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10 May 2016

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Abstract

This paper tests the fiscal sustainability for Saudi Arabia under the inter-temporal budget constraint for the variables public revenues and expenditures as ratio of GDP for a period 1980-2014. Both variables are found stationary at their first differences. Cointegration result proves the cointegrating relationships but the slope of public expenditures on public revenue is found less than one. Therefore, this study concludes a weak fiscal sustainability in Saudi Arabia and suggests the fiscal reforms to maintain a strong sustainability.

Key Words: Fiscal sustainability, Cointegration, Public expenditures, Public revenues
JEL Codes: H30, C22, H50, H20

Acknowledgement: This project was supported by the Deanship of Scientific Research at Prince Sattam bin Abdulaziz University under the research project # 2015/02/4447.

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1. Introduction

The fiscal sustainability issue has been attracted the attention of policy makers and economists around the world. Government budget imbalance and government loans are the common features of world economies. Saudi Arabia also facing these problem in the most of previous years and decades. It is largest oil producing country in the world and its government revenues are majorly depending on oil production, oil prices and ultimately oil-revenues. Its oil consumption is rising at 7% with a rising population, economic growth and subsidies on local oil price. At a same consumption growth rate, it is expected to consume more than twenty percent of total oil production in the coming years. Due to subsidies on oil and basic needs of community, Saudi Arabia is facing low government revenues from taxes and high government spending. On the other hands, with a negative oil price shock, it would be very hard to maintain its spending pattern. Now a day, oil prices are going down very sharply and creating problems to generate the public revenues to meet the spending needs. Furthermore, now a day, Saudi Arabia has disputes with the neighboring countries and spending a heavy budget on army. All these problems may emerge the issue of fiscal un-sustainability and may create a burden for the upcoming government spending plans. Because, the future net discounted government revenues surplus must be planned to repay the government loans. Then, future generation of any country will enjoy a sustainable economic growth and welfare. In case of fiscal un-sustainability, there is a need of fiscal reforms.

Oil producing countries has lesser control on economic cycles. In prosperous period of oil revenues, government expenditures may rise to support economic growth and in turn inflation may also rise. But a fall in oil revenue is requiring to reduce the public spending. Otherwise, there will be budget deficits and public debt may also rise. Therefore for a long term fiscal sustainable, government must save some revenues in the times of prosperity to support the economic growth and to spend on the very important project in time of recession. This task is also very important to support the sustainable development in the country (Medas and Zakharova, 2009).

There has been a very limited number of studies on Saudi Arabia economy to investigate a very important issue of fiscal sustainability. All studies has been done descriptive debate to discuss about the issue of fiscal sustainability by showing the trends of data (see i.e. Al-Hamidy, 2012). There has been no single study, which has tried to empirically check the hypothesis of fiscal sustainability in Saudi Arabia and quantify this problem through applying the government budget constraint in the analysis to avoid the burden of fiscal imbalances today on the future generations. This study is pioneering in the two ways. At first, it is a very first attempt to inspect the fiscal sustainability for Saudi Arabia. Secondly, the most of previous literature on fiscal sustainability has been based on the unit root test to verify this issue and ignore the cointegration test (Habib et al. 2016). This study intends at finding the fiscal sustainability of Saudi Arabia in the inter-temporal budget constraint by employing the most efficient econometric techniques i.e. ARDL, DOLS and FMOLS and by using data of period 1980-2014. The results of study will be helpful in formulating the appropriate fiscal policies and to maintain long term fiscal sustainability in Saudi Arabia.

2. Empirical Literature

There has been different attempts in testing the fiscal sustainability. This study divides these into two main streams. The first category of literature checks the fiscal sustainability with the unit root test only. For example, Macdonald (1992) verifies the sustainability of US fiscal policy by integration analysis. He estimates monthly data for a period of 1951-1984. He rejects the sustainability hypothesis for US economy. Baglioni and Chrubini (1993) estimate an inter-

temporal budget constraint by using a monthly data of Italian public debt for a period 1979-1991. They find a unit root problem in public debt and point towards an unsustainable fiscal policy.

The most of literature has focus to test the association between government expenditures and revenues to test fiscal sustainability. Hakkio and Rush (1991) find a cointegrating relationship between public expenditure and public revenue of US economy. Further, they prove a weak fiscal sustainability in analysis and recommend to reduce public spending and to increase public revenues. Furthermore, they state that fiscal deficit has been a short run phenomena. Smith and Zin (1991) prove an unsustainable borrowing policy for the Canadian economy through cointegration analysis on the monthly data. Tanner and Liu (1994) probe this issue for US fiscal policy by using a cointegration after incorporating a structural break in analysis. They find a significant structural break in 1981 and confirm a long run relationship after adjusting the break. Further, they find an evidence of a stationary fiscal deficit and one to one relationship between fiscal variables, hence conclude a strongly sustainable fiscal policy for US economy. Papadopoulos and Sidiropoulos (1999) use unit root, structural break and cointegration tests to check this issue in case of five EU countries. After adjusting the structural breaks in analysis, deficit for the Greek, Portuguese and Spanish economies are found sustainable. However, sustainability hypothesis has not been proved for Italy and Belgium. Olekalns (2000) explores inter-temporal budget constraint of Australia by taking care of fiscal reforms in analysis. After a reasonable testing, Australian fiscal policy remains unsustainable. Claeys (2007) investigates the fiscal sustainability for the European Union economies by the single country analysis and as a panel model. He finds a cointegration and concludes a sustainability for the panel of EU. But the analysis of single country case shows a mix evidence of fiscal sustainability. Habib et al. (2016) find the fiscal sustainability in the 20 developed countries' panel after using the most recent cointegration and structural breaks techniques on the quarterly data set.

3. Model Specification and Econometric Strategy

3.1 Budget Constraint (BC)

BC for sustainable fiscal is started from the following equation:

$$PE_t + (1 + r_t)PD_{t-1} = PR_t + PD_t \quad (1)$$

where PE_t is public expenditure, r_t is rate of return on public loans, PD_t government loans and PR_t the Public revenues. We need to divide it with Gross domestic product (GDP) to include the size of economy.

$$\frac{PE_t}{GDP_t} + \frac{(1+r_t)}{(1+q_t)}\frac{PD_{t-1}}{GDP_{t-1}} = \frac{PR_t}{GDP_t} + \frac{PD_t}{GDP_t} \quad (2)$$

where q_t is GDP growth rate. In the Inter-temporal Budget Constraint, the public loans can be express as:

$$PD_{t-1} = \sum_{j=t+1}^{\infty}\left(\frac{1}{1+r^*}\right)^{j-1}\left(PR_{J-1} - PE_{J-1}\right) + \lim_{j\to\infty}\left(\frac{1}{1+r}\right)^{j-1} PD_{j-1} \quad (3)$$

Imposing the restriction on public debt:

$$lim_{j\to\infty} E_t(\frac{1}{1+i^*})^{j-1} PD_{j-1} = 0 \quad (4)$$

This is a condition for non-Ponzi game principal. According to this principle, we may check the validity of budget constraint to be sustainable through cointegration between government revenues and expenditures as ratio of GDP. That is given below:

$$PR_t = \alpha + \beta PE_t + \mu_t \quad (5)$$

If there will be a cointegration, then we may say there is sustainability. Secondly, the coefficient of government expenditure on revenue will guide us about the strength of fiscal sustainability. For example, a positive and unit slope is a sign of a strong sustainability.

3.2 Estimation Strategy

To test the cointegration in the model, integration analysis requires. For the unit root analysis, ADF test is tested that is innovated by Dickey and Fuller (1981). The equation for test is as follows:

$$\Delta Y_t = \tau + \rho Y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + \varepsilon_t \quad (6)$$

Δ is for differencing the variable. Y_t assumes public revenues and expenditures one by one to test the stationarity. $\sum_{i=1}^{k} \gamma_i \Delta Y_{t-i}$ is used to remove auto-correlation in the equation. Null hypothesis is a unit root problem in individual time series ($\rho = 0$). A rejection of it, will ensure the stationarity. This equation is also tested by including trend in the analysis.

To ensure the strength of the analysis, a unit root test recommended by Elliot et al. (1996) has also been employed. This is an augmented version of ADF test that utilizes Generalized Least Square (GLS) estimation procedure and it is also known as DF-GLS test. It is more efficient than other test due to utilizing detrended series in the analysis. The test equation is as follows:

$$\Delta z_t^d = \varphi z_{t-1}^d + \sum_{j=1}^{k} \iota_j \Delta z_{t-j}^d + \upsilon_t \quad (7)$$

Here z assumes variables of our model one by one. The null hypothesis is same as in ADF test ($\varphi = 0$).

After confirming the integration level, this study uses the ARDL model innovated by Pesaran et al. (2001) to validate the cointegration. The test is as follows:

$$\Delta PR_t = \eta_1 + \eta_2 PR_{t-1} + \eta_3 PE_{t-1} + \sum_{i=1}^{k} \kappa_{1i} \Delta PR_{t-i} + \sum_{i=0}^{k} \kappa_{2i} \Delta PE_{t-i} + \omega_t \quad (8)$$

k is for optimum lag length. $\eta_1 = \eta_2 = 0$ is of no-cointegration hypothesis and long-run relationship will be proved with rejection of it. This test helps in deciding the fiscal

sustainability. As fiscal policy will be sustainable if cointegration will be proved in equation-8. After confirming the cointegration, long run parameters can be calculated with the following formulae:

$$\beta_i = \frac{\sum_{i=0}^{\hat{k}} \widehat{\kappa_{2i}}}{1-\sum_{i=1}^{\hat{k}} \widehat{\kappa_{1i}}}, \forall i = 1,2,\dots,k \quad (9)$$

After assessing the long run coefficients from the ARDL framework, this study uses the FMOLS and DOLS to verify the consistency of coefficients. Further, Wald test is performed on the estimated slope of public expenditures on revenues from ADRL, FMOLS and DOLS to validate the authenticity of the slope. This test has been performed in the two competing hypothesis i.e. $\beta = 1$ and $\beta = 0$. If $\beta = 1$ is not rejected then that will show a strong sustainability and if $\beta = 0$ is not rejected then that will show a sustainability.

4. Empirical Results

This section investigates the fiscal sustainability by applying integration and cointegration analyses. Integration analysis based on unit root tests are presented in table-1. The present study applies two tests to ensure authenticity of our conclusions about the integration level in the variables. The null hypothesis is a non-stationary variable. The results are showing that both variables are non-stationary at their levels i.e. have unit roots and are stationarity at their first difference.

Table 1
Unit Root Tests

H_0= A variable has unit root.				
Variable	ADF		DF-GLS	
	C	C & T	C	C & T
PR_t	-2.3730 (0)	-2.0832 (7)	-0.8835 (2)	-2.0705 (8)
PE_t	-2.0081 (0)	-2.5098 (0)	-1.8891 (0)	-2.5242 (0)
ΔPR_t	-5.8767*** (1)	-4.5991*** (0)	-2.9272** (8)	-5.9549*** (1)
ΔPE_t	-7.3916*** (0)	-7.3347*** (0)	-5.8163***(0)	-6.8992***(0)

Note: *, ** and *** showing stationary at 10%, 5% and 1%. () contains lag lengths.

Table-2 displays the F-value calculated by selected ARDL model with optimum lag lengths (1, 1). The diagnostic tests are presented in the table. The p-values are greater than 0.1 and that is showing a good health of selected model as there is no econometric disease in the model. The F-value of selected ARDL is 11.7204 that is higher than that of upper bound values at 1%. Therefore, a strong cointegration exist between public expenditures and revenues and fiscal sustainability has been proved for KSA. The next step is to verify the strength of sustainability. That can be tested through the coefficient of public spending on the public revenue.

Table 2

ARDL Bound Test: Dependent Variable is ΔPR_t

Variable	F-Statistic	At 0.01		At 0.05	
		I(0)	I(1)	I(0)	I(1)
ΔPE_t	11.7204	5.3709	6.2637	4.2628	5.0799
Diagnostic Tests					
Serial Correlation (χ^2)	Functional Form (χ^2)	Normality (χ^2)	Heteroscedasticity (χ^2)		
0.0384 (0.845)	0.5885 (0.443)	0.1757 (0.916)	2.6475 (0.104)		

Table-3 presents the slopes of public expenditures on public revenue. The long run coefficients are calculated through selected ARDL framework, FMOLS and DOLS. Three estimates are being considered as long run parameter and are very important in deciding the strength of sustainability. The estimated long run parameters are 0.7084, 0.6519 and 0.6267 calculated through ARDL, FMOLS and DOLS respectively. These parameters are positive and significant that is again showing the fiscal sustainability. But, magnitude of parameters are less than one and are showing a weak fiscal sustainability in case of KSA. Therefore, government of KSA requires fiscal reform to meet the strongly sustainable fiscal policy. In short run estimations, the parameter of ECT_{t-1} is negative and significant. Therefore, it can be concluded for a short-run relationship in the model. And short run slope is also positively significant. It is again showing the sustainability even in short run.

Table 3
Long-Run and Short-Run Results

Long Run Regression: Dependent Variable is PR_t			
Regressor	**ARDL**	**FMOLS**	**DOLS**
PE_t	0.7084 (0.000)***	0.6519 (0.000)***	0.6267 (0.000)***
Intercept	0.0575 (0.0450)**	.0713 (0.054)*	0.0737 (0.083)*
Short Run Results Based on ARDL Model: Dependent Variable is ΔPR_t			
ECT_{t-1}		-0.7287 (0.000)***	
ΔGE		0.8695 (0.000)***	

Note: ***,** and * are indicating significance at 1%, 5% and 10% respectively.

The results of table-3 have proved the weak sustainability of fiscal policy in KSA. To verify this result, Wald restriction test has been employed with the two null hypothesis of slope C(1)=0 and C(1)=0 in the table-4. The chi-square values are high and their p-values are low in the estimations. This is rejecting the both null hypotheses and verifies that slope is neither zero nor the unit. Therefore, estimated slopes are valid and fiscal policy is proved weakly sustainable again with this test.

Table 4
Wald Test

Estimators	**ARDL**	**FMOLS**	**DOLS**
Chi-Square (C(1)=1)	20.189 (0.001)	11.786 (0.0017)	11.802 (0.0020)
Chi-Square (C(1)=0)	54.9965 (0.000)	42.3134 (0.000)	33.2542 (0.000)

5. Conclusion and Implications

The present study investigates an important issue of fiscal sustainability in case of Saudi Arabia under the inter-temporal budget constraint. For this purpose, annual time-series data of a period 1980-2014 has been tested by applying ARDL cointegration, FMOLS and DOLS on relationship of public expenditures on revenues after testing the order of integration. Both variables have a unit root problem that indicating the un-sustainability of Saudi fiscal policy but the first difference of these variables are remained stationary and are indicating a chance being sustainable fiscal policy. Further, fiscal sustainability has been investigated with a cointegration analysis and it is proved sustainable with jointly integrated/ cointegration between fiscal variables: public expenditures and revenues. After confirming the sustainability, next step is verify the strength of sustainability. That is confirmed by long run slope of public expenditures on public revenues in ARDL, FMOLS and DOLS analyses. It has been found positive and significant between zero and one. This slope is most important in deciding the strength of sustainability as advocated by Habib et al. (2016). Therefore, the Wald restriction test on slope equal to zero and equal to one has been employed to verify this issue. It also confirms the magnitude of slope between zero and one and it is proving the weak fiscal sustainability in case of Saudi Arabia. So, there is a need for fiscal reforms to manage a strongly sustainable fiscal policy and the present study recommends the Saudi government to increase tax base instead of relying on just oil-revenues as tax is only 10% of public revenue in Saudi Arabia. An increasing tax based economy can resolve this weak sustainability issue by collecting more public revenue and to shift the burden of budget deficits on the present generation instead of future ones.

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