ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية
2011

working paper series

CYCLICALITY OF FISCAL BEHAVIOR IN DEVELOPING OIL-PRODUCING COUNTRIES: AN EMPIRICAL REVIEW

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Working Paper No. 638

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October 2011

I would like to thank Ibrahim Elbadawi, Cemile Sancak, Filiz Unsal, Mitali Das, Thomas Helbling, Peter Smith, Thomas Walter, Gulcin Ozkan,and the participants at the Economic Research Forum's 17th Annual Conference for their useful comments. I am grateful to MauricioVillafuerte for sharing his data set and his valuable comments. This work was sponsored by the Economic Research Forum (ERF) and has benefited from its support both financially and intellectually. The contents and recommendations do not necessarily reflect ERF's views.

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First published in 2011 by
The Economic Research Forum (ERF)
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Abstract

This paper examines the cyclicality of fiscal behavior in 28 developing oil-producing countries (OPCs) during 1990–2009. After testing five fiscal measures—government expenditure, consumption, investment, non-oil revenue, and non-oil primary balance—and correcting for reverse causality between non-oil output and fiscal variables, the results suggest that all of the five fiscal variables are strongly procyclical in the full sample. Also, the results are not uniform across income groups: expenditure is procyclical in the low and middle-income countries, while it is countercyclical in the high-income countries. Fiscal policy tends to be affected by the external financing constraints in the middle- and high-income groups. However, the quality of institutions and political structure appear to be more significant for the low-income group.

ملخص

تسعى هذه الورقة الى دراسة التقلبات الدورية في السلوك المالي ل 28 من البلدان النامية المنتجة للنفط (OPCs) خلال الفترة من 1990-2009. و بعد اختبار خمسة مقاييس مالية – الإنفاق الحكومى ، الاستهلاك، الاستثمار، العوائد غير النفطية و الميزان الأولي غير النفطي - و التصحيح بين المخرجات غير النفطية والمتغيرات المالية لأسباب عكسية، تشير النتائج إلى أن جميع المتغيرات المالية الخمسة شديدة الاتساق مع الاتجاهات الدورية للعينة. و كذلك، فإن النتائج ليست موحدة فيما بين مجموعات الدخل : حيث نجد ان النفقات شديدة الاتساق مع الاتجاهات الدورية في البلدان المنخفضة ومتوسطة الدخل، في حين أنها مضادة للتقلبات الدورية في البلدان ذات الدخول المرتفعة. لذا تتأثر السياسات المالية بشكل سلبى من قيود التمويل الخارجي في الفئات المتوسطة ومرتفعة الدخل. ومع ذلك، تعتبر نوعية المؤسسات والبنية السياسية أكثر أهمية بالنسبة للمجموعة ذات الدخل المنخفض.

1. Introduction

Oil price volatility has increased in recent years. Large, unpredictable swings have a major impact on fiscal balances in developing oil-producing economies (Figure 1).[1] Even a small fall in prices, for example, may lead to a substantial increase in financing needs, as the exports of these countries are not diversified and oil revenue accounts for a large portion of total revenue. The political, institutional, or budget structure of these countries, as well as their inability to accumulate financial assets or to gain access to credit markets, forces governments to react to oil price volatility by conducting procyclical fiscal policies. A large number of studies show that procyclical fiscal policies have harmful implications for developing countries.[2] When governments cut expenditure in response to a fall in oil revenue, the poor get hurt because of the weak safety net, and long-term growth is hampered as governments cut capital expenditure and withdraw resources from productive projects.

This paper examines whether fiscal behavior is indeed procyclical in 28 developing oil-producing countries (OPCs) (Table 1) by employing rigorous econometric tests. Although there are a growing number of studies on the topic, few have thoroughly studied the procyclicality of fiscal policies, particularly during the recent period of high oil prices. With this analysis, the paper contributes to the literature in three ways.

First, fiscal behavior is studied among different groups of OPCs by breaking down the country sample into three subgroups according to their level of development and conducting the cyclicality tests on the full sample, as well as on the subsamples. Since the OPCs are not a homogenous group, their fiscal policies are likely to respond differently to oil price shocks due to significant variations in the extent of their dependency on oil revenue, economic development, political and institutional structure, financial positions, the level of existing oil reserves, and the degree of maturity in oil production.[3] Due to these differences, it is important to study the fiscal behavior not only in a large group but also in smaller groups, to see whether countries with certain characteristics show consistent fiscal policy patterns; this, in turn, may be useful for designing effective policies. Indeed, this study finds that the results are not uniform across income groups. Total expenditure is highly procyclical in the low and middle-income groups, while it is countercyclical in the high-income countries. In addition, the estimation results show that political and institutional factors, as well as financing constraints, play a role in the cyclicality of fiscal policies in the OPCs, especially in the low-income group.

Second, the cyclical behavior of several fiscal policy variables is tested: total expenditure and its components, public consumption and investment; the non-oil primary balance; and non-oil revenue. Most studies use either expenditure or consumption as a dependent variable. However, this paper examines total government expenditure as well as its components, which will be a key contribution of the paper for the following reason. Focusing only on aggregates can be misleading if their subcomponents move in offsetting ways. Thus, looking at the subcomponents separately may further explain the preferred direction of fiscal policy and reveal important policy implications; for example, a government may change either consumption or investment more in response to a change in output. In fact, the estimation results in this paper show that expenditure is countercyclical for the high-income group, but its components move in different directions: consumption is procyclical while capital

[1] Throughout this paper, the term "oil" is used to refer to "hydrocarbon" or "petroleum" because gas is also an important resource in several countries (e.g., Algeria and Qatar).

[2] See Lane (2003) who reviews neoclassical and Keynesian arguments related to optimal cyclicality in fiscal policy.

[3] There is a noteworthy negative correlation between the use of the additional fiscal oil revenue and the income or development level of OPCs (Davis, Ossowski, and Fedelino, 2003).

expenditure is countercyclical. Similarly, Villafuerte and Lopez-Murphy (2010) and Arezki and Ismail (2010) indicate that, during oil price declines, governments reduce capital expenditure more than they reduce government consumption. Furthermore, the non-oil primary balance as a dependent variable will measure the injection/use of oil revenue in the economy and the overall level of fiscal effort. Finally, non-oil revenue will be a useful measure of the tax collection mechanism. All of these five fiscal variables show strong procyclical behavior in the full sample of OPCs.

Third, there have been only a few econometric studies on the procyclicality of OPCs. In this paper, not only are various econometric methods employed to test procyclicality, but the possibility of reverse causality between output growth and the fiscal variable is taken into account. Pooled ordinary least squares (OLS), fixed-effect, instrument variables (IV), and general methods of moments (GMM) estimations are used and their results compared.

The plan of the paper is as follows. In the next section, some special characteristics of OPCs that are relevant to the analysis will be discussed. In Section III, the empirical specification and the data will be described. In Section IV, the results will be presented, and Section V will conclude.

2. Background

Both the neoclassical and Keynesian theories support the idea that effective fiscal policy should smooth the volatility of output during the business cycle. Barro's (1973) "tax-smoothing" hypothesis of optimal fiscal policy suggests that, for a given path of government expenditure, tax rates should be held constant over the business cycle, and the budget surplus should move in a procyclical fashion. According to the Keynesian approach,however, if the economy is in recession, policy should increase government expenditure and lower taxes to help the economy out of the recession. During economic booms, the government should save the surpluses that emerge from the operation of automatic stabilizers and, if necessary, go further with discretionary tax increases or spending cuts. As a result, fiscal policies are expected to follow countercyclical patterns through automatic stabilizers and discretionary channels. In other words, one would expect a positive correlation between changes in output and changes in the fiscal balance or a negative correlation between changes in output and changes in government expenditure.

However, empirical studies show that fiscal policies are procyclical in developing countries and in OPCs.[4] They increase spending with an increase in oil revenue during an oil price boom. They are forced to reduce spending because of a revenue decline as a result of a drop in oil prices. Since, in general, these countries are not able to accumulate savings in years with high oil revenues, they can only finance deficits by cutting expenditure during revenue shortfalls. Fouad,et al. (2007), Abdih,et al.(2010), and Villafuerte and Lopez-Murphy (2010) find that oil-producing countries followed procyclical fiscal policies during the recent oil price cycle. Baldini (2005) and De Cima (2003) also present evidence for the procyclicality of fiscal policies in two oil-producing countries, Venezuela and Mexico. More recent studies, e.g. Ilzetzki and Vegh (2008), find, using instrumental variable regression, strong evidence of procyclical fiscal policy in developing countries.

Two broad arguments that have been proposed as an explanation for procyclical policies in developing counties also apply to OPCs: constraints on financing (or limited access to credit markets) and factors related to the structure of the economy (the budget, political power, and social structure, and weak institutions). In general, these factors are presented separately but

[4]Gavin and Perotti (1997) find total spending and its components are highly procyclical in Latin America. Kaminsky, Reinhart, and Végh (2004) find that fiscal policy is procyclical in their subsample of 83 low- and middle-income countries.

they go together and are likely to reinforce each other. For example, weak institutions, the budget structure, or a corrupt government may hinder prudent fiscal policies, which may, in turn, affect fiscal sustainability and creditworthiness by amplifying the financing constraints.

Liquidity and borrowing constraints emerge when a developing country needs financing the most--during a downturn--and that is when it is least likely to be able to obtain it. Many countries do not have significant foreign assets or developed domestic financial markets to raise funds. When these countries face long terms of trade shocks (i.e., a sharp fall in oil prices in the case of OPCs), investors may lose confidence and be less likely to lend, because they fear that the lack of policy credibility and discipline may force the government to run up large budget deficits and to default.[5]Governments in this situation will also experience recurring credit constraints in world capital markets ("sudden stops," as explained in Calvo and Reinhart(2000)), which hamper their ability to conduct countercyclical policies.

Oil stabilization funds have been increasingly used by OPCs as an instrument to cope with oil revenue volatility. These funds are aimed at stabilizing budgetary revenues: when oil revenues are high, some portion of the revenue would be channeled to the stabilization fund; when oil revenues are low, the stabilization fund would finance the shortfall. However, the creation of such funds is found to have no impact on the relationship between oil export earnings and government expenditure in countries where no sound and transparent fiscal and macroeconomic policies were implemented.[6] Moreover, some oil funds have operated outside existing budget systems and are often accountable to only a few political appointees. This makes such funds especially susceptible to abuse and political interference. Therefore, stabilization funds should not be regarded as a substitute for sound fiscal management.

The other argument proposed to explain the difficulty in implementing countercyclical policy focuses on procyclical government spending due to three aspects of the economy and the government: the budget structure, the weak political structure and institutions, and corruption in government.

First, developing countries run procyclical fiscal policies because of their budget structure. These countries have a few automatic stabilizers built into their budgets. As a result, government spending in developing and emerging countries displays less of a countercyclical pattern than in industrial countries. For example, Gavin and Perotti (1997) note that Latin American countries spend much less on transfers and subsidies than do richer OECD economies (24 percent of total government spending, compared with 42 percent in the industrial countries). Furthermore, most developing countries and OPCs cannot raise revenue effectively through taxes since they usually suffer from inefficient tax collection systems, owing to the low level of compliance with tax laws, insufficient political commitment, and a lack of capacity, expertise, and resources.[7] Additionally, non-oil tax bases in these countries are in general very low.[8]

Second, weak institutions and political structure encourage multiple powerful groups in a society to attempt to grab a greater share of national wealth by demanding higher public spending on their behalf. This behavior, called the "voracity effect" by Tornell and Lane (1999), results in fiscal procyclicality arising from common pool problems, whereby a positive shock to income leads to a more than proportional increase in public spending, even

[5] Reinhart, Rogoff, and Savastano (2003), Caballero and Krishnamurthy (2004), and Haussmann, et al.(1996).

[6]Davis, Ossowski, and Fedelino (2003), Fasano-Filho (2000), and Ossowski,et al. (2008).

[7] Davis, Ossowski, and Fedelino (2003). Furthermore, some countries until recently did not have even a full-fledged modern value-added tax (VAT) system. See Crandall and Bodin (2005).

[8] Most OPCs have quasi-fixed exchange rate regimes, which, coupled with high international capital mobility, limit the role of monetary policy.

if the shock is expected to be temporary. This is discussed extensively in "resource curse" literature as a reason for low economic growth in resource-rich countries.[9] Moreover, fiscal policies are more intense in countries with political systems having multiple fiscal veto points and higher output volatility (Stein, Talvi, and Grisanti,1998;and Talvi and Végh, 2000). Similarly, Lane (2003) and Fatas and Mihov (2001) find that countries with power dispersion are likely to experience volatile output and procyclical fiscal behavior.

Lastly, Alesina and Tabellini (2005) argue that a more corrupt government displays more procyclical fiscal policies as voters, who do not trust the government, demand higher utility when they see aggregate output rising. This behavior would be more prevalent in democracies since a corrupt government is accountable to the voters, whereas, in a dictatorship, the government would not be accountable and, even if corruption were widespread, voters could not influence fiscal policy. Alesina and Tabellini conclude that corrupt governments in democracies, rather than credit market imperfections, are the underlying cause of procyclicalfiscal policy.

3. Empirical Specification and Data

3.1 Empirical Specification

The following empirical model specification, which is widely used in the literature (Gavin and Perotti (1997), Alesina and Tabellini (2005) and Lledo, Yackovlev, and Gadenne (2009), among others) has been chosen.

$$\Delta(\log(Fiscal_t)) = \alpha + \beta\Delta(\log(non\text{-}oilGDP_{it})) + \theta\,\Delta(\log(TOT_{it})) + \delta\Delta(\log(Fiscal_{it-1})) + \delta\, Z_{it} + \eta_i + e_{it} \quad (1)$$

$$t=1,\ldots T, \quad i=1,\ldots,N,$$

where Fiscal represents a fiscal variable. The independent variables on the right-hand side are non-oil GDP, an index of the country's terms of trade, TOT, the lagged fiscal variable, a set of other control variables as Z, fiscal shocks as e_{it} and η_i as an unobserved, country fixed effect[10]. The *i* and *t* denote the country and the time period, respectively. Equation (1) is a fiscal reaction function where fiscal policy responds to contemporaneous output changes, terms of trade, the lagged fiscal variable, other control variables, and fiscal shocks (e_{it}). The terms of trade variable is important for developing countries in general but especially for OPCs, as their fiscal balances and economies are highly prone to terms of trade shocks, which usually originate from outside the domestic economy. Each individual country does not have control over the oil price; thus, including TOT provides a control for external shocks to the economy. Furthermore, the shocks to the fiscal balance or policy decisions in the previous year may have lasting effects on the following period, so the lagged dependent variable is included in the specification to allow for long-term mean reversion in fiscal behavior. The cyclicality of fiscal policy is determined by gauging the sign and the size of coefficient β, which measures the elasticity of the fiscal variable with respect to output growth. When fiscal policy is procyclical, a positive β for most of the fiscal measures, except for the non-oil primary balance, is expected. Government expenditure, consumption,

[9] Collier (1999), Sachs and Warner (1995), and Klare (2001).

[10] Other papers scale the variables in total GDP or take the deviations of GDP and fiscal variables from their long-run trends by using the Hodrick-Prescott (HP) filter. However, both transformations have shortcomings. In the former, the cyclical stance of fiscal policy may be dominated by the cyclical behavior of total output. In the later, the HP-based measures of cyclicality produce misleading results when samples have different levels of volatility. Furthermore, de-trending is not necessary in this study because it does not attempt to differentiate between discretionary fiscal policy and automatic stabilizers (likely very small in OPCs) and focuses on the evolution of actual fiscal balances (rather than the cyclically adjusted balances, which better reflect discretionary behavior).

revenues, and investment should move in the same direction as output. If output increases during booms, the fiscal variables also increase, while the opposite happens in recessions. An estimated β value above 1 implies a more-than-proportionate response of the fiscal variable to output fluctuations.

The issue of endogeneity needs to be addressed with equation (1) which emerges from three different channels.

The first is the endogeneity of the output growth with respect to contemporaneous fiscal policy shocks, $e_{it,}$ or, as stated in recent studies (e.g., Ilzetzki and Végh, 2008), as the reverse causality between output growth and fiscal policy.[11]

The second is the correlation between output growth and unobserved country-specific and time-invariant effects η : countries that are able to generate higher growth in their fiscal balances will, on average—as captured by higher values of the fixed effects η —tend to have a higher (or lower, depending on the sign of cyclicality) level of output growth; if this is not properly accounted for, the unobserved country fixed effects will exert an upward (or downward) bias on the estimated fiscal policy response to output growth.[12]

The third is serial correlation between the error term and the lagged dependent variable, which can cause endogeneity. Although the log differences of the variables are taken, endogeneity may still exist in the error term, if there was a persistent shock to the growth of the fiscal variable in the previous period.

In this linear panel framework, pooled OLS and dynamic fixed-effect estimations assume strict exogeneity of explanatory variables; however, this does not hold for this specification, and they produce biased and inconsistent estimators. Similarly, the IV estimates are also biased, and the precision of the IV estimates is lower than that of the OLS estimates. In the presence of weak instruments, the loss of precision will be severe, and the IV estimates may be no improvement over the OLS (Baum, 2007). However, all three sources of endogeneity bias can be addressed by using both difference (Diff-) and System (Sys-) GMM estimators (Arellano and Bond, 1991), as is commonly used in the literature. The Diff-GMM uses first-differenced equations with suitable lagged levels as instruments. The Sys-GMM augments the former by stacking the equation in first differences and the equation in levels together in a system of equations and employs both lagged levels and differences as instruments.

In general, if the explanatory variables are highly persistent, their lagged levels might only be very weak instruments for the first-differenced equations, due to serial correlation between the instruments and the error terms. As a result, the first-differenced GMM estimator potentially suffers from a downward bias (Blundell and Bond, 1998). An additional set of first-differenced instruments and equations in levels is used to make the system GMM estimator more efficient by overcoming the weak instrument problem inherent in the first-differenced GMM estimator. However, the Sys-GMM imposes more restrictions. As a result, equation (1) is estimated using both methods and the results are compared. Both methods take care of endogenity by instrumenting GDP growth and the lagged dependent variable. Widely used instruments are past values of the explanatory variables (Gali and Perotti, 2003; and Lane, 2003). In all GMM regressions, two lags of all endogenous variables (output growth and the lagged dependent variable) are used as instruments. In addition, the export-

[11] Rigobon (2004) and Jaimovic and Panizza (2007) question whether the fiscal policy shocks drive output and not the other way around. However, Ilzetzki and Vegh (2008) conduct a set of econometric tests to show that causality goes in both directions. But, once they take endogeneity into account, they find overwhelming evidence of procyclical fiscal policy in developing countries.

[12] Since the variables are differenced, the fixed effects may be eliminated. However, there may be fixed effects in the growth rates of the series.

weighted GDP growth of a country's trading partners is used as an instrument for GDP growth, as in other studies (Jaimovic and Panizza, 2007).

The Diff-GMM and Sys-GMM estimation results with two statistics are reported in order to verify the appropriateness of the choice of instruments: p-values for the Hansen overidentification test of orthogonality restrictions, and the Arellano-Bond (1991) test for autocorrelation in first and second differences to verify the absence of serial correlation.

3.2 Data and Variable Descriptions

The key explanatory variable is the growth of real GDP, excluding the oil sector (non-oil GDP). Non-oil GDP is more relevant to assess the status of economic conditions and the use of the labor factor, as the oil sector is typically an enclave sector, highly capital intensive with limited spillovers to the rest of the economy. Similarly, Barnett and Ossowski (2002), among others, argue that non-oil measures are more reliable variables of fiscal policy in OPCs than the overall balance, since oil revenue originates from abroad and non-oil variables are largely under the control of the authorities. The fiscal measurements used as dependent variables are real total general government expenditure, real general government consumption, real government capital expenditure, real non-oil revenue, and real non-oil primary balance.[13,14]

After testing the basic specification, the following robustness checks are performed by introducing additional control variables:

Two credit constraint variables are included to examine the origin of the possible credit constraint: domestic and external. As for domestic financing constraints, there are also two variables: credit to the private sector scaled in GDP as a proxy for the depth of the domestic credit market, and the real central bank interest rate to indicate the cost of domestic financing. As for the external financing constraint, the degree of access to international financing is measured by the ratio of net capital flows to GDP.

As indicators of institutional quality and political structure, several variables from the *International Country Risk Guide* database are used: bureaucracy quality, corruption, and law and order. In addition, the composite index of institutional quality will be included, representing all of these. Furthermore, for political structure, variables such as political competition, democracy, constraints on the decision-making authority, and checks and balances from the Polity IV Project dataset will be added[15].

To control for the vulnerability of the country to oil price changes, as well as to serve as a proxy for dependence on oil income, oil revenue as a share of total revenue is used.

The macroeconomic data come from Villafuerte and Lopez-Murphy (2010), updated by the World Economic Outlook database of the IMF for the period 1991– 2009. The frequency is annual. The availability of data varies by country. All variables are converted to constant using the CPI.[16] The data sources are listed in Table A1.

4. Estimation Results

Descriptive statistics in Table A2 in the Appendix describes the main variables. The data show that in general the growth of non-oil GDP and fiscal variables is more volatile in low income OPCs than in high-income OPCs. Average expenditure growth tends to be higher in low-income countries in part due to average higher growth in capital expenditure, while

[13] Instead of central government data, general government data are used to capture the response of the total government to output changes. Nevertheless, the distinction is small for most of the countries.

[14] Another policy instrument that may be useful is government tax rates, but data limitations for the sample countries prevent us from using these rates as a dependent variable.

[15] The Polity IV Project has data on the political authority characteristics of states in 163 countries.

[16] CPI is used as a deflator since a non-oil GDP deflator was not available across the sample countries.

average consumption growth is higher in high-income countries. The non-oil primary balance shows more volatility than the other variables, as expected, since it is in growth form and obtained as a residual from the others.

Simple correlations between fiscal variables and some relevant macroeconomic, financial, political, and institutional variables are presented in Appendix Table A3, where correlations higher than 30 percent are highlighted. GDP per capita seems to be positively correlated with the fiscal variables, except for the non-oil primary balance, for both the full sample and the low-income group, which may indicate that countries in different income groups have consistently different fiscal behavior patterns. There is no clear correlation pattern in the full sample as there may be a large variation in series among countries. For the high-income group, gross international reserves and oil wealth show strong correlations; data reveal that the higher the income, the greater the accumulation in savings and oil wealth.

Various econometric techniques are applied to equation (1), and the same tests are repeated for the five different fiscal variables as dependent variables for the three income groups, as well as for the full sample. First, to provide a benchmark, a bivariate pooled OLS regression of fiscal variables and the output variable are carried out; then, the equation is tested with the fixed-effects method to control for country effects. Next the IV estimation is run, together with the fixed effects, to introduce the instrument variables. Finally, the Diff-GMM and the Sys-GMM methods are used. Only the Diff-GMM estimation results are presented in the tables below; the other test results are presented in Appendix Tables A4 through A23.

The estimated coefficients for all fiscal variables for the full sample, except for the primary balance, are positive and statistically significant. It is worth noting that the OLS, fixed-effects, IV, and GMM results are qualitatively and quantitatively very similar. The results indicate that pooled OLS estimates had an upward bias and the fixed-effects model had a downward bias, confirming the appropriateness of using the GMM method for the model.

Estimates obtained from the Diff-GMM and Sys-GMM methods are consistent and in general are very close (Tables 2–6 and Appendix Tables A19–A23). The estimation results show that most Diff-GMM estimations were overidentified with exogenous instruments.[17] Most p-values of AR(1) are low, and, as a result, the null of no autocorrelation is rejected.[18] However, the Sys-GMM estimations also point to an overidentified equation, with a high Hansen test p-value--in fact, the value is too high to cast doubt on the satisfaction of moment conditions. As a result, Diff-GMM is chosen as the preferred method, and its results are reported in the text. The results of Sys-GMM are presented in Appendix Tables A19–A23.

The results in Tables 2–6 below show that the cyclicality coefficient β in equation (1) is always significant and positive for expenditure and consumption variables for the full, low and middle-income countries. Only high-income countries show an indication of countercyclical policy on total expenditure-- perhaps because their greater accumulation of financial assets eases their financial constraints when funds are needed. Non-oil revenue growth is strongly procyclical, especially in the middle-income sample, suggesting an increased tax collection as well as spillover effects of increased oil revenues. Capital expenditure growth also follows output growth positively and is significant for the full and low-income groups. Capital expenditure is countercyclical only for high-income countries. Again, as part of the countercyclical fiscal policies, high-income countries can afford to increase capital expenditure in recessions to stimulate the economy and to cut back during boom times to smooth output fluctuation. The non-oil primary balance is procyclical, and the

[17] The p-values for the **Hansen test** for overidentifying restrictions were high enough.

[18] Differenced errors are expected to follow an MA(1) process. But most of the p-values of AR(2) are high, so the null of no autocorrelation cannot be rejected, suggesting that the GMM estimator is consistent.

sign of the coefficient is negative; as output grows, the non-oil primary balance declines, implying that spending exceeds revenue, leading to a negative balance.

Before introducing the control variables related to financial constraints, as well as the political and institutional factors, into the regressions, the oil revenue share in total revenue is added to the estimation; this turns out to be significant. This variable indicates the country's degree of dependency on oil revenue. Then the financial constraint control variables are included in the regression. Tables 7 and 8 show the estimates of expenditure as a dependent variable with control variables for the full sample and subgroups, respectively.

The full sample results with financial constraints in Table 7 show that both the external and domestic credit markets matter for the full sample as they are significant. The results for the interest rate and the capital flows are weaker than those for the depth of financial markets (private credit to GDP). The sign of lagged net capital flows is negative, suggesting the countercyclical flow of external capitals, which is the opposite of what we had expected.

Only the significant results for the subgroups are presented in Table 8; the results are somewhat poor (the Hansen test p-values are very high). For the low-income group, the lagged central bank interest rate is significant but zero. For the middle- and high- income groups, the coefficients of lagged capital flows to GDP are significant and countercyclical, albeit very small.

Finally, the estimation results for the full sample, including the institutional and political control variables, are presented in Table 9. Among the political variables, bureaucracy quality, democracy, constraints on the decision-making authority (constraints on the executive), political competition, and checks and balances are significant. Except for democracy and checks and balances, the coefficients for the other variables are negative. From these results, it can be interpreted that fiscal behavior is more procyclical when the bureaucracy quality, the constraints on the executive and political competition are low. The coefficient for checks and balances is significant but very small. The coefficient for democracy is positive, indicating the higher the democracy variable, the higher is the expenditure, which partially supports the claim of Alesina and Tabellini (2005) that corrupt governments in democracies run procyclical fiscal policies.

As for the groups, most of the variables are significant for the low-income group, whereas only the composite index and checks and balances are significant for middle-income countries (Table 10). None of the variables are significant for the high-income group. However, the validity of the estimation is poor, as the p-values for the Hansen statistics are too high. The full sample and low-income results seem to be similar, which suggests that the latter group constitutes a large share of the full sample.

5. Conclusions and Policy Implications

This paper analyzes the cyclicality of fiscal behavior thoroughly in 28 OPCs during 1991-2009. It examines five fiscal variables—non-oil revenue; the non-oil primary balance; and total expenditure and its components, consumption and capital expenditure— for the full sample and subgroups divided by their development levels and by correcting the endogeneity bias between the fiscal variables and the output variable. Since the OPCs are not a homogenous group, it is important to divide them into groups and observe whether their fiscal policies show different patterns by groups if so, this may help in designing effective fiscal policies. Indeed, the results are not uniform across income groups, and total expenditure is highly procyclical in the full sample, in the low and middle-income groups. The low-income group constitutes a large share of the full sample, therefore weighing heavily in the results of the full sample. But it is countercyclical in the high-income countries--perhaps due to their greater accumulation of financial assets, which eases their financial

constraints when funds are needed. It is also important to look at the aggregate fiscal variables, as well as at their subcomponents separately, since the subcomponents may move in offsetting ways. In fact, the estimation results show that, although expenditure is countercyclical for the high-income group, its components move in different directions: consumption is procyclical, while capital expenditure is countercyclical.

The results confirm that political and institutional factors, as well as financing constraints, play a role in the cyclicality of fiscal policies in the OPCs. Most of the variables on the quality of institutions and the political structure appear to be significant for the low- income group. Two of the variables are significant for the middle-income countries: the composite institution index and checks and balances. None of the institutional variables turns out to be significant for the high-income countries.[19] Domestic financing constraints seem to matter for the low-income group. But fiscal policy is affected more by the external financing constraint in the middle- and high-income groups, as they may be more integrated into the global financial system than the low-income countries.

Despite their many differences, all the OPCs face volatile and unpredictable oil revenues, a situation that makes fiscal management challenging. For this reason, it is imperative for them to formulate effective countercyclical fiscal policies by which they can smooth government expenditure, decouple it from the volatile oil revenues, and prevent boom-and-bust cycles. Breaking away from a procyclical fiscal policy will enable them to sustain long-term growth and keep the safety net that the poor need. Sound fiscal policies and discipline require strong institutions, a higher-level bureaucracy, and more transparency. Strong institutions and transparency would also help reduce the "voracity effect," which, in turn, would facilitate the accumulation of financial assets and build up confidence among investors to raise funds when needed.

[19] It would be useful to look at the institutions and political structure in the high-income group in detail in future research.

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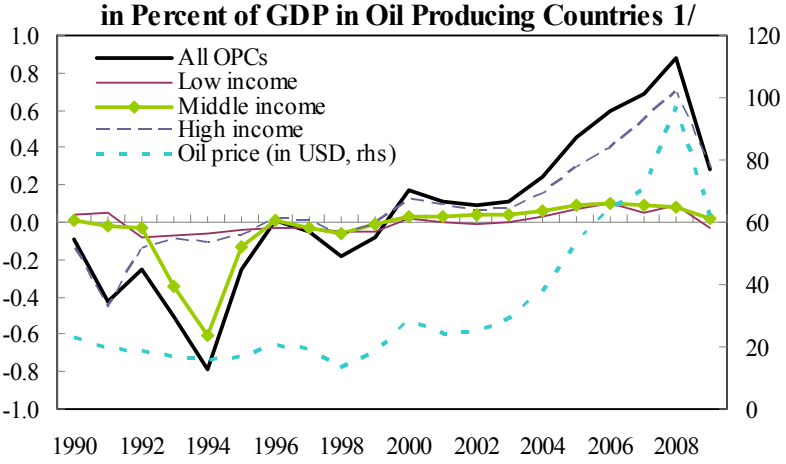
Figure 1. Oil Price and Overall Fiscal Balance in Percent of GDP in Oil Producing Countries 1/



Source: International Monetary Fund.

1/ Simple averages.

Table 1: OPCs Classified by Income Level

Low income		Middle income	High income
Algeria	Angola	Gabon	Bahrain
Azerbaijan	Cameroon	Kazakhstan	Brunei
Chad	Congo	Libya	Equatorial Guinea
Ecuador	Indonesia	Mexico	Kuwait
Iran	Nigeria	Russia	Qatar
Sudan	Syria	Venezuela	Saudi Arabia
Vietnam			Trinidad & Tobago
Yemen			

Notes: Based on 2009 World Bank country classification (nominal GNI per capita).

Table 2: Differenced GMM, Expenditure as Dependent Variable 1991–2009

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	*0.56***	*0.94***	*1.43***	*-0.57***
	(0.02)	(0.06)	(0.32)	(0.07)
Δ(log(Tot. Expend(t-1)))	0.10***	-0.15***	0.07	0.14***
	(0.01)	(0.02)	(0.21)	(0.02)
Δ(log(TOT))	0.22***	0.24***	-0.15*	0.25***
	(0.01)	(0.05)	(0.08)	(0.05)
Observations	416	209	80	127
No of countries	28	14	6	8
AR(1) test-p	0.0245	0.0843	0.0830	0.130
AR(2) test-p	0.155	0.0660	0.671	0.352
Hansen test-p	0.764	0.998	1	1

Table 3: Differenced GMM, Consumption as Dependent Variable

Independent Variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	*0.72***	*1.16***	*0.57**	*0.17*
	(0.04)	(0.05)	(0.32)	(0.19)
Δ(log(Consump(t-1)))	-0.18***	-0.13***	-0.16	-0.41***
	(0.00)	(0.02)	(0.10)	(0.10)
Δ(log(TOT))	0.14***	0.21***	-0.22	0.11***
	(0.01)	(0.04)	(0.15)	(0.03)
Observations	408	204	78	126
No of countries	28	14	6	8
AR(1) test-p	0.000685	0.0122	0.0493	0.0443
AR(2) test-p	0.481	0.741	0.274	0.754
Hansen test-p	0.773	1.000	1	1

Table 4: Differenced GMM, Non-oil Revenue as Dependent Variable

Independent Variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	*0.71***	*0.93***	*2.22**	*0.11*
	(0.04)	(0.17)	(1.08)	(0.41)
Δ(log(Revenue(t-1)))	-0.28***	-0.28***	-0.21***	-0.39***
	(0.00)	(0.07)	(0.06)	(0.08)
Δ(log(TOT))	0.02	0.03	-0.04	-0.00
	(0.02)	(0.07)	(0.11)	(0.09)
Observations	404	203	79	122
No of countries	28	14	6	8
AR(1) test-p	0.00556	0.0942	0.0944	0.0839
AR(2) test-p	0.348	0.830	0.986	0.758
Hansen test-p	0.797	0.999	1	1.000

Table 5: Differenced GMM, Capital Expenditure as Dependent Variable

Independent Variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	*1.34***	*1.43***	*1.30*	*-0.81**
	(0.06)	(0.21)	(1.05)	(0.48)
Δ(log(Capital Exp.(t-1)))	-0.12***	-0.24***	-0.22*	0.17
	(0.02)	(0.03)	(0.13)	(0.17)
Δ(log(TOT))	0.15***	0.42***	-0.20	-0.19***
	(0.04)	(0.11)	(0.17)	(0.03)
Observations	394	199	75	120
No of countries	28	14	6	8
AR(1) test-p	0.00109	0.0256	0.204	0.0293
AR(2) test-p	0.290	0.0853	0.442	0.383
Hansen test-p	0.552	0.994	1	1

Table 6: Differenced GMM, Non-oil Primary Balance as Dependent Variable

Independent Variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	*-3.70***	*-1.45*	*-0.60*	*-10.02*
	(0.17)	(0.96)	(3.45)	(6.18)
Δ(log(Primary Bal.(t-1)))	-0.13***	-0.11***	-0.12**	-0.27***
	(0.00)	(0.00)	(0.05)	(0.02)
Δ(log(TOT))	1.52***	0.61***	0.15	7.43***
	(0.02)	(0.10)	(0.39)	(1.57)
Observations	416	209	80	127
No of countries	28	14	6	8
AR(1) test-p	0.684	0.161	0.111	0.537
AR(2) test-p	0.247	0.284	0.648	0.700
Hansen test-p	0.707	1.000	1	1

Table 7: Financing Constraints, Impact on Procyclicality, 1991–2009

(Dependent variable: Expenditure, two-step, difference GMM estimates, full sample)

Δ(log(non-oil GDP))	**0.41*****	**0.06****	**0.33*****	**0.43*****	**0.21*****	**0.45*****
	(0.06)	(0.03)	(0.06)	(0.02)	(0.03)	(0.05)
Δ(log(Tot. Expend(t-1)))	0.18***	0.01	0.17***	0.15***	0.05***	0.17***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δ(log(TOT))	0.22***	0.42***	0.20***	0.28***	0.37***	0.25***
	(0.03)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
oilrevshare	0.38***	0.11*	0.38***			
	(0.03)	(0.06)	(0.05)			
lagged real central bank interest rate	0.01***			0.00***		
	(0.00)			(0.00)		
lagged net capital flows to GDP		-0.05***			-0.04***	
		(0.01)			(0.00)	
lagged pivate credit to GDP			0.16***			0.16***
			(0.02)			(0.02)
Observations	325	165	384	338	183	400
No of countries	27	24	28	27	24	28
AR(1) test-p	0.0211	0.167	0.0133	0.0196	0.132	0.00921
AR(2) test-p	0.168	0.269	0.120	0.127	0.282	0.129
Hansen test-p	0.824	0.977	0.744	0.754	0.894	0.644

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

All regressions include country fixed effects. GDP growth is instrumented using the growth of trading partners weighted by exports and past values of real GDP growth. For the lagged dependent variable, the past values are used as instrument.

Table 8: Financing Constraints, Impact on Procyclicality, 1991–2009

(Dependent variable: Expenditure, two-step, difference GMM estimates)

	Low to middle income	Upper-middle income	High income
Δ(log(non-oil GDP))	1.09***	0.00	-1.49***
	(0.30)	(0.00)	(0.38)
Δ(log(Tot. Expend(t-1)))	-0.25***	-6.88	-0.07
	(0.03)	(4.42)	(0.11)
Δ(log(TOT))	0.19***	4.59	0.46***
	(0.06)	(3.05)	(0.06)
oilrevshare	0.39***	-2.60*	0.66**
	(0.13)	(1.46)	(0.31)
lagged real central bank interest rate	-0.00***		
	(0.00)		
lagged net capital flows to GDP		-0.06*	-0.04*
		(0.04)	(0.02)
Observations	160	26	39
No of countries	13	4	7
AR(1) test-p	0.0982	-	0.233
AR(2) test-p	0.115	0.00708	0.415
Hansen test-p	1.000	1	1.000

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

All regressions include country fixed effects. GDP growth is instrumented using the growth of trading partners weighted by exports and past values of real GDP growth. For the lagged dependent variable, the past values are used as instrument.

Table 9: Political Factors, Impact on Procyclicality[20], 1991–2009

(Dependent variable: Expenditure, two-step, difference GMM estimates, full sample)

Δ(log(non-oil GDP))	**1.00*** **	**0.98*** **	**0.93*** **	**0.90*** **	**0.48*** **	**0.39*** **	**0.39*** **	**0.46*** **
	(0.05)	(0.05)	(0.04)	(0.05)	(0.02)	(0.04)	(0.04)	-0.03
Δ(log(Tot. Expend(t-1)))	-0.13***	-0.12***	-0.10***	-0.12***	0.10***	0.07***	0.07***	0.08***
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	-0.02
Δ(log(TOT))	0.09***	0.07***	0.07***	0.07***	0.15***	0.20***	0.19***	0.18***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	-0.02
oilrevshare	0.36***	0.41***	0.44***	0.41***	0.43***	0.39***	0.39***	0.41***
	(0.04)	(0.08)	(0.07)	(0.03)	(0.04)	(0.04)	(0.04)	-0.05
bureaucracy quality	-0.62***							
	(0.09)							
composite index		-0.00						
		(0.01)						
law and order			0.02					
			(0.38)					
risk for international liquidity				-0.19***				
				(0.03)				
democracy					0.09***			
					(0.01)			
constraints on executives						-0.03***		
						(0.00)		
political competition							-0.03***	
							(0.00)	
checks and balances								0.00***
								(0.00)
Observations	377	377	377	377	382	382	382	387
No of countries	26	26	26	26	27	27	27	28
AR(1) test-p	0.00860	0.00760	0.00756	0.00914	0.0320	0.0345	0.0345	0.0277
AR(2) test-p	0.370	0.409	0.369	0.306	0.150	0.146	0.146	0.159
Hansen test-p	0.889	0.860	0.860	0.836	0.928	0.869	0.874	0.767

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

All regressions include country fixed effects. GDP growth is instrumented using the growth of trading partners weighted by exports and past values of real GDP growth. For the lagged dependent variable, the past values are used as instrument.

[20] Corruption was included in the regressions, but, as the results were not significant, it was not included in the tables.

Table 10: Political and Institutional Factors, Impact on Procyclicality, 1991–2009

(Dependent variable: Expenditure, two-step, difference GMM estimates)

	Low to middle income							Upper-middle income		
Δ(log(non-oil GDP))	**0.96*** **	**0.94*** **	**0.70*** **	**0.82*** **	**0.55** **	**0.63** **	**0.13*** **	**1.71**	**3.41**	**9.27** **
	(0.24)	(0.19)	(0.18)	(0.20)	(0.23)	(0.25)	-0.05	(2.77)	(2.64)	-4.35
Δ(log(Tot. Expend(t-1)))	-0.20***	-0.21***	-0.22***	-0.18***	-0.24***	-0.24***	0.85***	-0.37	0.36	-1.82*
	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	-0.18	(1.30)	(0.26)	-1.09
Δ(log(TOT))	0.15***	0.13***	0.13***	0.10**	0.14***	0.15***	-0.21***	-0.41*	-0.12	-1.41**
	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	-0.04	(0.24)	(0.14)	-0.62
oilrevshare	0.56***	0.53***	0.54***	0.43***	0.39***	0.36***	0.43***	0.09	-0.62	3.84*
	(0.08)	(0.07)	(0.05)	(0.07)	(0.08)	(0.09)	-0.1	(2.18)	(1.46)	-2.03
bureaucracy quality	-0.93***									
	(0.18)									
composite index								0.08**		
								(0.04)		
law and order		0.37***								
		(0.11)								
risk for international liquidity			-0.13***						-0.58*	
			(0.05)						(0.34)	
democracy				0.08***						
				(0.02)						
					-0.02***					
					(0.00)					
						-0.02**				
						(0.01)				
checks and balances							0.00***			-0.10*
							(0.00)			-0.05
Observations	186	186	186	191	191	191	184	80	80	76
No of countries	13	13	13	14	14	14	14	6	6	6
AR(1) test-p	0.120	0.158	0.238	0.143	0.176	0.252	0.181	0.0545	0.291	0.035
AR(2) test-p	0.139	0.0551	1.48e-07	0.0410	0.0253	0.00352	0.0312	0.457	0.446	-
Hansen test-p	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

All regressions include country fixed effects. GDP growth is instrumented using the growth of trading partners weighted by exports and past values of real GDP growth. For the lagged dependent variable, the past values are used as instrument.

Appendix

Table A1: Definitions and Sources of Variables

Variable	Source	Description
Independent variable		
Real non-oil GDP growth	WEO	Growth in nominal GDP deflated using the CPI
Dependent variables	Villafuerte and Lopez-Murphy (2010) and WEO	
Real total government spending		Growth in nominal GDP deflated using the CPI
Real government consumption		
Real capital spending		
Real non-oil primary balance		
Real non-oil revenue		
Financial constraints variables		
Domestic		
Real central bank interest rate	WEO/IFS	
Private credit to GDP	WDI	
External		
Net foreign capital flows	WEO	
Debt-GDP ratio	WDI	
Inflation	WEO	
Political and Institutional Variables		
Bureaucracy Quality	ICRG	(Rating 0 to 4: low rating, low bureaucracy quality)
Composite Risk Rating	ICRG	(Rating 0 to 100; 0 is high risk, 100 is low risk)
Corruption	ICRG	(Rating 0 to 6; 0 is high, 6 is low corruption)
Law & Order	ICRG	(Rating 1 to 3; low rating, low law obedience)
Democracy	Polity4 database, polity2 variable	Difference between a democracy index (0 to 10) and an autocracy index (0 to 10)
Constraints on the executive	Polity4 database, xconst variable	Extent of institutionalized constraints on the decision making powers of chief
Political competition	Polity4 database, Polcom variable	Degree of institutionalization of political competition combined with the extent of government restriction on political competition, from 1 to 10
Other Control Variables		
Oil revenue as share of total revenue	WEO	

Table A2: Descriptive Statistics

		Low to middle income	Upper-middle income	High income	All countries
Real Non-oil GDP Growth	Mean	3.8	4.3	7.2	5.0
	Median	5.5	4.5	3.9	4.8
	St. Dev.	12.9	9.0	12.0	12.0
	Observation	241	89	155	485
Real Government Spending Growth	Mean	5.0	5.5	6.4	5.6
	Median	6.2	5.2	6.1	6.0
	St. Dev.	23.2	17.1	25.5	23.0
	Observation	244	98	173	515
Real Government Consumption Growth	Mean	4.0	5.9	5.6	4.9
	Median	7.2	5.9	5.1	6.2
	St. Dev.	23.3	16.4	13.6	19.3
	Observation	238	92	162	492
Real Government Investment Growth	Mean	9.3	9.3	8.9	9.2
	Median	7.1	9.3	4.1	7.1
	St. Dev.	42.2	33.5	29.5	36.8
	Observation	227	88	153	468
Real Non-oil Primary Balance Growth	Mean	-0.5	-18.3	45.2	10.9
	Median	5.6	0.1	6.7	5.8
	St. Dev.	216.7	194.0	637.9	402.2
	Observation	244	100	165	509
Real Non-oil Revenue Growth	Mean	4.5	4.1	4.7	4.5
	Median	6.2	5.5	4.3	5.6
	St. Dev.	24.1	22.4	34.8	27.7
	Observation	238	97	160	495
	Countries	14	6	9	29

Table A3: Correlation between Fiscal Variable and Other Relevant Variables

Low income	Total expenditure	Consumption	Capital expenditure	Non-oil revenue	Non-oil primary balance
Gross international reserve	0.414	0.414	0.351	0.356	-0.374
Share of oil revenue in total revenue	-0.330	-0.326	-0.274	-0.417	-0.018
Debt to GDP ratio	-0.301	-0.287	-0.331	-0.257	0.306
Inflation	-0.095	-0.094	-0.091	-0.100	0.048
Oil wealth	0.331	0.353	0.315	0.093	**-0.782**
GDP per capita	**0.955**	**0.943**	**0.903**	**0.902**	-0.684
The size of public sector	-0.368	-0.359	-0.347	-0.382	0.169
Capital flows	0.129	0.088	0.250	0.183	-0.015
Population	**0.746**	**0.729**	**0.655**	**0.785**	-0.310
Military expenditure (in % of GDP)	-0.291	-0.284	-0.260	-0.310	0.113
Domestic credit to private sector (% of GDP)	**0.625**	**0.602**	**0.689**	**0.560**	**-0.579**
Bureaucracy quality	**0.470**	**0.472**	**0.436**	**0.427**	-0.370
Corruption	0.002	-0.039	0.133	-0.011	-0.083
Composite index	0.152	0.126	0.245	0.113	-0.237
Law and order	0.113	0.092	0.215	0.053	-0.263
Risk for international liquidity	0.155	0.160	0.102	0.160	-0.066
Democracy	0.198	0.217	0.122	0.234	0.011
Constraints on executives	0.100	0.104	0.081	0.106	-0.037
Political competition	0.088	0.094	0.059	0.097	-0.017
Middle income					
Gross international reserve	-0.083	-0.058	-0.131	-0.048	0.095
Share of oil revenue in total revenue	0.025	0.030	0.014	-0.029	-0.094
Debt to GDP ratio	0.111	0.090	0.183	0.132	-0.035
Inflation	**0.443**	**0.392**	**0.574**	**0.548**	**-0.227**
Oil wealth	**0.555**	**0.593**	**0.430**	**0.551**	**-0.576**
GDP per capita	-0.200	-0.202	-0.194	-0.212	0.167
The size of public sector	0.365	0.342	0.424	0.356	-0.353
Capital flows	-0.242	-0.247	-0.225	-0.236	0.242
Population	-0.186	-0.157	-0.218	-0.152	0.198
Military expenditure (in % of GDP)	-0.087	-0.084	-0.083	-0.060	0.102
Domestic credit to private sector (% of GDP)	-0.187	-0.175	-0.216	-0.179	0.145
Bureaucracy quality	-0.282	-0.302	-0.241	-0.274	0.280
Corruption	-0.047	-0.082	0.010	-0.010	0.122
Composite index	**-0.343**	**-0.344**	**-0.431**	**-0.337**	**0.283**
Law and order	-0.320	-0.362	-0.237	-0.243	0.403
Risk for international liquidity	0.322	0.336	0.287	0.282	-0.357
Democracy	**0.460**	**0.464**	**0.441**	**0.490**	**-0.361**
Constraints on executives	0.399	0.395	0.395	0.435	-0.288
Political competition	0.362	0.367	0.349	0.405	-0.260

Table A3: Continued

High income					
Gross international reserve	**0.827**	**0.788**	**0.932**	**0.832**	**-0.837**
Share of oil revenue in total revenue	0.045	0.024	0.067	0.004	-0.055
Debt to GDP ratio	0.160	0.182	0.039	0.123	-0.107
Inflation	-0.021	-0.048	0.224	0.012	-0.022
Oil wealth	**0.845**	**0.819**	**0.883**	**0.859**	**-0.839**
GDP per capita	0.293	0.306	0.298	0.302	-0.355
The size of public sector	-0.198	-0.199	-0.263	-0.199	0.206
Capital flows	0.090	0.076	0.215	0.029	-0.132
Population	**0.942**	**0.950**	**0.804**	**0.889**	**-0.913**
Military expenditure (in % of GDP)	-0.111	-0.113	-0.120	-0.121	0.127
Domestic credit to private sector (% of GDP)	0.366	0.376	0.279	0.364	-0.367
Bureaucracy quality	-0.122	-0.125	-0.128	-0.087	0.092
Corruption	-0.581	-0.596	-0.527	-0.552	0.608
Composite index	-0.038	-0.054	-0.071	0.009	0.032
Law and order	0.151	0.148	0.034	0.121	-0.107
Risk for international liquidity	-0.037	-0.032	-0.049	0.004	0.067
Democracy	-0.703	-0.713	-0.624	-0.638	0.684
Constraints on executives	**-0.661**	**-0.668**	**-0.582**	**-0.590**	**0.623**
Political competition	**-0.502**	**-0.514**	**-0.471**	**-0.473**	**0.524**

Estimation with OLS

Table A4: Pooled OLS, expenditure as dependent variable

Independent variables	Full sample	Low income	Middle income	High income
Base Regression				
Δ(log(non-oil GDP))	**0.78*****	**1.18*****	**1.24*****	**-0.06**
	(0.08)	(0.09)	(0.16)	(0.17)
Constant	0.02**	0.01	0.01	0.07***
	(0.01)	(0.01)	(0.02)	(0.02)
Observations	477	233	89	155
R-squared	0.17	0.43	0.41	0.00
Regression with control variables				
Δ(log(non-oil GDP))	**0.62*****	**1.10*****	**1.25*****	**-0.16**
	(0.08)	(0.10)	(0.17)	(0.16)
Δlog(TOT)	0.30***	0.24***	-0.10	0.45***
	(0.05)	(0.06)	(0.10)	(0.09)
Δ(log(Tot. Expend(t-1)))	0.03	-0.10**	-0.00	0.14*
	(0.04)	(0.05)	(0.09)	(0.08)
Constant	0.02**	0.01	0.02	0.06***
	(0.01)	(0.01)	(0.02)	(0.02)
Observations	460	223	86	151
R-squared	0.19	0.41	0.40	0.19

Table A5: Pooled OLS, Consumption as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Base Regression				
Δ(log(non-oil GDP))	**0.85*****	**1.12*****	**1.00*****	**0.35*****
	(0.06)	(0.09)	(0.17)	(0.09)
Constant	0.01	0.00	0.02	0.03**
	(0.01)	(0.01)	(0.02)	(0.01)
Observations	472	229	88	155
R-squared	0.29	0.40	0.29	0.10
Regression with control variables				
Δ(log(non-oil GDP))	**0.73*****	**1.00*****	**1.03*****	**0.29*****
	(0.06)	(0.10)	(0.17)	(0.08)
Δlog(TOT)	0.15***	0.25***	-0.21**	0.12**
	(0.04)	(0.06)	(0.10)	(0.05)
Δ(log(Consump(t-1)))	-0.08**	-0.09*	-0.10	-0.19***
	(0.04)	(0.05)	(0.09)	(0.07)
Constant	0.02**	0.01	0.04*	0.05***
	(0.01)	(0.01)	(0.02)	(0.01)
Observations	452	218	84	150
R-squared	0.26	0.39	0.31	0.17

Table A6: Pooled OLS, Non-Oil Revenue as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Base Regression				
Δ(log(non-oil GDP))	**0.82*****	**0.97*****	**0.99*****	**0.51****
	(0.09)	(0.10)	(0.21)	(0.22)
Constant	0.02	0.01	0.01	0.03
	(0.01)	(0.01)	(0.02)	(0.03)
Observations	466	227	89	150
R-squared	0.14	0.28	0.21	0.04
Regression with control variables				
Δ(log(non-oil GDP))	**0.91*****	**1.02*****	**1.04*****	**0.69*****
	(0.10)	(0.11)	(0.22)	(0.23)
Δ(log(Revenue(t-1)))	-0.24***	-0.27***	-0.11	-0.26***
	(0.04)	(0.06)	(0.09)	(0.08)
Δlog(TOT)	0.07	0.08	-0.03	0.08
	(0.06)	(0.07)	(0.13)	(0.12)
Constant	0.03**	0.03**	0.02	0.03
	(0.01)	(0.01)	(0.02)	(0.03)
Observations	448	217	85	146
R-squared	0.20	0.31	0.22	0.12

Table A7. Pooled OLS, Capital Expenditure as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Base Regression				
Δ(log(non-oil GDP))	**0.89*** **	**1.37*** **	**2.03*** **	**0.26**
	(0.13)	(0.21)	(0.35)	(0.20)
Constant	0.05***	0.04	0.01	0.07**
	(0.02)	(0.03)	(0.03)	(0.03)
Observations	465	213	86	153
R-squared	0.09	0.23	0.29	0.01
Regression with control variables				
Δ(log(non-oil GDP))	1.12***	1.37***	2.06***	0.33
	(0.15)	(0.21)	(0.38)	(0.23)
Δ(log(Capital Exp.(t-1)))	-0.15***	-0.24***	-0.06	0.01
	(0.04)	(0.06)	(0.10)	(0.09)
Δlog(TOT)	0.14	0.40***	-0.01	-0.11
	(0.08)	(0.13)	(0.21)	(0.12)
Constant	0.04**	0.04	0.01	0.07**
	(0.02)	(0.03)	(0.04)	(0.03)
Observations	438	213	81	144
R-squared	0.13	0.23	0.29	0.02

Table A8: Pooled OLS, Non-Oil Primary Balance as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Base Regression				
Δ(log(non-oil GDP))	**-0.24**	**1.46**	**2.06**	**-4.80**
	(1.55)	(1.11)	(1.44)	(4.42)
Constant	0.16	-0.07	-0.12	0.84
	(0.20)	(0.15)	(0.14)	(0.62)
Observations	477	233	89	155
R-squared	0.00	0.01	0.02	0.01
Regression with control variables				
Δ(log(non-oil GDP))	**-0.99**	**1.53**	**1.78**	**-5.90**
	(1.68)	(1.28)	(1.42)	(4.43)
Δ(log(Primary Bal.(t-1)))	-0.05	-0.09	0.07	-0.08
	(0.05)	(0.07)	(0.09)	(0.08)
Δlog(TOT)	2.97***	0.22	0.30	7.01***
	(1.01)	(0.81)	(0.81)	(2.54)
Constant	0.14	-0.09	-0.08	0.77
	(0.21)	(0.16)	(0.14)	(0.63)
Observations	460	223	86	151
R-squared	0.02	0.02	0.03	0.06

Estimation with Fixed effects

Table A9: Fixed Effects, Expenditure as Dependent Variable

lependent variables	Full sample	Low income	Middle income	High income
og(non-oil GDP))	**0.55*** **	**1.10*** **	**1.24*** **	**-0.31**
	(0.17)	(0.16)	(0.24)	(0.22)
)g(TOT)	0.31***	0.23***	-0.10	0.49**
	(0.10)	(0.08)	(0.14)	(0.23)
.og(Tot. Expend(t-1)))	-0.00	-0.12	-0.04	0.09
	(0.13)	(0.10)	(0.13)	(0.26)
nstant	0.03	0.02	0.02	0.07*
	(0.02)	(0.01)	(0.02)	(0.04)
servations	460	223	86	151
squared	0.16	0.38	0.38	0.21
of countries	29	14	6	9

Table A10: Fixed Effects, Consumption as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**0.67*** **	**0.98*** **	**1.02*** **	**0.16**
	(0.13)	(0.16)	(0.20)	(0.11)
Δ(log(Consump(t-1)))	-0.12*	-0.11	-0.12	-0.30***
	(0.07)	(0.09)	(0.08)	(0.08)
Δlog(TOT)	0.15***	0.25***	-0.21	0.14***
	(0.05)	(0.07)	(0.13)	(0.05)
Constant	0.02**	0.01	0.04**	0.06***
	(0.01)	(0.01)	(0.02)	(0.01)
Observations	452	218	84	150
R-squared	0.24	0.36	0.30	0.22
No of countries	29	14	6	9

Table A11: Fixed Effects, Non-Oil Revenue As Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**0.88*** **	**0.98*** **	**1.09*** **	**0.64** **
	(0.13)	(0.10)	(0.35)	(0.28)
Δ(log(Revenue(t-1)))	-0.26***	-0.28**	-0.11	-0.27*
	(0.08)	(0.11)	(0.13)	(0.14)
Δlog(TOT)	0.06	0.08	-0.04	0.07
	(0.08)	(0.08)	(0.14)	(0.16)
Constant	0.03**	0.03*	0.02	0.04
	(0.01)	(0.02)	(0.02)	(0.03)
Observations	448	217	85	146
R-squared	0.18	0.28	0.22	0.12
No of countries	29	14	6	9

Table A12: Fixed Effects, Capital Expenditure as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**1.08*** **	**1.39*** **	**1.92*** **	**0.20**
	(0.24)	(0.31)	(0.57)	(0.25)
Δ(log(Capital Exp.(t-1)))	-0.18***	-0.27***	-0.11	-0.02
	(0.07)	(0.09)	(0.12)	(0.12)
Δlog(TOT)	0.15	0.40**	0.01	-0.09
	(0.11)	(0.16)	(0.28)	(0.18)
Constant	0.05**	0.04	0.03	0.08**
	(0.02)	(0.03)	(0.04)	(0.03)
Observations	438	213	81	144
R-squared	0.13	0.23	0.26	0.01
No of countries	29	14	6	9

Table A13: Fixed Effects, Non-Oil Primary Balance as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**-3.24**	**2.16** **	**1.67***	**-11.54**
	(3.91)	(0.91)	(0.92)	(9.59)
Δ(log(Primary Bal.(t-1)))	-0.12	-0.14	0.05	-0.17
	(0.11)	(0.10)	(0.07)	(0.16)
Δlog(TOT)	3.32	0.00	0.49	8.10
	(2.69)	(0.56)	(0.69)	(6.64)
Constant	0.26	-0.11	-0.08	1.20
	(0.33)	(0.16)	(0.13)	(1.06)
Observations	460	223	86	151
R-squared	0.04	0.03	0.03	0.11
No of countries	29	14	6	9

Estimation with 2SLS and Fixed Effects

Table A14. 2SLS with Fixed Effects, expenditure as dependent variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**0.55*****	**1.10*****	**1.24*****	**-0.31**
	(0.17)	(0.16)	(0.24)	(0.22)
Δlog(TOT)	0.31***	0.23***	-0.10	0.49**
	(0.10)	(0.08)	(0.14)	(0.23)
Δ(log(Tot. Expend(t-1)))	-0.00	-0.12	-0.04	0.09
	(0.13)	(0.10)	(0.13)	(0.26)
Constant	0.03	0.02	0.02	0.07*
	(0.02)	(0.01)	(0.02)	(0.04)
Observations	460	223	86	151
R-squared	0.16	0.38	0.38	0.21
No of countries	29	14	6	9

Table A15: 2SLS with Fixed Effects, Consumption as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**0.67*****	**0.98*****	**1.02*****	**0.16**
	(0.13)	(0.16)	(0.20)	(0.11)
Δ(log(Consump(t-1)))	-0.12*	-0.11	-0.12	-0.30***
	(0.07)	(0.09)	(0.08)	(0.08)
Δlog(TOT)	0.15***	0.25***	-0.21	0.14***
	(0.05)	(0.07)	(0.13)	(0.05)
Constant	0.02**	0.01	0.04**	0.06***
	(0.01)	(0.01)	(0.02)	(0.01)
Observations	452	218	84	150
R-squared	0.24	0.36	0.30	0.22
No of countries	29	14	6	9

Table A16: 2SLS with Fixed Effects, Non-Oil Revenue as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(Revenue(t-1)))	-0.26***	-0.28**	-0.11	-0.27*
	(0.08)	(0.11)	(0.13)	(0.14)
Δlog(TOT)	0.06	0.08	-0.04	0.07
	(0.08)	(0.08)	(0.14)	(0.16)
Δ(log(non-oil GDP))	**0.88*****	**0.98*****	**1.09*****	**0.64****
	(0.13)	(0.10)	(0.35)	(0.28)
Constant	0.03**	0.03*	0.02	0.04
	(0.01)	(0.02)	(0.02)	(0.03)
Observations	448	217	85	146
R-squared	0.18	0.28	0.22	0.12
No of countries	29	14	6	9

Table A17: 2SLS with Fixed Effects, Capital Expenditure as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(Capital Exp.(t-1)))	-0.18***	-0.27***	-0.11	-0.02
	(0.07)	(0.09)	(0.12)	(0.12)
Δlog(TOT)	0.15	0.40**	0.01	-0.09
	(0.11)	(0.16)	(0.28)	(0.18)
Δ(log(non-oil GDP))	**1.08*** **	**1.39*** **	**1.92*** **	**0.20**
	(0.24)	(0.31)	(0.57)	(0.25)
Constant	0.05**	0.04	0.03	0.08**
	(0.02)	(0.03)	(0.04)	(0.03)
Observations	438	213	81	144
R-squared	0.13	0.23	0.26	0.01
No of countries	29	14	6	9

Table A18: 2SLS with Fixed Effects, non-oil primary balance as dependent variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(Primary Bal.(t-1)))	-0.12	-0.14	0.05	-0.17
	(0.11)	(0.10)	(0.07)	(0.16)
Δlog(TOT)	3.32	0.00	0.49	8.10
	(2.69)	(0.56)	(0.69)	(6.64)
Δ(log(non-oil GDP))	**-3.24**	**2.16** **	**1.67***	**-11.54**
	(3.91)	(0.91)	(0.92)	(9.59)
Constant	0.26	-0.11	-0.08	1.20
	(0.33)	(0.16)	(0.13)	(1.06)
Observations	460	223	86	151
R-squared	0.04	0.03	0.03	0.11
No of countries	29	14	6	9

Estimation with System GMM

Table A19: System GMM, Expenditure as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**0.64*** **	**1.16*** **	**1.50*** **	**-0.32** **
	(0.05)	(0.05)	(0.50)	(0.16)
Δ(log(Tot. Expend(t-1)))	0.05***	-0.10***	-0.25	0.10
	(0.01)	(0.04)	(0.30)	(0.07)
Δ(log(TOT))	0.24***	0.19***	-0.26	0.29***
	(0.01)	(0.03)	(0.19)	(0.05)
Constant	0.02***	0.01***	0.02*	0.07***
	(0.00)	(0.00)	(0.01)	(0.01)
Observations	444	223	86	135
No of countries	28	14	6	8
AR1	0.0128	0.0464	0.135	0.196
AR2	0.151	0.0810	0.816	0.348
Hansen test-p	1.000	1	1	1

Table A20: System GMM, Consumption as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**0.91*** **	**1.04*** **	**1.03**	**3.00** **
	(0.05)	(0.16)	(0.87)	(1.42)
Δ(log(Consump(t-1)))	-0.11***	-0.13*	-0.13	-0.27
	(0.01)	(0.07)	(0.37)	(0.20)
Δ(log(TOT))	0.12***	0.21***	-0.13	-0.01
	(0.01)	(0.04)	(0.21)	(0.07)
Constant	0.01***	0.01	0.03	-0.16
	(0.00)	(0.01)	(0.02)	(0.11)
Observations	436	218	84	134
No of countries	28	14	6	8
AR1	0.000267	0.0109	0.250	0.167
AR2	0.822	0.879	0.844	0.182
Hansen test-p	1.000	1	1	1

Table A21: System GMM, Non-Oil Revenue as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**1.00*** **	**0.87** **	**1.92**	**5.26***
	(0.02)	(0.31)	(4.87)	(2.69)
Δ(log(Revenue(t-1)))	-0.20***	-0.18	-0.02	0.02
	(0.01)	(0.13)	(0.36)	(0.15)
Δ(log(TOT))	0.05***	0.05	-0.14	0.02
	(0.01)	(0.09)	(0.28)	(0.07)
Constant	0.02***	0.03	-0.03	-0.32
	(0.00)	(0.02)	(0.20)	(0.20)
Observations	432	217	85	130
No of countries	28	14	6	8
AR1	0.00495	0.0850	0.250	0.00356
AR2	0.0988	0.435	0.944	0.00998
Hansen test-p	1.000	1	1	1

Table A22: System GMM, Capital Expenditure as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**1.61*** **	**1.95*** **	**2.71**	**-0.16**
	(0.16)	(0.24)	(3.29)	(1.49)
Δ(log(Capital Exp.(t-1)))	-0.15***	-0.26***	-0.17	0.26
	(0.02)	(0.03)	(0.47)	(0.17)
Δ(log(TOT))	0.11***	0.39***	-0.18	-0.17***
	(0.02)	(0.10)	(0.20)	(0.03)
Constant	0.02**	0.02***	-0.01	0.08
	(0.01)	(0.01)	(0.08)	(0.11)
Observations	422	213	81	128
No of countries	28	14	6	8
AR1	0.000508	0.0177	0.0690	0.0329
AR2	0.347	0.0788	0.888	0.285
Hansen test-p	1.000	1	1	1

Table A23: System GMM, Non-Oil Primary Balance as Dependent Variable

Independent variables	Full sample	Low income	Middle income	High income
Δ(log(non-oil GDP))	**-1.17*** **	**-0.34**	**-3.16**	**-5.59*** **
	(0.11)	(1.25)	(10.85)	(1.46)
Δ(log(Primary Bal.(t-1)))	-0.04***	-0.10***	-0.18	-0.08***
	(0.00)	(0.00)	(0.22)	(0.00)
Δ(log(TOT))	1.76***	0.44***	0.23	6.18***
	(0.01)	(0.11)	(0.64)	(0.12)
Constant	0.22***	0.02	0.17	0.86***
	(0.00)	(0.04)	(0.39)	(0.14)
Observations	444	223	86	135
No of countries	28	14	6	8
AR1	0.237	0.163	0.174	0.0639
AR2	0.758	0.317	0.788	0.531
Hansen test-p	1.000	1	1	1