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Cyclicality of Fiscal Policy in Oil-Producing Countries

The article considers fiscal policy in countries that build on the use of nonrenewable natural resources. "Oil GDP," natural rent, and fiscal proceeds from the oil sector are estimated for Russia. These and similar parameters are compared across major oil-producing countries. An econometric procedure is suggested for measuring the overall impact of oil prices on fiscal performance to account for all channels of influence. This approach is used to examine the oil dependence of budget revenues and spending in five oil-exporting countries. Three countries (Iran, Venezuela, and Russia) demonstrate indications of a procyclical fiscal policy.

Economies with a dominant extractive sector have certain characteristics that dictate specific macroeconomic policy requirements. First, the nonrenewable nature of their natural resources has to be taken into account—their complete exhaustion usually takes only a few decades, and partial depletion may be measured in years. Second, in such economies earnings are subject to sharp fluctuations with changes in the international market situation (for instance, in the second half of 2008 average monthly oil prices fell by more than two-thirds).

In countries that export raw hydrocarbons, receipts from the oil and gas sector

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usually play the leading role in government revenues and vary with the terms of trade. In this case, keeping the budget deficit (or surplus) at a stable level means increasing spending when international raw material prices rise (which coincides with an economic upswing) and reducing it when prices fall. Changing international hydrocarbon prices significantly affect the incomes of economic agents and create a specific analogue of the business cycle.[1] Thus, with the standard policy, the volatility of raw material prices leads to procyclical behavior of government spending, which is expressed in unstable economic development and slows down economic growth.[2]

The characteristics of fiscal policy in Russia and leading oil-producing countries are analyzed below. A number of studies have been devoted to this question,[3] primarily concentrating on how to take into account fluctuations of the economy's earnings and the budget system's revenues, and also on the limited amount of natural resource reserves. A general approach to accomplishing these objectives has been worked out. It involves saving part of the revenues from use of nonrenewable natural resources in special funds.

Analysis of fiscal policy in oil-producing countries usually focuses on its cyclicality. However, oil prices affect the economy through myriad explicit and implicit, hard-to-identify channels. Therefore, the degree of cyclicality of fiscal policy in an extractive economy is not only hard to measure but also hard to determine.

To overcome these problems, all of the economy's earnings and budget revenues are customarily divided into two components: oil and general (nonoil). As a result, we get a simple indicator that enables us to judge the policy's cyclicality: the nonoil balance, that is, the difference between nonoil budget revenues and spending. Using this indicator makes it possible to take into account the special nature of oil revenues in fiscal policy. Because of limited nonrenewable natural resources, their extraction should be seen as the use of a certain asset at the country's disposal. In this case, oil revenues (current or previously accumulated) act as a source of funding for the nonoil deficit. Its amount shows how much government spending is not covered by general budget revenues. A combination of a nonoil deficit with a budget surplus indicates that part of the revenues from using natural resources is being spent and part is being saved. A budget deficit means that government spending is not covered by general budget revenues or by complete budget revenues including oil revenues. Growth of the nonoil deficit indicates an increasing gap between spending and general revenues and serves as an indirect sign that fiscal policy is weakening.

The budget's nonoil balance is often measured as a percentage of nonoil GDP, which is supposed to be relatively independent of the current foreign market situation, that is, it provides a reliable basis for comparing the fiscal policy conducted in different years. However, the amount of nonoil GDP actually depends significantly on oil prices, which usually affect production volumes in real terms as well as the amount of GDP in actual prices.

A negative correlation of the nonoil balance with oil revenues (or with oil prices) is considered a sign of a procyclical policy. Such a situation occurs if all or a considerable part of oil revenues are spent; in this case, oil revenue growth

automatically increases the nonoil deficit. And on the other hand, the absence of a correlation between oil revenues and the nonoil balance, that is, stability of the nonoil balance, means that an a countercyclical policy is being conducted. This implies that government spending is being smoothed out by saving part of the oil revenues in special funds when the foreign market situation is favorable, and using money previously accumulated in the funds when it deteriorates. Most of the leading oil-producing countries now have such funds, although the rules for creating and using them vary significantly.[4]

Managing oil revenues: Russia's experience

Russia is the largest economy in the world that depends on the oil sector. In 2007, it was in eleventh place in the world in GDP ($1.29 trillion) and had comparatively high per capita income for an oil-producing country ($14,692 per year at purchasing power parity [PPP]). At the same time, hydrocarbons are dominant in the breakdown of Russian exports (reaching 66 percent in 2008). The country accumulated diverse experience in managing oil and gas revenues. After the crisis of 1998 (caused mainly by the combination of the Russian economy's critical dependence on the foreign market situation with weak fiscal policy), protecting the economy from foreign market fluctuations became a priority of the government's macroeconomic policy.

First, we examine what part of the economy's total earnings and budget revenues comes from oil. Rosstat does not give official estimates of the oil and gas sector's total contribution to GDP (hereinafter, oil GDP), despite this indicator's importance. We thus have to rely on expert estimates of the sector's size.[5] We use a method that includes in the oil and gas sector all of the estimated value added created in oil production and processing, gas production, and oil and gas pipeline transportation sectors.[6] It is based on totaling the value of all components of the sector's final products and subtracting the amount of material costs.

This method, like the World Bank approach, shows that a significant portion of the value added created in the oil and gas sector is artificially shifted to the intermediary sphere using the mechanism of transfer prices. Our estimates put this portion back, including it in oil GDP. Where they can be compared, the different methods produce similar results. Table 1 gives estimates of Russia's oil GDP for the period between the two crises.

As our estimates indicate, oil GDP in dollars rose by a factor of more than six by 2007 in comparison with the crisis period of 1998–99. At the same time, the relative significance of this sector in GDP did not show a clear tendency to increase. The size of the sector reached a maximum in 2000, and in 2006–7 it decreased, in spite of surging hydrocarbon prices. Figure 1 shows that the correlation between oil prices and the size of the oil and gas sector is rather weak. Prices rose by a factor of more than five (even considering dollar inflation), while the oil and gas sector's share of GDP rose only slightly (from 14.4 percent to 18.8 percent). This is because rising oil prices were accompanied by real ruble appreciation and a slowdown of

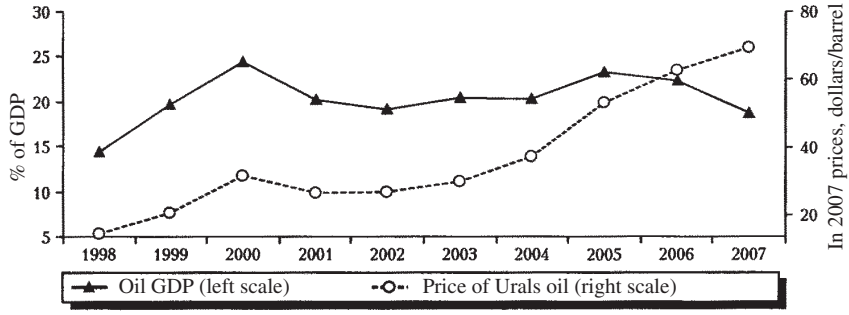
Table 1

Amount of Oil Revenues

	Billion dollars			% of GDP		
	Oil	Gas	Total	Oil	Gas	Total
1998	17	22	39	6.3	8.1	14.4
1999	24	15	39	12.1	7.6	19.7
2000	43	20	63	16.7	7.7	24.4
2001	40	22	62	13.2	7.0	20.2
2002	45	21	66	13.1	6.0	19.2
2003	61	28	89	14.1	6.4	20.5
2004	88	32	120	15.0	5.4	20.4
2005	134	44	178	17.6	5.7	23.3
2006	165	57	222	16.5	5.7	22.3
2007	181	61	242	14.0	4.7	18.8

Source: Authors' calculations.

Figure 1. **Trend of Factors Determining the Size of the Oil Sector**



Source: Authors' calculations.

hydrocarbon production. As a result, oil GDP in constant prices lagged behind nonoil GDP throughout the period under consideration (see Table 2). Moreover, our estimates reveal that oil GDP stopped growing in 2006, and actually began to fall in 2007, which is explained by inefficient operation of the gas sector, where production is hardly increasing, while per-unit costs are growing.

Ruble appreciation is significantly determined by improved trade terms. It is estimated that the oil price elasticity of the real exchange rate is 0.5.[7] This is typical of oil-producing countries. Based on a sample of twelve leading oil-producing countries, Finnish economists concluded that typical elasticity lies in

Table 2

Growth of Oil and Nonoil GDP in Comparable Prices (in %)

	2000	2001	2002	2003	2004	2005	2006	2007	Growth in 2000–2007
Oil sector	4.9	3.9	13.0	12.0	9.6	2.3	0.9	0.2	56.4
Gas sector	–5.9	–6.1	0.8	6.4	3.0	4.7	–2.8	–5.8	–6.5
Oil GDP, total	0.7	0.8	8.8	10.2	7.5	2.9	0.0	–1.3	32.8
Nonoil GDP	12.3	6.5	3.7	6.6	7.1	7.3	9.6	10.8	84.5
GDP, total	10.0	5.1	4.7	7.3	7.2	6.4	7.4	8.1	72.0

Source: Authors' calculations.

the range from 0.4 to 0.5.[8] At the same time, as Gurvich, Sokolov, and Uliukaev have shown,[9] more than a third of the ruble appreciation in the 2000s was due not to improved trade terms but was explained by the Balassa-Samuelson effect.

As Figure 2 reveals, Russia has a far lower ratio of oil GDP to total GDP than Middle Eastern countries and oil-producing countries of the Commonwealth of Independent States (CIS). With respect to the relative significance of the oil and gas sector in GDP, the Russian economy is more comparable to Norway, and less than one-quarter as dependent on oil and gas as the leader, Libya.

Oil budget revenues

We now consider revenues going to the budget from the oil and gas sector (hereinafter, oil revenues). Obviously, the government's ability to conduct a countercyclical policy depends largely on how fully additional earnings that the sector receives in favorable market conditions are appropriated to the budget. This is largely determined by the structure of the oil and gas sector (in particular, by the nature of ownership of production companies) and how the state appropriates resource rent. For instance, in Russia it is appropriated through a special tax (severance tax) and export duties. In the course of the tax reform that has been carried out in the 2000s, taxation of the oil and gas sectors was radically modified. As a result, in both sectors taxes were raised and became more flexible and tied to earnings. Since 2005, the portion of oil revenues that the budget receives has been approximately 60 percent. Table 3 gives data on the ratio of the budget system's oil revenues to total and oil GDP. The revenues here do not include proceeds from sale of the Yukos Oil Company's assets, since they are of a one-time nature and do not characterize the system for taxing oil revenues.

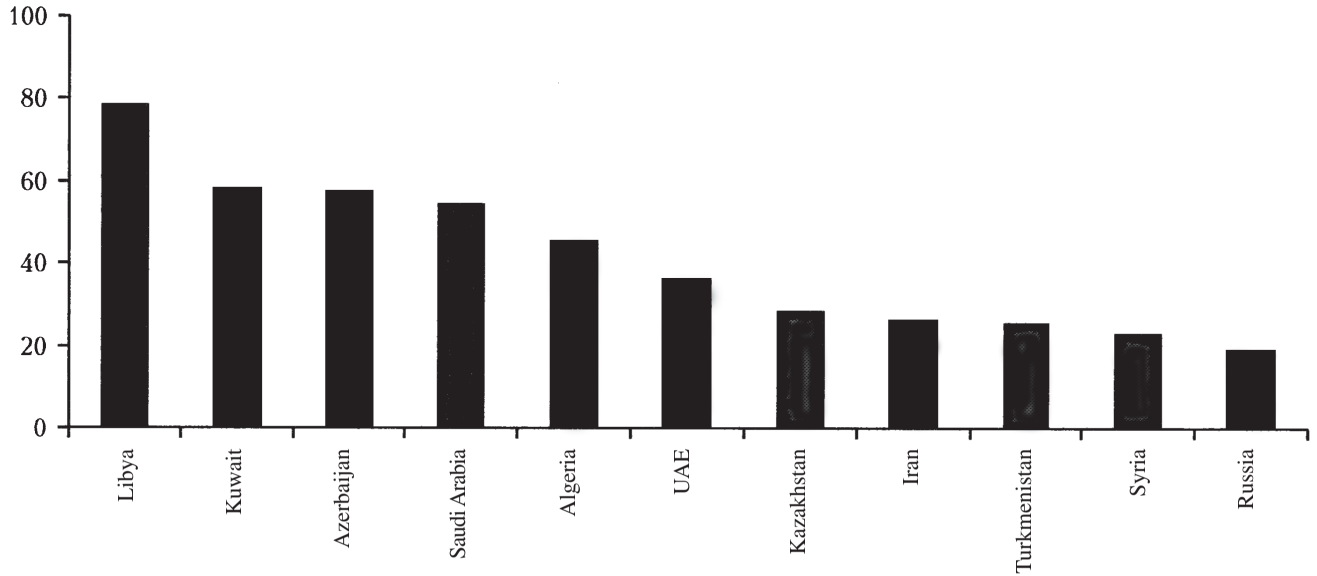
In countries with a federal system, oil revenues are usually concentrated at the federal level. In the case of Russia, this is indicated by the data given in Table 4, from which we can see that in recent years 90 percent of oil revenues have gone to the federal budget, amounting to close to or even more than half of all federal budget revenues.

Important from the perspective of a countercyclical policy are not only the average portion of oil revenues appropriated to the budget but also the change in budget revenues with oil price fluctuations, that is, the portion of additional oil revenues going to the budget as the price of oil rises. As Figure 3 shows, this figure almost doubled in the course of tax reform and is now about two-thirds.

In most leading oil-producing countries the relative significance of oil revenues in the creation of the central government's budget resources is higher than in Russia (see Figure 4). In 2007, only Syria and Kazakhstan had lower percentages. In Azerbaijan and Turkmenia it was approximately the same as in Russia, while in other countries of the sample it varies from 69 percent (Iran) to 90 percent (Libya).

The ratio of budget revenues from the oil sector to oil GDP is higher in Russia than in other CIS countries where production is done by joint companies with the participa-

Figure 2. **Oil GDP in Leading Oil-Producing Countries in 2007** (% of total GDP)



Source: Authors' estimates, based on data of the International Monetary Fund, *Regional Economic Outlook, Middle East and Central Asia* (October 2008).

Table 3

The Budget System's Oil Revenues

	% of GDP			Oil revenues, total		
	From oil sector	From gas sector	From pipeline transportation	% of GDP	% of oil GDP	% of budget system's total revenues
1999	3.2	1.7	0.5	5.5	27.7	16.1
2000	5.7	2.0	0.9	8.6	35.3	23.1
2001	5.4	2.5	1.2	9.1	44.9	24.2
2002	5.5	2.1	0.4	8.0	41.8	21.5
2003	5.9	1.9	0.4	8.2	40.1	22.5
2004	7.6	1.9	0.3	9.8	48.3	26.7
2005	11.3	1.8	0.3	13.5	58.0	35.1
2006	11.6	1.9	0.3	13.9	62.3	35.1
2007	9.3	1.4	0.3	11.0	58.8	28.6

Source: Authors' estimates.

Table 4

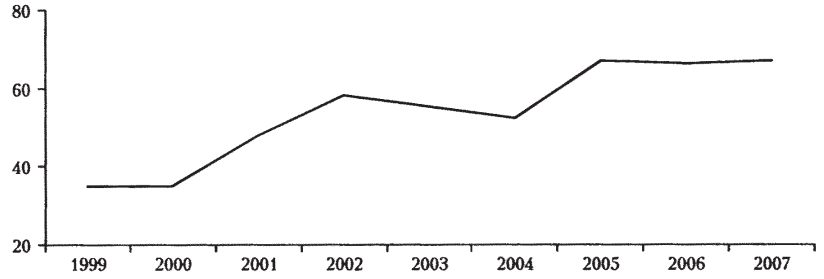
Federal Budget Oil Revenues

	2002	2003	2004	2005	2006	2007
% of GDP	6.3	6.4	8.0	11.4	12.5	9.2
% of federal budget revenues	33.1	31.1	39.1	49.1	56.1	49.1
% of all of the budget system's oil revenues	79.2	77.6	80.9	84.7	90.1	83.5

tion of foreign capital or by foreign companies on the basis of production sharing. At the same time, in Middle Eastern countries the appropriation of oil revenues to the budget is much greater, since production there is done primarily by state companies (see Figure 5). Oil revenues exceed oil GDP in the United Arab Emirates because they include earnings from investment of the money in oil savings funds.

A broad definition of oil revenues includes both rent payments for the use of nonrenewable natural resources and standard taxes on economic activity. It is better to apply special treatment only to revenues associated with appropriating resource rent, since they are created as a result of the limited nature of natural resources, which is a basic specific feature of the oil and gas sector. After exhaustion of their reserves, the factors of production shift to other sectors, continuing to generate a flow of standard taxes. We examine both of these definitions below.

Figure 3. **Percentage of Oil Revenues Appropriated to the Budget**



One feature of the approach we suggest for estimating the amount of resource rent is that it is based on an estimate of the sector's complete added value. The difference between this figure and calculated production costs is an estimate of the "true" (complete) profit, including profit shifted to the intermediary sector. Then the resource rent is determined as the difference between the sector's calculated complete profit and the "normal," economically justified profit. The latter parameter was calculated on the basis of relating profitability to the value of fixed assets in industry, disregarding oil and gas rent, which involved the following steps.

1. Intangible production costs Z_{ogc} were found, disregarding depreciation of the oil and gas complex (including pipeline transportation). When calculating these costs, payments to the budget for the use of natural resources were excluded, since these were considered part of the rent appropriated to the budget.

2. The total gross profit for industry P_{ind} was determined according to the system of national accounts (i.e., including hidden profit).

3. The gross profit for the oil and gas industry P_{og} was estimated according to input–output tables.

4. The residual value of fixed assets was found for industry as a whole FR_{ind}, the oil and gas industry FR_{og}, and the oil and gas complex FR_{ogc}, based on the total value of assets and depreciation.

5. The gross profit rate r was calculated in relation to the value of fixed assets for all industry except for the oil and gas industry:

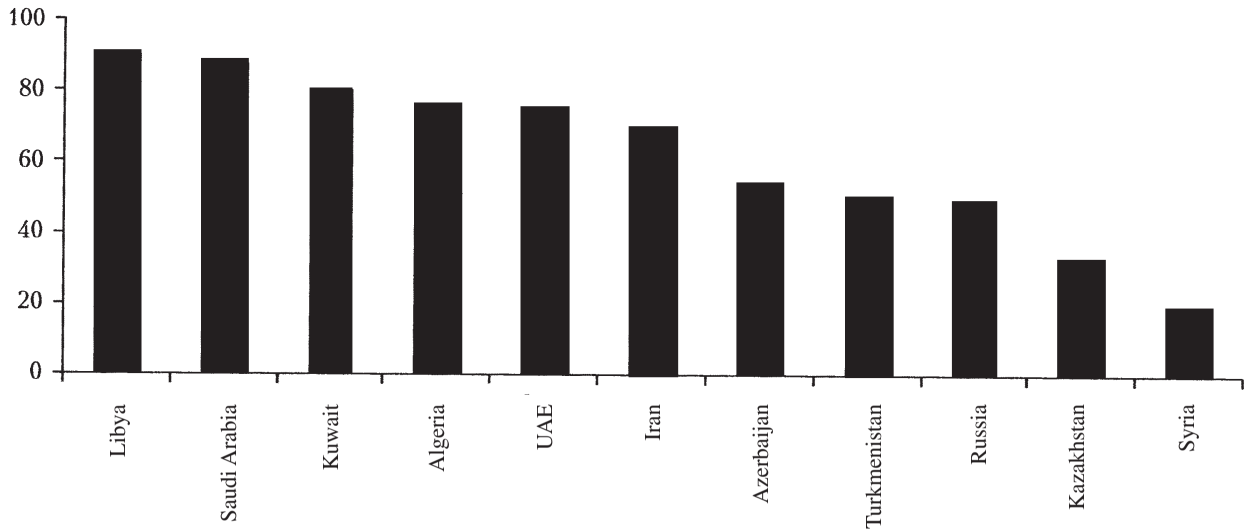
$$r = (P_{ind} - P_{og}) / (FR_{ind} - FR_{og}).$$

6. The "normal" gross profit for the oil and gas complex PN_{ogc} was determined, including pipeline transportation:

$$PN_{ogc} = r \times FR_{ogc}.$$

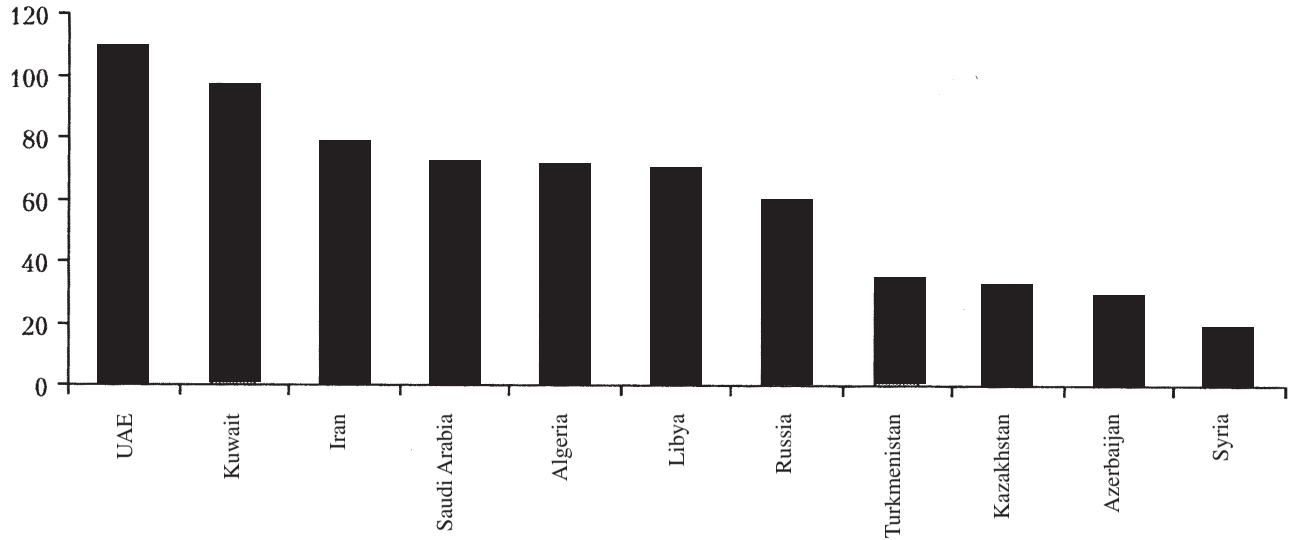
7. The amount of resource rent in the oil and gas complex R_{ogc} was found as the difference between the complete added value V_{ogc} that we calculated, costs Z_{ogc}, part of the indirect taxes (value-added tax [VAT] and excise taxes on petroleum products) TI_{ogc}, and the "normal" profit PN_{ogc}:

Figure 4. **Percentage of Oil Revenues in the Central Government's Budget in 2007**



Source: Authors' estimates based on International Monetary Fund data.
Note: For Kazakhstan, United Arab Emirates, and Syria, the data are for the expanded budget.

Figure 5. **Percentage of Oil Revenues Appropriated to the Budget in 2007**



Source: Authors' estimates based on International Monetary Fund data.

$$R_{ogc} = V_{ogc} - Z_{ogc} - TI_{ogc} - PN_{ogc}.$$

Tables 5 and 6 present the results. It is important to keep in mind that the amount of resource rent is determined by a combination of several parameters: (a) international hydrocarbon prices, (b) oil and gas production and export trends, and (c) the behavior of the real exchange rate (ruble appreciation means increased costs in dollar terms). As a result, the amount of resource rent in the sector in dollar terms rose in tandem with the growth of prices and volumes: from $25 billion in 1999 to $151 billion in 2007. However, the simultaneous rapid growth of GDP in dollars meant that the change in the amount of oil and gas rent as a percentage of GDP was considerably smaller. Except for periods of steep price increases in 2000 and 2005–6, the amount of rent stayed in a narrow range of 12–13 percent of GDP. Despite oil prices that were four times higher in 2007 than in 1999, the amount of resource rent in the oil and gas complex as a percentage of GDP actually declined slightly during this period.

The amounts of resource rent that we found are close (where they are comparable) to the estimates by Kuzyk, Ageev, and Volkonskii.[10] According to their calculations, the amount of resource rent in the oil and gas complex was $41 billion 2000 and $38 billion in 2001. Gaddy and Ickes estimated a considerably greater amount of rent: $190 billion in 2005.[11] These estimates seem too high, since they are almost equal to total sales in the oil and gas sector, which were $205 billion in 2005. However, we can assume that part of the resource rent is used to subsidize comparatively low energy prices for domestic consumers. Considering this component (which does not go to hydrocarbon producers, but to domestic consumers), the amount of rent substantially exceeds our estimates.

The gas sector's share of the rent received has declined consistently (from 45 percent in 1999 to 20 percent in 2007). This trend is explained by the slow growth of gas production and a rapid increase of material costs in this sector.

Tables 7 and 8 present estimates of the appropriation of resource rent to the budget through severance tax and export duties on oil and gas. The portion of the rent appropriated to the budget rose from 18 percent in 1999 to 77 percent in 2007. At the same time, significant differences can be seen in the appropriation of rent in the oil and gas sectors. In the former, the portion of rent appropriated to the budget reached 83 percent, while in the latter it was only 50 percent. This is because rent appropriation in the oil sector is closely tied to international price levels, while in the gas sector this linkage is much weaker. As a result, when hydrocarbon prices are high, the level of taxation in the oil sector is significantly higher than in the gas sector. The flip side of this situation is that when prices fall the gas sector's losses are much greater.

Management of oil revenues

In recent years, Russia has used three approaches to managing oil revenues. From 2000 through 2003, the government planned federal budget spending so that its amount corresponded to the calculated revenues with oil priced at $20/barrel. Ad-

Table 5

Calculation of Resource Rent in the Oil and Gas Sector (% of GDP)

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Calculated gross profit	15.5	20.0	15.5	14.8	16.0	16.0	18.5	17.7	14.7
"Normal" gross profit	2.9	2.6	2.7	2.9	3.0	2.9	2.9	3.0	3.0
Resource rent	12.6	1.73	12.8	11.9	13.0	13.1	15.6	14.7	11.7
Billion dollars	24.8	45.0	39.1	40.9	55.9	77.2	118.9	146.5	150.7

Table 6

Sectoral Breakdown of Resource Rent in the Oil and Gas Sector (% of GDP)

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Oil sector	7.0	11.6	8.5	8.2	8.8	9.7	12.2	11.6	9.3
Gas sector	5.7	5.7	4.3	3.7	4.2	3.4	3.3	3.2	2.4

Table 7

Appropriation of Resource Rent to the Budget System (% of GDP)

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Oil sector	0.8	1.9	2.6	3.6	3.9	5.1	8.6	9.5	7.8
Gas sector	1.5	1.5	1.9	1.6	1.5	1.6	1.5	1.6	1.2
Oil and gas sector, total	2.3	3.5	4.4	5.2	5.5	6.7	10.2	11.1	9.0

Table 8

Percentage of Resource Rent Appropriated to the Budget System

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Oil sector	11.7	16.6	30.2	43.5	45.0	52.5	70.7	82.5	83.2
Gas sector	26.3	27.1	44.0	44.6	36.2	48.2	45.5	50.9	50.4
Oil and gas sector, total	18.2	20.0	34.9	43.9	42.2	51.4	65.3	75.7	76.6

ditional revenues from higher oil prices were saved to pay off foreign debt, although no special institution was created to do this.

From 2004 through 2007, Russia used a stabilization fund, which received any additional revenues in comparison with the base price. The base price was initially $20/barrel, and was then raised to $27/barrel in 2006, reflecting a change in estimates of long-term prices. According to our estimates, approximately three-fourths of the additional revenues from a favorable foreign market situation went to the Stabilization Fund. Moreover, the amount of oil revenues intended for spending depended on the planned price for the next year. Thus, this mechanism only partially smoothed out spending.[12] Over the four years of the Stabilization Fund's existence, more than $200 billion went into it.

Finally, the mechanism of a non–oil and gas budget was put in place starting in 2008. This concept calls for annual use of a fixed amount of oil and gas spending (oil and gas transfer), regardless of the amount of relevant current revenues. After a three-year transition period, the amount of the transfer is supposed to be fixed at 3.7 percent of GDP. Thus, in future this new approach should maintain a stable ratio of the non–oil and gas deficit to GDP.

Since total budget revenues are more stable than oil revenues, keeping the amount of the oil and gas transfer constant will smooth out government spending. In contrast to the stabilization fund, the new mechanism makes it possible not only to protect the economy from short-term oil price fluctuations but also to use the limited revenues from nonrenewable natural resources uniformly.

Both ways of managing oil revenues are actually varieties of countercyclical budget policy. To compare the operation of these two mechanisms, we can calculate the amount of the oil and gas transfer during the years of the Stabilization Fund's existence. Oil revenues going to the federal budget are divided into two parts: those credited to the Stabilization Fund (i.e., saved), and those used to fund spending. Assuming that the price of oil is correctly determined, the first part can be calculated. The second part (what is left as the remainder) is analogous to the oil and gas transfer. The calculated amounts of the federal budget's saved oil and gas revenues and the transfer are given in Table 9, which reveals that the amount of the transfer within the framework of the Stabilization Fund varies considerably depending on current oil prices and macroeconomic indicators. Over the course of four years, it varied from 3.2 percent to 6.4 percent of GDP. This demonstrates the advantages of the non–oil and gas budget mechanism in comparison with a stabilization fund. Additional advantages appear if the actual oil prices deviate from their forecast values.

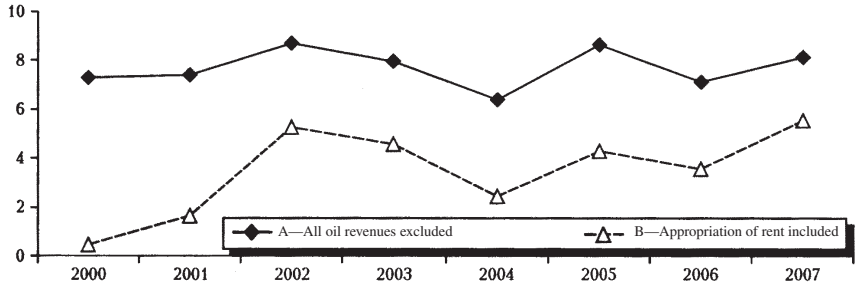
The next step is to determine the amount of the expanded budget's nonoil deficit. Figure 6 shows an example calculated by two methods. One includes in oil revenues all revenues from the oil and gas sector; the other, only the appropriation of resource rent. Depending on this, the oil deficit shows the amount of use of all oil revenues or only rent revenues. We see that the amount of the nonoil balance was comparatively stable using the first determination, in spite of oil price and the budget oil revenue fluctuations. Although the latter varied in a wide range, from 6.8

Table 9

Calculated Parameters of the Stabilization Fund's Operation if Oil Prices Are Correctly Forecast (% of GDP)

	2004	2005	2006	2007
Federal budget's oil and gas revenues	8.0	11.4	12.5	9.2
Going to the Stabilization Fund	4.1	7.0	6.1	6.0
Calculated transfer	3.9	4.5	6.4	3.2

Figure 6. **Nonoil Deficit of Russia's Expanded Budget, as Percentage of Nonoil GDP, 2007**

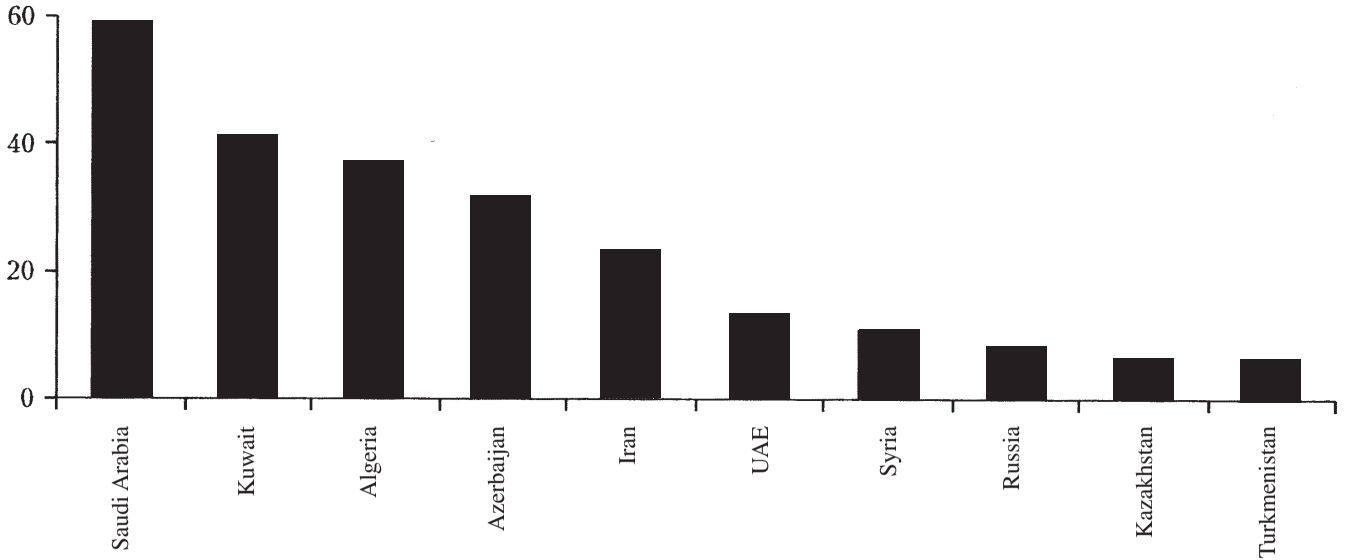


percent to 17.9 percent of nonoil GDP, the nonoil deficit stayed in a fairly narrow range, from 6.4 percent to 8.7 percent of nonoil GDP. In contrast, the nonoil deficit gradually rose in the second determination. The trends noted were due to the fact that in the course of tax reform general taxes were lowered and appropriation of resource rent was increased, which altered the mix of revenues from the oil and gas sector.

As Figure 7 shows, even after the increase in Russia's nonoil deficit it was less in 2007 than in most other oil-producing countries. Libya is left out of Figure 7, since it is extremely out of line from the general pattern, with a nonoil deficit of 136 percent of nonoil GDP.

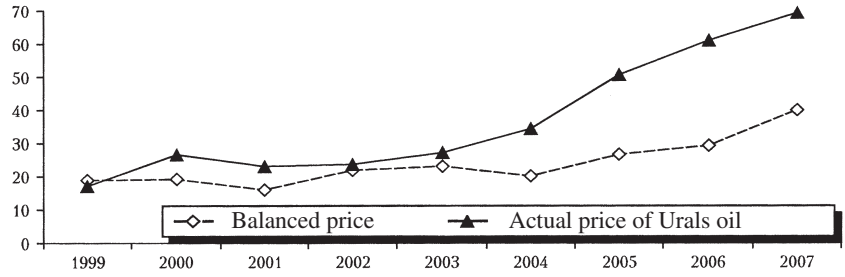
The "balanced" price of oil, that is, the price at which the expected revenues are equal to spending, is an important characteristic of budget policy in oil-producing countries. Figure 8 presents estimates of it for Russia's expanded budget. They take into account only the direct effect of a change in prices, without the indirect impact on the nonoil tax base. For the expanded budget the balanced price gradually rose from $20/barrel to $40/barrel. It seems that this increase should not be seen as the result of weakening of budget policy, but as a change in the anticipated long-term price level. During the period being analyzed, ideas about the "normal" value of hydrocarbons changed significantly in the direction of an increase.

Figure 7. **Nonoil Deficit as Percentage of Nonoil GDP**



Source: Authors' calculations.

Figure 8. **Calculated "Balanced" Price for the Expanded Budget** (dollars/barrel)



Source: Authors' calculations.

Table 10

"Balanced" Price for Fiscal Year 2008

	Dollars/barrel
Iran	90
Kazakhstan	59
Algeria	56
Saudi Arabia	49
Libya	47
Azerbaijan	40
Kuwait	33
United Arab Emirates	23

Source: International Monetary Fund, *Regional Economic Outlook, Middle East and Central Asia* (October 2008).

Table 10 gives the balanced prices calculated by International Monetary Fund (IMF) experts for other oil-producing countries in 2008. Russia is approximately in the middle of the list with respect to this indicator.

Econometric estimation of the dependence of fiscal policy on oil prices

The nonoil balance is easy to calculate and understand. However, it only provides a primary characterization of fiscal policy and should be supplemented by deeper analysis. In some cases, uncritical use of this indicator leads to incorrect conclusions. For example, this happens if a change in oil prices has a significant impact on the general tax base. Then an increase in spending will outwardly appear to be

justified, due to a rise in nonoil budget revenues. However, they are also linked, in a hidden way, with the increase in hydrocarbon prices. Here a procyclical budget policy is concealed behind a stable nonoil deficit.

A number of authors have presented a more complex analysis of fiscal policy in oil-producing countries.[13] This article offers a new approach to studying this problem, which can fully take into account the whole set of relationships between oil prices, budget revenues, and spending.

The first step is to estimate the complete effect of oil prices on budget revenues. This effect is manifested through several channels.

1. An oil price increase expands the base for most taxes, which can be taken into account through the increase in nominal GDP.
2. The structure of GDP may change. For example, in Russia the tax burden is higher in the oil sector than in other sectors, and so an increase in this sector's share will lead to budget revenue growth.
3. Tax rates in the oil sector, or the portion of resource rent appropriated in it, may depend (as in Russia) on oil prices, which additionally increases revenues when the price of hydrocarbons goes up.

The second step is to analyze the complete dependence of budget revenues on oil prices. Several channels are possible here.

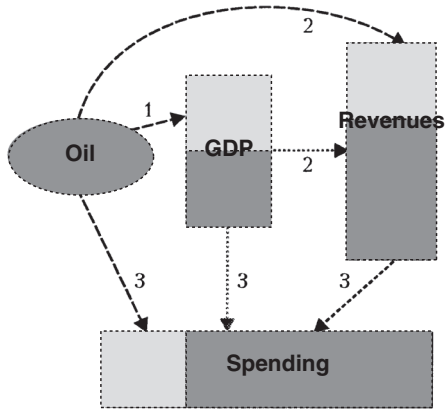
1. Direct: the government may, for example, interpret current prices as an indicator of their future level and assume obligations accordingly.
2. Indirect: through the level of GDP. For example, growth of incomes in the economy may require an increase in wages in the public sector.
3. Indirect: through budget revenues. The government may keep the deficit (surplus) at a constant level, adjusting spending in response to revenues.

When analyzing the relationship between the factors in question, the problem of multicollinearity arises. In fact, if GDP depends strongly on oil prices, then it is hard to separate the effect of these parameters on budget revenues. Instability of the regression coefficients makes the estimates obtained unreliable. One of the standard ways of eliminating multicollinearity is the *principal components method*, which involves orthogonalization of the variables.

The analysis included several stages.

1. *Study of the effect of oil prices on GDP*. As a result, the total GDP was broken down into two components: the function of oil prices and the remainder. We call these components "oil-dependent" and "oil-independent" GDP.
2. *Analysis of the dependence of budget revenues on oil prices and other factors.* This can be done in several ways, of which one is regression of revenues to oil-dependent and oil-independent GDP.
3. *Breakdown of budget revenues into several orthogonal components*. To do this, a dependence of budget revenues on oil prices was constructed. We call

Figure 9. **Model Structure**



this function "oil-dependent" revenues. The remaining part of revenues can then be broken down into those linked with the amount of GDP (we call them "regular") and others. Fiscal policy is largely characterized by how revenues respond to each of these components.

4. *Description of the dependence of spending on the variables that have been constructed*. Several versions were used here. One of them called for studying the relationship of spending with oil-dependent, regular, and other revenues; another involved constructing a dependence of spending on oil prices, oil-independent GDP, and the remaining revenues. The equations for spending (as well as revenues) included lag variables describing the inertia of the budget process. A strong correlation of spending with oil prices or with oil-dependent revenues indicates a procyclical fiscal policy.

While above we looked at oil GDP and oil budget revenues on the basis of direct calculation, in this section we use similar parameters, but they are determined econometrically, taking into account the indirect effect of oil prices on GDP and budget revenues through all channels.

Figure 9 presents the structure of the model. The arrows indicate the effect of some variables on others.

We are studying five hydrocarbon-exporting countries: Iran (1970–2004), Venezuela (1974–2004), Norway (1990–2006), Russia (1995–2006), and Kazakhstan (1997–2006). For each country, we used annual figures for GDP, budget revenues, and spending, in terms of constant domestic prices. As the price of oil, we took the OPEC basket price, which was also converted to real domestic prices each time. The data came from IMF state finance statistics, World Bank development indicators, and the national finance ministries. Four of the countries under

consideration have oil savings funds (although the rules for creating and using them vary appreciably). Iran is the only exception.

Analysis of the series in question showed that they are all nonstationary. Because of this, we used *first-order differences of the parameters*. The procedures that we employ are based on the least-squares method, which enables us to estimate the correlation between variables but cannot determine its direction. This is not a serious problem for oil prices: this parameter, obviously, is exogenous. For the other three variables (GDP, budget revenues, and spending), it is important to know the direction of their effect. The cause-and-effect nature of the relationship was assessed using the Granger test. Summary results of the model estimation are presented in the Appendix.

Results of econometric analysis

Iran

The state budget of Iran ran a deficit throughout the period under consideration. Figure 10 shows the high dependence of budget parameters on oil prices. The 50 percent change in GDP (R^2 = 50.3 percent) is explained by their behavior.

Breaking down revenues into the lag variable, oil-dependent, and oil-independent GDP shows that both components of GDP make a significant contribution to revenues, with a nonsignificant effect of inertia. The effect of oil-dependent GDP on revenues is more significant, which indicates that they depend strongly on oil prices. The change in Iran's budget spending is explained very well (90 percent) by the factors in question. In this case, spending depends significantly on both oil prices and oil-dependent GDP. Thus, Iran's fiscal policy is largely determined by prices in the oil market. Their variation is actually the main factor affecting the change in budget revenues. The Granger test did not reveal a clear direction of the cause-and-effect relationships.

Venezuela

Venezuela's budget parameters are also characterized by a strong dependence on oil revenues (see Figure 11). However, its spending appears more stable than revenues: the budget had a deficit during the period of cheap oil, and a surplus during the period of expensive oil.

The 24 percent change in GDP is determined by the behavior of oil prices. As in the case of Iran, oil-dependent GDP has a significant impact on the amount of revenues. The factors in question explain a significantly smaller portion of spending than in Iran. However, even here the amount of spending is strongly influenced by oil-dependent GDP (although the direct effect of oil prices on spending is not significant).

The Granger test confirmed the direction of one cause-and-effect relationship: in Venezuela, GDP influences budget spending, which, in turn, does not have any appreciable effect on GDP.

Figure 10. **Results of Economic Analysis, Iran**

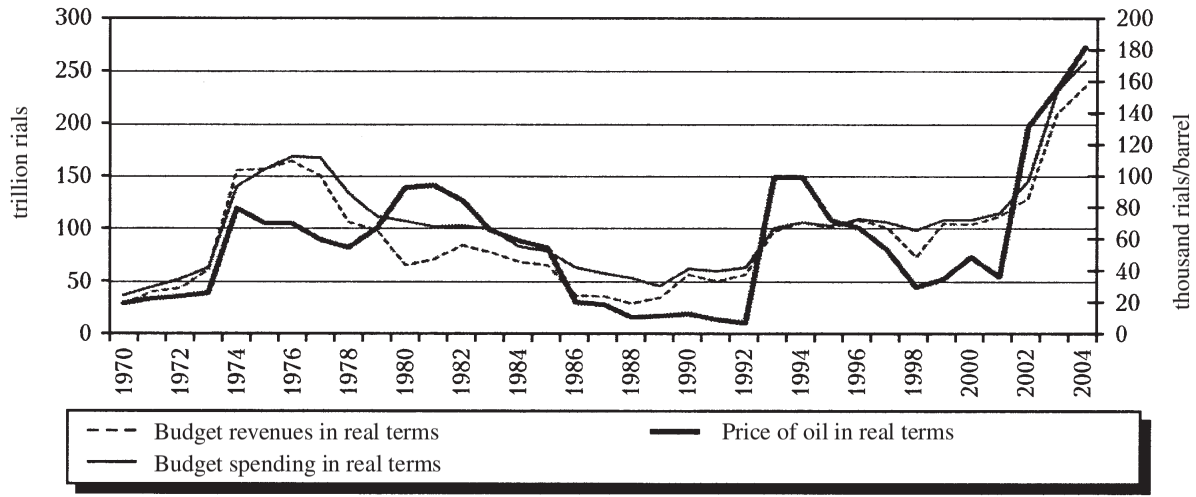
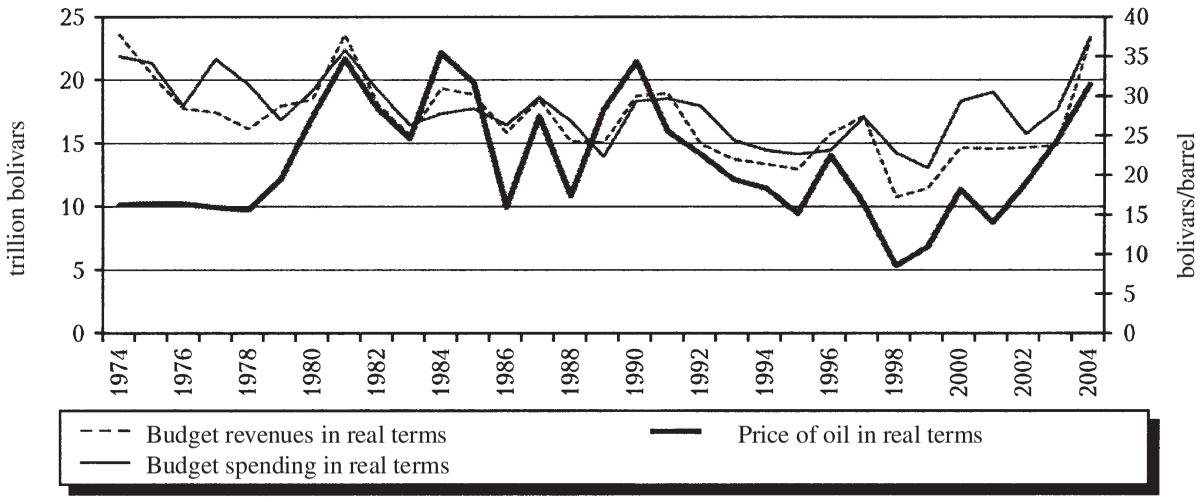


Figure 11. **Results of Economic Analysis, Venezuela**



Norway

The behavior of budget parameters in Norway indicates a close correlation of revenues with oil prices, with no apparent correlation for spending (Figure 12). This gives reason to assume that the country's fiscal policy is of a pronounced countercyclical cyclical nature.

The change in Norway's GDP by 87 percent is determined by the price of oil, which agrees with Sachs and Warner's conclusions.[14]

Budget revenues are well-described by the variables in question. In this case, the effect of oil-dependent GDP on revenues is highly significant. On the other hand, Norway's fiscal policy is neutral to oil prices, which do not affect the amount of budget spending, thus reducing the country's dependence on oil. Considering the significant dependence of its revenues on oil prices, we can conclude that Norway conducts a countercyclical policy. The main tool with which this policy is implemented is its fund for future generations (which was recently renamed the State Pension Fund), in which oil revenues are accumulated.

Russia

In Russia, the budget deficit in the 1990s, when oil prices were low, turned into a surplus when they rose in the 2000s (see Figure 13). This indicates elements of a countercyclical fiscal policy. At the same time, the amount of spending depends significantly on oil prices.

The variation of GDP by 83 percent is determined by the price of oil. It is interesting that only oil-dependent GDP is a significant variable in the equation determining budget revenues. Russia's budget spending is described well (87 percent) by the factors in question. At the same time, its dependence both directly on oil prices and on oil-dependent GDP is highly significant. Thus, in spite of Russia's use of the stabilization fund mechanism, its budget policy shows obviously procyclical features.

Analysis of the cause-and-effect relationships showed that GDP and budget revenues affect budget spending, while there was no effect in the opposite direction.

Kazakhstan

In Kazakhstan, the relationship of budget parameters and oil prices became closer in the 2000s (see Figure 14). Rising oil prices enabled the country to move from a budget deficit in the 1990s to a growing surplus. The price of oil explains only 4 percent of the change in GDP. Budget revenues are largely of an inertial nature and are determined mostly by the country's oil-independent GDP. Spending is also fairly inertial and demonstrates a dependence only on revenues not connected with oil, and GDP. Thus, contrary to expectations, fluctuations of oil prices do not have

Figure 12. **Results of Economic Analysis, Norway**

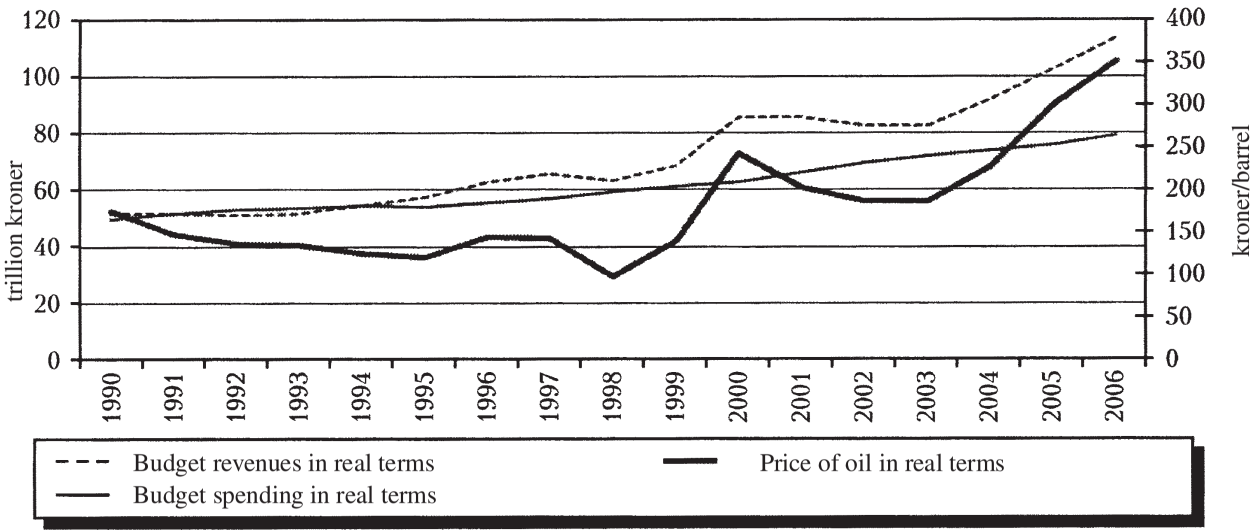


Figure 13. **Results of Economic Analysis, Russia**

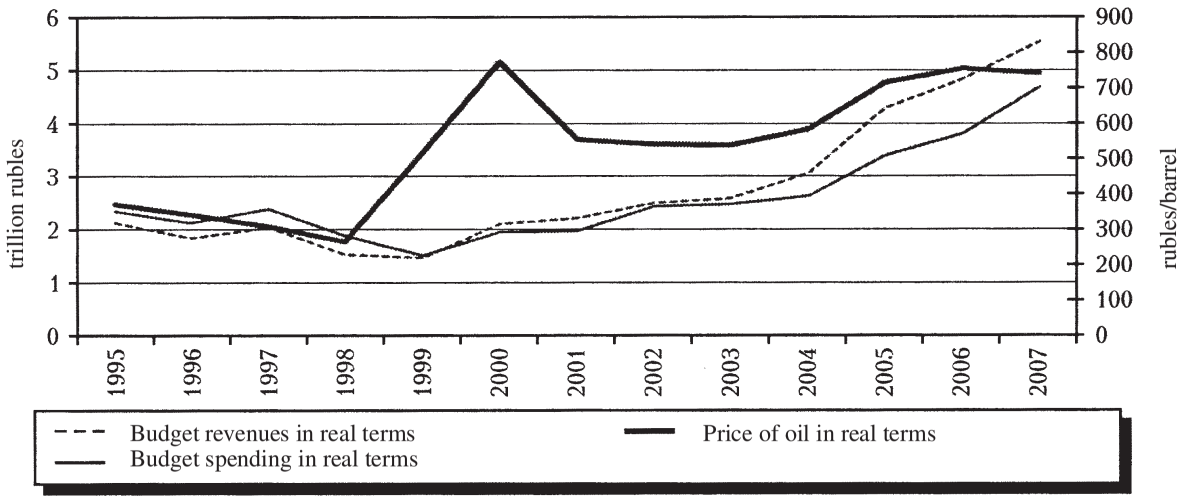
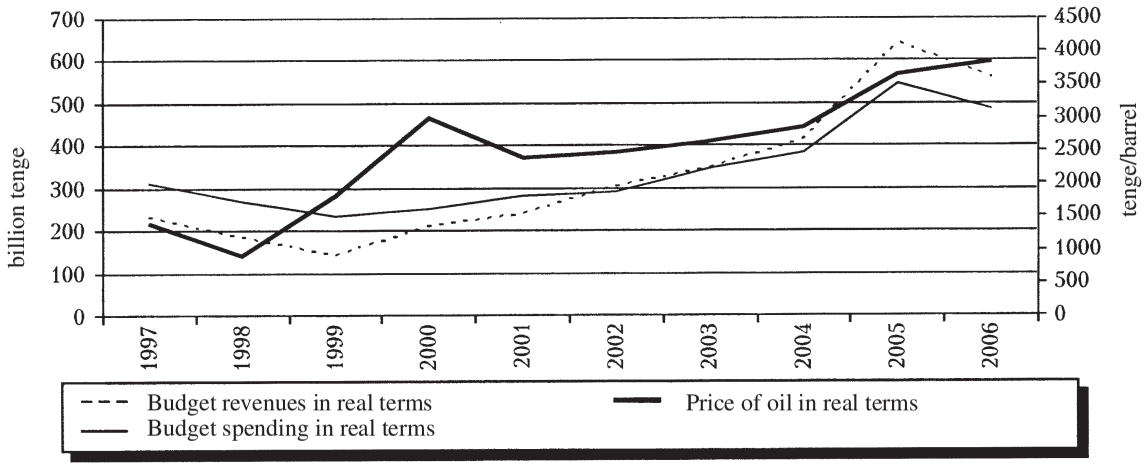


Figure 14. **Results of Economic Analysis, Kazakhstan**



a significant impact on Kazakhstan's budget parameters. Oil revenues probably go into an oil fund, bypassing the budget.

The analysis showed that the price of oil has a significant effect on the economy of four out of the five countries (from 24 percent to 88 percent). Russia, Norway, and Iran are the most susceptible to this effect (more than 50 percent), while in Venezuela only one-quarter of the change in GDP can be explained by the change in the price of oil. Also in four of the countries (except for Kazakhstan) the price of oil has a significant effect on determining budget revenues. In Iran, Venezuela, and Russia, spending policy demonstrates clear features of procyclicality. In contrast to this, in Norway the price of oil does not significantly affect the amount of government spending. This indicates that the country's better state institutions ensure that it conducts a countercyclical policy.

In the working papers cited above, IMF experts also studied the problem of the effect of oil prices on the fiscal policy of oil-exporting countries.[15] They used different econometric tools (vector autoregressions were constructed), but got qualitatively similar results. In particular, for Kazakhstan it was noted that price shocks do not affect budget revenues in relation to GDP, while for Russia and Iran such a dependence was found. In these countries, oil prices affect both budget revenues and spending. In Norway, a countercyclical fiscal policy is seen in relation to oil prices, and institutional measures are taken to ensure that spending from the state budget is independent of oil revenues and oil price fluctuations.

Notes

1. See A.M. Husain, K. Tazhibayeva, and A. Ter-Martirosyan, "Fiscal Policy and Economic Cycles in Oil-Exporting Countries," IMF Working Paper no. 08/253, 2008.

2. See S. Barnett and R. Ossowski, "Operational Aspects of Fiscal Policy in Oil-Producing Countries," IMF Working Paper no. 02/177, 2002.

3. E. Gurvich, "Biudzhetnaia i monetarnaia politika pri nestabil′noi vneshnei kon″iunkture," *Voprosy ekonomiki*, 2006, no. 3; A. Kudrin, "Stabilizatsionnyi fond: zarubezhnyi i rossiiskii opyt," *Voprosy ekonomiki*, 2006, no. 2; J. Davis, R. Ossowski, and A. Fedelino, eds., *Fiscal Policy Formulation and Implementation in Oil-Producing Countries* (IMF, 2003).

4. R. Ossowski, M. Villafuerte, P.A. Medas et al., *Managing the Oil Revenue Boom: The Role of Fiscal Institutions* (IMF, 2008).

5. See Memorandum ob ekonomicheskom polozhenii Rossiiskoi Federatsii "Ot ekonomiki perekhodnogo perioda k ekonomike razvitiia" (World Bank, 2004) (see also *Voprosy ekonomiki*, 2004, no. 5, pp. 33–34); M. Kuboniwa, S. Tabata, and N. Ustinova, "How Large Is the Oil and Gas Sector of Russia? A Research Report," *Eurasian Geography and Economics*, 2005, vol. 46, no. 1.

6. See E. Gurvich, "Makroekonomicheskaia otsenka roli rossiiskogo neftegazovogo kompleksa," *Voprosy ekonomiki*, 2004, no. 10.

7. N. Oomes and K. Kalcheva, "Diagnosing Dutch Disease: Does Russia Have the Symptoms?" IMF Working Paper no. 07/102, 2007.

8. I. Korhonen and T. Juurikkala, "Equilibrium Exchange Rates in Oil-Dependent Countries," BOFIT Discussion Papers no. 8, 2007.

9. E. Gurvich, V. Sokolov, and A. Uliukaev, "Otsenka vklada effekta Balassy-Samuel′sona v dinamiku real′nogo kursa rublia," *Voprosy ekonomiki*, 2008, no. 7.

10. B.N. Kuzyk, A.I. Ageev, and V.A. Volkonskii, *Prirodnaia renta v ekonomike Rossii* (Moscow: INES, 2003).

11. C. Gaddy and B. Ickes, "Resource Rents and the Russian Economy," *Eurasian Geography and Economics*, 2005, vol. 46, no. 8.

12. The restraints associated with the use of this mechanism are considered in E. Gurvich, "Formirovanie i ispol′zovanie Stabilizatsionnogo fonda," *Voprosy ekonomiki*, 2006, no. 4.

13. F. Kumah and J. Matovu, "Commodity Price Shocks and the Odds of Fiscal Performance: A Structural VAR Approach," IMF Working Paper no. 05/171, 2005; Husain, Tazhibayeva, and Ter-Martirosyan, "Fiscal Policy and Economic Cycles in Oil-Exporting Countries."

14. J. Sachs and A. Warner, "The Curse of Natural Resources," *European Economic Review*, 2001, vol. 45, pp. 827–38.

15. Kumah and Matovu, "Commodity Price Shocks and the Odds of Fiscal Performance"; Husain, Tazhibayeva, and Ter-Martirosyan, "Fiscal Policy and Economic Cycles in Oil-Exporting Countries."

[Appendix follows]

Appendix

Summary Results of Model Estimation

			Coefficient by country									
			Iran		Venezuela		Norway		Russia		Kazakhstan	
Variables	Models	Factors	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value	Coeff.	*p*-value
		R^2	0.50		0.24		0.89		0.83		0.04	
GDP		Price of oil	1.11**	2.6E-06	421.80**	0.006	1.52**	8.7E-08	72.20**	0.0003	14.20	0.600
		R^2	0.45		0.56		0.98		0.73		0.75	
		Oil-dependent GDP	0.47**	0.0006	0.60**	0.0002	83.6**	1.3E-10	0.52**	0.009	0.13	0.910
		Oil-independent GDP	0.33*	0.014	0.25**	0.002	70.6**	0.0002	0.48*	0.02	1.89*	0.030
Revenues		Revenue lag	0.07	0.63	0.05	0.75	0.033	0.58	0.017	0.95	1.58*	0.040
		R^2	0.90		0.56		0.25		0.87		0.92	
		Price of oil	0.98**	3.3E-10	108.00	0.065	3.00	0.69	38.10*	0.03	6.34	0.440
		Oil-independent GDP	0.62**	8.3E-10	0.23**	0.002	12.90	0.38	0.52**	0.002	0.25	0.710
		Remaining revenues	0.75**	4.1E-11	0.64**	0.001	0.10	0.80	0.74*	0.03	0.73	0.098
	1	Spending lag	0.19**	0.0066	0.085	0.62	0.62	0.10	–0.14	0.60	0.01*	0.030
		R^2	0.90		0.56		0.25		0.87		0.92	
		Oil-dependent GDP	7.06**	3.3E-10	1.19**	0.0005	0.018	0.69	2.36*	0.03	0.32	0.990
		Oil-independent regular revenues	1.77**	8.3E-10	1.02	0.065	2.07	0.071	1.05**	0.002	0.63	0.440
		Other revenues	0.75**	4.1E-11	0.64**	0.001	0.102	0.80	0.74*	0.03	0.73	0.730
Spending	2	Spending lag	0.19**	0.0066	0.085	0.62	0.62	0.10	–0.14	0.61	0.01	0.098

*Significant at the 1 percent level; **significant at the 5 percent level.