NBER WORKING PAPER SERIES

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Working Paper 19748
http://www.nber.org/papers/w19748

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2013

We are grateful to Yan Carriere, Juan Matamala and Sergio Salgado for excellent research assistantship and to Cristian Muñoz for data collection. We are also grateful to Luis Catao for sharing his data with us. We thank Guillermo Calvo, Choongsoo Kim, Harald Uhlig and three anonymous referees for very useful comments and suggestions. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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NBER Working Paper No. 19748
December 2013
JEL No. E62,F21,F32,F41,H12,H6,H63

ABSTRACT

We revisit the issue of fiscal procyclicality in commodity-rich nations –commodity republics in the nomenclature of this paper. Since commodity prices are plausibly a main driver of fiscal policy outcomes in these countries, we focus on the behavior of fiscal variables across the commodity cycle, in contrast to behavior across the output cycle, which has been the main focus of earlier research on fiscal procyclicality. We present evidence of reduced fiscal policy procyclicality in a number of countries. Our empirical results suggest that improvements in institutional quality have led to a more countercyclical fiscal policy stance in a number of countries. The presence of fiscal rules also seems to have made a difference: countries that use them displayed a larger shift toward fiscal counter-cyclicality between the two episodes.

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1. Introduction

According to standard economic theory, fiscal policy should be countercyclical. In the neoclassical smoothing model of Barro (1979), a government should optimally run surpluses in good times and deficits in bad times.[3] That is the same a government should do, though for different reasons, in the standard Keynesian or neo-Keynesian framework.

Yet in practice governments often seem to follow a procyclical fiscal policy. Cuddington (1989), Talvi and Vegh (2005) and Sinnott (2009), among others, document that governments save little or even disave in booms. Procyclicality is most evident in Latin America (Gavin et al (1996), Gavin and Perotti (1997), Stein et al (1999)) but is also present in OECD countries (Talvi and Vegh (2005), Arreaza et al (1999), Lane (2003)). Using quarterly data and a set of econometric models to correct for the potential reverse causality from fiscal policy to business cycle, Ilzetski and Vegh (2008) provide evidence that confirms the idea that fiscal policy in developing countries is procyclical.

The problem of procyclicality seems to be especially acute for commodity-rich nations --*commodity republics* in the nomenclature of this paper. In those countries, commodity-linked revenues (taxes, royalties, profits) can be a large portion of government revenue (see Sinnott (2009)). And by any measure, commodity price volatility is large.[4] As a result, overall revenues are quite volatile --and so can be spending and the fiscal balance. If expenditures react more than proportionally to revenue increases, then the fiscal balance can move with the cycle.

In this paper we revisit the issue of fiscal procyclicality in commodity republics. Since commodity prices are plausibly a main driver of fiscal policy outcomes in these countries, we focus on the behavior of fiscal variables across the commodity cycle, in contrast to behavior across the output cycle, which has been the main focus of earlier research on fiscal procyclicality.

The paper has two goals. First, to document over a long period of time the behavior of fiscal policy for a large number of commodity-producing countries. Second, to see whether the behavior of fiscal policy in such countries has changed over time. In particular, we wish to test the hypothesis that "this time was different": given that commodity-producing nations improved the rules and institutions that govern their fiscal policies, did fiscal policy behave less procyclically --and perhaps even countercyclically-- in the recent commodity boom episode?

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[3] If, of course, the fluctuations are expected to be temporary, not permanent. We return to this point below.

[4] Mendoza (1995) estimates that close to one-half of the variation in aggregate output for a group of 30 developed and developing economies can be attributed to terms of trade shocks. Kose (2002) using a similar framework finds that terms of trade shocks can explain almost all of the variance in output in small open developing economies.

We construct a commodity price index for a group of 48 economies, incorporating information on the importance of each commodity in the total commodity output of the country for the period 1960-2010. Using that index we identify commodity boom episodes: periods of significant increases in commodity prices in the period 1900-2010 for the 32 countries that given the high importance of commodity production in total production may be considered commodity republics. We define a commodity boom episode as a period in which our domestic production-weighted commodity price index surpasses its historical trend by a certain threshold margin. For most of the countries under study we identify two boom episodes: one taking place in the 1970s and early 1980s, and another in the years immediately prior to 2008.

Next we study the behavior of key fiscal variables surrounding these commodity boom episodes. We analyze how real government expenditures, real government revenues and the fiscal balance behave over the commodity price cycle. Then we study how procyclical or countercyclical fiscal policy was during these episodes. To that end, and using two different specifications, we estimate coefficients that capture, country by country, the response of fiscal variables to movements in commodity prices.

This first set of results suggests that the fiscal policy of many commodity republics was indeed quite procyclical in the earlier boom episode. For instance, in several cases we identify a negative relationship between the fiscal balance (as a percentage of GDP) and the behavior of commodity prices. That is, the fiscal balance deteriorates as commodity prices increase, in exactly the opposite fashion to what theory would suggest.

To test the established wisdom that "this time was different" with regard to the conduct of fiscal policy in commodity-rich nations, we look for systematic differences between the most recent episode of increases in commodity prices and the previous episode. The results are encouraging: there is evidence of reduced procyclicality in a number of countries. The number of negative relationships between the fiscal balances and commodity prices drops significantly, showing there are fewer countries whose fiscal policy seems to have been overtly procyclical in the recent episode. Behind this is change stands an improvement in the cyclical behavior of revenues. Regarding the behavior of expenditure, our evidence points towards a reduction in its procylicality.

The paper is organized as follows. In the next section we briefly summarize recent related literature on the cyclicality of fiscal policy in commodity-rich nations or with respect to terms of trade shocks. Then we review what the theoretical literature has to say about the cyclical behavior of fiscal policy in commodity rich countries. Later we specify the commodity price index and the precise definition of a boom. Having identified the boom episodes, in the following section we describe the behavior of fiscal and macro variables during times of high prices. Then, in section 6, we carry out the econometric estimation of the elasticities of fiscal variables with respect to the commodity price index. In that section we tackle the question of whether fiscal behavior was different in a

statistically significant way across boom episodes. Section 7 then analyzes the role of a few institutional and political variables in trying to explain the changed pattern of fiscal behavior. Section 8 concludes.

2. Related literature

As mentioned in the introduction, the empirical literature tends to support the view that governments in developing countries often follow a procyclical fiscal policy. Some recent studies have concentrated their analysis on commodity-rich nations or have concentrated in the impact of terms of trade shocks on fiscal outcomes. We briefly summarize here the conclusions of some the main papers on this issue.

Villafuerte and Lopez-Murphy (2010) evaluate the behavior of fiscal policy in oil-producing countries during the recent oil price cycle (2003-2008). Their dataset includes 31 countries in which oil revenue was at least a 25 percent of total fiscal revenue. They show that the overall fiscal balance for those countries improved significantly during the recent oil price cycle. Nonetheless, the non-oil primary fiscal balance worsened significantly as a result of increased primary spending. They also provide evidence of procyclical fiscal policy behavior in oil producing countries. Interestingly, they find that higher degrees of fiscal procyclicality are negatively correlated with the income level of countries.

Centered also on oil producing countries, Erbil (2011) studies fiscal cyclicality in 28 developing countries for the period 1990-2009. He estimates the elasticity of different fiscal measures –such as government expenditure and public investment— to output, controlling for the terms of trade and also taking into account potential reverse causality. He provides evidence supporting the existence of procyclical fiscal policy in low and middle-income countries. Some evidence suggests that higher political quality and better institutions factors –as well as less binding financial constraints– are associated with lower cyclicality of fiscal policy.

Kaminsky (2009) studies the links between the fiscal stance and terms of trade cycles for a sample of 74 countries. She finds that fiscal policy is countercyclical in OECD countries and procyclical in developing countries vis a vis GDP. Regarding terms of trade cycles, she provides evidence that fiscal policy in OECD and low-income countries is acyclical. For upper-middle-income countries fiscal policy is countercyclical with respect to the terms of trade while the response of fiscal policy in lower-middle-income countries is procyclical. Nonetheless, for both upper-middle income and lower-middle income countries, fiscal policy tends to be more procyclical during terms of trade booms relative to normal times.

So, fiscal policy in developing economies, including commodity–rich nations, tends to be procyclical. In the next section we provide a framework that shows that deviations

of fiscal policy from what the standard economic theory predicts can be explained by political economy factors. Then we provide evidence that relates changes in fiscal policy cyclicality with changes in political and institutional factors.

3. What theory predicts

In this section we review what the response of fiscal expenditure and the fiscal balance should be to shocks to government income --as captured, for instance, by the increase in price of a natural resource owned by the government. We begin by studying the optimal response of a single benevolent policymaker. We then study the case of several policy makers that interact strategically, giving rise to the "voracity" effect. This voracity effect has been presented as an explanation for the procyclicality of fiscal policy documented in the empirical literature.

3.1 The case of a single policymaker

3.1.1 The government budget constraint

Consider a government that spends a real flow g_t, financed either by collecting revenue τ_t, enjoying the benefits of a positive income shock ε_t, or decumulating assets whose stock is denominated by b_t and which pay a fixed rate of interest rate r.

The corresponding government budget constraint is

$$\dot{b}_t = rb_t + \tau_t + \varepsilon_t - g_t, \tag{1}$$

where $\dot{b}_t$ can be interpreted as the fiscal surplus or deficit at time t. Any such government must also impose the standard no Ponzi game condition that the discounted value of government assets be zero at infinity:

$$\lim_{t\to\infty} b_t e^{-rt} = 0. \tag{2}$$

Using this expression, flow constraint 1 can be solved forward and written as:

$$\int_t^\infty g_s e^{-r(s-t)} ds = b_t + \int_t^\infty (\tau_s + \varepsilon_s)\, e^{-r(s-t)} ds, \tag{3}$$

so that the present value of expenditures is equal to the current stock of assets plus the present value of government income.

Assume next that revenue is fixed ($\tau_t = \tau$ for all t) and that the government

income shock has a rate of decay equal to ρ:

$$\varepsilon_s = \varepsilon_t e^{-\rho(s-t)}. \tag{4}$$

This holds for times $s > t$. Notice that the shock is permanent if $\rho = 0$, and the length of the shock goes to zero as $\rho \to \infty$. A natural way to think about this setup is to assume that this government is going along with revenue τ until unexpectedly at time t is experiences the positive shock ε_t, whose dynamics is given by 4. This shock can be interpreted as an increase in commodity prices, which translates into higher income for the government.

Incorporating these two assumptions into the government budget constraint 3 yields

$$\int_t^\infty g_s e^{-r(s-t)} ds = b_t + \frac{\tau}{r} + \frac{\varepsilon_t}{r+\rho}. \tag{5}$$

It is natural to assume that $b_t + \frac{\tau}{r} > 0$, so that the government has positive wealth before the positive income shock takes place.

3.1.2 Government preferences and optimal policy

Now suppose the government has the following preferences over the flow of government expenditure:

$$U_t = \int_t^\infty \left(\frac{\sigma}{\sigma-1}\right) g_s^{\frac{\sigma-1}{\sigma}} e^{-\delta(s-t)} ds, \tag{6}$$

where σ is the intertemporal elasticity of substitution and δ the instantaneous rate of discount. The solution to the government's standard problem of maximizing 6 subject to 5 is summarized by the Euler equation

$$\dot{g}_t = g_t \sigma \left(r - \delta\right) \tag{7}$$

which implies

$$g_s = g_t e^{\sigma(r-\delta)(s-t)} \tag{8}$$

Using this in the government budget constraint 5 finally yields

$$g_t = \left[\left(1-\sigma\right) r + \sigma\delta\right] \left[b_t + \frac{\tau}{r} + \frac{\varepsilon_t}{r+\rho}\right]. \tag{9}$$

It follows that each moment in time the government optimally spends a fixed share $(1-\sigma)r+\sigma\delta$ of its wealth, given by the stock of bonds it holds plus the present value of its revenue.

3.1.3 The effects of shocks

It follows from 9 that

$$\frac{\partial g_t}{\partial \varepsilon_t}\frac{\varepsilon_t}{g_t} = \frac{\frac{\varepsilon_t}{r+\rho}}{b_t + \frac{\tau}{r} + \frac{\varepsilon_t}{r+\rho}} \tag{10}$$

That is, the optimal elasticity of government expenditure with respect to the income shock is positive and smaller (larger) than one if $b_t + \frac{\tau}{r}$ is larger (smaller) than zero. Since we have assumed $b_t + \frac{\tau}{r} > 0$, the resulting elasticity is smaller than one: if the income shock increases by $x\%$, expenditure should optimally rise by less than $x\%$.

Recall now from 3 that the government surplus is the difference between income and total expenditure. Using 9 in 3 we have

$$\text{Fiscal surplus} = \dot{b}_t = \sigma\left(r-\delta\right)\left[b_t + \frac{\tau_t}{r}\right] + \left[\frac{\sigma\left(r-\delta\right)+\rho}{r+\rho}\right]\varepsilon_t. \tag{11}$$

Notice that if the rate of interest is equal to the rate of discount, this simplifies to

$$\dot{b}_t = \left(\frac{\rho}{r+\rho}\right)\varepsilon_t. \tag{12}$$

This expression is equal to zero if $\rho = 0$: when the shock is permanent no accumulation or decumulation of assets should take place.

We are finally ready to ask what is the effect of an income shock on the fiscal balance:

$$\frac{\partial \dot{b}_t}{\partial \varepsilon_t} = \frac{\sigma\left(r-\delta\right)+\rho}{r+\rho}. \tag{13}$$

This expression is positive if $r + \rho\sigma^{-1} > \delta$. That is, if for a given rate of interest, the elasticity of intertemporal substitution in government spending is sufficiently low (σ^{-1} is large), the shock is sufficiently temporary (the rate of decay ρ is large), and the rate of discount δ is small. This is intuitive: if the governments preference for smoothing is strong, the shock is not going to last too long and the future is not discounted too heavily, then the government should optimally shift some of the current income to the future; it accomplishes that by running a larger fiscal surplus and accumulating assets.

3.2 Many policymakers and the voracity effect

3.2.1 The fiscal policy problem with many groups

If the general case is that fiscal policy should be countercyclical in response to shocks that are sufficiently temporary, under what conditions can it turn procyclical? One common explanation is that in bad times governments –particularly in emerging markets– are credit-constrained. When times improve such constraints are presumably lifted, and governments are free to go on a debt-financed spending spree.

This story has its appeal –among other reasons because international capital flows are also procyclical, as borrowing constraints are relaxed during booms. This fact is documented, among others, by Gavin, Hausmann, Perotti and Talvi (1996), Kaminsky, Reinhart, and Vegh (2005), Mendoza and Terrones (2008), and Reinhart and Reinhart (2009).

But borrowing constraints that do not bind in good times are not sufficient in themselves to explain fiscal procylicality. The fact that a government can borrow during a boom does not mean that the government will find it desirable to borrow during a boom. For that to be the case, an additional explanation is necessary.

One possibility is the " voracity effect" presented in Lane and Tornell (1996) and Tornell and Lane (1999), based on the model by Tornell and Velasco (1991).[5] If fiscal policy is decided on a decentralized basis, with many interest groups vying for their share of the fiscal spoils, standard smoothing behavior breaks down, and groups spend too large a share of temporary positive income shocks –that is, they save too little during booms.

The political economy plausibly unfolds differently under different political arrangements or institutions. A basic prediction of the " voracity approach" is that political systems in which power is diffused among a number of agents will produce a higher degree of fiscal procyclicality relative to a centralized or “unitary” system. This is what

[5] See also Velasco (1998) and (2003) for applications of that model to a fiscal framework.

Stein et al (1999) and Lane (2003) find, using different country samples and varying measures of power dispersion. Conversely, Arezki and Brückner (2010) show that commodity price booms lead to increased government spending, external debt and default risk in autocracies, but have smaller such effects in democracies.[6]

Suppose, as in Velasco (2000), that there isn't a single policymaker but n of them, indexed by i, each of whom gets benefits from public expenditure accruing to the policymakers constituency. In this case budget constraint 1 becomes

$$\dot{b}_t = rb_t + \tau + \varepsilon_t - \sum_{i=1}^{n} g_{it}, \tag{14}$$

Suppose next that each group i maximizes

$$U_{it} = \int_t^{\infty} \left(\frac{\sigma}{\sigma-1}\right) g_{is}^{\frac{\sigma-1}{\sigma}} e^{-\delta(s-t)} ds, \tag{15}$$

subject to 14 and to the spending rule used by all other groups, given by

$$g_{it} = \phi\left[b_t + \frac{\tau}{r} + \frac{\varepsilon_t}{r+\rho}\right], \tag{16}$$

where ϕ is a coefficient to be determined.

Using 16 in 14 we have

$$\dot{b}_t = \left[r - \phi\left(n-1\right)\right] b_t + \tau_t + \varepsilon_t - \phi\left(n-1\right)\left[\frac{\tau}{r} + \frac{\varepsilon_t}{r+\rho}\right] - g_{it}, \tag{17}$$

The Euler equation corresponding to this problem is

$$\dot{g}_t = g_t \sigma\left[r - \phi\left(n-1\right) - \delta\right], \tag{18}$$

which implies

[6] Another political economy story that yields fiscal procyclicality is that of Alesina et al (2008), who focus on a political agency problem: voters face corrupt governments that can appropriate part of tax revenues for unproductive public consumption. This agency problem interacts with lack of information: voters observe the state of the economy, but they cannot observe government borrowing. Hence, when voters see the economy booming, they demand higher utility for themselves in the form of lower taxes or better public goods. This forces the government to impart a procyclical bias to fiscal policy, and to borrow too much.

$$g_s = g_t e^{\sigma[r-\phi(n-1)-\delta](s-t)}. \tag{19}$$

Solving 14 forward, imposing 4, the no Ponzi game condition 2 and symmetry across all n groups yields

$$n\int_t^{\infty} g_s e^{-r(s-t)} ds = b_t + \frac{\tau}{r} + \frac{\varepsilon_t}{r+\rho}. \tag{20}$$

Plugging 19 in 20 we have

$$g_{it} = \left[\frac{(1-\sigma)r + \sigma\delta + \sigma\phi(n-1)}{n}\right]\left[b_t + \frac{\tau}{r} + \frac{\varepsilon_t}{r+\rho}\right] \tag{21}$$

Now, combining 16 and 21 to solve for ϕ yields

$$\phi = \frac{(1-\sigma)r + \sigma\delta}{n - \sigma(n-1)}, \tag{22}$$

so that again each group spends a fixed portion of government resources. It follows that

$$g_t = ng_{it} = \eta\left[(1-\sigma)r + \sigma\delta\right]\left[b_t + \frac{\tau}{r} + \frac{\varepsilon_t}{r+\rho}\right] \tag{23}$$

where $\eta = \frac{n}{n-\sigma(n-1)} > 1$ is increasing in n. Notice that when $n=1$, $\eta = 1$ and this solution collapses to expression 9 in the earlier section.

Notice from this solution that the larger the number of groups, the more each decides to spend. The intuition is that with more groups, the larger is the share of current wealth the others can spend, and therefore the more each group wishes to spend in response.

3.2.2 The effects of shocks

Applying 23 in 14 we have

$$\text{Fiscal balance} = \dot{b}_t = \left[b_t + \frac{\tau}{r}\right]\left[r - \eta\left[(1-\sigma)r + \sigma\delta\right]\right] + \varepsilon_t\left[\frac{r+\rho-\eta\left[r(1-\sigma)+\sigma\delta\right]}{r+\rho}\right], \tag{24}$$

We are finally ready to ask what is the effect of an income shock on the fiscal balance:

$$\frac{\partial \dot{b}_t}{\partial \varepsilon_t} = \frac{r+\rho-\eta\left[r\left(1-\sigma\right)+\sigma\delta\right]}{r+\rho}. \tag{25}$$

This expression is decreasing in η and positive if $\eta < \frac{r+\rho}{r\left(1-\sigma\right)+\sigma\delta}$. In words, as n increases so does η, and as a result the response of the fiscal balance to a shock is reduced. If there are many groups and therefore η is sufficiently large, then the response can have a negative sign: the surplus shrinks (or the deficit becomes larger) as the shock increases and government income rises. This is how the voracity effect can make fiscal policy pro-cyclical, even though in the absence of power fragmentation it ought to be countercyclical.

4. Commodity prices and their behavior

The first task is to document the behavior of the commodities relevant for each of the economies we study. Table 1 shows the shares of primary commodity production in total national production for the period 1990-2008 and the share of commodity exports in total 1999-2006 exports for a set of 48 countries for which we have collected data on these dimensions.

Clearly, not all countries in this sample qualify as commodity republics: the output share of commodity production in total production ranges from a low of 0.4% in Portugal to a high of 52.6% in Kuwait. The average is 16% over the period 1990-2008, suggesting that commodities are indeed quite important in most of the countries in the sample. Moreover, the average share of primary commodities in total production has reached almost 28% in recent years for these countries.

Regarding the share of commodities in total 1999-2006 exports of these 48 nations, here commodities play a more important role. The average share is 41.4%, and only in a handful of advanced economies (Austria, France, Germany, Italy, Portugal, Spain and the UK), plus China, is the commodity export share 10% or less. In what follows we remove these 8 countries from the sample, remove also another 8 countries due to data availability, and focus on the remaining 32, which can indeed be labeled commodity republics.

To identify periods of commodity booms, we construct for each country a commodity price index that includes the commodities produced domestically. The commodity price indices often used in the literature are Laspeyres-style indices based on

Grilli & Yang's (1988) methodology and extended by Pfaffenzeller et al. (2007), which use a fixed basket of commodity weights for each country. This method has the advantage of being comparable across time: since weights are fixed over the length of the series, the composition of the index does not change and movements in the series can be directly interpreted as movements in the price of those commodities.

The disadvantage of such a methodology, however, is precisely that the weights remain constant over time and thus do not capture changes in the commodity production matrix. This problem is especially pronounced when considering long historical samples, and is one of the reasons that papers in the literature have addressed relatively short time periods (e.g. Blattman, Hwang and Williamson (2007); Cashin, Céspedes and Sahay (2004)).

To demonstrate the first-order importance of this limitation, consider the case of Chile. During the first half of the twentieth century, commodity production was dominated by saltpeter. When a synthetic alternative was discovered in the 1930s, world prices dropped suddenly and production was gradually phased out. By 1950, Chile no longer produced saltpeter at all, and copper began to dominate commodity production. A commodity price index constructed using weights fixed in recent years --as has been used in the literature-- would be a completely inappropriate measure of prices for the first half of the 20th century.

An alternative to this approach is to employ a Passche-style index in which weights are updated in each period. The disadvantages of such a procedure are two: comparability over time is more difficult, and the index will reflect changes in production quantities that might not be completely exogenous to domestic policy over short time periods.

In contrast to previous literature, we construct the weights for each commodity in the final index using the value of that commodity in total commodity production of the country. This strategy allows us to cover representatively a longer period.

Since our aim is to examine the evolution of fiscal policy during exogenous commodity booms across countries and over an extended historical period (1900-2008), we employ a methodology that is a compromise between the fixed-weights Laspeyres index employed in the literature and a Paasche index described above. To allow for structural shifts in the production matrix, we recalculate weights in 30-year intervals, and splice the series using the rescale factor obtained by taking the ratio in overlapping periods. The choice of 30-year intervals is admittedly ad-hoc, but is convenient due to the availability of certain production and price data series.

The commodity price index for country i is computed as follows:

$$ {}_{k}COMBI_{t}^{i} = \sum_{j} s_{k}^{j} \left(\frac{p_{t}^{j}}{\overline{p}^{j}} \right), $$

where $s_k^j = \frac{1}{30} \sum_{k}^{k+30} \left(\frac{p_t^j q_t^j}{\sum_j p_t^j q_t^j} \right)$ is commodity j's share of total commodity production in country i, averaged over the 30-year base period beginning in year $k = \{1900, 1930, 1960, 1990\}$; $\overline{p}^j$ is the average price of commodity j over the period of 1960-1990; p_t^j is the international price of commodity j at time t in US dollars; and q_t^j is the output of commodity j during year t in the units of the corresponding price. We employ production data from Mitchell's World Historical Statistics volumes, the U.N. Food and Agriculture Organization, and national agencies. Price series reported in the database provided by Pfaffenzeller et al. (2007) have been extended using information from the U.S. Geological Service, the World Bank's Global Economic Monitor, and the B.P. Statistical Review of World Energy.

The final index is then constructed by splicing the COMBI index across base years:

$$ COMBI_t^i = {}_{k}COMBI_t^i \text{ for } k = 1990 \text{ and } t \geq 1990 $$

$$ COMBI_t^i = \left(\frac{{}_{k}COMBI_t^i}{{}_{k+30}COMBI_t^i} \right) {}_{k}COMBI_t^i \text{ for } k = \{1900, 1930, 1990\} \text{ and } k \leq t < k + 30 $$

The indices are then normalized such that $\mathrm{COMBI}_{2000}^{\mathrm{i}} = 100$ for all *i*. Finally, the index is deflated using the producer price index for the United States.

A commodity boom is defined as an episode during which the index reaches a level of at least 25% above its trend. The trend is computed using a centered moving average with a 50-year window. An episode ends when the commodity price index comes back to a level lower than 10% above its trend.

This algorithm produces the same characterization for most of the countries: in the period 1970-2008, 25 countries out of 33 experienced two commodity booms in two different cycles: one starting in the 70s and running all the way to 1985 or so (exact dates vary somewhat from country to country) and one staring at one point after 2000 that runs all the way to 2008. As can be seen in Table 2, Costa Rica, Denmark, the Dominican Republic, Guatemala, Jamaica, Nicaragua, Paraguay and Uruguay experienced one or two commodity booms in only one cycle (the 1970s or in recent years). And India and New Zealand experienced three: two in the 1970s and one in the most recent cycle.

This characterization of commodity booms provides a sharp testing ground for the hypothesis of “this time is different” with regard to fiscal policy in commodity republics. Since most countries in the sample experienced two booms --one three decades ago and

one recently--- one can naturally compare behavior around both episodes to see whether fiscal policy indeed changed. That is precisely the course we follow in later sections of this paper.

Table 2 also shows some stylized facts regarding the behavior of commodity prices around the boom episodes. The first thing to notice is that the 1970s episode was long, covering a decade or more in some cases, with the average episode lasting 10 years for our sample of countries. This is in contrast to the recent episode, whose average duration (with 2008 as the cutoff point) is almost 5 years.

How sharp was the increase in commodity prices in these episodes? If we take for each country the average level of the index during the boom episode, and compare it with the level of the index in the two years prior to the beginning of the boom, we see in Table 3 that the 1970s episode implied an average commodity price increase of 86.6%, while the recent episode involved an increase of 54.5%.

In Table 3 we also provide an alternative characterization of the boom periods. The current boom episode is still ongoing, and therefore we have no information on its total duration or its eventual undoing. To make the situation more symmetric across the two boom episodes (1970s-80s versus current), for the earlier case we define the boom episode as lasting from its beginning to its peak. In this case the average length of the earlier episode is reduced to 5.8 years, not too different from the 4.9 years of average duration (so far) of the most recent boom.

What about commodity price increases under this alternative characterization? Table 3 contains the relevant information. For the earlier episode the average increase in the index was 74.1%, not too different from the 61.7% increase in the most recent boom. We conclude, therefore, that regardless of the exact definition used, the magnitude of both booms --at least as measured by the increase in the relevant commodity prices--- is quite similar.

In what follows we adopt the beginning-to-peak definition of the earlier episode, which has the advantage of making both booms also more comparable in terms of length. But appendix A contains the analysis using the alternative definition. As the interested reader can check, results are almost identical with either definition.

5. The behavior of macro variables during commodity price booms

In this section we characterize the behavior of fiscal variables and the real exchange rate around times of commodity booms. The characterization in this section is descriptive and informal. The next section contains an estimation of the relevant cyclical

elasticities.[7]

Figure 1A shows the behavior of the fiscal balance around the commodity price booms. We display the average fiscal deficit or surplus during country *i* boom episode, as a share of GDP, minus the average fiscal balance over the 2 years prior to the episode. The result is striking: during the 1970s boom, fiscal balances worsened on average 1 percentage points of GDP. In contrast, during the recent episode they improved on average by 2.7 percentage points of GDP.

In Figure 1B we show the change in fiscal balance for those countries that have episodes in both commodity boom episodes (the one starting in the 70s and the one staring at one point after 2000). In particular, we compare the average fiscal balance in the most recent commodity boom episode for country *j* with the average fiscal balance in a past episode. The picture that emerges is consistent. For those countries that experienced episodes in both commodity price cycles under study, during the most recent episode the fiscal balance improved with respect to the past episode.

A natural question emerges in at this point, what explains the changing behavior of the fiscal balance across episodes? Apparently not the behavior of revenues. Figure 2A shows what happened to revenues in the 1970s and recently. There are almost no differences in the averages. Government revenue increased by 2.6 percentage points in the early episode and by 2.8 percentage points this time around. When we consider only countries with episodes in both cycles the results are similar (Figure 2B). Government revenue increased 3.1 percentage points in the 1970s cycle and 2.6 percentage points in the 2000s cycle.

Where we do find an important difference across booms is in the behavior of government expenditure, shown in Figure 3A and Figure3B. In the 1970s, countries, on average, spent even more than the increase in the windfall: real expenditure rose by 4.2 percentage points of GDP, significantly above the increase in revenues. In contrast, in the recent episode spending remained almost unchanged on average. This result is confirmed when we only consider countries with episodes in both cycles (Figure 3B).

In short, these figures do suggest that something seems to have been different this time around in terms of the conduct of fiscal policy in times of commodity booms. But while suggestive, the analysis thus far has limitations. Averages are interesting, but they do hide substantial heterogeneity in individual experiences. More importantly, individual performances have to be conditioned on the actual change in commodity prices affecting each country to be reliably revealing. That is precisely what we do in the section that follows.

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[7] The series used in the empirical analysis come from the WDI database and Catao, Fostel, and Kapur (2009). Fiscal data has been also complemented using the Fiscal Monitor Database and IMF Article IV consultations.

6. The cyclical behavior of fiscal policy across commodity boom episodes

In order to obtain measures of the cyclicality of fiscal policy variables we estimate country-by-country regressions using to different methodological strategies. The first strategy consists in estimating the following regression:

$$d(logF_{it}) = \alpha_i + \beta_i d(logI_{it}) + \varepsilon_{it}, \tag{26}$$

where $d(\cdot)$ corresponds to the differential operator, I_{it} is the commodity price index for country i at time t, F_{it} is a fiscal variable in country i at time t, and the coefficient β_i is our index of cyclicality for this particular variable: it measures the elasticity of F_{it} with respect to the respective commodity price index. In our estimations, F_{it} stands for either real fiscal revenues or real government expenditures. In the case of government expenditures, a positive value of β_i implies procyclical behavior.

For the case of the fiscal balance, we run the regression

$$B_{it} = \alpha_i + \beta_i d(logI_{it}) + \varepsilon_{it}, \tag{27}$$

where B_{it} is the fiscal balance measured as a percentage of GDP. In this case, β_i must be interpreted as a semi-elasticity. A negative value suggests pro-cyclicality of the fiscal balance with respect to commodity prices. [8]

In contrast to what happens when cyclicality is estimated with respect to output, as is done in much of the literature, here the issues of endogeneity are of a lower importance, since the prices of commodities are arguably exogenous to the conduct of domestic fiscal policy.

We estimate the equations (26) and (27) by ordinary least squares, with a correction for first-order serial correlation in the error term. This is the same approach to measuring cyclicality adopted by Arreaza et al (1999), Sorensen et al (2001) and Lane (2003).

We run each regression twice for each country. First, using data from the years 1965 to 1985, to obtain the relevant elasticity corresponding to the first boom episode. Second, using data from the years 1995 to 2008, we do the same in the case of the second

[8] As discussed by Sorensen et al. (2001), since the surplus hovers around zero, it is not necessary to regress the growth rate of the fiscal balance.

boom episode. We then compare the resulting elasticities to check whether the cyclical behavior of these variables changed from one boom episode to the next.[9]

Figure 4 summarizes the results of these regressions, which are contained in Table A in the appendix. Consider first the cyclical behavior of the fiscal balance. As Figure 4A shows, the relevant (semi-) elasticities are much larger in the recent episode than earlier, both for developed and developing economies. In the earlier episode there is suggestive evidence of procyclicality. Of the 31 estimated semi-elasticities, 9 are negative.[10] This means that when commodity prices increased, in those countries the fiscal balance actually deteriorated. Of the remaining positive values, most are very close to zero, and none exceeds 0.15. That means that if the commodity price index of a country increased by 1%, in no country would the fiscal balance increase by more than 0.15 percentage points of GDP. The average semi-elasticity is just 0.03, suggesting a very small improvement in the fiscal position as a result of the commodity price boom. Moreover, only 6 of the 31 estimated elasticities are statistically significant at the 10% level or better. This also suggests a week relationship between the fiscal balance and movements in commodity prices.

The situation was different during the recent episode of commodity affluence. The average elasticity of the fiscal balance rises from 0.03 in the 1970s to 0.10 more recently. Only 3 of the coefficients are negative suggesting very little prevalence of procyclical fiscal balances. And in this case, 18 of the estimated semi-elasticities are statistically significant at least at the 10% level.

What could cause this pattern of behavior of the fiscal balance? Begin with revenues, whose behavior across episodes is also summarized in Figure 4B. On average, the revenue elasticity for the early episode is 0.2, so that a 10% increase in commodity prices induces a 2% increase in government revenues. Somewhat surprisingly, there are 8 countries with a negative elasticity, suggesting a fall in revenues at the time of the commodity boom. Notice also that 13 out of the 30 elasticities are significant at the 10% level or better, suggesting a fairly tight association between revenues and commodity prices.

The pattern of behavior of revenues changed in the recent episode. Revenues become more responsive to the commodity cycle, as can be seen in Figure 4B. Now the average revenue elasticity is 0.46 (up from 0.20), reflecting perhaps higher tax rates on commodity production and/or improved tax collection and enforcement, with the coefficients for 18 countries being statistically significant.

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[9] In some cases, due to data availability we estimate these relationships using a shorter sample period. We also include in the analysis countries that only experienced a commodity boom episode in the first period (1965-1985).

[10] We present the details of the estimation in the appendix.

Across episodes there is also change in the cyclical behavior of expenditures, as can be seen in panel C of Figure 4. In the early episode the behavior of expenditures in the first episode is only loosely linked to commodity prices. The average expenditure elasticity is 0.08: a 10% increase in commodity prices induces just a 0.8% increase in government expenditures. For developed countries the average elasticity is negative, which is slightly puzzling. Considering both groups of countries, only 4 of the 28 estimated elasticities are statistically significant. An especially large propensity to spend is present in the early years only in Kuwait (1.15), where expenditure is seen to have gone up more than proportionately to the increase in commodity prices.

Things change on the expenditure side during the recent episode. The average elasticity is now 0.11 --up slightly from the earlier episode, even though it remains negative for developed countries as a group and in spite of sharp reductions in the elasticities for some individual developing countries. Countries with particularly large drops (changes of over 0.2 in the relevant elasticity) are Argentina, Chile, Ecuador, Iran, Kuwait and Nigeria. An outlier in the other directions is Venezuela, where the elasticity during the recent boom is 0.47, implying a large increase in spending in response in commodity prices. This represents an increase of 0.46 in the relevant elasticity for Venezuela between the two commodity boom episodes. Having said all of this, note however that in this estimation only six of the individual elasticities are statistically significant.

The second strategy to estimate the cyclicality of fiscal policy variables follows the specification utilized by Gavin and Perotti (1997) and Alesina et al (2008). In particular, the following types of regressions are estimated:

$$dF_{it} = \alpha_i + \beta_i C_{it} + \gamma_i F_{it-1} + \varepsilon_{it} \tag{28}$$

$$dF_{it} = \alpha_i + \beta_i C_{it} + \phi_{it} Y_{it} + \gamma_i F_{it-1} + \varepsilon_{it} \tag{29}$$

where $d(\cdot)$ corresponds to the differential operator, C_{it} is the cyclical component of the commodity price index for country i and Y_{it} is the output gap for country i at time t. In these estimations F_{it} can stand for the fiscal balance, government expenditure or fiscal revenues, all as a share of GDP.

By including the cyclical component of the commodity price index, rather than the commodity price itself, we incorporate the transitory elements of the movements in commodity prices. Recall from our theoretical discussion above that it is transitory increases in revenue that should give rise to fiscal savings. The cyclical component of commodity prices and the output gap are computed by applying an HP filter to the raw index.

We estimate them country by country, again using data from the years 1965 to

1985 for the first boom episode and data from the years 1995 to 2008 for the second. The method of estimation is again ordinary least squares.

Figure 5 summarizes the results of this estimation, whose details are contained in Table B in the appendix. They are broadly congruent with the earlier set of results. To begin we consider the equation with the fiscal balance on the LHS. As the panel A of Figure 5 shows clearly, the relevant sensitivity to the cycle rises sharply across episodes, both for developed and developing nations.

In the earlier episode we find 11 negative coefficients, suggesting strong procyclicality of the fiscal balance in those countries. The average of the β coefficients is almost zero (0.01). Moreover, only 3 of the estimated coefficients in the individual country regressions turn out to be significant at the 10% level or better. In contrast, for the recent episode the average of the β coefficients is 0.11, and only 4 are negative (and very near zero in absolute value). In this case, 19 of them are significant at the 10% level or better.

As Table 3 shows, Argentina, Bolivia, Brazil, Chile, Cameroon, Colombia, Ecuador, Iran, Mexico, Nigeria, Norway, Russia, Saudi Arabia and Trinidad & Tobago are the countries showing largest increases --almost the same group as in the earlier estimation. We conduct a test for the statistical significance of the difference of the two estimated coefficients. Table 3 shows that 18 of the differences are statistically significant at the 1% level, 1 of them at the 5% level, and 2 at the 10% level.

The results hardly change when we run the second equation, controlling now for the output gap. For the early episode the average of the β coefficients remains the same (0.01), with only 6 of the new coefficients being significant. For the later episode the average of the β coefficients is slightly higher that in the previous estimation, 0.10. In this case, 17 of the estimated coefficients are significant at the 10% level or better.

Figure 6 summarizes the estimates for the parameter showing the sensitivity of fiscal variables with respect to the output gap. Considering the behavior of the fiscal balance in the early episode the average of the ϕ coefficients is just 0.02, again very close to zero. And indeed, most of the estimated coefficients for individual countries in Latin America (Argentina, Bolivia, Brazil, Cameroon, Chile, Colombia, Costa Rica, Ecuador, Ghana, Guatemala, Mexico, Malaysia, Paraguay, Trinidad & Tobago and Venezuela) are negative, suggesting that the fiscal balance would deteriorate if output is above its natural level.

The situation changes significantly during the more recent episode. The average of the ϕ coefficients moves up to 0.2. In several of the countries where the coefficient was negative in the early episode, it turns positive in the later episode.

Next, consider the same equations but now estimated with government spending

as a share of GDP on the LHS. Summary results can be found in the bottom panels of figures 5 and 6. The results are very similar regardless of whether we control for the output gap. The average coefficient is zero or slightly larger in the first commodity boom episode, suggesting that as GDP rose so did real government expenditure, and in about the same percentage. By contrast, in the recent boom episode the average coefficient is negative (in both equations, controlling and not for the output gap). Eight of the individual estimates are statistically significant at the 10% level or better. This is suggestive of a tighter spending stance in the commodity boom of the 2000s. This result is consistent with the one obtained by Frankel et al (2011).

For revenues, a summary of the estimates appears in the middle panels of figures 5 and 6. Again, the estimates are similar regardless of whether care is taken to control for the output gap. The sensitivity to the commodity cycle rises sharply across episodes, especially for developing countries –just as it happened under the alternative specification—and the quality of the estimates also rises. By contrast, very few of the estimates for the output gap coefficient are statistically significant, regardless of the episode considered. The estimates are small in absolute value and for the recent episode they are negative on average for both developed and developing countries, which is counter-intuitive. This suggests that once the effect of the commodity cycle has been taken into account, the output gap does not have a great deal of power for explaining the behavior of government revenues across the cycle. This may be the result that output may be a function of commodity prices. Assuming that commodity prices are relatively exogenous, as we have argued, this dependency does not alter the main results we have obtained in terms of the elasticity of fiscal variables to commodity prices.

The results of this section can be summarized as follows. For the earlier episode, we do not find a very tight association between the behavior of commodity prices and that of fiscal variables. But the presence of a number of negative coefficients --in both specifications--- suggests the presence of procyclical fiscal balances in a number of countries in the 1970s and 1980s.

The recent episode shows a different pattern. Hardly any of the coefficients showing the response of the fiscal balance are negative (regardless of specification), and many of the coefficients increase sharply and become large and positive for a number of countries. This is suggestive a much more countercyclical stance during the recent commodity boom episode. This change is related to what appears to have been a more restrained response of government expenditures, plus a more favorable reaction of revenues, during the recent boom.

7. What caused the change in fiscal behavior?

In order to explain the cross-section variation of our cyclicality measures, we estimate different versions of the following specification:

$$\beta_i = \delta + \lambda Z_i + \varepsilon_i, \tag{30}$$

where β_i corresponds to the cyclicality measures with respect to the commodity price index estimated in the previous section. In particular, we use the measures of fiscal balance and government expenditure cyclicality obtained from the estimation of equation (28).

The vector Z_i contains in the first place a set of variables to measure political and institutional quality, highlighted in our theoretical framework as leading candidates to explain the procyclicality of fiscal policy. The vector Z_i also includes a variable closely related to the previous variables as a potential explanatory variable of procyclicality of fiscal policy: a dummy that takes value 1 if a fiscal rule was in place in the estimation period (FR). Also included is an index of exchange rate flexibility and the share of total commodity production in country *i* on the total production of that country.

The variables used to capture political and institutional quality are rule of law, politics, and institutional quality. The rule of law index is an assessment of the law and order tradition of a country constructed by the International Country Risk Guide (ICRG). It ranges from 0 to 6, where a higher number is associated with a stronger law and order tradition. Politics corresponds to the political risk index that assesses the political stability of the country *i* constructed by ICRG (where the higher the index, the lower the political risk). The institutional quality index corresponds to the EFW index that measures institutional quality in five major areas: (1) size of government, (2) legal structure and security of property rights, (3) access to sound money, (4) exchange with foreigners, and (5) regulation of capital, labor, and business. A higher value for the index indicates better institutional quality.

The fiscal rule dummy is constructed from information reported by Schaechter et al (2012). As discussed in IMF (2009), until the 1990s fiscal rules were used only in a few countries. In recent years, the number of countries implementing some type of fiscal rule has increased significantly. In early 2009, 80 countries members of the IMF were implementing a fiscal rule while in early 1990 only 7 countries had fiscal rules. The fiscal rules considered in the IMF database correspond to those rules implemented to promote fiscal sustainability. Those rules include budget balance rules, debt rules, expenditure rules and revenue rules. Other things equal, we would expect countries that have used a fiscal rule to exhibit a more countercyclical fiscal performance.

The flexibility of the exchange rate regime is captured using two different variables. One corresponds to the official IMF classification and the other corresponds to the one reported by Ilzetzki, Reinhart and Rogoff (2008). In both cases a higher value for this index indicates a more flexible exchange rate. The IMF classification goes from 1 to 4, where 1 is associated to preannounced pegs and 4 correspond to freely floating exchange

rate regimes. In the case of Ilzetzki, Reinhart and Rogoff (2008)'s classification, a regime with no separate legal tender takes a value of 1 while in the other extreme a freely floating regime takes a value of 13. Regarding the expected relationship between our fiscal cyclicality measure and the degree of exchange rate flexibility, the conventional wisdom indicates that fixed exchange rate regimes provide more fiscal discipline due to the inconsistency between lax fiscal policy and the peg. Nonetheless, Tornell and Velasco (2000) argue that this is not necessarily the case because under flexible rates bad behavior has costs as unsound fiscal policy manifests immediately through movements in the exchange rate. If fiscal authorities are relatively impatient, flexible rates provide more fiscal discipline.

Regarding the share of commodity production in total production of country *i*, we use this variable in the case in which the cyclicality variable under analysis is the fiscal balance. We do it to recognize that the response of government revenues to commodity price shocks depends on the importance of commodity-linked fiscal revenues.

To estimate equation (30) we use weighted least squares to take into account that the dependent variable is estimated with different degrees of precision across countries. The results for the estimation of the cross-section regression are presented in tables 4 and 5.[11]

In the case of the estimation for the government expenditure cyclicality measure we have that the political and institutional quality variables are statistically significant in explaining the cyclicality of government expenditure (Table 4). The fiscal rule dummy is also statistically significant. These results suggest that countries with higher institutional quality have a more countercyclical fiscal policy, as predicted by our theoretical framework.

Regarding the importance of exchange rate flexibility in explaining the cyclicality of fiscal policy, the two proxies considered in the empirical analysis turns out insignificant in the government expenditure cyclicality estimation.

The results for the determinants of the cyclicality of the fiscal balance are somewhat similar to the ones for the case of the government expenditure cyclicality (Table 5). However, in this case the political and institutional quality variables are not always significant. The fiscal rule dummy is a significant determinant of fiscal balance cyclicality. The exchange rate flexibility variable obtained from the IMF classification is statistically significant and positively correlated with fiscal balance cyclicality, in a manner similar to the results in Tornell and Velasco (2000).

[11] Here t-statistics are presented in parentheses. ***, **, * denote significance at the 1, 5 and 10 percent levels respectively.

8. Conclusions

Was this time different with regard to the behavior of fiscal policy over the commodity cycle? This paper provides an affirmative answer to this question.

Different econometric estimations suggest that in many countries fiscal policy was either acyclical or decidedly pro-cyclical in the commodity price boom of the 1970s and 1980s. That was not the case in the recent boom: in many countries –particularly in Latin America and the Middle East— revenues seem to have risen strongly in tandem with the increase in commodity prices, while expenditure was held in relative check and even fell in a few cases. The result was a much larger increase in fiscal savings (or at least a reduction in fiscal dis-saving) during the commodity boom that took place before the 2008-09 world financial crisis.

Why did fiscal behavior change across episodes? This paper provides a preliminary answer to this important question. Our empirical results suggest that improvements in institutional quality have led to a more countercyclical fiscal policy stance in some countries. The presence of fiscal rules also seems to have made a difference: countries that use them displayed a larger shift toward fiscal counter-cyclicality between the two episodes. The movement in exchange rate regimes, mostly from fixed to flexible rates, may also have affected the cyclical behavior of fiscal policy.

The experience of Chile in the implementation of fiscal policy is particularly interesting in connection with the role played by institutional factors and fiscal rules. Different measures for institutional quality, such as the ones used in this paper, indicate that there has been a significant improvement in the quality of institutions in Chile. Changes in budget procedures and the implementation of a structural balance fiscal rule have been associated with better fiscal outcomes.

Some key features of the existing budget process in Chile are: all public entities' revenue and spending are consolidated into a single fiscal budget; the budget must be discussed and approved by the Legislature in the 60 days preceding November 30th each year, and if approval is not forthcoming the bill as presented initially by the Executive passes into law; no taxes may be legally earmarked for specific purposes or expenditures; only the Executive may propose or modify all legislation relating to taxation, pensions, and any legislation requiring fiscal spending; the Ministry of Finance's explicit approval is required for all public entities, including state-owned enterprises, to take on debt; and state guarantees to private sector agents require authorization from the Ministry of Finance since they constitute contingent fiscal liabilities. In this regards, this set of clear budget procedures, a strong executive, substantial transparency and stringent deadlines have been associated to better fiscal outcomes, as suggested also by the work of Alesina, Hausmann, Hommes y Stein (1999) y Von Hagen y Harden (1995).

In addition to this set of budget institutions, a structural approach to fiscal policy was adopted in 2001. As of theat year, the is budget based on a structural or cyclically-adjusted fiscal balance. In the political economy dimension, the structural rule provides a legitimate and clearly explained ceiling for both Ministers' and the Legislature's budget demands. Additionally, the rule functions as a commitment device reducing the temptation to deviate from the target, due to the credibility losses that such a move would entail. Finally, the rule sets strict limits on post-budget expenditure demands. It was precisely the commitment to this rule that allowed a significant accumulation of fiscal surpluses during the second commodity price boom period analyzed in this work that allowed fiscal policy to play a significant stabilizing role before, during and after the global financial crisis of 2008-2009.

One pending question is what happened to fiscal policy in commodity-rich countries since the end of the second commodity boom. When the 2008-09 world financial crisis arrived, many of the nations studied here (including Chile) put in place sharply counter-cyclical fiscal policies. That was presumably one further step toward the kind of fiscal policy theory prescribes. But as the crisis receded and many emerging market nations took off on a path of very fast growth, theory would also have prescribed a tightening of fiscal policy. Increasing spending or cutting taxes is politically easy; doing the opposite is politically hard. Only when we learn –and that is a fascinating subject for future research— that nations tightened fiscal policy after having loosened it during the crisis, will we be able to claim victory over the age-old problem of fiscal procylicality.

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Table 1: Share of primary commodities in total production and in total exports

Country	Share in total production*	Share in total exports**
Argentina	15.0	57.0
Australia	6.4	56.0
Austria	0.7	6.0
Belgium	0.5	11.0
Bolivia	27.4	65.0
Brazil	9.1	36.0
Cameroon	17.6	92.0
Canada	13.3	22.0
Chile	13.9	55.0
China	17.2	6.0
Colombia	13.0	56.0
Costa Rica	12.5	20.0
Cuba	5.7	64.0
Denmark	2.5	15.0
Dominican Republic	3.8	37.0
Ecuador	37.3	75.0
France	0.9	6.0
Germany	0.7	7.0
Ghana	14.9	74.0
Guatemala	9.2	44.0
Hungary	4.5	
India	21.2	16.0
Indonesia	20.3	40.0
Iran	40.1	88.0
Italy	0.7	6.0
Jamaica	6.9	73.0
Kuwait	52.6	92.9
Malawi	38.1	27.0
Malaysia	21.3	17.0
Mexico	8.7	11.0
Netherlands	3.0	13.0
New Zealand	4.6	32.0
Nicaragua	15.6	60.0
Nigeria	47.2	
Norway	19.2	70.0
Paraguay	23.1	78.0
Peru	4.9	69.0
Poland	5.2	10.0
Portugal	0.4	5.0
Romania	13.4	14.0
Russia	41.9	61.0
Saudi Arabia	49.3	90.5
South Africa	10.6	21.0
Spain	0.6	8.0
Trinidad & Tobago	40.1	62.0
United Kingdom	2.6	10.0
Uruguay	9.7	39.0
Venezuela	38.7	87.0
Average	16.0	41.4

(*): Average share of primary commodity production in total national production for the period 1990-2008.
(**): Average share of primary commodity exports in total exports for the period 1999-2006.

Table 2: Commodity boom episodes

Episode	Start	End	Duration	Commodity price index increase*	Maximum	Duration to maximum	Commodity price index increase to maximum**
Argentina	1973	1985	13	30.7%	1980	8	36.2%
Argentina	2003	2009	7	51.3%	2008	6	52.7%
Australia	1973	1985	13	15.3%	1980	8	48.8%
Australia	2004	2009	6	12.5%	2008	5	31.3%
Bolivia	1973	1985	13	71.6%	1980	8	73.4%
Bolivia	2003	2009	7	46.2%	2008	6	52.7%
Brazil	1973	1981	9	26.9%	1980	8	29.2%
Brazil	2007	2009	3	11.0%	2008	2	17.1%
Canada	1973	1985	13	72.1%	1980	8	67.9%
Canada	2003	2009	7	50.1%	2008	6	57.3%
Chile	1970	1983	14	15.3%	1980	11	18.1%
Chile	2006	2009	4	38.9%	2008	3	44.6%
Cameroon	1974	1985	12	97.5%	1979	6	91.2%
Cameroon	2005	2009	5	61.6%	2008	4	66.3%
Colombia	1973	1985	13	61.2%	1980	8	67.8%
Colombia	2005	2009	5	47.6%	2008	4	44.0%
Costa Rica	1977	1980	4	28.4%	1979	3	28.0%
Denmark	2005	2009	5	62.1%	2008	4	66.8%
Dominican Republic	1973	1977	5	41.6%	1974	2	71.9%
Ecuador	1974	1985	12	89.4%	1980	7	92.2%
Ecuador	2005	2009	5	63.8%	2008	4	68.1%
Ghana	1977	1984	8	27.8%	1980	4	40.9%
Ghana	2007	2009	3	33.2%	2008	2	28.0%
Guatemala	1973	1980	8	41.8%	1977	5	40.3%
Indonesia	1974	1985	12	83.1%	1980	7	78.5%
Indonesia	2003	2009	7	57.4%	2008	6	64.0%
India	1973	1975	3	100.0%	1974	2	110.6%
India	1979	1983	5	29.6%	1980	2	52.4%
India	2006	2009	4	31.5%	2008	3	30.5%
Iran	1974	1985	12	234.2%	1980	7	226.2%
Iran	2003	2009	7	71.1%	2008	6	77.8%
Jamaica	1974	1975	2	38.3%	1974	1	40.7%
Kuwait	1974	1985	12	279.9%	1980	7	270.7%
Kuwait	2004	2009	6	80.0%	2008	5	86.1%
Mexico	1974	1985	12	95.1%	1980	7	94.1%
Mexico	2004	2009	6	67.8%	2008	5	73.9%
Malaysia	1974	1985	12	116.7%	1980	7	112.1%
Malaysia	2003	2009	7	57.2%	2008	6	64.5%
Nicaragua	1973	1974	2	40.0%	1973	1	41.9%
Nicaragua	1977	1980	4	30.4%	1980	4	30.5%
Nigeria	1974	1985	12	159.8%	1980	7	155.1%
Nigeria	2004	2009	6	76.3%	2008	5	82.4%
Norway	1974	1990	17	93.1%	1980	7	103.9%
Norway	2004	2009	6	64.7%	2008	5	71.4%
New Zealand	1977	1985	9	65.0%	1980	4	82.3%
New Zealand	2003	2009	7	34.0%	2008	6	40.6%
Peru	1974	1985	12	65.4%	1980	7	69.9%
Peru	2005	2009	5	54.3%	2008	4	60.0%
Paraguay	1973	1974	2	24.9%	1973	1	26.2%
Paraguay	1979	1981	3	18.2%	1980	2	26.9%
Russia	1973	1993	21	111.0%	1980	8	124.6%
Russia	2000	2009	10	54.0%	2008	9	114.0%
Saudi Arabia	1974	1985	12	278.0%	1980	7	269.0%
Saudi Arabia	2004	2009	6	77.6%	2008	5	83.8%
Trinidad & Tobago	1974	1987	14	212.5%	1980	7	222.8%
Trinidad & Tobago	2000	2009	10	109.3%	2008	9	119.3%
Uruguay	1966	1974	9	31.6%	1973	8	33.7%
Uruguay	1977	1981	5	80.6%	1980	4	84.5%
Venezuela	1973	1985	13	243.2%	1980	8	235.4%
Venezuela	2004	2009	6	73.1%	2008	5	79.2%
South Africa	1973	1990	18	66.3%	1980	8	73.7%
South Africa	2006	2009	4	31.2%	2008	3	28.5%
Average during episodes before 2000			10.0	86.6%		5.8	74.1%
Average during episodes after 2000			5.9	54.5%		4.9	61.7%

(*): Commodity price increase corresponds to the percent change in the average commodity price index during the episode with respect to average commodity price index in the two years previous to the beginning of the episode.

(**): Commodity price increase corresponds to the percent change in the average commodity price index from the beginning of the episode until its maximum value during the episode with respect to average commodity price index in the two years previous to the beginning of the episode.

Table 3: Changes in fiscal balance cyclicality with respect to commodity prices

	Elasticity fiscal balance around episode 1	Elasticity fiscal balance around episode 2	Difference	
Argentina	-0.02	0.11	0.13	***
Australia	0.02	-0.03	-0.05	***
Bolivia	-0.02	0.09	0.10	**
Brazil	-0.09	0.08	0.17	***
Canada	0.03	0.03	0.00	
Chile	0.10	0.21	0.11	***
Cameroon	0.01	0.07	0.06	***
Colombia	-0.03	0.06	0.09	***
Ecuador	-0.04	0.09	0.13	***
Ghana	0.00	-0.03	-0.03	*
Indonesia	0.01	0.03	0.02	**
India	0.01	-0.01	-0.01	
Iran	0.00	0.10	0.10	***
Mexico	-0.04	0.06	0.10	***
Malaysia	-0.01	0.03	0.04	
Nigeria	0.06	0.32	0.26	***
Norway	0.01	0.21	0.19	***
New Zealand	-0.01	0.00	0.01	
Peru	0.09	0.07	-0.02	
Russia	0.01	0.15	0.15	***
Saudi Arabia	-0.10	0.51	0.61	***
Trinidad & Tobago	0.06	0.15	0.08	***
Venezuela	0.10	0.12	0.02	
South Africa	0.05	-0.07	-0.12	***
Average	0.01	0.10	0.09	

Elasticity corresponds to the value β of the regression Δ(Fiscal Balance as % GDP)=α+β*(Cyclical component commodity price)
(***);(**);(*) corresponds to rejection of the null hypothesis of equal coefficients at significance levels of 1%,5% and 10% respectively.

Table 4: Determinants of fiscal cyclicality-Government expenditure cyclicality

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Institutional quality	-0.015 (-3.02)***			-0.012 (-2.17)**			-0.017 (-2.71)***			-0.013 (-2.36)**		
Politics		-0.001 (-3.14)***			-0.001 (-2.59)**			-0.001 (-2.99)***			-0.001 (-2.69)***	
Rule of law			-0.012 (-3.24)***			-0.010 (-2.76)***			-0.012 (-3.06)***			-0.011 (-3.02)***
Fiscal rule				-0.020 (-1.64)*	-0.021 (-1.72)*	-0.021 (-1.79)*						
Exchange rate flexibility IMF							0.003 (0.56)	0.003 (0.51)	0.000 (0.00)			
Exchange rate flexibility IRR										-0.002 (-0.92)	-0.001 (-0.55)	-0.002 (-1.15)
Number of observations	56	57	57	56	57	57	54	55	55	54	55	55
R2	0.14	0.15	0.16	0.19	0.2	0.21	0.14	0.16	0.16	0.15	0.16	0.18
F test	9.11***	9.85***	10.53***	6.05***	6.58***	7.07***	4.19**	4.82**	5.04***	4.49**	4.85**	5.83***

Al regressions are estimated using a constant.

(***);(**);(*), significance levels at 1%,5% and 10% respectively.

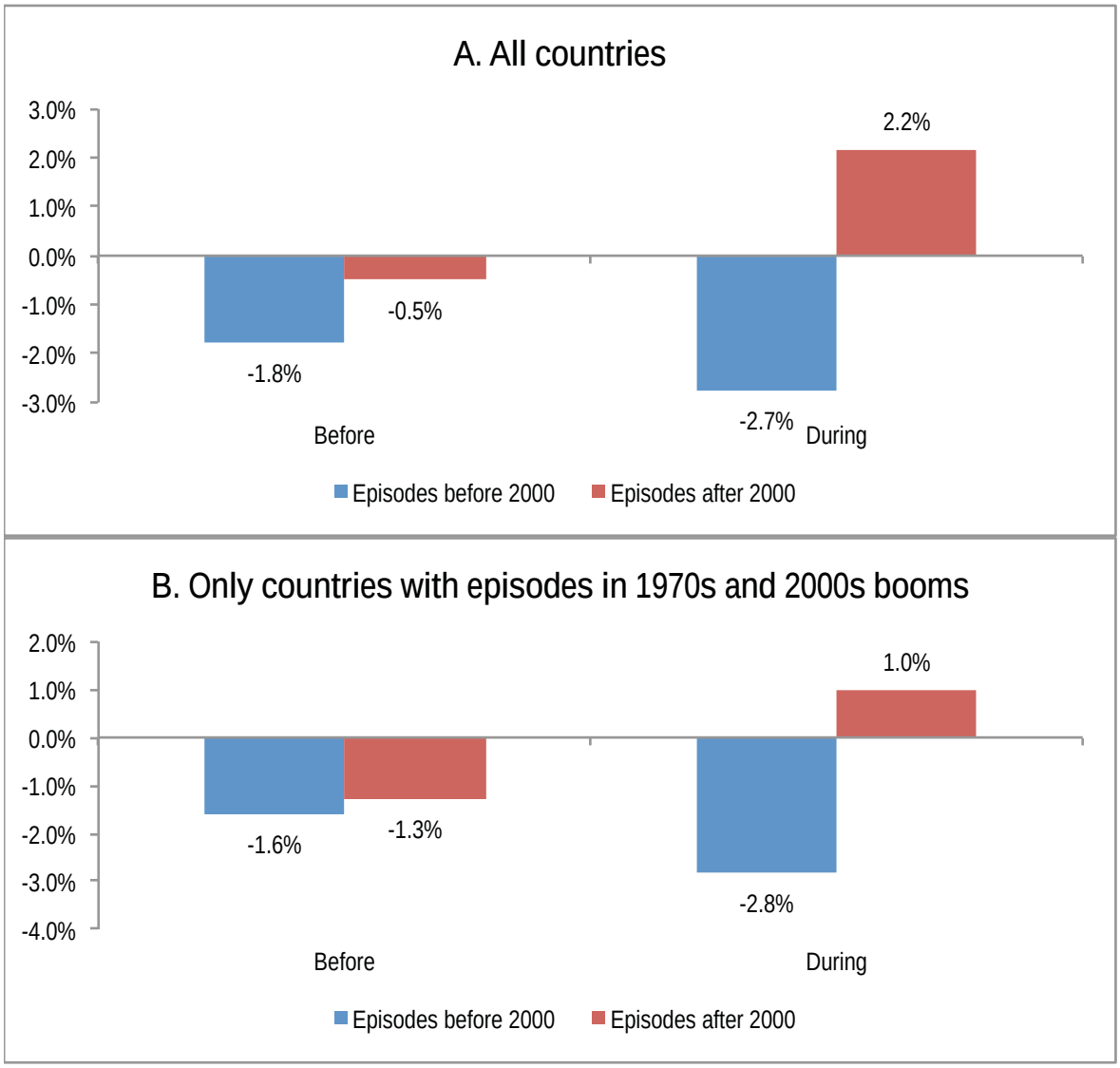
Table 5: Determinants of fiscal cyclicality-Fiscal balance cyclicality

xplanatory variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
stitutional quality	0.012 (1.92)*			0.021 (2.83)***			0.016 (2.32)**			0.011 (1.39)			0.014 (1.68)*		
olitics		0.000 (0.67)			0.000 (0.82)			0.000 (0.78)			0.001 (1.30)			0.001 (1.54)	
ule of law			0.005 (1.03)			0.007 (1.42)			0.008 (1.63)*			0.007 (1.37)			0.007 (1.44)
scal rule							0.047 (3.42)***	0.053 (3.63)***	0.053 (3.75)***						
xchange rate flexibility MF										0.014 (2.44)**	0.015 (2.39)**	0.016 (2.65)**			
xchange rate flexibility ER													0.003 (1.14)	0.003 (1.11)	0.003 (1.38)
hare commodities roduction				0.001 (2.17)**	0.001 (0.98)	0.001 (1.30)	0.002 (2.77)***	0.001 (1.95)*	0.001 (2.33)**	0.002 (2.93)***	0.002 (3.11)***	0.002 (3.10)***	0.002 (2.59)**	0.002 (2.83)***	0.002 (2.74)***
umber of observations	55	56	56	55	56	56	55	56	56	53	54	54	53	54	54
2	0.07	0.01	0.02	0.14	0.03	0.05	0.30	0.22	0.25	0.24	0.23	0.24	0.17	0.17	0.16
test	3.69*	0.45	1.06	4.33**	0.71	1.39	7.37***	4.98***	5.85***	5.28***	5.07***	5.15***	3.45**	3.32**	3.20**

regressions are estimated using a constant.
**);(**);(*), significance levels at 1%,5% and 10% respectively.

Figure 1: Fiscal balance around commodity boom episodes

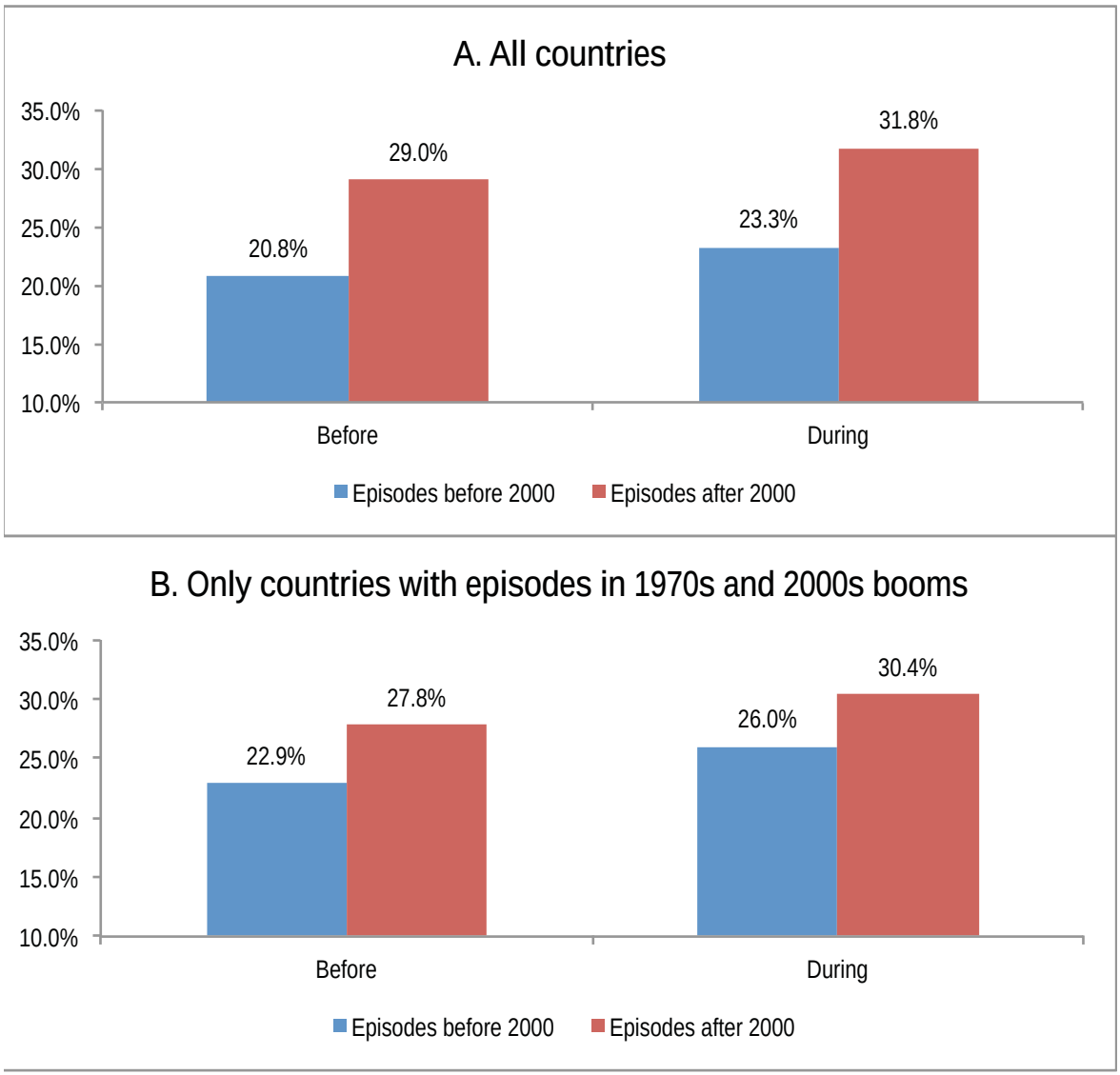
(% GDP)



Before corresponds to the average fiscal balance two years before the beginning of the episode and during corresponds to the average fiscal balance during the episode.

Figure 2: Government revenues around commodity boom episodes

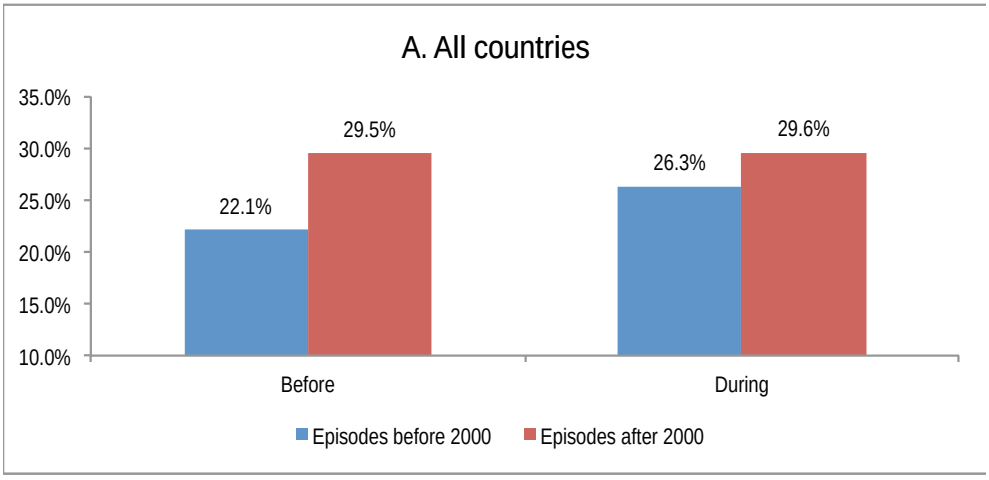
(% GDP)

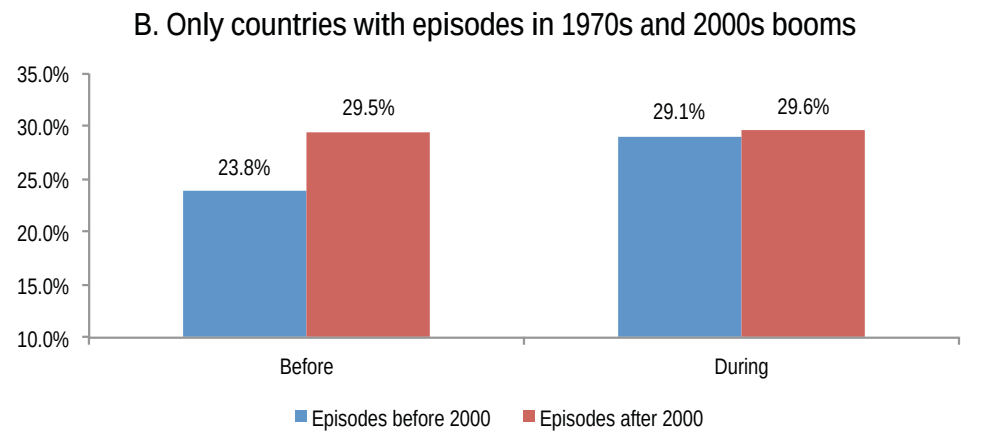


Before corresponds to the average government revenues two years before the beginning of the episode and during corresponds to the average government revenues during the episode.

Figure 3: Government expenditures around commodity boom episodes

(% GDP)





Before corresponds to the average government expenditures two years before the beginning of the episode and during corresponds to the average government expenditures during the episode.

Figure 4: Average elasticity of fiscal variable to commodity prices

$\Delta(\ln(\text{Fiscal variable}))=\alpha+\beta*\Delta(\ln(\text{Commodity price index}))$

(Fiscal balance(% GDP))$=\alpha+\beta*\Delta(\ln(\text{Commodity price index}))$

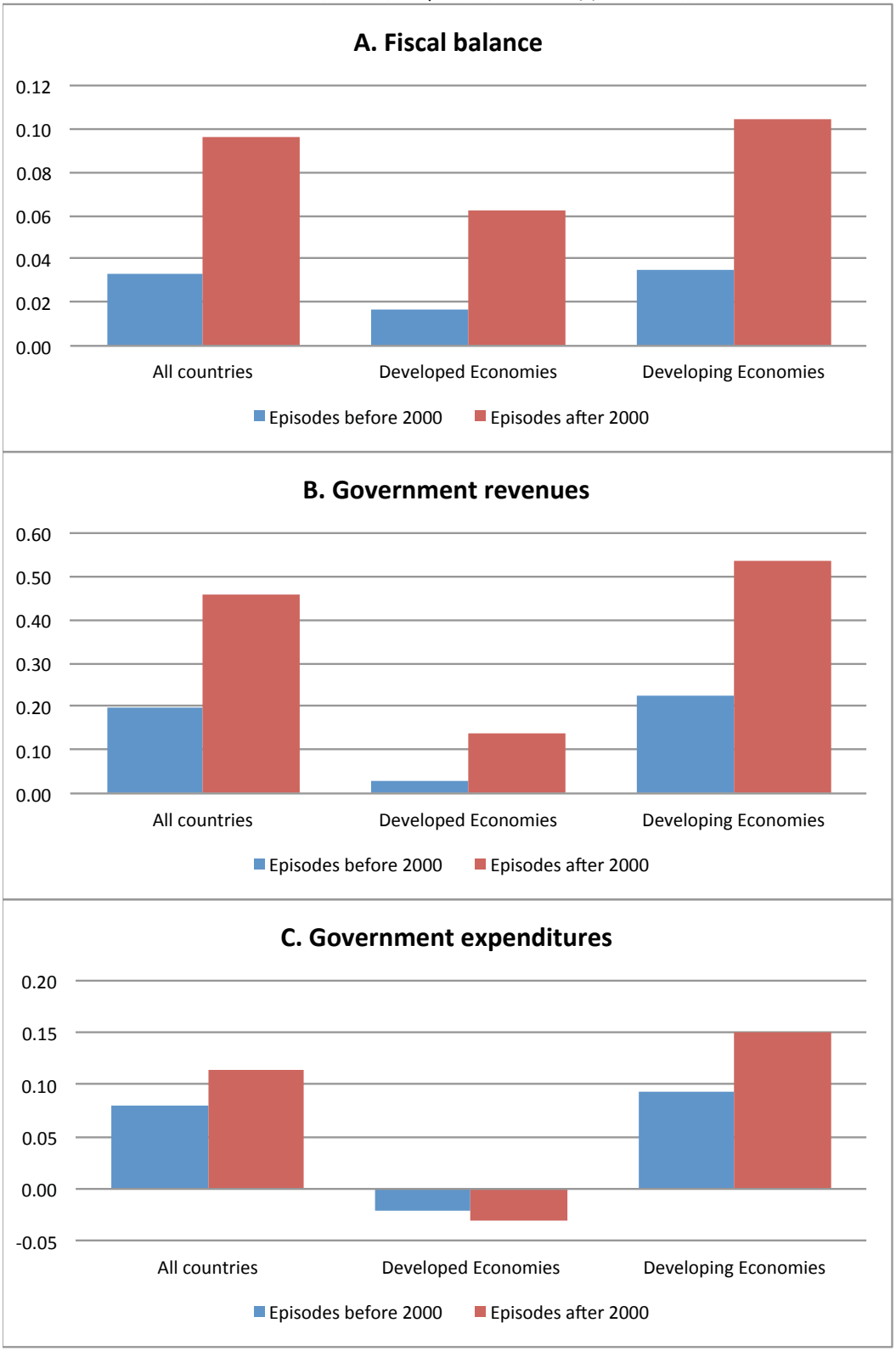


Figure 5: Average elasticity of fiscal variable to commodity prices

Δ(Fiscal variable as % GDP)=α+β*(Cyclical component commodity price)

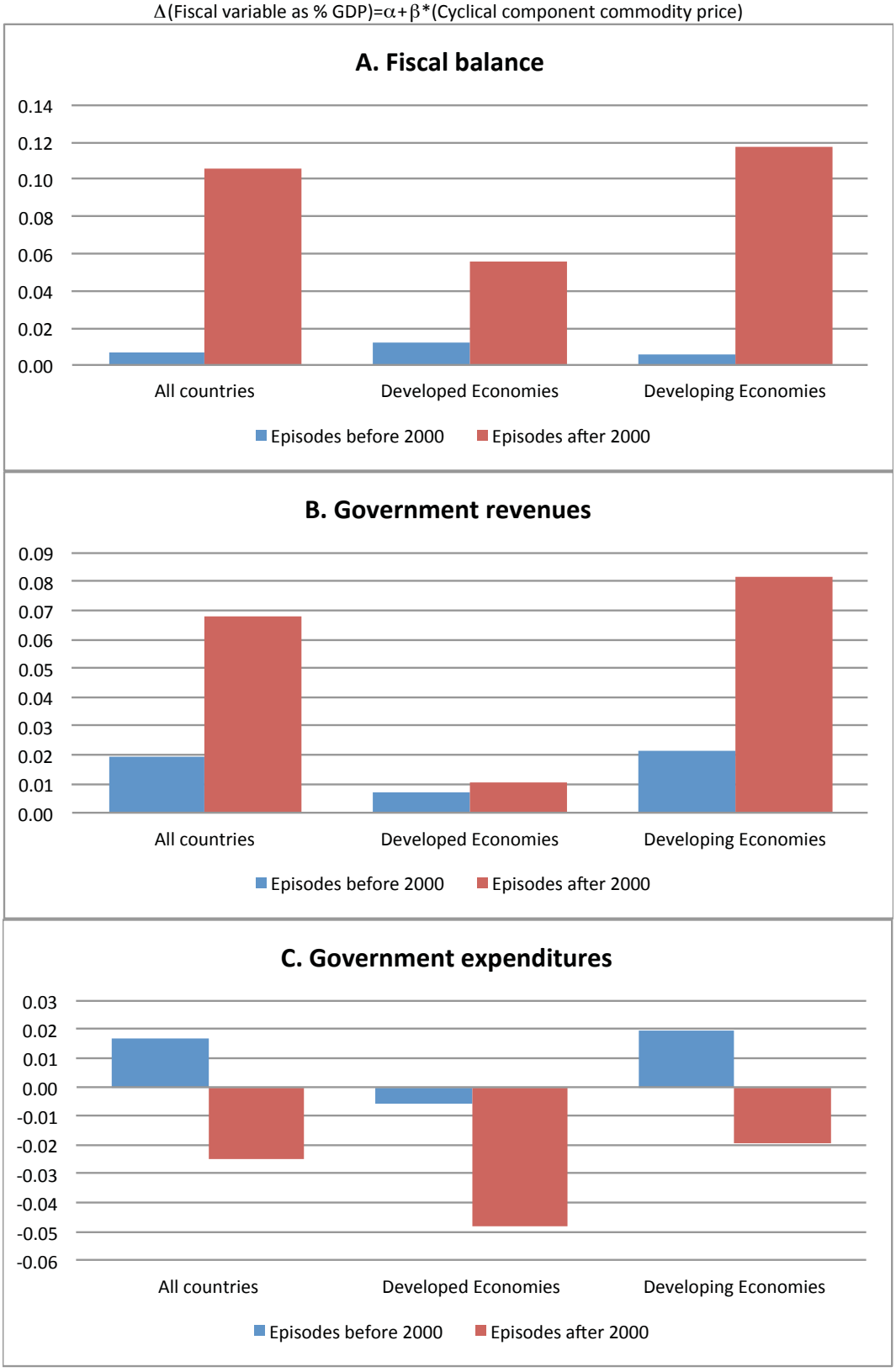


Figure 6: Average elasticity of fiscal variable to output gap

Δ(Fiscal variable as % GDP)=α+β*(cyclical component commodity price)+γ*(output gap)

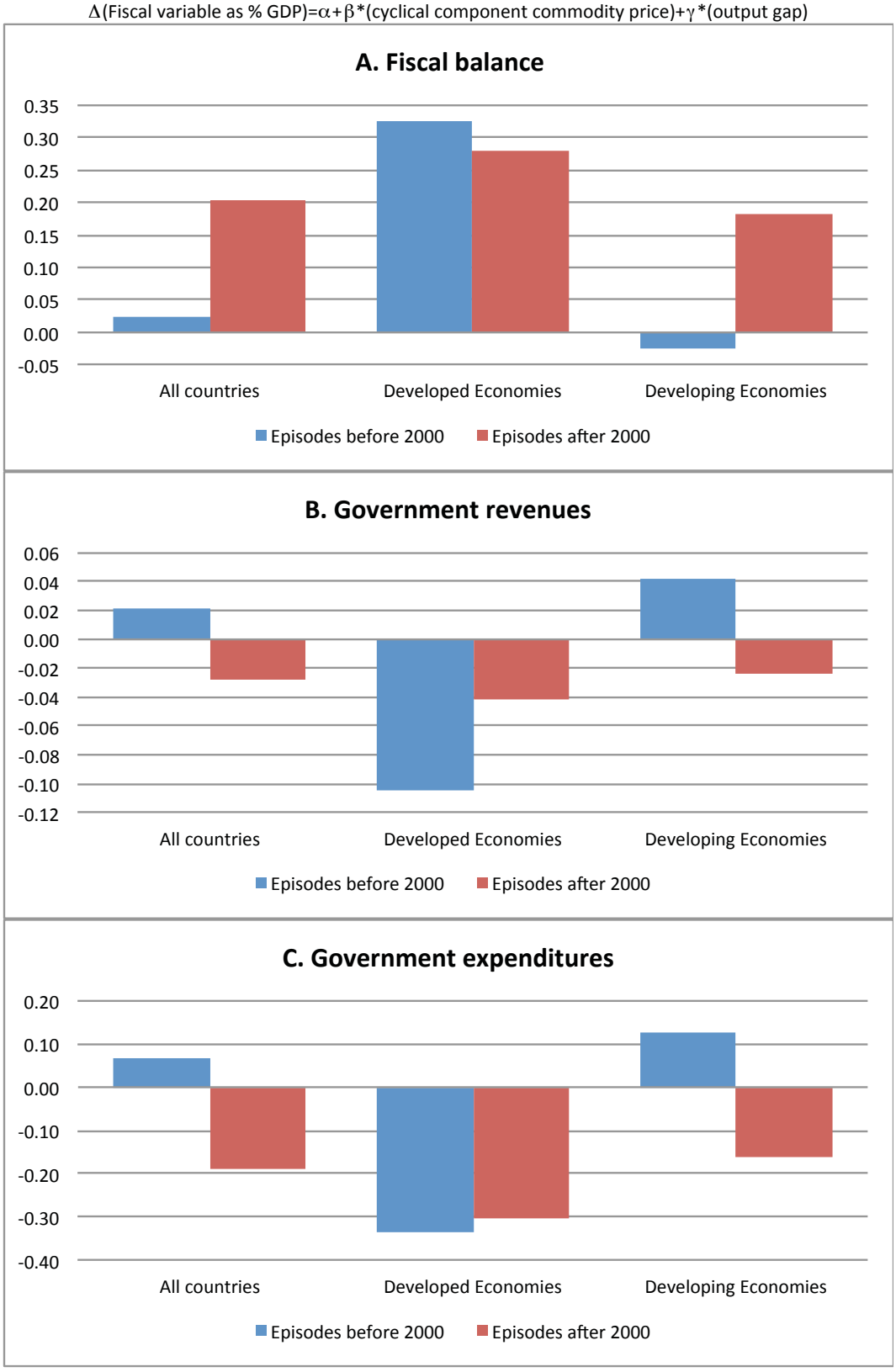


Table A: Cyclicality of fiscal variable to commodity price index

		Elasticity of fiscal variable to commodity price index*					
		Government expenditures		Government revenues		Fiscal balance	
Argentina	1965-1985	0.07		0.29		0.03	
Argentina	1995-2009	-0.24		0.14		0.06	
Australia	1970-1985	-0.12		-0.05		0.02	
Australia	1995-2009	-0.19	***	-0.08		0.02	*
Bolivia	1970-1985	-0.36		0.21		0.10	*
Bolivia	1995-2009	0.02		0.18		0.05	
Brazil	1970-1985	0.03		-0.36		-0.03	
Brazil	1996-2009	-0.15		0.01		0.07	**
Canada	1965-1985	0.04		0.20	**	0.06	**
Canada	1995-2009	-0.01		0.14	**	0.05	***
Chile	1965-1985	0.13		0.41		0.10	*
Chile	1995-2009	-0.12	**	0.45	**	0.11	**
Cameroon	1965-1985	-0.04		-0.04		0.01	
Cameroon	1995-2009	0.40		0.63	***	0.06	
Colombia	1971-1985	-0.01		-0.08		-0.01	
Colombia	1995-2009	0.05		0.23	**	0.05	***
Costa Rica	1965-1985	0.35		0.24		-0.02	
Denmark	1995-2009	-0.02		0.08	***	0.04	**
Dominican Republic	1965-1985	0.31	***	0.22	*	0.00	
Ecuador	1970-1985	0.27		0.33		0.00	
Ecuador	1995-2009	-0.17		0.13		0.08	**
Ghana	1965-1985	-0.55		-0.25		0.04	
Ghana	1995-2009	1.26	**	1.04		-0.08	
Guatemala	1970-1985	0.16		0.32		0.01	
Indonesia	1969-1985	0.19		0.37	**	0.02	
Indonesia	1995-2009	0.27		0.45	**	0.03	
India	1965-1985	-0.20		-0.24	***	0.00	
India	1995-2009	0.12		-0.06		-0.05	
Iran	1970-1985	0.53	***	0.69	***	0.01	
Iran	1995-2009	0.03		0.80	***	0.10	***
Jamaica	1965-1985	0.07		-0.09		-0.05	
Kuwait	1965-1985	1.15	***				
Kuwait	1995-2009	0.05		0.68	***	0.23	*
Mexico	1965-1985	-0.07		0.05		0.01	
Mexico	1995-2009	0.03		0.26	***	0.04	**
Malaysia	1972-1985	-0.08		0.18	**	0.08	
Malaysia	1995-2009	0.18	***	0.18		0.02	
Nigeria	1965-1985	0.40		0.89	***	0.10	
Nigeria	1995-2009	0.19		1.21	***	0.27	**
Nicaragua	1965-1985	-0.16		0.10		0.07	
Norway	1970-1985	0.03		0.04		-0.01	
Norway	1995-2009	-0.02		0.35	***	0.17	***
New Zealand	1972-1985	-0.04		-0.07		-0.01	
New Zealand	1995-2009	0.08		0.20	***	0.03	*
Peru	1970-1985	-0.04		0.32	*	0.04	
Peru	1995-2009	0.01		0.36	*	0.08	*
Paraguay	1965-1985	-0.10		0.04		0.02	
Russia	1970-1985					0.00	
Russia	1995-2009	0.00		0.49	***	0.12	***
Saudi Arabia	1969-1985	0.03		0.62	**	0.11	
Saudi Arabia	1995-2009	0.06		1.63	***	0.56	***
Trinidad & Tobago	1965-1985	0.44	***	0.61	***	0.04	
Trinidad & Tobago	1995-2009	0.28		0.95	***	0.21	***
Uruguay	1965-1985	0.11		0.31	***	0.05	*
Venezuela	1970-1985	0.01		0.54	***	0.15	***
Venezuela	1995-2009	0.47	*	1.06	***	0.18	***
South Africa	1965-1985	-0.10		0.13	*	0.06	**
South Africa	1995-2009	0.41	***	0.40	*	0.00	
Average episodes before 2000		0.08		0.20		0.03	
Average episodes after 2000		0.11		0.46		0.10	

(*) corresponds to the value β of the regression $\Delta(\ln(\text{Fiscal variable})) = \alpha + \beta * \Delta(\ln(\text{Commodity price index}))$, where Fiscal variable corresponds to the levels of real government expenditute and real government revenues. In the case of the fiscal balance we run the regression $(\text{Fiscal balance(\% GDP)}) = \alpha + \beta * \Delta(\ln(\text{Commodity price index}))$.

(***);(**);(*), significance levels at 1%,5% and 10% respectively.

Table B: Cyclicality of fiscal variable to commodity price index

		Government expenditures						Government revenues						Fiscal balance					
		(a)		(b)				(a)		(b)				(a)		(b)			
		Commodity price		Commodity price		Output gap		Commodity price		Commodity price		Output gap		Commodity price		Commodity price		Output gap	
Argentina	1965-1985	0.12	***	0.12	**	0.00		0.09	*	0.11	*	-0.17		-0.02		0.00		-0.10	
Argentina	1995-2009	-0.06		-0.05		-0.12		-0.01		-0.01		-0.01		0.11		0.12	***	0.43	***
Australia	1970-1985	-0.01		-0.01		-0.53	**	0.01	**	0.01		-0.04		0.02		0.01		0.34	**
Australia	1995-2009	-0.02		-0.02		0.01		-0.04	**	-0.05	**	0.09		-0.03		-0.03		-0.02	
Bolivia	1970-1985	-0.04		-0.05		0.05		-0.02		-0.01		-0.15		-0.02		-0.01		-0.09	
Bolivia	1995-2009	0.02		0.02		-0.17		0.09	***	0.10	***	0.21	*	0.09	**	0.11	***	0.47	**
Brazil	1970-1985	-0.05		-0.07		0.10		-0.11		-0.05		-0.49		-0.09		-0.01		-0.66	*
Brazil	1996-2009	-0.08		-0.05		-0.14		0.01		0.02		-0.06		0.08	**	0.08	*	0.04	
Canada	1965-1985	0.03		0.06	*	-0.56	**	0.06	**	0.07	**	-0.05		0.03		0.00		0.58	***
Canada	1995-2009	-0.04		-0.03		-0.19		0.01		0.02		-0.05		0.03		0.02		0.35	
Chile	1965-1985	-0.11		-0.22	**	0.35	*	-0.03		-0.04		0.04		0.10		0.18	**	-0.27	**
Chile	1995-2009	-0.09	**	-0.09	**	-0.17		0.09	***	0.10	***	-0.08		0.21	***	0.21	***	0.01	
Cameroon	1965-1985	0.04		0.04		0.08		0.00		-0.01		-0.08		0.01		0.01		-0.06	
Cameroon	1995-2009	-0.01		-0.01		-0.13		0.06	***	0.06	**	0.03		0.07	**	0.08	**	0.22	
Colombia	1971-1985	0.03		0.00		0.29	**	0.00		-0.02		0.16		-0.03		-0.02		-0.06	
Colombia	1995-2009	-0.02		-0.02		-0.05		0.02		0.02		-0.04		0.06	***	0.06	***	-0.02	
Costa Rica	1965-1985	0.02		0.00		0.08		-0.01		0.02		-0.09		-0.05		0.00		-0.24	
Denmark	1995-2009	-0.07	**	-0.01		-0.77	***	-0.01		0.00		-0.20		0.07	*	0.02		0.64	**
Dominican Republic	1965-1985	0.02		0.03		-0.05		0.04	*	0.02		0.24		0.01		-0.01		0.36	**
Ecuador	1970-1985	0.01		0.02		-0.03		0.00		0.00		-0.04		-0.04		-0.04		-0.19	
Ecuador	1995-2009	0.07		0.06		0.05		0.12	***	0.13	***	-0.23	*	0.09	*	0.09	**	-0.21	
Ghana	1965-1985	-0.07		-0.08		0.06		-0.07	*	-0.08		0.03		0.00		0.00		-0.01	
Ghana	1995-2009	0.07	*	0.08	*	-0.09		0.02		0.06		-0.50		-0.03		-0.02		-0.18	
Guatemala	1970-1985	0.02		-0.05	*	0.40	***	0.03	*	0.00		0.22	*	0.02		0.06	**	-0.28	**
Indonesia	1969-1985	0.03		0.03		0.03		0.04	*	0.03		0.20		0.01		0.00		0.33	
Indonesia	1995-2009	0.04		0.06	**	-0.14	*	0.06	***	0.07	***	-0.01		0.03	*	0.01		0.14	**
India	1965-1985	-0.03		-0.04		-0.06		-0.02		-0.02		-0.02		0.01		0.01		0.03	
India	1995-2009	0.01		0.02		-0.06		0.00		0.01		-0.06		-0.01		-0.01		0.02	
Iran	1970-1985	0.06		0.07		0.11		0.06		0.09		0.22		0.00		0.03		0.26	***
Iran	1995-2009	0.02		0.01		0.43		0.12	**	0.11	**	0.45		0.10	**	0.12	**	-0.30	
Jamaica	1965-1985	0.12	***	0.12	**	0.03		0.02		0.02		0.00		-0.11	**	-0.10	*	0.00	
Kuwait	1965-1985	0.07	**																
Kuwait	1995-2009	-0.19	**	-0.27	***	0.10		0.14		0.21	**	-0.17		0.34	**	0.47	***	-0.20	
Mexico	1965-1985	0.05	*	0.01		0.51	***	0.03	*	0.02		0.04		-0.04		0.00		-0.44	***
Mexico	1995-2009	-0.02		0.02		-0.35	***	0.04	**	0.04	**	-0.06		0.06	**	0.03		0.29	***
Malaysia	1972-1985	0.11		0.10		1.16		0.08	*	0.12	**	-0.51	*	-0.01		0.03		-0.51	
Malaysia	1995-2009	-0.01		0.02		-0.28	**	0.00		-0.04		0.22		0.03		-0.04	*	0.41	***
Nigeria	1965-1985	0.03		0.04		-0.08		0.06		0.06	**	0.20	***	0.06		0.05		0.32	**
Nigeria	1995-2009	-0.09		-0.06		-0.87		0.18		0.24	**	-1.21	*	0.32	***	0.32	***	0.42	
Nicaragua	1965-1985	0.06		0.04		-0.17		0.06		0.04		-0.13		0.06		0.07		0.07	
Norway	1970-1985	-0.03		-0.03		0.00		-0.02		-0.01		0.04		0.01		0.01		0.34	
Norway	1995-2009	-0.11	***	-0.08	***	-0.37	**	0.08	***	0.09	***	-0.13		0.21	***	0.19	***	0.14	
New Zealand	1972-1985	-0.02		-0.03		-0.24		-0.03		-0.05	***	-0.37	***	-0.01		-0.01		0.04	
New Zealand	1995-2009	-0.01		0.01		-0.18	**	0.01		0.01		0.09		0.00		0.00		0.30	*
Peru	1970-1985	-0.06		-0.01		-0.51		0.01		0.01		0.07		0.09		0.01		0.77	*
Peru	1995-2009	-0.03		-0.03	**	0.04		0.04	**	0.04	**	0.04		0.07	***	0.07	**	0.00	
Paraguay	1965-1985	-0.02		-0.02		0.01		-0.01		-0.01		0.00		0.02		0.02		-0.01	
Russia	1970-1985	0.10						0.10						0.01					
Russia	1995-2009	0.00		0.01		-0.49	*	0.09	***	0.05		0.15		0.15	**	0.03		0.68	***
Saudi Arabia	1969-1985	0.01		-0.02		0.13		-0.04		0.03		1.54	***	-0.10		-0.19		0.61	
Saudi Arabia	1995-2009	-0.16	***	-0.15	**	-0.52		0.41	***	0.37	***	0.81		0.51	***	0.46	***	1.06	
Trinidad & Tobago	1965-1985	0.06		0.04		0.38	**	0.13	***	0.13	***	-0.15		0.06		0.09	*	-0.48	**
Trinidad & Tobago	1995-2009	-0.03		0.00		-0.26		0.09	***	0.09	**	-0.02		0.15	***	0.11	***	0.33	**
Uruguay	1965-1985	-0.01		-0.01		0.11		0.02		0.01		0.05		0.04		0.05		0.19	
Venezuela	1970-1985	0.02		0.02		0.13		0.12	**	0.12	**	-0.18		0.10	**	0.11	**	-0.41	*
Venezuela	1995-2009	0.08	*	0.08	*	-0.01		0.20	***	0.21	***	-0.21	*	0.12	*	0.14	*	-0.21	
South Africa	1965-1985	-0.04		-0.05		0.22		-0.02	*	-0.02	**	0.08		0.05	**	0.04	**	0.25	
South Africa	1995-2009	0.05	***	0.07	***	-0.21	***	-0.03		-0.03		0.24	**	-0.07	*	-0.12	***	0.47	***
Average episodes before 2000		0.02		0.00		0.07		0.02		0.02		0.02		0.01		0.01		0.02	
Average episodes after 2000		-0.02		-0.02		-0.19		0.07		0.07		-0.03		0.11		0.10		0.20	

(a) corresponds to the value β of the regression Δ(Fiscal variable as % GDP)=$\alpha+\beta$*(Cyclical component commodity price).

(b) corresponds to values β and γ of the regression Δ(Fiscal variable as % GDP)=$\alpha+\beta$*(cyclical component commodity price)+γ*(output gap)

(***);(**);(*), significance levels at 1%,5% and 10% respectively.