Oleg Eismont

World Oil Price Fluctuations and Development of the Russian Economy

Working paper #2000/019

The paper was presented at the conference "Transforming Government Sector in Economies in Transition", October 1999, New Economic School, Moscow. The study was supported by Ford Foundation grant

МОСКВА
2000

Eismont O.A. World oil price fluctuations and development of the Russian economy/ Working paper # 2000/019 - Moscow, New Economic School, 2000.- 19p. (Engl.)

Dynamics of a development of the Russian economy, within the past 2-3 years, is analyzed. It is shown that the behavior of domestic output can be explained by fluctuating world oil prices which, first, in 1998, plummeted and then, in 1999, rebounded, causing the corresponding fluctuations of demand for domestic output. Exchange-rate policy of the Russian Central Bank, within this period, is analyzed. Macroeconomic explanation of the dynamics of non-monetary transactions in 1998-1999 is suggested.

Эйсмонт О.А. Колебания мировых цен на нефть и развитие российской экономики. / Препринт № 2000/019 .-М: Российская экономическая школа, 2000.- 19 с. (Англ.)

Анализируется развитие российской экономики в течение последних 2-3 лет. Показано, что поведение внутреннего производства может быть объяснено колебаниями мировой цены на нефть, которая вначале в 1998 г. существенно упала, а затем в 1999 г. значительно возросла, что привело к соответствующим колебаниям спроса на товары и услуги, производимые внутри страны. Анализируется политика Центрального Банка России в отношении обменного курса рубля. Предложено макроэкономическое объяснение динамики неденежных расчетов в 1998-1999 гг.

ISBN 5-8211-

1. Introduction

Within the past 2-3 years the Russian economy experienced considerable swings in its development. After a relatively short period of economic stabilization in 1997, which has been claimed to signify the beginning of economic recovery, the first half of 1998 exhibited economic decline, followed by a collapse caused by financial crisis of August 1998 which, in its turn, was followed by the unprecedented, since the start of economic reforms, economic growth (fig. 1). This growth has been observed in sectors outside oil & gas business that experienced revenue boom, due to tripling world oil prices. In addition to economic growth, statistics fixed sharp decline in non-monetary transactions (fig. 2). These economic data have been interpreted, by a number of economists and politicians, as a convincing evidence of the start of sustainable growth of the Russian economy. To what extent are these claims true? How can the observed dynamics of the Russian economy be rationally explained? Was the monetary policy of the Russian Central Bank, within the recent years, justified? What caused non-monetary transactions' decline after August 1998? These are the main questions that the paper aims to address. Though reasonable explanations of some aspects of the recent development of the Russian economy (after financial crisis of August 1998) have been suggested in a number of publications (see for example, Montes and Popov 1999, Alexashenko 2000), no formal analysis of the above mentioned issues has been presented so far.

As opposed to the above cited optimistic claims, the paper asserts that the recent development of the Russian economy can be explained by fluctuating oil prices, which, first, went down in late 1997- early 1998 and then, in 1999, rebounded, reaching in the early 2000 the highest level since the Gulf war.

2. The Model

To formally prove this theory, as a working tool for the analysis, the model, based on Dornbush (1976), Eastwood and Venables (1982), Neary and Wijnbergen (1984), is used. Similar problems (i.e. the effects of increasing oil prices for oil-exporting countries) have been considered also in Buiter and Purvis (1983), Neary and Wijnbergen (1986). Small open economy is considered so that the world interest rate and prices of imported goods, nominated in foreign currency, can be viewed as exogenously fixed, thus making domestic price of imported goods equal to a nominal exchange rate. There is perfect capital mobility between the considered economy and outside world. Domestic money market, as well as foreign-exchange market, clear instantaneously. Domestic interest rate and exchange rate can move discontinuously. While in Eastwood and Venables (1982), Neary and Wijnbergen (1984) supply of domestic output is fixed, in this paper, it is assumed to depend on inputs of imported raw materials and intermediate goods. Domestic prices are relatively sticky. Apart from producing domestic output, the country receives oil exports revenues. In fact, by oil exports revenues, all kinds of revenues from the outside world, that are not accounted for in domestic output, are meant (e.g. financial aid from IMF, portfolio investments from abroad, etc). The events that are analyzed (like oil price movements, financial crisis, etc.) are assumed to be unanticipated for economic agents.

Under the above stated assumptions, the basic equations of the model will be as follows:

$$m = \phi y - \lambda r + \alpha p + (1-\alpha)e + \varepsilon(f + e - p), \tag{1}$$

$$d = \delta(e - p) + \varsigma y - \sigma(r - \dot{p}) + \eta(f + e - p), \tag{2}$$

$$r = r_* + \dot{e} + R, \tag{3}$$

$$\dot{p} = \beta(d - y_S), \tag{4}$$

$$y_S = \psi(p - e), \tag{5}$$

$$y = \min\{d, y_S\}, \tag{6}$$

where m - money supply, d - demand for domestic output, y_S - supply of domestic output y - actual domestic output, r, r_* - domestic and foreign interest rates, respectively, R - risk premium, p - price of domestic output, e - nominal exchange rate (the domestic currency cost of a unit of foreign currency), f - oil exports revenues nominated in foreign currency. All these variables, except interest rates and risk premium, are logs of the corresponding values.

Equation (1) states equilibrium on domestic money market, its right-hand-side being demand for money which depends on actual domestic output, nominal domestic interest rate, average domestic price (with the weights α and $1-\alpha$ assigned to domestic output price and import price, respectively). Equation (2) states that demand for domestic product depends on the ratio of prices of domestically produced and imported goods, real interest rate and oil exports revenues. Equation (3) represents uncovered interest rate parity, under perfect international capital mobility, when domestic and foreign assets are not perfect substitutes, and holding domestic assets is risky, compared to holding foreign assets. Risk premium depends on both economic and political factors, such as government debt, political uncertainty, etc., and is considered to be exogenous.

Perfect foresight in the foreign-exchange market is assumed, so that expected domestic currency depreciation (appreciation) is always realized. Equation (4) describes dynamics of the price of domestic output, which depends on the ratio of demand and supply and is, in fact, the analogue of a Philips curve. Equation (5) states that, under profit maximization condition, domestic output depends on the ratio of domestic to foreign prices. Finally, as equation (6) states, real output is constrained by the lesser of demand and supply.

After simple, though tedious, transformations, the system (1)-(6) can be reduced to two differential equations. For the case $y_S < d$ the system is as follows:

$$\lambda \dot{e} = (1 - \alpha + \varepsilon - \phi\psi)e + (\alpha + \phi\psi - \varepsilon)\, p + \varepsilon f - m - \lambda(r_* + R), \tag{7}$$

$$\frac{1-\beta\sigma}{\beta}\,\dot{p} = [\delta + \eta + \psi(1 - \varsigma + \frac{\sigma\phi}{\lambda}) - \frac{\sigma}{\lambda}(1 - \alpha + \varepsilon)]e - [\delta + \eta + \psi(1 - \varsigma + \frac{\sigma\phi}{\lambda}) + \frac{\sigma}{\lambda}(\alpha - \varepsilon)]p + (\eta - \frac{\sigma\varepsilon}{\lambda})\, f + \frac{\sigma m}{\lambda}. \tag{8}$$

If $y_S > d$ the following system can be derived:

$$\dot{e} = \frac{1 - \varsigma - \beta\sigma}{\phi\sigma + \lambda(1 - \varsigma - \beta\sigma)}\{[1 - (\alpha - \varepsilon) + \frac{\phi(\delta + \eta + \beta\sigma\psi)}{1 - \varsigma - \beta\sigma}]e + [\alpha - \varepsilon - \frac{\phi(\delta + \eta + \beta\sigma\psi)}{1 - \varsigma - \beta\sigma}]p + \frac{\eta\phi + \varepsilon(1 - \varsigma - \beta\sigma)}{1 - \varsigma - \beta\sigma}\, f - m\} - r_* - R, \tag{9}$$

$$\dot{p} = \frac{\beta}{\phi\sigma + \lambda(1 - \varsigma - \beta\sigma)}\{[\lambda(\delta + \eta) - \sigma(1 - \alpha + \varepsilon) + \psi((1 - \varsigma)\lambda + \phi\sigma)]e - [\lambda(\delta + \eta + \psi(1 - \varsigma)) + \sigma(\alpha - \varepsilon) + \phi\sigma\psi]p + (\eta\lambda - \varepsilon\sigma)\, f + \sigma m\}. \tag{10}$$

For the subsequent analysis, it is assumed that the following inequalities hold:

$$1-\alpha+\varepsilon-\phi\psi>0, \tag{11}$$

$$\alpha+\phi\psi-\varepsilon>0, \tag{12}$$

$$\delta+\eta+\psi(1-\varsigma+\frac{\sigma\phi}{\lambda})-\frac{\sigma(1-\alpha+\varepsilon)}{\lambda}>0, \tag{13}$$

$$\alpha-\varepsilon-\frac{\phi(\delta+\eta+\beta\sigma\psi)}{1-\varsigma-\beta\sigma}>0. \tag{14}$$

From (8) and (10), it is easily seen that the slope of the line $p(e)$, corresponding to the locus $\dot{p}=0$, is less than 1 in both cases. Besides, it can be checked that, while the locus $\dot{p}=0$ for the case $y_S>d$ is the same as that for the case $y_S<d$, the locus $\dot{e}=0$ is different for the two cases, with the slope of the line $p(e)$, corresponding to the locus $\dot{e}=0$, being steeper in case $y_S>d$. Thus, the locus $\dot{e}=0$ is kinked at the intersection with the locus $\dot{p}=0$.

From the equations (7)-(8), and (9)-(10) the phase diagram, corresponding to the system (1)-(6), will be that presented in fig. 3. The steady state is characterized by the following equilibrium values of nominal price and exchange rate:

$$p_* = m + \frac{(1-\alpha)\eta - \delta\varepsilon - [\eta\phi + (1-\varsigma)\varepsilon]\psi}{\delta + \eta + (1-\varsigma)\psi} f + \frac{\lambda[\delta + \eta + \psi(1-\varsigma+\frac{\sigma\phi}{\lambda}) - \frac{\sigma}{\lambda}(1-\alpha+\varepsilon)]}{\delta + \eta + (1-\varsigma)\psi}(r_* + R), \quad (15)$$

$$e_* = m - \frac{\alpha\eta + \delta\varepsilon + [\eta\phi + (1-\varsigma)\varepsilon]\psi}{\delta + \eta + (1-\varsigma)\psi} f + \frac{\lambda[\delta + \eta + \psi(1-\varsigma+\frac{\sigma\phi}{\lambda}) + \frac{\sigma}{\lambda}(\alpha-\varepsilon)]}{\delta + \eta + (1-\varsigma)\psi}(r_* + R). \quad (16)$$

An important feature of a steady state that will be used in the analysis of the model, is the sign of $\partial p_* / \partial f$. Under more or less realistic parameter values, it can be assumed that

$$\delta\varepsilon + [\eta\phi + (1-\varsigma)\varepsilon]\psi > (1-\alpha)\eta, \quad (17)$$

which guarantees that $\partial p_* / \partial f < 0$. It can be noted that taking into account dependence of domestic output supply on the imported raw materials and intermediate goods ($\psi > 0$) adds to the inequality (17) being held.

It can be argued that, under the conditions, prevailing in the transition Russian economy, demand for money should depend on the expected rates of inflation and domestic currency depreciation as well, reflecting the fact that there are four kinds of assets – domestic money, domestic bonds, foreign currency, and goods. In that case, the equation (1) will be as follows:

$$m = \phi y - \lambda r + \alpha p + (1-\alpha)e - \kappa\dot{p} - \chi\dot{e} + \varepsilon(f + e - p). \quad (1')$$

It can be shown that inclusion of these additional terms into the equation (1), though making the analysis technically more tiresome, does not change any of the qualitative results, obtained in this paper.

3. Analysis of the Model and Policy Implications

Assume that at the initial moment (end of 1997) the Russian economy was in a steady state, corresponding to the point A in the phase diagram (fig. 3). Then oil prices plummeted, which, in terms of the described above model, is equivalent to a stepwise decrease of f. Of course, in reality, world oil prices, within the analyzed period, have been changing gradually (though rather fast) and the assumption of a stepwise dynamics of world oil price is adopted for the sake of making the analysis analytically tractable. Under lower values of f, the new steady state will be point B in the phase diagram. To reach the new steady state B, under floating exchange rate regime, the economy should follow the trajectory AB'B, along which domestic currency instantaneously depreciates, followed by gradual increase of domestic output price and domestic currency appreciation. However, at that time the Central Bank of Russia was pursuing a policy of, actually, fixed exchange rate. To keep exchange rate fixed, the Central Bank had to sell foreign currency, which resulted in effectively increasing f, relative to its level after the collapse of the world oil prices, and correspondingly decreasing domestic money supply. As a result of these Central Bank interventions, the new steady state had to move to point C. To reach the steady state C, under fixed exchange rate, the economy has to move along the trajectory AC, with decreasing (eventually to a zero level when the steady state C is attained) Central Bank interventions in foreign currency exchange. The steady state C is characterized by the same real exchange rate as steady state point B and differs from it only by money supply (as can be seen from (15), (16), real exchange rate

does not depend on money supply, so the line CB has a slope equal to 1). As can be easily seen, along the trajectory AC, the price of domestic output had to decrease. However, as is well known, prices exhibit substantial downward stickiness, which resulted in the economy staying in point A in a state of disequilibrium, which is characterized by supply exceeding demand, with the gap between demand and supply increasing. As a result of this disequilibrium, actual domestic output, constrained by decreased demand, has fallen. This state of affairs lasted until August 1998, when, faced with rapidly decreasing foreign-currency reserves, the Central Bank abandoned the regime of a fixed exchange rate and let the Ruble float. Besides, prior to August 1998, foreign investors withdrew considerable share of their assets from Russia, and the rate of capital flight increased as well. These events caused further decrease of f and a new steady state moved to point D. Under floating exchange rate, adjustment to a new steady state, along the trajectory AD'D, was accompanied by depreciation of Ruble, followed by increasing price of domestic output. Depreciation of domestic currency lead to decreased supply, so that the actual domestic output first fell down (due to a fall in supply) and then started to grow, following rising price of domestic output. Thus while in the first half of 1998 domestic output was constrained by demand, after the financial crisis of August 1998 domestic output was constrained by supply. It should be noted that this growth of domestic output took place in spite of still low world oil prices and was due to dramatically increased demand. Then, starting from March 1999, world oil prices rebounded, resulting in higher oil export revenues (and thus higher values of f), and the steady state, under freely floating exchange rate, had to move to point E. Assuming that by this time the economy has already reached the steady state D, transition trajectory to a new steady state would be DE'E, with appreciating domestic currency and decreasing price of domestic output. However, under downward stickiness of domestic prices, the economy would have got into a

new state of disequilibrium (point E'), similar to that, corresponding to the initial point A, after collapse of world oil prices. However, the Central Bank of Russia intervened in a foreign exchange, buying foreign currency, to keep exchange rate constant and to build up its foreign-currency reserves. Within the first six months of 2000, foreign-currency reserves, excluding gold, increased by $8 billion, i.e. doubled. Thus the Central Bank effectively lowered f and increased money supply. These actions of the Central Bank resulted in a steady state moving, ultimately, to point F, so that transition trajectory was DF. Similar to the above presented arguments, to keep the economy on this trajectory, the Central Bank has to buy foreign currency at a diminishing rate, until the steady state F is reached and Central Bank interventions are no longer needed. Point F is characterized by the same real exchange rate as point E, the only difference being higher money supply (thus the slope of the line EF equals 1). Of course, not letting the economy get into a state of disequilibrium (point E') is beneficial for the actual domestic output. On the other hand, this policy leads, until the steady state point F is reached, to lower domestic output, as compared to that, corresponding to point E, and to lower consumption, due to decreasing imports (it should be mentioned that consumption goods account for about two thirds of the total Russian imports). Thus, without Central Bank interventions, the economy will get into a permanent state of disequilibrium, with actual output being lower than that, corresponding to a steady state. On the other hand, under fixed exchange rate, the economy will move to a steady state, with the output being possibly, for some time during transition, lower than that in a state of disequilibrium, and definitely higher when a steady state is reached. The qualitative behavior of demand and supply of domestic output in Russia, within the recent years, resulting from the above analysis, is presented in fig. 4 (the dates on the X axis are given for illustrative purposes). In relatively short-term perspective, the policy of the Central Bank of Russia, aimed at

preventing the Ruble from appreciation, can be viewed as positive - besides attainment of a steady state, with high level of domestic output, it allows for building up foreign-currency reserves. It can be added that in, practically, all East Asian countries, after the financial crisis of 1997-1998, foreign-currency reserves have significantly increased. For example, in South Korea they increased from about $30 billion before the crisis to over $80 billion at present. Though foreign-currency reserves in Russia are rapidly increasing, still they are too low, relative to its GDP. Thus the policy of building up foreign-currency reserves can be continued for some time, until the steady state F is reached. However, on the other hand, this exchange rate policy does not look so favorable for the Russian economy. In this respect, the situation in Russia is quite different from that in East Asian countries. While East Asian countries export manufacturing goods, in Russia, natural resources account for a lion's share of exports. Thus, while undervaluing domestic currency adds to the competitiveness of export oriented manufacturing sector in East Asian countries, in Russia, keeping exchange rate of domestic currency at a low level prevents uncompetitive manufacturing sector (with its obsolete technologies and equipment) from getting foreign investments and thus favors natural resource sectors dominance in the Russian economy.

Generally speaking, under rising world oil prices, oil-exporting country faces the well-known "Dutch Disease" problem, which results in crowding out manufacturing sector (see for example, Enders and Herberg 1983, Corden 1984). Building up foreign-currency reserves is, to a certain extent, equivalent to investment abroad, which is known to be an efficient policy of preventing the adverse effects of the "Dutch Disease". This was the policy followed by some Middle-East OPEC countries, like Saudi Arabia and Kuwait. Until interest payments on foreign investments can be ignored, the only difference between investment abroad and building up foreign-currency reserves is that in a latter case

domestic money supply increases. Another way of efficient use of windfall gains, especially in Russia, and mitigating, to some extent, the "Dutch Disease" problem could be the appropriate fiscal policy. The idea is to shift tax burden from labor and capital to natural resource rent. Critics of this idea often claim that the share of natural resource sectors in total tax revenues is already very high. However, it is important to bear in mind that the tax receipts originating from the natural resource sectors include a whole range of non-rental payments, e.g. taxes on labor and capital, excises, etc. Shifting tax burden from labor and capital to natural resources provides double dividend – supporting manufacturing sector, at the expense of natural resource sector, and decreasing distortionary effects of the existing tax system. Besides, there are the following additional factors in favor of this tax shifting:

- Russia is very abundant in natural resources (the corresponding sectors produce more than 20% of GDP, rough estimates (e.g. L'vov 1994) show that natural resource rent in oil and gas sectors is about $30 billion which is more than the total federal budget);

- natural resource taxes are relatively easy to assess and collect, and hard to evade;

-the government still owns most natural resources, which makes it easier to introduce such taxes.

Of course, this tax reform will have only a temporary effect and cannot solve the long-term problems of the "Dutch Disease". Nevertheless, it will provide more beneficial conditions for the Russian economy during transition period.

Within the described model, another important feature of Russian economic development can find macroeconomic explanation (in addition to the existing microeconomic ones) – unusually high level of non-monetary transactions (barter, non-payments, wechsels), which have been rising before the August 1998 financial

crisis, and then, after the crisis, dramatically decreased. Usually, when analyzing this phenomenon, microeconomic approach is used. One of the widespread explanations of non-monetary transactions is liquidity constraint experienced by enterprises. However, this assertion is not supported by empirical data (Guriev and Ickes 2000). On a macroeconomic level, real money balances can serve as a proxy for enterprises liquidity. Real money balances decreased significantly after the August 1998 financial crisis, due to rapidly rising prices. Nevertheless, the share of non-monetary transactions decreased as well. To explain considerable decrease of non-monetary transactions after the financial crisis, the following hypothesis is suggested: the share of non-monetary transactions depends on the ratio of demand and supply of domestic output. Clearly, when demand is high, relative to supply, the seller will choose the buyer who can pay in cash, rather than to accept barter or wechsels, and the buyer, to get the product he needs, will do his best to pay in cash. The opposite is the case when supply is higher than demand. Based on this hypothesis, the dynamics of non-monetary transactions can be easily explained. According to the above stated arguments, prior to August 1998, demand for domestic output was lower than supply, while after August 1998 this situation has dramatically reversed.

4. Conclusions

Development of the Russian economy within the past 2-3 years can be explained by fluctuations of world oil prices, which, first, plummeted in 1998 and then rebounded in 1999. Oil exports revenues affected demand for domestic output, which served as an important factor of economic development. Claims that the Russian economy has embarked on a trajectory of sustainable economic growth are unfounded, at least for the time being. The policy of the Russian Central Bank to keep exchange rate fixed, after collapse of the world oil prices in 1997, was

detrimental to the Russian economy, which was stuck, in the first half of 1998, in a state of disequilibrium, with demand for domestic output being lower than supply. Financial crisis of August 1998 put an end to the policy of a fixed exchange rate, which resulted in a demand boom and a speedy recovery of the Russian economy. Central Bank policy, following rising world oil prices, aimed at preventing the Ruble from appreciation, was beneficial for the domestic output. However, this policy cannot last for long. If high world oil prices persist, the Russian economy will be faced again with the "Dutch Disease" problem and its adverse effects for the manufacturing sector. One of the efficient ways of using oil export revenues could be shifting tax burden from labor and capital to natural resources.

References

Alexashenko S., "Can the Weak Ruble Strengthen the Russian Economy?", *Expert*, # 19, 2000 (in Russian).

Buiter W.H. and D. Purvis, "Oil, Disinflation, and Export Competitiveness: A Model of the "Dutch Disease", in J. Bhandar and B. Putnam eds., *Economic Interdependence and Flexible Exchange Rates*, Cambridge, Mass.: MIT Press, 1983.

Corden W., "Booming Sector and Dutch Disease Economics: Survey and Consolidation", *Oxford Economic Papers*, vol. 36, 359-380, 1984.

Dornbush R. "Expectations and Exchange Rate Dynamics", *Journal of Political Economy*, 1976, vol. 84, 1161-1176.

Eastwood R.K. and A.J. Venables, "The Macroeconomic Implications of a Resource Discovery in an Open Economy", *The Economic Journal*, 1982, vol. 92, 285-299.

Enders K., and Herberg, "The Dutch Disease: Causes. Consequences, Cure and Calmatives", *Weltwirtschaftliches Archiv*, vol. 119, 473-497, 1983.

Goskomstat, *Socio-Economic State of Russia*, 1999, 2000.

Guriev S.M., and B. Ickes, *Barter in Russia,* New Economic School Working Paper #2000/015.

L'vov D., "Real Course of Economic Transformations", *Ekonomika i Matematicheskie Metody (Economics and Mathematical Methods)*, vol. 30, #1, 5-18, 1994 (in Russian).

Montes M.F., and V.V. Popov, *Asian Virus or "Dutch Disease": Theory and History of Currency Crises in Russia and Other Countries*, Delo, Moscow, 1999.

Neary J.P. and S. Van Wijnbergen, "Can an Oil Discovery Lead to a Recession? A Comment on Eastwood and Venables", *The Economic Journal,* 1984, vol. 94, 390-395.

Neary J.P. and S. van Wijnbergen, "Natural Resources and the Macroeconomy: A Theoretical Framework", in J.P. Neary and S. van Wijnbergen eds., *Natural Resources and the Macroeconomy*, Basil Blackwell, 1986.

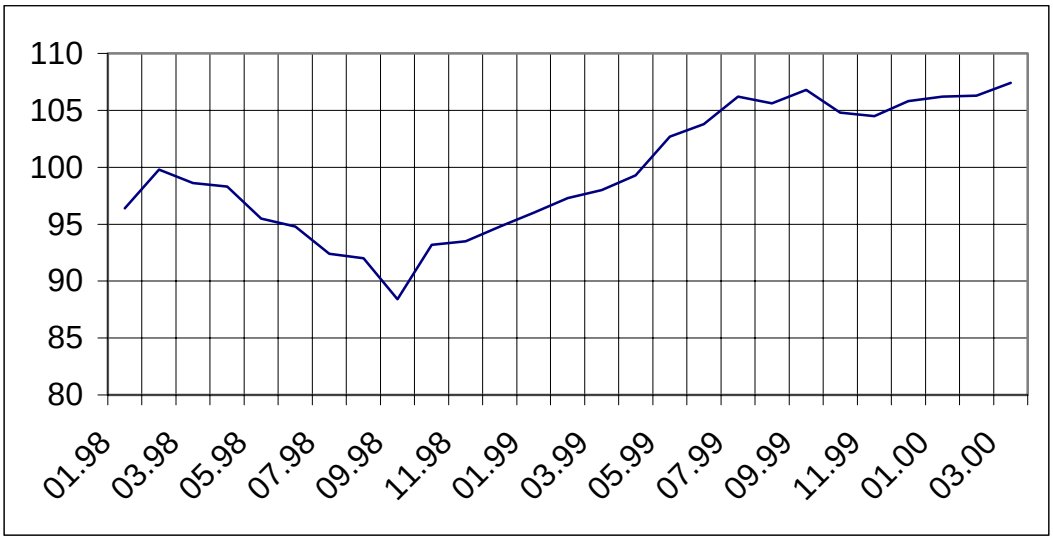


Figure 1. Industrial output in Russia (seasonally adjusted, 1997=100) (Goskomstat, 1999, 2000)

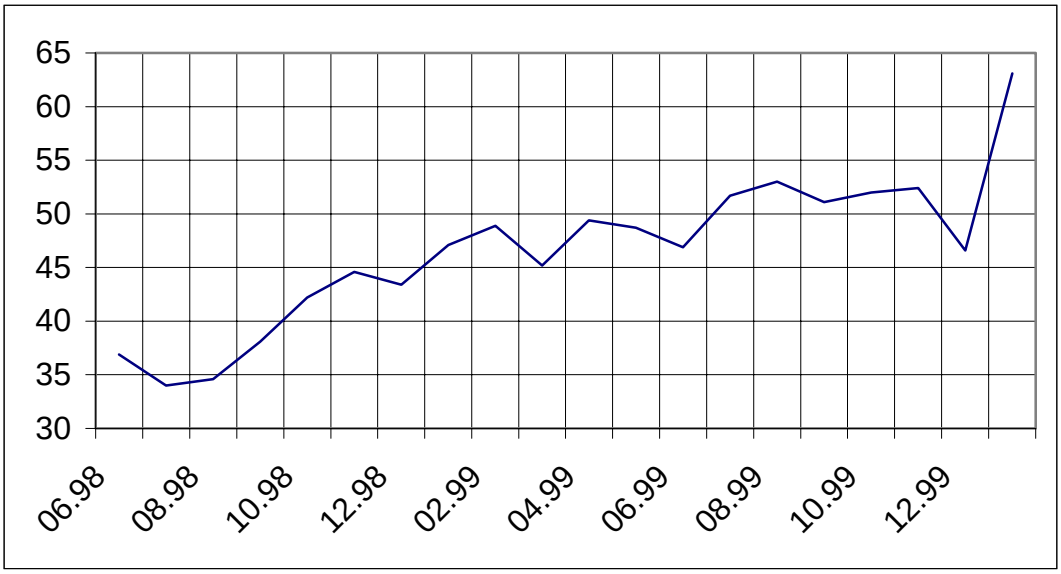
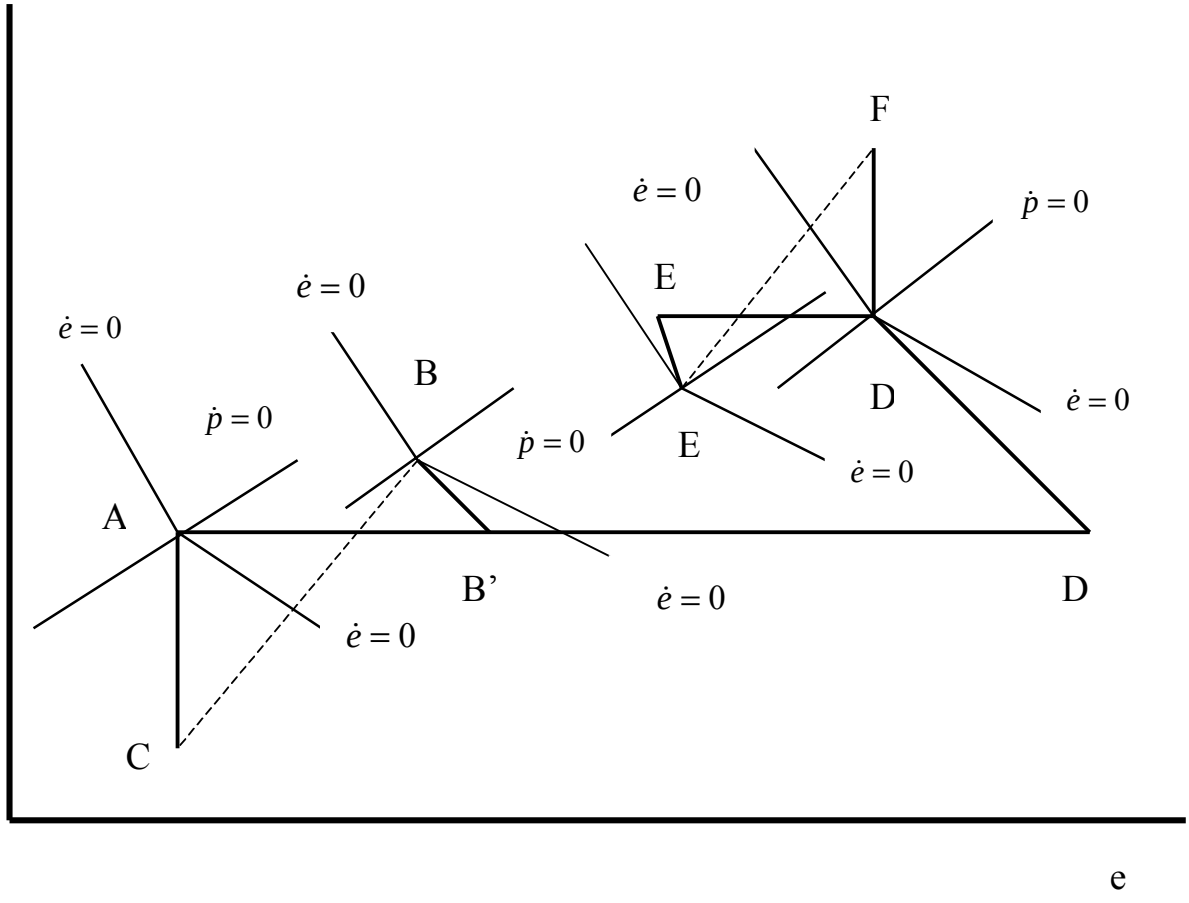


Figure 2. Dynamics of a share of monetary transactions (%) among the major tax-payers in Russia (Goskomstat 1999, 2000)


F
$\dot{e} = 0$
$\dot{p} = 0$
E
$\dot{e} = 0$
B
D
$\dot{e} = 0$
$\dot{p} = 0$
$\dot{p} = 0$
E
$\dot{e} = 0$
A
B'
$\dot{e} = 0$
D
$\dot{e} = 0$
C
e

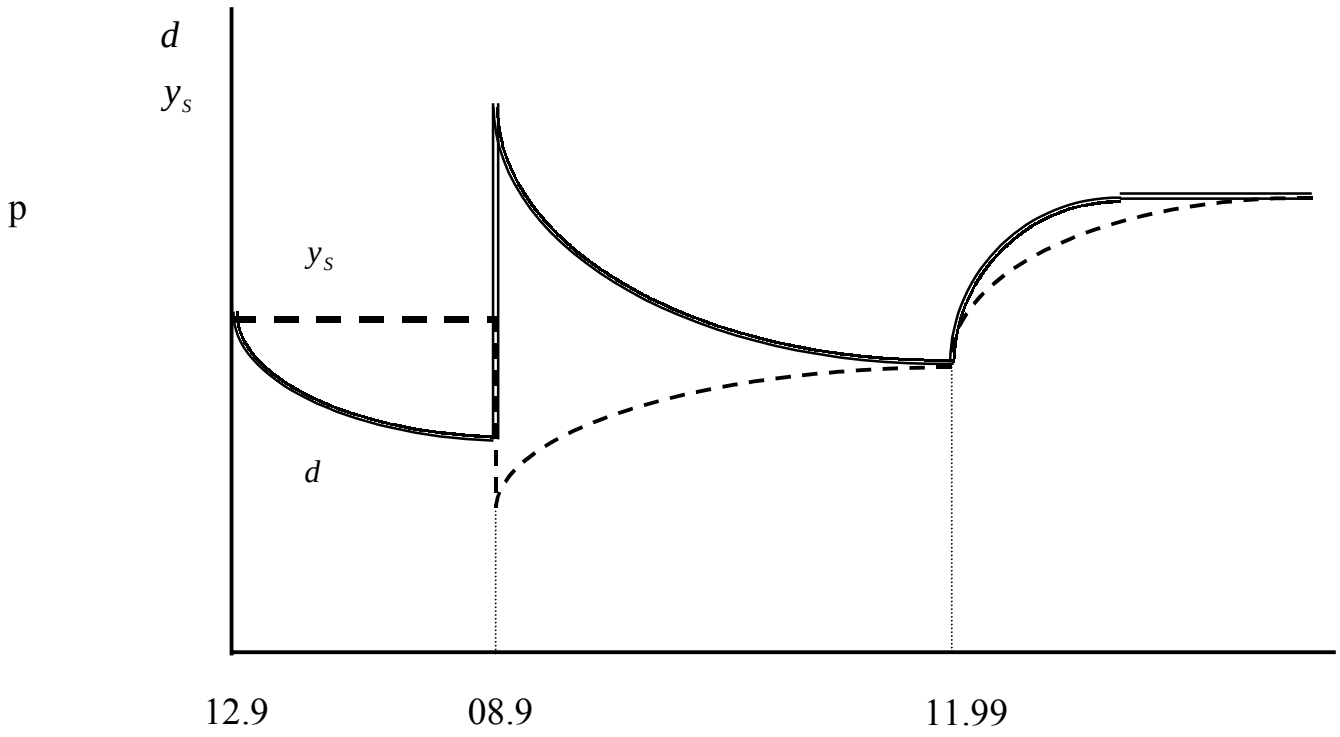


Figure 4. Dynamics of domestic demand and supply

Figure 3. Phase diagrams, corresponding to different states of the Russian economy