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Money in the Soviet Administrative Command Economy: A Quantitative Analysis

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Abstract

This paper quantitatively examined the relation between money and real economy in the Soviet economy. The institutional and historical analysis of the Soviet monetary management yielded the tasks of quantitative analysis. The quantitative analysis showed that the institutional division of cash and non-cash was effective, demand for cash was not predictable, and there was no significant relation between money and real production. This result suggested that the Soviet monetary management relying on some vague money supply target could not function well and only the control on wage which was supported by the division of cash and non-cash could weakly ceil money supply. A fundamental problem of the Soviet economy seemed that a mechanism to bridge between money and real economy was lacked, while money was used. It is, therefore, difficult to regard the Soviet economic system as an complete economic system equivalent to the market economy.

1. Introduction

The Soviet administrative command economy was the largest economic experiment in the twentieth century: the results of this experiment are a unique material to investigate an economic system as a whole. The opening-up of the Soviet archives greatly helped to understand the Soviet economic system (see Gregory, 2001; Gregory, 2004; Gregory and Harrison, 2005); many questions, however, remain still unanswered. The monetary management in the Soviet economy is one of those questions.

Material planning, that is, administrative allocation of resources, was the main pillar of the Soviet economic system. Material planning restricted the role of money more or less; it did not, however, demise money. The 'passive money' concept summarized the role of money in the Soviet economy (see Baykov, pp. 414-5; Gregory, p. 192; Brus, pp. 65-83): Holding money was not sufficient to move economic resources; administrative permission was always necessary to transact resources except for in the sphere of household consumption. On the other hand, whenever economic resources were transacted, money moved according to the transaction. Because money

always followed the movements of resources, money was able to serve as a tool to monitor and control economic activities.

This concept of passive money reflected the realities of money in the Soviet economy well. The concept, nevertheless, had some ambiguity: First, the concept of passive money said nothing about illegal economic transactions. The point noted here is not that how significant illegal economic activities were, but that the concept of passive money concerns the legal and institutional aspects of monetary management. Secondary, contrasting to the first point, the concept of passive money scarcely explained economic contents of the Soviet monetary management: what the concepts said was only that money moved legally and passively according to legal economic transactions. It is certainly different questions if a transaction is legal and if the transaction is economically rational. Even if a legal transaction is not economically rational, money will move legally according to the transaction. Assuming only that we do not have perfect foresight, allocations of resources are not always economically rational. This leads to the third ambiguity of the passive money concept: how the Soviet authority managed the legal but economically irrational movements of money? This consideration further leads to a fundamental question on the passive money concept: how we can understand the situation in which money had its economic value and, at the same time, money was passive. What that money has its economic value means that money has power to influence resource allocation. If money cannot influence resource allocation at all, it is not very meaningful to discuss monetary stability and monetary management. In the actual Soviet economy, monetary disequilibrium manifested itself as phenomena of queues, shortages, excess stocks, low productivity, vitalization of shadow economy, and social dissatisfaction. If material planning was revised to eliminate these phenomena, we may say that money could actively influence resource allocation and had economic value.

The purpose of this study is to quantitatively examine how money was related to real economy, passively or actively, using monetary statistics which have become available recently. We will return to discussion on the validity of the passive money concept after the quantitative analysis.

The scope of this study is limited to legal economic activities; illegal economic activities are not the subject of investigation. This is firstly because data needed to

investigate illegal economic activities are not available. Secondarily, it seems that we are able to find fundamental difficulty in the Soviet money management even if we limit our scope to legal economic activities.

The structure of the paper is as follows: Section 2 reviews the historical and institutional aspects of the Soviet money management to make it clear what we should quantitatively analyze. Section 3 explains the data used for the quantitative analysis and reports the results of preliminary analysis of the data. Section 4 reports the findings and results of the quantitative analysis. Section 5 discusses the validity of the passive money concept and directions of the further research.

2. Soviet monetary management: history and institution

Both Soviet and non-Soviet literature explains institutions and functions of the Soviet monetary management (Ikonnikov, 1954; Tochil'nikov   1973; Alkhimov, 1981; Podshivalenko, 1983; Kravtsovaya, 1983; Garvy, 1972; Kuschepeta, 1978; Sigg, 1981). This section surveys the goal, the institution, and the targets and instruments of the Soviet monetary management to design the quantitative analysis.

2.1 The goal of monetary management

Soviet literature claimed that the goal of the Soviet monetary management was the stability in the value of money and the Soviet planned economy, where one could directly control demand and supply of goods as well as prices of goods, could achieve the goal (see Baykov, 1970, p. 415; Ikonnikov, 1954, pp. 31-39; Institute, 1962, ch. 32; Tsagolov, ch. 25). On the other hand, non-Soviet scholars have discussed repressed or hidden inflation in the Soviet economy: they believed that monetary disequilibria occurred and caused various negative phenomenon including queues, shortages, and prosperity in black markets (Holzman, 1960; Grossman, 1963; Dyker, 1985, pp. 79-84; Birman, 1981).

Systematic data which showed what the target of the Soviet monetary management was and how they intended to achieve the target were not available: in the first place, Soviet literature did not give a clear definition of the stability in the value of money. The Soviet authority, nevertheless, obviously recognized that monetary disequilibria could cause serious economic problems. This understanding seemed to be

based on not theoretical considerations but the experiences of hyperinflation during the periods of the war communism, the first years of the first five-year plan, and World War II. Additionally to those periods, they experienced hyperinflation during the latter half of the Perestroika period. It seems that the war communism and the first years of the first five-year plan were only the periods when the Soviet authority intentionally lowered the priority of the monetary stabilization: in the periods of World War II and the Perestroika, the Soviet authority was forced to compromise the monetary stability for the war financing and the acceleration policy of economic growth, respectively. We briefly survey the situation of the monetary management in those periods.

The war communism was the period when the monetary stability was abandoned because of not only need for the war financing but also the belief in communist ideology (see Ikonnikov, 1954, ch. 5). The Imperial Russia suspended the gold standard in January 1914 to finance the costs of World War I. The Soviet government, which was in serious financial difficulty under the civil and interfering war, abolished in May 1919 all restrictions on banknote issue that still existed after the abandonment of the gold standard. In January 1920, the Soviet government abolished the banking system itself and started using governmental paper money only. The result of this policy was the hyperinflation and the barter economy[1]. As the civil and interfering war was over, the economic policy of the war communism was regarded as unsustainable. The policy course was changed to the New Economic Policy, which reintroduced the elements of market economy. In October 1921, less than one year after its abolition, the banking system was reestablished. The reestablished Gosbank[2] had right to issue banknotes subject to the issue guarantee and the limit on issue. After reintroduction of the banking system, monetary reform had been carried out during the period of 1922 to 1924. The eleventh party congress in 1922 set the principle of the monetary reform to stabilize the value of money by maintaining budget surplus and reintroduction of a gold-standard currency. Following this resolution, Gosbank issued

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[1] 93% of the total wage were paid in kind around the beginning of 1921 (Kuschpeta, 1978, p. 28)

[2] The name of the bank reestablished was the People's Bank of the RSFSR. Hereafter, Gosbank (Gosdurstvenyii bank: the state bank) is used to refer to the bank that was located at the center of the Soviet banking system, ignoring the accuracy of the name.

Chervonets notes; 25% of their value were backed by gold and foreign exchange and the other 75% by short-term bills and goods. Chervonets circulated from 1922 through to 1924. Chervonets were traded at the international money markets at that time and kept a stable exchange rate (Segal and Santalov, 1925, p. 347; Segal and Santalov, 1930, p. 417). The inflation, however, did not stop until 1924 when the trade balance and the budget balance turned to surplus (Ikonnikov, 1954, pp. 144-7). In 1924, the 1924-face Ruble was issued and all other old banknotes including Chervonets, paper moneys, and money surrogates were withdrawn from circulation: the monetary reform was completed.

In 1930s, the period of the Industrialization, the course of monetary policy was in dispute as the course of economic policy was. Davies(2001, pp. 72-3) indicated that Pyatakov, who was the president of Gosbank in 1928, executed an inflationary policy to provide firms with funds almost without limitation to accelerate the industrialization. As negative influences of the inflation became clear, the policy was changed and Pyatakov was removed from his post in October 1930. After that, Gosbank followed a tight monetary policy: Gregory (2004, p. 228-9) noted that the Soviet authority wanted to keeping the growth rate of monetary supply with the real economic growth rate. Such tight monetary policy could not accommodate to rapid structural changes in economy at the Industrialization period. Most of senior managers in the Gosbank, who supported the tight monetary policy or the monetary policy in the time of the gold standard, were expelled during the Purge of 1936 to 1939; it was, however, not clear how the purge was related to dispute on monetary policy (see Davies, 2003).

During World War II, money supply increased rapidly to finance the war efforts. The increase in money supply caused increase in prices both in the state sector and in the kolkhoz market. The Soviet monetary authority was cautious to the risk of excess liquidity held by rural households and the hyperinflation: this means that the Soviet monetary authority recognized that money might actively influence resource allocation (see CBR, 2007b; CBR, 2007c). A monetary reform was envisaged already during the war (CBR, 2007a). The monetary reform was carried out in 1947 after abolishing the rationing system and raising state retail prices: the reform was successful in restoring the monetary stabilization. In the 1947 monetary reform, the old-face ruble notes were exchanged with the new-face ones at the rate of 10 to 1. The amount of

households deposits less than three thousands ruble at the saving bureau (Seberkassa) kept the same amount at new ruble; household deposits over 3000 to 10,000 at old ruble were reduced to two thirds of its amount at new ruble; household deposits over 10,000 at old ruble were halved at new ruble. Business deposits were not revalued. Because the 1947 monetary reform did not include denomination, the nominal amounts of financial flows including wages and pensions remained unchanged. The Soviet official statistics did not do any adjustment to the values of the nominal indicators such as nominal net material products and average monthly wage before and after the 1947 monetary reform. As a matter of fact, the 1947 monetary reform was a vigorous action to reduce excess liquidity by confiscating horded currency and high-amount deposits. There is not much doubt on that the Soviet authority concerned over monetary destabilization.

During the 1950s, the Soviet authority executed a policy which was to reduce consumer prices in order to increase real income (Nove, 1992, pp. 333-335, 354-358; Khanin, 2003). Consumer prices were increased in 1946 for abolition of the rationing in 1947; consumer prices showed a decreasing tendency afterwards. Industrial wholesale prices were increased as subsidies were decreased in 1949; they were reduced in 1950 and 1952. Money supply, however, grew low but continuously during the period from 1950 to 1960: The monetary authority (CBR, 2008) reported that it was contented itself so far with that money supply was controlled within the permissible range, but it was watching carefully the increasing tendency of money stock and, therefore, requested the planning and industrial authorities to increase retail sales in order to channel currency back to Gosbank.

Inflation occurred in the Perestroika period (see Ellman, 1992). One important cause for the inflation was to finance budget deficits by Gosbank credit. At the same time, price control was weaken as private economic activities were allowed. Apart from the judgment if the economic policy in the Perestroika period was appropriate, it was understandable that the Soviet authority gave priority to continuation of the Soviet system over the monetary stability.

This survey showed that the stability of the value in money was at least one of the goals of the Soviet monetary management.

2.2 Institutional background of the Soviet monetary management

The main institutional pillars of the Soviet monetary management were the

mono-bank system, the ban on commercial credits and the restricted provision of bank credit, the division of cash and non-cash money flows, and the foreign exchange monopoly. The key institutional framework of the monetary management was formed at the 1930/32 credit reform[3] and have remained basically unchanged until the collapse of the Soviet system. We survey the institutional framework of the Soviet monetary management focusing on money supply channels.

The basic elements of the mono-bank system were rejection of the two tire banking system, concentration of banking operations in Gosbank, and assigning each firm to one and only bank branch office.

Gosbank was only bank through the Soviet era. Until the end of the New Economic Policy, there were various banking institutions. Gosbank was, however, the dominant bank at that time, which performed both commercial and central banking services. Gosbank's performing both commercial and central banking services was not a socialist invention but a tradition form the Imperial State Bank (Gurvy, 1972, pp. 882-3). Even after the 1930/32 credit reform, there were other banks including the foreign trade bank and some sectoral banks. The foreign trade bank had performed solely foreign exchange operations and almost nothing to do with domestic banking. After the 1930/32 credit reform, the sectoral banks have performed long-term credit service only; the long-term credit service was actually to administer investment funds which were financed by the state budget and disbursed to the specific spheres including housing construction and agricultural cooperatives[4]. There did not exist a commercial bank - central bank relationship between Gosbank and the sectoral banks. Gosbank performed all of short-term credit service and all settlement operations. All firms had transactional relationship with Gosbank through Gosbank's settlements service, while each firm was

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[3] The major decrees and resolutions dated on 30 January 1930, 14 January 1931, 20 March 1931, 23 March 1931, 21 October 1931, and 5 May 19329 931.3.20 are printed in Reshenya (1967, vol.2).

[4] Capital investments and increases in prescribed liquid assets in the state corporate sector were directly financed by the state budget. The 1965 economic reform introduced long-term bank credit as a financing source for the state capital investment projects for the first time (Resheniya, vol. 5, 1968, pp. 658-685, Art. 41). The share of the long-term credit in the total amount of the state capital investments remained around five percent even in the 1980s (Podshivalenko, 1983, p. 66).

allowed to open its bank account only one Gosbank branch office. This scheme gave Gosbank a possibility to monitor all individual transactions of all firms.

The ban on commercial credit was an instrument to increase Gosbank's ability to monitor firms. Short-term credits provided by Gosbank replaced commercial credits; at the same time, granting short-term credit was restricted. Gregory and Tikhonov(2000) and Gregory(2003, pp. 224-6) reported that Gosbank granted credits almost freely at firms' demands occurred at the first stage of 1930/32 credit reform. This caused the inflation in the first years of the 1930s. Facing the unexpected outcome, the initial concept of the credit reform was revised: short-term credits were granted to cover only financial needs difficult to be forecasted and standardized, such as outlay related to seasonal fluctuations and to goods under transportation and settlement. The loans should be secured with material collaterals and using borrowing funds for purposes other than the prescribed was prohibited. Therefore, the item of loan was changed from loan to work-in-progress goods, to loan to finished goods, to loan to goods on transportation, and finally to loan to goods on settlement as the production process advanced within a firm (Smirnov, 1982, p. 40). While use of bank loan was restricted, the interest rate was uniformly fixed and terms of loan were not differentiated by firm. Supply and demand for bank loan was adjusted administratively: Gosbank allocated quotas by item of loan to each firm on applications from the firm. The basic idea of the Soviet credit system was that the financial needs of the firms should be covered by the state budget (see Baykov, 1970, pp. 407-8); short-term credit was regarded as a subsidiary financial source.

Commercial credit was banned; it, however, continued to exist in the forms of accounts receivable and payable after the 1930/32 credit reform through to the collapse of the Soviet system (Gregory, 2003, pp. 226-31; Nakamura, 1984). These inter-company credits accounted for 13 to 20% of the liquid assets financing of the state enterprises[5]. On the other hand, the state enterprises in the heavy industry scarcely used bank credits until the latter part of the 1950s. It was relatively easy to forecast and standardize the demands for liquid funds in the heavy industry sector; these financial

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[5] Narkhoz(1968, p. 862; 1981, p.511; 1991, p. 27) indicated that the inter-company credit accounted for 20%, 14%, 13%, 23.5%, and 23.1% of the liquid asset financing of the state firms at the end of 1950, 1960, 1970, 1980, and 1990, respectively.

needs were financed by the budget money. Use of bank credit started to expand in the heavy industry sector in the latter part of the 1950s when the policy course was changed to a more flexible short-term credit supply (Rotleider, 1979, ch. 15)[6]. The purposes of increasing the flexibility of short-term credit were as follows: First, the switch from budget financing free from principal and interest repayments to credit financing with obligations of repayment was expected to increase efficiency of funds use[7]. Second, flexible financing was expected to eliminate the financing sources that were out of Gosbank control, such as inter-company credit and funds allocation among corporations by order of the higher industrial administrative organizations (see Davies, 1953; Shenger, 1961, p. 225-230; Gregory and Tikhonov, 2000). A bank loan facility (kredit po oborot) which grew in use around the 1965 economic reform boosted to use of bank loan[8] by the state enterprises. The loan facility was similar to the overdraft account: material collaterals to the loan were not required, the object of the loan was not specified, and temporal overdrawing was allowed. The introduction of this loan facility, however, resulted in a deterioration of the financial discipline of corporations. The use of the facility was restricted in the latter half of the 1970s; the 1979 economic reform (see Resheniya, vol. 13, p. 116, Art. 57) expanded again use of the facility (see Nakamura, 1984, pp. 54-5).

The division of cash and non-cash money flows represented the following institutional setting: the transactions of the household sector were settled by cash money, while all other transactions by account transfer by each transaction. Gosbank obtained a possibility to monitor each transaction of the corporations and could limit cash money circulation to the sphere of household transactions. Because of this institutional setting, the corporations did not need to transact cash money except for wage payments and proceeds from retail sales. The corporations were permitted to withdraw cash money from their non-cash funds only to pay wages, the amount of which was most severely

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[6] See Resheniya, 21 August 1954, Arts. 12-17, vol. 4, pp. 129-144; Resheniya, 4 October 1965, Arts. 20 and 45, vol.8, pp. 658-685; Resheniya, 3 April 1967, Arts. 4 and 7, vol.6, pp. 365-376; Resheniya, 22 August 1973, Arts. 1 and 2, vol. 9, 632-634.

[7] Differentiation of terms of loan to poorly performing and defaulting corporations was introduced in 1954 (Reshenya, 21 August 1954, Art. 2-12, vol. 4, pp. 129-144).

[8] See Resheniya, 4 October 1965, Art. 43, vol.8, pp. 658-685.

controlled by the authority.

There is not much doubt on that the division of cash and non-cash money flows contributed to improving the Soviet authority's ability to control a money supply channel, along which financing the corporations by the state budget funds and the bank loans resulted in an increase in cash money. The Soviet authority highly relied on the effectiveness of the division of cash and non-cash money flows: Savluk (1982, pp. 156-7) wrote that the relation between cash and non-cash money flows and its possible influence on the monetary management were not considered at all until to the 1950s. The division of cash and non-cash money flows, however, could not mean that there was no economic relation between cash and non-cash money. If we consider illegal and law-circumventing activities, the corporations could convert their non-cash funds into cash money through the Soviet era (Gregory, 2004, pp. 220-221). Even if we consider only the legal activities, cash and non-cash money flows were interacted. When the corporations withdrew cash, they needed to have had non-cash funds (Shenger, 1961, p. 102): the cash flow depends on funding situations of the corporation itself and its partner corporations. Their funding situations were, at least, partly related to financing by budget money and bank loans. Some poor-performing corporations might pay wages thank to financial help in the form of budget money, bank loan, inter-company credit, and funds allocated by the higher administrative organization. Even after that some Soviet scholars began to admit the existence of economic relation between cash and non-cash money (see Shenger, 1961; Levchuk, 1971; Barkovskii, 1976) in the latter part of the 1950s, it did not seem to seriously inquire how effectively cash and non-cash money were interacted. To quantify this effectiveness is one of the purposes of our quantitative analysis.

The monopoly of foreign exchange reflected that the domestic circulation of ruble and the flow of foreign exchange were institutionally speparated (Garvy, 1977, ch. 7; Kuschpeta, 1978, pp. 189-202; Sigg, 1981, ch. 6). The corporations were not allowed to transact foreign exchange and foreign currency even when they did export and import; there was, therefore, no need for the corporations to exchange foreign currency with ruble. Because there was no need to exchange foreign currency except for tourism, there was no foreign exchange market and no exchange rate. This administrative separation between the flows of foreign exchange and ruble closed another money

supply channel, along which exchange of foreign currency caused changes in the volume of ruble supply.

It was difficult to find any evidence that the Soviet authority considered the exchange ratios of ruble to foreign currencies as a important factor in monetary management. Although there was no market exchange rate in the Soviet economy, it was possible to calculate an ex post ratio of the foreign sales price to the domestic procurement price of an export good (see Marer, 1985, 28-33; IMF et al., 1991, vol. 1, pp. 421-430). The Soviet authority might use the information of this conversion ratio for the monetary management. CBR(2008, p. 62) revealed that the Soviet authority set the gold parity of the 1961 ruble at about one twenty-second of that of the before 1961 ruble in order to reduce an export subsidy of 33 billion Ruble on the 1961 annual economic plan to 7 billion; on the other hand, the conversion ratio of the new ruble to the old ruble was 10 to 1 at the 1961 denomination. So far as this change in the gold parity altered the Gosbank balance sheet, it might influence the domestic money supply; this change in the gold parity, however, seemed relevant not to the monetary management but to the fiscal policy. In the rest of this paper, we assume that the Soviet authority did not consider external purchasing power of ruble as a factor in monetary management.

The review on the institutional design of the Soviet monetary management indicated that there existed only the money supply channel of wages payments, assuming the fiscal discipline and the foreign exchange monopoly.

2.3 Final target, intermediate target, and instruments

The Soviet authority pursued the monetary stability in the institutional settings of monetary management described above; it was, however, not clear how the monetary stability was defined. Early Soviet economics textbooks like the Institute edition (1962, chs. 26 and 32) claimed that the value of ruble was secured because the gold parity of ruble was set. This view was, however, not acceptable: ruble was neither gold coin nor gold-convertible note. In the system of managed money where money itself (in the forms of paper note, electric signal, and so on) did not contain economic value, the stability of value in money is defined in relation with price index, exchange rate, and interest rate. The value in money itself, therefore, cannot serve as an operable target of

the monetary management. The intermediate targets, which can be controlled by policy instruments, are necessary to attain the final goal of monetary stability. In the Soviet economy, money supply was controlled through 'the balance method of money circulation management' (Kravtsovaya, 1983, p. 145). The balance method meant that cash money circulation was planned and managed being based on the balance tables including 'the monetary income and outlay balance of the household sector', 'the cash flow balance of the Gosbank', and 'the balance of bank credit'. This sub-section discusses what the intermediate targets in the Soviet monetary management were and which policy instruments they intended to use to achieve the intermediate targets.

The monetary income and outlay balance (Table 1 (A)) was a part of annual economic plan; the national planning agency, Gosplan, was in charge of compilation of both prospective and report balances in the annual and quarterly terms. The change in household deposits was an item of outlay in the balance; the closing item was the change in cash money hold by households. As cash money was circulated only in the sphere of household transactions, the monetary income and outlay balance comprised all cash transactions.

The cash flow balance (Table 1 (B)) was a document for Gobank's cash operation. The cash flow balance was not a part of the annual economic plan; it should be, however, approved by the council of ministers (Ikonnikov, 1954, p. 35; Alkhimov, 1981, p. 43). All unit of the Gosbank network, from the headquarter to the terminal branch offices, compiled the monthly, quarterly, and annual cash flow balances to avoid excess and deficiency of cash money by them. The most important source of information for a Gosbank branch office to compile the cash flow balance was the cash plans of the enterprises and organizations which have their accounts at the branch office[9]. It was obviously impossible to foresee all cash flows perfectly: cash flowed not as foreseen because the economy moved not as planned. Excesses and deficiencies of cash occurred at branch offices; these excesses and deficiencies of cash money should be managed firstly by the cash reserves held by the branch offices and secondarily by accommodation with cash by the higher units in the Gosbank network. If the Gosbank headquarter was in short of cash, the new banknotes would be emitted. As Table 1 (B)

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[9] Kravtsovaya (1983, p. 151-53) showed an example of *the cash balance* of an corporation.

shows, the closing item of the cash flow balance of the Gosbank headquarter was changes in cash money issued. Guarantee was required for banknote issues and the council of ministers set the upper limit on issue for each quarter.

The credit balance (Table 1 (C)) was another Gosbank's operational document. Because of the requirement for guarantee of issue, a banknote issue should be accompanied by a corresponding increase in asset of Gosbank, mostly an increase in loans given by Gosbank. The cash flow balance and the credit balance were interacted in this way; Soviet literature, however, mentioned little about what relation existed between the two balances in the actual operation (see Kuschpeta, 1978, pp. 173-175). The reason for this ignorance was probably the trust in the division of cash and non-cash flows: the permitted amount of wage imposed a ceiling on cash money supply, irrelevantly to the amount of loan given by Gosbank.

The Soviet authority attached importance to controlling households cash demand and, therefore, to the monetary income and outlay balance. The Soviet monetary theory defined the amount of cash money that the household sector needed to transact goods and services in a period as 'the required amount of money in circulation': they claimed that the monetary stability would be attained by supplying cash money to the amount no more and no less than this required amount. It was, however, doubtful how much information on the required amount of money in circulation or the optimal money supply the monetary income and outlay balance could provide. First, the prospective balance of monetary income and outlay could be closed in many ways: Gosbank complained that it was not clear which should be adjusted, retail sales, consumer prices, supply of consumer goods, or wage, to compile the prospective monetary income and out lay balance and the cash flow balance for the 3rd five-year plan (CBR, 2007c). Second, we needed to quantify the change in the amounts of cash money and deposit held by households in order to establish an operational target for issue or absorb of money. Third, even if the target for money supply was established using the framework of the monetary income and outlay balance, the target seemed far from operable because the target might indicate the end-period change in money in circulation. The end-period target for money supply gave not much information how much money should issue or absorb day by day if we consider regional and temporal fluctuation in demand for money. Actually, there existed only all-Union balance of

monetary income and outlay of the household sector until 1959; the republic balances were not compiled until then (Kravtsovaya, 1983, p. 143). Even after 1959, the regional balances included only the A1 and A2 parts of Table 1(A), because it was not possible to forecast the amount of cash transactions within the household sector and the magnitude of inter-republic migration of people, goods, and money (Tochil'nikov, 1973, p. 284-5; Ischshenko, 1983, p.285). The fact that the republic head offices of Gosbank were authorized to supply cash money over the amount stipulated in the prospective cash flow balance probably reflected the difficulty in foreseeing demand for money (Tochil'nikov, 1973, p. 299).

It seemed difficult to deduce the optimal money supply from the monetary income and outlay balance; the Soviet authority, nevertheless, seemed to establish a target for money supply somehow, because there seemed to be no other criteria which could be used for monetary management. Soviet literature was vague at this point how to establish an operational target of money supply, while it stressed on the concept of the required amount of money in circulation. The money supply target might be calculated being based on real national income (see Gregory, 2004, p. 228-9), total wage, total monetary income of the household sector, or a mixture of these indicators under the assumption of constant velocity of money (Kuschpeta, 1978, pp. 164-6).

The next question is how the Soviet authority intended to achieve the money supply target. Soviet literature emphasized the role of the limit on banknote issue, that is, the direct control on money supply; Soviet literature was, however, ambiguous again about how the issue limit functioned as a tool of monetary management. Although Soviet literature scarcely discussed the relation between the balances of cash flow and monetary income and outlay, it seemed that these balances were closely related in the planning process (Ikonnikov, 1954; Tochil'nikov, 1973; Kravtsovaya, 1983). The balance of monetary income and outlay gave a rough estimation of changes in money supply and this estimation was probably related to establishment of the limit on banknote issue. The prospective balance of cash flow was probably compiled so that the volume of banknote issue on the balance was kept within the limit.

It is, however, doubtful if imposition of a issue limit was an effective instrument of monetary management. For Japan, Bank of Japan law, which was enacted in 1941 after Japan's transition from the gold-standard to the managed money system,

required guarantee for banknote issue and imposed a limit on banknote issue. Both the guarantee requirement and the limitation of banknote issue were abolished when new Bank of Japan law was enacted in 1997: the reasons for the abolishment were as follows (FSA, 1999). First, it was not possible to establish a method to calculate the optimal limit of banknote issue. Second, it was not clear what kind of significance it had to stop banknote issue when demand for banknote existed. It had been a customary practice in Japan that banknotes had been issued over the limit and the revision of the limit was authorized following the fact.

If the limit of banknote issue should be kept, the simplest way to achieve it was to follow the balances of monetary income and outlay and the cash flow balance as they planned. Soviet literature indeed emphasized control of wage payments, the main balance item of cash disbursement, and of retail sales, the main balance item of cash receipt. The control of wage payments and retail sales, however, could not be an effective instrument of monetary management. Gosbank had authority to change neither the amount of wage payments nor the production volumes and the prices of consumer goods. Moreover, it seemed theoretically groundless and practically infeasible to change wage and retail sales in order to keep the planned balances and the limit on banknote issue, as it was in Japan.

In summary, keeping the limit on banknote issue through controlling wage payments and retail sales did not seem an effective method to attain monetary stability, even under the institutional framework of the Soviet monetary management. 'The balance method of managing money circulation' might be rather a scheme being based on the following simple idea: if you absorbed through retail sales so much cash money as disbursed through wage payments, cash money could not circulate excessively. The idea was logically true and fairly realistic during the time when people accepted any consumer goods and services offered. It was, nevertheless, not considered almost at all what the monetary authority to do in the cases like that retail sales could not absorb cash money sufficiently.

2.4 Task of the quantitative analysis

The Soviet authority intended to achieve monetary stability through keeping the limit on banknote issue and controlling wage payments and retail sales. It, however, seemed inevitable that the limit on banknote issue and the planned amounts of wage and

retail sales differed from their actual figures, simply because the plan was based on forecasts and expectations. Table 2 showed that the actual achievement differed from the plan: the Soviet 'planned' economy did not move as it was planned. If the plan and the achievement always differed, then adherence to the prospective balances and the planned limit on banknote issue would not be very meaningful. Occurrence of monetary disequilibria in a sense that the actual figures differed from the planned figures seemed inevitable as well. On the other hand, the Soviet economy institutionally excluded the information sources such as price indexes, interest rates, and exchange rates to analyze the situation of monetary economy and to monitor the efficiency and effectiveness of policy instruments used[10]. Moreover, the institutional settings of the Soviet economy circumscribed the possibility of the monetary authority to exercise the policy instruments including open-market operation, reserve requirement, and money rates operation. In the Soviet administrative command economy, monetary disequilibria would be recognized through the phenomena of shortage of consumption goods, queuing, increase in household deposits and hoarded money, and thriving black markets; the only way to deal with the phenomena might be to change the material planning including the amount of wage and the volumes and prices of consumer goods. If this was true, money influenced the real economy.

In the following sections, we investigate quantitatively the relation between the monetary and real sides of the Soviet economy. The opening-up of the Soviet archives significantly improved the availability of the Soviet monetary data, the available Soviet monetary data are, nevertheless, too scarce to fully investigate the function and performance of the Soviet monetary management. We limit our quantitative analysis on the following points:

First, we inspect the division of cash and non-cash money flows. If this division would not be effective, it would mean that a money supply channel, through which supply of non-cash funds increased cash money, was still opened. If it would be the case, the Soviet monetary management depending solely on control of the cash money circulation would not be functioning.

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[10] Levchuk(1971, pp. 129-30), a Soviet economist, recognized already in the beginning of 1970s that the lack for means to monitor the influences of monetary fluctuations on the economy was the problem.

Second, we examine if it was possible to forecast demand for cash money. The Soviet monetary management relied on keeping the money supply target through limiting banknote issue and controlling wage payments and retail sales. The precondition for functioning of this monetary management system was that the demand for cash money was more or less predictable. To keep inappropriate limits and targets were not meaningful. To access the predictability of demand for money, we estimate regression models which probably reflect the Soviet planning custom: It is known that a simple rule that an increment was added to the achieved level in the last period was extensively adopted in the Soviet planning practice (Birman, 1978; Dyker, 1985, pp. 1-8; Gregory, 2004, pp. 209-212).

Finally, we investigate the relation between money supply and real economy. We use Vector Auto-regression (VAR) models and Vector Error Correction (VER) models to statistically identify the relation between money supply and the real economy. This analysis concerns the predictability of demand for cash money as well; it is, however, improbable that the Soviet monetary authority used VAR and VEC models to predict demand for cash money.

3. Data and preliminary analysis

3.1 Test of stationarity

The series we use for the quantitative analysis are nominal net material product (NNMP), real net material product (RNMP), price level (PLEV), household monetary income (DD), end-year stock of cash money in circulation (NDVO), end-year stock of household deposits (DPO), end-year stock of broad money (M1), retail sales (CS), end-year stock of bank loan (CRD). All series excluding PLEV and M1 were based on the Soviet official statistics and the Soviet archives; a few missing figures were estimated. Appendix Table explained in detail the sources and the method of the estimations. The price level index, PLEV, is an implicit deflator calculated from NNMP and RNMP; the broad money, M1, is the sum of NDVO and DPO. All series started in the 1920s; only CRD started from 1949. CRD was used as a proxy of non-cash money in the quantitative analysis, because no other series like corporation deposits that could represent non-cash money was not available.

Appendix Table shows the original figures, while the log-transformed figures were used in the quantitative analysis. Hereafter, when we refer to the log-transformed level variables, we use the names in the block capital, like RNMP and NNMP. When

the prefix *g* is added to the block-capital name of a variable like gRNMP and gNNMP, it indicates the log-differenced variable. A log-difference figure approximates the growth rate of the original level variable.

Table 3 shows the results of the unit root test. The ADF and PP statistics indicated that all series excluding DD, DPO, and CS were level non-stationary and first difference stationary. DD, DPO, and CS showed a change in trend around the war period (see Appendix Chart). Regression of DD, DPO, and CS to the time trend showed the adjusted *R*-squared (R^2) higher than 0.99 under the assumptions that the time trend changed once in 1945 for DD, in 1940 for DPO, and in 1941 for CS. If a structural change in trend exist, the power of the unit root test is lowered. Perron's unit root test (1989), which took the structural change in account, was additionally done for DD, DPO, and CS. The basis of Perron's test is to perform the ADF test on the detrended series. The results of Perron's test showed the ADF statistics of -3.88, -2.61, -4.67 for the detrended DD, DPO, and CS, respectively. According to the Perron's table for model (C) (Perron, 1989, pp. 1336-7), the detrended DD and DPO were level non-stationary at the 5% significance level, while the detrended CS was stationary at the 5% significance level. DD and DPO were, therefore, regarded as the difference stationary series, while we needed to consider the possibilities that CS was level or difference stationary.

3.2 Preliminary analysis of the data

This sub-section reports the results of preliminary visual inspection on the data, focusing on the newly available data, household monetary income (DD) and cash money in circulation (NDVO).

The nominal series, NNMP, DD, NDVO, and CS, showed the common pattern that the increasing trend was strong before the war and weak afterwards (see Appendix Chart 1). Table 4 indicates a high correlation between these nominal indicators. gNNMP, gDD, gNDVO, and gCS, which represent the changes in the corresponding indicators, also showed a common pattern: they had a decreasing trend and relatively large fluctuations before the war and showed no clear tendency and relatively small fluctuations afterwards (see Appendix Chart 2). gNDVO appeared at first sight to move somewhat differently from the other series; gNDVO, however, also shared the common pattern, if we excluded the large changes caused by the 1924 monetary reform, the 1947 monetary reform, and the 1960 denomination.

DD and NNMP appeared to move closely together; the ratio of DD to NNMP, DD/NNMP, however, changed (Chart 1). In the periods before the war, DD/NNMP fluctuated largely: the ratio sharply increased during 1925 to 1932, then it sharply decreased during 1933 to 1935. DD/NNMP sharply increased again in 1942 and the ratio stayed over one during 1943 to 1945. DD/NNMP can be larger than one, because DD includes withdrawals of hoarded money and deposits. Appendix Chart 1 indicated household deposits (DPO) decreased, while cash money in circulation (NDVO) increased during 1941 to 1943. It was probably true that DD/NNMP was at the high level at that time; it, nevertheless, seemed implausible that DD/NNMP remained higher than one in the three consecutive years. We need to consider that the data reliability was low during the war time. The fluctuations of DD/NNMP were small after 1950. We can, nevertheless, relatively clearly see changes in the tendency: a decreasing tendency in 1950s, an increasing tendency from 1960 to 1975, a stagnating or decreasing tendency from the latter half of 1970s to 1985, and a sharp increase from 1985 to the end of the Soviet system.

The ratios of cash money in circulation to household monetary income (NDVO/DD) and to nominal net material product (NDVO/NNMP) moved similarly as DD and NNMP showed a common pattern of the movements. An increasing trend in NDVO/DD was seen since the latter half of the 1930s. The increasing trend was interrupted at the 1947 monetary reform, at the 1961 denomination, and in the years around 1980; the influences of these events, however, did not last. NDVO/NNMP moved slightly differently from NDVO/DD before 1945; NDVO/NNMP and NDVO/DD showed the similar increasing tendency after 1960.

The ratio of NDVO to real net material product (NDVO/RNMP) showed an increasing tendency before 1941; the ratio, however, stagnated during 1932 to 1936. These movements of NDVO/RNMP matched the development of monetary policy in the period described in Sub-section 2.1. NDVO/RNMP outstood during 1941 to 1947, reflecting the war-time inflation. NDVO/RNMP sharply decreased after the 1947 monetary reform and continued to decrease to 1960. The tendency turned upward after 1961; in the latter half of the Perestroika period, NDVO/RNMP increased at a speed comparable to that in the war time.

Chart 2 compared NDVO, DPO, Broad Money (M1), and Bank Loan (CRD). DPO was almost one tenth of NDVO around 1930, exceeded NDVO in 1954, and was about three times larger than NDVO in the final years of the Soviet system: DPO increased much faster than NDVO. The overall tendencies were, nevertheless, common in NDVO and DPO, except for a large decrease in NDVO at the 1947 monetary reform. DPO showed a small increase in 1947: this may support the Soviet authority's claim that the magnitude of the confiscation of household deposits at the 1947 monetary reform was small. Because the patterns of the movements in NDVO and DPO generally matched, M1, which was defined as the sum of NDVO and DPO, moved also similarly to NDVO and DPO.

Chart 3 showed the ratios of CRD to NDVO, to DPO, and to M1. CRD/NDVO was around 0.6 and almost unchanged during 1950 to the middle of 1970s, excluding a decrease in 1954 and a pinnacle in 1960. The decrease in 1954 may be related to the introduction of differentiated loan terms; the decrease in NDVO at the 1961 denomination may cause the increase in CRD/NDVO in 1960. CRD/NDVO started to increase in 1975, showed a sharp increase in 1981, remained at a high level during 1981 to 1985, then decreased rapidly after 1986. Chart 1 indicates that CRD/NDVO increased in 1981 because CRD grew faster than NDVO in 1981. On the other hand, the decreasing tendency in CRD/NDVO after 1986 reflected that NDVO grew rapidly in the period while CRD decreased. The cause for the different movements between NDVO and CRD after 1980 was not clear. The ratio of bank loan to broad money (CRD/M1) had a decreasing tendency except for a small rise around 1980: this was the consequence of that DPO grew faster than CRD after 1950 excluding a few years (see Appendix Chart 2). The visual inspection suggested that the division of cash and non-cash flows was effective in the sense that CRD did not appear to increase NDVO and M1. We quantitatively inspect this point in the following section.

As discussed in 2.3, the Soviet authority seemed to pursue for keeping the growth rate of cash money supply (gNDVO) within the range from zero to the growth rate of household monetary income (gDD). Keeping gNDVO at zero means that Gosbank collects all cash money disbursed from Gosbank in a period within the same period. If gNDVO is set at gDD, then it is:

$$\Delta DD \cdot \frac{NDVO_{t-1}}{DD_{t-1}} = \Delta NDVO \text{ ,}$$

where Δx denotes the time differential of the before-log-transformed variable x: x_t-x_{t-1} and $\Delta x/x_{t-1} \approx gx$. Setting gNDVO at gDD, therefore, means to supply additional cash money ($\Delta NDVO$), considering the money circulation velocity defined as $DD_{t-1}/NDVO_{t-1}$ and the increase in DD (ΔDD).

Household deposits (DPO) is an important factor to control cash money. An increase in DPO was a redemption of cash money, while DPO was easily monetized. There was no doubt that the Soviet authority was cautious with increase in DPO (see CBR, 2008), while Soviet literature gave little information on how to control household deposits and how to deal with unintended changes in household deposits. Whatever

intention the Soviet authority had, it seemed difficult for the Soviet authority to manage household deposits. There was no reliable and effective policy instrument to control households deposit excluding the de-facto confiscation at the 1947 monetary reform and the de-facto forced purchase of government bonds by households that existed until 1957 (see Sychev and Boldyrev, 1984, p. 250)[11]. If control of household deposits was difficult, control of cash money was also difficult.

Chart 4 shows the ratios of ΔNDVO and ΔM1 to DD (ΔNDVO/DD and ΔM1/DD) and the ratios of the growth rates of NDVO and M1 to the growth rate of DD (gNDVO/gDD and gM1/gDD). Note that ΔNDVO and ΔM1 are the flow amounts. ΔNDVO/DD seemed to fluctuate largely before the 1947 monetary reform. After 1947 until the latter half of the Perestroika period, ΔNDVO/DD appeared to fall in a certain narrow range. On the other hand, ΔM1/DD increased exceeding ΔNDVO/DD after 1947: this reflected that the weight of household deposits in M1 had rapidly increased after 1950. ΔM1/DD dropped in 1964 and in 1980 to 1982. The causes of these decrease were not clear.

Both gNDVO/gDD and gM1/gDD appeared fairly stable excluding the large changes in 1933, 1941, 1947, 1953 (only in gM1/gDD), 1960, 1963-64 (only in gM1/gDD), and 1970 (only in gNDVO/gDD). gM1/gDD varied larger than gNDVO/gDD during 1953 to 1964; it seemed more stable than gNDVO/gDD after 1965. The simple average and the standard deviation of gNDVO/gDD in the period from 1927 to 1990 excluding 1941 and 1947 were 1.12 and 1.29, respectively, while the simple average and the standard deviation of gM1/gDD in the same period were 1.49 and 1.30 respectively. The cause of the large change in gNDVO/gDD and gM1/gDD was related to the economic crisis at that time in 1933, to the war in 1941, to the monetary reform and denomination in 1947 and 1961. In 1964, DPO had changed large; NDVO did not. On the other hand, NDVO changed and DPO did not in 1970. The causes of these changes in 1964 and 1970 were not clear.

The visual inspection on ΔNDVO/DD and gNDVO/gDD showed that they were fairly stable except for the sporadic large changes; the cash money stock, NDVO,

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[11] The year-end amount of government bonds hold by households was 5.7, 6.6, 4.6, and 3.4 times larger than the year-end amount of household deposits in 1940, 1950, 1955, and 1957, respectively (RGAE, F1562/O41/E233/L134).

nevertheless, grew more rapidly than household monetary income, DD. The simple average of the ratio of the growth rates of cash money stock and household monetary income, gNDVO/gDD, from 1927 to 1990 was 1.12. gNDVO, was under zero only a few years and the simple average of the annual growth rates of NDVO (not log-transformed) from 1927 to 1990 was 11.3%. If the Soviet authority intended to keep the growth rate of cash money stock (gNDVO) in the range from zero to the growth rate of household monetary income (gDD), the intention was not realized.

4. Results of Quantitative Analysis

4.1 Division of cash and non-cash money flows

To examine the effectiveness of the division between cash and non-cash money flows, Vector Auto-regression (VAR) and Vector Error Correction (VEC) models including two variables, cash money in circulation (NDVO) and bank loan (CRD), were estimated. It would be better to discuss the effectiveness of the division in a wider model of interactions between the monetary and real economies; it was, however, not possible mostly because the CRD series started in 1949. From the econometric perspective, the shortness of the series inevitably reduce the power of cointegration test and the reliability of VAR and VEC models. From the economics perspective, the shortness of the CRD series may not be a serious problem if we limit our analysis to the division between cash and non-cash flows, because the institution of the division between cash and non-cash flow was established after the 1930/32 credit reform.

First, gNDVO-gCRD two variables VAR models were estimated. Setting the max lag length at 5, all lag order criteria, LR, FPE, AIC, SC, and HQ, indicated the lag order of 1 for the models including the constant term and the lag order of 2 for the model without the constant term. Both VAR models showed a poor fitness: only the constant terms and the own auto-regression terms were significant at the 5% level in each regression equation of both VAR models. Granger causality test on the VAR model with the lag order of 1 showed that Granger causality from gCRD to gNDVO was significant at 10% level; the Ganger causality from gNDVO to gCRD was rejected. Granger causality test on the VAR model with the lag order of 2 showed that gCRD and gNDVO did not Granger-cause each other.

The VAR model with the lag order of 1 showed a possibility that non-cash

money influenced cash. The impulse response analysis of the VAR model with the lag order 1 indicated, however, that gCRD inversely influenced gNDVO: an increase (decrease) in gCRD caused a decrease (increase) in gNDVO. The cumulative response of gNDVO three periods after a one standard-deviation shock in gCRD was -0.022 with Cholesky order from gNDVO to gCRD and -0.025 with Cholesky order from gCRD to gNDVO. The inverse relation between cash and non-cash money is not the relation we suppose: the influence of gCRD on gNDVO that the VAR model with the lag order of 1 identified was probably reflect the fact that NDVO and CRD moved in the directions opposite to each other in the 1980s (see Chart 3).

Because both NDVO and CRD are first-difference stationery, they can be co-integrated: that is, NDVO and CRD can be linearly combined with co-integration vectors to form stationery composite variables. A model, which added composite variables to the original VAR model, is a Vector Error Correction (VEC) model. The composite variables can be interpreted as that they represent the short-term deviations from the long-term relations between the original variables; the composite variables, therefore, called the error correction terms. If a statistically significant error correction term is omitted, the model is underspecified and the estimation results of the model does not have consistency.

Johansen test showed that no co-integration vector existed for the VAR model with the lag order of 1, while both trace statistic and max eigenvalue statistic of Johansen test showed that the existence of one co-integration vector at the 5% significance level for the VAR model with the lag order of 2. From this result, the VEC model with the lag order 2 including one error correction term was estimated. The VEC model showed poor fitness; only the error correction term in the gNDVO equation and the own first order atuo-regression term in the gCRD equation were significant at the 5% level. Granger causality test indicated no significant Granger causality between gNDVO and gCRD. Note that the error correction terms are not the subject of Granger causality test in a VEC model.

The estimation results of the cash money - bank loan VAR and VEC models suggested that there were no statistically significant relation between cash money and bank loan; the division of cash and non-cash money was probably effective in this sense.

4.2 Predictability of demand for cash money

The monetary authority should know how demand for cash money were related to the other variables and be able to more or less accurately forecast changes demand for cash money. From discussion on 'the balance method of cash money management', the Soviet authority probably used the variables that appeared in the balance of monetary income and some other variables such as nominal and real net material product to forecast demand for cash money. Although the available data were annual data, the time scope of the Soviet monetary management might be shorter than one year. We assume two cases where the Soviet authority used information in the previous period and in the same period: this may contribute to coping with the shorter time scope of the Soviet authority.

Table 5 showed the estimation results of the regression models of demand for cash money: for all estimations in the table, the figures of gNDVO for 1947, 1948, 1960, and 1961 were excluded to avoid influences of the large jumps caused by the 1947 monetary reform and the 1961 denomination.

Models of (a) to (f) in Panel (A) regressed gNDVO to the information in the previous period. Our purpose is to assess the predictability of demand for cash money; Model (a), therefore, includes all candidate variables so that the fitness, the adjusted R-squared (R^2), was as high as possible. One or more variables of the explanatory variables in Model (a) were dropped in the other estimation equations: R^2 of the other models are smaller than that of model (a) if we ignore possible small increases in R^2 caused by changes in the degree of freedom.

The highest R^2 was 0.16 in the models of (a) to (f): this means that the forecast models using information in the previous period could accounted for at best only 16% of changes in demand for cash money. In the models of (a) to (c), only the trend and the dummy terms were statistically significant at 5% level[12]. The R^2 of the models of (d) to (g) for the post-war period was smaller than that of the models of (a) to (c) for the entire period. Moreover, only Model (e) was significant at 5% as the model in whole (see F-value). Model (e) included bank loan (gCRD), household monetary income (gDD),

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[12] Other settings of the dummy and trend terms were tried for the models of (a) to (c). Their results were not reported in Table 7, because they were statistically not significant or they changed R^2 only negligibly.

and consumer aales (gCS) as the explanatory variables: only the constant term and gDD were significant at 5% level. Model (f), which included gDD and gCS and, therefore, represented the basic structure of the monetary income and outlay balance, was not significant as the model in whole.

Models of (g) to (k) in Panel A of Table 5 regressed gNDVO to the information in the concurrent period. The highest R^2 was 0.24 for Model (g) that included all candidate explanatory variables. Model (h), which represented the basic structure of the monetary income and outlay balance, showed a low R^2, 0.22. Only gDD in the explanatory variables of Model (h) was significant. Models of (i) to (k) for the post-war period showed relatively high R^2; the significant explanatory variable, however, was only gDD in all equations of (i) to (j). Model (k), which included only gDD as the explanatory variable, showed a R^2 of 0.47: this value of R^2 was as high as that of Model (i). This result suggested that it was sufficient to use only the information of household monetary income in the current period to predict the current demand for cash money: Household monetary income (gDD), the factor of cash money disbursement, influenced demand for cash money, while consumer sales (gCS), the factor of money redemption, did not. Model (h) for the entire period showed the similar characteristic.

Panel (B) of Table 5 indicate the estimation results of regression of gNDVO to the level variables: DD, RNMP, and CS. The level variables were non-stationary; the Soviet authority, however, might use the level variables. Only model (g) for the entire period was significant at 5% level as a model in whole; R^2 was, however, low and DD was not significant.   .

Table 5 showed that it was difficult to predict changes in demand for cash money using the variables in the current and previous periods. It was probable that the Soviet authority intended to control money circulation using the targets related to the volume or the growth rate of cash money supply; it, however, did not seem very meaningful if demand for money was not predictable.

4.3 Money supply and real economy

The purpose of the analysis in this sub-section is to statistically examine if any relation existed between money supply and real economy; the policy operability of the variables and the possible structural relations between the variables which the Soviet monetary management assumed were not considered.

4.3.1 Money-Income-Real Production VAR model

We estimate a VAR model including cash money in circulation (gNDVO), household monetary income (gDD), and real net material product (RNMP) as the explanatory variables. The results of the analyses in Sub-section 4.2 suggested that it would little improve the VAR model to include more explanatory variables. It was worth to consider to include price index, PLEV, as an explanatory variable or to deflate NDVO and DD by PLEV; this settings, however, were not adopted. It was doubtful if PLEV could be a proxy for consumer price index because of the methodology to calculate PLEV. We can assume that DD includes the price factor. Consumer sales (CS), which was the absorption factor of cash money, was not included in the explanatory variables. This is firstly because the analysis in the subsection 4.2 showed that CS little influenced cash money circulation and DD and NDVO can approximate the absorption of cash money (DD - NDVO ≈ CS). It would be desirable to include bank loan (CRD) in the VAR model to represent the relation between money and real economy; CRD was, however, excluded. The analysis in Sub-section 4.1 showed the division between cash and non-cash flows was effective. Moreover, the CRD series are short: the accuracy of the estimation is reduced if we include CRD in the VAR model. The figures of gNDVO for 1947, 1948, 1960, and 1961 were excluded as they were in Sub-section 4.2.

From a visual inspection of the variables (see Appendix Chart 2), introduction of a dummy variable which distinguish between the periods before and after the war was considered; the dummy variable was, however, not statistically significant. On the other hand, it was difficult to decide to include a trend term or not; both cases with and without trend term, therefore, were considered.

For the model without trend term, two of the five test statistics of the lag order test indicated the lag orders of 1 and 3, each; the other test statistics indicated the lag order of 5. The lag order of 5 seemed too long because we used annual data; it, however, might be possible that the lag order of 5 related to some five-year plan cycle for the Soviet case. The lag exclusion test on the VAR model with the lag order of 5 indicated that the 3rd, 4th, and 5th order lags were not jointly significant at the 5% level: The lag exclusion test on the VAR model with 1st, 2nd, and 5th lags indicated that the 5th order lag was not jointly significant at the 5% level. From these results, three cases of the lag

orders, the lag order of 1, the lag order of 3, and the 1st and 5th lags, were adopted for the VAR model without trend term.

For the VAR model with the trend term, four test statistics of the lag order test indicated the lag order of 2 and the other statistics the lag order of 1; a VAR model with the trend term with the lag order of 2 was, therefore, chosen.

Chart 5 showed the results of Granger causality test on the estimated VAR models: only the VAR model of the lag order of 3 indicated (Lag3NT) a Granger causal relation from gNDVO to gRNMP at the 5% significant level. Table 6 showed the results of the impulse response analysis of the VAR models: the cumulative response after three periods caused by one standard-deviation shock in a variable were indicated. Cholesky ordering was set as from gRNMP, to gDD, and to NDVO, considering the possible influence path from money to real production[13].　Table 6 supported the results of Granger causality test: a shock in gNDVO reduced gRNMP only in the model with the lag order of 3 (Lag3NT)[14]. On the other hand, a shock in gRNMP reduced both gDD and gNDVO in all cases. This inverse influences from gNDVO to gRNMP in the model with the lag order of 3 and form gRNMP to gNDVO in all models were not regarded as an usual relation between money and real production.

From the analysis of the VAR models, we found that money supply did not influence real production except for the model with the lag order of 3. The influence from money to real production in the model with the lag order of 3 was a relation which an increase (decrease) in money supply leads to a decrease (increase) in real production. We found that real production influenced money supply in all models; this relation was again an inverse relation. The inverse relation between money supply and real production probably reflects the fact that deterioration in real economy and increase in money supply occurred at the same time during the inflation in the periods of the early 1930s, the war, and Perestroika.

4.3.2 Money - Income - Real Production VEC model

DD, RNMP, and NDVO are difference stationary; we need, therefore, to

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[13]　Influences of changes in Cholesky order were negligible in this case.

[14]　The shock in gNDVO caused changes in gRNMP which were too small to present in a number with two digits after decimal.

consider VEC models of DD, RNMP, and NDVO. We assume from the analysis in 4.3.1 the following four cases: (1) the lag order of 1, (2) the lag order of 2, (3) the lag order of 3, and (4) the lags of 1 and 5, and perform Johansen test on each case. Both trace statistic and max eigenvalue statistic for Cases (1) to (3) showed the existence of one co-integration vector at the 5% significance level, while both statistics for Case (4) rejected existence of co-integration vector at the significance 5% level.

Because the VEC models used the level variables, introduction of a dummy variable (D2346) that was 1 in the years from 1923 through to 1946 and 0 in the other years was considered to identify the periods before and after the 1947 monetary reform. For the model with the lag order of 1, D2346 was significant at the 5% level in the gRNMP equation and not significant in the other equations; we, therefore, estimated the models of the lag order of 1 both with D2346 and without D2346. For the models with the lag orders of 2 and 3, D2346 was not significant at 5% level in all equations.

Chart 6 shows the results of Granger causality test on the estimated VEC models. The VEC model with the lag order of 1 without D2346 showed that gNDVO Granger-caused gRNMP at the 10% significance level, while the VEC model with the lag order of 1 with D2346 showed that gRNMP Granger-caused gNDVO at the 10% significance level. The models with the lag orders of 2 and 3 showed that gNDVO Ganger-caused gRNMP at the 1% significance level. Granger causality test suggested that cash money influenced real economy.

Table 7 showed the results of the impulse response analysis of the VEC models: the results showed that a shock in NDVO inversely influenced RNMP in the VEC models as same as in the Money - Income - Real Production VAR models. RNMP also influenced NDVO inversely: an increase (decrease) in real production caused a decrease (increase) in cash money. Note that the results showed the impulse responses between the level variables in the VEC models. There were only a few years when the level of NDVO or RNMP actually decreased (see Appendix Table, Appendix Chart 1, and Appendix Chart 2). The inverse relation between NDVO and RNMP probably reflected that real production decreased during the inflation periods before the 1947 monetary reform. The Perestroika period was not the case, because the levels of NDVO and RNMP were not reduced during the Perestroika period, so far as the official statistics reported.

The error correction terms in the VEC models can be interpreted as the long term relations between the level variables of NDVO, DD, and RNMP: the estimated coefficient of the error correction term indicates the adjustment coefficient, that is the ratio of adjustment within a period to the deviation from the long-term relation. Table 8(A) indicates the adjustments coefficients of the VEC models. An adjustment coefficient should be within the rage of -1 to 0, if a VEC model actually represent an error correction behavior. All estimated coefficients were in the range; the estimated values, however, seemed too small. The inverse of an adjustment coefficient indicates the number of period needed to eliminate a deviation occurred in a certain period. The adjustment period calculated from the estimated coefficient in Table 8 was 6 years in the shortest case of gNDVO in the *Lag3ND* model and 34 years in the longest cases of gRNMP in the *Lag1ND* model and gNDVO in the *Lag1WD* model. The adjustment period of 6 years seems too long for a relation between money and real production.

Table 8(B) shows the coefficients of the level variables in the long-term relations (the error correction terms) that are transformed to put NDVO at the left-hand side. Because the variables are log-transformed, the absolute values of the figures in Table 8 (B) indicate the elasticity of NDVO to DD and RNMP in their long-term relations. The values and signs of the estimated coefficients varied according to the model. In the *Lag1ND* and *Lag1WD* models, the estimated coefficient suggested that NDVO and RNMP moved in the same direction, while NDVO and DD moved in the opposite directions. In the *Lag3ND* model, NDVO moved parallel to DD, but inversely to RNMP. It is difficult to suppose that cash money supply moves inversely to nominal monetary income and real production. Only the *Lag2ND* model, where NDVO, DD, and RNMP move in the same direction, probably indicated an appropriate relation between NDVO, DD, and RNMP.

The analysis of the error correction terms in the VEC models indicated that it was difficult to interpret that the VEC models represented the behavior of the Soviet authority. The VEC models, nevertheless, statistically reflected the relations between the variables. The periods when cash money in circulation (NDVO) moved opposite to real net material product (RNMP) were the Industrialization period and the war-time inflation period only: increases in money and deterioration in real production indeed occurred at the same time in these periods. In the other periods, influences between cash

money and real production were probably weak in both directions, if they existed. Table 11 shows the results of the variance decomposition of the VEC models: change in NDVO accounted for a few percentage of a change in RNMP in all model settings.

The estimation results of the VEC models suggested that cash money supply inversely influenced real production in the inflation periods and there were no significant relation between cash money and real production in the other periods.

5. Discussion

We discuss economic meaning of the results of the quantitative analysis and the future direction of research in this section.

We analyzed the Soviet monetary management historically and institutionally and confirmed that the Soviet authority basically pursued for monetary stability. The Soviet authority seemed to intend to manage money circulation with some volume target of cash money supply. How to establish the target and how to achieve the target were, however, not clear: the Soviet authority seemed to rely on the limit on bank notes issue and securing it by control on wage payments and consumer sales, assuming that the institutional division between the cash and non-cash money flows were effective. Soviet literature did not present the method and the procedure to decide the issue limit. Moreover, Soviet literature fell silent about policy instruments to manage excessive money, although actual money supply seemed to inevitably differ from expected money supply.

Being based on the results of the historical and institutional analysis, we quantitatively analyzed the effectiveness of the division of cash and non-cash money flows which was the cornerstone of the Soviet monetary management. This is followed by the analysis of the predictability of demand for cash money. Unless demand for cash money was more or less predictable, limiting supply of cash money was not very meaningful. Finally, we statistically examined how cash money supply related to real economy.

The results of the quantitative analyses showed the following: First, the division of cash and non-cash money flows was effective. Second, it was difficult to predict demand for cash money from information in the previous and the current periods.

It was doubtful that the Soviet monetary management, which was based on the limit of banknote issue, functioned effectively. Indeed, the actual changes in cash money supply did not seem to follow simple rules of cash money supply, although some obscure upper limit of cash money supply seemed to exist. Third, cash money supply and real production influenced not strongly each other. The analysis suggested that cash money supply inversely influenced real production; this inverse relation was probably a statistical reflection of the inverse relation between money and real production during the inflations in the Industrialization, the war, and the Perestroika periods.

The results of our study seems consistent with Gorssman's theory on the Soviet money (Grossman, 1963; Grossman, 1966) and the recent results of micro economic analysis using Soviet archives by Gregory and others (Grgory, 2001: Gregory, 2004, Gregory and Harrison, 2005). The Soviet monetary management was probably far less functional than one might imagine. The monetary management seemed to depend solely on control of wage payments; the effectively of limiting banknote issue seemed highly doubtful. It was more or less true that wage payments was only the pathway to supply cash money because the institutional division of cash and non-cash money flows probably worked. The control of wage payments set a vague ceiling on cash money supply; it was, however, unpredictable where money supply fell around the ceiling. None could foresee how the production plan of consumer goods would be achieved, how consumers reacted to consumer goods offered, how much it was allowed to pay wage over the planned limit, how many and to what degree bad performed enterprises were bailed out, and so on. These were determined as a result of numerous and uncoordinated administrative and political decisions. This is reflected by our finding that the level of cash money showed a strong correlation with the other level variables and changes in cash money fell in a certain range, while demand for cash money was unpredictable.

We can conclude that it is not appropriate to explain the role of money in the Soviet administrative command economy with either passive or active money concept. Rather, the fundamental problem of the Soviet monetary management was that the role of money could not be explained either passive or active money concept (see Grossman, 1966, p.235). Money mattered in the Soviet economy (see Gregory, pp. 218-222); this was the very reason why the Soviet authority pursued for monetary stability. What they

could not do was to construct an effective institution of monetary management. It was true that influence of money on resource allocation was weak in the Soviet economy as our quantitative analysis showed; the monetary disequilibria caused by defects of material plans, nevertheless, caused shortage, queuing, excess hoard of money, rapid increase in deposits, expansion of black markets, and circulation of money surrogate including hard currencies. It was ironical that material planning was partially successful to maintain the value of ruble: Ruble's having its value meant that ruble had power to move economic resources. On the other hand, under the Soviet command administrative economy where price index, interest rates, and foreign exchange rate were institutionally eliminated, it was difficult to detect monetary disequilibria and to understand their economic meanings: the Soviet institutional settings also deprived the monetary authority the monetary policy instruments. Changes in political and administrative decision and material planning were necessary to eliminate monetary disequilibria. There did not seem to exist an automatic and economic mechanism to adjust monetary disequilibria; non-existence of systematic relation between money and real production that our research showed probably reflected this situation. If monetary disequilibrium was serious, then political and administrative measures to eliminate the disequilibrium might be also serious. Ignoring the risk of political and social unrests, it was easy to eliminate monetary disequilibrium: through raising consumer prices, decreasing wages, increasing tax, or confiscating financial assets as it was done in the 1947 monetary reform. When none expected that vigorous measures lead to a recovery from an economic disequilibrium and to sustainable economic development, it was almost impossible to exert the measures.

The result of this research made it difficult to consider the Soviet administrative command economy as a complete economic system that could substitute the market economy system: the problem of monetary management seemed to be left unsolved in the Soviet system. We can suppose that the Soviet system did not intend to solve the problem from the beginning. If it is true, the question should be asked is this: why such Soviet system existed until 1990 and was not collapsed before then? The Soviet system had still many political, social and economic mysteries to be cleared.

The availability of data limited severely our analysis: the important data including the balance of payments, the balance sheets of the banks, the financial flows

between the state budget and the banking system, the disbursement and repayment of bank loans may sleep in the Soviet archives. If data on expectations and prospects of the Soviet authority were available, we can deepen our analysis greatly and construct more sophisticated models. The more data become available, the further researches on the economic, political, and social aspects of the Soviet monetary management advance.

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Table 1   Models of the balances

(A) Balance of Household Monetary Income and Outlay

Income	Outlay

A1. From state and cooperative corporations and organizations
    Wages
    Payments to kolkhoz members
    Sales of private agricultural products
    Pensions and other benefits
    Receipts from financial institutions
    Other incomes
	A2. To state and cooperative corporations and organizations
	    Purchases of goods and services
	    Mandatory payments
	    Other payments
	    Savings

B1. Income from trade within the Household sector	B2. Outlay for trade within the household sector
C. Total income (=A1+B1)	D. Total outlay(=A2+B2)
	Chang in cash money held by households (=C-D)(+/-)

(B) Cash Flow Balance of Gosbank

Receipt	Disbursement
Proceeds of goods and services Transportation fares Communal transportation fares Housing rents and public utility charges Receipts of the service sector Taxes Receipts on kolkhoz accounts Receipts on housing cooperative accounts Receipts of postal services Receipts of saving institutions	Wages State procurements of agricultural products Payments from kolkhoz accounts Pensions, benefits, and insurance claims Loans to households Travel allowances and other expenses Payments to postal offices Payments to saving institutions
Total receipt	Total disbursement
Withdrawal banknotes from the reserve fund (banknote issue)	Transfer of banknotes to the reserve funds (banknote redemption)

(C) Consolidated short-term credit plan of Gosbank (Abridged)

Sources	Utilization
1. Funds and profits of Gosbank 2. Deposits of the state budget 3. Deposits of the economic sector 4. Deposits of current accouts 5. Household savings 6. Deposits of financial institutions 7. Money in circulation 8. Other sources	1. Credit against goods 2. Credit against seasonal and surplus stocks 3. Credit against documents 4. Settlement credit 5. Credit for covering temporary expenses 6. Credit granted for wage payments 7.Overdue credits 8.Outstanding credits 9.Reserves of the Gosbank presidium 10. Other assets
Total	Total

Sources: Ikonnikov(1954), Tochil'nikov (1973), Kuschepeta(1978), Sigg (1981), Kravtsovaya (1983), CBR (2006).

Table 2 Achievements of Annual Economic Plans:1966-88 (%)

	Growth rate		Achievement[1]			
	plan	actual	average	max	min	s. d.
Real Income per capita	4.2	3.7	86.9	124.1	4.8	22.9
National income, used	5.1	4.6	89.5	141.7	46.5	20.7
Industrial labor productivity[2]	4.6	4.4	96.9	140.0	51.1	23.3
Total wages[3]	4.2	5.1	123.2	200.0	87.2	20.8
Monthly wage in industry[4]	2.7	3.7	140.2	368.4	93.8	60.2
Sales of state and cooperative trade[5]	5.6	5.8	103.5	177.8	50.0	24.0

Source: The annual economic plans and the reports of fulfillments of the annual economic plan for 1966 to 1988 published in *Ekonomicheskaya Gazeta*.

Notes:

1. The achievement was defined as: achievement = 100 × planned growth rate / actual growth rate. The average is the simple average of the annual achievements.

2. The figures for 1968, 1973, and 1987 were not available.

3. The figures for 1969 and 1970 were not available.

4. The figures for 1966, 1967, 1972, 1977, 1982, 1985, and 1986 were not available.

5. The figure for 1982 was not available.

Table 3 Unit root test

Series		Level			1st difference		
		ADF		PP	ADF		PP
		t	*L*	*T*	*t*	*L*	*t*
RNMP	TI	-1.91	1	-1.52	***-5.51	0	***-5.41
	I	-2.44	1	*-2.77	***-4.96	0	***-4.88
	No	2.47	1	3.88	***-3.56	0	***-3.37
NNMP	TI	-1.27	9	-2.72	-1.15	8	***-5.93
	I	0.14	9	***-5.71	***-4.41	8	***-4.59
	No	1.88	9	3.56	***-4.87	8	***-3.09
PLEV	TI	-2.05	9	-1.58	-1.50	8	***-5.01
	I	**-3.22	8	-2.39	-1.16	8	***-4.92
	No	1.40	10	1.55	-0.82	9	***-4.69
DD	TI	**-3.72	2	**-3.69	*-3.26	2	***-6.07
	I	0.43	1	***-5.05	*-2.88	2	***-5.09
	No	1.68	3	3.68	***-2.03	2	***-3.37
NDVO	TI	***-4.41	0	-3.08	***-8.87	0	***-8.97
	I	*-2.75	0	-1.83	***-8.85	0	***-8.89
	No	3.17	0	3.24	***-7.66	0	***-7.65
M1	TI	-3.11	0	-3.10	***-8.25	0	***-8.26
	I	-1.55	0	-1.59	***-8.22	0	***-8.22
	No	3.36	0	3.36	***-6.89	0	***-6.96
DPO	TI	*-3.20	1	***-4.19	***-4.83	0	***-4.70
	I	-1.98	1	***-3.58	***-4.61	0	***-4.50
	No	2.14	1	3.15	***-3.30	0	***-3.18
CS	TI	***-4.466	1	**-3.72	***-3.58	0	***-4.61
	I	-2.33	4	**-3.20	***-4.20	3	***-4.44
	No	2.63	2	3.19	***-3.58	0	***-3.41
CRD	TI	1.74	0	1.21	**-4.17	0	***-4.38
	I	-1.35	2	-2.31	-2.16	1	***-4.00
	No	1.05	2	3.75	*-1.91	1	***-3.16

Notations: see Appendix Table for the series; *ADF*: Augmented Ditcky-Fullaer statistics; *PP*: Philips-Perron statistics; *t*: t-value, *TI*: with trend and interception; *I*: intercept only; *No*: without trend and intercept; *L*: automatically selected lag length for ADF test; ***: significant at 1% level; **: significant at the 5% level; *: significant at the 10% level.

Table 4 Correlation coefficients between the nominal level variables

	D D	*C S*	*N N M P*
N D V O	0.981	0.959	0.970
D D		0.988	0.996
C S			0.995

Notations: see Appendix Table for the names of variables.

Note: The variables are log-transformed.

Table 5   Predictability of demand for cash

(A) dependent variable: *gNDVO*

Period	C	lagged variables of						Dmy	R^2	DW	F
		gNDVO	gDD	gRNMP	gPLEV	gCS	gCRD				
(a) 31-90	0.10	-0.08	-0.03	0.16	-0.21	-0.25		0.15	0.15	2.04	*2.53
(52)	*†4.43*	*-0.52*	*-0.14*	*0.50*	*-0.71*	*-1.31*		*†3.22*			
(b) 31-90	0.10		-0.05	0.17	-0.23	-0.26		0.15	0.16	2.17	*2.99
(53)	*†5.14*		*-0.25*	*0.56*	*-0.78*	*-1.36*		*†3.16*			
(c) 31-90	0.11		-0.05			-0.15		0.11	0.16	2.20	†4.53
(56)	*†6.22*		*-0.33*			*-1.23*		*†3.23*			
(d) 52-90	0.05	0.00	0.92	0.07	0.15	-0.07	-0.12		0.00	2.26	1.01
(36)	*1.55*	*0.02*	*1.33*	*0.14*	*0.28*	*-0.12*	*-0.87*				
(e 51-90	0.06		1.14			-0.34	-0.16		0.11	2.24	*2.60
(38)	*2.09*		*2.11*			*-0.71*	*-1.48*				
(f) 49-90	0.09		-0.08			0.20			0.00	1.44	0.09
(40)	*†4.32*		*-0.32*			*0.41*					

Period	C	current variables of					Dmy	R^2	DW	F
		gDD	gRNMP	gPLEV	gCS	gCRD				
(g) 30-90	0.08	0.33	-0.02	0.26	-0.13		0.06	0.24	2.16	†4.39
(54)	*†4.47*	*1.93*	*-0.08*	*0.99*	*-0.73*		*1.45*			
(h) 30-90	0.09	0.59			-0.23			0.22	2.21	†8.79
(57)	*†4.77*	*†4.19*			*-1.98*					
(i) 51-90	0.01	1.55	0.35	0.45	-0.34	-0.15		0.47	1.75	†7.66
(38)	*0.40*	*†3.50*	*1.08*	*1.16*	*-0.80*	*-1.55*				
(j) 49-90		1.61			-0.10			0.45	2.04	-
(40)		*†4.10*			*-0.25*					
(k) 49-90		1.51						0.47	2.05	-
(40)		*†16.9*								

(B) dependent variable: *gNDVO*

Period	C	lagged variables of			R^2	DW	F
		DD	RNMP	CS			
(l) 30-90	0.66	-0.08	0.11	-0.05	0.16	1.98	†4.66
(57)	*1.23*	*-1.22*	*1.42*	*-0.51*			
(m)49-90	2.68	-0.32	-0.23	0.54	0.00	1.48	0.52
(40)	*1.17*	*-1.02*	*-1.44*	*1.22*			

		current variables of			R^2	DW	F
		DD	RNMP	CS			
(n) 29-90	-0.39	0.04	0.18	-0.23	0.24	2.07	†6.88
(58)	*-0.73*	*0.73*	*2.62*	*-2.44*			
(o) 49-90	2.94	-0.34	-0.32	0.64	0.05	1.77	1.65
(40)	*1.26*	*-1.11*	*-2.05*	*1.50*			

Notation: See text and the Appendix Table for the names of variables; *C*: constant; *Dmy*: a dummy variable which is 1 in the years of 1923 to 1946 and zero in the other years; R^2: adjusted R squared, *DW*: Durbin-Watson statistic; *F*: *F*-value; †: significant at the 1% level; *: significant at the 5% level.

Notes: The upper entries of the column 'Period' indicate the start and end years of the sample; the lower figures in parentheses show the number of sample. The upper figures of the variable entries are the estimated coefficient; the lower figures in italics the *t*-value.

Table 6 Impulse response analysis of the VAR models

Response	Shock from:		
	gDD	gRNMP	gNDVO
Lag1NT			
gDD	0.13	-0.05	0.03
gRNMP	0.09	0.09	0.00
gNDVO	0.07	-0.02	0.11
Lag2WT			
gDD	0.07	-0.06	0.03
gRNMP	0.06	0.09	0.00
gNDVO	0.02	-0.05	0.08
Lag1,5NT			
gDD	0.10	-0.06	0.03
gRNMP	0.08	0.09	0.00
gNDVO	0.04	-0.04	0.10
Lag3NT			
gDD	0.12	-0.05	0.02
gRNMP	0.09	0.07	-0.01
gNDVO	0.08	-0.05	0.08

Notes:

1. One standard deviation shock at the variables of origin (in the row second from above). The figures are the cumulative changes in the variables of destination (in the column first from left) at the end of the 3rd period after the shock.
2. The Cholesky ordering: gRNMP, gDD, gNDVO.
3. *Lag x*T* indicates the model specification: *x*: the order of lag; *WT*: including the trend term; *NT*: no trend terms.

Table 7 Impulse response analysis of the VEC models

	shock from:		
	DD	RNMP	NDVO
Response	Lag1ND		
DD	0.23	-0.10	0.02
RNMP	0.14	0.22	-0.02
NDVO	0.06	-0.12	0.30
	Lag1WD		
DD	0.23	-0.09	0.02
RNMP	0.15	0.16	-0.02
NDVO	0.07	-0.11	0.31
	Lag2ND		
DD	0.17	-0.05	0.05
RNMP	0.13	0.22	-0.03
NDVO	0.05	-0.12	0.28
	Lag3ND		
DD	0.15	-0.04	0.07
RNMP	0.13	0.22	-0.04
NDVO	0.01	-0.14	0.26

Notes:

1. One standard deviation shock at the variable of origin (in the row second from above) . The figures are the cumulative changes in the variables of destination at the end of the 3rd period after the shock.
2. The Cholesky ordering: gRNMP, gDD, gNDVO.
3. *Lag x*D* indicates the model specification: *n*: the order of lag; *ND*: without the dummy variable *D2346*; *WD*: including *D2346*.

Table 8 Error correction terms in the VEC models

(A) Adjustment coefficient of the error correction term

| Models | Adjustment coefficient in the estimated equation of: | | |
	gNDVO	gDD	gRNMP
Lag1ND	-0.059	-0.059	-0.029
	-3.13	-4.40	-2.32
Lag1WD	-0.029	-0.039	-0.040
	-1.95	-3.62	-4.48
Lag2ND	-0.117	-0.138	-0.039
	-2.91	-5.48	-1.70
Lag3ND	-0.166	-0.128	-0.056
	-3.79	-5.26	-2.36

(B) Elasticity in the estimated long term relation

| Models | Estimated coefficient of: | | |
	DD	RNMP	D2346
Lag1ND	-2.66	2.96	-
Lag1WD	-2.07	1.34	-0.89
Lag2ND	1.45	0.08	-
Lag3ND	3.16	-1.33	-

Notes:

1. In Panel (A), the upper values are the estimated coefficients and the lower values the t statistics.
2. Panel (B) shows the coefficients, $a1$, $a2$, and $a3$, in the long term relation equation calculated from the estimated error collection term: $NDVO = a_1 \cdot DD + a_2 \cdot RNMP + a_3 \cdot D2346 + a_4 \cdot Constant$.
3. See Table 7 for the notations of *Models*.

Table 9 Variance decomposition of the VEC models (%)

source of the variation:	NDVO	DD	RNMP
	Lag1ND		
NDVO	12.0	82.4	5.6
RNMP	1.1	0.9	98.0
	Lag1WD		
NDVO	80.5	13.9	5.6
RNMP	1.6	5.1	93.4
	Lag2ND		
NDVO	79.4	12.9	7.59
RNMP	2.0	0.7	97.3
	Lag3ND		
NDVO	77.1	8.1	14.8
RNMP	4.3	0.3	95.4

Notes:

1. The variances of NDVO and RNMP at the 3rd period are decomposed by the sources of the variation: NDVO, DD, and RNMP. The sum of each row makes 100%.
2. Cholesky ordering: RNMP, DD, NDVO.
3. See Table 7 for the notation of the model settings.

Chart 1 Ratios of monetary and production indicators
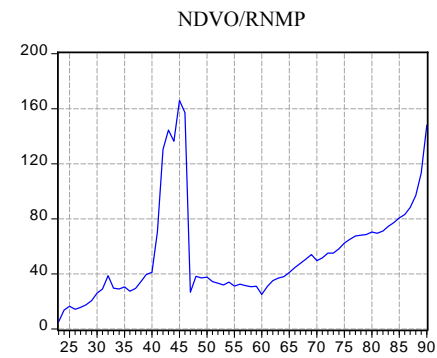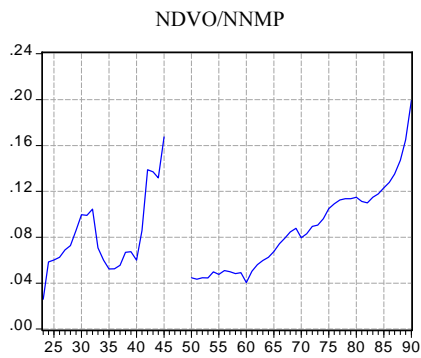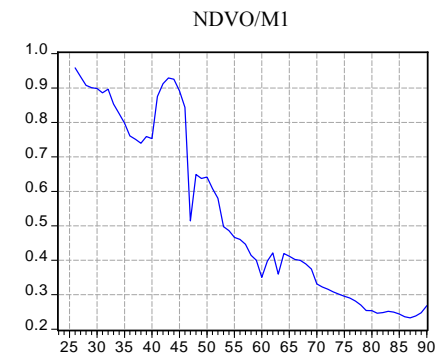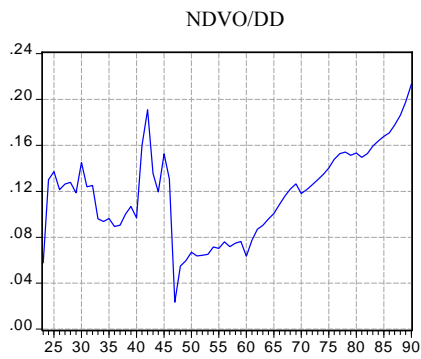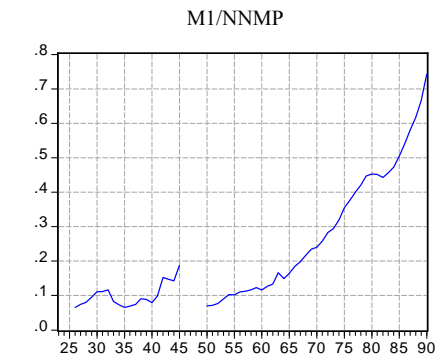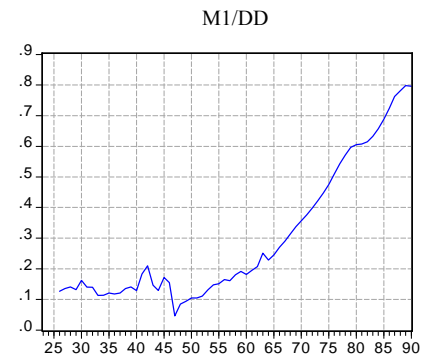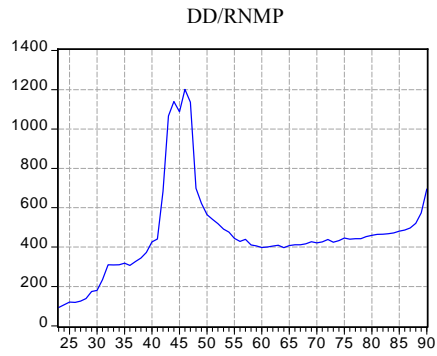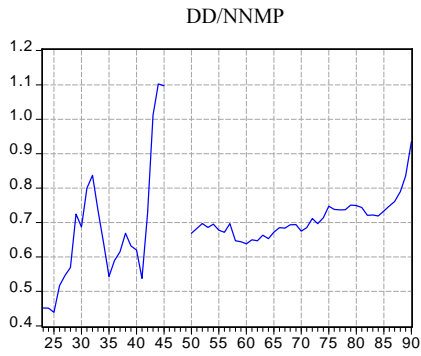
Chart 2 Monetary indicators

(A) Absolute values (log-trans formed)
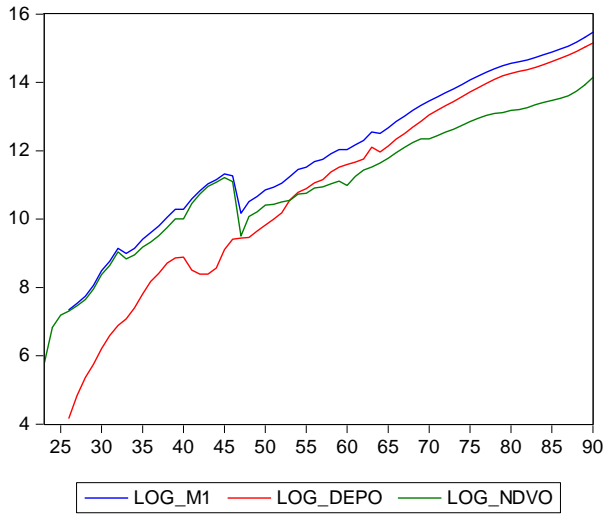
(B) Ratios of monetary indicators to nominal net material product
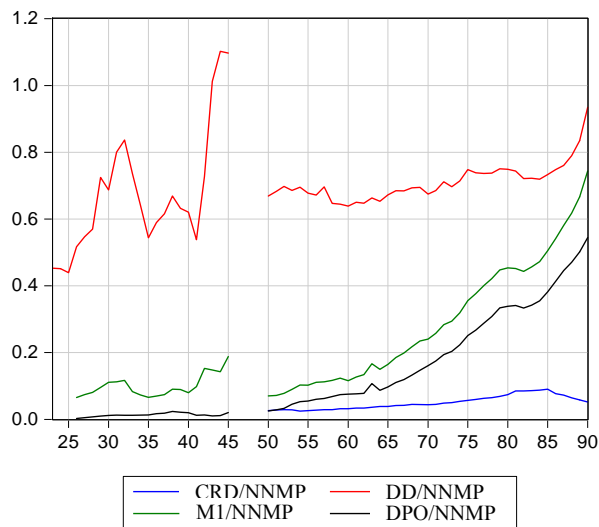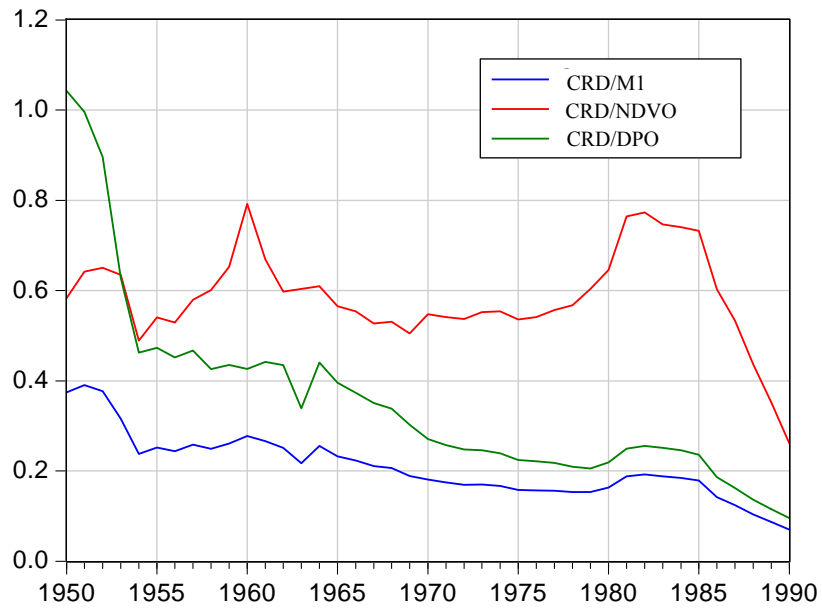
Chart 3 Bank loan and money indicators
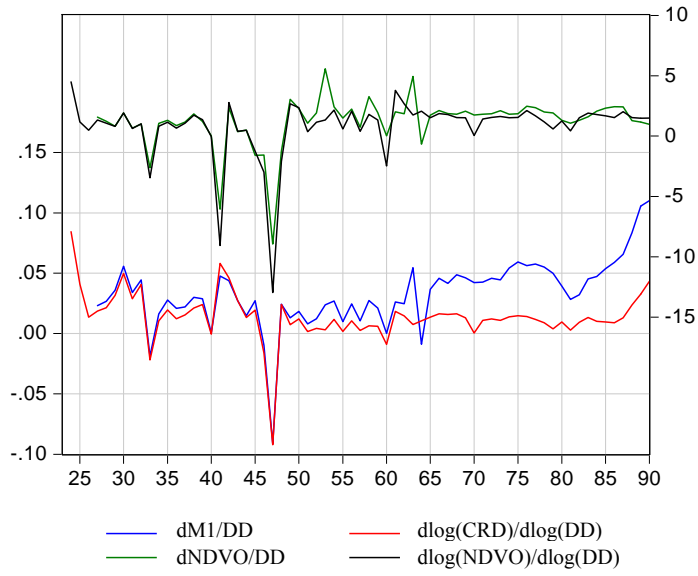
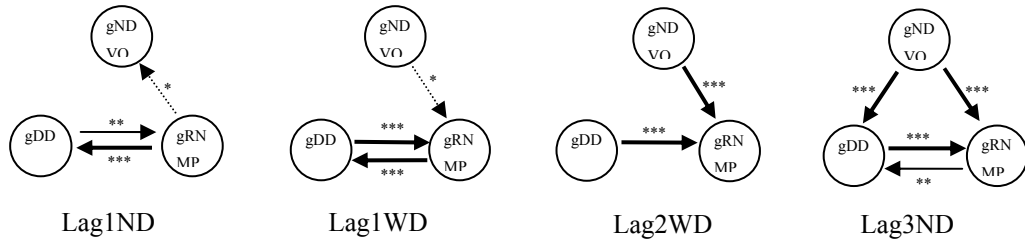**Chart 4 Ratios of money to household monetary income**

Chart 5 Granger causality in the VAR models

Lag1NT   Lag2WT   Lag3NT   Lag1,5NT
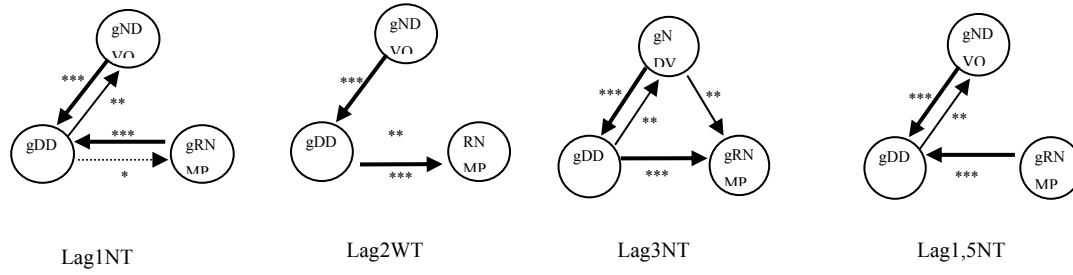
Notation: See Table 6 for the notation of the model settings; ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level.

Chart 6 Granger causality in the VEC models

Lag1ND   Lag1WD   Lag2WD   Lag3ND

Notation: See Table 7 for the notation of the model settings; ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level.

Appendix Table

	NNMP	RNMP	PLEV	NDVO	DD	CS	DPO	CRD
1923	12.5	61	205.0	0.33	6	-	-	-
1924	15.8	67	236.0	0.93	7	-	-	-
1925	22.0	80	274.8	1.32	10	-	-	-
1926	23.8	103	230.8	1.49	12	-	0.07	-
1927	25.3	110	230.3	1.75	14	-	0.13	-
1928	28.8	119	242.2	2.10	16	-	0.21	-
1929	33.3	138	241.2	2.86	24	16.2	0.32	-
1930	43.7	167	261.6	4.36	30	19.4	0.49	-
1931	57.2	195	293.6	5.67	46	30.3	0.73	-
1932	80.4	217	370.6	8.41	67	44.3	0.97	-
1933	97.0	231	419.9	6.86	71	50.5	1.18	-
1934	128.7	266	483.8	7.73	83	60.8	1.64	-
1935	185.5	317	585.2	9.71	101	78.9	2.46	-
1936	213.8	410	521.6	11.26	126	104.2	3.54	-
1937	243.8	459	531.2	13.58	150	121.9	4.52	-
1938	257.4	500	514.8	17.22	172	136.6	6.06	-
1939	328.8	558	589.2	22.21	208	164.2	7.06	-
1940	368.2	535	688.2	22.10	228	184.3	7.25	-
1941	404.1	492	821.3	34.73	217	161.3	4.96	-
1942	330.1	352	939.1	45.83	240	95.8	4.41	-
1943	418.6	397	1054.5	57.37	424	110.2	4.41	-
1944	489.6	473	1034.5	64.53	540	148.0	5.23	-
1945	441.4	445	992.1	73.89	484	183.8	9.00	-
1946	-	419	-	65.83	503	267.6	12.21	-
1947	-	500	-	13.42	569	341.4	12.66	-
1948	-	620	-	23.78	433	318.1	12.88	-
1949	-	730	-	27.13	455	344.5	15.46	14.3
1950	740.4	877	844.2	33.11	495	373.9	18.53	19.3
1951	780.9	985	792.8	33.99	533	399.0	21.92	21.8
1952	812.6	1092	744.1	36.44	567	419.2	26.45	23.7
1953	856.9	1196	716.5	38.25	587	459.0	38.65	24.3
1954	918.3	1341	684.8	45.74	638	506.0	48.35	22.4
1955	985.0	1501	656.2	46.97	668	529.3	53.66	25.4
1956	1068.0	1671	639.1	54.47	717	569.1	63.75	28.8
1957	1128.0	1788	630.9	56.44	785	648.1	81.00	32.7
1958	1277.0	2010	635.3	61.79	826	709.1	87.19	37.1
1959	1362.0	2160	630.6	67.05	877	759.4	100.56	43.8
1960	1450.0	2327	623.1	58.77	925	829.0	109.09	46.5
1961	1529.0	2485	615.3	77.04	994	856.0	116.71	51.5
1962	1646.0	2628	626.3	92.66	1065	929.0	127.45	55.4
1963	1688.0	2732	617.9	101.04	1119	982.0	180.00	61.0
1964	1813.0	2986	607.2	113.52	1184	1034.0	157.07	69.2
1965	1935.0	3192	606.2	131.03	1301	1120.0	187.27	74.0
1966	2074.0	3450	601.2	154.31	1420	1209.0	229.15	85.4
1967	2255.0	3748	601.7	178.78	1542	1324.0	268.69	94.2
1968	2441.0	4059	601.4	206.36	1693	1438.0	323.60	109.5
1969	2619.0	4253	615.7	230.03	1818	1546.0	383.97	116.1
1970	2899.0	4636	625.3	230.71	1955	1662.0	466.00	126.2
1971	3050.0	4896	623.0	253.45	2089	1773.0	532.15	137.0
1972	3136.0	5087	616.5	280.55	2231	1885.0	607.32	150.5
1973	3378.0	5540	609.8	305.94	2353	1986.0	686.60	168.9
1974	3540.0	5839	606.3	340.80	2527	2103.0	789.05	188.7
1975	3633.0	6101	595.4	380.92	2716	2245.0	909.85	204.0
1976	3857.0	6461	596.9	421.11	2848	2351.0	1030.00	227.9
1977	4056.0	6752	600.7	456.30	2987	2465.0	1166.60	254.0
1978	4263.0	7097	600.7	484.56	3142	2588.0	1311.39	274.9
1979	4383.0	7253	604.3	497.81	3288	2724.0	1462.40	300.4
1980	4622.0	7536	613.4	531.00	3462	2900.0	1565.00	342.6
1981	4867.0	7784	625.2	541.24	3619	3067.0	1657.00	413.5
1982	5234.0	8096	646.5	576.18	3771	3170.0	1743.42	445.5
1983	5472.0	8436	648.7	629.25	3950	3283.0	1869.00	469.7
1984	5696.0	8680	656.2	670.87	4095	3390.0	2020.58	496.8
1985	5785.0	8819	656.0	711.91	4242	3474.0	2208.00	521.3
1986	5874.0	9022	651.1	751.01	4393	3569.0	2428.00	452.6
1987	5996.0	9166	654.1	809.95	4560	3678.0	2669.00	432.1
1988	6308.0	9570	659.2	927.70	4981	3944.0	2967.00	404.6
1989	6737.0	9809	686.8	1111.19	5625	4317.0	3378.00	391.1
1990	7006.0	9415	744.1	1395.36	6545	4985.0	3814.00	364.4

-: not available.

Notes and Sources:

NNMP: nominal net material product; in billion before 1961 Ruble

The figures for 1923-27 are taken from RGAE(F7733/O4/E1052/L51). The figures for 1928-31 and 1935 are based on the figures in Vainshtein(1969); for 1924-27, the original fiscal year figures are adjusted to the calendar year annual figure under the assumption that a quarterly growth rate is equal to the annual rate powered with the factor of 1/4. For 1928-31, the amounts of turnover tax were added to the original Vainshtein figures according to Suhara (2008). The 1933 figure is estimated by Suhara (2008). Vainshtein (1969) reported another figure slightly different from Simonov(1996, p. 181)'s for 1937 and RGAE(F1562/O3/D698/L81) did for 1938. Because Simonov uses the archive materials newer than that Vainshtein used and RGAE(F1562/O3/D698/L81), I took Simonov's figures for 1937 and 1938. The 1932, 1934, and 1936 figures are my own estimation; For the estimation, I used the estimation equation which regresses NNMP to household money income, nominal retail trade turnover, year-end stock of currency in circulation, state budget revenue, and RNMP. The data for 1946-49 are not available. The data after 1950 are taken from *Narkhoz*.

The before 1961 Ruble means that the figures after 1961 denomination were simply multiplied by the factor of 10; the Soviet official statistics uses the same method as well.

RNMP: index number, 1913=100.

An official series of RNMP from 1925 through to 1991 is not published. Three published series the base years of which were 1926, 1960, and 1980 were connected with the annual growth rates; I used the series those have a newer base year as much as possible. The 1923 and 1924 figures were estimated using the estimation equation which regresses RNMP for 1913, 1917, 1920, 1921, and 1925 to agriculture and industrial production at the price before the WW1 in Segal and Santalov (1930, pp. 92-93).

PLEV: *the implicit deflator of net material product, index number.*

PLEV is calculated from *NNMP* and *RNMP*. The Soviet official statistics used the 'constant price' to deflate NNMP to RNMP; PLEV and the standard GDP deflator are, therefore, methodologically different.

DD: *annual money income of the household sector in billion of before 1961 Ruble.*

CBR(2006) published the series of *DD* from 1923/24 through to 1990. The same method as to adjust an original fiscal-year figure of *NNMP* to a calendar year figure was applied for DD for 1923-28. *DD* includes wages, kolkhoz payments, pensions and other social payments, and payments from financial institutions; it excludes only the money income from trade of goods within the household sector.

NDVO: *the end year stock of currency; in billion before 1961 Ruble.*

CBR(2007a) published the *NDVO* series; *NDVO* is equivalent to the currency item in the debt side of the Gosbank balance sheet. *NDVO*, therefore, includes the currency that the Gosbank and other banks hold. RGAE(F1562/O33/E3012/L25) showed the same series for 1922 through to 1955 which differ only slightly from the CBR(2007a) series.

CBR (2007a) shows the year-end amounts of various government paper moneys denominated at 1923 ruble, of Chervonetz denominated at 1924 ruble, and of other credit moneys such as Gold Ruble issued in 1924 separately and did not show the total sum for 1923. I recalculated the amount of the government paper moneys at 1924 ruble with using the ratio of one 1924 ruble to 50 thousands 1923 Ruble according to Segal and Santalov (1925) and added it to the amount of Chervonets and the other credit moneys. It turned out that the amount of government paper moneys denominated at 1924 ruble accounted for only about one percent of the total end-year currency stock denominated at 1924 ruble.

DPO: *the end year stock of the household savings at the Sberkassa in billion before 1961 Ruble.*

The DPO series are taken from Narkhoz; the figure for 1957 is, however, taken from RGAE(F1562/O41/E233/L134). RGAE(F1562/O41/E233/L134) shows the DPO figures for 1940, 1950, and 1955-57; the figures before 1957 are the same as those *Narkhoz* shows.

DPO is not equal to all bank deposits hold by the household sector. There existed households saving deposits at financial institutions other than Sberkassa until 1929. On the other hand, Narkhoz indicated that DPO included savings of legal entities for 1928-33; it is not certain if DPO includes deposits of legal entities for other years. IMF (1991, vol.1, p.130) showed the DPO figure for 1980 that is the same as the figure Narkhoz and comments that the figure is the total amount of the household saving deposits held by both Sberkassa and the other financial institutions. Narkhoz shows, however, the amount of saving deposits at Sberkassa and at Gosbank separately for 1979. The amount of the household saving deposits at Gosbank for 1979 is almost the same as that for 1948. The year of 1948 is the earliest year for which I can find the amount of household saving deposit at Gosbank. The Gosbank household deposits accounted for 17.3% of the Sberkassa household deposits in 1948, while it accounted for 0.13% of that in 1979.
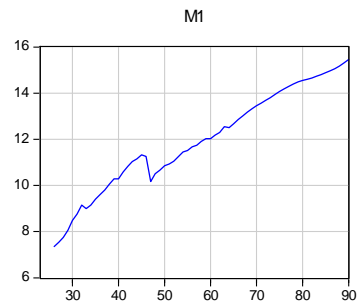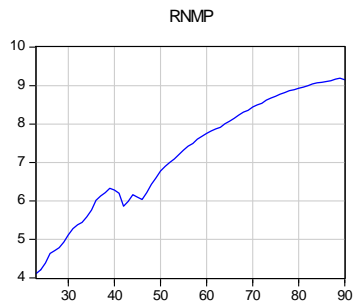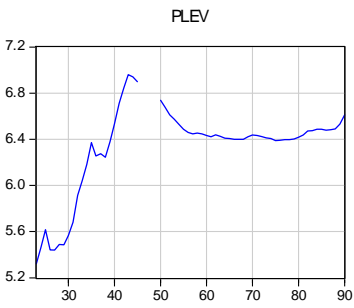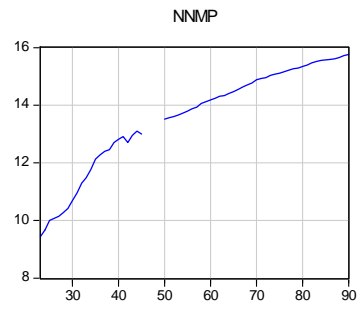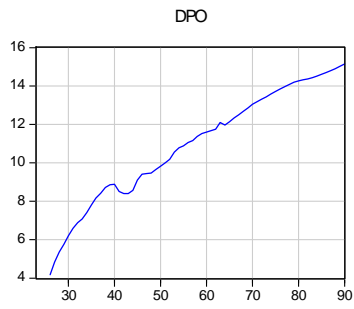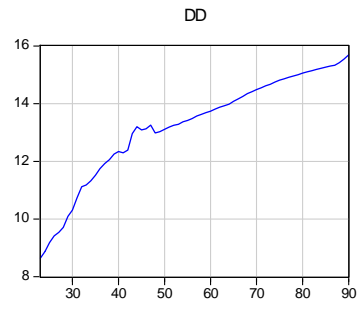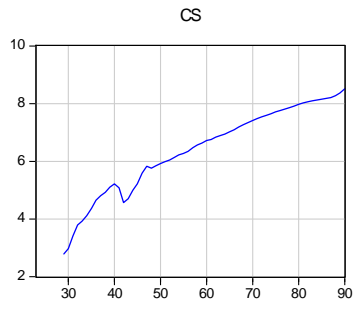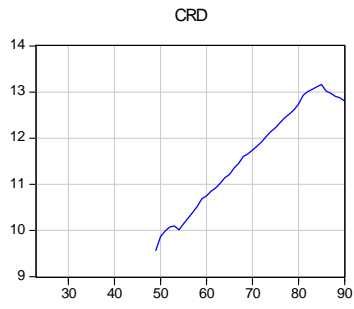
CS: retail sales turnover in billion of before 1961 ruble.

The CS series were taken from CBR (2006). CS includes retail turnover of state and cooperative shops, public catering, and spending on services.

CRD: the end year stock of the total bank credits in billion of before 1961 ruble.

The CRD series were taken from *Narkhoz*. CRD includes both long and short term credits to the economic and the household sectors.

Appendix Chart 1

Appendix Chart 2