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The Global Market for Energy Sources and the Pace of Economic Growth In Russia[1]

1. Introduction

For Russia, oil prices (taking into account the fact that the prices for prices for natural gas supplied to Europe are "tied" to them) serve as a critical indicator of the foreign trade conjuncture. The impact of favorable conditions in foreign trade upon economic growth in emerging countries and in transition economies seems to vary over time and as a function of the structure and peculiarities and stage of development of a particular country. Whilst it can hardly be disputed that appreciation of the real exchange rate for the rouble inhibits economic growth, favourable conditions in foreign trade have in recent times had a positive impact upon Russia's growth primarily, primarily owing to an increasing demand that made for an increase in productive capacity and an expansion of the range of production thanks to investments boosted by an increase in oil-and-gas revenues.

For this reason, it has become a matter of important theoretical and practical interest to distinguish between structural and conjunctural factors in Russia's economic growth, in so far as the latter are determined by the dynamics of world energy prices. Distinguishing structural from conjunctural factors can also be of use when applied to other macroeconomic indicators, for example tax revenues accruing to the Federal budget system, for example in measuring the prospects for a reduction of the tax burden on the economy.

2. Principal methods of isolating the structural and conjunctural components of a time series

The structural component of an economic indicator is fundamental and it changes slowly over time. This quality is regularly used when identifying the structural component by econometric methods. By contrast, the conjunctural component is determined by the current situation in the market and changes rapidly.

In practice the structural component is identified while assessing potential GDP[2], the natural rate of unemployment[3], and the structural deficit of the state budge[4]. The conjunctural (or cyclical) component of indicators is identified while measuring fluctuations in GDP in the course of business cycles[5], the cyclical level of unemployment[6], the cyclical budget deficit and, separately, state revenues and expenditures[7].

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[1] The paper was published in: Ekonomicheskaya politika № 5, 2009

[2] See: Cotis J.-Ph., Elmeskov J., Mourougane A. Estimates of Potential Output: Benefits and Pitfalls from a Policy Perspective. OECD Economics Department, 2005. www.oecd.org/ dataoecd/60/12/23527966.pdf); Razin A. Aggregate Supply and Potential Output / NBER Working Paper No 10294. 2004. http://www.nber.org/papers/wl0294; Romer D. Advanced Macroeconomics. L.: McGraw-Hill, 1996. P. 227—230, Sachs J.D., Larren F.B. Makroekonomika. Globalny podkhod. M.: Delo, 1996. p. 68, and other papers

[3] For more detailed analysis of NAIRU see: Ball L., Mankiw N.G. The NAIRU in Theory and Practice / NBER Working Paper No 8940. 2002. www.nber.org/papers/w8940; Friedman M. The Role of Monetary Policy // The American Economic Review. 1968. Vol. 58. No 1. P. 1—17; Phelps E.S. Money-Wage Dynamics and Labor-Market Equilibrium // The Journal of Political Economy. 1967. Vol. 76. No 4. Part 2: Issues in Monetary Research (Jul.—Aug. 1968). P. 678—711; Staiger D., Stock J.H., Watson M.W. How Precise are Estimates of the Natural Rate of Unemployment / NBER Working Paper No 5477. 1996. http://www.nber.org/papers/w5477, and other papers

[4] See, for instance: *Giorno C, Richardson P., Roseveare D., van der Noord P.* Estimating Potential Output, Output Gaps and Structural Budget Balances / OECD. Economics Department Working Papers No 152. 1995. www.oecd.org/dataoecd/2/43/33928808.pdf

[5] Different aspects of the issue can be examined in a greater detail in: *Burns A.F., Mitchell W.C.* Measuring Business Cycles. N.Y.: NBER, 1946. P. 7; *Campbell J.Y., Mankiw N.G.* Permanent and Transitory Components in Macroeconomic Fluctuations // The American Economic Review. 1987. Vol. 77. No 2. P. 111 — 117; *Kydland F., Prescott E.* Time to Build and Aggregate Fluctuations // Econometrica. 1982. Vol. 50. P. 1345—

In most cases, the structural component of a macroeconomic indicator can only be identified when it varies slowly. None of the applied filters is able to single out the structural component of a time series, if the component has changed frequently over the interval examined or if the series examined was fairly short. It should be noted that all the aforementioned methods require identification of the parameters of smoothing of an original series, and that this identification appears to be to more conceptual than formal. Given that we do not have any history of cycles of economic development in Russia, in the present paper we shall examine not cyclic fluctuations in the growth rate of GDP of the Federal economy but fluctuations associated with changes in world oil prices. Since the sample of statistical data available to us is so limited, the application of filters as a means of singling out the structural component of Russia's economic growth is inappropriate.

Given that changes in world oil prices are amongst the key factors influencing the conjunctural component of the dynamics of GDP and tax revenues, one way of evaluating the conjunctural component is to measure oil and gas revenues to the budget. In Russia, the methodology employed for calculation of oil and gas revenues is that of the RF Ministry of Finance as laid down in the Budget Code of the Russian Federation, i.e. the calculation of revenues that derive specifically from the price of oil (the tax on extraction of mineral resources and customs duties on unrefined petroleum, natural gas, and petroleum derivatives).

Data on the oil-and-gas and non-oil-and-gas parts of the federal budget of the Russian Federation from 2000 to 2008 are presented in *Table 1*.

TABLE 1.

Revenues and Expenditures of the Federal Budget of RF as a Proportion of GDP, 2000–2008 (%)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Expenditures (1)	14.2	14.8	18.9	17.8	15.8	16.3	15.9	18.1	18.2
Revenues (2)	15.5	17.8	20.3	19.5	20.1	23.7	23.3	23.6	22.3
including:									
Non oil and gas revenues (2.1)	11.7	13.1	15.1	14.1	13.5	13.6	12.7	14.6	11.8
Oil and gas revenues (2.2)	3.8	4.7	5.2	5.4	6.6	10.1	10.9	9.0	10.6
Surplus of the Federal budget of RF, % of GDP (3)=(2)–(1)	1.4	3	1.4	1.7	4.3	7.4	7.5	5.5	4.1
Non oil and gas deficit (4)=(1)–(2.1)	–2.5	–1.7	–3.8	–3.7	–2.3	–2.7	–3.4	–3.5	–6.4

Source: Federal Treasury (IET calculations)

1370; *Lucas R.E. Jr.* Expectations and the Neutrality of Money // Journal of Economic Theory. 1972. Vol. 4. No 2. P. 103—124; *Schumpeter J.* Business Cycles: a Theoretical, Historical and Statistical Analysis of the Capitalist Process*:* 2 vols. N.Y.:McGraw-Hill, 1939, and other papers.

[6] See: Martins M.M.F. Trend and Cycle in the EURO Area: New Tests and Estimates from an Unobserved Components Model / CEMPRE, Faculdade de Economia, Universidade do Porto. 2001. www.ecomod.net/conferences/ecomod2001/papers_web/Martins_new_Manuel%20Martins%2020011. pdf; Mocan H.N. Structural Unemployment, Cyclical Unemployment, and Income Inequality // The Review of Economics and Statistics. 1999. Vol. 81. No 1. P. 122—134; Weber Ch.E. Cyclical Output, Cyclical Unemployment, and Okun's Coefficient: A New Approach // Journal of Applied Econometrics. 1995. Vol. 10. No 4. P. 433—445.

[7] More specifically, assessment of the value of the cyclic deficit in the OECD countries was conducted in: *Giorno C, Richardson P., Roseveare D., van der Noord P.* Op. cit.

A proportion of oil and gas revenues is spent on funding current expenditures of the Federal Budget (the oil-and-gas transfer) and a proportion may be saved. For the assessment of conjunctural risks, it is the non-oil-and-gas deficit indicator (the difference between non-oil-and-gas ("structural") revenues and aggregate budgetary expenditures) that matters. This indicator measures the structural deficit of the federal budget. As shown by the data in *Table 1*, over the whole period in question expenditures regularly exceeded non-oil-and-gas revenues and the structural deficit represented a significant share of GDP. This gives rise to serious risks for the stability of public finances.

The approach we have described for to singling out the structural and conjunctural components of the tax revenues to the Federal budget assumes a distinction between "structural" and "conjunctural" taxes. Conjunctural taxes are deemed to be those that directly depend upon prices for oil and gas. However, this approach does not factor in the effect of changes in the oil price on the volumes of revenues from other taxes. For example, it is clear that oil and gas prices affect the profitability of the oil-and-gas sector and of other sectors, which in turn determines the volume of revenues from taxation of corporate profits.

There are several methods employed throughout the world for measuring the contribution of natural resources to GDP. For example, the International Monetary Fund measures the proportion of oil-and-gas production in total GDP[8], whereas the World Bank estimates revenues from high prices for oil oil-based windfall revenues by evaluating revenues from rent[9].

The simplicity and clarity of the approach of the Russian Ministry of Finance for estimating oil-and-gas revenues over the methodology of the IMF and over the World Bank's methodology for calculating the contribution of natural resources to GDP gives it an indisputable advantage. Also, for all their transparency, these methods do not fully allow for the factoring in of the direct and indirect influence of favorable trade conditions on rates of economic growth.

The method for examining the impact of world energy prices on economic growth that is discussed in this paper does not presuppose a model of economic growth for the Russian economy as a whole. Rather, the purpose is to examine world oil prices as one of principal factors influencing economic growth.

3. Econometric Analysis Methodology

In this paper, we shall put forward a method of distinguishing between the structural and conjunctural components of economic growth rates in the Russian Federation that is based upon a study of the impact favorable conditions in foreign trade area upon growth rates. This study can be represented in terms of models of economic growth, of the theory of production functions, and of models of the equilibrium between the money and commodity markets.

In considering the impact of changes in the export prices for raw materials and energy sources upon economic growth, we need to note the positive effect of favourable conditions in stimulating monetary and fiscal policy and in increasing the volume of investments funded by additional export revenues (the "investment-based" growth mechanism), and also the impact of the wealth effect. The negative influence of an increase in oil prices on economic growth

[8] See: Russian Federation: Selected Issues. Country Report 06/430 / International Monetary Fund. 2006. September 27. www.imf.org/external/pubs/ft/scr/2006/cr06430.pdf.

[9] For more details, see:: *Kunte A. et al.* Estimating National Wealth: Methodology and Results / World Bank. 1998. www-wds.worldbank.org/servlet/WDSServlet?pcont=details&eid=000009265_3981013134540

manifests itself in the form the "Dutch disease" and in politico-economic phenomena that inhibit economic development[10].

The long-term impact of trade conditions upon output (the real GDP) depends upon the volume of investment, which depends upon the volume of resources channeled into the economy prevailing conditions in the global energy market. The level of oil prices determines the value oil exports, the volume of imports, including the import of resources needed for investment, which in turn determines growth in the value of physical and human capital and technology in the economy and, thus, potential growth in the volume of output (economic growth) in the medium- and long run. This means that the growth in investment implies a correlation between the growth rates of the economy and price levels – when prices are low, investments decline and this makes for low growth of GDP and when prices are high investments increase and, accordingly, we have high rates of growth of GDP. In this way, growth of GDP is a constant for any given level of oil prices.

In other words, the price level for oil determines an increase in output, i.e. under a preset price level for oil there exists some constant (stationary) growth rate of GDP; accordingly, should world oil prices rise, the GDP growth rate accelerates. It should be emphasized that the inter-relationship noted is one between GDP growth rates and levels – as price levels increase, growth increases, driven by a greater volume of investment. To test the long-term dependence of GDP growth rates upon oil prices, we employ the Engle-Granger two-step procedure[11] that suggests testing co-integration correlation (1) between the GDP increase (the first-order integration series) and the level of oil prices (the first-order integration series) and, on condition of stationarity of the residuals of this co-integration correlation, building the error-correction model (2)
:

$$\Delta Y_t = \alpha_0 + \alpha_1 P\_oil_t + \eta_t , \qquad (1)$$

$$\Delta^2 Y_t = \beta_0 + \beta_1 \Delta P\_oil_t + \beta_2 \eta_{t-1} + \upsilon_t , \qquad (2)$$

where: ΔY_t – GDP increase at the moment of time t, P_oil_t – the oil price level at the moment of time t, $\Delta^2 Y_t$ – change in the GDP growth rate, i.e. its acceleration at the moment of time t, ΔP_oil_t – oil price increment at the moment of time t, $\eta_{t-1} = \Delta Y_{t-1} - \alpha_1 P\_oil_{t-1}$ – residuals of the cointegration correlation (1) in the first lag.

According to the hypothesis of the presence of a co-integration correlation in the medium- and long run, an actual increase in GDP is determined by the level of world oil prices. Given favourable conditions of foreign trade, then economic growth rates will be high, driven by the volume of investments, and vice-versa – low growth rates will be noted under low oil prices. The error-correction model demonstrates that, if in the preceding moment of time the oil price level was high relative to GDP growth rates, then at the present moment of time the GDP growth rate should accelerate; conversely, when the price level for energy sources is low relative to the GDP growth rate, the latter will decelerate.

[10] This problem is considered in a greater detail in: Kadochnikov P.A., Kazakova M.V., Sinelnikov-Mourylev S.G. Analiz strukturnoy i kon'yunkturnoy sostavlyayuschey nalogovoy nagruzki v rossiyskoy ekonomike//Naychnye trudy IEPP. 2009. № 129 (this publication has also been posted on www.iet.ru).
[11] *See: Engle R.F., Granger C.W.J.* Co-Integration and Error Correction: Representation, Estimation, and Testing // Econometrica. 1987. Vol. 55. No 2. P. 251—276.

Constant oil price fluctuations do not necessarily suggest transition of GDP to a new, long-term, growth trajectory, driven by the investment dynamic. Temporary variations of the actual pace of growth of output from the stationary one are determined by fluctuations of the aggregate demand, a fraction of which is associated with short-term changes in the oil price level. Other fluctuations of the demand can be explained by other factors, such as the mood of the population and of investors, monetary and budget policies, etc. These variations reflect the short-term influence of the market for energy sources on GDP growth rates.

In the short run, transition to another level (that is, an increase or decrease) of prices and a change in net exports can (by affecting the volume of aggregate demand) result in deviations from the constant rate of economic growth – either an acceleration of the constant rate of growth of GDP (in other words, an increase in the constant growth rate), or its slowdown in conditions of falling oil prices. Here we are talking of the impact of price levels on the level of output. With the world prices for oil soaring, the volume of exports increases and, accordingly, so does aggregate demand. Hence, should there be spare capacity and labour, the level of GDP should grow, i.e. in other words the correlation between the oil price level and the level of GDP should hold good.

There cannot be a direct test of the hypothesis of the existence of a correlation between the oil price level and the growth rate of GDP because the series in question differ in their order of integration (the oil price level is of the first order of integration, whereas the level of GDP belongs to the second level of integration).

Therefore, in order to consider the variables differentiated the same number of times, testing must be based on a measurement of the dependence of the correlation between residuals of the co-integration relationship (between GDP growth and price levels upon the price increase for oil:

$$\eta_t = \Delta Y_t - \alpha_0 - \alpha_1 P\_oil_t = \gamma_0 + \gamma_2 \Delta P\_oil_t + \vartheta_t, \qquad (3)$$

i.e. the dynamic of the stationary residuals of the cointegration correlation η_t, which is not explained by variable P_oil, is explained by variable ΔP_oil.

Besides, both of the above-mentioned mechanisms of dependence of economic growth upon world oil prices (in the long run and in the short run) can be described in a single model, provided there exists a co-integration between growth of GDP and increase in oil prices. As noted above, in addition to the mechanism of growth of GDP consequent upon a high level of oil prices, according to the cointegration correlation model (the growth in GDP deriving from increased investments), increased prices for oil and the resulting growth in aggregate demand produce a growth in GDP associated with an additional loading of available capacities (growth in output under the Keynesian supply function). So, it is possible to formulate a hypothesis of a simultaneous existence of the correlation between increase in GDP (i) and the level of the world oil prices (and other factors) and increase in the world oil price level. The latter correlation is equivalent to the impact of the price level (the aggregate demand level) on the GDP level. So, it becomes possible to express the correlation between the GDP increase and, simultaneously, the oil prices level and their surge in the following form:

$$\Delta Y_t = \gamma_0 + \gamma_1 P\_oil_t + \gamma_2 \Delta P\_oil_t + \ldots + \vartheta_t, \qquad (4)$$

The model, described by equation (4), can be tested using the dynamic least square method (DOLS)[12], which displays certain advantages vis-à-vis the error-correction model, for, if applied to small data samples, its realization enables one to overcome the flaws of the regular least square method (including the bias of the respective results due to the standard regression error being correlated with the first gains of explanatory variables).

It should also be noted that under small data samplings:

1. The LS-testing of the cointegration vector appears substantially distinguishing from the coefficients' genuine values, while DOLS-testing is closer to them;
2. The testing of the coefficient under variable ΔP_oil in equation (4) may vary from the testing of the coefficient under this particular variable in equation (3), which is tested with the use of the LS method.
3. Should the testing of the coefficient under variable ΔP_oil in equation (4) appear statistically insignificant (meanwhile, to obtain statistical conclusions about of the coefficient under variable ΔP_oil, t-statistics can be employed), this does not result in a coincidence of the testing of the cointegration vector in equations tested by means of LS with those tested by DOLS.

   So, the testing of the cointegration vector that appears a sole one with an accuracy rate up to normalization with the use of LS-method results in a bias, which can be a considerable one under small samples and tends to diminish, should a sample be extended, which is associated with a notable value of correlation between P_oil and ΔP_oil under small samples and its descent in greater samples. Hence, to test small samples, it is more preferable to opt for DOLS, even if the testing of the coefficient under ΔP_oil in equation (5) appears insignificant[13].

4. Analisys of the Structural and Conjunctural Compoments of Economic Growth in RF in 1999-2007

Analysis of stationarity of the employed data

The time series employed in the econometric testing of the impact the world prices for energy sources have on Russia's economic growth comprise:

- GDP in real terms (the basic index in price equivalent as of 1st quarter 1999);
- Investment in fixed assets in real terms (the basic index in price equivalent as of 1st quarter 1999);
- The actual price of *Brent* in nominal terms (USD/bbl).

All the aforementioned series cover the period between the 1st quarter 1999 and the 1st quarter 2009 (thus the size of the sample is 41 observations). Let us examine the series in a greater detail. We employ the volume of GDP in real terms (the basic index in the price equivalent as of 1st quarter 1999) as a dependent variable in the cointegration correlation (1) (*Fig.1*). The series was built on the basis of the real volume of GDP presented in the form of a chain index (as % to its respective quarter of the prior year) by the Rosstat's methodology.

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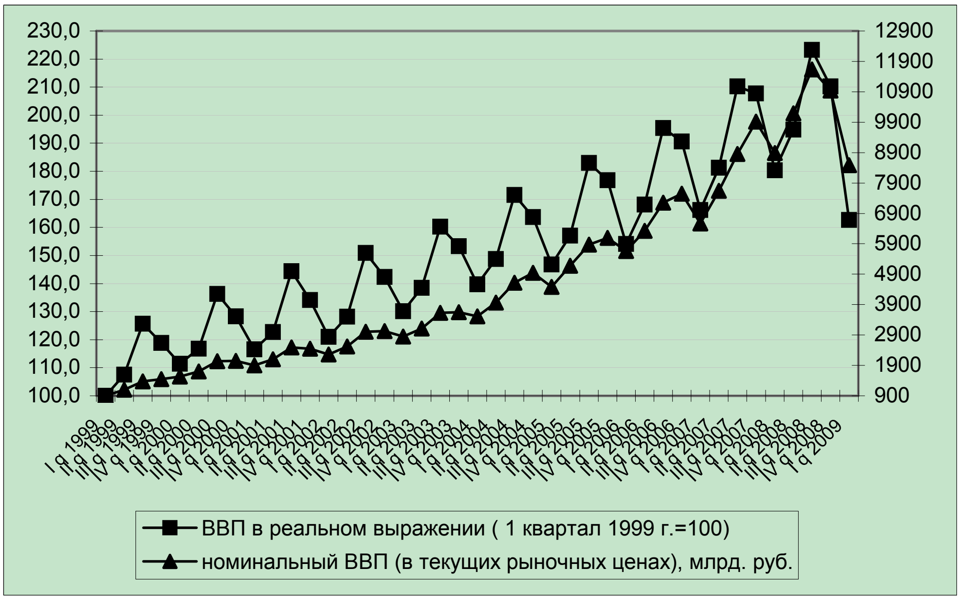
[12] The least square method (DOLS) was developed in: *Philips P.C.B., Loretan M* Estimating Long-Run Economic Equilibria // Review of Economic Studies. 1991. Vol. 58. P. 407— 436. cowles.econ.yale.edu/P/cp/p07b/p0785.pdi); *Saikkonen P.* Asymptotically Efficient Estimation of Cointegration Regressions // Econometric theory. 1991. Vol. 7. P. 1—21. journals.cambridge.org/ abstract_S0266466600004217, а также: *Stock J.H., Watson M.W.* A Simple Estimator of Cointegration Vectors in Higher Order Integrated Systems // Econometrica. 1993. Vol. 61. pp. 783—820.

[13] While preparing this section, the authors used materials provided by V.P. Nosko

Fig. 2 highlights a series of real investment in fixed assets (the basic index) in the price equivalent of the 1st quarter 1999 with the help of the CPI deflator, and a series of actual investment in nominal terms.



GDP in real terms (1st quarter 1999=100)
Nominal GDP (in current market prices), as Rb. bn

Source: Rosstat, the authors' calculations

FIG. 1. The Level of GDP in Real and Nominal Terms, 1st quarter 1999-1st quarter 2009

Investment in fixed assets in real terms (1st quarter 1999=100)

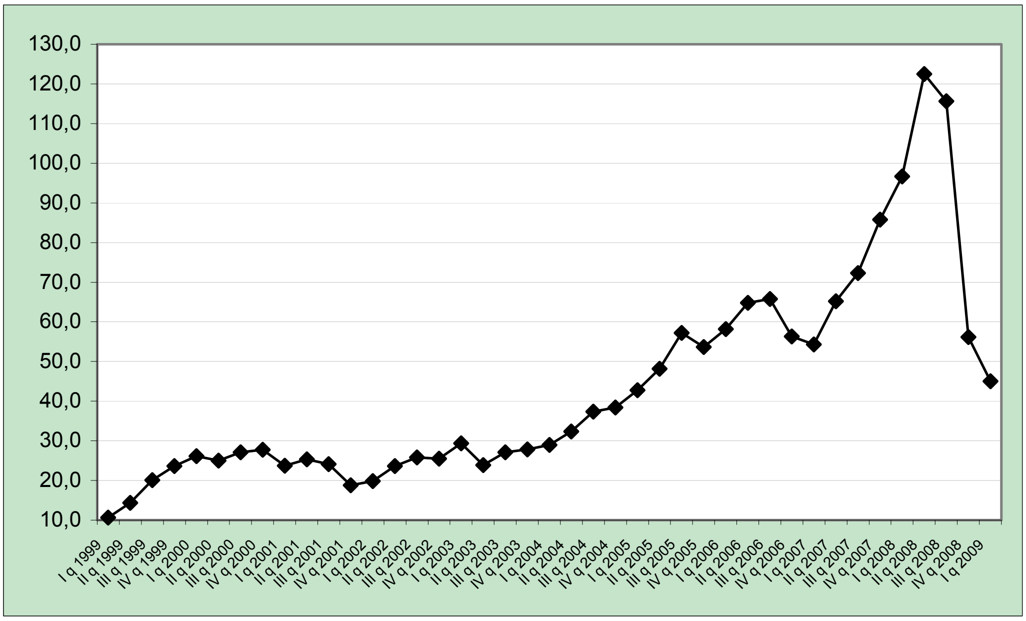
Nominal investment in fixed assets (in current prices), as Rb.bn

Source: Rosstat, the authors' calculations

FIG. 2. The Level of Real and Nominal Investment in Fixed Assets, 1st quarter 1999-1st quarter 2009

Fig. 3 displays a series that depicts an actual level of the nominal price of *Brent*.

As evidenced by Fig. 3, since 2008 the time series in question have been changing their qualities due to both a rapid surge of the world prices for oil between the 1st and 2nd quarters of 2008 and their subsequent downfall against the backdrop of the global financial crisis in the second half 2008. Accordingly, for the sake of decomposition of the GDP growth rates into the structural and conjunctural components, in further calculations we will be employing a data sample that ends up with the 4th quarter 2007 (thus the size of the sample will account for 36 observations).



Source: IMF (International Financial Statistics database, CD-ROM edition, April 2009).

FIG. 3. The Actual Level of the Nominal Price of Oil (USD/bbl), the 1st Quarter 1999 - the 1st Quarter 2009

A stationarity test run on all the time series employed in testing of the correlation between the GDP increase and oil prices on the time interval concerned was made using ADF- and KPSS tests. The respective results speak in favor of a hypothesis that the GDP level and the level of investment in fixed assets in real terms form non-stationary second-order integration series (1(2)), while the level of the nominal price of *Brent* (USD/bbl) is a non-stationary first-order series (1(1)). In addition, it is worth noting that the real GDP and real investment display an explicit seasonality (see *Fig. 1* and *Fig.2*)[14], which should be ascribed to Russia's weather and climatic peculiarities, the rhythm of production processes, educational process, etc.

Testing the impact of the world prices for energy sources on economic growth in Russia

On the basis of results of the stationarity test of the employed time series we built a model for singling out the structural and conjunctural components of economic growth rate. The model rests upon testing the impact the world oil prices have on Russia's GDP growth rates in the long- and short run. To test this correlation, we employed, primarily, the error-correction model. In

[14] See: *Bessonov V.A*. Vvedeniye v analiz rossiyskoy makroekonomicheskoy dinamiki perekhodnogo perioda. M.: IEPP, 2003, p. 18 (also posted on www.iet.ru)

addition, we employed the DOLS procedure that enables one to test correlation between economic growth and oil prices and their surge.

An initial equation that reflects the above correlation became co-integration correlation between the GDP increase in real terms (in the price equivalent as of the 1st quarter 1999) and the level of the nominal price of *Brent* (USD/bbl). Having tested the equation, no cointegration between the dependent variable and the explanatory variable was found. We believe that such a finding can be ascribed to the fact that the variables presented in the real and nominal terms cannot be compared with each other, as well as with seasonality in the series of the real GDP.

That is why we further tested a series of equations of the error-correction model in which the dependent variable is formed by the seasonally smoothed GDP in real terms[15], while explained variables are represented by the oil price in real terms in the price equivalent as of the 1st quarter 1999 (in several variants calculated using various deflators, including Russia and the US's CPIs, the USD nominal effective exchange rate (NEER), the Rb. real effective exchange rate (REER), among others.

In addition to oil prices, we added to the cointegration correlation a variable that reflects the investment dynamic. As demonstrated above, short-term fluctuations of the aggregate demand occur not only because of changes in oil price levels – according to our hypothesis, behind the impact the oil prices have on economic growth in the medium- and long run lies expansion of the production possibilities frontier. The latter is fueled by investments generated by an incomes transfer into an economy under a highly favorable state of affairs on the world markets for energy sources. That is why the equation was complemented by a variable that characterizes the dynamic of investment cleared from short-term price changes for oil (an investment increase that takes place under an averaged multi-year oil price[16]). To this effect we tested the cointegration correlation between the increase in real investment and the real price level of oil. On the basis of the respective equation we further calculated a theoretical value of the investment increase under an averaged multi-year price that can be interpreted as an increase in autonomous investment. By results of the ADF test, the respective series can be considered a zero-order integration series (1(0)).

Therefore, in order to decompose the GDP increase into the structural component and the conjunctural one by means of the LS method, we tested equation (5) that describes a long-term correlation between the seasonally smoothed GDP in real terms (series 1(1)), the oil price in real terms (with deflator being the Rb. real effective exchange rate (REER)) (series (1(1)), and the increase in autonomous investment in fixed assets (series 1(0)):

$$\Delta Y_t = \alpha_0 + \alpha_1 P\_oil_t + \alpha_2 \Delta Inv\_A_t + \eta_t , \qquad (5)$$

where ΔInv_A_t – increase in autonomous investment at the moment of time t, P_oil_t – the oil price level in real terms (in the price equivalent of the 1st quarter 1999, deflator – REER) at the moment of time t.

As demonstrated by *Fig. 4–5* and *Table 2*, there exists a cointegration between two non-stationary series 1(1 employed in equation (5).

So, equation (5) constitutes co-integration correlation between the GDP increase and the oil price level with the increase in autonomous investment factored in. Scattering charts of the dependent variable and explanatory variable are given in *Fig. 4* and *6*, which illustrate the presence of correlation between the dependent variable and the independent one in the equation in question.

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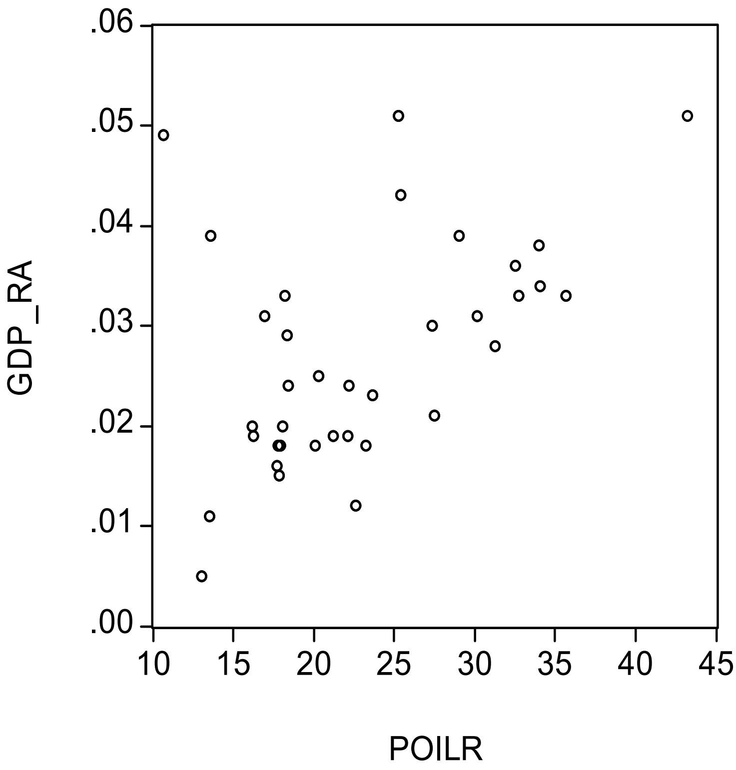
[15] Using Census X12 method.

[16] The average multi-year oil price was calculated by employing the moving average method across 25 points to the effective price in real terms.



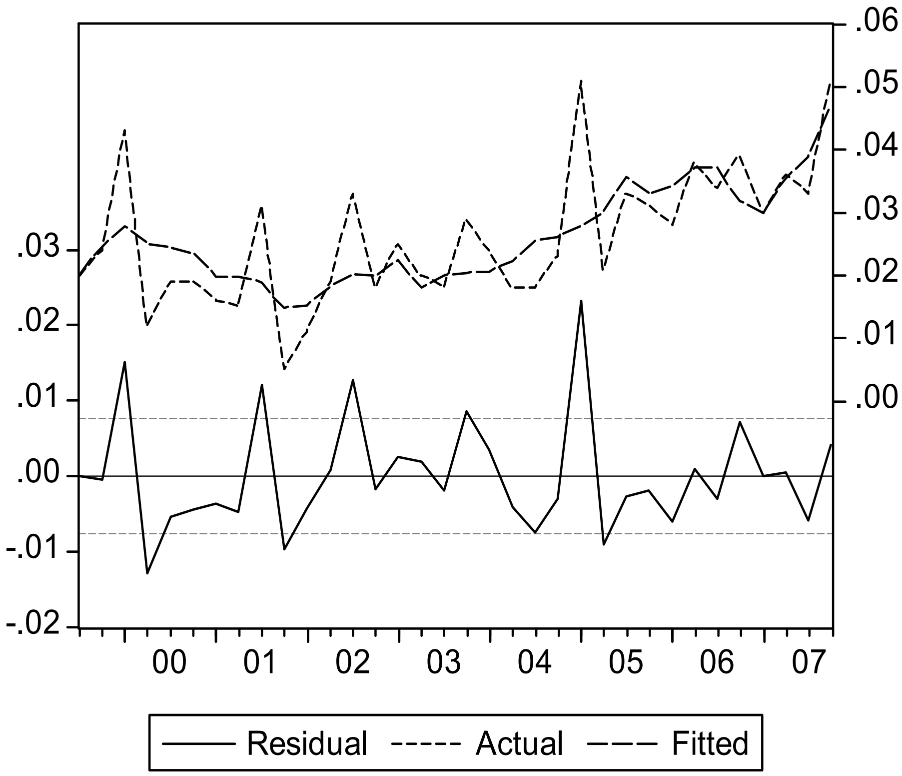
Source: Rosstat, IMF (IFS database, CD-ROM edition, October 2008), the IET calculations

FIG. 4. Scattering Chart: Increase in the Seasonally Smoothed Real GDP and the Real Oil Price, in Prices of the 1st Quarter 1999, 1st Quarter 1999- 4th Quarter 2007

TABLE 2.

Results of Testing of the Cointegration Correlation between the GDP Increase and the Price Level for Oil (in Real Terms)

Explained variable	GDP increase in real terms			
Explanatory variables	*Coefficient*	*Standard bias*	*t-stat*	*P-value*
The price level for oil in real terms	0.001	0,0002	5,76	0,0000
Constant	0.001	0,005	0,18	0,8577
F-stat	33.36			
P-value F-stat	0.0000			
Sample	3rd quarter 1999 – 4th quarter 2007			
Number of observations	34			
R-sq	0.51			
Adj. R-sq	0.50			
DW-stat.	2.49			



Note: actual – chart of the original series of the dependent variable, fitted – chart of the theoretical value of the dependent variable, residual – regression residuals.

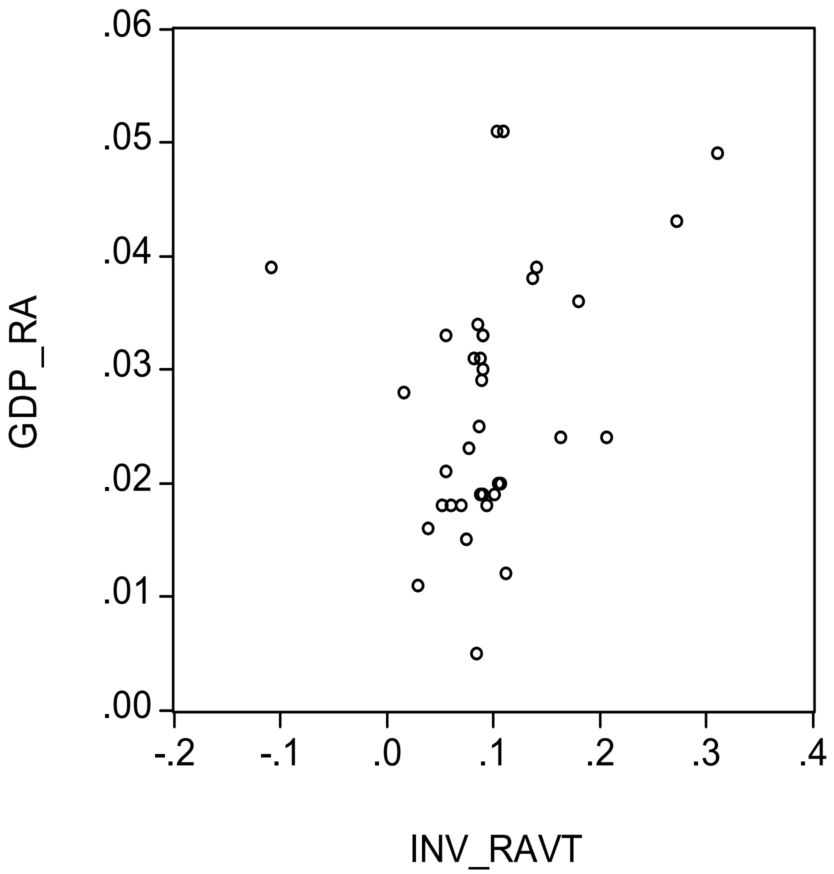
FIG. 5. Results of Testing of the Cointegration Correlation between the GDP Increase and the Price Level for Oil (in Real Terms)

Results of the LS testing of equation (5) are presented in *Table 3*, as well as in *Fig.7*.

Meanwhile, as demonstrated above (see section 2 of the present paper), under small data samples, the testing of a cointegration correlation with the use of the LS method results in a bias of the testing of coefficients of the correlation, as the series of residuals of equation (6) η_t appear correlated with increments in the explaining variables P_oil_t and ΔInv_A_t, as proved by cross-correlograms η_t и ΔP_oil_t and $\Delta^2 Inv\_A_t$.

The cointegration between the GDP increase and the oil price level in real terms allows employment of DOLS in order to avoid a bias of the testing of the coefficient of equation (5), i.e. testing the equation in the following form:

$$\Delta Y_t = a_0 + a_1 P\_oil_t + a_2 \Delta P\_oil_t + a_3 \Delta P\_oil_{t-1} + ... + a_i \Delta Inv\_A_t + a_j \Delta^2 Inv\_A_t + a_k \Delta^2 Inv\_A_{t-1} + ... + \varpi_t \quad (5')$$



Source: Rosstat, the IET calculations

FIG 6. Scattering Chart: Increase in the Seasonally Smoothed Real GDP (GDP_RA) and Increase in Autonomous Investment in Capital (INV_RAVT), in Prices of the 1st Quarter 1999, 1st Quarter 1999- 4th Quarter 2007

TABLE 3.

Results of Testing of the Correlation between the GDP Increase, the Oil Price Level and the Increase in Autonomous Investment in Fixed Assets (in Real Terms)

Explained variable	GDP increase in real terms			
Explanatory variables	*coefficient*	*standard bias*	*t-stat*	*P-value*
Oil price level in real terms	0.001	0,0002	6,06	0,0000
Increase in autonomous investment in fixed assets	0.07	0,02	2,95	0,0059
Constant	–0.005	0,005	–1,07	0,2928
F-stat	25.07			
P-value F-stat	0.0000			
Sample	3rd quarter 1999 – 4th quarter 2007			
Number of observations	34			
R-sq	0.62			
Adj. R-sq	0.59			
DW-stat.	2.36			

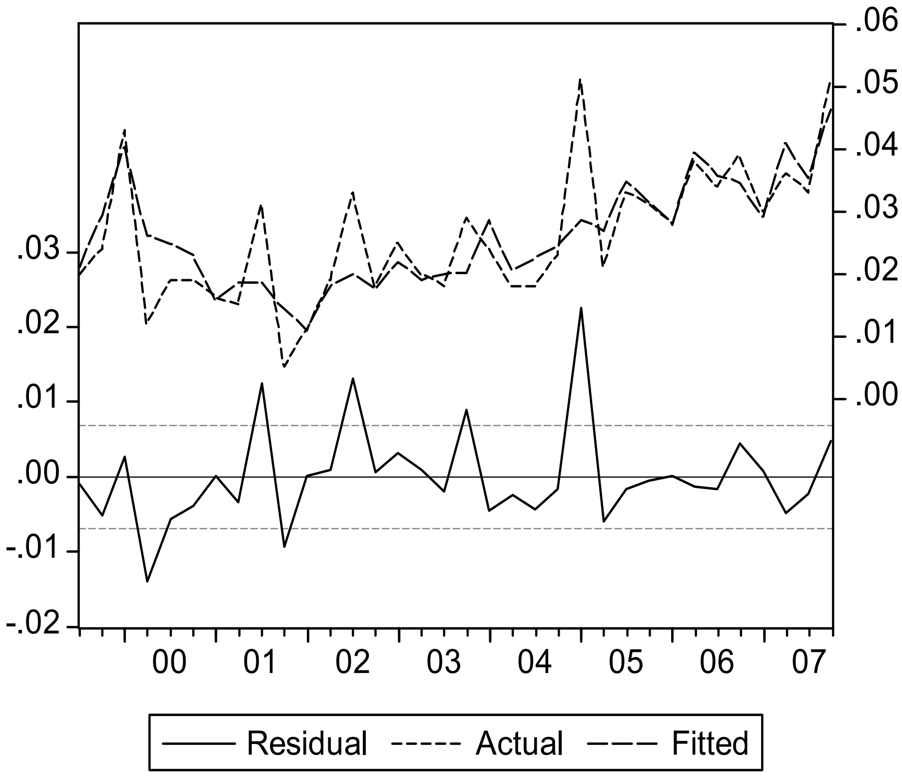


FIG. 7. Results of the Testing of the Correlation between the GDP Increase, the Oil Price Level and the Increase in Autonomous Investment in Fixed Assets (in Real Terms)

Because of the small number of observations, we cannot select a maximum number of lags and leads across all the variables, which significantly lowers the quality of the testing. That is why, in accordance with numbers of the cross-correlograms (significant lagging and leading "hikes"), we are going to include in equation (5) the second lag of variable ΔP_oil_t and two leads of variable $\Delta^2 Inv\_A_t$. As well, guided by conceptual considerations (see below), the equation is to be complemented by the current increase in variable P_oil_t; thus, we test the equation of the following form:

$$\Delta Y_t = a_0 + a_1 P\_oil_t + a_2 \Delta P\_oil_t + a_3 \Delta P\_oil_{t-2} + a_4 \Delta Inv\_A_t + a_5 \Delta^2 Inv\_A_{t+1} + a_6 \Delta^2 Inv\_A_{t+2} + \varpi_t \quad (5'')$$

Results of the DOLS testing of equation (5") are presented in *Table 4* and *Fig. 8*

TABLE 4.

Results of the DOLS Testing of the Correlation between the GDP Increase, the Oil Price level and Increase in Autonomous Investment in Fixed Assets (in Real Terms)

Explained variable	ΔY_t			
Explanatory variables	*Coefficient*	*Standard bias*	*t-stat*	*P-value*
P_oil_t	0.0009	0,0002	3,79	0,0009
ΔP_oil_t	0.0002	0,0006	0,33	0,7457

ΔP_oil_{t-2}	–0.0002	0,0006	–0,30	0,7638
ΔInv_A_t	0.07	0,05	1,29	0,2109
$\Delta^2 Inv\_A_{t+1}$	–0.002	0,05	–0,04	0,9662
$\Delta^2 Inv\_A_{t+2}$	–0.002	0,04	–0,06	0,9534
Константа	–0.003	0,007	–0,42	0,6753
F-stat	4.78			
P-value F-stat	0.0024			

sample 4th quarter 1999 – 2nd quarter 2007

The number of observations	31
R-sq	0.54
Adj. R-sq	0.43
DW-stat.	2.37

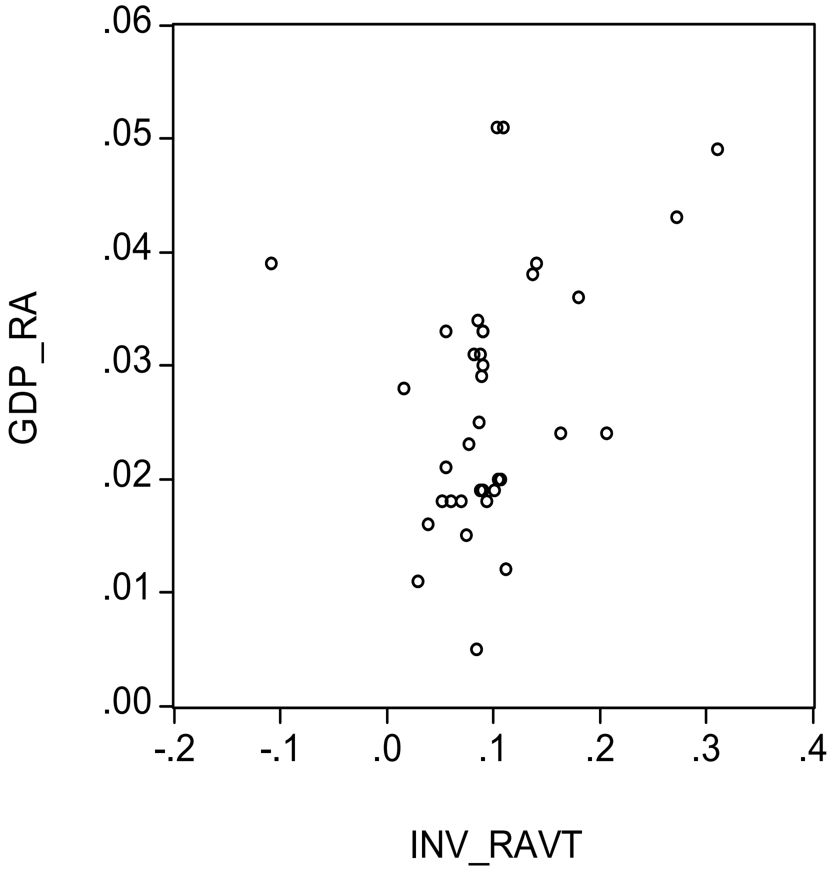


FIG 8. Results of the DOLS Testing of the Correlation between the GDP Increase, the Oil Price level and Increase in Autonomous Investment in Fixed Assets (in Real Terms)

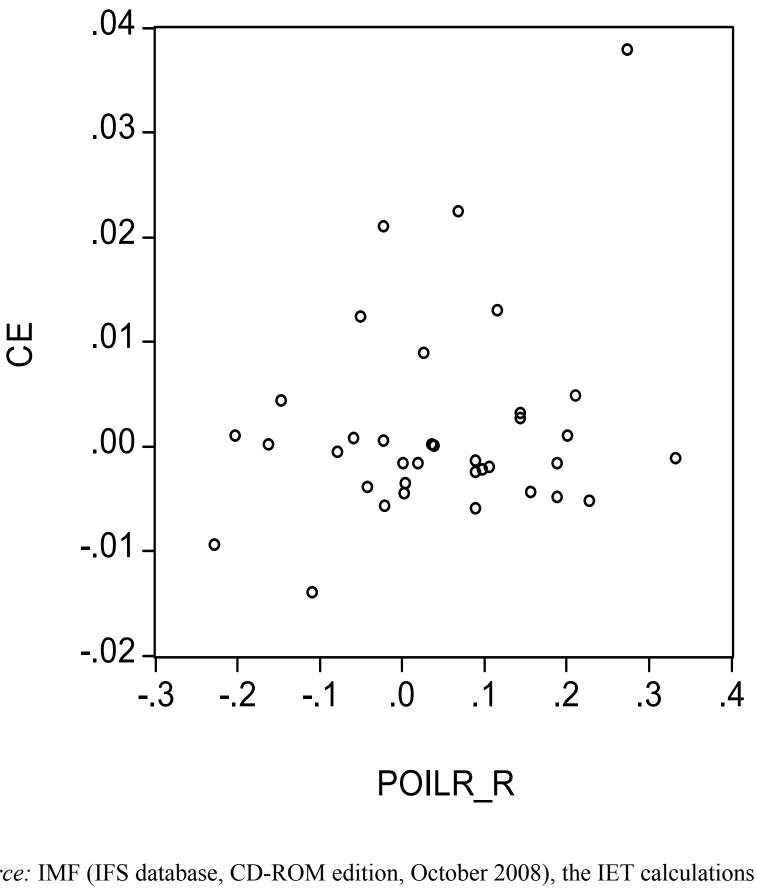
As evidenced by the data of *Table 4,* in equation (5'') variables ΔP_oil_t, ΔP_oil_{t-2}, $\Delta^2 Inv\_A_{t+1}$, and $\Delta^2 Inv\_A_{t+2}$ appear statistically insignificant, both individually and combined, which is proved by results of the Wald test. Meanwhile the testing of coefficients under variables P_oil_t and ΔInv_A_t in equation (5'') appear close to analogous LS tests in equation (5). The value of the Durbin Watson statistics evidences that the hypothesis of the absence of autocorrelation of residuals is not rejected both for equation (5) and equation (5'') (see *Tables 3* and *4*).

It should be emphasized once again that the insignificant variable ΔP_oil_t in equation (5'') is not just a technical variable, but bears a conceptual sense, for, as demonstrated in section 2 of the present paper, factoring this variable in the cointegration correlation allows description of the correlation between economic growth rates and an oil prices increase in the short run, which we have failed to prove in this particular case.

To examine the correlation between economic growth rates and the oil prices increase in the short run and, accordingly, to single out the conjunctural component of increase in GDP, which is determined by short-term fluctuations of oil prices, we also tested the correlation between residuals of the described above equation (5) and oil prices increase rate in real terms:

$$\eta_t = \Delta Y_t - \alpha_0 - \alpha_1 P\_oil_t - \alpha_2 \Delta Inv\_A_t = \gamma_0 + \gamma_2 \Delta P\_oil_t + \vartheta_t \qquad (6)$$

Having examined results of the econometric testing of equation (6) with the use of the LS method, it was found out that the equation appears insignificant as a whole (*Fig.9*).



Source: IMF (IFS database, CD-ROM edition, October 2008), the IET calculations

FIG. 9. Scattering Chart: the Real Oil Price Increase (POILR_R, 1st quarter 1999.=100, deflator – REER) and Residuals of the Cointegration Correlation (CE) between the GDP Increase, the Oil Price Level and the Increase in Autonomous Investment (in Real Terms); 1st quarter 1999 – 4th quarter 2007.

So, it is possible to draw the conclusion that the variable of the increase in oil prices remains insignificant both in the case of applying DOLS to equation (5) and under the testing of equation (6). Apparently, the insignificance of the variable can be ascribed to a short length of the series and the presence of shock impacts on short-term fluctuations of GDP other than oil prices. Accordingly, while decomposing Russia's GDP growth rates into the structural and conjunctural components, we will be employing the results of the LS testing of the cointegration correlation (5) between the increase in GDP and the level of oil prices with account to the increase in autonomous investment (see *Table 3*).

While interpreting the testing of the coefficients of equation (5), it should be noticed that the equation employs a variable of increase in the real GDP (that is, increment in the variable measured in percentage points of the real GDP in the 1999 prices), increase in autonomous investment (in percentage points of the real volume of autonomous investment in the 1999 prices), and the real price level for oil (as USD/bbl).

According to data of *Table 3*, an increase in GDP appears positively correlated with the oil price level and an increase in autonomous investment in fixed capital. Given that according to Rosstat, in the basic 1999, the volume of GDP accounted for Rb. 4.8trln, the 2000 price rise for oil at one USD means a Rb. 4.8bn- worth gain in GDP; meanwhile, a 1 p.p. rise in autonomous investment in turn suggests growth in GDP equivalent to Rb. 337.6bn. From the conceptual perspective, such a finding means that if the price level for oil has risen at one USD over the current period, a surge in the volume of export receipts from sales of oil means an increase in investment in fixed assets that results in a Rb. 4.8bn-worth growth in output in the long run. Accordingly, a 1.1 p.p. increase in autonomous investments, which are explained by other factors (the monetary policy, the budgetary policy, the population's mood, etc) that are independent of short-term fluctuations of oil prices, secure a Rb. 337.6bn-worth rise in output.

So, these figures speak in favor of the hypothesis of the presence of correlation between increase in GDP and the level of oil prices in the long run. The hypothesis reads that each price level for oil is matched by a certain pace of economic growth. A low level of oil prices suggests a low level of investment behind a low rate of growth of GDP. And, vice versa, high oil prices suggest huge investments and, accordingly, high GDP growth rates.

Singling out the structural and conjunctural components of GDP growth rates in 1999-2007

Basing on the testing of the coefficients in equation (5), one can employ the following methodology of decomposition of an increase in the real GDP into the structural component and the conjunctural one.

The structural increase in GDP constitutes a theoretical value of the increase in GDP under the average multiyear oil price $\overline{P\_oil_t}$ and an actual increase in autonomous investment ΔInv_A_t in equation (6):

$$\Delta\overline{Y}_t = -0.005 + 0.001\overline{P\_oil_t} + 0.07\Delta Inv\_A_t$$

-*The conjunctural increase in GDP* ($\Delta Y_t^{oil\_inv}$) is calculated as the difference between the theoretical value of increase in GDP under actual values of the variables in equation (6) ($\hat{\Delta} Y_t$) and the structural increase in GDP ($\overline{\Delta Y_t}$); in other words, this is the component of an increase in GDP emerging at the expense of biases of the actual oil price from its averaged multiyear level:

$$\Delta Y_t^{oil\_inv} = \hat{\Delta} Y_t - \overline{\Delta Y_t},$$ which is equivalent to $$\Delta Y_t^{oil\_inv} = 0.001*(P\_oil_t - \overline{P\_oil_t})$$

– *The conjunctural increase in GDP determined by oil price fluctuations over a short period of time (*$\Delta Y_t^{oil\_SR}$*)* is singled out on the basis of equation (7):

$\Delta Y_t^{oil\_SR} = \hat{\gamma}_2 * (\Delta P\_oil_t - \overline{\Delta P\_oil_t})$, where $\hat{\gamma}_2$ - the testing of the coefficient in equation (7). But, as it was demonstrated above, as the equation describing the logic of the impact oil prices have on the GDP growth rates over a short term appears insignificant over the time interval in question, results of such a decomposition cannot be employed in their final form.

- Contribution *by autonomous investment and other factors that are not factored in the model (* ΔY_t^{other} *)* is calculated as the difference between the actual increase in GDP and the theoretical increase in GDP in real terms resulted from the substitution into a tested cointegration correlation of factual values of the explanatory variables ,i.e:

$$\Delta Y_t^{other} = \Delta Y_t - \hat{\Delta} Y_t$$

As it was demonstrated in the subsection "Testing the impact of the world prices for energy sources on economic growth in Russia", interpretation of the scores of the coefficients in equation (5) is applicable solely to the real GDP measured in terms of increase. Accordingly, to decompose GDP growth rates into the structural component and the conjunctural one, we have completed a transition from increase in GDP to GDP growth rates by means of arithmetical transformations. Main results of such a transformation, which is based on the logic of the cointergration correlation describing the long-term correlation between economic growth rates and oil prices, are given in *Table 5*.

As demonstrated by the data of *Table 5*, the world oil prices were behind over 75% of the overall actual GDP growth rate, But, in the light of the conceptual considerations, this seems to be an overstated rate. It is likely to be explained by the fact that in this paper no testing was run on Russia's model of economic growth. That is why the oil price variable mirrors the impact of all the other factors that were not factored in while decomposing GDP growth rates into the structural and conjunctural components.

TABLE 3.

Results of Decomposition of HDP Growth Rates in Real Terms, 1999–2007 гг. (as Per Cent)

	Overall (actual) GDP growth rate	**Structural GDP growth rate**	**Conjunctural GDP growth rate that depends on changes in oil prices**	**Conjunctural GDP growth rate explained by autonomous investment and other factors**	**For reference:**	
					Price of Brent in real terms (USD/bbl in1999 prices)	*Nominal price of Brent (USD/bbl.)*
1999	6.4	4.9	0.1	1.4	18.0	18.0
	100.0%	*76.1%*	*1.5%*	*22.4%*		
2000	10.0	4.9	2.8	2.3	25.6	28.2
	100.0%	*49.2%*	*28.2%*	*22.6%*		
2001	5.1	3.4	1.0	0.7	18.3	24.3
	100.0%	*67.6%*	*19.2%*	*13.1%*		
2002	4.7	3.7	1.0	0.1	18.3	25.0
	100.0%	*78.2%*	*20.4%*	*1.5%*		

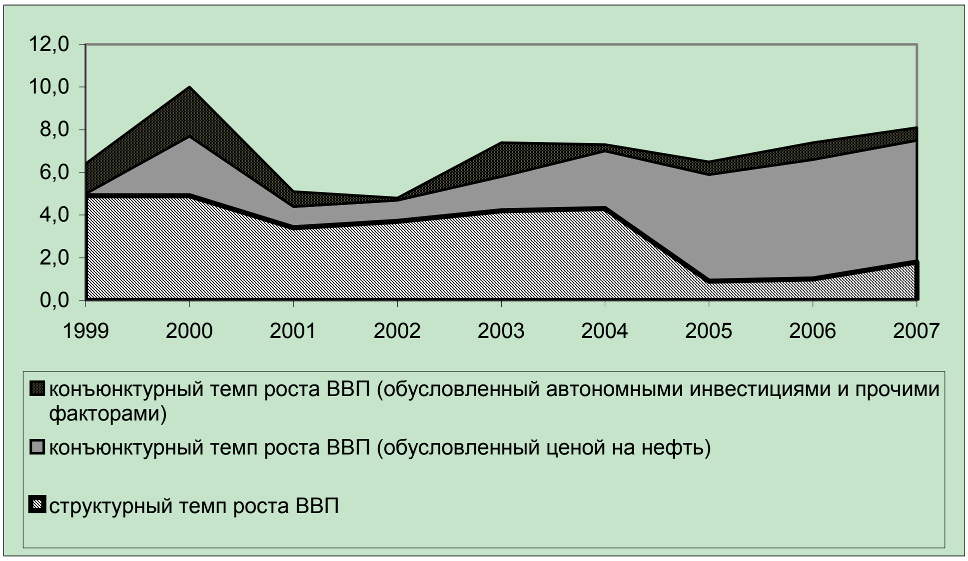
2003	7.3	4.2	1.6	1.6	20.6	28.9
	100.0%	*57.4%*	*21.3%*	*21.3%*		
2004	7.2	4.3	2.7	0.3	24.9	37.8
	100.0%	*59.4%*	*36.8%*	*3.7%*		
2005	6.4	0.9	5.0	0.6	32.4	53.4
	100.0%	*13.4%*	*77.6%*	*9.0%*		
2006	7.4	1.0	5.6	0.8	35.6	64.3
	100.0%	*13.5%*	*75.2%*	*11.3%*		
2007	8.1	1.8	5.7	0.6	37.3	71.1
	100.0%	*22.4%*	*69.9%*	*7.7%*		

Note: in the second line, in italics are given proportions of the respective components of the GDP growth rate in the overall value of the actual GDP growth rate in real terms (as a percentage)

Source: Rosstat, IMF (IFS database, CD-ROM edition, October 2008), the authors' calculations.

Fig. 10 highlights the 1999-2007 dynamics of the structural and conjunctural components of the GDP growth rates. *Fig. 10* evidences that the both components have been positive over the period in question. This can be ascribed to the fact that over that time interval the oil price in real terms was at a level higher than its averaged multiyear value.

As evidenced by the data presented in *Table 5* and *Fig. 10,* the proportion of the structural component of the GDP growth rate was high between 1999 and 2004. That it was such between 1999-2000 can be attributed to the recovery nature of Russia's economic growth. As demonstrated by Ye. Gaidar[17], recovery growth is based upon earlier created production capacities and earlier trained workforce. A distinctive quality of Russia's economy between 2001 and 2002, nonetheless, has become a soaring investment demand.



The conjunctural GDP growth rate (determined by autonomous investment and other factors)

The conjunctural GDP growth rate (determined by oil prices)

The structural GDP growth rate

Source: Rosstat, the authors' calculations

FIG. 1. The Structural and Conjunctural Components of GDP Growth Rates (in Percentage Points), 1999–2007

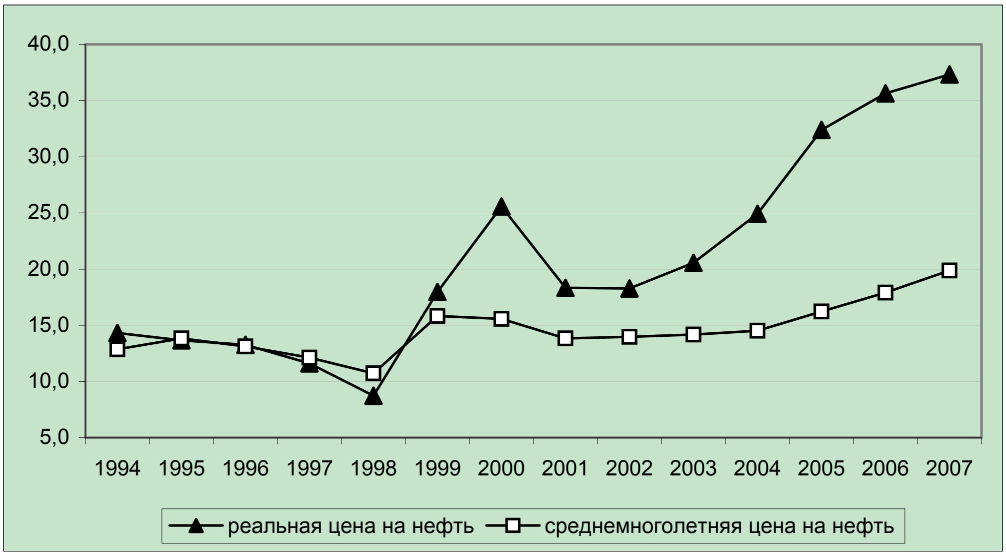
The period between 2000 and 2004 saw a trend to an advanced growth in investment in fixed assets vis-à-vis the dynamics of GDP and output of the basic industry sectors. Such an

[17] *Gaidar Ye.T.* Dolgoye vremya. Ocherki ekonomicheskoy istorii. M.: Delo, 2005, p. 400-403

investment dynamic to a significant degree was fueled by an intensive rise of the economy's incomes that were associated, on the one hand, with favorable changes in the world market for carbohydrate minerals and metals and with the local processes of substitution for imports with domestic goods, on the other[18].

So, in 2001-2002, inasmuch as Russia's economy recovery growth potential was subsiding, the role played by the structural factors of growth experienced some decline, which explains the contraction of the structural component of Russia's GDP in 2001, which, most likely fueled by surging investment, posted a slight growth up to 2004, (see *Fig.10*). The positive value of the conjunctural component of the real GDP growth rate, which in 1999-2004 had been determined by oil prices and which was noted occurring in tandem with the plunge of the oil prices from USD 25.6/bbl in 2000 to USD18.4/bbl in 2001, is explained by the fact that, as noted above, between 1999 and 2007 the actual oil price in real terms was at a level higher than its averaged multiyear value. The situation was a stark contrast to the period of 1995-98, when the averaged multiyear oil prices had been greater than the actual ones (*Fig.11*).

According to the data presented in *Table 5*, the role played by conjunctural factors of economic growth, primarily high world oil prices for energy sources, has intensified since 2005 (see *Fig.11.)*. In 2005, the proportion of the conjunctural component of the GDP growth rates soared up to 5%, or up to 77.6% of the actual GDP growth rate (i.e. more than doubled vis-à-vis its respective value of 2004), while the structural component tumbled (see *Fig.10*).



Real oil price Averaged multiyear oil price

Source: (IFS database, CD-ROM edition, October 2008), the authors' calculations.

FIG. 2. Dynamics of the Real (in the1999 Prices) and the Averaged Multiyear Prices of Brent (as USD/bbl), 1994–2007 гг.

The simultaneous expansion of the domestic market and the external one fueled Russia's sustained economic advancement in 2005-2007.While the dynamic of the external demand was fueled by a favorable state of affairs on the world markets for fuel and mineral resources, the expansion of the domestic market was driven by a cumulative impact of the factors of growing business activity and the population's effective demand. The growing business activity was stirred by an advanced rise in investment vis-à-vis the dynamic of final consumption and had a

[18] Rossiyskaya ekonomika v 2004 g. Tendentsii I perspektivy. Vyp. 26.M.: IEPP, 2005.pp 288-290 (also available at: www.iet.ru)

substantial impact on the nature of structural shifts in the produced and consumed GDP. With a 8.1% growth in the 2007 GDP, the households' final consumption rose at 13.1%, while investment in fixed assets soared at 21.1% (compared with 2006)[19].

These processes were mirrored by dynamics of the structural and conjunctural components of the nation's economic growth. *Table 5* demonstrates that the period between 2005 and 2007 is characterized by a rapid growth of GDP. A high level of oil prices, a greater volume of export proceeds and, accordingly, a greater volume of import, including investment resources, fueled economic growth rates in the medium- and long run. Affected by oil prices, the 2007 negligible contraction of the proportion of the conjunctural component of the GDP growth rates in turn can be ascribed to a gradual exhaustion of the role the oil prices played in Russia' economic growth and to an increasing role of the domestic demand factors.

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The employed in the present paper approach to decomposition of economic growth into the structural component and the conjunctural one rests upon testing the influence the oil prices exert on economic growth in the long-, as well as in the short, run, with the account of dynamics of the volume of investment in fixed capital assets.

The paper suggests that, overall, until 2004 behind the growth rates of Russia's GDP had been the recovery nature of the 1999-2000 growth and a subsequent expansion of the domestic demand fueled by an intense increase of incomes in the economy. After 2004, Russia's high economic growth rates were fueled largely by a favorable state of affairs in the foreign trade area. With the domestic producers' competitiveness being relatively low and production diversification nonexistent, a significant proportion of the conjunctural component of the nation's GDP growth rate corroborates a high vulnerability of Russia's economy to fluctuations on the world markets for energy sources.

[19] Rossiyskaya ekonomika v 2007 g. Tendentsii I perspektivy. Vyp. 29.M.: IEPP, 2008.pp 233-234 (also available at: www.iet.ru)