What Caused Russian Non-monetary Trade

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Abstract: The persistent growth in the use of non-monetary trade (NMT) that the Russian producers seemingly favored in 1992-8 has been a surprise development that economists could not explain using conventional economic theories. Yet, non-conventional explanations proved to be unsatisfactory as well.

This paper takes as a working hypothesis and tests the proposition that agents choose between monetary trade and NMT after they compare their respective costs. It takes a monthly series on the fraction of NMT in total trade and finds that it is trend-stationary with several structural breaks. Since the NMT series is not cointegrated, the paper focuses on the investigation of the breaks. It shows that several financial series exhibit breaks simultaneously. They are the fraction of government loans in total banking loan portfolio and the distribution of money funds among households, traders, and producers. An FGLS regression of the de-trended NMT on the same series generates statistically significant estimates of the expected sign. These findings confirm the existence of the link between NMT and the financial indicators mentioned above, albeit unstable in time.

The paper asks the question of how the distribution of money holdings can affect the costs of using money in trade and suggests that financial intermediation was costly. It puts emphasis on the appearance of new speculative opportunities (such as the opening of commodities and stock exchanges and the market for government bonds), to which commercial banks responded by diverting money away from producers. The tight monetary policy of 1993-8 exacerbated the situation by pushing interest rates up. As producers found that the costs of monetary trade were steadily increasing, they resorted to NMT.

JEL: E6, G14, P2

Keywords: Non-monetary trade, imperfect financial markets.

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A spectacular growth in the volume of non-monetary trade (NMT) during the Russian transition from plan to market caught economists by surprise. In spite of numerous suggestions aimed at clarifying the issue, the question of why Russian firms turned to NMT has not been answered affirmatively.

The paper takes a general theoretical framework that contrasts the costs of using monetary and non-monetary trades and checks if data support this theory. It shows that NMT and monetary indicators responded to the same shocks that permanently changed their dynamics. This result suggests the existence of structural breaks (or significant institutional developments) common to money and NMT. The breaks altered market equilibrium conditions and initiated long-term (inertial) processes of their adjustment to new environment. The timing of the breaks often coincided with major political events thus implying that money markets responded to state-sponsored developments. The paper finds that the short-run fluctuations in the composition of money funds held by different categories of agents go together with transitory changes in NMT. It suggests that the appearance of the market for government bonds and commodity and stock exchanges were factors that affected the behavior of moneylenders. The paper concludes that major institutional changes in the Russian financial structure affected producers’ access to liquid funds and they increased their reliance on NMT.

The paper consists of seven sections. It starts with an introduction of the monthly data on NMT collected by the Russian Economic Barometer, which is the longest time series on NMT for Russia. Section 2 discusses theories of producers’ choice of NMT. The paper settles on the proposition that NMT and monetary trade are alternatives chosen to save on transaction costs. Section 3 considers what components of the transaction costs could be affected in the Russian case. It analyses the time pattern of the NMT series and finds that it is time-stationary. This finding suggests that NMT is an inertial development set in motion by major institutional changes and, therefore, the relationship between NMT and the transaction costs is not structurally stable. This instability prompts an investigation, reported in section 4, of the events that followed August 1998 when the NMT series exhibited a crucial structural break. The paper focuses on the dynamics of some financial parameters (such as the composition of money holdings and banking loan portfolio) and finds that they had a break during the same period. Section 5 continues the
search for similarities between NMT and financial parameters. It determines that the NMT series exhibits three more structural breaks and that the composition of money holdings and banking loan portfolio changed at the same time. This finding confirms that NMT and these financial parameters are related. A discussion of events that happened at the break points reveals a link between major political events and the financial indicators. The paper argues that changes in the state policy upset the banking system, which responded by limiting access to credit for producers. This argument is supported by the results of statistical analysis reported in section 6. It finds that transitory fluctuations in NMT are statistically related to temporary changes in the composition of money funds.

The last section reiterates the main steps in argumentation. It concludes that Russian producers resorted to NMT when the financial system responded to new opportunities of financial investment and redirected money flows thus causing the growth in the costs of using money for transaction purposes.

1. Introducing Russian Non-monetary Trade

Because the literature does not provide an agreed definition on what constitutes NMT, it is expedient to explain this term first.

NMT includes all types of transactions that agents perform without using the conventional means of exchange – money – as a legal tender. Spot barter, which is casually introduced in economic theory as an antithesis to monetary trade, is the most familiar example of NMT. However, a complex economic system generates other types of NMT such as inter-temporal barter and the use of quasi-monetary means of exchange. For example, when trade partners locked in a long-term relationship (say, a coal mine and electric plant) they can find expedient to clear mutual debts through bookkeeping operations with no money entering balance sheets. Or a bill of exchange issued by a large company can be accepted by the third party that uses it as a means of exchange before the bill comes back to the issuer. Both these and other examples of NMT have one common feature: agents do not use money to complete a transaction.
This is the definition of NMT that the Russian Economic Barometer (REB) employs for its monthly data on the fraction of NMT in total sales. The series started in February 1992 (one month after prices and trade were liberalized) and continues now. Figure 1 presents the series.

Figure 1: Fraction of non-monetary trade in total sales, average sample size is around 200. Sources: see Footnote 1

2. Theories of Non-monetary Trade

There are several theoretical considerations that an empirical researcher should address before he considers explanations for a particular instance of NMT.

First, the perception of NMT is often influenced by the stylized account about the development of money. Traditionally, money is considered to be a mechanism developed to overcome difficulties inherent to NMT, most of all to reduce the transaction costs associated with the “double coincidence of wants”. Some economists believe that this view is counterfactual. They assert that historically barter does not precede money but

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2 REB is a laboratory associated with the Institute of World Economy and International Relationships (IMEMO) in Moscow. It sends a monthly survey to about 500 companies, mainly established industrial firms. REB receives around 200 responses on average and publishes a simple average for the fraction of NMT in total sales.


3 See Dalton [1982].
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 up 12 % from 2000.⁴

Second, the usual approach to modeling the choice of trade is to contrast spot barter with cash trade, which are instantly cleared transactions. As a result, they do not require a bond between the trader and buyer.⁵ In reality, spot trading is relatively uncommon and is overshadowed by trade that requires the setting of customer’s accounts and their subsequent clearance through various debt schemes. The exclusion of debt components limits the practical applications of the model. For example, it cannot explain how the operations of financial intermediaries affect the choice of trade.⁶

The above considerations have several implications for empirical analysis. A greater reliance on NMT does not signify that agents suddenly moved back to pre-historic times. They still had a choice between two types of trade and chose NMT as the least expensive.⁷

Two developments can result in the relative reduction in the costs of NMT. First, the costs of NMT fall, e.g. through learning process. Second, the costs of using money in trade grow, for example because money supply has contracted or the demand for money for non-transactional purposes has increased.

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⁵ For example, the search model of money (see, among others, Kiyotaki and Wright [1993]) considers the following dilemma that an agent faces. If he chooses to barter his wares, he reduces his chances of finding a suitable customer thus increasing search costs. If the agent prefers money, the probability that he sells now grows but at the costs delayed consumption. The agent needs to turn money in consumables and, hence, has to complete two transactions instead of one.
⁶ Technically, the model can be expanded to include other types of trade, for example trade on credit (see, among others, Li [2001]). Yet, such refinements do not change the basic structure of the model and no intermediation takes place.
⁷ This paper ignores non-monetary reasons for NMT as being counterfactual. For example, Gaddy and Ickes [2002] maintain that NMT was sponsored by the state in Russia. However, numerous surveys point out that respondents consistently indicated that NMT was conditioned by monetary reasons.
The first explanation, that the costs of NMT have fallen, is unlikely to be true in the Russian case. Two arguments can be brought forward. Let, for the sake of argument, assume that the producers have learned how to conduct NMT more efficiently. Then, *ceteris paribus*, the NMT fraction in total trade grows until it settles on a new equilibrium level. This inference is counterfactual: producers moved away from NMT after the default, thus discarding the knowledge of NMT that we have assumed they had acquired. Such behavior is rational only if there was no or insignificant efficiency gain from the use of NMT. Second, knowledge about NMT is specific to particular products. Suppose a better understanding of how to trade without money is the true reason for its growth in 1992-8. Then, it is natural to expect that trade for some products became almost entirely non-monetary while trade for other products stayed predominantly monetary. In reality, producers increased their use of NMT rather uniformly across sectors (see Table 1). Since synchronous learning is unlikely to happen, it is reasonable to suggest that a factor general to all sectors caused the growth in NMT.

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<td>3 Consumption products</td>
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<td>4 Agriculture</td>
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Table 1: Fraction of NMT in sales for a sample of about 200 firms in industry and agriculture, in percent. Source: see footnote.8

Since we discount the unlikely possibility that NMT grew because producers learned how to conduct it more efficiently, we are left with the second explanation: NMT grew because monetary trade became more expensive. To show that it is true we need to find a link between NMT and the costs of using money in trade.

Two words of caution are in order. The effective cost of money is often but not necessarily always is reflected in interest rates. If moneylenders believe that some borrowers are not trustworthy, they discriminate among potential clients by means other than raising interest rate. This is a problem of moral hazard: a higher interest rate attracts riskier borrowers. The stock of money used for transaction purposes is a better indicator of the effective costs of money if credit rationing is suspected. Yet, it has its own deficiencies. For example, if banks learn how to clear payments faster, the velocity of circulation grows, and a smaller stock of money is needed for the same number of transactions. This concern limits the usefulness of money aggregates for statistical analysis.

3. Cointegrating NMT and Money

The preceding discussion leads to the proposition that the Russian producers turned to NMT because they found expensive to use money for transaction purposes. If it is true, we expect the time series on NMT and some indicator(s) of the costs of money in trade to go in tandem. However, to proceed with the regular statistical analysis of potential relationship is technically incorrect. The problem is that the NMT series is likely to be non-stationary (see Figure 1). If it is, the method of cointegration is the most appropriate for our case. A brief explanation of the method is in order.

The term ‘cointegration’ is coined by Engle and Granger [1987]. They respond to the critique that using the method of differencing, that time series analysts employ to avoid the problems associated with non-stationarity, leave some relevant information outside. The critics claim that if two variables trend together, they are potentially in a long-run relationship. Engle and Granger address the problem of non-stationarity by separating the trend, that at least one explanatory variable shares with the dependent

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10 The concern with slow operations of banking clearance centers was particularly strong in Russia in 1992-3 (see Johnson [2000], Chapter 4).
11 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.
variable, and the short-term fluctuations that can be viewed as transitory shocks exhibited by the dependent variable due to other factors.\(^{12}\)

The first step is to check that the NMT series is in fact non-stationary. The presence of non-stationarity is generally verified with the use of 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

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

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 \(\rho = 1\) (the series is non-stationary) against the alternative that \(\rho < 1\) (the series is stationary).

To make equation [1] operational, we need to determine the number of lags. Several studies suggest that the sequential general to specific rule (described in Hall [1994]) is superior to available alternatives (see Maddala and Kim [1998, p. 78]). Hall recommends starting with an arbitrary large \(p\), to test for significance of the last coefficient, and to reduce \(p\) iteratively until a significant statistics is encountered. Starting with \(p_{\text{max}} = 15\), we find that the last coefficient is significant when \(p = 6\).

\(^{12}\) In practice, to determine if variables are cointegrated, one needs to address the following issues. First, the variables should be tested on stationarity. If the dependent variable is found to be stationary, it is not cointegrated. If it is non-stationary, both dependent and proposed explanatory variables are tested on the order of integration (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 out if their trends are compatible. If tests show that they are (there is a cointegrating relationship), the error term of the cointegrating regression is included in a broader econometric specification along with other non-cointegrated explanatory variables.
Three statistics are used to test for unit-root. All of them indicate that the null hypothesis of non-stationarity cannot be rejected at 10 percent level\(^{13}\)

\[
t = \frac{\hat{\rho} - 1}{se(\hat{\rho})} = \frac{-0.017}{0.013} = -1.276 > t_{100,0.1} = -3.15
\]

\[
K = \frac{T(\hat{\rho} - 1)}{1 - \sum_{j=1}^{p} \hat{\beta}_j} = \frac{112 \times (-0.017)}{1 - 0.526} = -3.956 > K_{100,0.1} = -17.5
\]

\[
F = \left( \frac{RSSR - USSR}{USSR / (T - K)} \right) = \frac{(259.5 - 254.4) / 1}{254.4 / (112 - 9)} = 1.627 < F_{100,0.1} = 5.47
\]

Yet, the results of ADF test should not be relied blindly. The ADF test has several shortcomings. The most relevant to this case 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 amending the test to include in the specification \([1]\) dummies that represent changes in intercept or time trend or both. Perron is not specific about how the existence of a break is to be detected 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 viewed as the prime instance of a structural break. We conduct Perron’s test that is based on the following specification

\[
\Delta y_t = \alpha + \beta_0 t + D_{98}(\bar{\alpha} + \bar{\beta}_t t) + (\rho - 1)y_{t-1} + \sum_{z=1}^{6} \beta_z \Delta y_{t-z} + e_t
\]

where \(D_{98}\) is a dummy variable that equals 0 up and including August 1998 and 1 afterwards.

The same three statistics as in equation [2] indicate that the null hypothesis that the series is non-stationary can be rejected at 1 percent level if the breaks in intercept and time trend are allowed\(^{14}\)

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\(^{13}\) \(F\)-test uses the residual sums of squares for the model described by equation [1]. The unrestricted specification estimates all coefficients. In the restricted model coefficients \(\beta_0 = 0\) and \(\rho = 1\).

Critical values for the tests are taken from Hamilton [1994], Tables B5-7, 100 observations.

\(^{14}\) Critical values for the tests are taken from Perron [1989], Tables VI A-B and Hamilton [1994], Table B7.
t = \frac{(\hat{\rho} - 1)}{se(\hat{\rho})} = \frac{-0.462}{0.061} = -7.625 < t_{100,0.01} = -4.8

K = \frac{T(\hat{\rho} - 1)}{1 - \sum_{j=1}^{p} \hat{\beta}_j} = \frac{112 \times (-0.462)}{1 - 0.613} = -127.7 < K_{100,0.01} = -43.6 \quad [4]

F = \frac{(RSSR - USSR) / J}{USSR / (T - K)} = \frac{(256.8 - 167.6) / 1}{167.6 / (112 - 11)} = 53.72 > F_{100,0.01} = 8.73

The results of Perron’s test have profound implications for our analysis. First, the revealed 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 NMT suggests that the period prior to the default exhibited institutional features that were persistently unfavorable to monetary trade and favorable afterwards.\(^{15}\) Finally, the existence of the break point indicates that the default critically affected producers’ perception of costs associated with monetary trade. Thus an examination of structural changes that took place after August 1998 can elucidate the reasons for the NMT dynamics.

4. Institutional Changes after the Default and NMT

Let us restate our working hypothesis: producers turned to NMT because monetary trade became costly. If it is true, the default, through institutional changes that it precipitated, made a lasting impact on the costs of using money in trade. What can these changes be?

The inability of the Federal Government to serve its debt was the immediate cause of the default.\(^{16}\) 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 not raise the

\(^{15}\) Recall from Section 2 that the alternative explanation – producers learned how to conduct NMT cheaper – has been ruled out.

\(^{16}\) 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 organizations). Yet, such ex post rationalization does not disprove the fact that the liquidity of the Federal Government was dangerously low.
expected amount of funds at domestic and foreign financial markets and/or reschedule the payment of matured debts.

The fact that lenders refused to roll over state debts suggests that the market was satiated with government bonds. In fact, the fraction of state debts in total banking loan portfolio crossed 40 percent mark in November 1996 and hovered around that level for almost two years (see Figure 2). Can the collapse of the market for state debt reduce the costs of using money in trade?

Figure 2: Fraction of government bonds in the total loan portfolio of the domestic banking system, in percent. Sources: see footnote.17

Yes, by two factors. First, because producers keep liquid funds to finance their operations, they forego profit that they would receive if they invest in state bonds. Thus the opportunity cost of keeping money for trade increases with the interest rate. When the demand of the Russian government for loans was high, the interest rates rose as well. In the aftermath of the default the government was unable to raise funds through open market operations, the interest rates fell, and the opportunity cost for using money in trade decreased (see Figure 3b). Second, after the default the government had to bring its monetary and fiscal policies in conformance with new realities. It restructured state debts to failed banks and provided them necessary credit, cleared state-taxpayers arrears, and

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17 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 from RET [2002, series 461 (GKO-OFZ outstanding stock adjusted to match data for December 1993) for May – November 1993; IMF [1996] quarterly data for December 1993 – March 1995 (interpolated in between); and CBR [2002] from June 1995 on.
moved to balance federal budget. This complex of measures resulted, in due time, in a real growth in money supply (see Figure 3a). \(^{18}\)

![Figure 3: (a) Stock of real money M2 aggregate without deposits in foreign currency (deflated by industrial PPI), (b) annual real interest rate on commercial loans (deflated by industrial PPI). Sources: see footnote.\(^{19}\)](image)

The other consequence of the default was that the established composition of money holdings was upset. In theory, who owns liquid funds does not matter because money finds its optimal employment. However, this theoretical proposition holds rests on

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\(^{18}\) A post-default increase in the fraction of government loans kept by domestic banking system is an artifact. Banks were compensated for emergency loans issued to the government by the Central Bank of Russia (CBR) that lent necessary funds. 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 started to fall 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 \([1986]\).

\(^{19}\) Money supply: RET [2002], series 488 (M2) after December 1996 and the difference between series 639 (M2X, which includes foreign deposits) and 640 (foreign deposits) for 1992-6, series 372 (industrial PPI).

Real interest rate: Found according to the formula \(r_t = \ln \left(\frac{1 + i_t}{(PPI_t/PPI_{t-1})^{12}}\right)\), 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 \(t\). \(i\) 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 – from the CBR’s website at http://www.cbr.ru/statistics/credit_statistics/.
the assumption that financial markets are perfectly integrated (savers move funds to borrowers at no cost). When the markets are fragmented (it is costly to move money), the ownership structure makes a difference. One problem is that there are institutional barriers to lending. For example, pension funds are sometimes required to keep a large portion of their assets in low-risk securities (such as government bonds). When such organizations accumulate money, private borrowers may discover that the supply of loans has dried up. The other, mentioned above, is the problem of moral hazard. If loan supply is sufficiently scarce, interest rates rise high enough to attract risky borrowers. To reduce the probability of losing the principal, lenders keep interest rates below the equilibrium levels and choose borrowers with the highest market value of collateral.

The fraction of money funds held by households increased steadily prior to the default and fell in its aftermath (see Figure 4). 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. The fraction of liquid funds owned by other sectors grew and problems associated with their access to monetary credit became less pressing.

![Figure 4: Fraction of household money holdings in the total amount of money in circulation (cash and deposits), in percent. Sources: see footnote.](image)

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20 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 the State Saving Bank or Sberbank), 202 (HH deposits at commercial banks), and 204 (HH deposits in foreign currency). Broad money aggregate M2X is presented in series 639.
Among non-households, industrial and trading establishments represent two distinct groups and their money holdings should be distinguished. The problem is methodological. The NMT series, that the paper sets to explain, represents responses from producers (industrial and agricultural enterprises) and not from the non-household sector in general. Thus, data on money funds held by non-producers should be excluded from consideration.

Data on the distribution of money funds between industrial and trading establishments are unavailable. As its approximation the paper takes the ratio of inventories held by retailers to industrial output (see Figure 5). The rationale is that both parameters are representative of the market value of their (unobservable) collateral, which the paper argues is correlated with their access to credit.

![Figure 5](image.png)

**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), 275 (industrial output at current prices).

### 5. 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 can elucidate the reasons for the development of NMT. In particular, it has attracted attention to the potential structural link between NMT and producers’ access to money funds. The next step is to look for other structural breaks in
the NMT series and, if there are any, to check that they similarly affect the monetary indicators discussed above. The following procedure is employed.

The first step is to de-trend the NMT series. The regression of the NMT series on intercept, time parameter, and their dummies associated with the default of August 1998 provides the following results

\[ NMT_t = -1.66 + 0.66t + D_{98} (137 - 1.73t) + e_t \]  
\[ (0.63) \quad (0.01) \quad (3.87)(0.04) \]  

where \( D_{98} = 0 \) until and including August 1998 and 1 – afterwards. (The numbers in parentheses are standard errors.)

The test statistics presented in equation [4] confirms that the transformed NMT is stationary. However, the condition of stationarity for the whole period does not preclude the existence of structural breaks for shorter intervals. If the NMT series has only one structural break (of 1998), residuals \( e_t \) (which are called the ‘transformed NMT’ in what follows) should not exhibit time trends. Figure 6 presents the graph of the transformed NMT.

![Graph of Transformed NMT](image)

Figure 6: Transformed NMT (the error term from equation [5]). Source: Author’s calculations

Since the timing of breaks is unknown, a CUSUM test for the stability of the time trend is appropriate.\(^{21}\) The test requires separating a sample into two sub-samples and

\(^{21}\) In this case it is the test of the cumulative sums of the residuals.
running a regression of the model to be tested for stability on the first sub-sample. The estimates obtained with the regression are used to calculate the forecast errors (the difference between the forecast and actual observations from the second sub-sample). If the forecast errors accumulate fast enough, the stability of the model (in this case the model presented by equation [5]) becomes questionable.^{22}

The CUSUM test reveals three potential structural breaks. 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 last break occurred between February and June 1994 when the interest rate turned positive in real terms following the decisions of monetary authorities to tighten money supply and fiscal authorities to stop borrowing from the Central Bank of Russia (CBR).^{23}

Political upheavals are not part of the story told up to now. Theoretically, they are coincidental to NMT. However, what happens in political sphere may affect parameters that make impact, in its turn, on NMT. Let check if the monetary indicators introduced in the previous section and NMT had the breaks at the same time. Since the timing for the breaks is suggested, the regular Chow test can be used.

Consider the model of a variable that is determined by a time trend that changes over period $T$

$$y_{t} = \alpha_{0} + \beta_{0}t + \sum_{z \in Z} D_{z}(\alpha_{z} + \beta_{z}t) + \varepsilon_{t}, \quad [6]$$

where $Z$ is equal to the number of breaks (four in this case) and $D_{z}$ is a dummy associated with break $z$. If $y$ series exhibits 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 (with $J = 2$ for intercept and time trend, $T = 119$, and $K = 10$) are presented in Table 2.^{24}

The results reported in Table 2 support the proposition that the changes in the time trend displayed by NMT were reactions to the structural changes experienced by the parameters that the paper claims affected the costs of using money in trade. The timing of the breaks is informative about the reasons for these developments.

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^{22} The author has employed the test as described in Greene [1993, p. 225].

^{23} 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.

^{24} The series under consideration are trend-stationary as shown in the next section. So, $F$-statistics is unbiased.
Table 2: The results of tests for structural breaks. Source: author’s calculations

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<td>$D = 1$ after February 1994 and $D = 0$ before</td>
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<td>$D = 24.211$</td>
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<td>$= 1$ after June 1996 and $D = 0$ before</td>
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<td>$D = 1$ after August 1998 and $D = 0$ before</td>
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<td>$D = 1$ after May 1999 and $D = 0$ before</td>
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Critical value: $F (2, 109)$ at 1 percent $4.82$

The first break, identified by February 1994, is associated with a major drop in the inflation rate.\(^{25}\) The drop did not apparently affect inflationary expectations and traders raised the level of inventories relative to industrial output (see Figure 5). Given that the market value of collateral is representative of agents’ access to money funds, producers became more constrained in their access to liquid funds. 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 that the deposits were gradually shifted to the safer Sberbank that was insured by the state.\(^{26}\) The existing regulations required the Sberbank to invest in government securities. This further constrained producers’ access to money and NMT started to grow faster.

The second break, associated with the election of 1996, affected the market for government securities. The failure of the communist challenger to win the elections raised expectations of political stability. As a result, the federal government became able to borrow abroad with a subsequent drop in the interest rate (see Figure 3).\(^{27}\) The opportunity cost of using money in trade declined prompting a fall in the rate of growth for NMT.

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\(^{25}\) A tighter monetary policy of the CBR, that raised its refinancing rate above the inflation rate in the end of 1993 for the first time, is responsible for the drop in inflation rate.

\(^{26}\) See series 201 and 202 of RET [2002] on households’ deposits kept at both types of banks.

\(^{27}\) Potentially, the opportunity to borrow abroad was the lifeline for the Federal Government of that time. The effective reserve ratio (the ratio of reserves to deposits kept by commercial banks) reached its lowest point in May 1996. Further lending to the government would endanger the liquidity of the commercial banking system.
The last break occurred in May 1999. It took several dimensions. First, the government debt in domestic banking loan portfolio started to decline. The Primakov’s government increased money supply to clear arrears and the end of the clearance scheme pushed interest rate up (see Figure 3). Second, the steep decline in the ratio of inventories to industrial output was over signaling the end of the period when producers became increasingly eligible for loans. As money became more expensive and less easy to get, the rate of decline in NMT slowed down.

6. Explaining Transitory Fluctuations in NMT

The previous sections have presented evidence that supports the proposition of monetary causes for the growth in NMT. In particular, it has been found that NMT and the variables that describe the distribution of money funds are related on the level of structural breaks. This finding suggests that major changes in the costs of financial intermediation (the costs of transferring liquid funds from savers to borrowers) made a permanent impact on the NMT trend. However, if both variables are related on the level of major disturbances, it is consistent to expect that their transitory changes are not.

It is obvious from the visual examination that the explanatory variables presented in Figure 4 and 5 (the fraction of money funds held by household and the ratio of the value of inventories industrial output) are non-stationary. The ADF test confirms this fact. Hence, the regular tools of statistical analysis cannot be applied to raw data on technical grounds. First, it is necessary to make the series stationary.

There are two methods that we can employ: to difference series until they become stationary or to remove time trend(s) if any is present. The second method is preferable on the grounds that it has been used to transform the NMT series. Let consider if both series are trend-stationary when four structural breaks, the timing of which is determined

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28 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.

29 The series are not cointegrated according to Engle and Granger [1987], and hence, it is impossible to construct their linear combination, which is stationary, and to use it as an explanatory variable.
above, are allowed. The same Perron’s test as described in equation [4] generates the following results (see Table 3).

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

Table 3: Results of the Perron’s test of trend-stationarity for two explanatory variables. Source: Author’s calculations

The results of the Perron’s test indicate that both series are stationary. Thus they can be included in the specification in a transformed form. Figure 7 shows the transformed series of two explanatory variables.

![Figure 7: Transformed explanatory variables](image)

Note, that the regression with the transformed variables

\[ NMT_t = \beta_2 M2HH_t + \beta_3 Trâdê_t + \hat{\omega}_t \]  

is (almost) identical to the regression that uses the original data of the form
\[ NMT_t = \alpha_0 + \beta_0 t + \sum_{j=1}^{4} D_j (\alpha_j + \beta_j t) + \beta_3 M2HH_t + \beta_4 Trade_t + \omega_t \quad [7a] \]

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

The OLS regression produces autoregressive residuals \( \omega \), according to the results of both Durbin-Watson and Box-Pierce tests of autocorrelation.\(^{31}\) The likeliest form of autocorrelation for \( \omega \), is AR (1). Thus a further transformation is required.

To deal with the problem of autocorrelated residuals, the two-stages FGLS regression is employed.\(^{32}\) First, the Theil’s estimator of autocorrelation coefficient \( \rho = 0.233 \) is found by running the auxiliary OLS regression and the variables are transformed as the difference between the observation at time \( t \) and the observation at time \( t-1 \) multiplied by coefficient \( \rho \)

\[ \bar{z}_t = \hat{z}_t - \rho \times \hat{z}_{t-1} \quad [8] \]

Second, the OLS regression is applied to the transformed variables (found with equation [8]). The results of this regression are reported in Table 4.

<table>
<thead>
<tr>
<th>Fraction of M2 held by households</th>
<th>( \beta )</th>
<th>t-statistics</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.532</td>
<td>2.237</td>
<td>0.027</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ratio of retail inventories to industrial output</th>
<th>( \beta )</th>
<th>t-statistics</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.642</td>
<td>4.387</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

\( R^2 = 0.262 \)

\( T = 119 \)

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): \( \chi^2(3) \) for 0.95 percent is 7.815

-3.432

Table 4: The results of FGLS regression applied to equation [7], variables are transformed to account for autocorrelation. Source: author’s calculations

The results of FGLS regression show that the transitory changes in NMT and the short-run changes in the fractions of money funds held by households and traders are

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\(^{30}\) The transformed series are found as the error term in equation [6], which is the same transformation that has been used to obtain the transformed NMT.

\(^{31}\) 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. The technical description of both tests can be found *inter alia* in Greene [1993, p. 453]
related in statistically significant way. Therefore, the hypothesis that producers turned to NMT because money became scarce (due to high costs of financial intermediation) gets additional support.

7. Conclusion

This paper has addressed the question of what caused the growth and decline in non-monetary trade (NMT) in the Russian transition of 1992-8 and beyond. It has started with a short introduction of NMT, whose time series exhibited a ‘mountain-shaped’ pattern (see Figure 1), and focused on finding an explanation for it.

After having considered general economic theory of money and barter, the paper has concluded that the growing costs of using money in trade is the most likely reason for NMT. However, the search for a stable long-run relationship (cointegration) between NMT and money parameters has not succeeded. It has been shown that NMT fluctuated around a time stationary trend that had a break in the time of default of August 1998. The paper has suggested that NMT was a stationary (inertial) process whose long-run dynamics was determined by institutional innovations and moved to explore structural developments that took place after the default.

The examination of institutional changes of late 1998 has highlighted the potential importance of events that occurred in financial markets. It has been shown that the composition of money holdings changed in favor of the industrial sector while the sectors of households and traders experienced relative outflow of funds. The paper has conjectured that the composition of money holdings affected NMT because the transfer of funds across sectors was costly. This line of reasoning has implied that the costs of financial intermediation were high or, in other words, that the banking system was inefficient. The paper has sketched potential difficulties with the intermediation: the appearance of a large market for government securities that absorbed savings and the problem of moral hazard which pushed lenders to choose borrowers with the highest value of collateral. Persistent inflationary expectations in commodity markets led to price overshooting and the market value of trade inventories grew above the equilibrium level.

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32 See Greene [1993, p. 443] for technical details of how FGLS (Feasible Generalized Least Squares) regression has been conducted.
As a result, traders became more eligible for monetary credit than producers were. When the composition of money holdings shifted in favor of producers after the default, they became less dependent on financial intermediation. In addition, the default affected inflationary expectations, the market value of inventories fell and producers became more eligible for credit.

The paper has found that the NMT series exhibits three more structural breaks and that they affect the composition of money holdings and commercial banking loan portfolio as well. The breaks have coincided with major political events. This finding has been interpreted as evidence of the causal link from policy-related shocks through disturbances in financial markets to NMT.

After having completed the investigation of structural changes, the paper has proceeded with statistical analysis of the short-run fluctuations in NMT around its trend. It has confirmed that the relationship between NMT and the composition of money holdings extends to the level of transitory shocks. This finding has been consistent with the earlier proposition that the composition of money holdings affected NMT.

Among topics for further research, the paper has highlighted the importance of developing theoretical insight into the interaction between policy changes and the choice of trade. The argument about the causal chain from general political events to individual trade decisions has been at best cursory, particularly on macroeconomic level. A more detailed discussion of the role that the banking system plays in determining the composition of money holdings across sectors would be appropriate as well.

The general conclusion of the paper is that the non-monetary trade in Russia was driven by the developments that took place in financial markets. Russian banking system was disturbed with numerous institutional and political changes and unable to finance producers. As a result, the latter relied on contracting own funds and resorted to NMT as the second best alternative.

References


