MINISTRY OF FINANCE
OF THE CZECH REPUBLIC

WORKING PAPER

FISCAL POLICY PROCYCLICALITY IN RESOURCE-RICH COUNTIRES

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No. 1/2013
ISSN 1804-8056

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September, 2013

This study has been reviewed and published as a part of CERGE-EI dissertation, Aliyev I. (2013) "Essays on Natural Resources Impact".

The views expressed in the paper do not necessarily reflect those of the Ministry of Finance of the Czech Republic. All errors are my own.

ABSTRAKT

Tento článek se zabývá procyklicitou fiskálních politik v zemích bohatých na suroviny. Zjistili jsme, že závislost procyklicity vládních kapitálových výdajů na míře surovinového bohatství vyjádřené jako podíl exportu nerostných surovin na celkovém exportu je kvazikonvexní ve tvaru U. Tato závislost je robustní i v případě použití různých metodik a jiných nemetodických úprav. Zabýváme se dvěma hypotézami vysvětlení tohoto vztahu: hypotézou politické ekonomie a hypotézou úvěrového omezení. Empirická pozorování se jeví jako konsistentní s těmito hypotézami. Sestavili jsme model, který umožňuje vytvořit efekt dané kvazikonvexní závislosti tvarované do U na základě hypotézy politické ekonomie a úvěrového omezení. Tvrdíme, že při použití takového modelu s jednoduchým nastavením můžeme danou kvazikonvexní závislost tvarovanou do U získat a zároveň ji interpretovat.

Klíčová slova: úvěrová omezení, rozvojové země, fiskální politika, politická ekonomie, hojnost přírodních zdrojů, procykličnost.

ABSTRACT

This study analyzes fiscal policy procyclicality in resource-rich countries. A strong U-shaped relationship between the procyclicality of government capital expenditures and the resource richness measure comprised of the mineral exports share in total merchandise exports is obtained for developing countries. Such a relationship is robust to different methodologies and various checks. Two hypotheses have been considered: first, the political economy hypothesis, and second, the borrowing constraints hypothesis. Empirical observations appear to be consistent with the hypotheses. A model has been built that is able to generate a U-shape effect combining political economy and borrowing constraint hypotheses. Arguably, with a model of simple settings such a U-shape relationship can be obtained and interpreted.

Keywords: borrowing constraints, developing countries, fiscal policy, political economy, resource-rich, procyclicality**.**

JEL Classification: E62, F34, F41, O23, Q32.

CONTENT

Introduction

Recently, more attention in the literature has been devoted to analyzing the cycles of fiscal policy. The consensus is that, in developing countries fiscal policy is highly procyclical, whereas in developed countries it is less so, or is countercyclical (Lane and Tornell 1998, and Kaminsky, Reinhart and Vegh 2004). The key explanation of procyclical fiscal policy offered by the literature is based on „political economy" factors, such as rent-seeking and corruption (Gavin and Perotti 1997, Lane 2003, and Talvi and Vegh 2005). Henceforth, this is referred to as political economy aspects. Developed countries are equipped with stronger institutions and political systems, whereas developing countries rarely have strong, healthy and stable political institutions and problems associated with political economy factors are likely.

Given an absence of strong legal and political institutions in developing countries, Gavin and Perotti (1997), Tornell and Lane (1999) among others argue that the existence of multiple powerful groups fighting over fiscal transfers would lead to a more than proportional increase of fiscal redistribution in case of favorable shocks, resulting in inefficient capital projects. Powerful groups will try to access income to the extent that they can via the fiscal process. Also, according to Alesina, Campante and Tabellini (2008), voters do not trust a corrupt government, which can appropriate tax revenues for unproductive consumption expenditures. Therefore, if the economy is booming, voters tend to demand immediate benefits, as they believe that the government would steal it through political rents. This leads to procyclical fiscal policies. Alesina et al (2008) show that the procyclicality of fiscal policy is more pronounced in corrupt democracies where voters can hold their governments accountable.

Another commonly accepted explanation of fiscal policy procyclicality is that developing countries usually face borrowing constraints on the international financial markets (e.g. Aizenman, Gavin and Hausmann 2000, Gavin and Perotti 1997). During unfavorable times, developing countries may face tighter credit constraints which may necessitate cuts in their expenditures, leading to procyclicality. Here, explanations based on political economy and borrowing constraints cannot be independent from each other, nor are they substitutes. A natural question is why credit-constrained governments do not save in favorable times, anticipating that in unfavorable times they will have to cut their expenditures significantly. To answer this question, we should consider the political and institutional environments in those countries. The procyclicality of fiscal policy is directly related to a governments' failure to save in favorable times.

In the current research, we analyze fiscal policy procyclicality in resource-rich developing economies. Resource richness may bring out and intensify the two types of effects, political economy and borrowing constraint, on fiscal policy procyclicality. As argued in the literature, resource richness may induce rent-seeking and corrupt behavior by a government, increasing the procyclicality of the fiscal policy. For example, Karl (1999) observes that the governments of oil exporting countries have less incentives to be frugal, efficient, and cautious in policymaking. Access to easy money stemming from oil revenues weakens institutions and decreases fiscal discipline. In the case of resource abundance, the common pool problem becomes more severe and fighting over resources intensifies, as argued in Alesina, Campante and Tabellini (2008). The governments of resource-rich countries may come under constant political pressure to spend revenues resulting from raising resource prices. In the case of lower resource prices, maintaining high levels of government spending may not be possible, leading to significant cuts. Eifert, Gelb and Tallroth (2003) discuss how different political systems can lead to different fiscal policy behaviors in resource-rich countries. As they argue, mature democracies or reformist autocracies are better able to smooth the government expenditures across cycles and thus run a less procyclical fiscal policy, whereas other political systems may have difficulties in this respect.

Despite their negative effects on rent-seeking and corruption, discoveries of natural resources can be considered a windfall to governments, because the resource sector is usually owned by the government. Such ownership provides extra "fiscal space" to governments, which they can use to finance their expenditures. In such a case, to increase public spending today, the government need not decrease spending in the future. The government would have an additional opportunity to save in "good times" and therefore to pursue a less procyclical fiscal policies in "bad times". Many resource-rich countries could build vast international reserves from their resource revenues. Karmann and Maltritz (2004) relate the ability of a government to pay its debt and default risk to its foreign exchange reserves. Owning significant reserves may help governments to decrease expenditures less in case of negative shocks to the economy by alleviating the borrowing constraint. In light of this, Zhou (2009) argues that, in developing countries, political risk, cyclicality of fiscal policies, and their level of international reserves are strongly related to each other. Moreover, even the "least" creditworthy resource-rich countries are able to cash in on their natural resources. For example, despite being assigned very low credit ratings, Bolivia, Venezuela and Iran export their oil and gas resources as there is a global demand.[1]

The contribution of this study is in documenting a strong non-linear U-shaped relationship between resource richness and fiscal procyclicality. Up to a certain level of resource richness, fiscal procyclicality declines, and afterwards it increases. Although the literature predicts a somewhat linear relationship between resource richness and weaker political institutions, and hence higher fiscal procyclicality, we claim that resource richness can decrease fiscal procyclicality by alleviating the borrowing constraint. We argue that the two key reasons for fiscal procyclicality, political economy frictions and borrowing constraint, create two opposite effects stemming from resource richness. This may well be the reason for the U-shaped pattern. We present empirical evidence that is consistent with the above-mentioned hypotheses. We develop a rather simple theoretical framework that addresses these hypotheses and, consequently, generates a U-shaped pattern.

The paper is organized as follows: the next section discusses procyclicality in resource-rich countries, documents the key observations, and outlines the basis for the main hypotheses. In Section 2, we provide important empirical evidence that is consistent with our story and hypotheses. Section 3 builds a model that incorporates these hypotheses and discusses the model-driven results.

[1] As of September 2009, Moody's assigned a very low credit rating of B2 to the governments of Venezuela and Bolivia for their foreign currency bonds. Iran was not assessed.

1 Fiscal procyclicality in resource-rich countries

First of all, a relevant measure should be defined to analyze fiscal policy cyclicality, as there is not one readily available and this needs to be estimated. Such a cyclicality measure could be estimated using different fiscal aggregates such as primary fiscal balance, government expenditures, or tax revenues, and using different estimation methodologies.

Here, we will use total government expenditures and their components for our analysis. Using revenue side variables may not best suit for fiscal procyclicality analysis in resource-rich developing countries due to several reasons. First, tax collection is costly and requires a strong tax infrastructure in place, which requires significant investments in this area. As a large part of government revenues consists of resource revenues, and governments of resource rich countries rely heavily on resource revenues, the tax infrastructure of such countries is usually weak. In this case, tax rates as a fiscal policy instrument become ineffective. Second, in resource rich countries, separation of resource and non-resource tax revenue is a challenge. Separation of the revenue types is important, as resource revenues are mostly driven exogenously, whereas non-resource revenues depend mainly on domestic fiscal policy and tax infrastructure. Usually, resources are produced by government-owned enterprises. Taxes paid by a state-owned company operating in oil production is also revenue stemming from resources, although it is reported as tax revenue. This diminishes the role of tax revenues and rates as the fiscal policy indicators.

According to Kaminsky et al (2004), from a theoretical point of view, government expenditures and tax rates are most suitable indicators for studying fiscal cyclicality. However, in practice, as they argue, there is no systematic tax rates data, and hence, government spending is the best indicator to be used in estimating fiscal policy procyclicality.

Overall, the most suitable fiscal variable for fiscal policy cyclicality analysis in the context of our work is government expenditures. To obtain the cyclicality measure we run the following regression between the growth of real government expenditures and real GDP growth[2], similar to Woo (2009).

$$\ln G_{it} - \ln G_{it-1} = \delta_i + \beta_i [\ln Y_{it} - \ln Y_{it-1}] + \varepsilon_{it} \qquad (1)$$

Along with the cyclicality measure for real total government expenditures (*beta_rtote*), we obtain cyclicality measures for real government current (*beta_rcure*) and capital expenditures (*beta_rcape*). The summary of obtained cyclicality measures - β's, is reported in Table 1 below. Although we started with 170 countries, due to data limitations we were able to obtain cyclicality measures for only 99 countries. For some countries, there are only 4 years of observations during the 1970-2007 period. As a low number of observations leads to larger errors in obtained cyclicality measures, for some countries the measure may not be representative. Therefore, to get a more reliable measure we decided to use only the sample of countries which have at least 20 years of observations, reducing the number of countries in our study to 61.

Table 1 demonstrates that, consistent with the existing literature (Gavin and Perotti 1997, Lane and Tornell 1998, Lane 2003 among others), government expenditures for non-OECD countries are on average more procyclical, whereas for OECD countries they are less procyclical, and even countercyclical. This result holds not only for total expenditures, but also for current and capital expenditures. Also, for all country groups – both OECD and non-OECD countries - the capital expenditures are more procyclical than current expenditures. The same applies for resource-rich and resource-poor countries as well. This is not surprising, as the real business cycles literature documents much higher volatility for capital expenditures than for current expenditures.

[2] See Appendix A for a detailed description.

Table 1: Averages of betas obtained through equation (1), for countries that have at least 20 years of government expenditure data

Country groups	Total expenditures procyclicality	Current expenditures procyclicality	Capital expenditures procyclicality	Growth volatility 1960-2003
All countries	0,53	0,40	1,39	1,80
OECD countries	-0,04	-0,06	0,37	1,12
Non-OECD countries	0,87	0,68	2,05	2,09
Group 1: Resource-poor non-OECD	0,97	0,85	2,29	1,83
Group 2: Resource-rich non-OECD	0,71	0,49	1,75	2,52
Group 3: Resource-rich[1] OECD	0,43	0,35	1,29	0,99
Group 4: Resource-poor OECD	-0,14	-0,15	0,16	1,14

1) A country is considered to be resource-rich if the average mineral exports share in total merchandise exports during 1961-2000 is higher than 20 percent. Otherwise the country is defined as resource-poor.

The table also shows that, within the resource-rich group, resource-rich non-OECD countries have higher procyclicality than resource-rich OECD countries. Non-OECD countries have generally weaker institutions than do OECD countries. As argued in the literature, resource richness creates enormous financial wealth that may foster corruption and rent seeking. This is consistent with the ***political economy*** story in the literature, which argues that developing countries with weak institutions may suffer more in correlation with resource richness. Karl (1999) discusses the political problems facing the oil-producing countries, including low fiscal discipline, rent seeking, and corruption, due to access to easy money by the political authorities. Leaders of oil-producing countries can afford to be less efficient and cautious in policymaking. Eifert, Gelb and Tallroth (2003) describe the autocratic regimes in different oil-exporting countries that fail to save enough during booms and therefore run procyclical fiscal policies.

The statistics in Table 1 for resource-rich and poor country groups within OECD and non-OECD countries gives an even more interesting picture. Within OECD, for the resource-rich countries a government's total expenditures and its components are more procyclical than for resource-poor countries. However, for non-OECD countries, the opposite is true. This implies that resource richness facilitates different types of fiscal behavior for the governments of OECD countries as compared to those of non-OECD countries. This result is somewhat surprising, as the literature implicitly predicts a more procyclical fiscal policy with more resource abundance due to the common pool problém (Tornell and Lane 1999, Talvi and Vegh 2005). Even if the common pool problem exists, this result suggests that another effect may exist that decreases procyclicality with resource richness.

In this context, to explain the observation that resource-rich developing countries may run less procyclical fiscal policies than resource-poor developing countries, the ***borrowing constraint alleviation*** story is more plausible. This mechanism suggests that if a country is not facing a credit constraint, it can borrow during unfavorable shocks so as not to decrease government expenditures with the business cycle, and therefore run a less procyclical or countercyclical fiscal policy[3]. Consequently, if a country is constrained, procyclical fiscal policy is more likely. Governments that own mineral resources and the foreign exchange stemming from it should be able to finance the expenditures. Also, many resource-rich countries have built vast international reserves from resource exports. From an international investor perspective, governments that own huge wealth are less likely to default, which increases the investors' willingness to lend. It might be the case for developing countries that a country richer in mineral resources will face a less tight borrowing constraint.

[3] Here, it is assumed that it is optimal to run countercyclical or acyclical fiscal policies. Although, the countercyclical fiscal policy is preferred, Perotti (2007) summarizes situations when a procyclical fiscal policy can be optimal. Such optimality mainly assumes a distortionary role of the government for the private sector of the economy.

In order to build our political economy and borrowing constraint stories, we make two crucial assumptions. First, we assume that OECD countries face looser or no borrowing constraints compared to non-OECD countries. The second assumption is that OECD countries have strong institutions that can effectively limit rent-seeking and corruption. Table 2 clearly shows the plausibility of these assumptions. As an indicator of borrowing constraint, if we look at the government bond ratings assigned by Moody's to the OECD countries, it is on average AA2, whereas in non-OECD countries it is very significantly worse, averaging around BAA3. The data on governance and institutional quality by the World Bank clearly indicates highly significant differences between OECD and non-OECD country groups in all these measures.

It is also important that the political economy situation and a government's borrowing constraints are strongly related to each other. Arguably, a government that is rent seeking and corrupt is likely to face tighter borrowing constraints. If the institutional environment is unable to control corruption or rent seeking, then resource richness can lead to even tighter borrowing constraints, in contrast to the borrowing constraint alleviation described above. However, the borrowing constraint alleviation story in our hypothesis can be understood as a "wealth" effect with resource ownership. Resource-rich governments possess significant resource wealth that increases their fiscal sustainability, which in turn helps to alleviate borrowing constraints.

Table 2: Government bond ratings and institutional quality in OECD vs. Non-OECD

Indicators	All countries	OECD countries	Non-OECD countries
Bond ratings by Moody's, September 2009	BAA1	AA2	BAA3
Government effectiveness	0,00	1,52	-0,34
Control of corruption	0,06	1,47	-0,35
Voice and accountability	-0,04	1,22	-0,31
Political stability	-0,11	0,88	-0,33

Source: Governance indicators by the World Bank and Moody's Investor Service.

Given that there are at least two effects, as stated in our hypotheses, stemming from resource ownership in developing countries, we would expect a non-linear or non-monotonous relationship between procyclicality and resource richness, whereas for OECD countries the relationship is expected to be different and possibly non-existent. Below, Figure 1 to Figure 3 show a direct relationship between fiscal policy cyclicality and resource richness. As a resource richness measure, we use mineral exports share in total merchandise exports between 1961 and 2000 (*min6100*) taken from WDI.[4]

Interesting patterns emerge. In Figure 1, we observe a somewhat U-shaped pattern in the betas for total government expenditures with respect to resource richness. In Figure 2, there is no clear pattern for current expenditures cyclicality. However, Figure 3 suggests that there is a clear U-shaped relationship between resource richness and capital expenditure cyclicality in non-OECD countries.

[4] Appendix A contains a more detailed data description.

Figure 1: The cyclicality of total government expenditures in non-OECD countries – for countries that have at least 20 years of government expenditure data

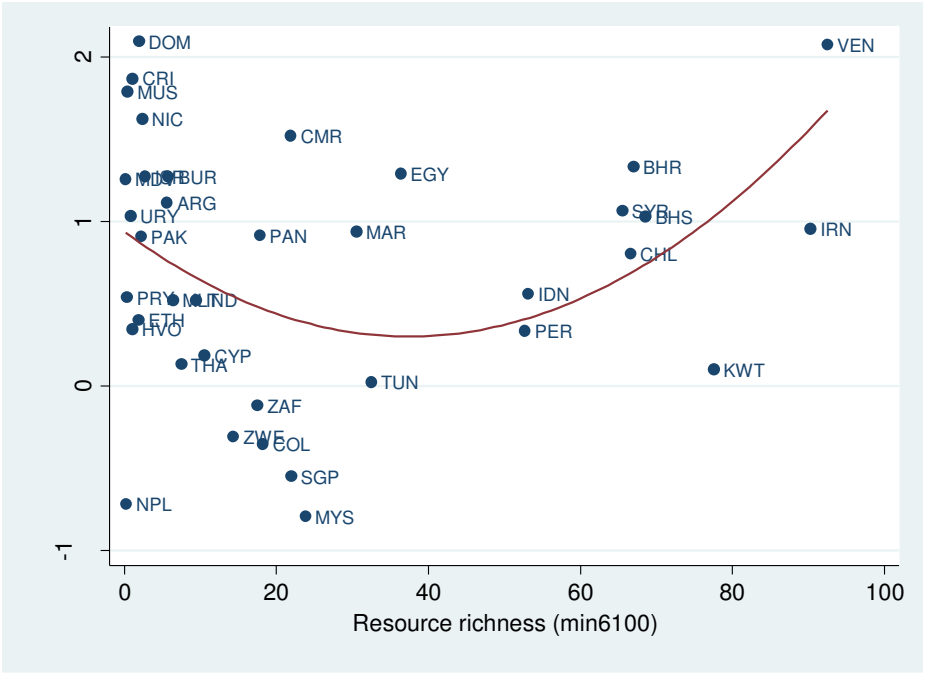


Figure 2: The cyclicality of current government expenditures in non-OECD countries – for countries that have at least 20 years of government expenditure data

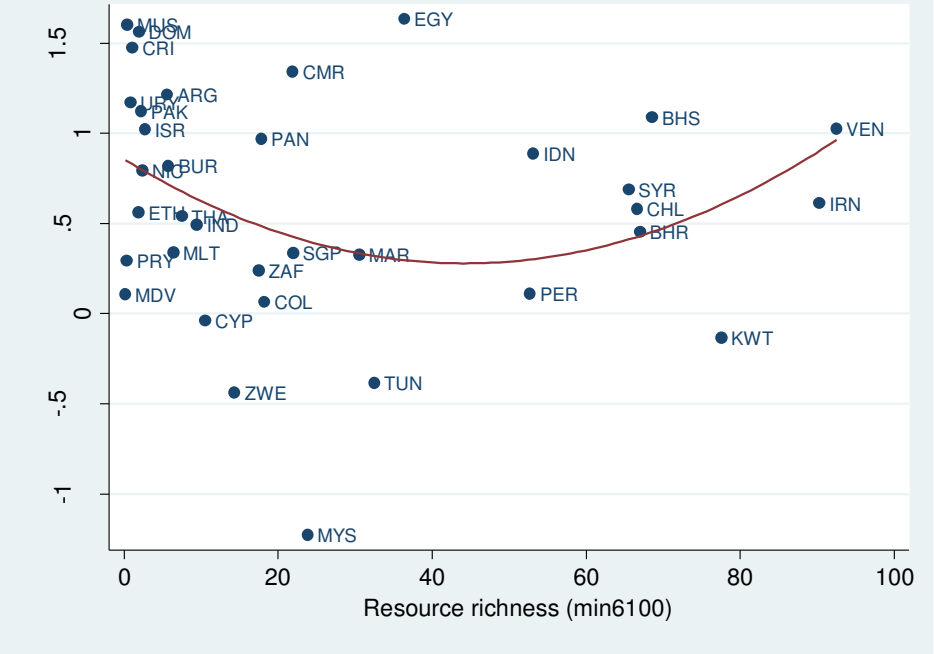
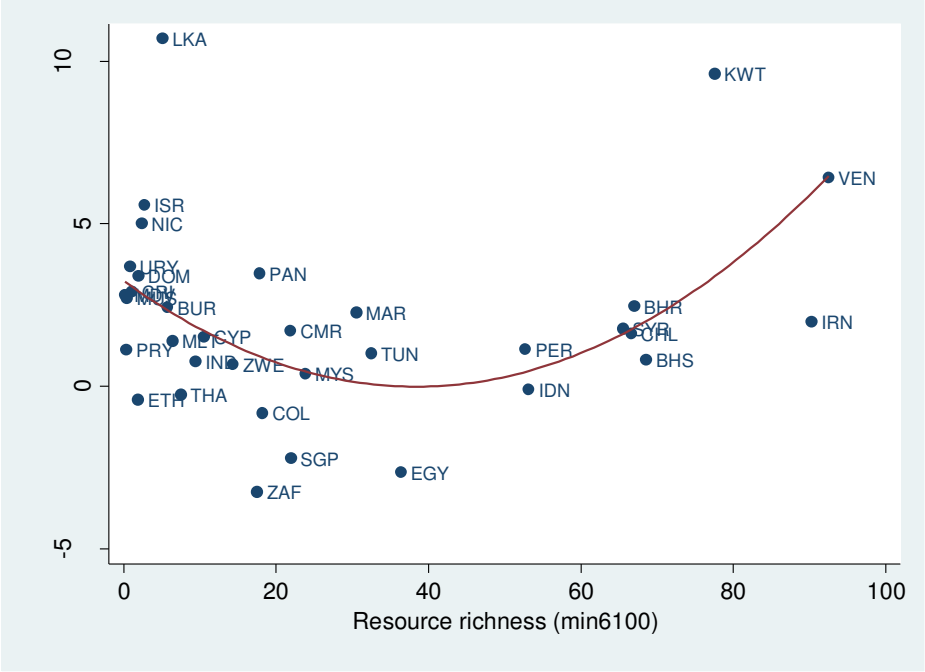


Figure 3: The cyclicality of government capital expenditures in non-OECD countries – for countries that have at least 20 years of government expenditure data



To check the statistical significance of the U-shaped pattern, Table 3 below reports the simple regression relationship between fiscal procyclicality and the resource richness measure with its squared term.

Table 3: OLS regressions - Government expenditures procyclicality measures vs. resource richness, for non-OECD countries that have at least 20 years of government expenditure data

	Total expenditures procyclicality		Current expenditures procyclicality		Capital expenditures procyclicality	
MIN6100	-0,0017 (-0,25)	-0,0415 (-1,81)*	-0,0042 (-0,84)	-0,0261 (-1,50)	0,0094 (0,53)	-0,1651 (-3,03)***
MIN6100_2	-	0,0005 (1,81)*	-	0,0003 (1,32)	-	0,0022 (3,34)***
Adjusted R-squared	0,00	0,03	0,00	0,01	0,00	0,22
Number of observations	38	38	37	37	35	35

t-stats are in the brackets under coefficients. Variables: **MIN6100** – fuels and ores and metals exports share in total merchandise exports over the 1961-2000 period, **MIN6100_2** - the square of min6100.

From Table 3 it can be seen that resource richness alone does not explain the cross-country differences in fiscal cyclicality. Interestingly, inclusion of the squared term of resource richness variable changes the picture significantly; both the resource richness and its squared term become statistically significant. This is especially true for the betas of capital expenditures, though the betas for current expenditures also exhibit some level of statistical significance. This confirms that procyclical current expenditures can create more political pressure; thus governments prefer to smooth the current expenditures along the business cycles more than capital expenditures. Possibly, the capital expenditures are of a more discretionary nature.

We also perform a robustness check for the estimation of our procyclicality measures. Specifically, as an alternative to the main method, we estimate the procyclicality measure as the correlation between the cyclical components of GDP and government expenditures. Having done

so, we confirm the U-type relationship between procyclicality and resource richness. Appendix B provides further details.

We also check whether such a U-shaped relationship persists if we use alternative measures of resource richness. For this, we turn to three additional measures used in the literature: the share of primary products in GNP; the share of mineral production in GNP (borrowed from Sachs and Warner 1997); and the fraction of GDP produced in the Mining and Quarrying sector (borrowed from Sala-i-Martin et al 2004). Detailed description of the data can be found in the Appendix A. Table 4 below checks the existence of U-shaped dependence between capital expenditure procyclicality and those resource richness measures.

The results in columns (2) and (4) show that there is no U-shaped pattern for the share of exports of primary products in GNP (SXP and SXP80). Instead, there is a strong positive linear dependence as shown in columns (1) and (3). On the other hand, columns (6) and (8) exhibit a statistically significant U-shaped relationship for the share of mineral production in GDP (SNR) and for the fraction of GDP produced in the Mining and Quarrying sector (MINING).

In order to interpret the differences in results, it is important to understand the differences in the measures of resource abundance. In general, we have considered two categories of resource abundance measures based on: 1) primary products (such as SXP and SXP80); and 2) mineral products (such as SNR, MINING and MIN6100). Mineral products are perceived to be exhaustible; primary products include both exhaustible and non-exhaustible resources. We claim that these differences originate from the nature of the resource abundance measures. According to the Standard International Trade Classification, primary products are broader than mineral products, the latter including: food and live animals (SITC 0), beverages and tobacco (SITC 1), crude materials, inedible, except fuels (SITC 2), mineral fuels, lubricants and related materials (SITC 3), animal and vegetable oils and fats (SITC 4) and non-ferrous metals (SITC 68). Mineral goods may have a different ownership structure than non-mineral primary goods. Mineral resources are mainly owned by national governments or by state enterprises. McPherson (2003) claims that 90% of oil reserves are controlled by national oil companies, accounting for 73% of oil production globally. According to the U.S. Energy Information Administration, national oil companies controled 88% of global oil reserves and at least 55% of the oil production in 2010. This fact translates into significant export earnings from resources accruing into government accounts, whereas earnings from non-mineral resources exports, such as agricultural products, are collected partially through taxes. Therefore, these two categories of resources may have different fiscal implications (Aliyev, 2011).

Table 4: OLS regressions - Government capital expenditures procyclicality measures vs. alternative resource richness measures, for non-OECD countries that have at least 20 years of government expenditure data
Dependent variable: government capital expenditures procyclicality - *beta_rcape*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SXP	0,0941 (2,70)**	0,0197 (0,19)	-	-	-	-	-	-
SXP_2	-	0,0011 (0,79)	-	-	-	-	-	-
SXP80	-	-	0,1023 (2,66)**	0,0351 (0,33)	-	-	-	-
SXP80_2	-	-	-	0,0011 (0,67)	-	-	-	-
SNR	-	-	-	-	0,0690 (1,94)*	-0,1755 (1,81)*	-	-
SNR_2	-	-	-	-	-	0,0046 (2,79)**	-	-
MINING	-	-	-	-	-	-	0,1027 (1,30)	-0,3173 (1,82)*
MINING_2	-	-	-	-	-	-	-	0,0175 (2,65)**
Adjusted R-squared	0.16	0.15	0.17	0.15	0.08	0.23	0.02	0.18
Number of observations	33	33	31	31	33	33	33	33

t-stats are in the brackets under coefficients. Regression in the column (3) excludes BHS and BHR which has extremely high SXP80, more than 100%. Variables: **SXP** – the share of primary products in GNP in 1971 (**SXP_2** - its squared term), **SXP80** – the share of primary products in GNP in 1980 (**SXP80_2** – its squared term), **SNR** – the share of mineral production in GNP in 1971 (**SNR_2** – its squared term), **MINING** – the fraction of GDP produced in the Mining and Quarrying sector (**MINING_2** – its squared term).

2 Empirical observations

To summarize the hypotheses described in the previous section, for non-OECD countries with mineral resource ownership two effects kick in for fiscal policy procyclicality: 1) political economy problems, such as rent seeking and corruption; 2) credit constraint alleviation. In this section, we provide empirical support for those hypotheses.

2.1 Resource richness and institutions

We now turn our attention to the first hypothesis, the existence of a positive relationship between resource richness and political economy problems. As previous studies have found, we would expect resource richness to induce rent seeking and corrupt behavior by a government. We check whether a direct relationship exists between resources, control of corruption, and a government's effectiveness measures. Table 5 serves this purpose.

Table 5: OLS regressions – Institutional quality vs. resource richness, non-OECD countries

	Control of corruption	Government effectiveness	Voice and accountability	Political stability
MIN6100	-0,0081 (-3,10)***	-0,0069 (-2,76)***	-0,0096 (-3,65)***	-0,0073 (-2,32)**
LGDPEA70	0,5575 (5,71)***	0,5631 (6,07)***	0,5022 (5,21)***	0,4717 (4,10)***
Adjusted R-squared	0,285	0,279	0,243	0,148
Number of observations	82	93	94	94

t-stats are in the brackets under coefficients. Variables: **MIN6100** - fuels and ores and metals exports share in total merchandise exports over the 1961-2000 period, **LGDPEA70** – the log of per capita GDP in 1970.

The regression columns in Table 5 indicate that resource richness is significant in explaining corruption and government effectiveness. We include initial per capita income (log of per capita GDP in 1970) as an additional control variable. In high income countries, control of corruption and government effectiveness would be high, and therefore, create bias in the estimation. The coefficients are highly statistically significant and have the expected sign. In this case, the results tell us that resource richness decreases control of corruption, government effectiveness, voice and accountability, and political stability, as was expected.

In most cases, rich countries have strong political and economic institutions in place. They are characterized by clear property rights, high control of corruption, contained rent seeking, and more effective governments. Generally, government investments are complements, not substitutes, for private investments. Under these circumstances, such governments pursue long-horizon policies which help them efficiently use resource revenues. OECD countries are considered to be rich and mature democracies. However, a few rich non-OECD countries with strong institutions do exist, including Singapore, Chile (which recently became an OECD member) and Malaysia. These countries enjoy a high level of transparency in their political systems, enabling them to run effective economic and fiscal policies.

Below, Figure 4 and Figure 5 visualize the negative relationship between political economy variables and resource richness for the poorer non-OECD countries, i.e. those that had lower GDP per capita in 1970 than the average OECD measure.

Figure 4: Control of corruption during 1996-2008 vs. resource richness measure MIN6100: for resource-rich non-OECD countries that had per capita GDP lower than average OECD in 1970

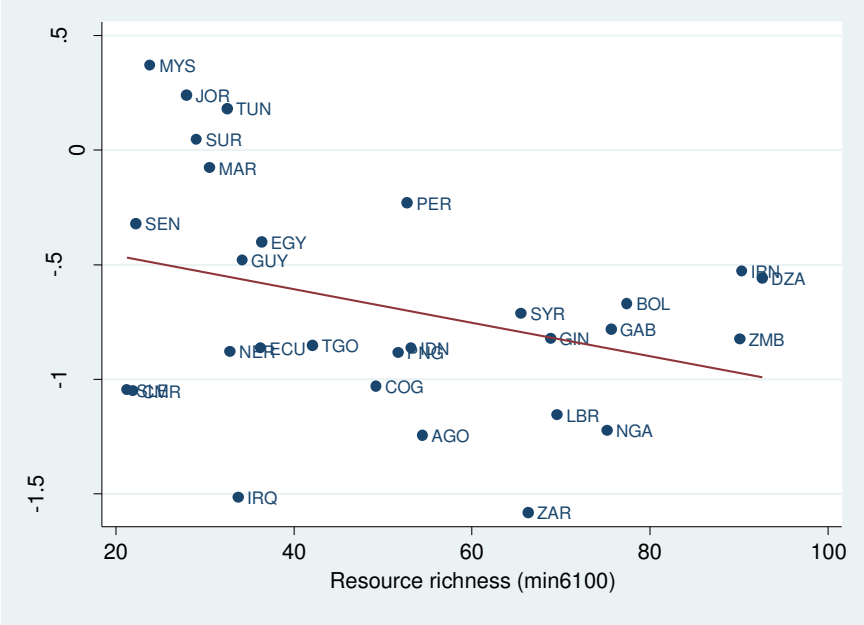
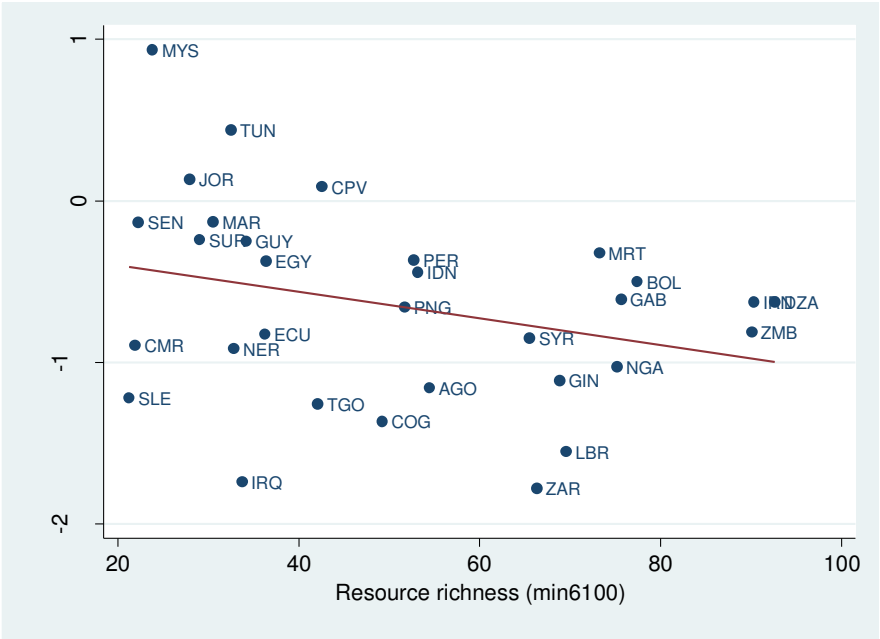


Figure 5: Government effectiveness during 1996-2008 vs. resource richness measure MIN6100: for resource-rich non-OECD countries that had per capita GDP lower than average OECD in 1970



In general, commodity shocks, either of price or production nature, often can be very large, leading to very significant swings in economic growth and government revenues. In order to avoid a highly procyclical fiscal policy, such shocks may necessitate running large fiscal surplus or deficits. This may not always be possible. If a government is not credible and trustworthy, it cannot successfully defend running large surpluses during favorable times and hence increases its expenditures to appease the public. In unfavorable times, if it cannot borrow, it must cut its expenditures significantly.

2.2 Resource richness and borrowing constraint

In this section we look at the credit constraint alleviation hypothesis. First, we need to have a measure for credit constraint. Here, we use Foreign-Currency Government Bond Ratings issued by Moody's Investors Service, as such a measure "reflects the government's capacity and willingness to mobilize foreign exchange to repay its foreign-currency denominated bonds on a timely basis" (Moody's Investors Service 2006). These ratings are not published numerically, so we assign numerical values to the issued ratings between 1 and 19, with 1 representing the least constrained governments. We then look at the relationship between the mineral export share and government bond ratings issued by Moody's, shown in Table 6.

Table 6: OLS regressions – Government bond ratings vs. resource richness, non-OECD countries

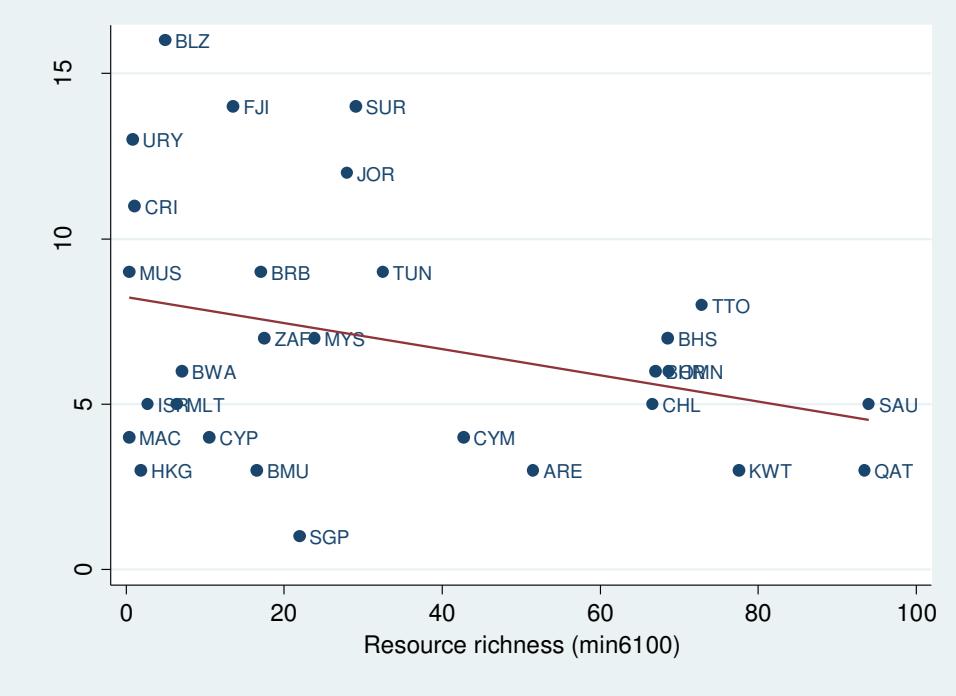
Dependent variable: Foreign-Currency Government Bond Ratings by Moody's in September 2009					
MIN6100	-0,0385* (-1,75)	-0,0254* (-1,95)	-0,0417*** (-3,57)	-0,0330* (-1,99)	-0,0391** (-2,68)
CC9608	-	-4,705*** (-9,58)	-	-5,0684*** (-8,76)	-
GE9608	-	-	-5,5443*** (-11,17)	-	-5,7557*** (-10,63)
LGDPEA70	-	-	-	1,3539* (1,76)	1,0026 (1,54)
Adjusted R-squared	0,04	0,66	0,72	0,66	0,73
Number of observations	57	51	53	42	43

t-stats are in the brackets under coefficients. Variables: **MIN6100** - fuels and ores and metals exports share in total merchandise exports over 1961-2000 period, **GE9608** – government effectivenes during 1996-2008, **CC9608** – control of corruption during 1996-2008, **LGDPEA70** – the log of per capita GDP in 1970.

The table shows that the coefficient is negative and significant at conventional levels, meaning that more resource richness is associated with more positive bond ratings. As expected, bond ratings, i.e., borrowing constraint, are determined by many other important factors. One undeniable factor is the institutional and political economic situation of the country, which should be included as a control. From this we surmise that institutional development might be dominating resource richness in the determination of the ratings. For example, though Venezuela is very resource rich, it also has poorly-developed institutions which are probably a key determinant of its very low assigned bond ratings.

Inclusion of the institutional development measure, such as control of corruption or government effectiveness, improves the significance of resource richness on bond ratings. Figure 6 below shows how the ratings differ by resource richness for non-OECD countries; the relationship is negative. In this graph, we select only those countries that have at least some level of institutional development (i.e., $cc9608>0$) in order not to "lose" the visualization of the correlation between bond ratings and resource richness. The result is also consistent with the literature. Daud and Podivinsky (2011) find that accumulation of reserves has a positive impact on sovereign ratings.

Figure 6: Foreign currency government bond ratings by Moody's as of September 2009 vs. resource richness measure min6100: Non-OECD countries that have "some" control of corruption (cc9608>0)



Above, we provided supporting evidence for both of the resource impact channels on fiscal procyclicality. These channels are considered separately. Putting borrowing constraint and institutional quality measure into one equation together with their interaction term with resource richness variable would create conceptual obstacles in understanding the impacts. This is because it is difficult to find borrowing constraint and institutional quality measures that are independent of resource richness. We believe that resources affect both borrowing constraint and institutions. Hence, creating a more comprehensive econometric approach to estimate the impacts from those two channels would be challenging.

3 Theoretical framework

The U-shaped pattern which is the outcome of the empirical analysis above is not an obvious one. We want to design a rather simple and intuitive framework that would demonstrate why U-shape relationship may prevail. In this section, we build a simple theoretical model that incorporates the two hypotheses developed in the previous sections into one framework. Under these settings, we are able to obtain a U-shaped relationship between the procyclicality of government consumption and resource richness. Although the most significant U-shaped pattern is obtained with capital expenditures, as argued in the literature, those expenditures are actually consumption expenditures. For example, Talvi and Vegh (2005) claim that the public investments associated with commodity booms should be viewed as government consumption, as those non-productive investments fail to generate future consumption.

We consider a two-period social planner model. The government receives revenues from the resource sector Z as endowment and from the stable non-resource sector T as tax collections, and it can borrow B. The initial period budget constraint is:

$$C_0 = Z_0 + T + B \tag{2}$$

In the last period, to finance consumption C_1 it receives unchanged tax income T and resource income Z_1, and it has to fully repay its debt. Moreover, the government of the developing country faces a borrowing constraint in the international marketplace. To formalize the idea of credit constraint faced by governments when borrowing, we adopt the following representation that the higher the debt amount, the more interest it requires:

$$C_1 = Z_1 + T - R\left(\frac{B}{\bar{Z}}\right)B \tag{3}$$

Here, $R\left(\frac{B}{\bar{Z}}\right)$ is the interest rate, which is an increasing convex function, $R'(\cdot) > 0$ and $R''(\cdot) > 0$. Such a formalization implies limits on borrowing as the cost of serving the debt increases rapidly. $\bar{Z}$ is the long-term average resource income describing the resource wealth of the country. The motivation behind such a formulation is to capture the wealth effect arising from resource ownership, in which, if the government owns higher resource wealth, the sustainability of its debt becomes stronger, and hence, it decreases the interest rate by playing a collateral role.

One common way of introducing a borrowing constraint is to explicitly place limits on borrowing as $B \le \bar{B}(\bar{Z})$. In full-blown dynamic model settings, such a constraint would ensure an increase in the shadow price of borrowing, the closer the borrowing gets to its limit. In the two-period settings in this study, such a constraint would be binding and the borrowing amount would be predetermined. In order to study the impact of natural resources on the alleviation of the borrowing constraint, we explicitly introduce an increasing cost of borrowing.

The government maximizes 2-period utility by choosing the consumption in periods 0 and 1, and the borrowing in period 0. The aggregate utility function is given by:

$$U(C_0) + U(C_1) - f\left(\frac{PS_0}{T}\right)U(\bar{C}) \tag{4}$$

Here, $\overline{C}$ is the long-term average of consumption. In this formulation, the government's primary budget balance PS_0 enters into the utility through increasing convex function *f*, $f(0)=0$, $f'(\cdot)>0$ and $f''(\cdot)>0$. Formally, primary surplus is represented as:

$$PS_0 = T + Z_0 - C_0 \tag{5}$$

The last term in (4) implies that aggregate utility decreases with a higher primary budget balance. Then, function *f* is multiplied by average utility $U(\overline{C})$ in order to express this decrease in utility terms, which as a result causes the aggregate utility function to be homogenous. There is no explicit discounting appearing in the utility function. Nevertheless, there is implicit discounting going on through function *f*. As there is a utility "penalization" in the case of higher (lower) budget surplus, more (less) consumption in period 0 will be preferred.[5]

It is important to note that fiscal balance is represented as a ratio to *T*, which describes the size of the fiscal balance compared to a traditional economy and controls for the scale of the economy. Political pressure rises with *Z* and ceases with *T*, as *T* is collected as lump-sum taxes, whereas *Z* is an endowment. The convexity of the *f* function is directly related to the severity of the political pressures arising with the higher endowment shocks. If *f* is more convex, then the government has to cope with higher pressure and increase current consumption more to decrease the disutility.

Talvi and Vegh (2005) approach the pressure to spend coming from the primary surplus through the *f* function in two ways. First, they include it in the budget constraint as a fiscal rule. This leads to procyclicality of the current period consumption. Second, they claim that the pressure stemming from primary surplus can be modeled by including it in the utility function. In our model, we follow the second approach as our view is that, in most developing countries a spending increase in favorable times is not mainly due to the fiscal rules in place, but rather is due to ad hoc government actions to ease the pressure from interest groups through unlawful means, such as rent seeking and corruption.

Maximization of the government's objective (4) given (2), (3) and (5) with respect to *B* yields the following first-order condition:

$$U'(C_0) = U'(C_1)\left[R\left(\frac{B}{\overline{Z}}\right) + \frac{B}{\overline{Z}}R'\left(\frac{B}{\overline{Z}}\right)\right] - \frac{1}{T}f'\left(\frac{PS_0}{T}\right)U(\overline{C}) \tag{6}$$

The Euler equation shows that consumption smoothing is disturbed and the government needs to address the disutility coming from saving the resource endowment for the next period by increasing the consumption in period 0. Also, as interest payments increase disproportionately with the increase of the debt amount, the choice of debt amount will differ from the one corresponding to perfectly smoothed consumption. The last term in (2.6) decreases the marginal utility of consumption in period 0 and thus corresponds to the higher level of consumption in the same period. On the other hand, the term $\left[R\left(\frac{B}{\overline{Z}}\right) + \frac{B}{\overline{Z}}R'\left(\frac{B}{\overline{Z}}\right)\right]$ leads to higher marginal utility decreasing the consumption level in period 0.

[5] An interesting variation of the model with a slightly different utility function and discounting can be found in Aliyev (2012).

From the first-order condition (6) it can be determined that debt amount *B* decreases with the increase of resource revenue Z_0, $-1 < \frac{dB}{dZ_0} < 0$.[6] From (2), we find that current consumption increases with resource revenue but this increase is less than the resource revenue increase itself as future consumption also increases, $0 < \frac{dC_0}{dZ_0} = 1 + \frac{dB}{dZ_0} < 1$. In the current settings, procyclicality β would be defined as below indicating procyclical government consumption:

$$\beta = \frac{dC_0}{dZ_0}\frac{Z_0 + T}{C_0} > 0 \qquad (7)$$

We evaluate the model driven procyclicality at $Z_0 = Z_1 = \overline{Z}$, $\overline{\beta} = \left.\frac{dC_0}{dZ_0}\frac{Z_0 + T}{C_0}\right|_{Z_0=\overline{Z}}$. Then, as there is no investment, the whole income is consumed, $C_0 = C_1 = \overline{C} = \overline{Z} + T$. We assume the utility function to be $U(C) = C^{\rho}$ where $0 < \rho < 1$, and denote $\overline{S} \equiv \frac{\overline{Z}}{\overline{C}}$ - as the share of resource income in total income. Clearly, $0 \le \overline{S} \le 1$. We then obtain the following formula for $\overline{\beta}$ which depends on $\overline{S}$:

$$\overline{\beta} \equiv \beta(\overline{S}) = \frac{\rho(1-\rho)\overline{S}(1-\overline{S})^2 + 2\rho R'(0)(1-\overline{S})^2 + f''(0)}{2\rho(1-\rho)\overline{S}(1-\overline{S})^2 + 2\rho R'(0)(1-\overline{S})^2 + f''(0)\overline{S}} \qquad (8)$$

Equation (8) is key to describing the relationship between resource richness and government consumption procyclicality. Below, we discuss important properties of this equation that are consistent with observations in the previous section. As noted, the evidence suggests that there is a U-shaped relationship between resource richness and procyclicality. It can be shown that under the current assumptions the function $\beta(\overline{S})$ has a unique internal extreme - S^*, and that it is a minimum point in the interval $0 \le \overline{S} \le 1$, which we put as a separate proposition below. This fact gives rise to the U-shaped pattern of the function in the [0,1] region.

Proposition: *The function* $\beta(\overline{S})$ *as in (2.8) has a unique internal extreme in the [0,1] region and it is a minimum, given* $f''(0) > 0$, $R'(0) > 0$ and $0 < \rho < 1$.[7]

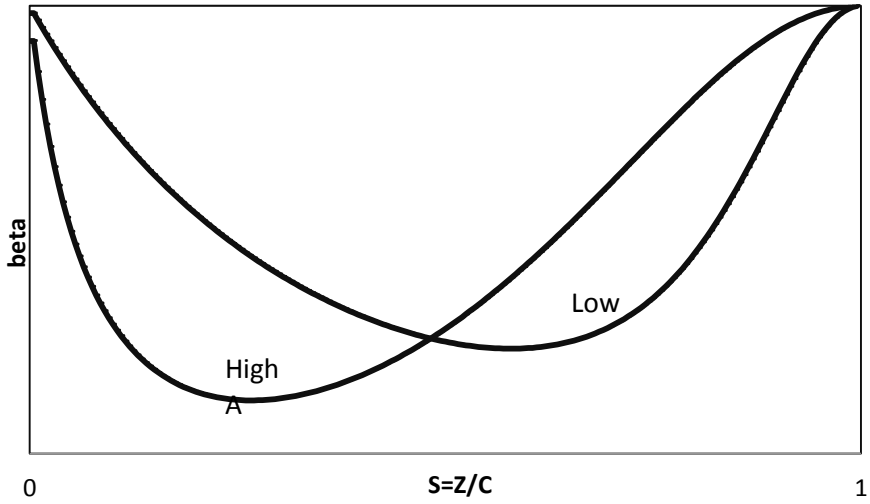
Below, we provide an illustration of the pattern that emerges from the model. The model incorporates two effects stemming from resource revenues: political economy problems represented by $f''(0)$, like rent-seeking or corruption, and borrowing constraint alleviation represented by $R'(0)$. As already mentioned, these effects are not independent of each other. Highly corrupt governments will likely face tighter borrowing constraints in the financial markets. In other words, the values of $f''(0)$ and $R'(0)$ are most probably positively correlated. To empirically support this claim, as mentioned earlier, there is a strong correlation between our political economy measure and the borrowing constraint measure. $A \equiv \frac{f''(0)}{\rho R'(0)}$ plays a central role in determining the minimum and the

[6] For detailed derivation of the model equations, please refer to Aliyev (2012).
[7] Please see Aliyev (2012) for the proof of the proposition.

shape of the curvature. Hence, in the illustration of our model we make use of this observation, and elaborate on the comparative values of $f''(0)$ and $R'(0)$.

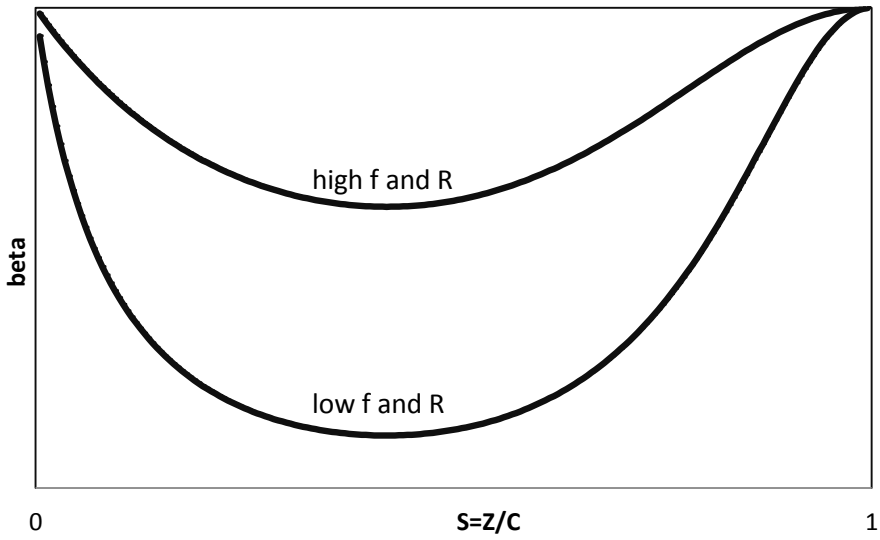
From Figure 7, we observe that with the increase of A the minimum of the curve moves leftwards closer to zero. Similarly, lower A is associated with the higher minimum that approaches the unit. With lower A, the borrowing constraint alleviation effect dominates the political economy effect for higher levels of resource richness.

Figure 7: Illustration of the model-driven U-shape at different levels of A



Although the ratio of $f''(0)$ and $R'(0)$ determines the location of the minimum, the level of the curve is determined by the values of $f''(0)$ and $R'(0)$. If we keep the ratio constant and increase the numerator and the denominator by the same multiplier then the U-curve will move upwards without changing the minimum, as shown in Figure 8.

Figure 8: Illustration of the model-driven U-shape for different $f''(0)$ & $R'(0)$ with the same minimum



Concluding remarks

In this paper, we analyzed fiscal policy procyclicality in resource-rich countries. For developing countries, we obtained a strong U-shaped relationship between the procyclicality of capital expenditures and the resource richness measure, i.e. the mineral exports share in total merchandise exports. The U-shaped pattern was robust for different methodologies and various checks. We considered two hypotheses that in combination can generate a U-shaped impact on procyclicality: first, the ***political economy hypothesis***, and second, the ***borrowing constraint hypothesis***. This motivated us to build the model in Section 3. We found empirical evidence that is consistent with both hypotheses.

Interestingly, when we look at OECD countries in Table 1, i.e. Group 3 and Group 4, we see that resource richness is associated with higher procyclicality, and that this is mainly due to capital expenditures. We noted in Section 1 that OECD countries do not face borrowing constraints and have strong institutional environments. This suggests that there may be a third reason why resource richness leads to higher procyclicality. One alternative hypothesis is that of ***revenue maximization***. When resource prices are high, the return on investment in the resource sector may also be very high, and a government may want to use the opportunity in the up-cycle to maximize its revenues. This would lead to higher capital expenditures by the government and consequently to higher output in the economy. Here, the government's behavior is similar to that of a profit-maximizing firm. Although plausible, we found no empirical support for this hypothesis in the available data. We obtained a procyclicality measure for the government expenditures on mining and mineral resources, manufacturing and construction using the method similar to equation (1). However, we found no pattern of dependence between the obtained measure and the resource richness measure. The revenue maximization hypothesis, therefore, is not supported by our data.

In order to illustrate the findings, we have built a model that generates the U-shaped effect combining political economy and borrowing constraint hypotheses. We have modeled political economy problems as the disutility from having a budget surplus. Under an imperfect institutional environment, high resource revenues (or budget surplus) create pressure on the government to increase spending. This leads to fiscal policy procyclicality. The borrowing constraint alleviation effect is modeled in so that resource ownership by the government creates a wealth effect. This signals the government's long-term debt sustainability and therefore alleviates the borrowing constraint.

Moreover, although we worked with multiple effects that generate a U-shaped pattern, we also explored the possibility of explaining the pattern with a single effect. Again, we found no reasonable hypothesis that can alone explain the U-shaped pattern. This study highlights the complexity of resource richness impact on fiscal policy procyclicality, and the implausibility of explaining the empirical U-shaped pattern with a single hypothesis. To the best of our knowledge, this is the first study to attempt to formalize the borrowing constraint alleviation hypothesis for resource-rich countries.

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Appendix A: Data description

Gross Domestic Product

The United Nations Statistical Division maintains the National Statistical Database that contains the main national account aggregates for 200 countries for the period starting from 1970. This is our source for current and constant price GDP in local currencies data. It allows us to derive the measure of economic growth and, using current and constant price GDP data, we obtain the GDP deflator. Later, this deflator is used to obtain constant price government expenditure data.

Resource richness

We use the annual mineral export and import data available from World Development Indicators (2009) from 1960 onwards. We add the two available measures– fuels exports and ores and metals exports as a share of total merchandise exports, and call it the mineral export share of total merchandise exports. Using the data, we derive our main measure of resource richness. We take the time series averages for 1961-2000, and obtain an average mineral export share as a share of total merchandise exports for each country (*min6100*). In addition, we refer to three other resource richness measures found in the literature; in Sachs and Warner (1997) and Sala-i-Martin, Doppelhofer and Miller (2004). These are:

- The share of exports of primary products in GNP in 1971 (*sxp*) and in 1980 (*sxp80*). Primary product exports are exports of fuel and non-fuel primary products. Non-fuel primary products correspond to SITC categories 0, 1, 2, 4 and 68. Fuels correspond to SITC category 3. These categories are from the Revision 1 of the SITC. Source: Sachs and Warner (1997).

- The share of mineral production in GNP in 1971. $SNR = \frac{M71*1000}{GNPD71*POP70}$, where M71 is the value of mineral production in 1971. This is calculated by Sachs and Warner (1997) from price and quantity data as: $M71_j = \sum_{j=1}^{23} p_i \cdot mq_{ij}$. The sum includes over 23 minerals.

- The fraction of GDP produced in the Mining and Quarrying sector. Data are for the year 1988 when possible, or the closest available year. Source: Sala-i-Martin et al (2004) taken from Hall and Jones (1999).

Government expenditures

Although for developing countries, government final consumption expenditures data are readily available in the national accounts tables by WDI or UN, due to measurement challenges the government investment data is missing from those tables. Government investment data for developing countries used in this study are from Easterly and Rebelo (1993), or more recent data from the Global Development Network Growth Database (GDN-GD) – Easterly database, covering 1970 to 2000. To analyze government expenditure data at the disaggregated level, we utilize the data from the GDN-GD database. The GDN Growth Database is publicly available at: http://go.worldbank.org/ZSQKYFU6J0.

Borrowing constraints

As a measure of the borrowing constraint, we refer to the ratings of government bonds issued by different rating agencies. Here, we use Foreign-Currency Government Bond Ratings issued by Moody's Investors Service. The ratings are as of September 2009, and "reflect the government's capacity and willingness to mobilize foreign exchange to repay its foreign-currency denominated bonds on a timely basis" (Moody's Investors Service 2006, http://www.moodys.com.br/brasil/pdf/SovGuide2006.pdf). We assign numerical values to the issued ratings between 1 and 19, 1 standing for the least constrained governments. More explicitly, AAA=1, AA1=2, AA2=3, AA3=4, A1=5, A2=6, A3=7, BAA1=8, BAA2=9, BAA3=10, BA1=11, BA2=12, BA3=13, B1=14, B2=15, B3=16, CAA1=17, CAA2=18 and CAA3=19.

Political economy measures

The source of political economy indicators are Control of Corruption and Government Effectiveness measures taken from the Worldwide Governance Indicators 1996-2008 by the World Bank. Control of Corruption (*CC9608*) captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Government Effectiveness (*GE9608*) – captures perceptions of the quality of public services, quality of the civil service and the degree of its independence from political pressures, quality of policy formulation and implementation, and credibility of the government's commitment to such policies. Voice and Accountability – captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Political stability – captures perceptions of the likelihood that a government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.

Appendix B: Robustness check

To obtain an alternative procyclicality measure, we run the log difference of real total government expenditures from its HP filtered level on the log-differenced real GDP gap.

$$\ln G_{it} - \ln G_{it}^{HP} = \delta_i + \beta_i [\ln Y_{it} - \ln Y_{it}^{HP}] + \varepsilon_{it} \qquad \text{(B.1)}$$

In the equation above, the variables denoted by HP are Hodrick-Prescott filtered series. Along with the cyclicality measure for real total government expenditures (*beta_rtote_gap*), we obtain an alternative cyclicality measure for real government current (*beta_rcure_gap*) and capital expenditures (*beta_rcape_gap*). As we have done with our main procyclicality measure, in Table 7 and Figure 9-11 below we do the same exercise for the alternative measure and show that the U-shaped pattern persists for the alternative procyclicality measure.

Table 7: OLS regressions – Alternative government expenditures procyclicality measures vs. resource richness, for non-OECD countries that have at least 20 years of government expenditure data

	Total expenditures procyclicality		Current expenditures procyclicality		Capital expenditures procyclicality	
MIN6100	-0,0012 (-0,23)	-0,0300 (-1,70)*	-0,0024 (-0,66)	-0,0122 (-0,91)	-0,0024 (-0,16)	-0,1521 (-3,11)***
MIN6100_2	-	0,0004 (1,70)*	-	0,0001 (0,76)	-	0,0019 (3,19)***
Adjusted R_squared	0,00	0,02	0,00	0,00	0,00	0,19
Number of observations	38	38	37	37	36	36

t-stats are in the brackets under coefficients. Variables: **MIN6100** – fuels and ores and metals exports share in total merchandise exports over the 1961-2000 period, **MIN6100_2** - the square of min6100.

Figure 9: Alternative total expenditures cyclicality measure in non-OECD countries – for countries that have at least 20 years of data

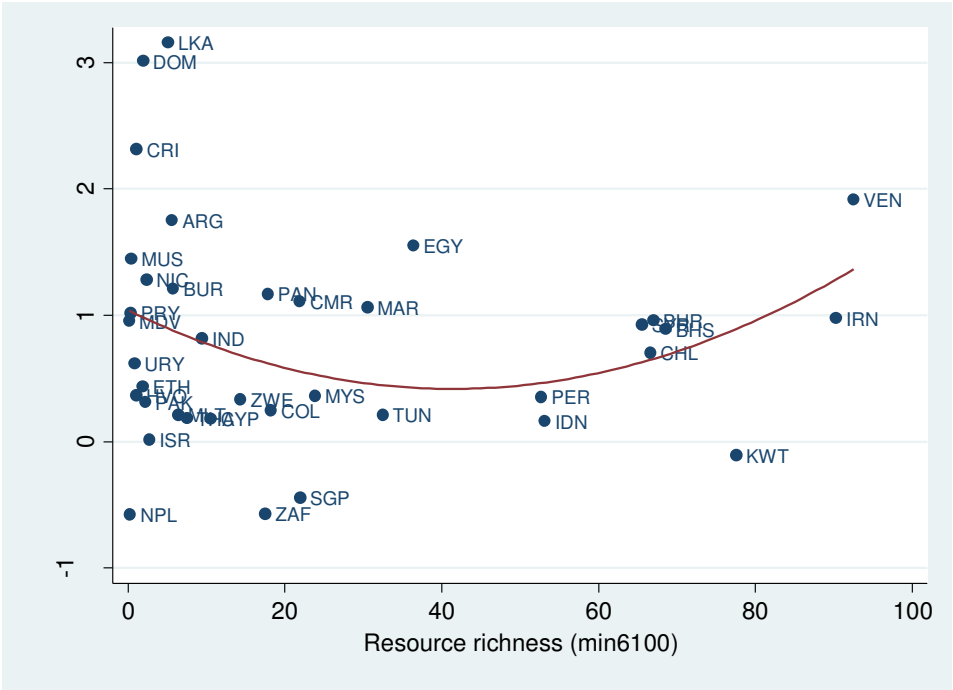


Figure 10: Alternative current expenditures cyclicality measure in non-OECD countries – for countries that have at least 20 years of data

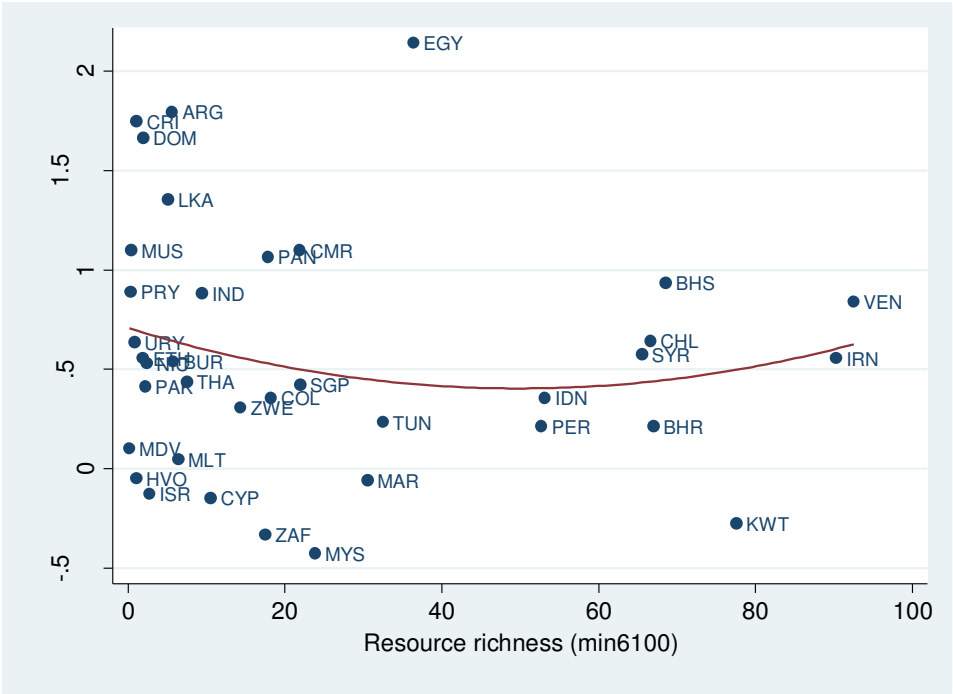
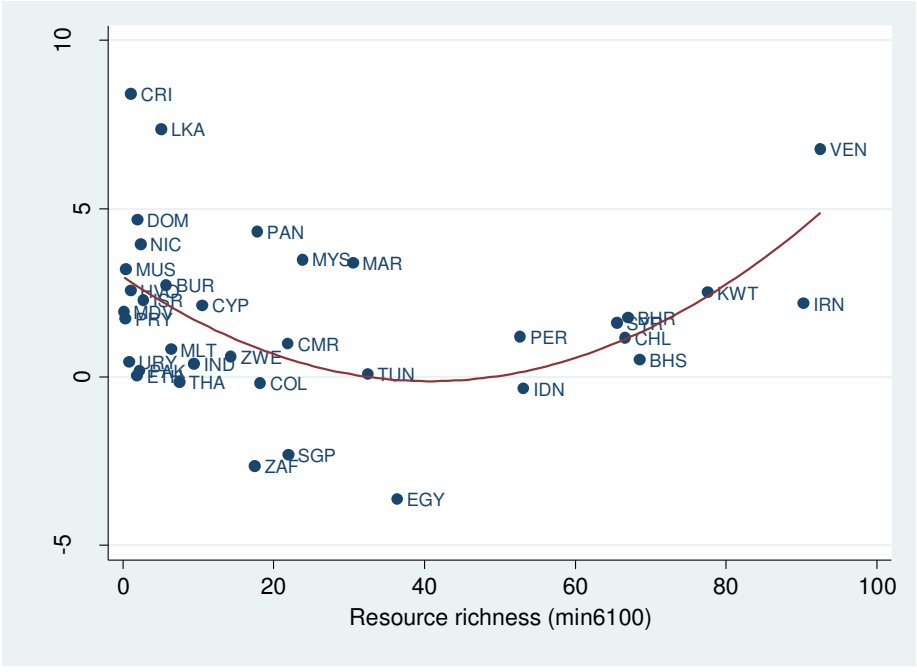


Figure 11: Alternative capital expenditures cyclicality measure in non-OECD countries – for countries that have at least 20 years of data



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