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*Access to Liquidity and Non-monetary Trade*

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## **Access to Liquidity and Non-monetary Trade**

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**Abstract:** This paper places non-monetary trade (NMT), a persistent growth of which in Russia in 1992-8 economists have struggled to explain, within the framework of the credit channel of the monetary policy. It shows that producers resorted to NMT responding to increases in the cost and unavailability of external funds. The paper traces the origin of structural breaks in the NMT trend and its transitory fluctuations to major shifts in state policy that affected financial markets and temporary shocks in the latter. It concludes that there is significant evidence supporting the existence of the credit channel in the Russian transition.

**JEL:** E6, G14, P2

**Keywords:** Non-monetary trade, credit rationing, Russia

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A spectacular growth and fall in the volume of Russia's non-monetary trade (NMT) during the transition from plan to market has caught many economists by surprise. In spite of numerous suggestions aimed at clarifying the issue, the development of NMT in Russia has remained a puzzle due to a number of reasons. Some researchers sought explanation in the logic of individual rational choice. They asserted that managers opted for NMT to maximize their share of firm's revenue at the expense of other claimants or to improve the bargaining position of the firm vis-à-vis suppliers and consumers. The trouble with this line of reasoning is that it goes contrary to empirical evidence. For example, the references to infringement of property rights of outsiders or informational asymmetries with regard to partners are essentially of static nature. Therefore, if such explanation were true, one would expect that NMT stood on particular levels. On the contrary, the Russia's NMT showed remarkable dynamics thus challenging researchers to spell out how, say, informational asymmetries might grow and fall steadily over time. Other researchers expected to find the answer by drawing parallels with the episodes of NMT in other countries, particularly in hyperinflationary environment. They noted that when inflation erodes the purchasing power of money, agents become increasingly unwilling to accept money as the means of payment. Since NMT offers an alternative, they concluded that Russians chose it to hedge against inflation. However, the Russia's NMT ballooned against the background of falling inflation, thus casting doubt on the role that inflation played in its promotion.

A promising explanation for the development of the Russia's NMT can be found in the burgeoning literature on the credit channel of monetary policy. Its general concept is rather uncontroversial. The idea is that troubles in financial markets affect

entrepreneurs who do not own sufficient funds to finance ongoing projects. As money becomes dear or impossible to obtain, the projects with low payoffs or benefits that cannot be pledged *ex ante* are cancelled triggering recession. The suggestion that entrepreneurs can avoid this outcome if they manage to compensate other claimants with non-monetary means of payment is a natural extension of the same proposition. Unfortunately, the profession has yet to decide on the existence of the credit channel of monetary policy, which means that the paper cannot take this proposition for granted.<sup>1</sup> Thus, presenting evidence that links NMT with monetary policy changes in a particular country, the paper pursues the dual objective of explaining the reason for the Russia's NMT through reference to the credit channel and contributing to the debate on its existence in general.

The paper uses two lines of argumentation. First, it identifies several structural breaks in the NMT series and links them to major political events that had repercussions in financial markets. In this respect, the paper is closely related to Bernanke (1983) who states that banking crises affect the real sector directly. Second, it shows that the transitory fluctuations in the producers' demand for money and unavailability of external funds are positively serially correlated with the short-run changes in the NMT series. This result is consistent with the proposition advanced by the supporters of the idea of microeconomic origin of credit rationing, e.g. Holmström and Tirole (2000). They say that, contrary to the Modigliani-Miller theorem, the source of financing matters if banking intermediation is imperfect. As firms experience an outflow of liquid funds and

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<sup>1</sup> In his influential book, Walsh (2003, p. 362) concludes that "skepticism still surrounds the existence, and importance, of the credit channel".

have to rely on expensive external financing, they choose either to cut production or, as in the Russian case, to resort to NMT.

The paper consists of six sections. It starts with a definition of NMT and moves to a rather agnostic consideration of theories and evidence that suggest why producers turn to NMT. The proposition that NMT and monetary trade are alternatives chosen to save on transaction costs is taken as the basis for statistical analysis that follows. Section 2 investigates the time pattern of the Russia's NMT and determines that it is time-stationary with a break. This result suggests that the NMT is an inertial development set in motion by structural changes in economic environment. Section 3 investigates institutional innovations associated with the break and explains how they affect the cost and availability of external finance. First, it shows that the default of 1998 made a lasting impact on the composition of money holdings. As the fraction of funds internal to enterprises grew as a result of import substitution caused by post-default currency depreciation, firms' limited access to external funds constrained them less and they returned to monetary trade. Second, the section finds that as the demand for domestic products picked up, trade turnover accelerated and producers needed less liquidity to maintain inventories. Section 4 determines that apart from the break associated with the default, the NMT series exhibits three more structural breaks. An investigation of causes for the breaks reveals a link between major political events and the dynamics of financial parameters. This is interpreted as further evidence that state policy changes affected the composition of liquid funds and trade turnover thus imposing constraints on the choice of trade. Section 5 shifts attention from structural to short-run dynamics in financial parameters and NMT. It shows that transitory fluctuations of the de-trended series of the

composition of money funds and trade turnover are positively serially correlated with the similarly de-trended NMT series. This result suggests that the link between NMT and the cost of and access to external funds goes beyond structural dependency. Section 6 reiterates the main steps in argumentation.

### **1. Non-monetary Trade: Theoretical Issues**

The concept of NMT should be carefully defined because often economists incorrectly associate it with spot barter. While spot barter comprises a part of NMT, various debt clearance schemes that do not involve money to complete transactions are used more commonly.<sup>2</sup> They take a number of forms. For example, trade partners locked along the same technological chain, say, a coal mine and electric plant, can find expedient to clear mutual debts through bookkeeping operations. Bills of exchange issued by large companies may circulate as the means of payments before they come to the issuer on maturity. In both instances traders do not need money to operate, which is the feature that distinguishes NMT from monetary trade.<sup>3</sup>

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<sup>2</sup> By all accounts, spot barter has not been the dominant part in the Russian NMT. For example, Commander and Mumssen (2000, Table 2.2) report that offsets and other types of trade – bills of exchange, etc. – accounted for around 60 percent of NMT in industrial sales and input purchases and up to 80-90 percent of non-monetary deals made with utility providers and tax authorities in 1998.

<sup>3</sup> The origin of the misperception that NMT is barter can be traced to textbooks on monetary economics, which, for didactic purposes, contrast money with barter explaining that money has evolved as a mechanism to overcome difficulties associated with the double coincidence of wants. Taken out of the context, this explanation leads to the conclusion that if agents do not use money in trade, they barter their wares.

Some economists believe that this view is counterfactual, e.g. see Dalton (1982). They assert that historically barter does not precede money but develops together with monetary trade. This line of reasoning implies that agents view two modes of trade as alternatives. Their choice depends not so much on the stage of historical process but the comparison of transaction costs that they entail. Under certain circumstances agents use NMT because it is the least costly, for example in hyperinflation. The resilience of barter clubs in developed market economies is consistent with this proposition. The report issued by International Reciprocal Trade Association, Chicago states that barter transactions amounted to \$ 7.8 billions in 2001 (see <http://www.irta.com/> → PR and Press Releases → “Commercial Barter Grows by Double Digits for Record Third Year”).

The ambiguity in the definition of NMT has been unfortunate. Being misled into thinking that barter is the only alternative to monetary trade, economic theorists have generally ignored inter-temporal NMT. For example, the search model of money by Kiyotaki and Wright (1993) considers the following choice that an agent faces. If she chooses to barter her products, the number of suitable partners becomes small. If she sells for cash, she incurs transaction costs associated with temporary holding of money. In this setting, the tradeoff takes the form of exchanging the probability of successful trading for the cost of keeping money funds. Although this model can be expanded to include credit arrangements, it leaves outside the difference between the costs of external and internal finance.<sup>4</sup> This gap in modeling makes it inappropriate for an empirical investigation that puts emphasis on the cost of financing.<sup>5</sup>

The fact that monetary theory is ambivalent with the respect to NMT may explain the abundance of hypotheses advanced by the researchers who have studied the Russia's NMT. Many of these explanations have been somewhat detached from empirical foundations and never tested.<sup>6</sup> Works that have generated empirical results fall in two major groups. The first emphasizes microeconomic considerations, apparently, reflecting the fact that cross-sectional data were first to appear. For example, Guriev and Kvasov (2000) suggest that oligopolists use NMT to discriminate in prices. They investigate if the

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<sup>4</sup> See, among others, Li (2001) who incorporates credit arrangements in the search model of money. Predictably, the availability of credit makes NMT a more appealing choice, thus indicating the link between the search model of money and Wicksellian model of pure credit.

<sup>5</sup> A more promising but insufficiently developed venue of investigation is suggested by Kocherlakota (1998). He shows that if a central agency records all transactions and clears them on completion instantaneously, no money is necessary for such an economy. The proposition that money saves on the costs of record keeping rationalizes on the aforementioned example that companies locked in long-term relationship use less money in mutual trade. The reason is that their record-keeping costs are low. The same argument applies to utility providers who need to record consumers' purchases on technical grounds.

<sup>6</sup> A reader can find a good summary of works on NMT in the transition economies in Seabright and Humphrey (2000).

Russia's NMT was more likely to occur in oligopolistic environment, which they approximate with the concentration ratio CR4, and find some statistical evidence that the CR4 and NMT are positively correlated. Guriev et al (2002) propose that indebted firms turn to NMT because they cannot obtain new credit. They find strong correlation between the Russian firms' reliance on NMT and their exposure to debts.<sup>7</sup> In both papers the authors control for firm's size, its export fraction in sales, regional location, and industrial affiliation, which are all found to have statistically significant coefficients. The other group of works aims at testing several hypotheses that are considered equally plausible *a priori*. The works by Carlin et al (2000), Marin et al (2000), and Commander et al (2002) explore such diverse reasons for NMT in various transition economies as inflation or tax avoidance, postponement of costly restructuring, and state subsidization. They arrive at a broadly similar conclusion that liquidity problems were responsible for NMT growth.<sup>8</sup>

The multitude of explanations for NMT that bear some sign of plausibility is frustrating. Yet, a careful examination of the obtained results shows that they are all compatible with a single proposition. Agents turn to NMT when monetary trade becomes more expensive or infeasible. The detected individual differences in the use of NMT correspond to various components of transaction costs associated with two types of trade. For example, a wider use of NMT by large firms may reflect their role as local clearinghouses, which their smaller customers use to complete transactions with one

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<sup>7</sup> This finding is unsurprising because, as the above discussion shows, debt arrangements figure prominently in NMT. Thus causality should be reversed: it is a growth in NMT that lead to an increase in debt. There might be two-way causality after the default of 1998 when some firms retired their otherwise unrecoverable old debt through return deliveries as Granger causality tests performed by the author have shown.

<sup>8</sup> The work by Brana and Maurel (1999) does not belong to either group. It sets a research agenda similar to this paper's studying the long-term relationship between the Russia's NMT and monetary parameters. Its conclusions are broadly compatible with the results obtained here. Unfortunately, their paper did not address several important questions.



another.<sup>9</sup> Since this additional benefit lowers the cost of trade credit that large firms obtain, they rely on NMT more extensively. The finding that some regions are more exposed to NMT than average can be a sign of credit rationing that enterprises located in depressed regions, such as coal mining Kemerovo *oblast*, or independent minded national republics of Bashkortostan and Tatarstan, faced.<sup>10</sup> Then, stricter requirements for credit eligibility are responsible for regional differences in the use of NMT.<sup>11</sup> The fact that exporters or producers of consumables used NMT less can be interpreted as an indication of their lesser need for external financing because their customers, foreigners and households, paid normally in cash.<sup>12</sup> These and other examples are consistent with the proposition advanced in this paper, which is that growing cost and unavailability of financial credit pushed producers towards NMT. Let us turn now to discussion the problem with the firm's liquidity and how it is solved in general.

Suppose a firm has sufficient capital, or sunken investment, to undertake a particular project that generates a strictly positive expected return. Further, assume that it takes time before the project is completed and that the firm uses labor and other non-

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<sup>9</sup> For example, large companies may issue bills of exchange that circulate within the area providing lacking liquidity for small, credit-constrained consumers.

<sup>10</sup> All three regions had larger than average exposure to NMT according to author's observations. This proposition is congruent with the view expressed in Woodruff (1999). He considers the Russia's NMT to be a consequence of political struggle between center and periphery for control of local resources. When the center cut on subsidies to rebellious regions, they responded with greater reliance on NMT, particularly collecting taxes in kind.

<sup>11</sup> OECD Economic Survey of the Russian Federation (Chapter 3, 1999-2000, Paris) suggests that it is local patronage that explains inter-regional differences. The idea is that since local taxes are easier to collect in-kind, the logic of tax competition between local and central governments prompts the former to stimulate NMT. Both Marin et al (2000) and Commander et al (2002) have found weak evidence that firms are pressured by local authorities to use NMT.

<sup>12</sup> The finding that the concentration ratio is positively correlated with NMT is somewhat inconsistent with the liquidity theory of NMT. However, this result can occur because of model misspecification. Since dummies for sectoral affiliation and sectoral CR4 index represent the same information, in actual calculation they should be distinguished by applying them to different sectors. Then CR4 index may catch inter-sectoral differences in the exposure to NMT that are irrelevant to oligopolistic power. For example, utility providers belong to oligopolistic sectors. Yet, they might have more exposure to NMT in Russia because they were better suited to conduct clearing operations and not because they

storable inputs during this period. Let the benefit of the project cannot be pledged *ex ante* due to, say, time inconsistency. Then, other claimants such as workers and suppliers request compensation *before* the project is completed. This explains why firms need liquid funds to operate. The total value of the claims that the firm pays before it realizes its benefit determines the amount of liquid funds that it needs either amass in advance or procure from external sources. The choice between two sources of financing matters because external funds are more costly due to several reasons. First, often the entrepreneur cannot commit *ex ante* to undertake the agreed project and creditors worry that loans will be diverted. Second, even he can, it is possible that the project will not generate the expected benefit due to individual riskiness. Third, supposedly secure projects can fail because market conditions change before the project has been finished. Each of the above considerations explains why creditors charge a risk premium thus making external funds more expensive than internal financing.

As the expected riskiness of the project increases in general, creditors raise the risk premium. This increase is not necessarily reflected in a higher interest rate. Stiglitz and Weiss (1981) show that it is irrational to raise the risk premium forever because a systemic growth in the cost of external finance adversely affects the pool of loan applicants that becomes increasingly populated with dishonest or risky clients. As creditors realize that they may not get the principal back if interest rate increases further, they keep it below the equilibrium level. As demand for loans exceeds its supply the creditors discriminate among applicants by severing contractual obligations such as requesting high collateral.<sup>13</sup> This situation is representative of credit rationing.

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discriminated among customers.

<sup>13</sup> See Stiglitz and Weiss (1981) for formal modeling of the credit rationing.

On the demand side, if the cost of external financing keeps growing, firms respond in a number of ways. They cut on projects with lower positive return thus triggering a recession.<sup>14</sup> The firms change the composition of projects favoring undertakings with a shorter production cycle. Finally, if renegotiations with other claimants are possible, the firms retain the projects in which workers, suppliers, or tax authorities are more likely to accept non-monetary means of payment.<sup>15</sup> The last consideration suggests a link between the cost and availability of external funds and the choice of trade. This is the topic that the present paper explores.

## 2. The Russia's Non-monetary Trade: Econometric Issues

The main data set used in the paper is the NMT series constructed by the Russian Economic Barometer (REB). It is shown on Figure 1.<sup>16</sup>

The preceding discussion has led to the proposition that producers turn to NMT when monetary trade becomes more expensive or infeasible. If this hypothesis is true, the presented series and some, yet undetermined, indicator(s) of the cost and availability of external funds should be serially correlated. However, it is technically incorrect to proceed with statistical analysis of the NMT series by the means of OLS regression. The problem is the series shown on Figure 1 is likely to be non-stationary. Then, its analysis

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<sup>14</sup> The last consideration is explored in Holmström and Tirole (1998). They claim that under certain circumstances public supply of liquidity increases social welfare. Their insight explains why the infusion of credit after the default of 1998 was more beneficial to the Russian economy than many expected.

<sup>15</sup> The paper ignores the possibility that Russian producers learned a trick that made money unnecessary in trade as counterfactual. If they did, they would not abandon NMT after 1998 *en masse*.

<sup>16</sup> REB is a laboratory associated with the Institute of World Economy and International Relationships (IMEMO) in Moscow. It has collected monthly data on the fraction of NMT in total sales since February 1992, one month after trade and prices were liberalized, up to now. REB sends a monthly survey to about 500 mainly established industrial firms receiving around 200 responses on average. The responses are aggregated and a simple average for the fraction of NMT in total sales is published. More information about REB is presented at the website <http://www.imemo.ru/barom/>.

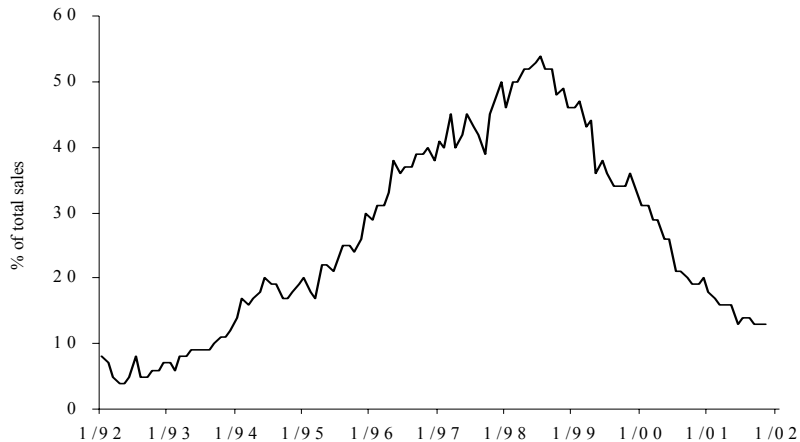


Figure 1: Fraction of non-monetary trade in total sales, average sample size is around 200. Sources: Woodruff (1999), Fig. 4, p. 148] for 1992; *Russian Economic Trends Quarterly* (1q-1998, fig. 32, p. 5) for 1993-September 1997 and (2q-2002, Table 46, p. 243 and Fig. 48, p. 246) for December 2000-December 2001; and Gara, Mario (2001). “The Emergence of Non-monetary Means of Payment in the Russian Economy”, *Post-Communist Economies*, 13, 1: 5-39, Table 5 for October 1997-November 2000.

may generate spurious results.<sup>17</sup> To prevent this from happening, one needs either to difference the series until it becomes stationary, or to transform it using the method of cointegration. Since the last option provides richer opportunities for research, it should be explored first. A brief explanation of the method of cointegration is in order. The term ‘cointegration’ is coined by Engle and Granger (1987). They respond to the critique that differencing, that time series analysts routinely use to solve the problem of non-stationarity, erases important information. Engle and Granger claim that if two non-stationary variables trend together, their relationship is potentially of long-run character. Thus a combination of two can be stationary and, as such, introduced in econometric

specification along with other, stationary, variables. Then, a researcher can proceed with a regular OLS regression without worrying that the obtained results are spurious.<sup>18</sup>

Let us check the NMT series for non-stationarity. Its presence is commonly detected using the augmented Dickey-Fuller (ADF) test that is suitable for autoregressive (AR) processes often present in time series. The test is based on the regression of the form

$$\Delta y_t = \alpha + \beta_0 t + (\rho - 1)y_{t-1} + \sum_{z=1}^p \beta_z \Delta y_{t-z} + e_t \quad (1)$$

where  $\Delta y_t$  is the first difference in  $y_t$ ,  $\Delta y_{t-j}$  is the  $j$ -th difference in  $y_{t-1}$ ,  $t$  stands for time trend, and  $p$  is the number of lags for AR ( $p$ ) process. The null hypothesis is  $\rho = 1$ , which means that  $y_t$  is non-stationary, against the alternative  $\rho < 1$  that indicates that  $y_t$  is stationary.

Equation (1) is not operational until the number of lags  $p$  is determined. Several studies suggest that the sequential *general to specific rule*, as described in Hall (1994), is superior to other alternatives.<sup>19</sup> Hall recommends starting with an arbitrary large  $p$ , to test for significance of the last coefficient, and to reduce  $p$  iteratively until the first significant statistics is encountered. Starting with  $p_{max} = 15$  the paper finds that the last coefficient is

<sup>17</sup> If a non-stationarity variable is present in the model, such statistics as  $t$ ,  $R^2$  and  $F$ -statistics do not retain their traditional characteristics and cannot be used in statistical inference.

<sup>18</sup> In practice, to determine if variables are cointegrated, one needs to address a number of issues. First, the variables should be tested on stationarity. If the dependent variable is found to be stationary, it can be used in levels. If it is non-stationary, both dependent and proposed explanatory variables are tested on the order of integration, which is the number of differences that one takes to make series stationary. If the dependent and explanatory variables are of the same order, the next step is to run a cointegrating regression to find if there exists a combination of two that is stationary. If tests show that there is, this combination is included as an error-correction term in the final econometric specification that is analyzed by the means of regular OLS regression.

<sup>19</sup> See Maddala and Kim (1998, p. 78).

significant when  $p = 6$ . All three statistics that are used to test for unit-root indicate that the null hypothesis of non-stationarity cannot be rejected at a 10 percent level.<sup>20</sup>

The results of the ADF test should not be relied upon blindly because the test has several shortcomings. The most relevant to the present study is the critique mounted by Perron (1989). He argues that the ADF test does not account for the possibility of a structural break and recommends including in equation (1) dummies that represent changes in intercept or time trend or both. His specification is of the form

$$\Delta y_t = \alpha + \beta_0 t + D(\tilde{\alpha} + \tilde{\beta}_0 t) + (\rho - 1)y_{t-1} + \sum_{z=1}^6 \beta_z \Delta y_{t-z} + e_t \quad (2)$$

where  $D$  is a dummy variable associated with the break. Perron is not specific about how to detect the timing of the break assuming that it should be obvious. A visual examination of Figure 1 shows that the default of August 1998 had a significant effect on the NMT trend and, hence, can be considered as the prime candidate for a structural break if any. The results of all three statistics of the OLS regression of equation (2) reject the null hypothesis that the series is non-stationary at the level of 1 percent. The break is detected in both intercept and time trend.<sup>21</sup>

The results of the Perron's test are significant. First, trend-stationarity of the NMT series precludes its cointegration. Thus searching for a stable long-run causal relationship, à la Engle and Granger, appears to be fruitless. Second, the stability of the time trend shown by the NMT prior and after the default attracts attention to pre- and

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<sup>20</sup> They are  $t$ -test,  $F$ -test, and  $K$ -test. The first two tests are regular and need not be introduced. It suffices to say that  $F$ -test checks the null hypothesis that coefficients  $\beta_0$  and  $(\rho - 1)$  are jointly zero.  $K$ -test is specific. It checks if  $(\rho - 1)$  is found to be zero because observations are autocorrelated of the order of  $p$ . The results of the tests are  $-1.276$ ,  $1.627$ , and  $-3.956$  while their critical values at 10 percent for 100 observations are  $-3.15$ ,  $5.47$ , and  $-17.5$  respectively. Critical values for the tests are taken from Hamilton (1994), Tables B5-7.

<sup>21</sup> The results of  $t$ -test,  $F$ -test, and  $K$ -test are  $-7.625$ ,  $53.72$ , and  $-127.7$  while their critical values at

post-default institutional arrangements that are likely to influence NMT for a significant period of time. Finally, the results suggest that if the main hypothesis advanced in this paper is correct, the default somehow affected the cost and availability of external funds. These considerations indicate that causes for the NMT can be hidden in institutional changes that happened around August 1998. They should be explored.

### **3. The Post-default Institutional Changes and NMT in Russia**

Let us restate the working hypothesis advanced in this paper: NMT develops when the cost and availability of external funds become a problem. If it is true, the fact that the Russia's NMT reversed its trend after the default suggests that monetary trade became cheaper or feasible after 1998. Let us consider the chronology of events to discover how the cost and availability of external funds might be affected by the default.

The inability of the Federal Government to serve its debt is the immediate cause of the default.<sup>22</sup> It did not happen because the government experienced a sudden drop in its revenue or had to spend more due to some unforeseen contingencies. Both the federal revenue and expenditure stayed about the same. What the government failed to accomplish was to follow through with its debt management plan. It could neither raise the expected amount of funds at domestic or foreign financial markets nor reschedule the payment of matured debts. The fact that lenders refused to roll over state debts suggests that the market for government bonds was satiated. In fact, as may be seen on Figure 2, the fraction of state debts in the loan portfolio of domestic banks crossed the 40 percent

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1 percent for 100 observations are  $-4.8$ ,  $8.73$ , and  $-43.6$  respectively. Critical values for the tests are taken from Perron (1989, Tables VI A-B) for  $t$ -test and  $K$ -test and Hamilton (1994, Table B7) for  $F$ -test.

<sup>22</sup> Some economists argued that the default was accidental and could be avoided if circumstances were more favorable (author's private correspondence with economists working in international financial

level in November 1996 and hovered around this mark for almost two years. Could the collapse of the market for state debt make monetary trade cheaper?

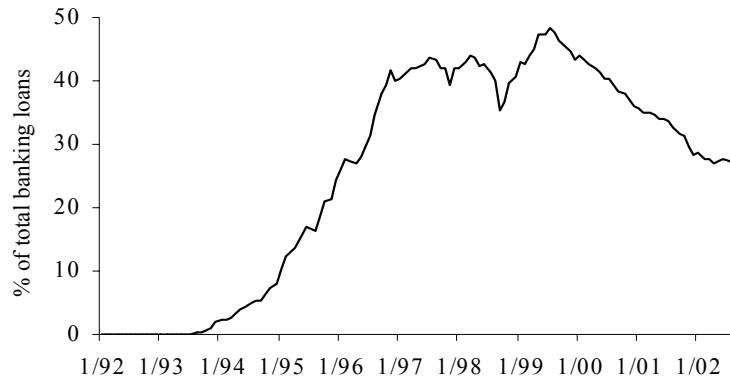


Figure 2: Fraction of government bonds in the total loan portfolio of the domestic banking system, in percent. Sources: Share of state securities in total banking loan portfolio is found as the ratio of loans extended to the government to the sum of loans extended to government and public and private enterprises by commercial banking system. Data are for May – November 1993 from RET (2002), series 461: outstanding stock of GKO-OFZ adjusted to match data for December 1993; for December 1993 – March 1995 from IMF (1996) quarterly data, interpolated in between; and from June 1995 on from CBR (2002).

Yes, by two counts. First, when the demand of the Russian government for loans was high, it crowded out private investments, and the real interest rate went up. After the default the government was denied access to credit markets, which effectively experienced a fall in the aggregate demand. Correspondingly, as Figure 3b attests, the real interest rate decreased and producers could borrow money at lesser cost. Second, the post-default government had to bring its monetary and fiscal policies in conformance with new realities. It restructured state debts to failed banks, extended necessary credit to

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organizations). Yet, such *ex post* rationalization does not reject the fact that the liquidity of the Federal Government was dangerously low.



large banks, cleared mutual debts between taxpayers and state agencies, and moved to balance the federal budget. These actions resulted, in due time, in a real growth in money supply visible on Figure 3a.<sup>23</sup>

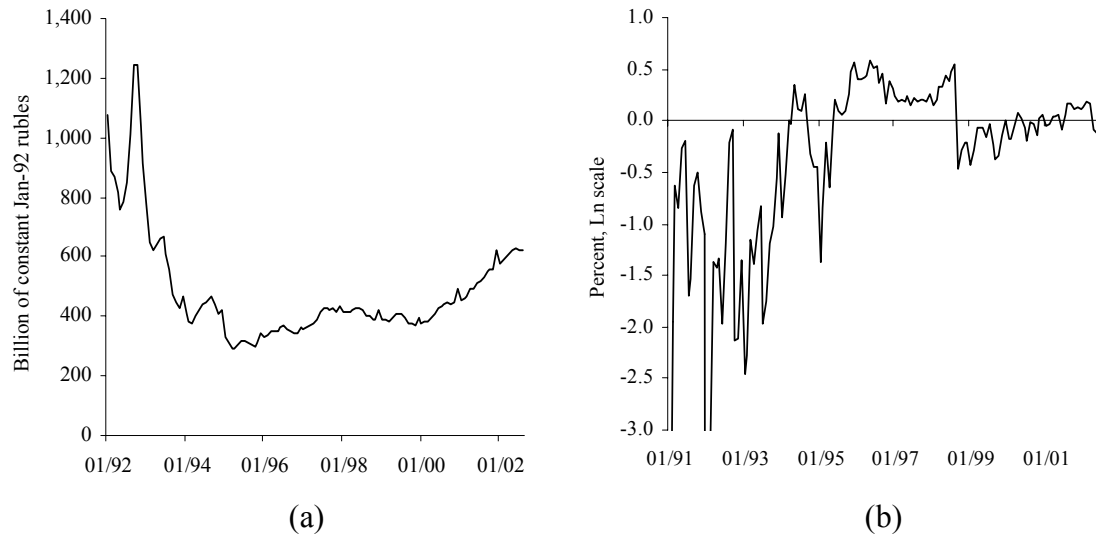


Figure 3: real M2 aggregate (a) and annual real interest rate on commercial loans (b); both deflated by industrial PPI. Sources: RET (2002), series 488: M2 after December 1996 and, for 1992-6, the difference between series 639: M2X including foreign deposits and 640: foreign deposits; series 372: industrial PPI. Real interest rate: Found according to the formula  $r_t = \text{Ln} [(1 + i_t)/(PPI_t/PPI_{t-1})^{12}]$ , where  $i_t$  is the average nominal annual interest rate on commercial loans extended to up to one year and  $PPI_t$  is the producer price index for month  $t$ .  $i_t$  for 1991 is taken from IET (1991), Table 16; for 1992 – from RET (1993-1), Table 7; for 1993 – from IET (1993), Figure 5; for 1994-5 – from RET (1996-1), Table 23; for later period – CBR (2002).

<sup>23</sup> A post-default increase in the fraction of government loans kept by domestic banking system is an artifact. The government restructured payments to commercial banks on its frozen obligations the total sum of which grew. Simultaneously, the Central Bank of Russia (CBR) extended credit to the same banks under effective collateral of their loans to the government. This conjecture can be deduced from the dynamics of two indicators. The CBR's net credit to banks (in real terms) grew steeply after the default and fell rapidly after September 1999. The fraction of government loans in banking loan portfolio grew after the default fell after August 1999.

One might speculate why a higher money supply was not countered with a similar increase in prices. Possibly, the fact that the government restructured and not monetized its debt and moved to boost its holding of international reserves lent credibility to its new policy. This argument is consistent with that of Sargent (1986).

The other consequence of the default was that the established composition of money holdings was upset. According to the Arrow-Debreu model, who owns liquid funds does not matter. However, this theoretical proposition is valid only if financial markets are perfectly integrated, that is when savers move funds to borrowers at no cost. Only then money finds its optimal employment automatically. When the markets are fragmented, the cost of financial intermediation is significant and the structure of savers and borrowers starts to matter. One problem lies in the inherent riskiness of lending discussed above. When the expected risk of default increases, external lenders charge a higher risk premium or refuse to extend uncollateralized loans altogether. The other problem is the existence of institutional barriers to lending. For example, pension funds are required to keep a large portion of their assets in low-risk securities, say government bonds. If, for some reason, savers move deposits from commercial banks to pension funds, private borrowers discover that the supply of loans has dried up. In both instances credit is rationed according to the definition provided in Stiglitz and Weiss (1981).<sup>24</sup>

The proposition that financial markets were fragmented in the Russian transition is uncontroversial. There was no commercial banking system in the USSR whose banks were little more than accounting establishments double-checking enterprises' compliance with the state plans. When such banks were relieved of control functions, they had no expertise in operating with household deposits. Newly established banks, that were mostly organized to serve trade operations, had no interest working with small savers either. The latter traditionally kept savings at the *Sberbank* (State Saving Bank), which

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<sup>24</sup> They define that credit is rationed when "... there are identifiable groups of individuals ... who, with a given supply of credit, are unable to obtain loans at any rate, even though with a larger supply of

was a special institution that was required by the banking regulations to keep a significant part of its assets in state securities. Thus a steady growth in the fraction of money funds held by households prior to the default amounted to an effective drop in commercial credit supply. More important, when the composition of money holdings as shown on Figure 4 shifted in favor of households, the amount of internal funds available to producers shrank. After 1998 producers controlled a larger fraction of money funds and needed to borrow less.<sup>25</sup> Correspondingly, the problems associated credit rationing became less severe.

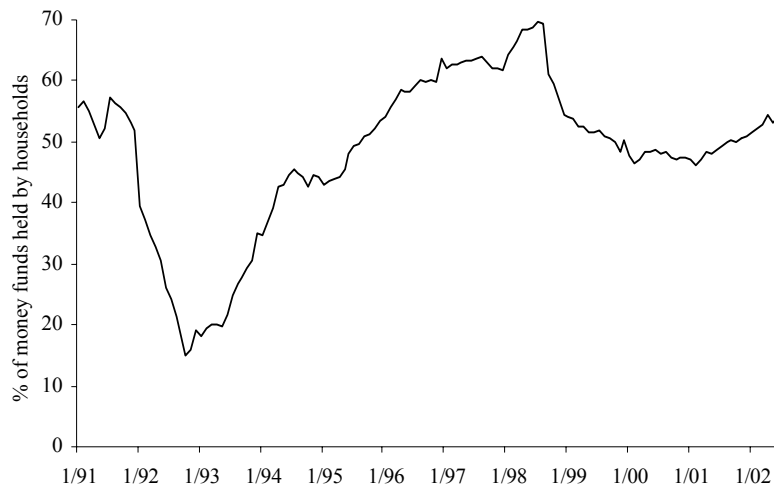


Figure 4: Fraction of household money holdings in the total amount of money in circulation, cash and deposits, in percent. Sources: Fraction of cash and deposits in domestic and foreign currency held by households (HH) in broad M2 aggregate including deposits in foreign currency. Data on money holdings by households is reported in RET (2002), series 200: HH cash holdings, 201: HH deposits at *Sberbank*, 202: HH deposits at commercial banks, 204: HH deposits in foreign currency, and 639: broad money aggregate M2X.

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credit, they would” (1981, p. 395).

<sup>25</sup> Partially, it happened because household deposits, kept in failed banks, were frozen in illiquid state obligations and depreciated after the inflation picked up in the end of 1998. At the same time the

Third, the default affected the demand for domestic goods. As the market exchange rate rose from 6.24 Rbl/\$ at the end of July 1998 to 20.84 Rbl/\$ five months later, massive import substitution took place.<sup>26</sup> Trade turnover accelerated, the stock of accumulated inventories dwindled, and producers needed less working capital for its maintenance.<sup>27</sup> Figure 5 demonstrates how the ratio of inventories held by retailers to industrial output changed over time.

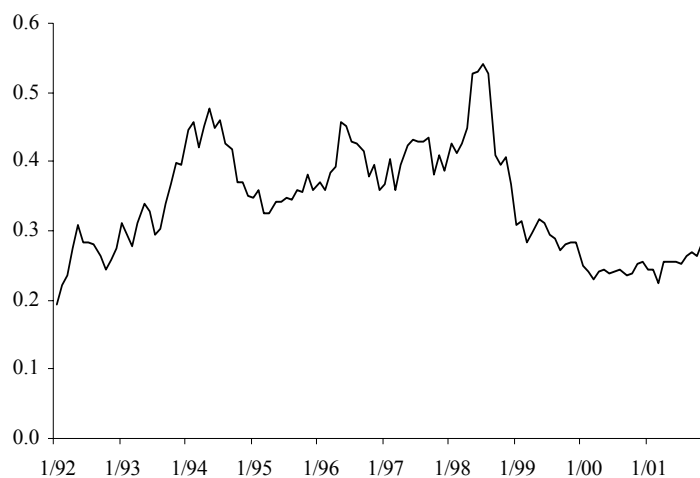


Figure 5: Ratio of the value of inventories kept at registered retail establishments at the end of month to monthly industrial output. Sources: RET (2002), series 186: stocks of consumer goods in registered retail trade and 275: industrial output at current prices.

#### 4. Other Structural Changes in NMT and Monetary Indicators

The preceding discussion shows that the investigation of the institutional changes initiated by the default of 1998 has been fruitful. In particular, it has revealed a structural

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government extended targeted new credit with the aim of providing financial relief to enterprises.

<sup>26</sup> See RET (2002), series 516: simple average monthly exchange rate at the Moscow International Currency Exchange.

<sup>27</sup> Effectively, this development amounted to the shortening of projects' completion period

link between NMT and producers' access to money funds. Let us continue this line of research and look for other potential structural breaks in the NMT series and, if there are any, to explore institutional changes associated with these periods. The first step is to de-trend the series thus removing the effect of the default. The regression of the NMT series on intercept, time parameter, and dummies associated with the break of August 1998 produces the following results

$$NMT_t = -1.66 + 0.66t + D_{98}(137 - 1.73t) + e_t \quad (3)$$

(0.63) (0.01) (3.87)(0.04)

where  $D_{98} = 0$  until and including August 1998 and 1 – afterwards and the numbers in parentheses are standard errors. If the NMT series has a single structural break of August 1998, residuals  $e_t$  should not exhibit time trends.<sup>28</sup> Figure 6 presents the graph of the NMT residuals.

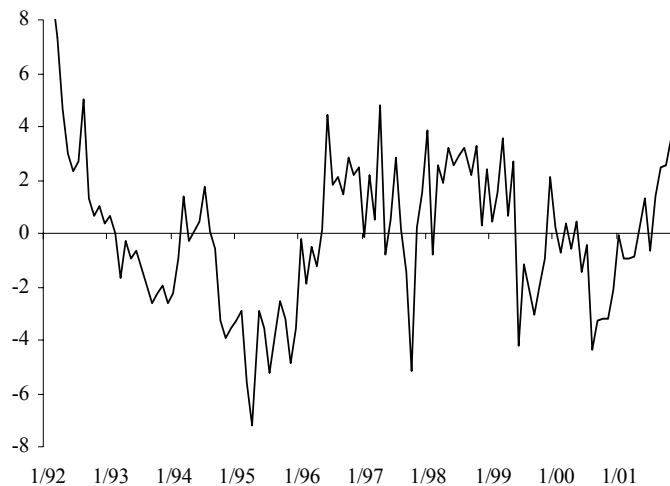


Figure 6: the NMT error term from equation (3). Source: author's calculations

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discussed above. Konstantin Loukine has suggested this point.

<sup>28</sup> It has been determined in Section 2 that the NMT series is trend-stationary. However, the condition of stationarity for the whole period does not preclude the existence of structural breaks for shorter intervals.

A visual investigation of the graph reveals several trends thus questioning the stability of specification presented by equation (3). Since timing of the breaks is unknown, a CUSUM test for its stability is appropriate.<sup>29</sup> The test requires separating a sample into two sub-samples and running an OLS regression of the specification to be tested on the first sub-sample. Obtained estimates of coefficients are used to forecast estimates of the dependent variable. The forecast values are checked against actual observations of the second sub-sample. If the forecast errors are persistently high, the stability of the model becomes questionable. The CUSUM test reveals three structural breaks for the model of the form

$$NMT_t = \alpha + \beta t + e_t \quad (4)$$

Two of them correspond to major political changes in Russia: President Eltzin's re-election in July 1996 and the end of the coalition government of Prime Minister Primakov in May 1999. The third break occurred between February and June 1994 when the real interest rate moved into positive territory after monetary authority tightened money supply and fiscal authority stopped borrowing from the Central Bank of Russia (CBR).<sup>30</sup>

Political upheavals are not a part of the story up to now. Theoretically, they are coincidental to NMT. However, what happens in political sphere may affect monetary markets that, in its turn, influence producers' choice of trade. Let us check if the series associated with the cost of and access to external funds and NMT have the breaks at the

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<sup>29</sup> In this case it is the test of the cumulative sums of the residuals. The paper employs the test as it is described in Greene (1990, p. 225).

<sup>30</sup> See Memorandum of Understanding between the Federal Government and CBR was signed in May of 1993. Its true implementation started in the end of 1993 and was completed before January 1995.

same time. Since the timing for the breaks is defined, the regular Chow test can be used.

Consider that a series  $y_t$  trends in time and its trend changes over the period or

$$y_t = \alpha_0 + \beta_0 t + \sum_{z \in Z} D_z (\alpha_z + \beta_z t) + \varepsilon_t \quad (5)$$

where  $Z$  is equal to the number of breaks, four in this case, and  $D_z$  is a dummy associated with break  $z$ . If  $y$  has a break at  $z$ , omitting  $D_z$  results in a significant loss of the goodness-of-fit, which is detected by  $F$ -statistics. The results of  $F$ -tests for the existence of individual breaks for several series are presented in Table 1.<sup>31</sup>

Break	$y$ : Households ' fraction in M2	$y$ : Ratio of retail inventories to industrial output	$y$ : Government debt in total banking loans	$y$ : NMT
$D = 1$ after February 1994 and $D = 0$ before	<b>24.211</b>	<b>24.363</b>	<b>223.806</b>	<b>12.806</b>
$D = 1$ after June 1996 and $D = 0$ before	2.826	<b>13.087</b>	<b>218.485</b>	<b>5.632</b>
$D = 1$ after August 1998 and $D = 0$ before	<b>26.572</b>	<b>35.982</b>	<b>34.842</b>	<b>39.410</b>
$D = 1$ after May 1999 and $D = 0$ before	<b>6.698</b>	<b>12.219</b>	<b>134.725</b>	<b>10.920</b>
<i>Memo: Critical value: <math>F(2, 109)</math> at 1 percent</i>	4.82			

Table 1:  $F$ -statistics for the test of structural breaks. Values significant at 1 percent are in bold. Source: author's calculations

The obtained results show that the series associated with easiness of external financing and the NMT series exhibit breaks at the same time. This finding supports the proposition that changes in the time trend displayed by NMT were reactions to structural changes in financial markets that, in its turn, were caused by major political innovations. Let us consider how policy regime changes have influenced external finance in each particular case. The first break, identified by February 1994, coincided with a major drop

<sup>31</sup> Parameters for the  $F$ -test are equal to:  $J = 2$ ,  $T = 119$ , and  $K = 10$ . The series under

in the inflation rate.<sup>32</sup> Given a downward price stickiness or, alternatively, persistent inflationary expectations of suppliers, market prices stayed above equilibrium level. Consumer demand fell while inventories accumulated relative to output as shown on Figure 5. As inventories grew, producers needed more liquid funds for their maintenance but their increased demand for money was not satisfied. Another development took place in the market for bank deposits. The fraction of deposits that households kept at commercial banks peaked in February 1994. After several bank panics during this time, households gradually shifted deposits to a safer, insured by the state, *Sberbank*. The latter kept assets predominantly in government securities in conformance with existing regulations.<sup>33</sup> This change in the saving behavior of households resulted in effective contraction of credit supply available to private borrowers. These two considerations explain why the NMT growth accelerated after February 1994.

The second break, associated with the presidential election of 1996, affected the market for government securities. The failure of the communist challenger to win the elections raised expectations of political stability. Subsequently, the federal government became able to borrow abroad. The effective supply of loans increased and the real interest rate dropped as one can see on Figure 3b.<sup>34</sup> As external funds became more available, the growth in NMT decelerated. The third break represents the regime change that took place after the Primakov's government resigned in May 1999. The new

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consideration are trend-stationary as shown in the next section. So,  $F$ -test generates unbiased results.

<sup>32</sup> A tighter monetary policy of the CBR is largely responsible for the drop in inflation rate. The CBR raised the refinancing rate on loans extended to commercial banks above the inflation rate for the first time in the end of 1993.

<sup>33</sup> See series 201 and 202 of RET (2002) on households' deposits kept at both types of banks.

<sup>34</sup> Potentially, the opportunity to borrow abroad was the lifeline thrown to the Federal Government of that time by international organizations. The effective reserve ratio, which is the ratio of reserves to deposits kept by commercial banks, reached its lowest point in May 1996. Further lending to the government was likely to endanger the liquidity of the commercial banking system that headed to imminent



government reversed the policy of easy credit that was aimed at clearing mutual arrears and the real interest rate started to grow thus making external funding more expensive. Households weathered the storm and their share of money holdings increased once more. Finally, trade turnover stopped accelerating indicating that a boom prompted by steep currency depreciation was over. As inventories accumulated, producers needed more funds for their maintenance. All these developments increased the cost and made external funds less available. Producers responded by slowing the rate of decline in NMT.

### **5. Explaining Transitory Fluctuations in NMT**

The previous sections have presented evidence supporting the proposition that Russia's NMT has been caused by structural changes that took place in financial markets. The paper has found that the cost and availability of external funds changed structurally at the same points in time as for the NMT series.<sup>35</sup> It has concluded that political innovations were responsible for these developments. However, the paper has provided no reason for distinguishing between long- and short-term effects that perturbations in financial markets make on producers' choice of trade. This section shows that the same indicators as above can explain transitory fluctuations in the NMT series as well.

To explore temporary shocks, a researcher needs to distinguish between trends and fluctuations. To separate one from the other one can either difference a series until it becomes stationary or remove its time trend. The second method is preferable because it

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financial crash.

<sup>35</sup> Certainly, the proposed importance of financial intermediation to trade is based on the assumption that producers rely on borrowed funds to transact. This assumption is generally considered to be uncontroversial. Normally, producers keep low money balances.

In the Russian case there might be a twist in this story. Tax authorities, as punishment for tax arrears, blocked many enterprises' bank accounts (up to 80 percent by some estimates). This constraint became less binding after the default when the government restructured tax obligations for many taxpayers.

has been already used in this paper.<sup>36</sup> The explanatory series are, in fact, trend-stationary as all three statistics of the Perron's test reported in Table 2 show.

	<i>t</i> -test	<i>K</i> -test	<i>F</i> -test
Fraction of M2 held by households (M2HH)	-5.50	-51.26	29.70
Ratio of retail inventories to industrial output (MT)	-8.37	-104.51	68.75
<i>Critical values at 1%, 100 observations</i>	-4.8	-43.6	8.73

Table 2: Results of the Perron's test of trend-stationarity. Source: OLS regressions of equation (2). Author's calculations

Note that the transformation of variables does not affect their relationship if the accepted form of linear specification is correct. Running regression

$$N\hat{M}T_t = \beta_5 M2\hat{H}H_t + \beta_6 \hat{T}rade_t + \hat{\omega}_t \quad (6)$$

where the hat sign denotes the error terms obtained with equation (5) generates the same results as regression that uses the original data of the form

$$NMT_t = \alpha_0 + \beta_0 t + \sum_{j=1}^4 D_j (\alpha_j + \beta_j t) + \beta_5 M2HH_t + \beta_6 Trade_t + \omega_t \quad (6a)$$

where the coefficients  $\alpha$ 's and  $\beta$ 's with subscripts from 0 to 4 are fixed.

The OLS regression based on equation (6) produces autoregressive residuals  $\hat{\omega}_t$  according to the results of Durbin-Watson and Box-Pierce tests of autocorrelation.<sup>37</sup> Thus a further transformation is appropriate. The two-stage FGLS regression solves this

<sup>36</sup> That is to use the residual of equation (5). It should be noted that the author has checked that the explanatory variables are not cointegrated in the sense of Engle and Granger (1987). Hence, it is impossible to construct their stationary combination and to use it as an explanatory variable instead of differencing.

<sup>37</sup> DW test result is 1.456, which is outside the acceptance interval of [1.725, 2.275]. Box-Pierce test (with three lags) produces 32.433 whenever the critical value of  $\chi^2(3)$  for 0.95 percent is 7.815. A

problem.<sup>38</sup> The paper employs the following procedure. First, it determines the order of autocorrelation and estimates autocorrelation coefficient(s). The examination of autocorrelation and partial autocorrelation functions of  $\hat{\omega}_t$  shows that it follows AR (1) process.<sup>39</sup> To estimate the correlation coefficient between  $\hat{\omega}_t$  and  $\hat{\omega}_{t-1}$ , the OLS regression of  $\hat{\omega}_t$  on its one-month lagged value is run and the obtained coefficient is transformed according to Theil's method arriving at  $\rho = 0.233$ . Next, each variable  $v_t$  used in equation (6), is recalculated according to the formula

$$\tilde{v}_t = \hat{v}_t - \rho \times \hat{v}_{t-1} \quad (7)$$

Finally, the OLS regression is applied to the variables recalculated with equation (7). Its results are reported in Table 3.

	$\beta$	<i>t</i> -statistic	<i>P</i> -value
Fraction of M2 held by households	12.532	2.237	0.027
Ratio of retail inventories to industrial output	24.642	4.387	0.000
$R^2$	0.262		
<i>T</i>	119		
Durbin-Watson test of autocorrelation: the acceptance region for no autocorrelation is [1.725,2.275]	1.92		
Box-Pierce test of autocorrelation (with three lags): critical value of $\chi^2(3)$ at 0.95 percent is 7.815	-3.432		

Table 3: The results of FGLS regression with variables being recalculated according to equation (7) to account for autoregressive residuals. Source: author's calculations

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technical description of both tests can be found *inter alia* in Greene (1990, p. 453)

<sup>38</sup> The FGLS (Feasible Generalized Least Squares) regression as described in Greene (1990, p. 443) has been employed in this paper. The Theil's transformation formula can be found at the same page.

<sup>39</sup> The author has used GRETl statistical package to plot autocorrelation and partial autocorrelation functions and Vandaele (1983, Ch. 4) to identify the order of autocorrelation.

The results show that transitory changes in the fraction of money funds external to producers and in their money demand influence the choice of trade. Thus the link between the Russia's NMT and producers' access to external funds goes beyond identical reactions to major policy events.<sup>40</sup>

## 6. Conclusion

This paper has pursued two interrelated questions. First, it has contributed to the ongoing debate about the existence and importance of the credit channel of monetary policy. The previous literature has suggested that firms are sensitive to monetary contractions thus implying that the access to liquidity influences their output decisions.<sup>41</sup> The paper has broadened the argument noting that firms can compensate for the lack of monetary liquidity with greater reliance on non-monetary trade (NMT). It has presented evidence confirming that the credit rationing played a role in the development of the Russia's NMT. Second, the paper has advanced the understanding of NMT that some economists thought was a phenomenon specific to transition economies. It has detailed and interpreted key episodes associated with its development in Russia and shown that a number of institutional barriers and policy developments; such as weak banking system, excessive state borrowing, and inflationary expectations; have fostered the growth in NMT. In this respect the paper has shown that NMT is a tractable event that can be successfully explored within the framework of mainstream economic theory.

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<sup>40</sup> A similar result is obtained by Kashyap, Lamont, and Stein (1994) who find that inventory investments by firms without access to public bond markets appears to be affected by liquidity constraints.

<sup>41</sup> Walsh (2003, p. 361) provides a summary of this work.

The paper has presented evidence that is broadly compatible with other works on credit rationing in general and the Russia's NMT in particular. It has found that structural changes in monetary policy and bank crises permanently changed the role played by NMT and, by all appearances, aggravated the Russian depression of 1992-8. Here, the present paper is closely related to the work originated by Bernanke (1983). Further, it has stressed the importance of firms' access to sources of liquid funds. It has been shown that when firms experienced an outflow of liquid funds or an increase in the duration of trade cycle, they mitigated their lack of necessary liquidity by relying on NMT more. This aspect of corporate policy that fits nicely the intuition advanced in Holmström and Tirole (1998) has been previously overlooked. The main argument of the paper, which is that changes in the cost of external finance and credit rationing were responsible for NMT, has been found compatible with other works dealing with NMT in transition.

The paper has indicated two general topics for further research. The first is of general theoretic nature. It has been argued that models of the choice of trade, particularly the search model of money, are incomplete because they exclude inter-temporal NMT from the consideration. The line of argumentation accepted in this paper leads to belief that NMT may be an imperfect substitute for lacking banking services. If this suggestion is true, developing a role for inter-temporal NMT in the search models of money will highlight the special role played by banks in financial intermediation. The second topic that the paper suggests is empirical. The present macroeconomic analysis has provided evidence supporting the existence of the credit channel of monetary policy in the Russian transition. However, different firms reacted to credit rationing differently. What determines differences in responses is a legitimate question to ask. It is interesting to

explore if the proposition that the means of *non-monetary* payment, in particular bills of exchange, were traded at a premium that traders paid for their role as a substitute for missing liquidity. Another proposition that follows from Holmström and Tirole (2000) asserts that as liquidity becomes constrained, projects with lower net return or longer production cycle are abandoned. This proposition can be formalized and tested on microeconomic data.

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