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An Empirical Analysis of Russia's Inflation and Implications for Policy Making*

By

Etibar Jafarov

Abstract

The main factors causing high inflation in Russia were financing the deficits of the government and quasi-public companies as well as "flight" from money. Therefore, with tight monetary and fiscal policies, inflation can be brought down rapidly. But price stability will not be sustainable without "hardening" budget constraints on quasi-public companies. That is, sustainable price stability requires both tight macroeconomic policies as well as vigorous structural reforms.

Key Words

Inflation, monetary expansion, money demand, sustainable price stability, weak financial discipline, structural reforms.

I. Introduction

Since the initiation of the transition towards a market economy in the early 1990s, inflation in the formerly socialist countries increased to very high levels and became a heavy burden on their societies, eroding the real value of the people's savings, hitting elderly people and pensioners severely. High and volatile inflation caused uncertainty about future prices and diverted resources away from productive uses. Instead, these resources have been channeled towards investment in inflation hedges such as real assets, jewelry, gold, cars, etc.

Aware of the high costs of inflation, officials in the transition countries have implemented a series of stabilization efforts aimed at moderating excessive inflation. These efforts have had varying degrees of success. Less success was attained in the former USSR countries, which were less familiar with non-centrally-planned economic systems than the other Eastern European countries and which are located far from the larger markets of more industrialized countries. In Russia, the perils of the transition have been felt even stronger despite continuing reform experiments and huge financial assistance packages from abroad. Russia continues to suffer from inflation and declining production.

*The opinions expressed in the paper are the author's and should not be interpreted as representing the views of the International Monetary Fund.

The aim of this paper is both to investigate the reasons for high inflation in Russia during its transition process and to analyze the implications for stabilization policy. It will do so by first reviewing related literature and facts on Russia's inflation, and then by explaining Russia's inflation process and its implications for stabilization. The paper will highlight the fact that Russian inflation was caused first by the monetization of fiscal imbalances of the public sector that include: (a) subsidies to public and quasi-public companies, and (b) credits to the same companies from the banking system, allocated without an appropriate evaluation of the creditworthiness of borrowers, and (b) credits to the government from the banking system; and, second by "flight" from the local currency. Then, it is shown that as financial discipline of the public companies was further weakened during the transition, the tightening of monetary policy without a simultaneous hardening of the budget constraints of the government and public enterprises would only result in an accumulation of arrears which would eventually need to be monetized, thereby only postponing rises in inflation. Therefore, it will be suggested that a stabilization policy will need to be implemented in conjunction with structural reforms which harden the budget constraints of both the government and its remaining state enterprises.

II. Review of Literature

Literature on Russia's inflation is scant. Early literature on Russia's inflation, especially by Russian economists, considers inflation in Russia as "cost-push" rather than "demand-pull". For example, Afanasyev and Vite (1995) and Belousov and Klepach (1995) consider increases in prices of inputs, which include prices of raw materials and wages paid to employees, as a far more important source of inflation than demand factors, showing that the quasi-money component of the money stock (interenterprise arrears, wage arrears, tax arrears, etc.) was a result of the "deficit of money". This means that arrears arose because there was not enough money in circulation, implying that if enterprises were given cheap money, this would not create inflation but would substitute quasi-money. However, this approach (1) does not take into account the efficiency (of production) considerations and does not notice that interenterprise and other arrears were the result of inefficient production and weak financial discipline of companies; and (2) fails to see that substituting of quasi-money by accounting money would simply change suppressed inflation to open inflation.

In contrast, Boone and Federov (1996), Gaidar (1995), and Ikes (1995) consider monetization of explicit and implicit fiscal obligations as the major source of inflation.¹ Illarionov (1995, 1996a, 1996b, 1996c) considers loose monetary and fiscal policies as well as declines in demand for money as major contributing factors of inflation in Russia and the former USSR countries.²

This paper, which includes a comprehensive empirical analysis of Russia's inflation,³ builds upon foundations of the second approach and considers financing of the public sector's fiscal imbalances by monetary expansion and "flight from money" as the main factors of Russia's inflation. Yet, the paper recognizes the relevance of arrears, but in contrast with the first approach considers them not to be a result of "too small amount of money in circulation" but a result of fiscal imbalances caused by loss making public companies and weak financial discipline. Therefore, tightening of

monetary and fiscal policies as well as hardening of budget constraints on both the government and public companies are considered as key to successful stabilization.

III. Facts on Russia's inflation

Before the transition to a market economy, the Russian economy had no open inflation because of administratively controlled prices and the limited role of money in the economy. In this environment, attempts to accelerate growth through expansionary fiscal policy in the late 1980s created so called "monetary overhang" or hidden inflation, which was observed in long queues at shops, empty store shelves, tight control on distribution of goods, and flourishing black markets.

After the liberalization of prices in January 1992, this hidden inflation became open inflation.⁴ Although price increases had been expected, actual inflation exceeded all expectations and often became uncontrollable (see Table 1). In January 1992 alone, consumer and producer prices grew by almost four and five times respectively. Monthly inflation (CPI) decelerated after that summer, but remained above 20 percent from October 1992 through February 1993. It declined steadily since the beginning of 1995, once the authorities tightened monetary policy, using the exchange rate as an anchor. Average monthly inflation fell to 7.2 percent in 1995 and 1.7 percent in 1996 from 10.1 percent in 1994.

In general, increases in consumer prices were closely related to both liberalization in centrally administered prices, especially in the early period of the transition (1992

¹Mainstream analyses of inflation process in other transition economies also consider monetization of explicit and implicit fiscal obligations as a major source of inflation (see Balcerowicz and Gelb (1994), Balino et al. (1997), Bruno (1993), De Mola et al. (1995), Commander (1992), Dodsworth et al. (1996), Fischer et al. (1996), Horvath et al (1998), and Saavalainen (1995)). *In case of low inflation*, following factors are also considered as important sources of inflation: (i) external shocks, — changes in energy prices for energy importing countries such as Central European countries were often quoted to have significant effect on overall price indices in these countries (see Commander, 1992); (ii) underlying pressures for an appreciation of the real exchange rate coupled with a policy of stabilizing the nominal exchange rate that might stem either from (a) initial undervaluation of the real exchange rate relative to its equilibrium level (see De Masi and Koen (1995) and Saavalainen (1995)) or (b) differential productivity growth between tradable and non-tradable sectors (so-called Balassa-Samuelson effect); (iii) relative price adjustment (see De Masi and Koen (1995) and Coorey et al. (1996)); (iv) indexation of contracts, including wage indexation (see Commander (1992) and Commander and Coricelli (1992)). It is also worth noting that opinions on the role of indexation in causing inflation in transition economies differ, for example, Cottarelli and Doyle (1999) shows that only in 6 transition economies was indexation used, and, moreover, all these 6 countries had low inflation. *In case of high inflation*, more attention is paid to declines in money demand (see Chowdhury et al (1990) and Frenkel and Taylor (1993)). This approach takes its origins from the seminal paper of Cagan (1956) on hyperinflation, which shows that people try to get rid of local money if they expect high inflation in the future and this process can create inflation regardless of changes in the money stock. Some writers emphasize the importance of structural problems. Poirot (1996) shows that institutional and structural problems derailed tight macroeconomic policies in Romania. De Mola et al. (1995) shows that liberalization of the economy generally reduced inflation and contributed to growth. Cottarelli et al. 1998 shows that relative price changes, central bank independence, the exchange rate regime, and the degree of price liberalization have significant effect on inflation. The role of exchange rate in stabilization also got extensive attention (see Ross, 1998). While concentrating on the reverse relationship between inflation and growth, Fischer et al. (1996), finds that while fiscal deficit increases inflation, pegging exchange rate and liberalization process reduces it.

²Taking into account an important role of demand for money in determining inflation, some recent literature exclusively analyzed velocity. De Broeck et al. (1997) for example, assesses the prospects for velocity developments in transition economies, including the likely pace of remonetization.

³The previous literature did not conduct empirical analysis.

⁴Although prices for some products were increased in a planned way before the liberalization, these increases in prices generally were of discrete character (despite some secondary effects from such increases).

Table 1. Russia: Inflation 1992-1996
(Percent changes from December to December)

	1991	1992	1993	1994	1995	1996
Overall CPI	...	2,501.4	837.2	217.3	130.3	21.8
Food	...	2,525.3	809.6	213.8	122.7	17.1
Nonfood	...	2,573.7	643.7	169.1	115.3	17.8
Paid services	...	2,124.5	2,317.3	525.0	231.4	48.4
Overall PPI	236	3,275	895	233	175	122
Electricity	110	5,409	1,258	229	199	135
Fuel	129	9,166	634	201	187	...
Ferrous metallurgy	237	3,525	1,086	242	185	116
Chemicals	165	3,791	848	262	168	118
Machinery	212	2,621	949	230	178	124
Construction materilas	215	2,714	1,169	212	171	134
Light industry	371	1,158	681	241	1,163	120
Food industry	312	2,628	1,229	208	156	122

Source: RED (Russia-1997)

-1993), and movements in exchange rates as consumption of imported goods increased rapidly. It is also worth observing that while prices for services lagged behind the commodity prices, especially prices of tradable goods such as energy products, up until the beginning of 1993, they grew faster than the non-service prices thereafter (see Table 1).

IV. Anatomy of Russia's Inflation

A. Structural problems of the companies

The root of Russia's inflation lies in inefficient public sector, including state owned companies that can not survive without explicit and implicit subsidies from the budget and the banking system. For example, by September 1998, already 48.9 percent of the total number of the companies were loss-making. In the industrial, construction, and transportation sectors, unprofitable enterprises accounted to 50.1, 42.3, and 59.2 percent of all enterprises respectively⁵ (see Table 2a and Table 2b). These losses have been financed through (1) explicit subsidies reflected in the official budget deficit

Table 2a. Russia: Share of Unprofitable Enterprises by Branches of the Economy
(In percent)

	1992	1993	1994	1995	1996	1997	1998 Sept. 1/
Percentage of loss-makers, all sectors	15.0	14.0	32.5	34.2	...	...	48.9
in the industrial sector	7.2	7.8	22.6	26.4	...	...	50.1
in agriculture	14.7	10.0	58.7	55.0	...	...
in the construction sector	7.6	5.9	14.5	17.7	...	...	42.3
in the transportation sector	20.7	16.6	28.8	31.5	...	...	59.2
Losses as percent of credits to the economy 2/	10.6	12.8	...	...	...	...	...

Sources: *Rossiyskiy Statisticheskiy Ejegodnik* (1994, 1996).

1/ September 1998 figures are taken from *Rossiyskaya Ekonomika v Yanvare-Sentyabre 1998 Goda: Tendentsii I Perspektivy*, Vol. 19, November 1998, Moscow.

2/ Calculated.

⁵These data sets should be considered with a grain of caution because companies in the transition countries tend to show less or no profit for tax evasion purposes.

Table 2b. Russia: Non-profitable Production
(In percent)

	1985-90	1994	1995	19961/
Share of non-profitable production in total production	8.0	10.0	11.0	14.0
Companies producing non-profitable products as percent of total number of companies	55.0	60.0	59.0	63.0

Source: Auktsionek (1997).

1/ First three quarters.

that needed monetary financing, (2) by "quasi-subsidies" such as cheap credits from banks, and (3) arrears build-up, in the absence of the first two channels, which was monetized from time to time. The first two channels have direct impact on prices while effects of arrears on prices are far more complex.⁶

B. Lax fiscal policy

One of the main causes of inflation is lax fiscal policy accompanied by accommodative monetary policy. After the liberalization, the demand for expenditures increased as (i) financial positions of a large number of enterprises worsened as these enterprises' business faced increased competition, and (ii) demand for expenditures to the social safety net such as unemployment benefits to alleviate the pains of transition increased. At the same time, government revenues declined as a result of tax evasion, declines in taxpayers' real income, and problems in adopting new taxes such as VAT. Facing reduced capacity to raise revenues and unable to cut expenditures, the government often resorted to credits from the central bank (see Table 3 and Table 5). This increased money supply and consequently caused inflation.⁷

It is often argued that borrowing in capital markets instead of borrowing from the central bank should curb inflation. However, it is worth noting that non-bank borrowing instead of seignorage could not stabilize prices in a sustained manner in the absence of hard budget constraints on the government and public companies. In Russia, since the beginning of 1995, the fiscal deficit was increasingly financed by borrowings in the (domestic) capital markets⁸ (see Table 4). It helped temporarily reduce observed

Table 3. Russia: The Government Operations 1992-1998
(In percent of GDP)

	1992	1993	1994	1995	1996	1997	1998
General government balance	-22.0	-7.6	-10.5	-5.7	-8.5	-7.5	-8.5
General government, total expenditure and net lending	69.0	44.9	45.4	38.4	40.3	39.4	36.4
General government, total revenue and grants	47.0	37.3	34.9	32.7	31.8	31.9	27.9

Source: WEO (IMF), various issues.

⁶See Jafarov (1999) and Chapter VII of this paper for the detailed discussion of this issue.

⁷It is worth noting that the published government budget balance figures are insufficient for evaluating the strictness of fiscal policies. Policymakers often have an incentive to show smaller budget deficits, for example to show to donors and international organizations, and use implicit state financing instead of explicit subsidies. In this case, the budget deficit might fall without monetary expansion and without hardening the budget constraints on enterprises.

In transition economies, the public sector's share in the economy is still large and the larger share of total credit extended to the economy goes to state enterprises. These state enterprises carry out some "fiscal functions", for example, supplying the workers with housing, hospital care, kindergarten facilities, and pensions. These functions, if returned to the government, would constitute an added burden on the budget. This means that by giving budget functions to large enterprises and later supplying them with cheap credits governments can create the appearance of a reduced budget deficit (see Tanzi 1993).

Table 4. Russia: Internal Debt Service, 1994-1998
(As percent of GDP)

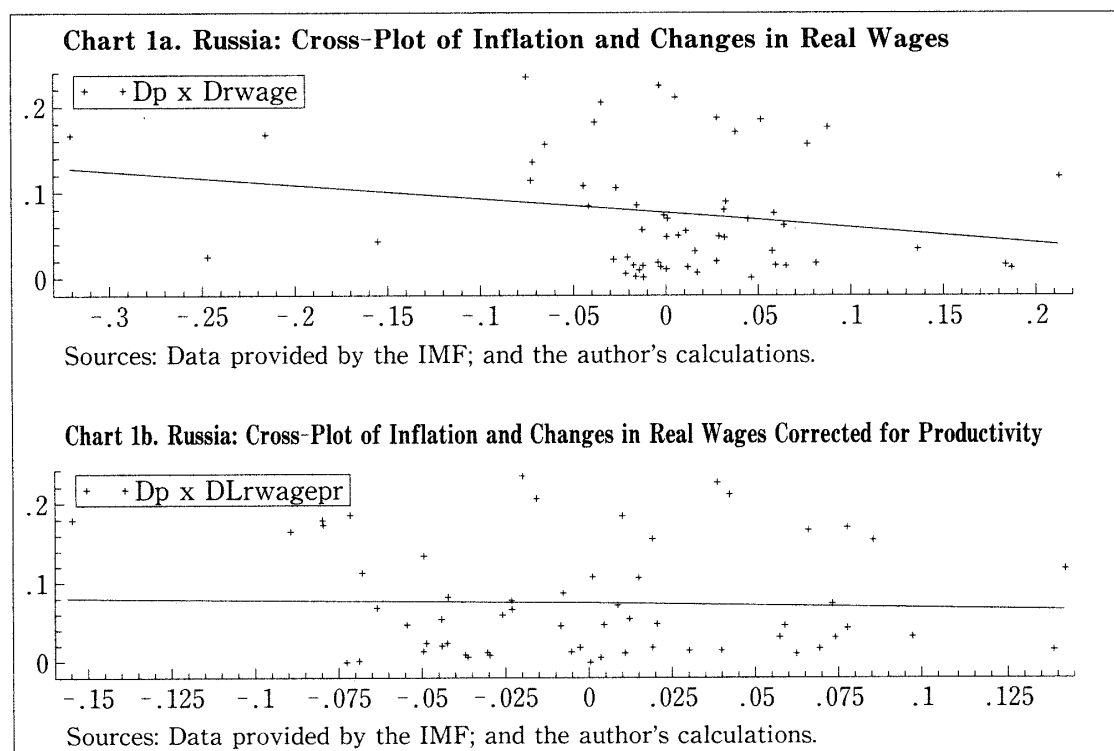
	On January 1 1994	On January 1 1995	On January 1 1996	On January 1 1997	On January 1 1998	On January 1 1999
Total internal debt	21.7	14.0	11.9	16.6	19.4	25.6
of which,						
bills and bonds	0.2	3.0	5.4	11.3	17.4	22.9
borrowing from the Central Bank	18.0	9.3	3.8	2.7	0.0	0.0
Interest on internal debt	0.6	2.6	2.4	4.8	3.7	3.9

Source: *Rossiyskaya Ekonomika v Yanvare-Sentyabre 1998 Goda: Tendentsii I Perspektivy*, Vol.19, November 1998, Moscow.

inflation as the government mopped up excess liquidity, but increased the financial burden of the state as the government resorted to more borrowing to pay these bonds. At the end of 1997, government borrowing from the local capital markets increased to 17.4 percent of GDP from 0.2 percent of GDP at the end of 1993. Servicing these bonds amounted to 4.8 percent of GDP at the end of 1996, much higher than 0.6 percent of GDP at the end of 1993. Eventually, this policy together with the effect of the Asian crisis and falling prices for minerals, which are main export items for Russia, led to the Russia's default on its bonds in 1998.

C. Wage-inflation spiral

Real wages in excess of productivity growth generally puts pressure on prices. In Russia, however, this seemingly causal relationship seems to be reversed. As can be



⁸Active participation of foreign investors in the market in 1996 and early 1997 increased sensitivity of the domestic markets to developments in the world financial markets. When, the Asian crisis unfolded in 1997, investors pulled back from the emerging markets and this put enormous strains on the financial system of a number of countries, including Russia.

seen from Chart 1a, which cross-plots inflation and changes in real wages, and Chart 1b, which cross-plots inflation and changes in real wages corrected for productivity, both real wages and real wages corrected for productivity seem to have a reverse relationship with inflation. This suggests that high inflation⁹ reduced real wages more than real wages caused inflation. However, as recorded wages and salaries include sizable wage arrears, this analysis should be taken with some caution. In particular, it is suspected that if corrected for the size of wage arrears,¹⁰ the relationship between real wages and salaries may change. Yet, it is worth noting that partial indexation of wages and salaries creates inertia in inflation, at least, in the short run.¹¹

D. Weak banking system

Having a heritage of the economic system where banks were providing loans according to state plans, banks in Russia—most of them new in business—lacked the expertise to evaluate the feasibility of projects and soundness of loans. They provided loans largely based on personal relationships and networks, rather than sound risk based analysis of projects. Additionally, they had strong incentive to increase lending because they gained from the inflationary process since banks' predominant source of credit was borrowing from the central bank.¹² Together with the limited supervision capacity of the central bank, this led to a rapid increase in (poor quality) credits that caused high inflation.

E. Weak financial discipline

During transition, market forces replace bureaucracy in determining resource reallocation, which in the long run improves the usage of these social resources. But while the old system of bureaucracy-determined resource allocation system weakens and the new market system is developed, there can be vacuum in the system of coordinating activities of economic agents.

A clear regulation of the activities of economic agents has been missing during the transition. Laws and regulations often contradicted each other and there were not enough experienced people to enforce the existing regulations. The newly created banks lacked the capital required to restructure a large number of nonviable firms, and there were no smoothly working capital markets. Most importantly, there was no exit mechanism for non-viable firms and banks.

The lack of rules and laws regulating the activities of the economic agents and the lack of an exit mechanism created the situation in which agents were not stimulated to fulfill their obligations against other agents. Under weak discipline, enterprises' budget constraints become soft¹³ and firms overspend without fear of bankruptcy.

F. Monetary expansions as a way of financing of fiscal imbalances of the public sector

All of the above explained sources of inflation have worked through monetary

⁹This also means that real wages recovered during low inflation periods.

¹⁰There is no available monthly or quarterly data on the size of wage arrears and therefore, real wages can not be corrected for wage arrears.

¹¹See Commander (1992), Commander and Coricelli (1992), Dornbush (1992), Dornbush and Fischer (1993), Kiguel and Liviatan (1990), Rebelo and Vegh (1995) on inflationary effects of wage indexation.

¹²In 1993, some leaders of the Russian Central Bank were calling for "helping domestic industry to survive". It is also worth noting that central bank loans increased considerably in the 1993-1994 period.

Table 5. Russia: Assets of the Banking System as Percent of Broad Money, 1992-1998
(In percent of total broad money)

	1992	1993	1994	1995	1996	1997	1998
Net foreign assets	47.7	69.7	45.8	25.5	13.8	3.6	-11.7
Domestic credits	66.3	108.5	149.3	131.9	150.9	144.2	176.1
Claims on general government	6.5	20.6	54.8	60.4	87.2	83.4	115.7
Monetary authorities	11.2	41.0	65.5	50.2	52.4	49.4	84.3
Commercial banks	-4.7	-20.4	-10.7	10.2	34.7	33.9	31.4
Claims on non-financial public enterprises	...	38.5	37.3	22.7	19.4	7.3	5.3
Claims on private sector	...	49.4	57.1	48.6	44.3	51.8	53.9
Claims on other financial institutions	...	-	-	0.2	0.1	1.8	1.1
Other items	-14.0	-78.2	-95.0	-57.3	-64.7	-47.8	-64.3
Total broad money	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Credits to the government and public enterprises as percent of broad money	...	59.1	92.2	83.1	106.6	90.6	121.0

Source: IMF *International Financial Statistics*, May 1999.

expansions: credits and subsidies to companies to pay for continuation of unprofitable activities and keep unnecessary employment, and credits to the government to finance the budget deficit were increasing broad money. As can be seen from Table 5, lending to the government was the largest item among assets of the banking system. Furthermore, most of these credits to the government were from the central bank, which is new money creation. In addition, credits to the public companies remained considerably large until 1997.

G. Motivations of the government

The governments' motivations to create or accommodate inflation may be as follows: first, inflation may be part of the public finances. As mentioned, the ability of the government in Russia to raise revenues by normal taxes has been low. As a result, the government often resorted to money creation for financing its budget deficit, especially in the early period of the transition. Second, the government could also accommodate inflation because of potentially high political and output costs associated with stabilization. Disinflation would require politically unpopular measures such as shutting down loss making companies, cutting government expenditures, or raising taxes. This would create strong opposition. Many governments do not stand up against such opposition and often accommodate inflation. Third, there is also a kind of background inflation (10-15 percent annually) as a result of changes in the relative prices of tradables and nontradables even in the countries considered successful in controlling inflation. The prices of tradables grew faster, reaching world price levels soon after the liberalization of prices. The prices of non-tradables grew with some

¹³The concept of soft budget constraints on enterprises was introduced by the Hungarian economist Janos Kornai (1980, 1986, 1992). The budget constraint is said to be "soft" if (1) an enterprise knows it can induce the authorities to modify the economic parameters, determined for that firm, through bargaining and (2) this perception is reflected in the enterprise's behavior. For an enterprise operating under a soft budget constraint, the maintenance of profitability is not a vital requirement for survival and growth, nor is it the main objective pursued by managers. As long as the enterprise is not subject to effective financial discipline, there is no incentive to respond to changes in price or cost parameters. If an enterprise does not have enough means to finance its activities it is not afraid of running arrears, knowing that it will not be punished for doing so.

inertia and nontradables became comparatively cheaper in the later period of transition. As a result, the demand for non-tradables increased and pushed the prices of non-tradables to grow faster. In summary, even after a successful disinflation with no price increases for tradables, the prices of non-tradables may continue to rise, increasing overall price index. Disinflation from this kind of inflation would be very costly and governments often accommodated it instead.¹⁴

V. Money Supply and Money Demand

A. Demand for nominal money and money supply

It is interesting to note that in Russia, inflation and a liquidity crunch coexisted for the following three reasons. First, price increases raised the demand for nominal money, especially the demand for cash,¹⁵ as ever increasing nominal GDP was being served by comparatively less money stock. That is, as a result of higher inflation, the ratio of money stock to nominal GDP decreased.¹⁶ Second, weak financial discipline prevailing in the transition period also contributed to increases in the demand for nominal money.¹⁷ Third, in transition economies, the consequent problem of a liquidity crunch was further exacerbated by increases in the number of companies, and, consequently, in the number of transactions. Increasing demand for nominal money put pressure on the monetary authorities to accommodate it through monetary expansion.

B. Demand for real money and velocity

While money is held for transaction purposes, it is also part of an asset portfolio. As an asset, the demand for money is related to the opportunity costs of holding money. To the extent that an alternative to holding money is holding securities, the relevant cost is the difference between interest rates on these securities and the money's own interest rate—deposit rate.¹⁸ If an alternative to holding money is holding goods, real assets, etc. the relevant cost is the difference between the expected inflation rate and the deposit rate. If a substitute for money is foreign exchange, then the relevant cost is the difference between the expected change in the exchange rate and the deposit rate (see Frenkel 1977, Abel et al.1979).

During periods of high inflation, the real value of cash money is eroded and the holders of money stock try to reduce their money holdings, hedging their wealth by investing in gold, jewelry, real assets, foreign currency, etc. This process, the so-called “flight from money”, reduces the demand for real money¹⁹ or increases the velocity, fueling inflation even further.²⁰ If people expect higher prices in the future, then the demand for real money decreases and the velocity of money increases.²¹ As it can be

¹⁴For the detailed discussion of this issue see Coorey et al. (1996).

¹⁵The increase in demand for cash can also be explained by (1) the existence of a large “shadow” economy and (2) long delays in payments and the resulting loss of confidence in the financial system. It is also worth noting that this led to an “exchange rate” (a sign of liquidity crunch) between the “cash money” and “account money” that was observed in the most of the FSU countries.

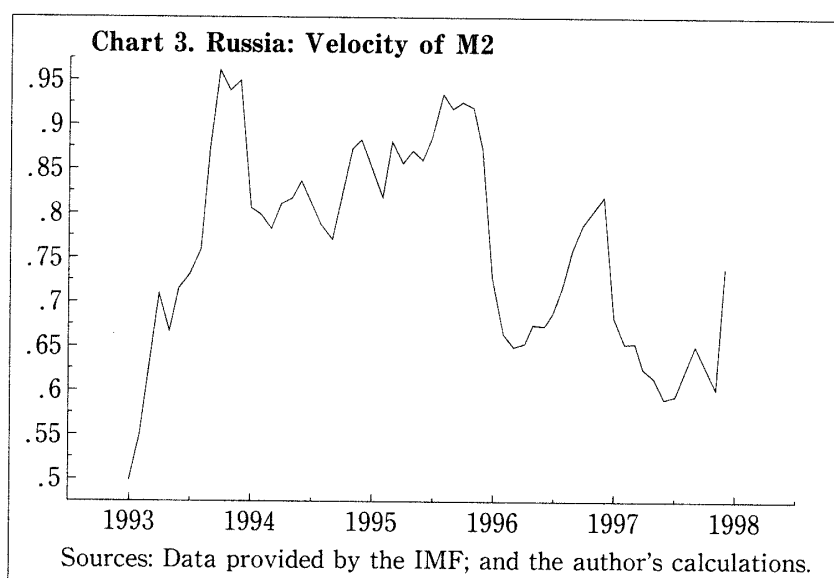
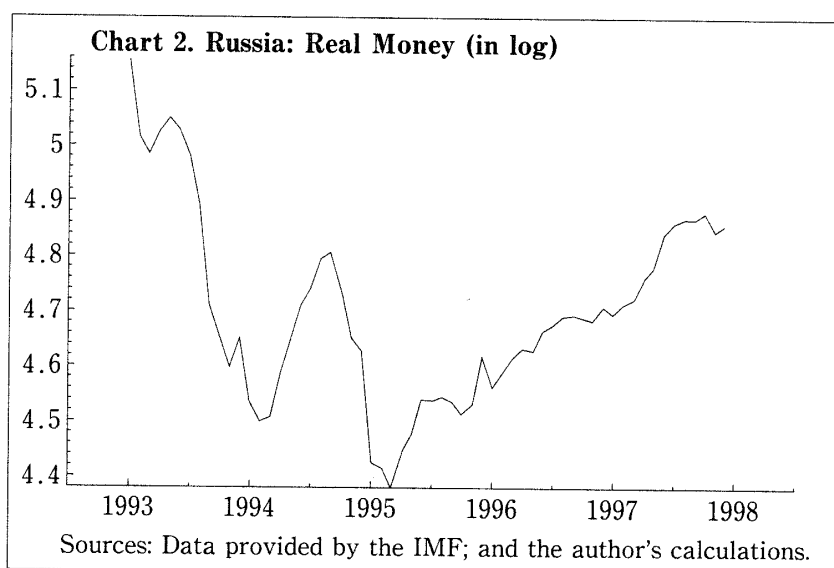
¹⁶The ratio of money stock to nominal GDP is the inverse of velocity, which is the subject of the next paragraph.

¹⁷In the environment of weakened financial discipline, economic agents tend to overspend (see Jafarov (1999)).

¹⁸Loss of confidence in the financial institutions might make deposit rates irrelevant.

¹⁹See Chart 2 for the log of real money in Russia.

²⁰For the discussion of this issue in hyperinflation episodes in 1920s, see Cagan (1956).

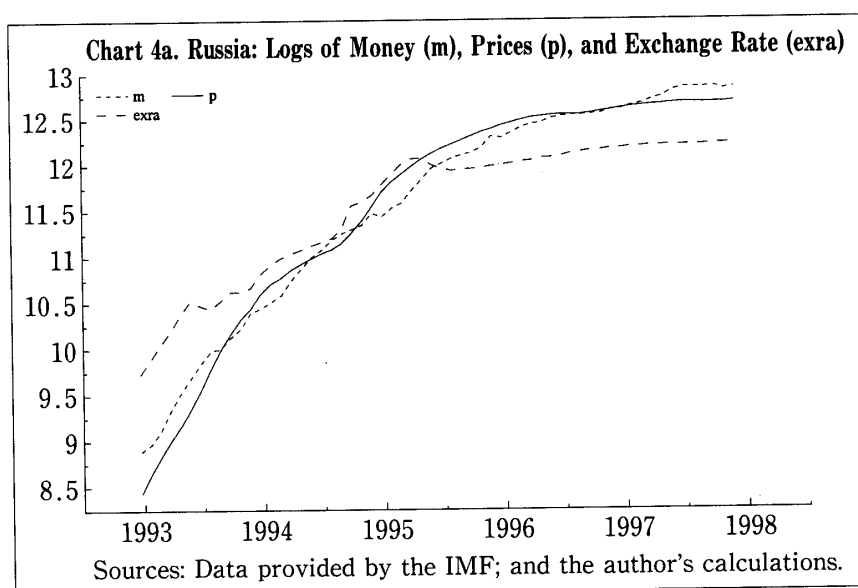


seen from Chart 3, the velocity of money has been very volatile in Russia. This has serious implications for disinflation.

B1. Expectations

In transition economies, together with changes in the money stock, the most important factors affecting expectations on future inflation are: (1) the expected changes in the exchange rate²² and (2) the depth and credibility of the reforms. Compared with other economic indicators such as the money stock, unemployment, etc., on which official statistics are announced with some delays and are less reliable, the exchange rate can be observed on a daily basis, and, therefore, becomes a very important indicator of changes in the economy. On the other hand, the depth and

²¹In a high inflation environment, developments in the real economy matter less and therefore, the (reverse) relationship between demand for money and velocity of money becomes stronger. It is also worth noting that, changes in the size of arrears make calculated velocity even more volatile.



credibility of reforms, although difficult to measure, determine changes in financial discipline and the degree of “hardening” budget constraints on both the companies and the government.

VI. Empirical Work

A. Analytical framework

As explained, inflation in Russia seems to be caused by (1) increases in the money stock needed to finance the fiscal imbalances of the public sector and (2) the “flight” from money or increases in velocity, determined by the expected inflation, the depth and credibility of reforms, and the money’s own interest rate–deposit rates. Therefore, the following price equation is analyzed to see the role of each factor of inflation:

$$P = f(M, EE, RGDP, FIDR, Ref),$$

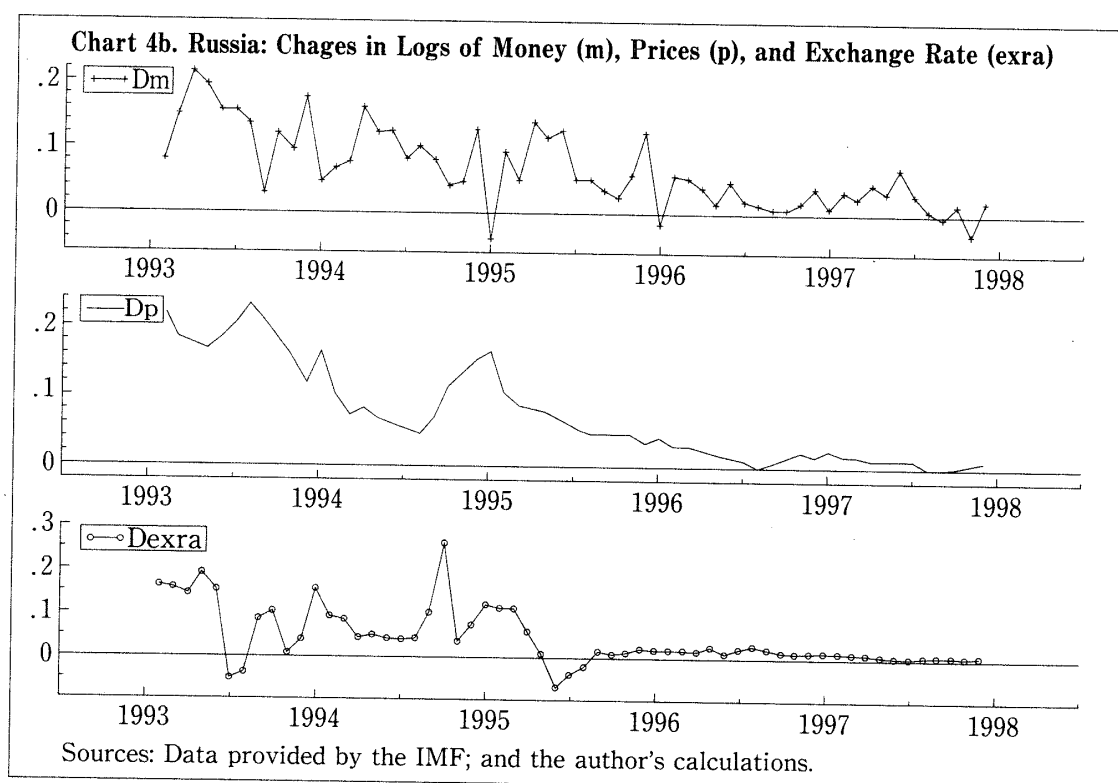
where P is the price level, M is the money stock, EE is the expected changes in the exchange rate, $RGDP$ is real GDP, $FIDR$ is the deposit rate,²³ and Ref is the depth of reforms.

B. Data

For the analytical work the monthly data set provided by the IMF for the period 1993–97 was used. The 1992 year was excluded because the economy in that year was

²²It can be seen from Chart 4a that up to mid-1995, exchange rates and price levels increased somewhat together, but since mid-1995 (this is the period, when the exchange rate was used as an anchor and at the beginning of 1996 the ruble corridor was introduced), they have moved almost together. It can also be argued that the exchange rates adapt to changes in price levels rather than reverse. In the long term, of course, there is a feedback from prices to exchange rate. But in Russia, in the short and medium term, exchange rate movements led inflation as the share of imported goods in the consumer “basket” was high and hard currencies were used as a hedging instrument against inflation. Since the exchange rate was used as an anchor to stabilize in 1995, this link between the exchange rate and inflation (stronger causation from the exchange rate to inflation rather than reverse) became even stronger. However, whatever the direction of causation, the Granger type causation is not important for the system analysis used in this paper and will be disregarded.

²³Interest rates on the government bonds—the main alternative to deposits—could also be included in the equation but was not included as there was not consistent data.



exposed to many shocks that would complicate the analysis.²⁴ CPI data, used for the price level measurement, broad money (M2), excluding foreign currency deposits, average monthly exchange rates (rubles per US dollar),²⁵ and real GDP were used in natural logs.²⁶ Deposit rates were used at nominal levels. GDP and interest rates were taken as non-modeled variables.²⁷ To catch the effect of the reforms, which are thought of as a function of time, a time trend was added. As there were clear signs of seasonality (see Chart 4b), seasonality dummies were introduced. Also, dummies were considered to catch the effects of (1) the usage of the exchange rate as an anchor since mid-1995 and the introduction of the ruble corridor (band) since the beginning of 1996, (2) the war in Chechnya, and (3) the presidential elections, but were omitted based on the results of F-tests and t-tests.

C. Cointegration

As the first step, to analyze the relationship between the variables, unit root tests have been conducted. The results of the unit root tests show that all variables are integrated of either order (0) or (1) (see Table 6). As the key variables are non-

²⁴In 1992, several structural changes occurred. In particular, prices and trade, including foreign trade, were liberalized; there were substantial changes in the tax system as turnover taxes were abolished, value-added taxes and excise duties were introduced, and tariffs were changed; the former USSR market disintegrated as member countries gained independence, most of which started trade relationships with other countries; and private ownership was allowed. Exclusion of the 1992 year from the analysis also helps get rid of the most of the jump effects of the liberalization of administered prices which pushed other prices up.

²⁵Actual changes in the exchange rate are taken as expected values.

²⁶Described by small letters.

²⁷In a high inflationary environment where changes in money demand compensate changes in the (nominal) money stock, it is a plausible assumption to consider real GDP as an exogenous variable in its relationship to money and inflation (see Cagan 1956). Moreover, in a transition economy such as Russia's, where soft budget constraints on companies prevailed, one would assume weak transmission of price and monetary signals into real production. Interest rates also were treated as exogenous as they were "guided" by the central bank.

Table 6. Russia: Augmented Dickey-Fuller Statistics for Testing for a Unit-root
 Sample period: 1993 (1) -1997 (12) 1/ 2/ 3/

Null order	Variables				
	p	m	extra	rgdp	FIDR
I (0)	-2.457 (-0.015)	-1.552 (-0.02)	-1.194 (-0.029)	-3.016 (-0.287)	1.377 (-0.474)
I (1)	-2.165 (-0.19)	-3.277 (-0.91)	-2.927 (-0.607)	-3.353 (-1.068)	-2.482 (-0.497)
I (2)	-4.31** (-1.08)	-4.522** (-2.56)	-4.318** (-2.0918)	-3.95** (-2.208)	-4.038* (-1.916)

1/ The data set has been seasonably adjusted; and trend is added.

2/ Two values are reported for each variable and null order: (1) the augmented Dickey-Fuller statistics, and (2) the estimated coefficient on the lagged variable, where the coefficient should be zero under the null hypothesis of a unit root.

3/ In this paper, * and ** stand for significance at the 5% and 1% level, respectively.

stationary, it is tempting to purge the nonstationarity by differencing and estimate using only differenced variables.²⁸ But in this case, valuable information concerning the long-run equilibrium properties of the data set would be lost.

As the time series used are non-stationary, a cointegration technique is used for assessing the long-term relationship between the variables. Cointegration means that one or more linear combinations of integrated variables are stationary even if these variables are not individually non-stationary. That is, cointegration is evidence of a long-term relationship between time series. The lack of cointegration would suggest a lack of links between the variables. Different techniques can be used to find cointegrating relationships. This paper follows Johansen (1988) and Johansen and Juselius (1990), which provide an asymptotically fully efficient maximum likelihood-based systems technique for determining the number of cointegrating vectors and conducting inferences about the cointegrating vectors.²⁹ If the cointegrating relationship is found, then as in Engle and Granger (1987), the data set can be presented through an error correction model, which provides a framework for analyzing both long-run relations and short-run dynamics.

D. Results

The Johansen procedure analysis with 6 lags³⁰ suggests two cointegrating relationships between prices, the money stock, and the exchange rate (with non-modeled real GDP, deposit rate, and trend). The model fits well with actual values. Residuals are normally distributed and the hypothesis that there is no residual autoregression can not be rejected (see Table 7).

²⁸Non-stationarity means that there is a possibility of a spurious relationship among the levels of economic variables. Additionally, unless the variables are cointegrated, the parameter estimates from a regression of one such variable on others would be inconsistent (see Dickey et al., 1991).

²⁹An alternative to this is Engle and Granger (1987) method proposing to test whether the residuals from a static regression of the integrated variables have a unit root. If the hypothesis of the unit root is rejected, then the static regression is interpreted as a cointegrating relationship and the variables are considered cointegrated. If the variables are cointegrated, the residuals can be treated as the error-correction term in subsequent specification of the dynamic model for the variables involved. Tests for a unit root are typically based on the (augmented) Dickey-Fuller statistics (see Dickey and Fuller (1979, 1981)), using critical values from McKinnon (1991). Although easy to implement, the Engle-Granger procedure suffers from some shortcomings. Banerjee et al. (1993) shows that the Engle-Granger procedure often has little power to detect cointegration, and that the long-run coefficient estimates from the static regression can be badly biased in finite samples. Also it can only identify one such relationship even though several cointegration relationship may exist.

³⁰The number of lags was chosen on the basis of the Akaike and Schwartz criteria.

Table 7. Russia: Cointegration Analysis of Prices, Money, Exchange Rate, and Interest Rates

Sample period: 1993 (7) -1997 (12)						
Eigenvalues	0.77	0.61	0.21			
Hypothesis 1/	$r=0$	$r \leq 1$	$r \leq 2$			
λ_{\max}	73.57**	46.63**	11.74			
95% critical value	25.5	19.0	12.3			
λ_{trace}	132.9**	59.37**	11.74			
95% critical value	42.4	25.3	12.3			
Standardized eigenvectors, γ'						
	p	m	extra	rgdp	R	Trend
	1.000	-0.941	-0.405	-0.162	-0.003	0.010
	-1.383	1.000	0.942	0.599	-0.0004	-0.021
	-1.141	-0.466	1.000	-1.266	-0.007	-0.025
Standardized adjustment coefficients, δ						
	p	m	extra	rgdp	R	Trend
			-0.326	0.116		0.005
			0.716	0.181		0.018
			-0.929	-0.078		-0.097

Vector portmeanteau 6 lags =61.07

Vector AR 1-3 F(27, 18) =1.13 [0.4033]

Vector normality Chi²(6) =11.58 [0.0720]

1/ λ_{\max} and λ_{trace} are Johansen's maximum eigenvalue and trace eigenvalue statistics for testing cointegration. The null hypothesis is in terms of the cointegration rank r . For example, rejection of $r=0$ and non-rejection of $r \leq 1$ are evidence of one cointegrating vector.

Table 8. Alternative Long-run Hypotheses Test Results (Restricted Cointegration Analysis)

Test Hypotheses	Test results	Significance	Estimated long-run vectors
1. No feedback on prices	$\chi^2(2) = 43.53$ p value=0.00		Not applicable
2. No feedback on M2	$\chi^2(2) = 42.97$ p value=0.00		Not applicable
3. No feedback on exchange rate	$\chi^2(2) = 11.43$ p value=0.003		Not applicable
4. p, m, rgdp, FIDR, t	$\chi^2(2) = 33.1$ p value=0.00		Not applicable
5. p, extra, rgdp, FIDR, t	$\chi^2(2) = 15.79$ p value=0.00		Not applicable
6. p, m, extra, rgdp, FIDR, t	$\chi^2(2) = 20.9$ p value=0.00		Not applicable
7. p, extra, rgdp, FIDR, t	$\chi^2(2) = 49.91$ p value=0.00		Not applicable
8. p, extra, rgdp, FIDR, t	$\chi^2(2) = 1.87$ p value=0.17	*	$p=1.758\text{extra}+3.42\text{rgdp}-0.013\text{FIDR}-0.04\text{t}$ $p=m-0.381\text{extra}+0.002\text{FIDR}-0.012\text{t}$
9. p, extra, rgdp, FIDR, t	$\chi^2(2) = 1.85$ p value=0.17	*	$p=1.068\text{extra}-14.073\text{rgdp}+0.046\text{FIDR}+0.122\text{t}$ $p=m+0.495\text{extra}+0.695\text{rgdp}-0.019\text{t}$
10. p, extra, rgdp, FIDR, t	No binding restriction p value=0.6		$p=1.59\text{extra}+2.41\text{rgdp}-0.010\text{FIDR}-0.031\text{t}$ $m-p=-0.329\text{extra}+0.325\text{rgdp}+0.004\text{FIDR}+0.009\text{t}$

Note: * Joint hypothesis acceptable with a probability value above 0.01.

To identify vectors, several restrictions were imposed on α and β values³¹ following Johansen and Juselius (1992, 1994). Restrictions on α values reveal that the feedback from the cointegration relationship on the exchange rate equation is weaker than the feedback on the prices and money stock. However, the hypothesis that there is no feedback from cointegrating vectors to the involved variables is rejected (see Table 8).

The results of imposing restrictions on β values suggest the significance of the modeled variables involved. The first vector suggests a long-term relationship between prices and exchange rate (with existing non-modeled variables). The hypothesis that the non-modeled variables are not relevant is rejected. As expected, prices are positively related to the exchange rate, real GDP, and reversely related to the deposit rates. The trend, which was taken as a proxy for reforming and hardening budget constraints on loss making companies, is reversely related to inflation. The second vector suggests the existence of a Cagan (1956) type money demand relationship where real money is reversely related to the exchange rate and positively related to the deposit rates, real GDP, and trend.

Then, in the single equation, inflation was regressed on the contemporaneous changes and 5 lags of the money stock, exchange rate, real GDP, deposit rate, and its own lagged values,³² and the lag of the first lag of cointegrating vectors, error-correction mechanism, from the cointegration analysis. As variables were taken in changes instead of levels, the trend became irrelevant and was dropped.³³ Based on the results of the F-test and the Schwartz criteria, some simplifications and reductions in lags were made. The final equation is given in Table 9. For the comparison of the actual and modeled values of inflation see Chart 5.

From the single equation model, it can be seen that there is a high degree of inertia in inflation. About 51 percent of inflation in the previous period is translated into contemporaneous inflation. About 13 percent of the changes in the money stock in the

Table 9. Russia: A Single Equation Inflation Model
Sample Period: 1993 (10) - 1997 (12)

$$Dp = -0.31 + 0.51Dp_{(t-1)} + 0.13Dm_{(t-1)} + 0.0005DFIDR + 0.001DFIDR_{(t-1)} \\ (-4.41) \quad (8.77) \quad (2.14) \quad (2.30) \quad (3.95) \\ + 0.15DDextra - 0.04ecmprice_{(t-1)} + 0.13ecmmd_{(t-1)} \\ (4.22) \quad (-5.77) \quad (5.11) \\ + (0.03S - 0.01S_{(t-1)} + 0.001S_{(t-2)} + 0.006S_{(t-3)} - 0.001S_{(t-4)} + 0.001S_{(t-5)} \\ - 0.004S_{(t-6)} - 0.01S_{(t-7)} - 0.0002S_{(t-8)} + 0.008S_{(t-9)} + 0.01S_{(t-10)}).$$

$$R^2 = 0.98 \quad \sigma = 0.008 \quad DW = 2.4 \\ \eta_1(3) = 5.8 \quad \eta_2(3.27) = 1.2 \\ ARCH_1(4) = 4.6 \quad ARCH_2(4, 22) = 0.62 \\ Norm(2) = 3.3 \quad RESET(1, 29) = 3.65$$

$$ecmprice : [p - 1.59extra - 2.41rgdp + 0.010FIDR + 0.031t]$$

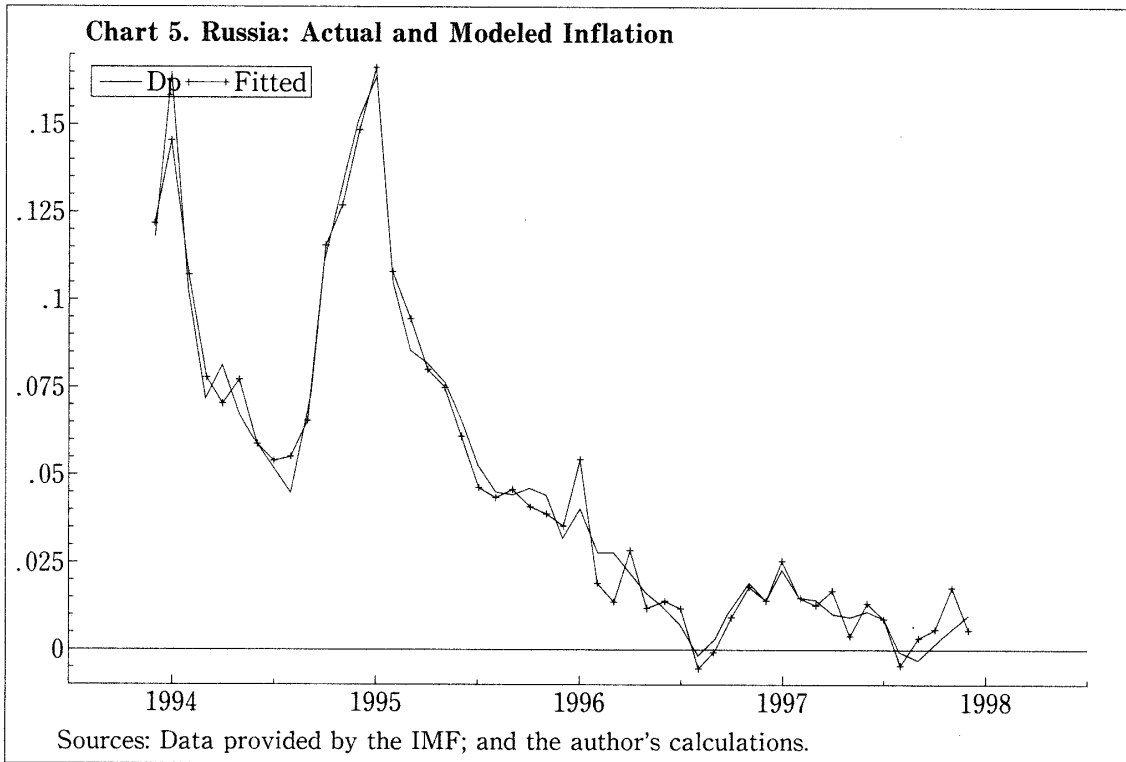
$$ecmmd : [m - p + 0.329extra - 0.325rgdp - 0.004FIDR - 0.009t]$$

Note: t values are in parentheses. DW is Durbin-Watson test, and η_1 and η_2 are Lagrange multiplier tests for autocorrelation distributed as $\chi^2(f)$ and $F(f_1, f_2)$, respectively. $ARCH_1$ and $ARCH_2$ are tests for autoregressive conditional heteroscedasticity distributed as $\chi^2(f)$ and $F(f_1, f_2)$, respectively. Norm is the Jarque-Bera test for normality distributed as $\chi^2(2)$, and $RESET$ is the first-order test statistic for heteroscedasticity suggested by Ramsey (1969) distributed as $F(1, f_1)$.

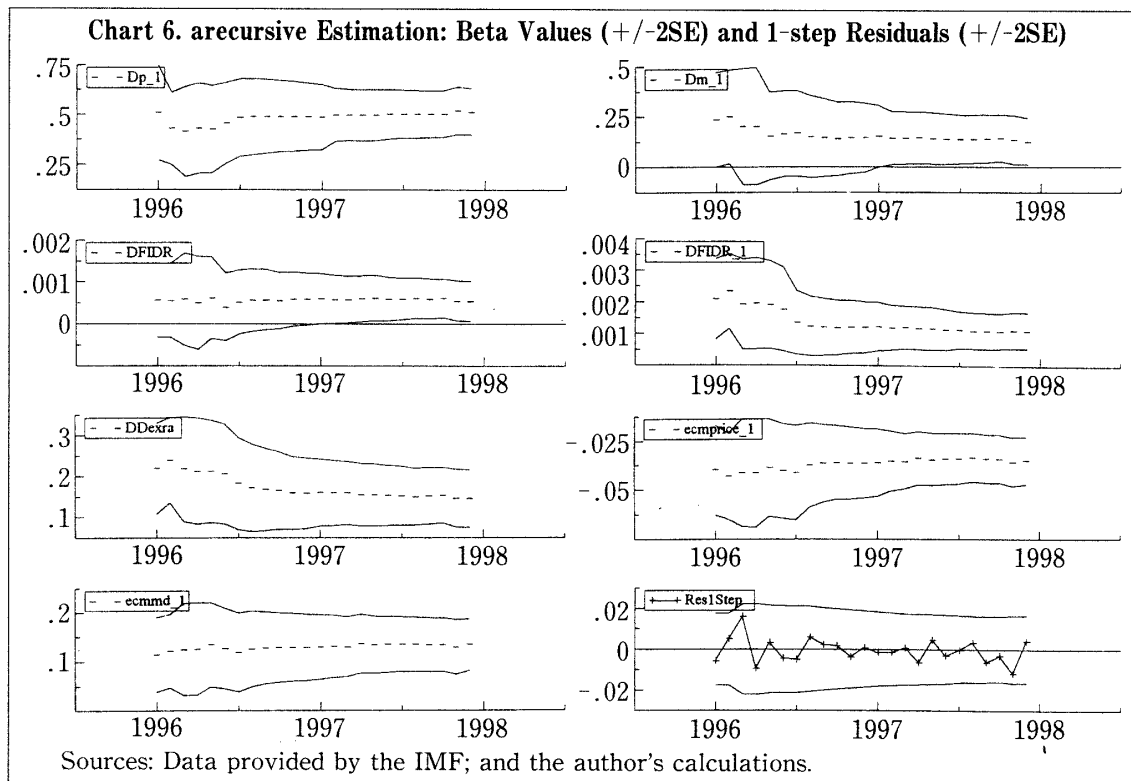
³¹ α is the adjustment or feedback matrix and β is the cointegrating matrix. For the description of the meaning of these matrices see Johansen (1998) and Darnell (1994).

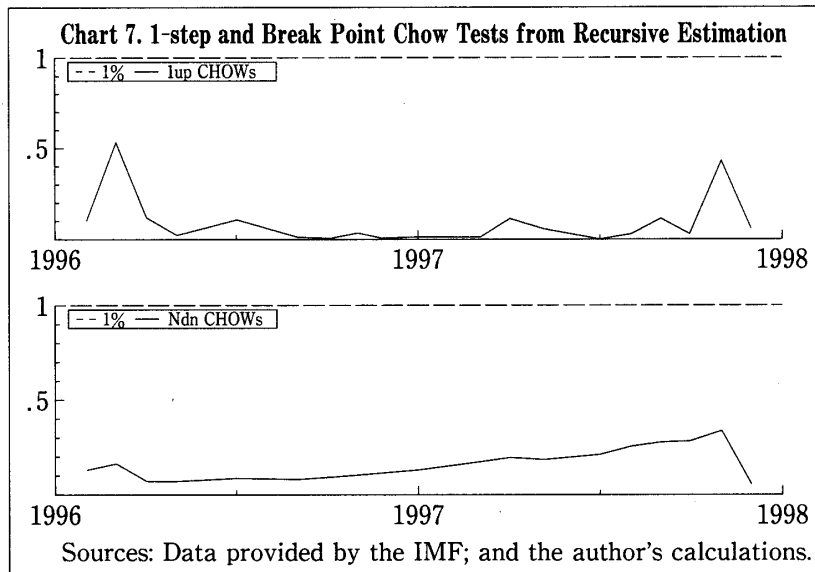
³²5 lags were chosen because the VAR analysis was conducted with 6 lags.

³³F-test and t-test results confirm this approach.



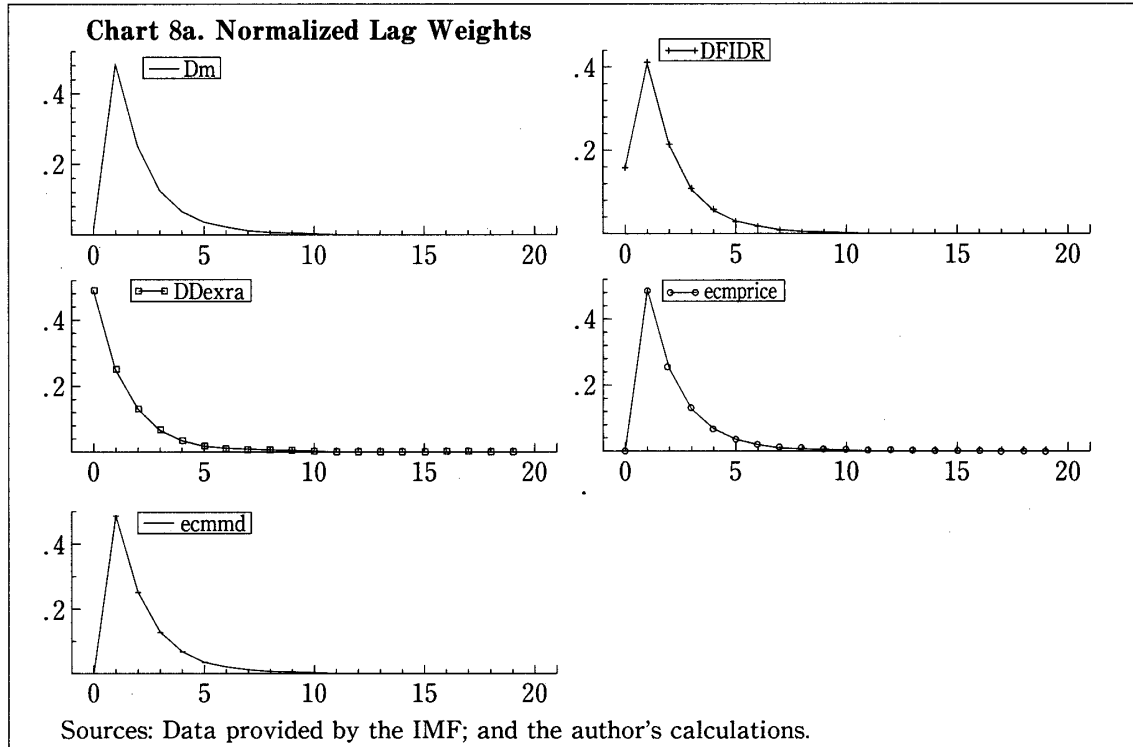
previous period is translated into inflation. Contemporaneous changes and other lags in the changes in the money stock were dropped. GDP variable and all its lags were also dropped. The effect of the changes in the deposit rate is small but significant.³⁴ About 15 percent of changes in the exchange rate changes is translated into inflation.



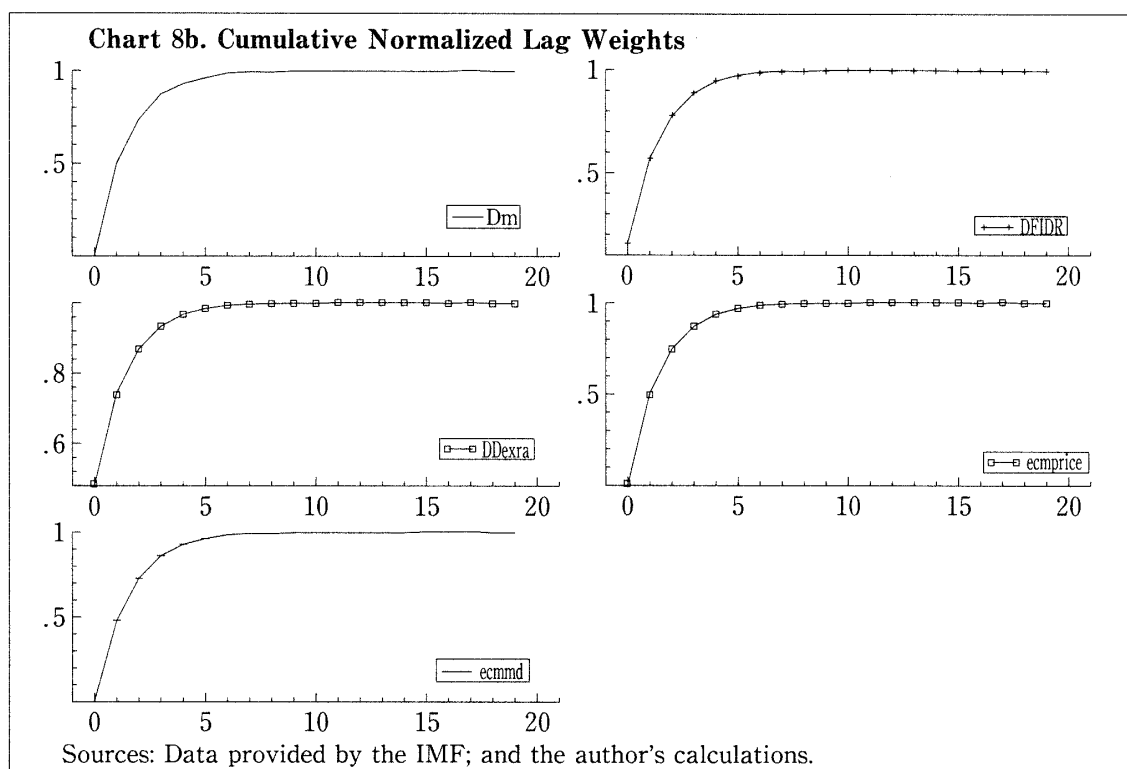


About 4 percent of the disequilibrium from the long term price-exchange rate relationship in the previous period determines inflation, and as expected, has a minus sign. Feedback from the second (money demand) vector is much stronger: about 13 percent of disequilibrium in the previous period is translated into inflation. As expected, this relationship, which is the excess of money supply over money demand, enters into the equation with a positive sign.

On the recursive estimation³⁵ of the model it is concluded that the model is stable



³⁴It is also worth noting that the deposit rate has a positive sign, which is not a strange observation in the transition economies, where the interest rates on lending are determined as a make-up over the deposit and are not binding factors for lending.



(see Charts 6 and 7). In the light of drastic changes in the economy, this is a remarkable conclusion.

Lag weights from the dynamic analysis in the single equation reveal that changes in the variables translate into inflation very quickly, somewhere within 6 months (see Charts 8a and 8b). This is a common observation in high inflation economies and has the following implication: with necessary efforts, inflation can be brought down rapidly.³⁶

VII. Disinflation: Major Obstacles

As it was shown above, Russia's inflation was caused by financing of the public sector imbalances through increases in the money stock and "flight" from money. However, the money stock in transition economies has two components: (1) money recorded in the official statistics and (2) quasi-money (interenterprise arrears, tax arrears, wage arrears, barter,³⁷ etc.).³⁸ As a result, a reduction in the officially recorded money stock alone may not necessarily bring down inflation immediately because increases in arrears and barter,³⁹ the uncontrollable part of the money stock, may

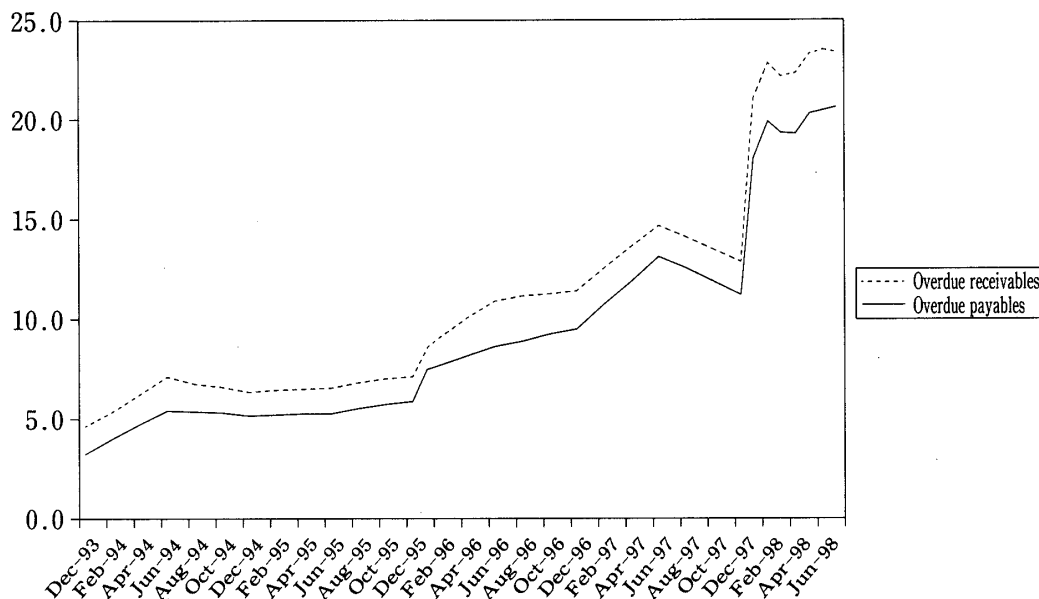
³⁵See Brown et al. (1975) for the explanation of using recursive residuals as a test of stability.

³⁶See Cagan (1956), Sargent (1982), Vegh (1992), and Rebelo and Vegh (1995).

³⁷Although no data is available on barter, anecdotal stories from mass media suggests that they have been used on a large scale.

³⁸Arrears should be considered as a part of the money stock. However, arrears were not included in the money stock in the empirical analysis as no consistent data was available, and arrears' effect on inflation is indirect and their velocity is very volatile, the latter depending on the degree of inclination of the government to monetize them.

³⁹The existence of quasi-money increases nominal GDP and consequently, the demand for cash. This adds to the depreciation of the accounting money vis-à-vis cash money (see footnote 15).

Chart 9. Russia: Overdue Receivables and Payables as Percent of GDP

Sources: Data provided by the IMF; and the author's calculations.

compensate for the reduction in subsidies and soft credits for some period. The existence of arrears itself is a direct result of weak financial discipline.

The relationship between increases in arrears and inflation is complicated. First of all, just the possibility of running arrears without being adequately punished affects the behaviour of economic agents who tend to overspend, eventually bidding up prices. Second, arrears paralyze the payment system and accumulate pressure on the government to eventually monetize them. Third, some kind of arrears such as wage arrears⁴⁰ and arrears in the budgetary expenditures may temporarily reduce inflation. At the same time, however, arrears themselves may be caused by increasing inflation in the short run when economic agents' financial burden increases in nominal terms. Finally, in the absence of strong financial discipline, loss making companies can finance their fiscal imbalances by running arrears instead of getting subsidies from the budget and (soft) credits from the banking system, which means arrears might increase during tight monetary policy.

As the size of arrears is not controlled by the central bank, arrears become a very significant hindrance to disinflation. In the short-run, the possibility of running arrears causes inertia in inflation as economic agents can increase prices that are unrelated to changes in the money stock. In the long run, arrears paralyze the payment system, adversely affecting even profitable companies. Thus, increasing arrears put pressure on the monetary authorities to monetize them. In Russia, the size of arrears reached dangerously high levels, threatening to the stability of the whole financial system

⁴⁰Wage arrears have been widely spread in Russia. Recurring strikes of workers for getting their salary payment, and the fact that the President of Russia, Yeltsin, treated the payment of salaries as one of the main pre-election issues shows the importance of this problem. In 1994, wage arrears in Russian firms were 2.3 percent of broad money. In 1995, this figure was 4.2 percent, and the number of the firms having wage arrears was 44 percent of the total number of enterprises. In the short run, wage arrears would reduce inflation, however, the relationship is not clear in the long run as the wage arrears undermine the confidence in the financial system and causes disintermediation.

Table 10. Russia: Arrears to the Budget 1992-1998
(In percent of GDP)

	1992	1993	1994	1995	1996	1997	1998 (first 6 months)
Arrears to the federal budget	0.3	1.2	2.0	2.1	1.0	1.2	2.1
Arrears to the consolidated budget	0.5	2.0	3.0	3.9	1.7	2.9	3.9

Source: Reproduced from the *Rossiyskaya Ekonomika v Yanvare-Sentyabre 1998 Goda: Tendentsii I Perspektivy*, Vol.19, November 1998, Moscow, p. 18.

(Chart 9), and have pushed the government to monetize them frequently.

Although arrears are a common feature of transition economies, it has become a destabilizing factor in the Russian economy since 1995⁴¹ when the government began to pursue tight monetary policy using exchange rate as an anchor and being relatively successful in stabilizing macroeconomic environment. However, as the necessary structural reforms in micro-level were not put together, this led to substantial increases in arrears, especially interenterprise arrears, despite some relaxation in fiscal policy.⁴²

When bankruptcy laws do not work and the political costs of the liquidation of non-viable enterprises are high, the non-viable enterprises may even be tempted to delay paying taxes because high inflation erodes the real value of the tax. Tax arrears should be thought of as a subsidy. At the end of 1995, the tax arrears in Russia were at about 4 percent of GDP. Although, tax arrears declined to 1.7 percent of GDP in 1996, they increased again in 1997 and 1998 (see Table 10).

VIII. Conclusions

Financing of the deficit of the government and loss making quasi-public companies by monetary expansion is the main cause of high inflation in Russia. Many enterprises in Russia continue the production of unprofitable products. They are able to stay in business only because of subsidies and quasi-subsidies. Disinflation would require substantial restructuring and liquidation of these companies.

Successful disinflation requires, first, the reduction of growth in the money stock which is the main source of financing the fiscal imbalances of the public sector. Second, reducing seignorage or credit expansion alone is not enough for successful disinflation. Changes in velocity and increases in arrears can compensate for the reduction in growth of the officially recorded money stock at least in the short run. The empirical analysis in this paper reveal that inflation and money are very closely related in the long term but far less related in the short term. Third, unless budget constraints on the firms are hardened, disinflation will not be successful. Under weak financial discipline, the firms would finance their deficits with quasi-money, which is not under the control of the monetary authorities, even if they can not get subsidies from the budget or soft credits from the banking system. The cointegration analysis also confirms this conclusion, where the time trend was taken as a proxy for continuation of reforms and

⁴¹Although no data is available, mass media reports shows that the size of interenterprise arrears also increased enormously in the early 1992, which eventually led to the resignation of Gaidar, the reformist prime minister, in the late 1992.

⁴²Total budgetary expenditures as percent of GDP rose to 43.1 percent in 1996 from 41.1 percent in 1995.

hardening budget constraints and was found to have been reversely related to inflation.

Based on the above analysis, it can be concluded that inflation in transition economies can be brought down quickly through consistent fiscal, monetary, and exchange rate policies but price stability will not be sustainable unless structural reforms are put in place.

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