

Ahmadov, Vugar; Sarkarli, Ulvi; Rahmanov, Ramiz

Working Paper

Structural budget balances in oil-rich countries: The cases of Azerbaijan, Kazakhstan, and Russia

Graduate Institute of International and Development Studies Working Paper, No. HEIDWP01-2018

Provided in Cooperation with:

International Economics Section, The Graduate Institute of International and Development Studies

Suggested Citation: Ahmadov, Vugar; Sarkarli, Ulvi; Rahmanov, Ramiz (2018) : Structural budget balances in oil-rich countries: The cases of Azerbaijan, Kazakhstan, and Russia, Graduate Institute of International and Development Studies Working Paper, No. HEIDWP01-2018, Graduate Institute of International and Development Studies, Geneva

This Version is available at:

<https://hdl.handle.net/10419/201684>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



—
INSTITUT DE HAUTES
ÉTUDES INTERNATIONALES
ET DU DÉVELOPPEMENT
GRADUATE INSTITUTE
OF INTERNATIONAL AND
DEVELOPMENT STUDIES

Graduate Institute of International and Development Studies
International Economics Department
Working Paper Series

Working Paper No. HEIDWP01-2018

**Structural Budget Balances in Oil-Rich Countries: The Cases
of Azerbaijan, Kazakhstan, and Russia**

Vugar Ahmadov
Central Bank of the Republic of Azerbaijan

Ulvi Sarkarli
Central Bank of the Republic of Azerbaijan

Ramiz Rahmanov
Central Bank of the Republic of Azerbaijan

Chemin Eugène-Rigot 2
P.O. Box 136
CH - 1211 Geneva 21
Switzerland

Structural Budget Balances in Oil-Rich Countries: The Cases of Azerbaijan, Kazakhstan, and Russia¹

Vugar Ahmadov², Ulvi Sarkarli³, and Ramiz Rahmanov⁴

Abstract

This study aims to analyse the discretionary fiscal policy of Azerbaijan, Kazakhstan, and Russia for the period 2003-2015 using the structural budget balance (SBB). The SBB considers the permanent component of oil revenue and therefore clearly defines the discretionary fiscal position and the aggregate demand effect of fiscal policy. The SBBs in Azerbaijan and Russia experience a deficit for most of the analysed period. A moderate SBB surplus is observed in Kazakhstan. The estimated SBBs also demonstrate that fiscal policies tend to be mainly pro-cyclical in Kazakhstan and Russia. Azerbaijan conducted a counter-cyclical fiscal policy for half of the investigated period. Moreover, governments placed more importance on economic stabilization in 2009 due to the global financial crisis.

Keywords: fiscal policy, structural budget balance, oil-rich countries, Azerbaijan, Kazakhstan, Russia.

JEL classification: E62, H60.

Introduction

The three-fold decline in crude oil prices in mid-2014 and the persistence of low oil prices have led to a deterioration of the budget deficits in Azerbaijan, Kazakhstan, and Russia due to the high transmission of oil prices to fiscal revenues. To reduce the dependence on oil revenues, policymakers have considered designing a counter-cyclical fiscal policy and establishing a medium-term budget framework.

A counter-cyclical fiscal policy cannot be effectively implemented if there exists no effective analytical toolkit for sound fiscal policy analysis. The literature proposes several indicators that are suitable for assessing fiscal policies in oil-rich economies, such as the non-oil

¹ The authors are greatly indebted to Prof. Ugo Panizza for his guidance and useful feedback throughout the course of the project and are also grateful to the BCC programme, the SECO and the Graduate Institute for their support. The authors would like to thank Salman Huseynov, Fuad Mammadov and other colleagues at the CRD for their fruitful comments and suggestions. The views expressed in this working paper are those of the authors and do not necessarily represent the official views of the Central Bank of the Republic of Azerbaijan.

² Vugar Ahmadov - Center for Research and Development, Central Bank of the Republic of Azerbaijan, email: Vugar_Ahmadov@cbar.az

³ Ulvi Sarkarli (corresponding author) - Center for Research and Development, Central Bank of the Republic of Azerbaijan, email: Ulvi_Sarkarli@cbar.az

⁴ Ramiz Rahmanov - Center for Research and Development, Central Bank of the Republic of Azerbaijan, email: Ramiz_Rahmanov@cbar.az

primary balance, the structural budget balance (SBB), and the modified SBB (Zakharova and Medas, 2009; Hagemann, 1999; Bornhorst *et al.*, 2011). Among them, the most comprehensive is the modified SBB, which shows the true fiscal position of a government, controlling for the budgetary effects of the business cycle and the movements in commodity prices (Bornhorst *et al.*, 2011). In other words, the SBB demonstrates what the financial position of a general government would be if the utilization of the production factors were at the midpoint of the business cycle.

Most studies examining fiscal policy in Azerbaijan, Kazakhstan, and Russia employ the non-oil primary balance in their analysis (Zakharova and Medas, 2009; Villafuerte and Lopez Murphy, 2010; Erbil, 2011). These studies show that the fiscal policies in these countries are mainly pro-cyclical. To the best of our knowledge, the only study employing the SBB approach to assess fiscal policy in oil-rich Commonwealth of Independent States (CIS) countries is that by Platonov (2012). Focusing his research on Russia in 2003-2010, the author concludes that in this period, the fiscal policy in this country was pro-cyclical.

This paper extends the study by Platonov (2012) in several ways. First, in our analysis, we use the modified SBB, which, along with standard cyclical adjustment, corrects for deviations in oil prices from their long-term trend. Second, this paper uses the estimated but not the assumed revenue items-to-output elasticities. In particular, we estimate how the business cycle and oil prices affect different tax categories of government revenues. Third, in addition to Platonov (2012), we conduct our analysis covering three oil-rich countries instead of one. The multi-country nature of this study provides evidence on how country heterogeneities – the extent of oil dependency, the level of oil reserves, and the degree of maturity in oil production – affect fiscal policy patterns. Fourth, this study incorporates recent statistics that contain information on more than one oil price cycle. Given these extensions to the existing framework by Platonov (2012), the present study delivers more accurate estimates of the dependence of fiscal policy performance on oil price volatility.

The results of the empirical analysis conducted covering 2003-2015 show that the pro-cyclicality of fiscal policy is still a problem in Azerbaijan, Kazakhstan, and Russia and that it must be addressed to safeguard medium-term fiscal sustainability and to smooth economic growth. The estimated revenue categories-to-output gap elasticities in Azerbaijan and Kazakhstan are lower than those in Russia. These results can be due to either a relatively better tax administration or tax system in Russia, if not both.

This article is organized as follows. The next two sections present the theoretical background and a review of the relevant literature. The fourth and fifth sections describe the methodology of the research and the data employed. The results are subsequently reported and comparatively discussed, and the final section concludes this article.

Theoretical background

In practice, fiscal policy efficiency largely depends on the adequacy of the measures of budget balance that the authorities consider when they make decisions regarding budget

expenditures. The use of inappropriate measures can have a high cost for society, as an ineffective fiscal policy can adversely affect the economic performance of the country. The traditional measures used to assess the fiscal stance are the overall and primary budget balances.⁵ If the fiscal authorities use these indicators to implement fiscal policy, then to keep the budget balanced, they need to keep their budget expenditures in line with their revenues, which usually co-move with the output. This strategy will lead to the pro-cyclicality of fiscal policy and can further exacerbate the economic situation during recessions through tightening the aggregate demand. This outcome does not accord with either Keynesian or neoclassical theories stating that fiscal policies must, in fact, be counter-cyclical. Thus, in times of recession, the government must reduce tax rates and increase expenditures (government debt increases), whereas in times of boom, it must raise taxes and reduce spending (government debt decreases). In other words, there must be a positive relationship between changes in output and the budget balance. This idea led to the development of a new measure of budget balance – the cyclically adjusted balance, which represents an indicator of the fiscal stance net of business cycle effects (Hagemann, 1999). To target this measure, the fiscal authorities must adjust their spending not in accordance with the changes in actual output but in accordance with the changes in potential output.

For oil-producing countries, the use of the overall and primary balances in assessing the fiscal stance is inadequate, as it does not produce true policy conclusions. For example, a temporary increase in oil prices can be associated with large budget surpluses in oil-producing countries, which can encourage the authorities to increase expenditures. Broad fiscal expansion in times of economic boom when the output is already above its potential level leads to negative efficiency gains. However, when, in the medium term, oil prices move back to their trend, the response of the authorities will be a reduction in public spending, which will narrow the aggregate demand and thus have an adverse effect on economic performance. For this reason, oil-producing countries have been advised to use non-oil fiscal indicators such as the non-oil overall balance and the non-oil primary balance (Zakharova and Medas, 2009). The non-oil overall balance is defined as the difference between non-oil revenues and non-oil expenditures; the non-oil primary balance is also defined as the difference between non-oil revenues and non-oil expenditures excluding interest payments.

Non-oil fiscal indicators reduce the influence of oil revenues on fiscal policy, but they are still affected by business cycle effects originating in the non-oil sector. Therefore, Villafuerte and Lopez-Murphy (2010) suggest using the cyclically adjusted non-oil balance instead of the conventional non-oil balance as a better measure of the fiscal stance. However, disregarding the oil sector can be inappropriate because the oil sector will remain an important part of oil-rich economies, at least in the medium term. Considering this argument, a comprehensive assessment of fiscal policy in these countries requires a measure that accounts for both temporary fluctuations in oil prices and the business cycle effects of the non-oil sector. The structurally adjusted fiscal balance, which corrects the conventional budget balance not only for cyclical

⁵ In contrast to the primary fiscal balance, the overall fiscal balance also accounts for interest payments on government liabilities.

effects but also for factors beyond the business cycle (Bornhorst *et al.*, 2011), can be such a measure of the fiscal stance. In practice, we divide fiscal revenues and expenditures into oil and non-oil parts and adjust them for temporary oil price fluctuations and cyclical effects, respectively to compute a structurally adjusted budget balance for oil-rich countries.

Literature review

Conditionally, the literature examining fiscal policy in oil-rich countries considering resource dependence can be divided into three generations. First-generation studies suggest using the non-oil primary balance instead of the overall primary balance to examine the cyclicity of the fiscal behaviour of oil-rich countries (Zakharova and Medas, 2009; Villafuerte and Lopez-Murphy, 2010; Erbil, 2011). The non-oil primary balance has been defined as the overall fiscal balance, excluding oil revenues and expenditures and net interest payments. This measure of the budget balance makes it possible to reveal difficulties in balancing budget revenues and expenditures, as high oil prices can conceal the looseness of the fiscal policy. Using the concept of the non-oil primary balance, Zakharova and Medas (2009) assess the fiscal stance in a group of oil-producing countries including Algeria, Nigeria, Qatar, Russia, and Saudi Arabia in 2001-2006. They find that although the primary balance in this period was positive, the non-oil primary balance was negative and large. Additionally, for a fiscal analysis of oil-producing countries, the authors suggest using non-oil revenues and non-oil expenditures. With a sample that also contains Azerbaijan, Kazakhstan, and Russia, Villafuerte and Lopez Murphy (2010) analyse the fiscal responses of oil-producing countries to fluctuations in oil prices using the non-oil primary balance, among a few other indicators. The authors conclude that fiscal policy was mainly pro-cyclical. In particular, they find that in the boom periods of 2004-2008, the governments implemented an expansionary fiscal policy, but in 2009, due to a drop in oil prices that began in the second half of 2008, the governments turned to a tight fiscal policy. The authors also establish that the extent of the pro-cyclicity of fiscal policy is negatively associated with the income level. Erbil (2011) uses a set of indicators including the non-oil primary balance to analyse the fiscal behaviour in 28 oil-producing countries, including Azerbaijan, Kazakhstan, and Russia, between 1990 and 2009. The empirical analysis, conducted using the differenced GMM estimator, shows that the non-oil primary balance is pro-cyclical. In other words, an increase in output leads to an excessive increase in spending, which ultimately leads to a deterioration of the balance. Similar to Villafuerte and Lopez Murphy (2010), Erbil (2011) also concludes that the fiscal policy in low-income oil-rich countries is more likely to be pro-cyclical than the fiscal policy in high-income oil-rich countries.

Fluctuations in the budget balance reflect changes in budget revenues and expenditures, which are subject to permanent and temporary shocks. For example, the budget receipts in oil-rich countries can temporarily decline (increase) in response to a temporarily negative (positive) change in the oil supply. However, structural changes induced by demand or supply factors, e.g., a technological change, will have a permanent effect on budget revenues. As volatility in public spending adversely affects the economic performance of countries, it is necessary to ensure that

budget spending changes only if there is a permanent change in revenues. The standard non-oil primary balance indicator makes it possible to assess the vulnerability of fiscal policy to an oil factor, but it does not distinguish between permanent and temporary changes in budgets. To account for temporary influences on the budget balance, Hagemann (1999) presents the methodology for computing so-called SBBs, which the IMF computes for developed countries. The computation of the SBB assumes that the cyclical part of the budget balance is subtracted from the overall budget balance. The cyclical part attributed to temporary budget income and spending shocks has been computed using information on the output gap and the cyclicalities of budget expenditures and revenues.

The introduction of the SBB concept led to the emergence of the second-generation literature in this area. For example, Pastor and Villagomez (2007) use this approach to compute the SBB for Mexico over the period 1980-2003. Their analysis of the dynamics of the SBB shows that the fiscal policy in Mexico during this period was pro-cyclical. Furthermore, the retrospective analysis of the consequences of this fiscal policy shows that it was not only inefficient but also counterproductive. Platonov (2012) estimates the SBB for Russia from 2003 to 2010 using the same approach. The author finds that the fiscal policy in Russia was pro-cyclical and concludes that the effects of the discretionary fiscal policy on economic performance were negative.

The SBB methodology described by Hagemann (1999) adjusts the budget balance for temporary fluctuations associated with changes in the output gap. However, adjusting for cyclical effects alone is not sufficient to obtain an adequate assessment of the fiscal policy; there are other factors, such as commodity price or asset price fluctuations, that cannot be well captured by movements in the output gap. For this reason, Bornhorst *et al.* (2011) suggest going beyond a simple cyclical adjustment to obtain a more satisfactory characterization of the fiscal stance. In particular, for resource-rich countries, the authors propose modifying the standard cyclical adjustment through correction for large deviations of commodity prices from their long-run levels. This improvement in the methodology for SBB calculation led to the establishment of the third-generation studies. For example, Ardanaz *et al.* (2015) use the refined approach to estimate the SBBs to assess the fiscal policy in 20 Latin American and Caribbean countries during the period 1990-2012. Their sample includes oil-rich countries such as Ecuador, Mexico, Trinidad and Tobago, and Venezuela, which are significantly dependent on oil revenues on the fiscal side. Their analysis supports the general view that Latin American countries pursue a pro-cyclical fiscal policy. Additionally, the authors find that countries with relatively low degrees of pro-cyclicality tend to have better institutions. Although the SBB analysis was mainly conducted for resource-rich countries in Latin America, there was an attempt to estimate SBBs adjusted for oil price fluctuations in Saudi Arabia, the largest oil producer and exporter. Thus, the SBB estimates by the IMF show that from 2006 to 2012, the SBB was in surplus while, in 2013, it was zero (Galal Eid, 2015).

The present paper contributes to the existing literature in several ways. First, this study is the first to compute the structural adjusted balance for Azerbaijan and Kazakhstan. Second,

calculating the structural adjusted balance for Russia, it extends the paper by Platonov (2012), who estimated the cyclical adjusted balance only, without specifically considering the effect of oil price fluctuations. Additionally, in this paper, we use a two-step procedure to produce estimates of the tax elasticities for main categories of taxes, which has not been done before for these countries. These tax elasticity estimates can be used in other studies and analyses. In fact, Platonov (2012) estimated tax elasticities for Russia, but he used a one-step procedure, which is a less precise method than the two-step procedure.

Methodology

The research methodology for the SSB calculation consists of three steps. The first step involves estimating the potential output and the corresponding output gap. The second step is estimating the tax elasticities to the output gap. The third step consists of adjusting beyond the business cycle and the effects of oil prices on fiscal revenues and obtaining the structural balance.

The first step: Estimating the potential output and the corresponding output gap

There are a few primary methodological techniques for the potential output estimation. The most complex method, which is broadly employed by the OECD, builds on the production function (Mourre *et al.*, 2014; Mc Morrow *et al.*, 2015). We are unable to choose the production function method because of a lack of data on capacity utilization, which are used to calculate total factor productivity, and the low quality of the labour and capital stock datasets.

The simplest methodological approach to calculating the potential output is based on statistical methods. We apply the univariate Hodrick-Prescott (HP) filter (Hodrick & Prescott, 1997) and the univariate Kalman filter (Clark, 1987).

Univariate HP filter: The HP filter is an extensively applied method for decomposing a time series into its trend and cyclical parts:

$$Y_t = Y_t^p + Y_t^c \quad (1)$$

where Y_t is the seasonally adjusted real GDP, Y_t^p is the potential output and Y_t^c is the cycle (the output gap at time t).

The trend component (potential output) is taken out from the time series by minimizing the function:

$$\min_{y_t^p} \sum_{t=1}^T (y_t - y_t^p)^2 + \lambda \sum_{t=2}^{T-1} [(y_{t+1}^p - y_t^p) - (y_t^p - y_{t-1}^p)]^2 \quad (2)$$

where y_t is an observation of the time series at time t , y_t^p is the trend component at time t , and λ is the Lagrange multiplier.

The relatively simple implementation of the HP filter is one of its considerable advantages. However, the HP filter also has some shortcomings. The choice of parameter λ affects both the calculated potential output and the output gap. Although the selection of λ can substantially alter the output of the filter, there is no theoretical background for the justification of any specific value choice.

Considering the relatively small size of the investigated economies, we let λ be equal to 100 for the quarterly data.

The HP filter also has the end-bias problem – a severe downside at the end of the sample. The minimized function aiming to decompose the trend and cycle of the time series includes the future values, which are unknown at the end of any time series. Thus, when these values are known, the HP filter becomes symmetric. The period of the real GDP data ends in 2017Q1, which helps us relatively decrease the end-point bias.

Univariate Kalman filter: The methodology proposed by Clark (1987) is another statistical method for decomposing a time series into a trend and cyclical components.

Clark suggested a model specification that is based on equation (1). A supplementary assumption about the individual components is added to the main equation. The specification of the potential output is a random walk with a drift:

$$y_t^p = y_{t-1}^p + d_t + \varepsilon_t \quad (3)$$

where d_t is the average growth rate of the potential output and ε_t is a residual that, on average, is zero and with a variance equal to $\sigma_{y^p}^2$. Additionally, it is assumed that a variable rate of potential growth follows a random walk:

$$d_t = d_{t-1} + \eta_t, \quad \eta_t \sim N(0, \sigma_d^2) \quad (4)$$

The cyclical component is specified as the autoregressive process of the second order:

$$y_t^c = \omega_1 y_{t-1}^c + \omega_2 y_{t-2}^c + v_t \quad (5)$$

The cyclical part at time t is bound up with two of its lags. ω_i are the parameters that are estimated, and v_t is a residual, $v_t \sim N(0, \sigma_v^2)$. Subsequently, the model is converted into a state-space format and is estimated applying the Kalman filter by maximizing the likelihood function. Then, the filtered estimates are “smoothed”.

The variability of the potential output in time is considered in the model, and equation (5) indicates that, on average, the output gap (cyclical component) is zero.

The second step: Estimating the tax elasticities to the output gap

We use the two-step methodology developed by Van den Noord (2000) and refined by Girouard and André (2005) and Price *et al.* (2015) to estimate the elasticities of the revenue categories with respect to the output gap. According to this method, revenues from personal income tax (PIT), corporate income tax (CIT), social security contributions (SSC) and indirect taxes are assumed to be cyclically sensitive. The elasticity of other revenues and total expenditures is considered to be zero. The output gap elasticity of revenue categories is estimated by calculating the revenue-to-base elasticity, $\varepsilon_{R_i/base}$, and the base-to-output gap elasticity, $\varepsilon_{base/OG}$. Then, the estimated elasticities are multiplied to obtain the elasticity of the revenue item with respect to the output gap, $\varepsilon_{R_i/OG}$. This calculation can be illustrated as follows:

$$\varepsilon_{R_i/OG} = \varepsilon_{R_i/base} * \varepsilon_{base/OG} \quad (6)$$

I. a) The elasticities of tax revenues with respect to their bases are empirically estimated.

The PIT and SSC tax base is employee compensation (less SSC). The CIT tax base is gross profits. The tax base for indirect taxes is household consumption expenditures.

We employ autoregressive distributed lag (ARDL) models. The ARDL method is chosen because it can be used with a combination of I(0) and I(1) data. Additionally, it involves only a

single-equation set-up, which implies easy implementation and interpretation. Finally, different variables included in the model can be assigned different lag lengths.

The short-term tax revenue-to-base elasticities are estimated using an ARDL equation:

$$\ln R_{i,t} = \alpha_0 + \alpha_1 \ln Base_{i,t} + e_{i,t} \quad (7)$$

In equation (7), $e_{i,t}$ denotes the error term of tax category i in year t , and α_1 denotes the short-term tax revenue elasticity, which indicates how much tax revenue changes based on the unit percentage change in the tax base.

We can also directly assume that the indirect tax revenue-to-base (private consumption) elasticity is close to unity, as Belinga *et al.* (2014) and Mourre *et al.* (2014) show that over the medium run, the elasticity is not far from one for most countries.

II. The tax bases-to-output gap elasticities are also computed from time series data.

The model is specified as follows:

$$\ln(Base_t/Y_t^p) = \alpha_0 + \alpha_1 \ln(Y_t/Y_t^p) + u_t \quad (8)$$

where $Base$ denotes the tax base, Y denotes the output and Y^p the potential output, and α_1 represents the short-run elasticity.

Finally, the revenue item-to-base elasticities and the base-to-output gap elasticities estimated are inserted into equation (6) to obtain the revenue item-to-output gap elasticities.

The third step: Adjusting for the effects of oil prices on fiscal revenues and obtaining the SBB.

The methodology of this stage is devised in Bornhorst *et al.* (2011) and Ardanaz *et al.* (2015):

$$SBB = \sum R_i \left(\frac{Y^p}{Y}\right)^{\varepsilon_{R,i}} + R^{OR} \left(\frac{P^{LR}}{P}\right)^{\alpha} - G \left(\frac{Y^p}{Y}\right)^{\varepsilon_G} \quad (9)$$

where SBB is the SBB, R_i is the revenue categories, R^{OR} is the revenue from oil resources, Y^p is the potential output, Y is the actual output, P is the price of a barrel of Brent oil, P^{LR} is the long-run price of Brent oil, which is the previous ten-year moving average of eth Brent oil price, $\varepsilon_{R,i}$ and ε_G are the output gap elasticity of each revenue category and expenditure, respectively, α is the elasticity of oil revenues with respect to oil prices, and G is the total fiscal expenditure. The elasticity of oil revenues with respect to oil prices is empirically estimated as follows:

$$\ln R_t^{OR} = \alpha_0 + \alpha_1 \ln P_{t-1} + e_{i,t} \quad (10)$$

where R_t^{OR} is the revenue from oil resources and P_{t-1} is the Brent oil price of a budget preparation year.

Data

In our analysis, we use quarterly data for nominal GDP, real GDP, aggregate budget revenue and expenditure, revenue of PIT, CIT, VAT, and excise, SSC, employee compensation, gross profits, household consumption, and the Brent oil price. More information on the definitions and sources of the data can be found in the Appendix.

The nominal and real GDP data used for estimating the output gap are obtained from the state statistical committees of the respective countries. Although the SBB analysis covers the period from 2003Q1 to 2015Q4, the data that we use to estimate the output gaps begin from 1996Q1 for Russia, from 2000Q1 for Kazakhstan and from 2001Q1 for Azerbaijan, and taking quarterly intervals, they end in 2017Q1. The reason why we use longer time series than necessary is to avoid the beginning and end-point bias problems from which univariate filters, such as the HP and Kalman filters, suffer.

The state budget, together with the State Social Protection Fund (SSPF), is chosen for Azerbaijan, the state budget is taken for Kazakhstan, and the consolidated budget is also selected for Russia. The time series from official sources used to estimate the elasticities for Azerbaijan and Kazakhstan cover the period 2003Q1-2015Q4, but the dataset for Russia ranges from 2004Q1 to 2015Q4. Brent oil price data are obtained from the IMF.

Following the mainstream literature, we identify several tax categories as being cyclically sensitive: 1) PIT; 2) SSC; 3) CIT; 4) indirect taxes (VAT and excise); and 5) social tax (only exists in Kazakhstan).

The respective tax bases are taken as employee compensation (less SSC) for PIT, SSC, and social tax, gross profits for CIT and household consumption for indirect taxes. We employ the regression-based temporal disaggregation method proposed by Chow and Lin (1971) using real and seasonally adjusted GDP as an indicator to obtain quarterly data for employee compensation, gross profits, and SSC in Azerbaijan. In Kazakhstan, the State Committee of Kazakhstan on Statistics (SCKS) has been reporting quarterly data on employee compensation and gross profits only after 2007. As a result, we apply the interpolation method by Chow and Lin (1971) for the abovementioned data from 2003 to 2006. The SSC of the Russian budget are interpolated using the method by Chow and Lin (1971) for the entire period.

The corresponding literature considers only spending relating to unemployment to be cyclically sensitive. The unemployment spending in the investigated countries is negligible. Thus, the elasticity of budget expenditures is assumed to be zero, which implies that we regard budget expenditures as being cyclically insensitive.

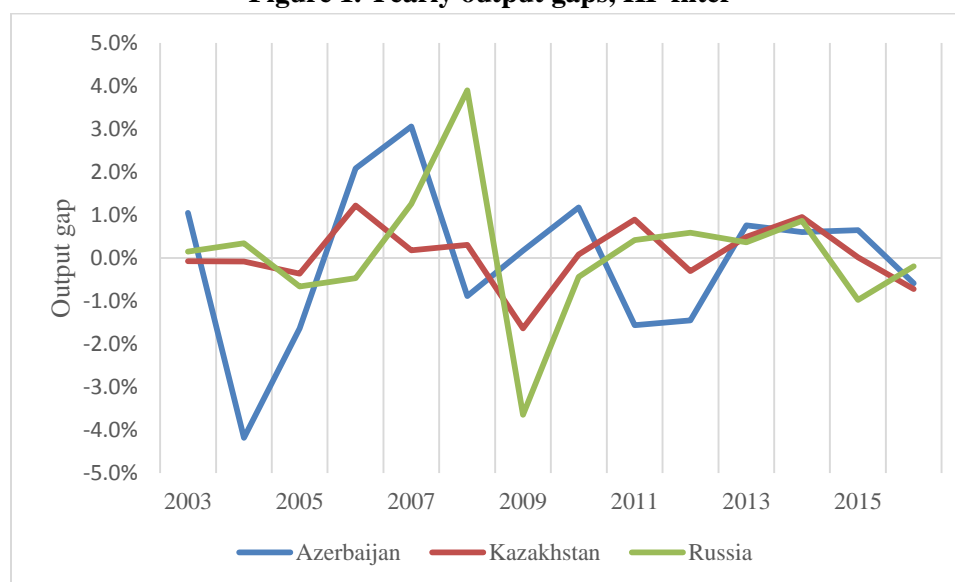
Empirical results and discussion

Output gap

The HP filter and the Kalman filter produce almost the same results for the output gap for all three countries. We arbitrarily choose the output gap and the potential output obtained from the HP filter to calculate the elasticities. Figure 1 shows that the output gap of Azerbaijan has been positive since 2006. The average yearly output gap from 2003 to 2016 is close to -0.1% for Azerbaijan and 0.1% for Kazakhstan and Russia. The output gap ranges between -4.2% and 3.1% for Azerbaijan, between -1.6% and 1.2% for Kazakhstan, and between -3.6% and 3.9% for Russia. As we can observe, Azerbaijan and Russia have a much larger range of output gaps than Kazakhstan. Figure 1 shows that the recent decline in oil prices affected the output gaps in all three oil-producing countries. The output gaps became negative in Azerbaijan and Kazakhstan in

2016, while in Russia, the gap had been negative since 2015. The financial crisis of 2008 also had an impact on the gap dynamics. In Azerbaijan, the output became negative immediately in 2008, whereas in Kazakhstan and Russia, the output gap became negative only in the following year. There were also negative gaps in other years that were not driven by global factors and that were due to internal economic processes.

Figure 1. Yearly output gaps, HP filter



Elasticity estimates

Using the disaggregated approach, we find that the output gap elasticity of total revenues is 0.26 for Kazakhstan, 0.39 for Azerbaijan, and 0.79 for Russia. The lower total revenues-to-output gap elasticity for Kazakhstan and Azerbaijan implies that the budget revenues in those countries are less cyclically sensitive than those in Russia. The evidence of a lower elasticity of revenues reflects, among other factors, the poor quality of the tax administrations and the weaker formalization of the economies.

Calculating the revenue elasticities allows us to quantify the cyclical sensitivity of the fiscal balance. As assumed, the budget expenditures do not depend on the business cycles (zero output gap elasticity); the budget balance sensitivity is obtained by multiplying the revenue elasticity with respect to the output gap by the ratio of government revenues to GDP. The results indicate that the budget balance of Azerbaijan and Kazakhstan tends to change by 0.1% of GDP for each additional percentage point change in the output gap. The output gap sensitivity of the budget balance for Russia is estimated to be 0.3%.

The elasticity estimates produced using the disaggregated methodology provide interesting insights. The elasticity results of different revenue categories across all three countries show a certain degree of heterogeneity (Table 1). In Azerbaijan and Kazakhstan, a 10% change in employee compensation will result in a short-run change of 4.5% in PIT revenue. The

tax revenues of the Russian budget, especially PIT and indirect tax revenues, are more sensitive to changes in their respective tax bases than are those in Azerbaijan and Kazakhstan. This result can signal a relatively low level of tax collection as a share of the economy in Azerbaijan and Kazakhstan compared with Russia and its peers. For policymakers, it implies the need to advance the quality of the tax administrations and to reduce the size of the shadow economy. Additionally, we find that the sensitivity of employee compensation and gross profits to the output gap is higher in Kazakhstan and Russia than in Azerbaijan.

Table 1. Tax revenues-to-tax bases and tax bases-to-output gap elasticities

	Azerbaijan	Kazakhstan	Russia	CEE, simple arithmetic average	CEE, range
Personal income tax to employee compensation	0.45** (0.1852)	0.45*** (0.1529)	1.04*** (0.1946)	1.73	1.11-2.43
Corporate income tax to gross profits	0.70*** (0.2050)	0.07 (0.1090)	0.71*** (0.2608)	1.83	1.23-2.72
Social security contributions to employee compensation	1.15*** (0.1407)	0.23*** (0.0824)	0.34 (0.3118)	1.04	0.93-1.36
Social tax to employee compensation	-	0.01 (0.0203)	-	-	-
Indirect taxes to household consumption	0.17*** (0.0554)	0.31*** (0.0820)	0.64*** (0.1718)	1.00	1-1
Employee compensation to output gap	0.77*** (0.1238)	1.50*** (0.4087)	1.24*** (0.3095)	0.81	0.62-1.04
Gross profits to output gap	0.44*** (0.1472)	5.90*** (0.2634)	2.68*** (0.7039)	1.20	0.99-1.45
Household consumption to output gap	0.70* (0.4294)	0.72* (0.4104)	0.48** (0.1900)	1.00	1-1
Oil revenue (year t) to oil price (year t-1)	0.68*** (0.2057)	0.94*** (0.1433)	1.40*** (0.1814)	-	-
Final elasticities for the structural budget balance estimation					
Personal income tax to output gap	0.35	0.68	1.29	1.62	1.15-1.93
Corporate income tax to output gap	0.31	0.00	1.90	2.19	1.58-3.76
Social security contributions to output gap	0.89	0.35	0.00	0.85	0.61-1.40
Social tax to output gap	-	0.00	-	-	-

Indirect taxes to output gap	0.12	0.22	0.31	1.00	1-1
Oil revenue (year t) to Oil price (year t-1)	0.68	0.94	1.40	-	-

Note: Standard errors are provided in parentheses. Asterisks indicate relative significance levels: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

To understand where Azerbaijan, Kazakhstan, and Russia stand in terms of the capacity to collect taxes, we compare our elasticity results with those for Central and Eastern European (CEE) countries⁶ (Mourre et al., 2014), as all these countries used to be socialist states. Table 1 shows that the estimated tax revenue elasticities with respect to the tax base and overall final elasticities for Azerbaijan and Kazakhstan stood even lower than the minimum elasticities for CEE countries. This result most likely reflects the high unofficial tax burden, tax evasion, corruption, and poor institutional quality of the tax systems. The elasticity results of Russia are higher than those for Azerbaijan and Kazakhstan and are nearly similar to those of CEE economies. Thus, one can suggest that Russia has a relatively better tax system and tax administration.

The elasticities of oil revenue⁷ to oil price are positive and high for all three countries. A 1% change in the Brent oil price will result in a change of 0.7% and 0.9% in transfers from the sovereign wealth funds (SWFs) to the state budgets in Azerbaijan and Kazakhstan, respectively, and a change of 1.4% in the oil revenue in Russia. In our opinion, the reason behind the higher elasticity with respect to the oil price in Russia is a high elasticity of oil and gas production and the progressive export duty scheme.

One point worth noting is that the impact of the oil price on the government revenues of Azerbaijan reflects only the effects of wealth fund transfers. Due to the lack of data, we were unable to include CIT revenues from the oil sector in the oil price elasticity calculation. Thus, the elasticity of the oil revenue to the oil price is most likely higher than the estimated elasticity.

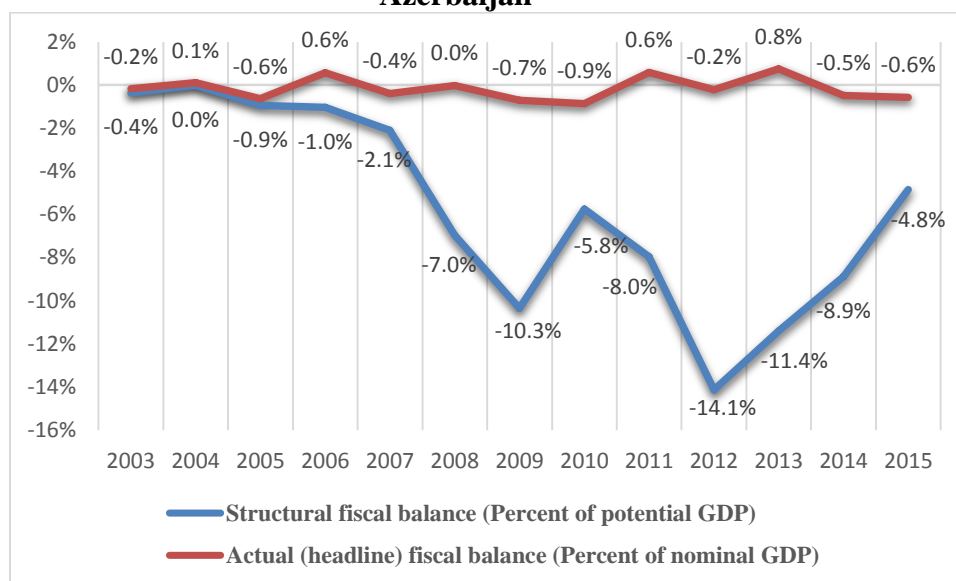
Structural budget balance results

This subsection discusses SBB estimates. Figure 2 presents the SBB estimates for Azerbaijan, comparing them with the actual (headline) budget balance values.

⁶ Estonia, Latvia, Lithuania, the Czech Republic, Slovakia, Hungary, Poland, Romania, Bulgaria, Slovenia, and Croatia

⁷ By oil revenue, we mean transfers from SWFs to the state budgets for Azerbaijan and Kazakhstan and the complete oil and gas revenues of the budget for the Russian Federation. The budget transfers for Kazakhstan include both guaranteed and targeted transfers.

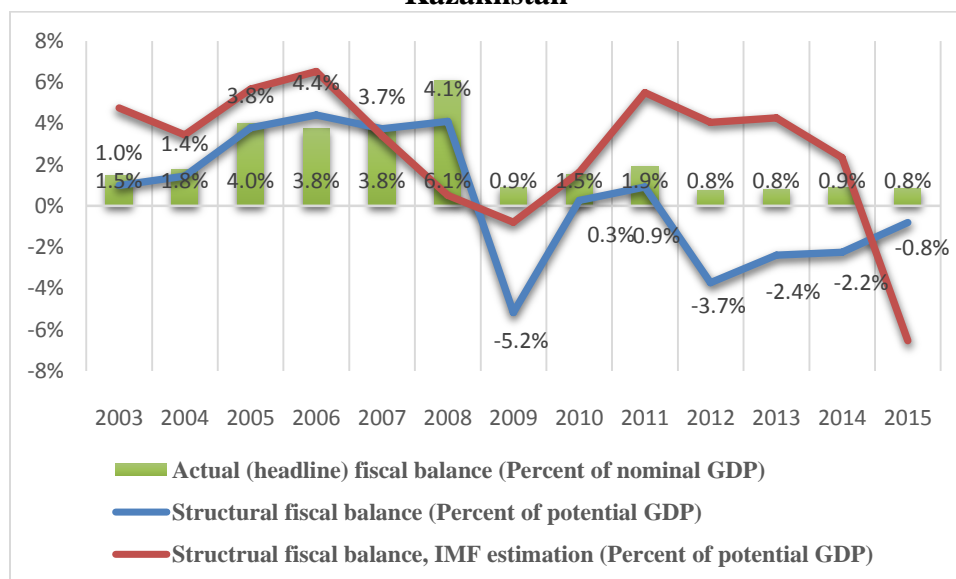
Figure 2. Comparison of the structural and actual budget balances of Azerbaijan



Note: The actual (headline) budget balance is the difference between revenues and expenditures divided by nominal GDP.

Our final results show that from 2003 to 2015, the average structural balance of the state budget of Azerbaijan was -5.7%, which is much smaller than the unadjusted budget balance average of -0.2%. This result means that the average annual contribution of cyclical and commodity fiscal revenues to the budget balance have been 5.5% since 2003. The relatively large difference in the average of the structural and headline budget balances hides periods of considerable decoupling between these series during the oil price boom after 2006 (Figure 2).

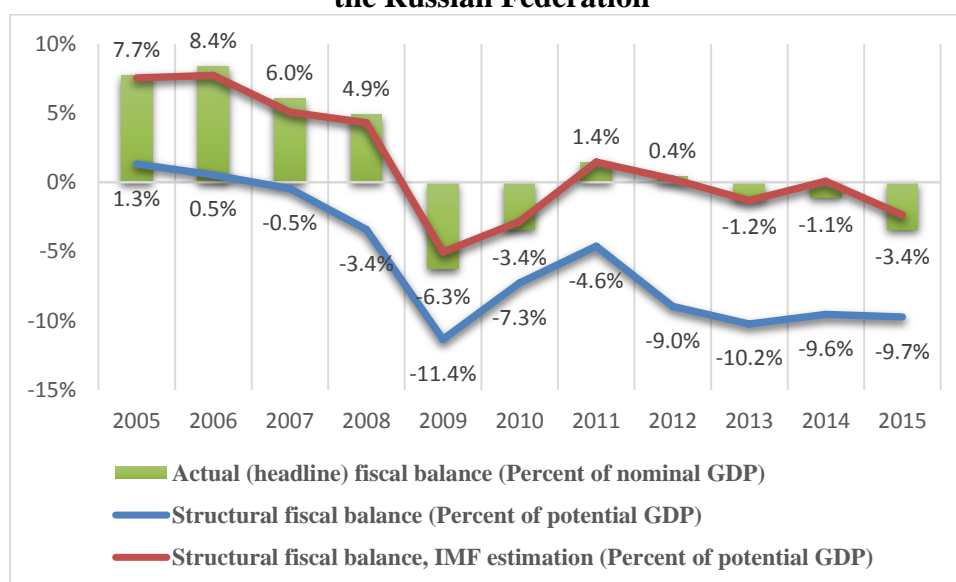
Figure 3. Comparison of the structural and actual budget balances of Kazakhstan



Note: The actual (headline) fiscal balance is the difference between revenues and expenditures divided by nominal GDP. The IMF estimation of the structural budget balance is obtained from World Economic Outlook database.

In 2009, the effects of the global financial crisis and lower oil prices became evident in all three countries (Figures 3-5). In Azerbaijan and Kazakhstan, budget revenues declined more than the decrease in expenditures, which led to a record deficit since 2003. For Russia, the structural deficit further accelerated after the collapse of Lehman Brothers, as the government decided to use fiscal policy to reverse a steeper economic slowdown. In general, the gap between the structural and actual budget balances has increased since 2011 in Kazakhstan and Russia. However, in contrast to Azerbaijan and Russia, the SBB in Kazakhstan experienced a moderate level of surplus for most of the period, except the years with lower oil prices, 2009 and 2015.

Figure 4. Comparison of the structural and actual budget balances of the Russian Federation



Note: The actual (headline) budget balance is the difference between revenues and expenditures divided by nominal GDP. The IMF estimation of the structural budget balance is obtained from World Economic Outlook database.

After 2005, the policy intentions of governments to raise state investments during an increase in cyclical and oil revenues led to a faster decrease in the SBB. In general, the SBB experienced a deficit after 2005 in Azerbaijan, after 2011 in Kazakhstan, and after 2007 in Russia. The estimated SBB has considerably deteriorated in all three countries during the post-Lehman period. The year 2010 was a period of staggered recovery.

Although the observed fiscal balance was relatively steady during the investigated period, the estimates of structural balance show considerable changes in the fiscal policy stance across years. The structural balance in Kazakhstan and Russia became progressively worse during the higher oil price period of 2010-2014. In Azerbaijan, the SBB deteriorated from 2010 to 2012; however, the SBB deficit decreased after 2012, gaining momentum in 2014-2015. In contrast to Azerbaijan and Kazakhstan where the SBB experienced a recovery during the recent period of oil price decline, the SBB was relatively stable in Russia. The large change in the estimated

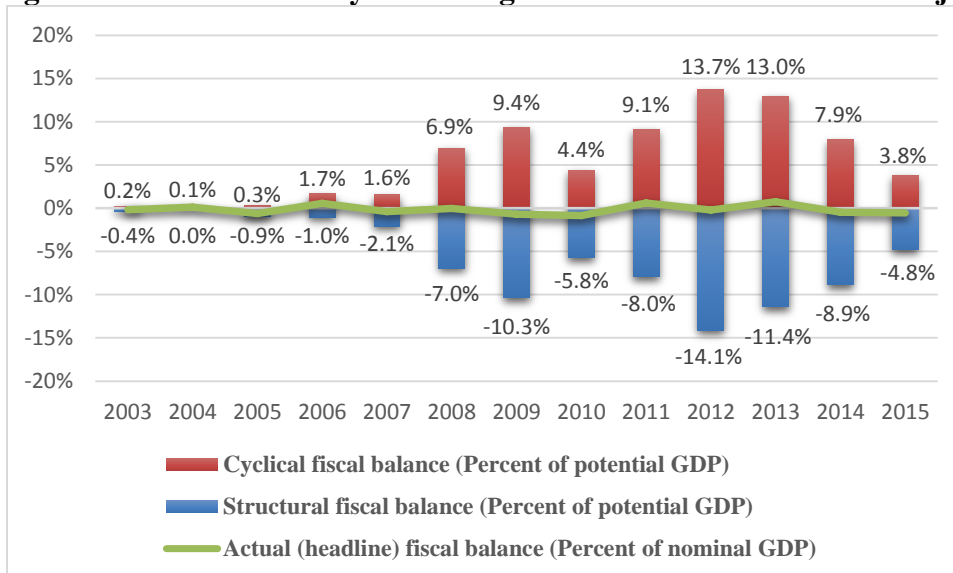
structural fiscal balances bring to light that by assessing the stance of fiscal policy using only the headline budget results can lead to the wrong conclusions.

Cyclical balance vs. structural balance

This subsection discusses the effects of cyclical drivers on the budgets of these countries by decomposing the actual budget balance. The cyclical fiscal balance presents the effects of economic cycles on budget performance, particularly the impact of tax collection, as automatic stabilizers. The cyclical balance is also interpreted as a passive response of fiscal policy.

The Azerbaijani estimations of the cyclical budget balance (CBB) display a very low level of balance in the early 2000s – averaging 0.2% of potential GDP (see Figure 5). The results show that the budgetary effect of business cycles was approximately 7.5% of potential GDP for the period of the oil boom (2006-2013). Because of the higher oil dependence, most of the CBB in the abovementioned period comes from oil revenues and favourable economic environment stemming from higher oil prices. In the year of the global financial crisis and the subsequent year, the SBB declined significantly. However, the SBB was also negative and very high in normal times, in 2012-2014 when oil prices were very high, which implies that the fiscal authorities were spending surplus oil revenues excessively in these years.

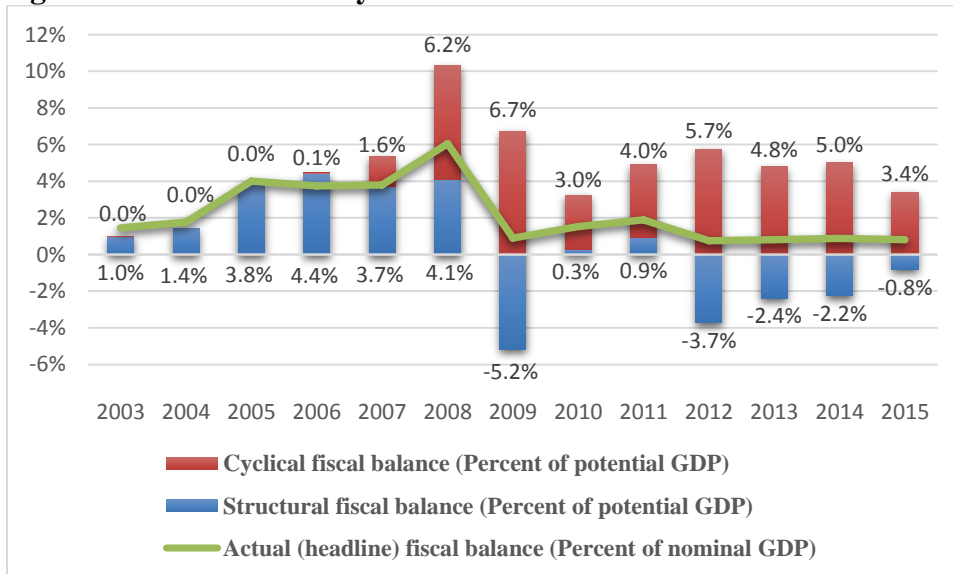
Figure 5. Structural and cyclical budget balance estimates in Azerbaijan



In Kazakhstan, the CBB was close to zero in 2003-2006 but subsequently increased (Figure 6). The SBB also shows an interesting pattern: it was positive and growing in 2003-2008 and then suddenly declined and remained negative in most years (Figure 6). The SBB dynamics implies that the Kazakh fiscal authorities were conservative in the early years of the oil boom; later, however, they started spending more from temporary increases in oil revenues. Interestingly, in 2009, when the Kazakh economy was hit by the global financial crisis, the SBB reached -5.2%, while in 2015, when the oil market collapsed, the SBB was only -0.8%. This fact

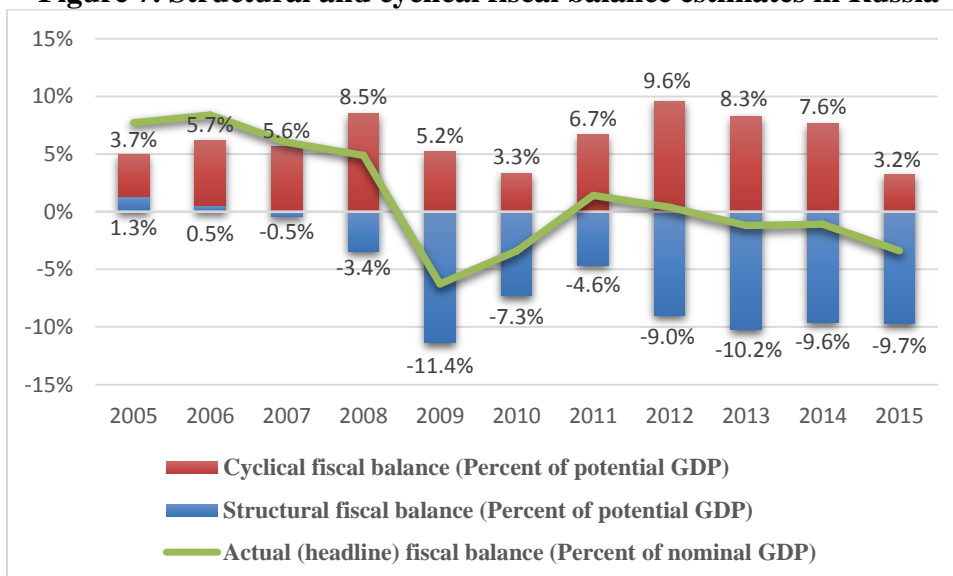
can indirectly indicate that the Kazakh authorities considered the global financial crisis to be a temporary phenomenon and the decline in oil prices to be a permanent phenomenon.

Figure 6. Structural and cyclical fiscal balance estimates in Kazakhstan



In Russia, the CBB was positive in 2005-2015, while the SBB was negative in all years except 2005-2006 (Figure 7). This pattern implies that since 2008, the Russian fiscal authorities had always been generous in spending oil revenues on various social and infrastructure projects, paying limited attention to fiscal discipline. Differently from Azerbaijan and Kazakhstan, in Russia, the fiscal authorities did not consolidate their budget in response to a sudden decline in oil revenues.

Figure 7. Structural and cyclical fiscal balance estimates in Russia



In summary, decomposing the observed budget balance into its cyclical and structural components endorses the negative relationship between the fiscal policy stance and tax collection

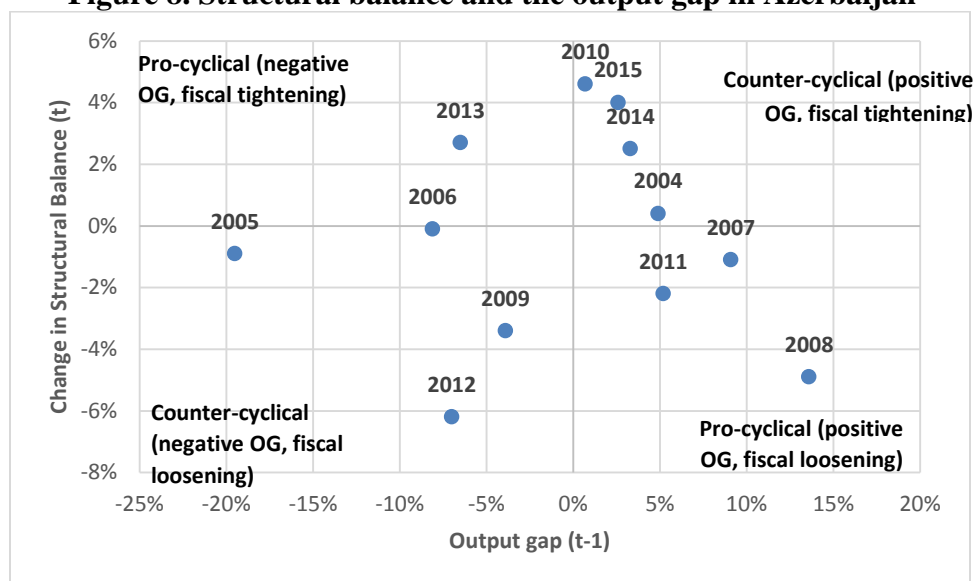
as an automatic stabilizer. In fact, the negative correlation between the SBB and CBB demonstrates the pro-cyclicality of the fiscal policy of these countries, especially after 2009. Additionally, our results provide evidence that both oil price cycles and business cycles play an equally important role as a fiscal driver.

The fiscal impulse

The SBB reflects the discretionary fiscal decisions of governments. The implication is that changes in the SBB indicate a fiscal impulse given to an economy. We plot changes in the SBB against the output gap of the previous periods to assess the cyclicity of the fiscal policies.

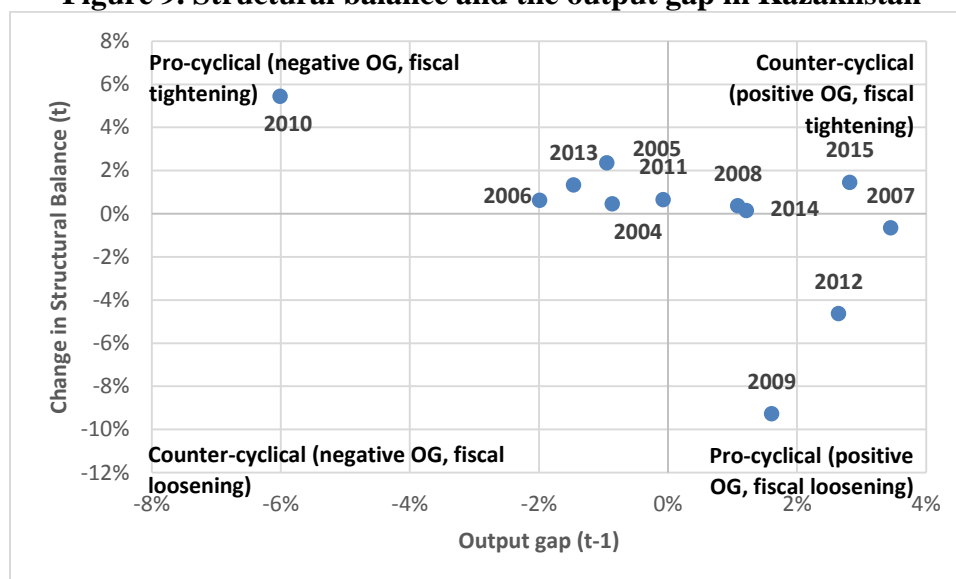
Based on our results, the fiscal policy of Azerbaijan experienced counter-cyclicality and was contractionary in the years of 2004, 2010 and 2014-2015. The estimated fiscal drag was approximately 3% of potential GDP for the abovementioned years. Our calculations show a pro-cyclical fiscal expansion in 2007-2008 and 2011, averaging 3% of potential GDP (see Figure 8). The fiscal policy was counter-cyclical and expansionary in 2009, which was the year when the global financial crisis hit the economy. Thus, the fiscal policy of Azerbaijan was counter-cyclical for half of the twelve years studied.

Figure 8. Structural balance and the output gap in Azerbaijan



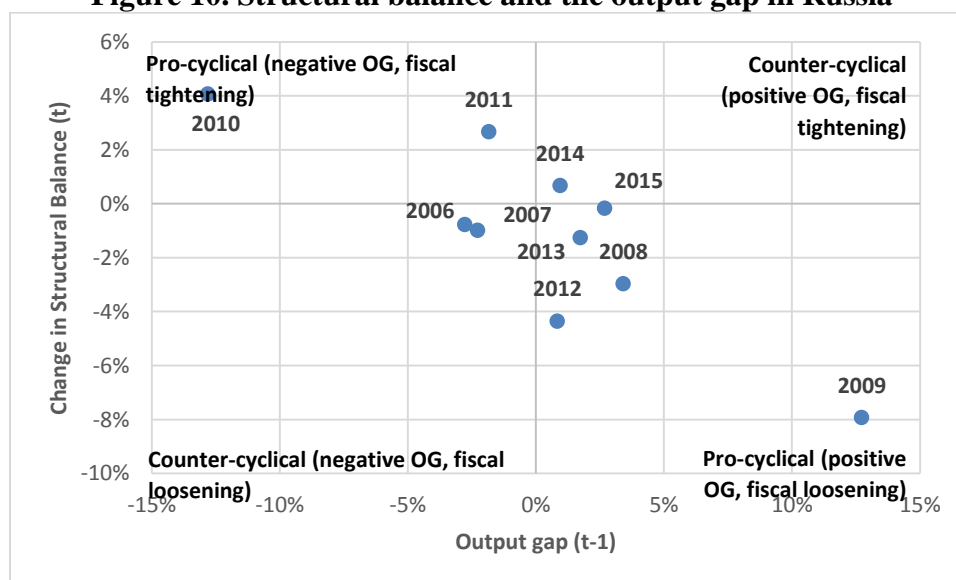
Comparing the two periods of lower oil prices for Kazakhstan (2009-2010 and 2014-2015), we observe differences in the type and in the magnitude of the fiscal policy (Figure 9). The figure shows that there was a large fiscal consolidation in 2010 after the strongest fiscal stimulus during the recession of 2009. The government of Kazakhstan also conducted a contractionary fiscal policy in 2014-2015. It is quite interesting that the fiscal policy of Kazakhstan was nearly neutral during half of the years analysed (2004, 2006, 2007, 2008, 2011, and 2014). The government conducted a counter-cyclical policy only in 2015.

Figure 9. Structural balance and the output gap in Kazakhstan



The fiscal policy of Russia was mainly expansionary for the researched period, except the years 2010, 2011, and 2014 (see Figure 10). The main similarity between the Russian and Kazakh fiscal policies is the pro-cyclicality for most of the period. Moreover, similar to the fiscal policy of Kazakhstan, the government loosened its fiscal policy by approximately 8% of potential GDP in 2009, and then, there was a fiscal consolidation equal to approximately 4% of potential GDP. Our calculations show that the fiscal impulse was especially strong in 2009, 2010, and 2012.

Figure 10. Structural balance and the output gap in Russia



Conclusions

In this paper, we calculate the SBB for Azerbaijan, Kazakhstan, and Russia to analyse discretionary fiscal policy for the period 2003-2015. For this purpose, we also estimate the elasticities of several tax revenues to tax bases and tax bases to the output gap for these three oil-rich CIS countries.

The range of SBBs is much larger in all three countries than in the non-oil CEE countries. This range poses a significant fiscal risk and undermines fiscal sustainability. Thus, undertaking carefully defined fiscal consolidation measures in the medium term is crucial. The estimations show that the fiscal policy is still pro-cyclical in Azerbaijan, Kazakhstan, and Russia. However, the results imply that there are still areas for continued development in conducting fiscal policy, stabilizing these economies over the course of business cycles. The current budget framework should include incentives for a genuinely counter-cyclical fiscal action.

The estimated elasticities show that the revenue categories-to-output gap elasticities are lower in the analysed countries than in CEE countries. Improving the institutional quality of the tax administrations, reducing tax fraud and tax evasion, broadening the tax bases, especially the non-oil tax bases, increasing transparency, and decreasing the size of the informal economy will contribute to fiscal consolidation on the revenue side and increase the elasticities of tax revenues to their respective tax bases. Furthermore, considering the higher elasticities of oil transfers with respect to the oil price in Azerbaijan and Kazakhstan, one can suggest that well-defined deposit and withdrawal rules can increase the effectiveness of the SWF and help in stabilizing the budget and smoothing public expenditures. For this purpose, we need strong independent oversight bodies, such as fiscal councils, to prevent these fiscal rules from being circumvented.

The main limitation of the research is that we assume that the state budget expenditure of the investigated countries is cyclically insensitive. Due to the lack of quarterly current and capital expenditure data, we could not empirically assess the sensitivity of these expenditures to the output gap in a robust manner. However, to have some idea, we did some back-of-the-envelope calculations using annual data. The results show that the current expenditure is a-cyclical while the capital expenditure is pro-cyclical in both Azerbaijan and Kazakhstan. We could not replicate the same exercises for Russia due to a lack of even annual data. Hence, once the data availability improves, there will be a need to assess the elasticities of different expenditure categories to increase the precision of the estimated SBBs. Moreover, neither the state statistical committee nor the Ministry of Finance of Azerbaijan provides data on corporate tax revenue decomposing into oil and non-oil sectors. Thus, we could not adjust the CIT revenues of the oil sector to the changes in oil price for Azerbaijan. Therefore, as the authorities start reporting disaggregated CIT data, further studies on Azerbaijan should adjust the CIT of the oil sector to fluctuation in oil prices.

Reference

Ardanaz, M., N. Caballero, A. Gonzales, A. Corbacho (2015), “Structural Fiscal Balances in Latin America and the Caribbean: New Dataset and Estimations”, IDB Publications (Working Papers), No. 579.

Belinga, V., D. Benedek, R. de Mooij and J. Norregaard (2014), "Tax buoyancy in OECD countries", IMF Working Paper, No. 14/110.

Bornhorst, Fabian; Dobrescu, Gabriela; Fedelino, Annalisa; Gottschalk, Jan; Nakata, Taisuke; April 2011 –“When and How to Adjust Beyond the Business Cycle? A Guide to Structural Fiscal Balances”, IMF Technical Notes and Manuals, (Washington: International Monetary Fund).

Chebi, C. and Ozlale, U. (2011), “Structural Budget Balance and Fiscal Stance in Turkey”, Working Paper No: 11/11, Central Bank of the Republic of Turkey.

Chow, G.C., and A. Lin (1971), “Best Linear Unbiased Interpolation, Distribution, and Extrapolation of Times Series by Related Series,” *The Review of Economic and Statistics*, Vol. 53(4), pp. 372–375.

Clark, Peter K. 1987. “The Cyclical Component of U.S. Economic Activity.” *The Quarterly Journal of Economics* 102 (4): 797–814 (November).

Erbil, N. 2011. Is Fiscal Policy Procyclical in Developing Oil-Producing Countries?. IMF Working Paper 171, PP. 1-32.

Fedelino, Annalisa, Anna Ivanova and Mark Horton (2009), “Computing Cyclically-Adjusted Balances and Automatic Stabilizers,” IMF Technical Notes and Manuals No 09/05, (Washington, D.C: International Monetary Fund).

Galal Eid, Ashraf. 2015. Budgetary Institutions, Fiscal Policy, and Economic Growth: The Case of Saudi Arabia. Working Paper 967, The Economic Research Forum (ERF).

Girouard, N. and C. Andre (2005), *Measuring Cyclically-Adjusted Budget Balances for the OECD Countries*, OECD Economics Department Working Papers 434.

Hagemann R. *The Structural Budget Balance: The IMF’s Methodology: Working Papers of the International Monetary Fund*. WP/99/95. 1999.

Hodrick, R. and Prescott, E. (1981), “Post-war U.S. Business Cycles: An Empirical Investigation,” Working Paper, Carnegie-Mellon, University. Reprinted in *Journal of Money, Credit and Banking*, Vol. 29, No. 1, February 1997.

Lang, L. and Mareš, J. (2015), “Cyclical adjustment of the government balance”, Information paper 1/2015, Ministry of Finance of Czech Republic.

Mc Morrow, K., W. Roeger, V. Vandermeulen, K. Havik (2015), An Assessment of the Relative Quality of the Output Gap Estimates Produced by the EU's Production Function Methodology, European Economy, *Economic Papers* 020.

Mourre, G., C. Astarita, S. Princen (2014), Adjusting the budget balance for the business cycle: the EU methodology, European Economy, *Economic Papers* 536.

Oreng, M., (2012), "Brazil's Structural Fiscal Balance", Working Paper №6, Itaú Unibanco.

Pastor, J. and Villagómez, A. 2007. The structural budget balance: A preliminary estimation for Mexico. *Applied Economics*, 39: 1599–607.

Platonov, Konstantin E. Structural Budget Balance and Fiscal Policy Indicators in Russia: Working paper WP12/2012/03 / National Research University "Higher School of Economics". – Moscow: Publishing House of the Higher School of Economics, 2012.

Price, R.W.R., Dang, T., Botev J., 2015. "Adjusting fiscal balances for the business cycle: New tax and expenditure elasticity estimates for OECD countries," OECD Economics Department Working Papers 1275, OECD Publishing.

Van den Noord, P. (2000), The Size and Role of Automatic Fiscal Stabilizers in the 1990s and Beyond, OECD Economics Department Working Papers 230.

Villafuerte, M. and Lopez-Murphy, P. 2010. Fiscal Policy in Oil Producing Countries During the Recent Oil Price Cycle, IMF Working Paper No. 10/28, Washington D.C.

Zack, Guido, Pilar Poncela, Eva Senra, and Daniel Sotelsek. 2014. "Some New Results on the Estimation of Structural Budget Balance for Spain." *Hacienda Publica Espanola / Review of Public Economics*, 210(3): 11-31.

Zakharova, Daria and Medas, Paulo A., A Primer on Fiscal Analysis in Oil-Producing Countries (March 2009). IMF Working Papers, Vol., pp. 1-39, 2009. Available at SSRN: <https://ssrn.com/abstract=1366184>.

Appendix: Data Sources

This section provides the description of the data employed in this study and their sources.

Real GDP

Azerbaijan. The State Statistical Committee of Azerbaijan (SSCA) calculates GDP figures using two different methodologies. The GDP data that are used are based on the value-added (production) approach. The SSCA calculates real GDP figures based on average annual prices for 2005. We employ the TRAMO-SEATS seasonal adjustment package to obtain seasonally adjusted series.

Kazakhstan. GDP data based on the production method are obtained from the SCKS. Real GDP is calculated based on average annual prices for 2005. We apply the TRAMO-SEATS seasonal adjustment package to obtain seasonally adjusted series.

Russian Federation. Real GDP data based on the production method are published by the Federal State Statistics Service (Rosstat). Quarterly real GDP figures with 2008 prices cover the period 2003-2011. The real GDP for the duration of 2011-2015 is based on 2011 prices. Thus, we use the period-to-period real growth rates to extend the real GDP with 2008 prices beyond 2011.

Budget data

Azerbaijan. The statistics for the different tax revenue categories and for total expenditure are collected from the “Socio-Economic Development” monthly bulletin of the SSCA. Here, the TRAMO-SEATS package is also applied to obtain seasonally adjusted series. The SSPF does not provide complete quarterly data on SSC for the period 2003-2015, not even on an annual basis. Thus, annual data on SSC are obtained from the “Statistics” and “Press releases” sections of the official website of the SSPF. Then, annual figures are interpolated employing the methodology by Chow and Lin (1971). As an explanatory variable, we use the seasonally adjusted real GDP.

Kazakhstan. The data on the actual tax revenues to the state budget are published by the State Revenue Committee, under the Ministry of Finance of the Republic of Kazakhstan.

Russian Federation. The data on the execution of the consolidated budget of the Russian Federation and budgets of extra-budgetary state funds are obtained from the “Social and Economic Situation in Russia” monthly report. The annual SSC figures are obtained from the official website of Rosstat. To obtain quarterly data, we apply the methodology by Chow and Lin (1971), with seasonally adjusted real GDP figures as an explanatory variable.

Oil revenues

Azerbaijan. Transfers from the State Oil Fund of the Republic of Azerbaijan (SOFAZ) to the state budget are considered the oil revenue of the budget. The data on transfers are obtained from SOFAZ quarterly reports.

Kazakhstan. The data on transfers from the National Fund of the Republic of Kazakhstan to the state budget are taken from the monthly bulletins of the Ministry of Finance of the Republic of Kazakhstan.

Russian Federation. The following revenues comprise the oil revenues of the consolidated budget of Russian Federation:

- oil and gas production tax (oil, natural gas, gas condensate);
- export customs duty on crude oil;
- export customs duty on natural gas; and
- export customs duty on oil products.

These data are calculated from the monthly reports of the Federal Treasury of the Russian Federation.

Tax bases

Azerbaijan. The SSCA has been publishing GDP figures and their components (compensation of employees and gross operating surplus) based on the income approach at current prices on an annual basis since 2005. The SSCA has kindly provided us with the abovementioned data for the years 2003 and 2004. Thus, we interpolate the annual values applying the methodology by Chow and Lin (1971), with seasonally adjusted real GDP figures (production approach) as an explanatory variable. The SSCA reports household consumption expenditure as part of quarterly nominal GDP values based on the expenditure approach. Real household consumption expenditure is obtained employing quarterly CPI (2005=100). The TRAMO-SEATS seasonal adjustment package is applied to obtain seasonally adjusted series.

Kazakhstan. GDP figures and their components based on the income approach have been reported on a quarterly basis by the State Committee of Kazakhstan on Statistics (SCKS) since 2007. We employ the methodology by Chow and Lin (1971), with seasonally adjusted real GDP figures (production approach) as an explanatory variable, to obtain quarterly tax base data for the period 2003-2006. Real GDP data based on the expenditure approach, which includes the final consumption expenditure of households, are published on a quarterly basis. The quarterly domestic CPI (2005=100) is applied to obtain real figures, and the TRAMO-SEATS package is used to obtain final seasonally adjusted series.

Russian Federation. The Rosstat reports nominal GDP data and their components on a quarterly basis based on the income approach for the investigated period. The quarterly domestic CPI (2008=100) is used to obtain real series, and the TRAMO-SEATS package is employed to obtain seasonally adjusted figures.

CPI

Domestic CPI values are collected from monthly the statistical bulletins of the state statistical committees of the researched countries. The monthly data for March, June, September and December are taken as the respective quarterly figures.

Exchange rate

The nominal exchange rate data are obtained from the central banks of the respective countries. Monthly data are averaged for quarterly figures.

Oil price

The oil price data are taken from the monthly updated publication of the IMF on primary commodity prices. These data are the per barrel USD price of crude oil (dated Brent, light blend). Monthly data are averaged to obtain quarterly series. The TRAMO-SEATS package is applied to obtain seasonally adjusted series.