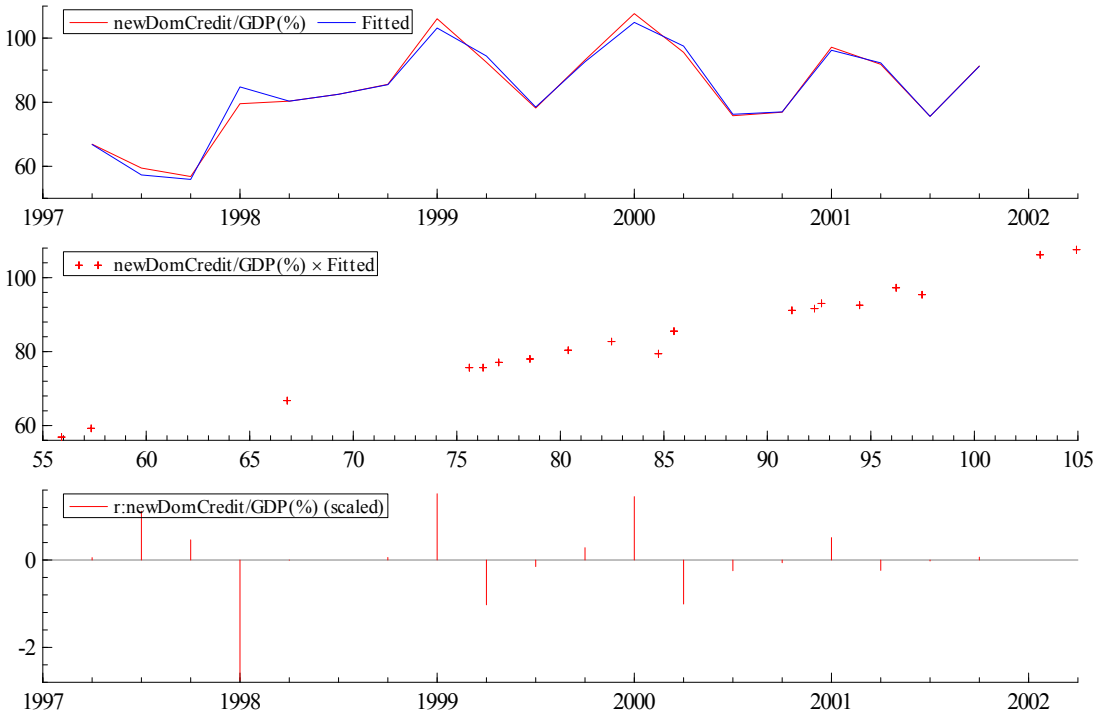

Figure 6 Test on estimation fitting: regressing OLS(2) on Ukrainian data set.