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Resource Windfalls, Macroeconomic Stability and Growth: The Role of Political Institutions

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CESIFO WORKING PAPER NO. 3678
CATEGORY 6: FISCAL POLICY, MACROECONOMICS AND GROWTH
DECEMBER 2011

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Abstract

We use a new dataset on non-resource GDP to examine the performance of commodity-exporting countries in terms of macroeconomic stability and economic growth in a panel of up to 129 countries during the period 1970-2007. Our main findings are threefold. First, we find that overall government spending in commodity-exporting countries has been procyclical. Second, we find that resource windfalls initially crowd out non-resource GDP which then increases as a result of the fiscal expansion. Third, we find that in the long run resource windfalls have negative effects on non-resource sector GDP growth. Yet, the effects turn out to be statistically insignificant when controlling for government spending. Both the effects of resource windfalls on macroeconomic stability and economic growth are moderated by the quality of political institutions.

JEL-Code: O130, H300, C330.

Keywords: commodity, fiscal policy, macroeconomic stability, economic growth.

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November 2011
The views expressed in this paper are those of the authors alone and do not necessarily represent those of the IMF or the World Bank. All remaining errors are ours.

1. Introduction

Fluctuations in commodity prices pose serious challenges to developing countries. In the present paper, we focus on the effects that these price fluctuations may have on commodity-exporting countries. Indeed, the episodes of sharp increases in commodity prices since the early 2000s have renewed the debate among academics and policy makers on the risks faced by commodity exporters. Figure 1 shows that the evolution of government spending tracks that of the index of commodity export price in Venezuela and the extent of the synchronization has been increasing during the 2000's commodity price boom. In contrast, Figure 2 shows that government spending appears to move exactly opposite compared to the index of commodity export price in Norway. This cursory look at the data seems to suggest that there may be some fundamental factors which may shape the commodity exporters' reaction to commodity price fluctuations. In this paper, we rigorously examine the impact of resource windfalls on macroeconomic stability and long run economic growth using panel data for a world sample of up to 134 countries during the period 1970-2007.

This paper makes two main contributions. First, the paper specifically focuses on the effect of resource windfalls on the non-resource sector. To do so, we use a new dataset on non-resource GDP allowing us to avoid the "noise" introduced by the resource sector contribution to the overall GDP.[1] Indeed, Hartwick (1977) provides a canonical rule for sustainability in resource dependent economies which can help consumption to be maintained indefinitely, even in the face of finite resources and fixed technology. The rule consists in setting genuine saving to zero at each point in time; this sets traditional net savings just equal to resource depletion. From that perspective, non-resource sector GDP should thus be the relevant measure to be used when assessing both macroeconomic stability and long run economic performance in commodity-exporting countries.

[1] Section 2 describes the estimation of the non-resource GDP which takes into account the depletion of the stock of natural resources.

From a policy perspective, preserving the macroeconomic stability of the non-resource sector specifically will contribute to fostering investments in that sector and thus will contribute to sustained economic growth after natural resources are depleted. Second, unlike in previous studies, the econometric investigation explicitly takes into account the role of fiscal policy (government spending more specifically) in the analysis of the so called "resource curse".[2] Indeed, the resource sector often lacks direct structural linkages with the rest of the economy but exercises a significant externality mostly through the fact that a large chunk of government spending is financed from revenues originating from the resource sector (through state ownership or taxation or export tariffs...). Identifying the nature of that externality can help foster our understanding of both the short run dynamics of the non-resource sector and its long run economic viability after natural resources are depleted.

Our main findings are threefold. First, we find that overall government spending in commodity-exporting countries has been procyclical. Second, we find that resource windfalls initially crowd out non-resource GDP which then increases as a result of the fiscal expansion. Third, we find that in the long run resource windfalls have negative effects on the non-resource sector GDP growth. Yet, the effects turn out to be statistically insignificant when controlling for government spending. Both effects of resource windfalls on macroeconomic stability and on growth are moderated by the quality of political institutions.

This paper links to the literature on the role of fiscal policy in shaping the economic performance of developing countries. There is ample evidence that fiscal policy in developing countries has achieved mixed results both in the short and long run. In the short run, Kaminsky, Reinhart, and Vegh (2004), among others, provide evidence that fiscal policy tends to be procyclical in developing countries especially when compared to industrialized countries. Three

[2] Gylfason (2001) and Sachs and Warner (1995) have provided early evidence of a significant negative correlation between natural resource abundance and economic growth.

important characteristics of commodity-exporting countries complicate the conduct of fiscal policy and are likely to make government spending more procyclical than in non commodity-exporting countries. First, government revenues derived from the exploitation of natural resources are more volatile than other sources of government revenue. Second, the size of the revenues derived from natural resources is often disproportionately large in commodity-exporting countries. Third, those revenues are prone to rent-seeking behavior as they transit more directly to the government coffers. Cuddington (1989) provides some evidence supporting the claim that fiscal policy is more procyclical in commodity-exporting countries. In the long run, there is also mixed evidence that government spending has helped boost developing countries' economic performance (see Blejer and Khan (1984) and Khan (1996)). Gelb (1988) provides careful case studies that governments in those commodity-exporting countries often embark on large investment projects following commodity price booms. He argues that those investment projects were plagued by inefficiencies and also contributed to resource misallocation. In addition, those disproportionally large investment projects get depreciated quickly or even become obsolete as governments are unable to cover the associated high maintenance costs due to lack of continued financing. Torvik and Robinson (2005) provide a political economy model, where "white elephants" may be preferred to socially efficient projects when the political benefits are large compared to the economic surplus generated. This evidence could suggest that poor long-run economic performance in commodity-exporting countries may stem from both inefficiencies in government spending rather than underinvestment.

Further, this paper relates to the literature on the resource curse focusing specifically on the effects of resource endowment on the economic performance of commodity-exporting countries. This literature has emphasized several channels through which resource windfalls may affect economic performance, including the so called "Dutch disease" and a deterioration of institutions,

to name a few (see Frankel (2011), for a survey).[3] Overall, there is some evidence, albeit controversial, that commodity-exporting countries' growth performance compares less favorably with the growth performance of non commodity-exporting countries. Among others, Alexeev and Conrad (2009) provide evidence supporting a more skeptical view of the resource curse. Using traditional cross-sectional growth regressions, they find, for instance, that the empirical association between resource dependence and economic performance is not robust to using samples with different starting years or to the inclusion of additional controls. In a recent attempt to reconcile these conflicting evidences regarding the existence of a resource curse, Collier and Goderis (2007) use panel cointegration techniques allowing them to disentangle the short and long run effects of resource windfalls on overall GDP growth. They find that commodity price shocks have a positive effect in the short run but a negative effect in the long run.

This paper also relates to the literature which has stressed the importance of political institutions in achieving better policy outcomes (see for example Persson, 2002). In their seminal contribution to the growth and institutions literature, Acemoglu et al. (2001, 2002) have shown that political institutions are key determinants for long-run economic development.

The remainder of this paper is organized as follows. Section 2 describes the data. Section 3 presents the estimation strategy and main results. Section 4 discusses a number of robustness checks. Section 5 concludes.

[3] This paper departs from the traditional Dutch disease literature distinguishing between tradable and non tradable sectors. Instead, we focus here on the distinction between the resource and non-resource sector.

2. Data

2.1. Non-resource GDP (NRGDP)

Non-resource GDP is approximated by subtracting the real values of natural resources rents from total GDP in 2005 PPP adjusted USD (see Hamilton and Ruta (2008), for more details on resource rents computation).[4] Natural resources give rise to rents because they are not produced; in contrast, for produced goods and services competitive forces will expand supply until economic profits are driven to zero. An economic rent represents an excess return to a given factor of production. For each type of resource and each country, unit resource rents are thereby derived by taking the difference between world prices (to reflect the social opportunity cost of resource extraction) and the average unit extraction or harvest costs (including a "normal" return on capital). Unit rents are then multiplied by the physical quantity extracted or harvested to arrive at total rent.[5]

2.2. Resource Windfalls

To capture revenue windfalls from international commodity price booms, we construct a country-specific and plausibly exogenous index. The index consists of a geometric average of international prices of various commodities using (time-invariant) weights based on the average value of exports of each commodity in the GDP for a given country. Annual international commodity price data are for the 1970-2007 period from UNCTAD Commodity Statistics, while data on the value of commodity exports is from the NBER-United Nations Trade Database. Because the time-series behavior of many international commodity prices is highly persistent, resource windfall shocks are identified by the (log) change in the international commodity price.[6]

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[4] The resource rents data are from World Bank (2011). The GDP data are from Heston et al. (2009).

[5] The energy resources include oil, natural gas and coal, while metals and minerals include bauxite, copper, gold, iron ore, lead, nickel, phosphate, silver, tin, and zinc.

[6] The commodities included in the commodity export price index are aluminum, beef, coffee, cocoa, copper, cotton, gold, iron, maize, oil, rice, rubber, sugar, tea, tobacco, wheat, and wood. In case there were multiple prices listed for the same commodity a simple arithmetic price average was used.

2.3. Political Institutions: Democracy

Democracy is measured by the revised combined Polity score (Polity2) of the Polity IV database (Marshall and Jaggers, 2009). The classification uses a 10-point scale that categorizes four attributes of political systems: the competitiveness of political participation, the competitiveness of executive recruitment, the openness of executive recruitment, and the constraints on the chief executive. At one end of the scale, +10, are the most politically competitive and open democracies. At the other, –10, are the least open and competitive autocracies. Following Persson and Tabellini (2003, 2006) and the Polity IV project, we classify countries as deep democracies, if their Polity2 score is larger than or equal to 6, and as deep autocracies, if their Polity2 score is smaller than or equal to -6.

3. Estimation Strategy and Main Results

3.1. Preliminary Analysis

Table 1 provides basic summary statistics for the variables used in the empirical analysis; namely, the resource windfall index, NRGDP growth (in level and per capita), government spending, government's share in NRGDP (government size), real effective exchange rate (REER), and Polity 2.[7]

In the following, we further explore whether the series used in the empirical analysis are stationary in level or in first difference. Table 2 presents the results of three different panel unit root tests. The tests proposed by Levin, Lin and Chu (2002) (LLC) and Im-Pesaran-Shin (2003) (IPS) use as null hypothesis that all the cross-units contain a unit root. We also use the Hadri (2000) Lagrange multiplier test which uses as null hypothesis that all the cross-units are stationary. The

[7] Government spending is measured by the ratio of government expenditures to non-resource GDP. Government expenditure data is from Heston et al. (2009). The real exchange rate data is obtained from IMF(2010a), while the current account data is obtained from IMF(2010b).

tests provide conflicting results which suggest that we cannot rule out that some of the key variables indeed contain unit root. When considering the logarithm of NRGDP in level, LLC indicates that we should reject the null of all cross-units containing a unit root while IPS test indicate that we fail to reject the same null hypothesis. The Hadri test rejects the null hypothesis of stationarity of all cross-units. When taking the first difference in the logarithm of NRGDP, LLC and IPS now both reject that the null of all cross-units contain unit roots, while Hadri still indicates that we should reject the null of all cross-units contain stationary series.[8] Similar results are obtained when considering the logarithm of NRGDP in per capita. The various panel unit root tests performed on our resource windfall index, government spending, and REER deliver conflicting messages in level suggesting some evidence that those variables contain non stationary series. When taking the first difference of those variables, we now have evidence of stationarity. We further test for the presence of cointegration between these variables using the four tests developed by Westerlund (2007) and Persyn and Westerlund (2008). The results of the various panel cointegration tests are presented in Table 3. They clearly fail to reject the null of no cointegration for various combination of the variables used in the following empirical analysis. Both the evidence of non difference-stationarity and the absence of cointegration between the variables used in our empirical analysis suggest that we should use the variables in differences in our empirical analysis.[9]

3.2. Macroeconomic Stability

We now turn to the empirical investigation of the experience of commodity-exporting countries with macroeconomic stability. To do so, we use panel Vector Auto-Regression (VAR) techniques. The use of panel VAR techniques makes it possible to isolate the dynamics of a

[8] According to Hlouskova and Wagner (2006), the Hadri test tends to over-reject the null hypothesis and thus may yield results that directly contradict those obtained using alternative test statistics.

[9] Indeed, using those variables in level would lead to spurious results because of the lack of cointegration relationship between those variables. In contrast, using the series in differences allows us to appropriately explore the relationship between stationary processes.

statistical relationship and the interdependencies between multiple economic variables; namely, resource windfalls, which assumed to be exogenous, and two endogenous variables: non-resource GDP and government spending. Another advantage of panel VAR techniques is that they allow the simultaneous estimation of all relationships while taking into account specific country characteristics through the use of fixed effects. The method consists of a simultaneous IV-GMM estimation of series of equations. Denoting the vector of endogenous variables by z_{it} and the resource windfall index by p_{it}, our system of equations can be specified as follows:

$$z_{i,t} = \Gamma_0 + \Gamma_1 z_{i,t-1} + \Gamma_3 p_{it} + \Gamma_4 f_i + \alpha_t + e_{i,t}$$

$$p_{i,t} = \gamma_i + \gamma_1 p_{i,t-1} + \varepsilon_{i,t}$$

where f_i is a set of time-invariant country fixed effects. Mean differencing, which is usually used in estimating panel data models, will create a bias in the estimates, since the fixed effects will be correlated with the independent variables due to the presence of a lagged dependent variable. As in Arellano and Bover (1995), we apply forward mean-differencing and use the lagged regressors as instruments in the estimation of the system.

The results of the estimations are presented in Table 4. The dynamic effects of the various shocks are illustrated by the impulse responses presented in Figure 3. Those results suggest that the average effect of an increase in resource windfalls is followed by a statistically and economically significant increase in government spending. Indeed, we find that an increase of resource windfall by one standard deviation leads at its peak to an increase in government spending by slightly less than a tenth of a standard deviation. This result provides supportive evidence that on average commodity-exporting countries have pursued procyclical government spending policy. Figure 3 also shows that resource windfall shocks initially crowd out non-resource GDP which in turn increases as a result of the fiscal expansion. An increase by one standard deviation in resource

windfall leads on impact to a reduction by about one standard deviation in non-resource GDP and to an increase by half a standard deviation in the following period. The intuition behind this result is that an increase in resource windfalls increases the return of investing in the resource sector leading in turn to a reallocation of factors away from the non-resource sector in favor of the resource sector.[10] As government spending increases in response to an increase in government revenues following a resource windfall, the non-resource sector expands. The latter results provide empirical evidence of a resource sector externality onto the non-resource sector stemming from resource windfalls spurring government spending.

When expanding the empirical analysis to the real exchange rate and the non-resource current account, we find that resource windfalls lead to an increase in the growth of real effective exchange rate and to a deterioration of the non-resource current account (results not reported in tables).[11] Those results are consistent with the so called "Dutch disease". Indeed, government spending directed toward the non tradable sector with and inelastic supply, leads to an increase in the relative price of non tradable compared to tradable goods. This increase leads to an appreciation of the real exchange rate with potentially harmful effects on external competitiveness consistent with a deterioration of the non-resource current account following a resource windfall shock.

We now explore whether the quality of political institutions influences the way resource windfall shocks impact macroeconomic stability in commodity-exporting countries. To do so, we split the sample between deep autocracies and deep democracies and run our panel VAR regressions for each sub-sample separately. We find stronger evidence that government spending in autocracies increases following a resource windfall shock. Quantitatively, a one standard deviation shock to resource windfall leads, at its peak, to an about one standard deviation increase in government spending in deep autocracies (Figure 6). Those effects are much larger than when

[10] This result holds when controlling for the changes in REER, as shown in Figure 4.
[11] The non-resource current account is constructed by subtracting commodity exports from overall current account.

considering our overall sample. In deep democracies, we find evidence that government spending has been counter-cyclical. Indeed, we find that on impact an increase in one standard deviation in resource windfall index lead to a decrease by slightly less than a standard deviation in government spending (Figure 5). During the period following the shock, the effect of a resource windfall on government spending in deep democracies becomes positive but is no longer statistically significant. When comparing the effect on non-resource GDP following a resource windfall shock, we find that in both groups resource windfall shocks initially crowd out non-resource GDP which then increases following the fiscal expansion. However, we find that the evidence of a crowding out effect is quantitatively smaller in deep democracies compared to deep autocracies. Indeed, in autocracies a one standard deviation increase in the resource windfall index leads on impact to a decrease of about a third of a standard deviation in non-resource GDP in autocracies and to a decrease by tenth of a standard deviation in democracies. A large share of commodity windfalls accrues to government sector (through state ownership or taxation or export tariffs...). These results suggest that democracy, through promoting accountability and consensus, reduces the perverse effect that resource windfalls may have on the non-resource sector. Indeed, more accountable government may exercise less discretion in the conduct of fiscal policy in turn leading to less macroeconomic instability. That evidence is consistent with for instance Persson (2002) who has stressed the importance of political institutions in achieving better policy outcomes.

3.3. Economic Growth

The above-mentioned results suggest that commodity-exporting countries are, on average, subject to macroeconomic instability which in turn can lead to potential adverse effects on their long run economic performance. In addition, one of the key challenges that commodity-exporting countries face is the need to reduce their dependence on commodities by rebalancing their wealth from natural capital in favor of reproducible capital and social capital, including human capital.

Figure 7 illustrates for instance that commodity-exporting countries in Sub-Saharan Africa and the Middle East have a disproportionately higher share (over 30 percent) of their total wealth as natural capital. However, a large increase in government spending risks yielding both poor technical and allocative efficiencies. To take stock of the historical experiences of commodity-exporting countries, we now systematically investigate the impact of government spending on long run non-resource sector growth in the face of resource windfall shocks.

To do so, we use the Pooled-Mean-Group (PMG) techniques developed by Pesaran and Smith (1995), Pesaran (1997), and Pesaran, Shin and Smith (1999) to estimate the effects of resource windfalls and government spending on non-resource GDP growth per capita. The use of panel cointegration techniques allows us to separate out the short run from the long run effects of government spending on non-resource GDP growth.

The long-run growth regression equation is specified as an ARDL (p,q) process with an error-correction term as follows:

$$\Delta Y_{i,t} = \sum_{j=1}^{p-1} \gamma_j^i \, \Delta Y_{i,t-j} + \sum_{j=0}^{p-1} \delta_j^i \, \Delta X_{i,t-j} + \varphi^i \left[Y_{i,t-1} - \left\{ \beta_0^i + \beta_1^i X_{i,t-1} \right\} \right] + \varepsilon_{i,t} \qquad (1)$$

where, *Y* is the growth rate of real per capita non-resource GDP, and *X* is a set of exogenous variables; namely, our resource windfall index, the share of government spending in non-resource GDP, the initial level of income proxied by the lagged value of non-resource GDP per capita, the change in the logarithm of real exchange rate and the quality of political institutions. Disturbance term is denoted by ε. [12] The estimations provide us with a set of short run coefficients γ and δ, a set of long run coefficients β, and a speed of adjustment coefficient φ. The pooled-mean-group

[12] The specification also includes time and fixed effects.

estimation by Pesaran, Shin, and Smith (1999) imposes equality in long run coefficients but treats short run coefficients as heterogeneous.[13]

Table 5 presents the results of the PMG estimations focusing on the long run coefficients. On average, we find that resource windfall shocks have statistically and economically significant negative effect on the long run non-resource sector GDP growth as shown in column (1). Indeed, we find that increase in our resource windfall by one standard deviation would lead to a reduction of long run economic growth by about a fifth of a standard deviation. We also find that on average, an increase in the share of government spending has a negative effect on long run non-resource GDP growth, as shown in column (2). Those two results are in line with the existing literature providing evidence that resource windfalls and larger governments both lead to weaker long run economic growth. However, what is new is that resource windfalls stop having a negative effect on long run non-resource growth when controlling for government spending as shown in columns (3) to (5). This result suggests that government spending is an important vehicle of the resource curse hypothesis. In other words, the externality stemming from the resource sector to the non-resource sector is conveyed through government spending chiefly financed by resource sector related government revenues. When controlling for the change in the real exchange rate as shown in column (4), resource windfall shocks have a positive effect on non-resource GDP growth. This result confirms that Dutch disease is a relevant channel of the resource curse. When controlling for the quality of political institutions as shown in column (5), the above results do not appear to change significantly. Given that the quality of political institutions changes little over time, it is perhaps hard to meaningfully assess the individual effect of democracy on long run economic growth when exploiting within country variation over a few decades.

[13] The results of a Hausman test support the validity of those imposed restrictions.

In Table 6 we explore the potential heterogeneity in the effect of resource windfalls and government spending on non-resource GDP growth. We explore whether the quality of political institutions helps alleviate the resource curse by interacting both our resource windfall index and government spending with our measure of the quality of political institutions. We find that the impact of resource windfalls and government spending are moderated by the quality of political institutions. Everything else being equal, an increase in Polity2 from that of Gabon to that of Norway would lead to a reduction in the effect of resource windfalls on non-resource GDP growth by half. While an improvement in the quality of political institutions could reduce the effect of resource windfall on economic growth, we find that even with the highest quality of political institutions, the effect of resource windfall on non-resource GDP remains negative as shown in columns (1) and (2). In columns (3) and (4), we also provide evidence that the quality of political institutions moderates the effect of government spending on long run non-resource GDP growth suggesting that the benefit of political institutions on economic growth are channeled through better fiscal policy. Indeed, as a large share of commodity windfalls accrues to government sector, more accountable governments can better support non-resource sector's long run economic performance by reducing government spending inefficiencies and resource misallocation. Those results are consistent with the political economy literature which has stressed the importance of political institutions in achieving better policy outcomes (see for example Persson, 2002) and Acemoglu et al. (2001, 2002) who have shown that political institutions are key determinants for long-run economic development.

4. Robustness Checks

A relevant question is whether our results are driven by the quality of economic institutions rather than political institutions. Indeed, the indicator capturing the quality of political institutions displays a relatively high correlation with the indicator capturing the quality of economic institutions namely the rule of law indicator (0.31). Also, Melhum et al. (2006) provide some

evidence that good economic institutions can alleviate the resource curse using standard cross-sectional growth regression. To test whether economic institutions play a moderating role in shaping the effect of resource windfall on economic growth, we try interacting resource windfalls with various (or combination of) indicators capturing the quality of economic institutions including the rule of law or corruption indices from Political Risk Services (2009). Because the data on economic institution is available from 1985 onwards, we tried both using it as is, and solely using its average value in an interaction term with our resource windfall index. Irrespective of which economic institution indicator we use or of the way in which the indicator is used, we do not find any robust evidence that economic institutions moderate the effect of resource windfalls on non-resource GDP growth. The results are indeed not robust across specifications, and those results are supportive of the "primacy" of political institutions over economic institutions as a tool to moderate the effect of resource windfalls on non-resource GDP growth.

5. Summary

This paper examined the performance of commodity-exporting countries in terms of macroeconomic stability and growth in a panel of up to 129 countries during the period 1970-2007. To do so, we used a new dataset on non-resource GDP. Our main findings are threefold. First, we find that on average government spending in commodity-exporting countries has been procyclical. Second, we find that resource windfalls initially crowd out non-resource GDP which then increases as a result of the fiscal expansion. Third, we find that in the long run resource windfalls have negative effects on non-resource sector GDP growth. Yet, the effects turn out to be statistically insignificant when controlling for government spending. Both the effects of resource windfalls on macroeconomic stability and economic growth are moderated by the quality of political institutions.

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Appendix

Figure 1. Evolution of Government Spending and Resource Windfalls in Venezuela

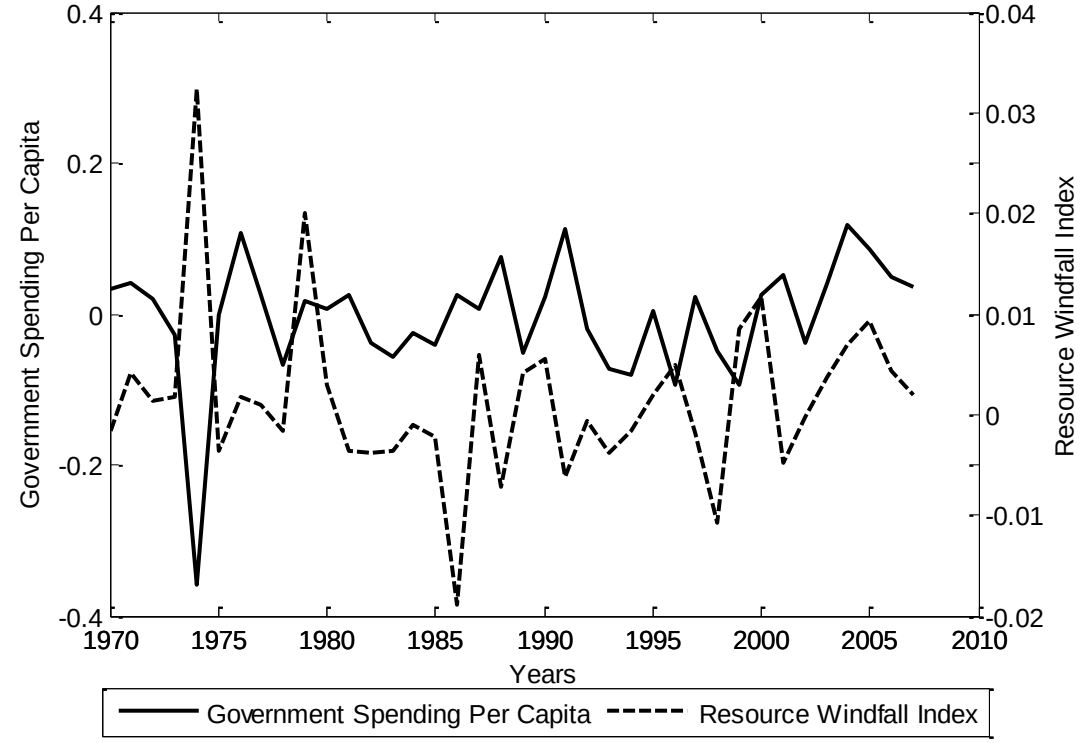

Figure 2. Evolution of Government Spending and Resource Windfalls in Norway

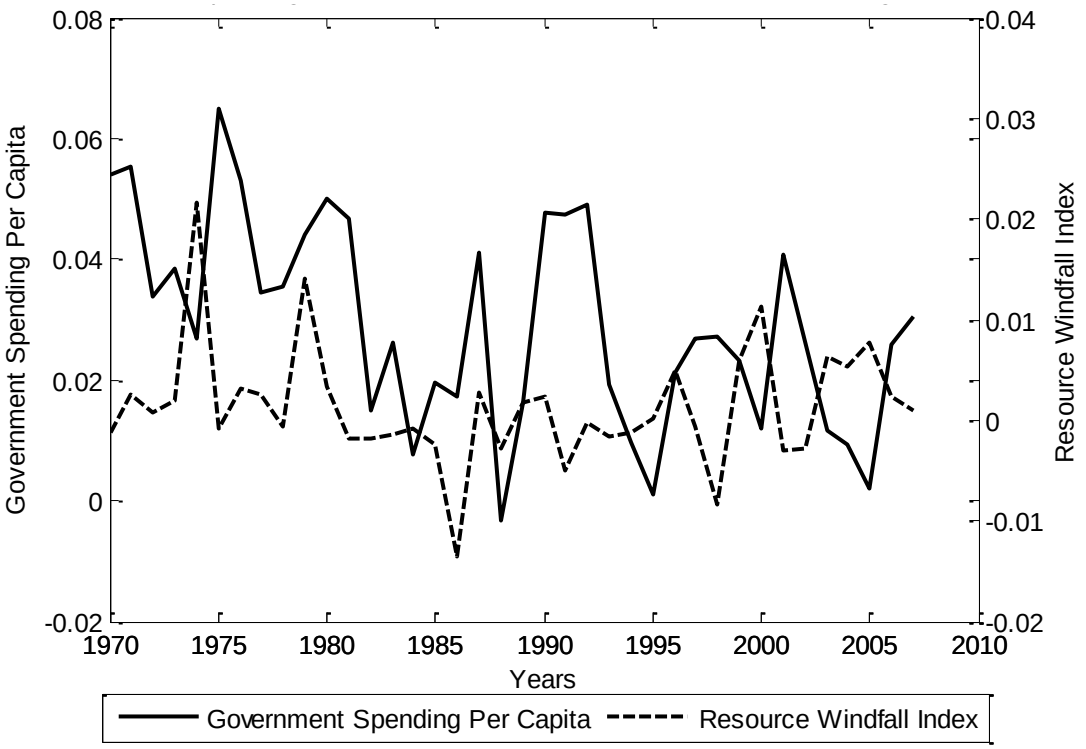

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Δ Resource Windfall Index	4823	0.000	0.006	-0.055	0.085
Δ log NRGDP	4823	0.032	0.083	-1.108	0.774
Δ log Government Spending	4823	0.035	0.144	-2.102	1.753
Δ log NRGDP per Capita	3996	0.015	0.067	-0.691	0.553
Initial log NRGDP per Capita	3888	8.542	1.134	5.735	11.446
Government Share in NRGDP	4104	0.180	0.096	0.014	0.739
Δ REER	2944	-0.016	0.263	-11.665	2.189
Polity 2	3560	1.123	7.506	-10.000	10.000
log(Polity2 +12)	3560	2.344	0.742	0.693	3.091
Average log(Polity2 +12)	3610	2.350	0.578	0.693	3.091

Note: Pooled-Mean-Group estimations use the logarithm of Polity 2 score plus 12.

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Table 2. Panel Unit Root Tests

		LLC		IPS		Hadri			
Variable	trend	Stat[1]	P-value	Stat[2]	P-value	Stat[3]	P-value	No. of countries	No. of Years
NRGDP	yes	-6.93	0.00	10.24	1.00	119.26	0.00	129	38
ΔNRGDP		-29.65	0.00	-34.26	0.00	4.90	0.00	129	37
Resource Windfall Index		-2.72	0.00	-1.89	0.03	36.65	0.00	108	38
Δ Resource Windfall Index		-32.49	0.00	-33.71	0.00	-2.41	0.99	108	38
Government Size		-2.94	0.00	-2.31	0.01	128.22	0.00	129	38
Δ Government Size	Yes	-26.62	0.00	-39.48	0.00	-2.46	0.99	129	37
ln(REER)		-5.38	0.00	-4.19	0.23	112.10	0.00	129	28
Δ ln(REER)		-22.36	0.00	-26.09	0.00	-6.30	1.00	129	27

Notes: All tests include an intercept.

[1] Levin, Lin and Chu (2002) (LLC) adjusted t-statistics
[2] Im-Pesaran-Shin (2003) (IPS) z-tilde-bar statistics
[5] The Hadri (2000) LM test (Hadri) z-statistics

Table 3. Panel Cointegration Tests

	Ga		Gt		Pa		Pt	
Variables	Z-value	p-value	Z-value	p-value	Z-value	p-value	Z-value	p-value
	Intercept							
y, G/NGDP, P	11.77	1.00	7.87	1.00	6.01	1.00	2.75	1.00
y, G/NGDP, P, REER, NCA	15.08	1.00	12.94	1.00	11.48	1.00	9.07	1.00
	Trend and Intercept							
y, G/NGDP, P	2.87	1.00	6.35	1.00	0.21	0.58	1.80	0.96
y, G/NGDP, P, REER, NCA	8.01	1.00	14.44	1.00	7.38	1.00	11.04	1.00

Note: The Ga and Gt test statistics test H_0: $\varphi^i = 0$ for all *i* versus H_1: $\varphi^i < 0$ for at least one *i*. These statistics start from a weighted average of the individually estimated φ^is and their t-ratio's respectively. Rejection of H_0 therefore implies the existence of a cointegration relationship for at least one of the cross-sectional units. The Pa and Pt test statistics used the pooled information over all the cross-sectional units to test H0: $\varphi^i = 0$ for all *i* vs H1: $\varphi^i < 0$ for all *i*. Rejection of H0 should therefore be taken as evidence of cointegration for the panel as a whole. The difference between Ga and Gt as well as between Pa and Pt is their asymptotic power. Ga and Pa are preferred to Gt and Pt when *T* is substantially greater than *N*. We present the results for all four tests for completeness.

Table 4. Panel VAR Estimation Results

LHS Variable	RHS Variable	Coefficient	GMM S.E.	GMM t-stat
Δ Resource Windfall Index				
	Δ Resource Windfall Index	-0.012	0.026	-0.456
Δ Government Spending				
	Δ Resource Windfall Index	1.895	0.438	4.328
	Δ Government Spending	-0.148	0.046	-3.217
	Δ NRGDP	0.147	0.067	2.188
Δ NRGDP				
	Δ Resource Windfall Index	1.005	0.379	2.653
	Δ Government Spending	-0.009	0.015	-0.639
	Δ NRGDP	0.114	0.045	2.525
Number of Countries		108		
Number of Observations		4689		

Figure 3. Impulse Responses for All Countries

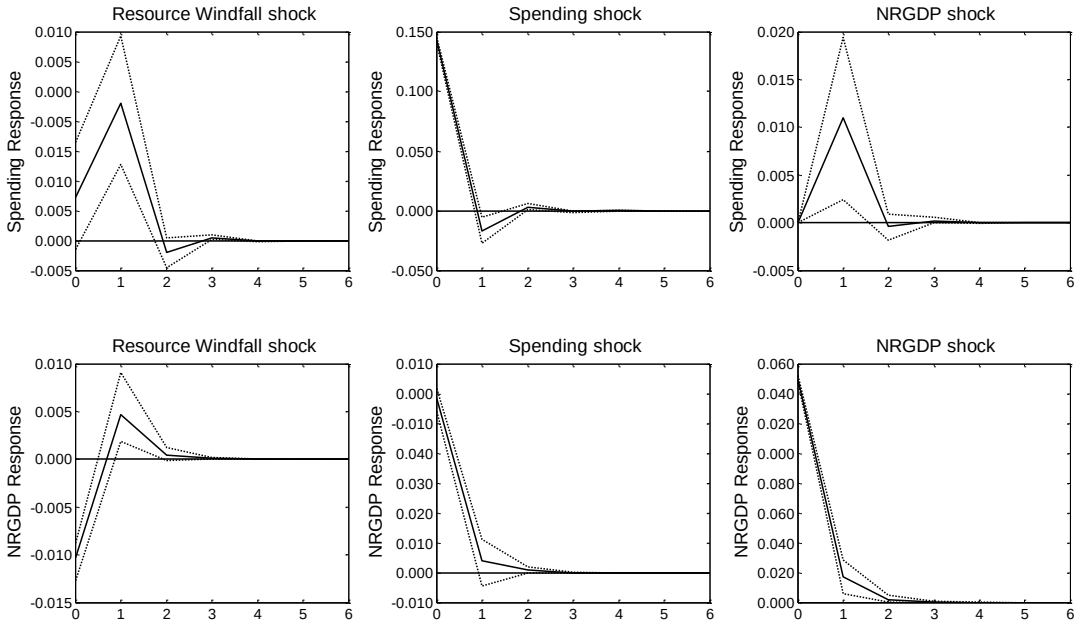

Figure 4: Impulse Responses including REER for All Countries

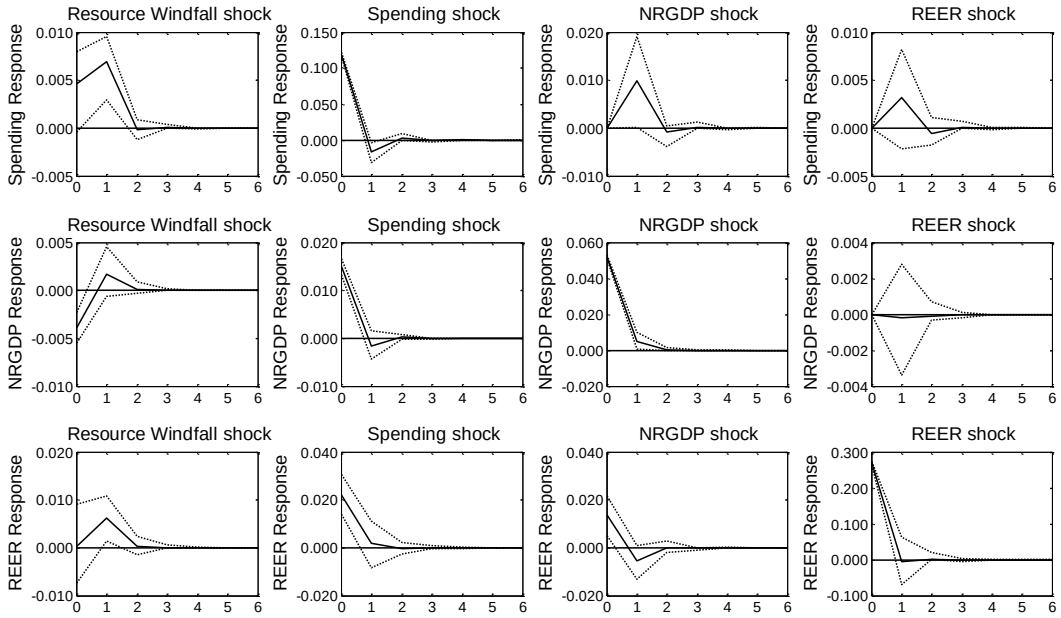

Figure 5. Impulse Responses for Deep Democracies

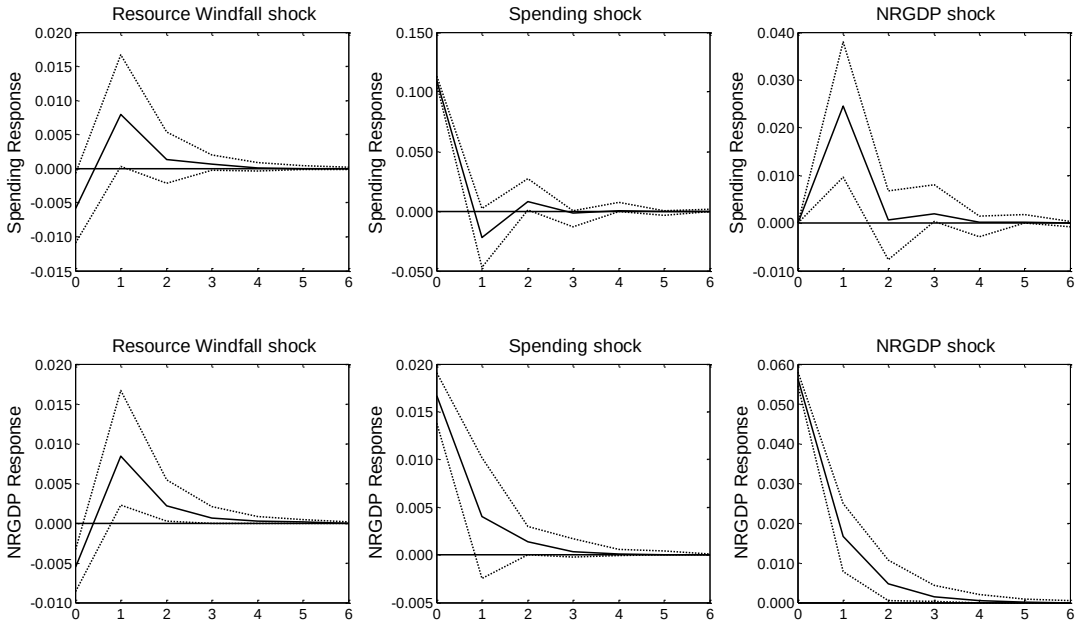

Figure 6. Impulse Responses for Deep Autocracies

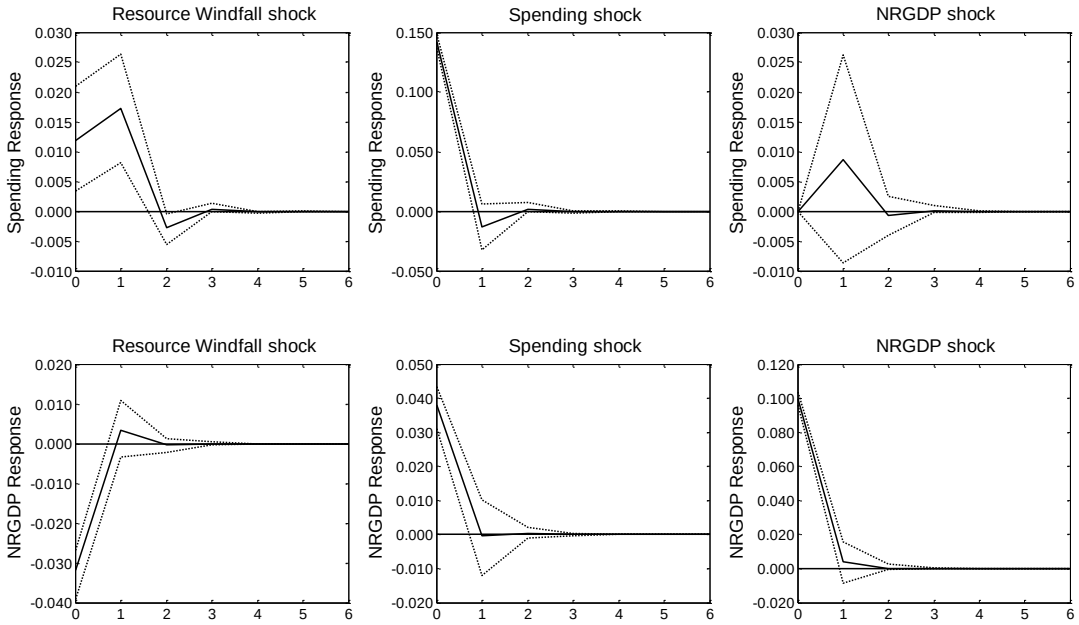

Figure 7. Natural Capital Around The World

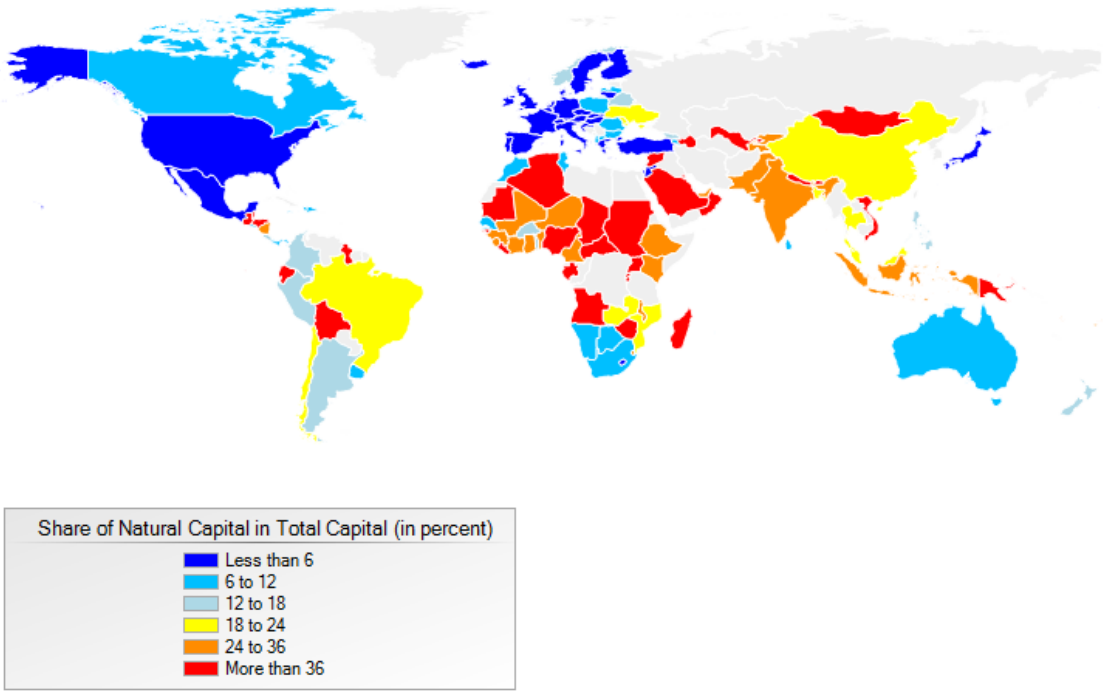

Table 5. Pooled-Mean-Group Estimation Results

Variables	(1)	(2)	(3)	(4)	(5)
Long-Run Coefficients					
Initial NRGDP	**-0.089**	**-0.051**	**-0.074**	**-0.107**	**-0.061**
	0.006	0.004	0.006	0.006	0.006
Δ Resource Windfall Index	**-1.082**		-0.804	**5.399**	-0.160
	0.454		0.501	0.657	0.497
Government share in NRGDP		**-0.049**	-0.022	**-0.081**	**-0.042**
		0.018	0.020	0.022	0.017
Δ REER				**0.018**	
				0.005	
Polity II					**0.004**
					0.002
Error-Correction Coefficient					
Phi	**-0.820**	**-0.909**	**-0.805**	**-0.688**	**-0.838**
	0.034	0.030	0.040	0.048	0.042
Short-Run Coefficients					
Δ Growth (-1)	-0.036	0.021	-0.038	**-0.073**	-0.022
	0.023	0.020	0.026	0.038	0.028
Δ2 Resource Windfall Index	-0.426		-0.790	**-5.518**	**-0.979**
	0.535		0.673	0.681	0.582
Δ Government share in NRGDP		**-1.480**	**-1.451**	**-1.275**	**-1.415**
		0.138	0.157	0.171	0.161
Δ^2 REER				**0.024**	
				0.014	
Δ Polity II					**-0.058**
					0.015
Intercept	-0.010	-0.006	-0.013	**-0.019**	-0.010
	0.010	0.005	0.008	0.011	0.007
No. Of Countries	108	129	94	94	94
No. of Observations	3564	4257	3102	2277	3094

Note: The dependent variable is NRGDP per capita growth. The numbers in bold indicate statistical significance at 5% or more. The lag order for the ARDL was chosen using SBIC. Only coefficients associated with the first lags are presented in this table to conserve space.

Table 6. Pooled-Mean-Group Estimation Results with Interactive Effects

Variables	Model 1	Model 2	Model 3	Model 4
Long-Run Coefficients				
Initial NRGDP	**-0.080**	**-0.062**	**-0.075**	**-0.041**
	0.006	0.005	0.005	0.004
Δ Resource Windfall Index	**-1.866**	**-0.834**		0.388
	0.597	0.497		0.429
Government share in NRGDP		**-0.030**	-0.019	**-0.061**
		0.017	0.018	0.020
Polity2	**0.004**	**0.003**	0.003	**0.005**
	0.002	0.002	0.002	0.002
Polity2 x Windfall	**0.072**	**0.160**		
	0.040	0.037		
Polity2 x Gov. Size			**0.002**	**0.001**
			0.001	0.000
Error-Correction Coefficient				
Phi	**-0.798**	**-0.807**	**-0.874**	**-0.896**
	0.038	0.043	0.042	0.040
Short-Run Coefficients				
Δ Growth (-1)	-0.056	-0.035	-0.014	0.029
	0.030	0.030	0.027	0.020
Δ2 Resource Windfall Index	-0.280	-0.511		**-2.414**
	0.755	0.623		0.551
Δ Government share in NRGDP		**-1.342**	**-1.568**	**-1.520**
		0.171	0.175	0.174
Δ Polity2	**-0.047**	**-0.062**	**-0.041**	**-0.035**
	0.017	0.017	0.014	0.013
Δ Polity2 x Windfall	-0.047	**-0.059**		
	0.032	0.032		
Δ Polity2 x G-size			0.000	0.000
			0.001	0.001
Intercept	-0.006	-0.007	-0.009	-0.007
	0.009	0.007	0.009	0.005
SC	4143.8	4149.1	4110.1	4271.0
No. Of Countries	94	94	94	94
No. of Observations	3290	3290	3290	3290

Note: The dependent variable is NRGDP per capita growth. The numbers in bold indicate statistical significance at 5% or more. The lag order for the ARDL was chosen using SBIC. Only coefficients associated with the first lags are presented in this table to conserve space.