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MODELLING OIL-SECTOR DEPENDENCY OF TAX REVENUES IN A RESOURCE RICH COUNTRY: EVIDENCE FROM AZERBAIJAN

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Abstract

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Forecasting tax revenues is an important issue in budget planning. As a resource rich country, Azerbaijan's budget revenues is severely depend on oil price and production levels. This study investigates oil sector dependency of state budget tax revenues in case of Azerbaijan by employing FMOLS, DOLS and CCR cointegration methods for the period of 2000Q1–2015Q2. Empirical results indicate statistically and economically significant positive long-run impact of both oil related factors on tax revenues. Considering current fiscal challenges in the country, research findings are very useful for policy purposes and fills the gap in the literature by drawing mechanism of the association and estimating the relationship empirically.

Keywords: tax revenues, oil price, oil production, oil dependency, Azerbaijan

INTRODUCTION

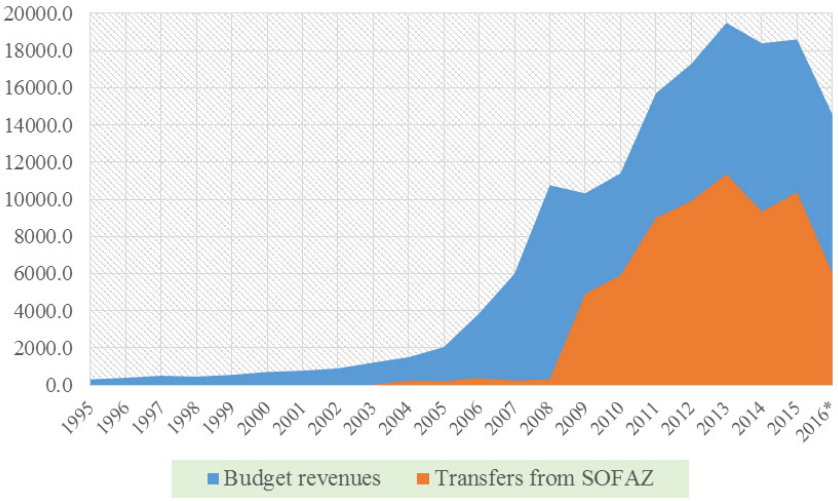
Oil sector dependency is a crucial and widely discussed factor in resource rich countries. Having rich natural resources is blessing or curse for the economies is still open for discussions. There are vast amount of studies in resource-curse literature devoted to investigate this issue. Dependency implies the effects of oil price and production level on economic growth and sustainability of economic policies. It is still debated how oil price affects economic growth. Some studies induce existence of negative relationship (Kilian, 2008; Kilian and Vigfusson, 2011a) while others argue that the relationship is nonlinear (Hamilton, 2003; Kilian and Vigfusson, 2011b) depend on a country's development level.

If total produced amount is classified as oil sector and non-oil sector output, certainly these two factors determine economic growth in oil sector while effects on non-oil sector should be studied carefully.

Meanwhile, governments inject resource revenues to the economy through fiscal challenges in such economies. However, this enhances dependency of budget revenues from the oil related factors as a threat to fiscal sustainability in the long-run. In this context, the study investigates elasticity of Azerbaijan's tax revenues to the oil price and production changes.

MATERIALS AND METHODS

In our case, Azerbaijan witnessed oil boom period after 2005 (Aliyev and Suleymanov, 2015). This was accompanied with sharp expansionary fiscal policy such as increasing budget expenditures in parallel to huge tax concessions to the non-oil sector, mostly financed by direct transfers from the State Oil Fund of the Republic of Azerbaijan (SOFAZ) (Aliyev and Gasimov, 2017).

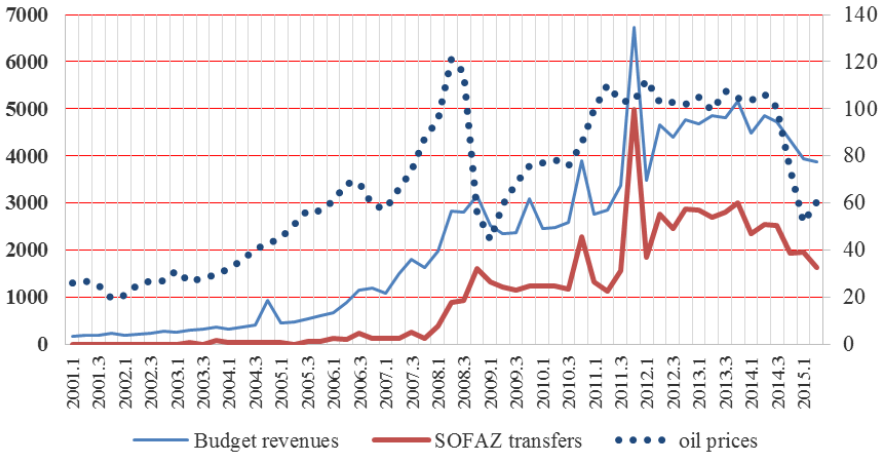


1: *Share of SOFAZ transfers in total budget revenues (million AZN)*
Source: Authors' own compilation

However, "honeymoon" is ended for the country since December, 2014 mainly because of 3-fold fall in world oil prices. On the other hand, average daily oil production demonstrates downside trend since 2011 which is expected to fall further in the near future. That is why Aliyev and Gasimov (207) calls the years following 2014 as "post-oil boom" period. Now, expansionary trend is followed by contractionary fiscal policy. In light of decreasing export revenues from the oil sector and lower direct transfers from SOFAZ, government attempts to increase tax revenues. However, *we argue that Azerbaijan's tax revenues is also highly elastic to oil related factors, in other words, oil price and production* which must be taken into consideration by fiscal policy-makers.

As we mentioned above, direct transfers from SOFAZ has been as the major source of financing budget expenditures within the oil boom period. To support this claim, Fig. 1 presents the share of the transfers in total revenues of the state budget before-and-after the oil boom. The amount of transfers climbed after 2008 with reaching peak level in 2013. In 2016 budget, the amount fell to 7.5 billion AZN. It is crucial that SOFAZ assets has also been decreasing. By the first quarter of 2016, total amount of direct transfers is 65.6 billion AZN. Remaining assets of the Fund is now approximately 34.25 billion USD or 51.15 billon AZN. Beyond direct transfers, SOFAZ has also participated in financing several national and international projects (valued nearly 6.6 billion AZN) which might be financed from the state budget. Obviously, reserves are limited and financing expenditures by using SOFAZ assets can not last so long.

Off course, price of Azerbaijan oil is the main determinant of SOFAZ revenues. From the Fig. 2, we can observe the association between oil price changes and SOFAZ transfers / budget revenues based on quarterly data. Given trend line of the variables, it is observed that transfers and budget



2: *Budget revenues, SOFAZ transfers (left-hand axis, million AZN) and oil prices (right-hand axis, USD)*
Source: Authors' own creation based on the data from the State Statistical Committee of Azerbaijan Republic, Central Bank of Azerbaijan, SOFAZ quarterly statements.

revenues positively response to the oil price changes with 1–2 quarter lags.

Positive response of total budget revenues to oil price/production level changes is straightforward and plausible in the context of direct transfers from SOFAZ. However, we claim for existence of more severe dependence. Below, Fig. 3 outlines the mechanism of how oil sector takes the role in budget revenue formulation in Azerbaijan. There are several impact channels which SOFAZ direct transfers is only one of those.

Hence, SOFAZ also pays taxes (profit tax and other legal taxes) to the state budget. Moreover, the companies take place activities in the oil sector are also major tax-payers. As the third indirect impact channel, the association between oil sector changes and non-oil sector performance is disputable but expected to be positive as oil industry and SOFAZ projects create additional demand for the non-oil sector. And finally increasing budget expenditures financed by oil-related revenues should also expand tax base or increase tax revenues.

Existing literature investigating oil sector dependency of tax revenues is limited. However, there are a lot of researches devoted to empirically examine the relationship between oil price fluctuations and economic growth in the current literature. For example, Rotemberg and Woodfrod (1996) identifies that economic output decreases nearly 2.5 % in response to the 10 % oil price increase after 5–6 quarters. Kazemi and Kazemikhasragh (2013) conclude significant and asymmetric influence of oil price changes over economic growth for oil importing and exporting economies. For Bahrain, Al-Ezzee (2011) takes 1980–2005 period and employ Cointegration techniques, Engle-Granger test as well as Vector Error Correction Model (VECM). The research provide scientific evidence of significant long-run association between world oil prices and real GDP growth of Bahrain (Al-Ezzee, 2011). Bercement *et al.* (2009) examine oil price – economic growth association for Middle East and North Africa (MENA) countries and conclude with existence of positive and statistically significant impact of oil prices for Algeria, Iran, Kuwait, Libya, Oman, Qatar, Syria and United Arab Emirates while the impact is found insignificant for Bahrain, Egypt, Israel, Jordan, Djibouti, Tunisia and Morocco. Clearly, the strength and direction of the association changes in different case studies (see also Cunado and Perez-de-Gracia, 2005; Hanabusa, 2009; Lescaroux and Mignon, 2008; Jin, 2008; Du *et al.*, 2010; Suleiman, 2013; Okoro, 2014; Wilson *et al.*, 2014; Bouzid, 2012 Mendoza and Vera, 2010; Nwanna and Eyedayi, 2016 Donwa *et al.*, 2015 among others).

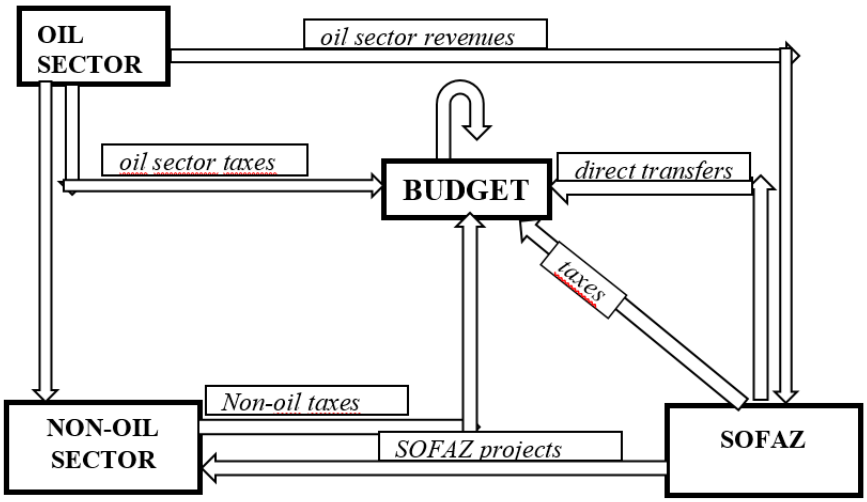
Theoretically, tax revenues is the function of total output and tax rates. In Azerbaijan, tax rates (t) has not been changed significantly within the analyzed period. If we denote total output produced as Y, oil sector as Y' and non-oil sector output as Y'', then tax revenues (T) equals:

$$T = f(Y', Y'', t) \quad (1)$$

Where $Y = Y' + Y''$ and $Y' = f(oil\ price\ (oprc), oil\ production\ (oprn))$. Under these conditions, econometric model could be expressed as:

$$\log(T) = \gamma_{0+}\gamma_1 \log(Y'_t) + \gamma_2 \log(oprc_t) + \gamma_3 \log(oprn_t) + \varepsilon_t \quad (2)$$

Here, T stand for tax receipts which is proxied with non-transfer budget revenues (subtracting direct SOFAZ transfers from budget revenues for each quarter), Y' denotes non-oil gross domestic product (GDP) while γ_i, $i \in (0\ldots3)$ represent long-run elasticity coefficients and ε_t is the error term with zero mean and constant variance. We expect $\gamma_2 > 0$ and $\gamma_3 > 0$, and to be statistically and economically significant. "*log*" means natural logarithm which is substituted simply hereafter by adding "*l*"



3: *Overview of the impact channels*
Source: Authors' own creation

before the abbreviation of each variable below. To obtain robust results, Fully Modified Least Squares (FMOLS), Dynamic Least Squares (DOLS) and Canonical Cointegrating Regression (CCR) cointegration methods are employed to examine long-run relationship of interest.

Note that FMOLS is developed by Phillips and Hansen (1990) and has advantages such as correcting for endogeneity and serial correlation effects (Narayan and Narayan, 2004). Advocated by Stock and Watson (1993), DOLS is employed to estimate long-run equilibria which is corrected for potential simultaneity bias among regressors (Narayan and Narayan, 2004). Another cointegration approach employed here, CCR is developed by Park (1992) allows OLS to provide asymptotically efficient estimators. Moreover, we apply Engle-Granger and Philips-Ouliaris cointegration tests for all employed cointegration approaches to reveal if cointegration exists among the variables.

Given the importance of determining integration order of the variables for estimating cointegration equations, three different unit root tests (Augmented Dickey Fuller (ADF), the Phillips-Perron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS)) are employed to get robust results. It is noteworthy to mention that the null hypothesis in ADF and PP tests is "there is unit root problem" while KPSS tests the null hypothesis of (trend) stationarity.

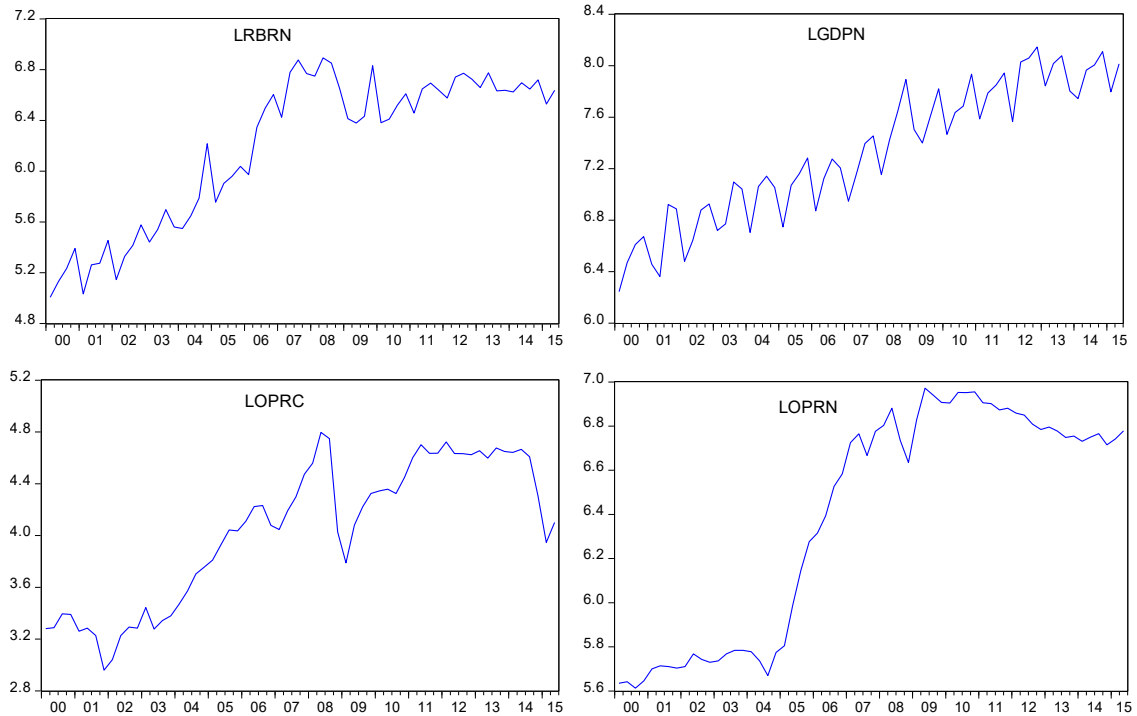
To save space, here we will not discuss methodological background of these empirical methods. Estimations are realized by employing E-Views 9 econometric software.

Data is quarterly covering 2000Q1–2015Q2 period. Short definition of the variables is given below:

Real non-transfer budget revenues (RBRN) measured in million AZN, is the amount of budget revenues excluding direct transfers from SOFAZ for each quarter. Note that quarterly total budget revenues is obtained from CBAR database and SOFAZ announce the amount of direct transfers to the state budget in its quarterly statements.

Real non-oil GDP (RGDPN) is sum of total output produced in the non-oil sector. Quarterly data is compiled and released by the Central Bank of Azerbaijan (CBAR) and the State Statistical Committee of Azerbaijan. The data employed in the empirical tests is from the statistical bulletins of CBAR, which can be accessed online[1].

Oil production (OPrn) is the measure of Azerbaijan's quarterly average daily oil production in thousands of barrels per day. The monthly data is obtained from Trading Economics database[2] and converted to quarterly data.



4: *Time profile of the logs of variables*

1 Central Bank of Azerbaijan Republic regularly publishing monthly statistical bulletin of Azerbaijan economy. For more information, see: http://en.cbar.az/pages/publications-researches/statistic-bulletin/

2 Trading Economics was founded by Antonio J Fernandes Sousa and Anna Fedec in New York City, provides accurate statistical information for 196 countries. Azerbaijan's oil production records is retrieved from: http://www.tradingeconomics.com/azerbaijan/crude-oil-production/, 01.10.2015.

I: *The unit root tests results*

	Variable	The ADF test			The PP test			The KPSS test	
		Level	k	First difference	k	Level	First difference	Level	First difference
Intercept	*lrbrn*	–1.835	1	–11.531***	0	–1.978	–13.263***	0.832***	0.317
	lrgdpn	–1.255	3	–15.672***	2	–2.108	–19.064***	0.982***	0.181
	loprc	–1.333	2	–6.8455***	1	–1.515	–5.6081***	0.828***	0.228
	loprn	–1.300	1	–5.7735***	0	–1.272	–5.7375***	0.830***	0.299
Intercept and trend	*lrbrn*	–1.800	1	–11.602***	0	–2.603	–26.347***	0.217**	0.186*
	lrgdpn	–1.811	4	–15.717***	2	–7010***	–19.829***	0.107	0.094
	loprc	–1.459	2	–6.8702***	1	–1.529	–5.7116***	0.183**	0.110
	loprn	–0.433	0	–5.8550***	0	–0.667	–5.7719***	0.183**	0.166**

Notes: ADF, PP and KPSS denote the Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin tests respectively. Maximum lag order is set to 10 and optimal lag order (k) is selected based on Schwarz criterion in the ADF test; ***, ** and * indicate rejection of the null hypotheses at the 1%, 5% and 10% significance levels respectively; The critical values are taken from MacKinnon (1996) and Kwiatkowski-Phillips-Schmidt-Shin (1992) for the ADF, PP and KPSS tests respectively. Estimation period: 2000Q1-2015Q2.

Oil price (OPrc) is the quarterly world average price of one barrel of oil, measured in USD, taken from the *index mundi* database. Original data was monthly, which was converted to quarterly frequency.

Figure 4 displays time profile of employed data in empirical estimations.

RESULTS

Before applying cointegration methods, integration of order of the variables is examined. Tab. 1 tabulates ADF, PP and KPSS unit root (UR) test results with intercept, and with trend and intercept. All UR tests end with the same integration order for the variables. It is found that originally all variables are non-stationary. However, first-differenced data is stationary. Therefore, it is concluded that our variables are integrated of order one or I(1).

The next step is testing for existence of cointegration in estimated long-run relationship models. This is examined by using Engle-Granger and Phillips-Ouliaris Cointegration tests of which Tab. II report the results. It is surprising that both tests produced the same *tau-statistic* and *z-statistic* values for all cointegration equations estimated by employing FMOLS, DOLS and CCR. Against the null hypothesis of no cointegration, the null is rejected at 10 % level of significance for all cases. Therefore, we find evidence for the existence of long-run relationship in estimated cointegration equations. We can proceed to interpretation of long-run coefficients.

Tab. III presents long-run coefficients in the equations estimated by using FMOLS, DOLS, and CCR cointegration methods respectively. Results indicates no significant relationship between non-oil GDP and tax revenues of the state budget. FMOLS and CCR produce positive but DOLS present negative association. Theoretically, positive association is expected. Note that DOLS coefficient is negative but very small, neither economically nor statistically significant. Such insignificant linkage could be seen as surprising but is reasonable when tax concessions to the non-oil sector is considered. This also supports our hypothesis that non-oil sector's contribution to tax revenues of the state budget is not as much as oil sector does. Coefficients of oil price and oil production also strengthens our claim.

Hence, all models present statistically and economically significant impact of oil related factors over tax revenues. More precisely, empirical estimations indicate that in average, 1 % increase in world oil price level for per barrel rises the tax revenues approximately 0.42–0.57 % while holding other factors fixed. Under the same conditions, 1 % more oil production triggers tax incomes of the state budget by 0.52–0.53 %. In the context of the framework described in Fig. 3, such conclusion is reliable.

II: *Results of the cointegration tests*

	Engle-Granger Cointegration test		Phillips-Ouliaris Cointegration test	
	Tau-statistic	*z-statistic*	*Tau-statistic*	*z-statistic*
FMOLS	–4.077*	–25.390*	–4.029*	–23.879*
DOLS	–4.077*	–25.390*	–4.029*	–23.879*
CCR	–4.077*	–25.390*	–4.029*	–23.879*

Notes: Dependent variable is *lrbrn*. Null hypothesis for both tests is: variables are not cointegrated; ***, ** and * indicate significance of the coefficients at 1%, 5% and 10% significance level respectively; Optimal lag length is selected based on the Schwarz criterion taking 4 lags as a maximum; p-values are MacKinnon(1996) p-values for tau-statistic.

Considering the impact of oil price on economic growth, Pradhan, Arvin and Ghoshray (2015) conclude with existence of long-run association for G20 countries. Though Difiglio (2014) reveals weakening role of oil price shocks in USA, Ito (2012) finds positive long-run effect of oil price changes on the growth in case of Russia. For Azerbaijan, taking the same period and methodology, Aliyev, Dehning and Nadirov (2016) conclude with individually and jointly insignificant impact of oil related factors on non-oil sector output growth. However, employing Autoregressive Distributed Lagged Bounds Testing (ARDLBT) approach to cointegration, Dehning, Aliyev and Nadirov (2016) finds significant positive association between oil sector and non-oil growth in case of Azerbaijan. Therefore, oil dependency of tax revenues through the non-oil sector channel is open to discussions for future research. Our finding directly demonstrate the volatility of tax payments from oil sector due to oil price and production changes.

III: *Results of long-run estimations*

Variable	FMOLS	DOLS	CCR
lrgdpn	0.1722	–0.0032	0.1393
loprc	0.4189***	0.5617***	0.4352***
loprn	0.5198***	0.5184***	0.5307***
C	–0.1056	0.6255	0.0008

Notes: Dependent variable is . Estimation period is 2000q1–2015q2. ***, ** and * indicate significance of the coefficients at 1 %, 5 % and 10 % significance level respectively.

DISCUSSION AND CONCLUSION

Historical records show volatility characteristics of oil prices. Meanwhile, natural resources – oil is exhaustible. Azerbaijan also enjoyed oil boom period since 2005 until the end of 2014 in terms of both high level of production and prices in the world market. In this sense, dependency of economic indicators, especially budget revenues from oil sector performance is at the focus of policy-makers for post-boom period. Although direct transfers from SOFAZ is discussed as the indicator of dependence at first sight, this research goes further and claims for more severe linkage and provide the mechanism association.

Employing FMOLS, DOLS, and CCR cointegration methods for 2000Q1–2015Q2 data, the study reveals significant supporting evidence of dependence even after subtracting direct transfers from SOFAZ to the state budget. In other words, the research finds that both oil price and production significantly affects tax revenues in the long-run and there is strong positive association. In time of lower oil prices and decreasing production level, this finding is a big contribution to the literature and very useful for the government officials while making forecasts for tax revenues.

However, there is certain limitations which requires further investigations. The research analyses the relationship at total bases, without dividing tax revenues into different source categories across type of taxes, i.e. Value Added Tax, income tax, profit tax, etc. Such investigation would allow policy-makers to be aware of which sources will decline the most. This would make the findings much more useful in application.

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