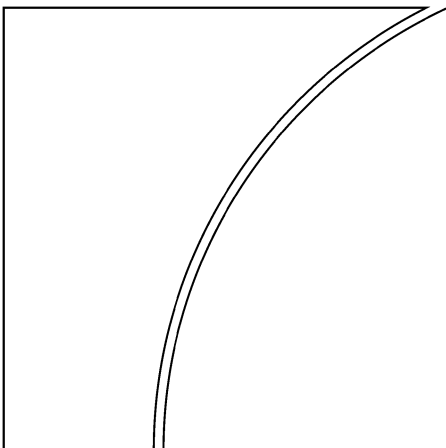BANK FOR INTERNATIONAL SETTLEMENTS

BIS Working Papers
No 365

Was This Time Different?: Fiscal Policy in Commodity Republics

by Luis Felipe Céspedes and Andrés Velasco, Discussion Comments by Choongsoo Kim and Guillermo Calvo

Monetary and Economic Department

November 2011

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Foreword

On 23–24 June 2011, the BIS held its Tenth Annual Conference, on "Fiscal policy and its implications for monetary and financial stability" in Lucerne, Switzerland. The event brought together senior representatives of central banks and academic institutions who exchanged views on this topic. The papers presented at the conference and the discussants' comments are released as BIS Working Papers 361 to 365. A forthcoming BIS Paper will contain the opening address of Stephen Cecchetti (Economic Adviser, BIS), a keynote address from Martin Feldstein, and the contributions of the policy panel on "Fiscal policy sustainability and implications for monetary and financial stability". The participants in the policy panel discussion, chaired by Jaime Caruana (General Manager, BIS), were José De Gregorio (Bank of Chile), Peter Diamond (Massachussets Institute of Technology) and Peter Praet (European Central Bank).

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(by Luis Felipe Céspedes and Andrés Velasco)

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Was This Time Different?: Fiscal Policy in Commodity Republics[1]

Luis Felipe Céspedes[2] and Andrés Velasco[3]

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.[4] 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 pro-cyclical 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)).

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. 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. Given that the behavior of commodity prices is 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 the behavior of fiscal policy (and other macro variables) for a large number of commodity-producing over a long period of time. 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" , with fiscal policy behaving less procyclically – and perhaps even countercyclically – in the recent commodity boom episode, as commodity-producing nations improved the rules and institutions that govern their fiscal policies.

We begin by constructing a commodity price index for a group of 50 economies, incorporating information on the importance of each commodity in the total commodity output

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

of the country for the period 1900-2010. Using that index we identify commodity boom episodes: periods of significant increases in commodity prices in the period 1900-2010 for the same group of 50 economies. 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 almost every country 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 with particular focus on fiscal variables. We analyze how real government expenditures, real government revenues and the fiscal balance behave over the commodity price cycle. Then we study how pro-cyclical 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 any 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 procyclicality.

Among nations that had procyclical policies in the past, but which seem to have behaved quite countercyclically in the recent episode, most of Latin America – with the glaring exception of Venezuela—stands out, as do the three countries from the middle East in our sample – Iran, Kuwait and Saudi Arabia – and New Zealand and Norway among advanced economies.

The paper is organized as follows. In the next section we review what the theoretical literature has to say about the cyclical behavior of fiscal policy. Then 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 V, 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 VI then analyzes the role of a few institutional and political variables in trying to explain the changed pattern of fiscal behavior. Section VII concludes.

1.   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.

1.1 The case of a single policymaker

1.1.1 *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

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

where $\overset{\circ}{b}_t$ 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

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

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 assumption into the government budget constraint 3 yields

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

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

1.1.2 *Government preferences and optimal policy*

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

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

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

$$\overset{\circ}{g}_t = g_t \sigma (r - \delta) \tag{7}$$

which implies

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

Using this in the government budget constraint 5 finally yields

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

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.

1.1.3   The effects of shocks

It follows from 9 that

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

That is, the optimal elasticity of government expenditure with respect to the income shock is positive and smaller (larger) than one if $b_t + \dfrac{\tau}{r}$ is larger (smaller) than zero. Since we have assumed $b_t + \dfrac{\tau}{r} > 0$, 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

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

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

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

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:

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

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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.

1.2   Many policymakers and the voracity effect

1.2.1   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 pro-cyclical? 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 procyclicality. 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 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 (1999), that there isnt 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

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

[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.

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

(14)

Suppose next that each group i maximizes

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

(15)

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

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

(16)

where ϕ is a coefficient to be determined.

Using 16 in 14 we have

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

(17)

The Euler equation corresponding to this problem is

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

(18)

which implies

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

(19)

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

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

(20)

Plugging 19 in 20 we have

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

(21)

Now, combining 16 and 21 to solve for ϕ yields

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

(22)

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

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

(23)

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

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Notice from this solution that the larger the number of groups, the more each decides to spend. The intuitition 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.

1.2.2   The effects of shocks

Applying 23 in 14 we have

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

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

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

This expression is decreasing in η and positive if $\eta < \dfrac{r+\rho}{r(1-\sigma)+\sigma\delta}$. 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.

2.   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 two most important commodities in each of 48 countries, measured as the average shares of primary commodity production in national output for the period 1990-2008. Not all countries in this sample qualify as commodity republics: the output share of the four most important commodities ranges from a low of 0,51% in Belgium to a high of 52,64% 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.

In turn, Table 2 shows the share of these same commodities in total 1999-2006 exports of these 48 nations. Here commodities play a more important role: the average share is 46,3%, 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 $k = \{1960, 1990\}$; $\overline{p}^j$ 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:

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

$$= \left(\frac{_k COMBI_t^i}{_{30+k} COMBI_t^i} \right)_k COMBI_t^i \text{ for k} = 1960 \text{ and } k \leq t \leq k + 30.$$

The indices are then normalized such that $COMBI_{200}^i = 100$ 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. Each episode begins in the first year in which the index surpasses the trend, and ends in the year prior to the index returning below the trend.

This algorithm produces the same characterization for most of the countries: in the period 1970-2008, 26 countries out of 32 experienced two commodity booms: one starting in the 70s and running all the way to 1984 or so (exact dates vary somewhat from country to country) and one staring around 2004 that runs all the way to 2008. As can be seen in Table 3, Costa Rica, the Dominican Republic, Honduras, Jamaica, Nicaragua and Paraguay experienced only one commodity boom (in the 1970s) and none in recent years. And only New Zealand experienced three: the 1970s episode is split into two (71-74 and 77-84).

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 3 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 11,7 years for our sample of countries. This is in contrast to the recent episode, whose average duration (with 2008 as the cutoff point) is 5,4 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 4 that the 1970s episode implied an average commodity price increase of 59,9%, while the recent episode involved an increase of 59,6%. By this measure, the two episodes are almost identical.

In Table 5 we 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 6,5 years, not too different from the 5,4 years of average duration (so far) of the recent boom.

What about commodity price increases under this alternative characterization? Table 6 contains the relevant information. For the earlier episode the average increase in the index was 63,7%, not too different from the 59,6% increase in the 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.

3. 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.

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 improved on average only 0,2 percentage points of GDP. In contrast, during the recent episode they improved on average by 3,6 percentage points of GDP.

In figure 1b we show the change in fiscal balance for those countries that have two episodes in our sample. 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 clear. For most of the countries, during the most recent episode the fiscal balance improved with respect to the past episode.

Of course, there is substantial cross-national heterogeneity. There are the countries such as Ghana, where the deficit widened during both commodity price booms. This is perhaps an example of the voracity hypothesis at work, with demands on the fiscal system intensifying during periods of abundance. Granted, the deterioration in Ghana´s fiscal performance is much less in the recent boom (1.0 percentage points of GDP) than in the earlier boom (5.8 percentage points of GDP), but the persistently negative sign is remarkable.

Then there are countries were, regardless of starting point, performance deteriorated across the two boom episodes. A striking example is Venezuela, where in the 1970s the boom brought an increase in the fiscal surplus equal to 3,7 percentage points of GDP, while recently the dramatic increase in the price of oil only caused the fiscal deficit to shrink by 0,6 percentage points of GDP, from -0,7% to -0,1%.

There are also a number of countries where fiscal performance improved markedly from the 70s to the first decade of the 21st century. One such case is Chile, where a reduction in the deficit of only 1,9 percentage points of GDP four decades ago changed into an increase in the surplus of 6,4 percentage points of GDP during the recent boom. Something similar, but even more dramatic, occurred in oil-producing Kuwait and Saudi Arabia. In this latter case, the recent boom brought an increase in the fiscal surplus of 20,7 percentage points of GDP, far above the 3,1 percentage point increase in the 1970s.

An interesting case is that of Argentina, a nation not usually associated with prudent fiscal management. Argentina's performance improved a great deal across episodes. In the 1970s the fiscal deficit actually deteriorated by 2.4 percentage points of GDP, while this time around the deficit shrank by an impressive 8.2 points. Recall, however, that a deep financial crisis took place right before the onset of the latter episode. This tended to amplify the change in the fiscal surplus.

More generally, 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 3,2 percentage points in the early episode and by 3,1 percentage points this time around.

Needless to say, again there is a fair bit of variation around the averages (see Figure 2b). In a number of countries revenues were broadly stable or even fell in the 1970s, while they increased substantially in the recent episode. Among the countries showing such an improvement are Argentina, Bolivia, Ghana, Perú and South Africa.

Where we do find an important difference across booms is in the behavior of government spending, shown in Figure 3a. In the 1970s, countries, on average, fully spent the windfall: real expenditure rose by 3,2 percentage points of GDP, the same increase as in revenues. In contrast, in the recent episode spending fell – on average – by 0,5 percentage points of GDP.

Countries where spending as a share of output was either stable or fell in the recent episode are Argentina, Bolivia, Chile, Guatemala, Indonesia, India, Kuwait, Mexico, Malaysia, Nigeria, Norway, Peru, Russia and Saudi Arabia (see Figure 3b). This is quite remarkable, given that in every single one of those countries the price of the commodities it produces increased sharply.[7]

Last in this section, consider the behavior of the real exchange rate during the two boom episodes. This is an important variable in the context of commodity price fluctuations, since governments reasonably fear the onset of Dutch disease as the improvement in the terms of trade causes the real exchange rate to appreciate, potentially creating trouble for non-commodity exporters. As Figure 4 shows, this concern was amply borne out in the episode of the 1970s. The real exchange appreciated by 9,3%. In the more recent episode, by contrast, the real exchange rate again appreciated, but only by 5,9%. It seems plausible to conjecture that the more moderate pace of expansion in government spending in the latter episode may have contributed to the smaller loss in competitiveness.

Remarkably, the real exchange rate actually depreciated in a few countries during the recent episode: Argentina, Bolivia, Ecuador, Kuwait, Mexico, Malaysia and Venezuela. In Chile, Cameroon, India, Norway, Trinidad & Tobago and Uruguay it appreciated by less than 5%, in spite of sharp increases in commodity prices. In contrast, in other nations the real exchange rate appreciated sharply (more than 10%) during the recent boom episode: Australia, Brazil, Canada, Colombia, Indonesia, New Zealand, Nigeria, Russia and South Africa.

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.

4.   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 of the form:

$$d\left(\log F_{it}\right) = \alpha_i + \beta_i d\left(\log I_t\right) + \varepsilon_{it}$$,

where 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 fiscal expenditures. In the case of fiscal expenditures, a positive value of β_i implies procyclical behavior.

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[7]   Of course, in these countries government spending rose, but it did so more slowly than output.

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

$$B_{it} = \alpha_i + \beta_i d(\log I_{it}) + \varepsilon_{it} \,,$$

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 there are no issues of endogeneity, since the prices of commodities are clearly exogenous to the conduct of domestic fiscal policy.

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

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 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 5 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 5A 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 32 estimated semi-elasticities, 8 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 7 of the 32 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 elasticity of the fiscal balance rises from 0.03 in the 1970s to 0.10 more recently. The increase is particularly large (of at least 0.10) in Brazil, Kuwait, Nigeria, Norway, Saudi Arabia and Trinidad & Tobago. Only 3 of the coefficients are negative, and all of them are quite close to zero, suggesting very little prevalence of pro-cyclical fiscal balances. And in this case, 17 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 5B. 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

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[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.

[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.

also that 14 out of the 31 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 5B. 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 17 countries being statistically significant. The increase in the elasticity is especially large (changes of over 0.2) in Brazil, Cameroon, Colombia, Ghana, Mexico, Nigeria, Norway, New Zealand, Russia, Saudi Arabia, Trinidad, Venezuela and South Africa. Particularly large elasticities appear in the case of Ghana, Saudi Arabia and Venezuela, with coefficients larger than one that suggest a more than proportional increase in revenues in response to an increase in commodity prices.

Across episodes there is also change in the cyclical behavior of expenditures, as can be seen in panel C of figure 5. 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, Guatemala, Iran, Kuwait and Nigeria. Trinidad & Tobago is right behind, with a drop of 0.16. 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.

To check the robustness of these results, we also estimate the cyclicality of these results using an alternative specification, utilized by Gavin and Perotti (1997) and Alesina et al (2008). Consider the equations:

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

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

where 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 componente 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 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 OLS.

Figure 6 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 with consider the equation with the fiscal balance on the LHS. As the panel A of Figure 6 shows clearly, the relevant sensitivity to the cycle rises sharply accros 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 4 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 0.10, 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 9 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 9 shows that 19 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 barely budges from 0.01 to 0.02, with only 7 of the new coefficients being significant. For the later episode the average of the β coefficients is the same that in the previous estimation, 0.10. In this case, 18 of the estimated coefficients are significant at the 10% level or better.

Figure 7 summarizes the estimates for the parameter showing the sensitivity of fiscal variables with respect to the output gap. Consider 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, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Trinidad & Tobago and Venezuela) are negative, suggesting that the fiscal balance would deteriorate if output is above its natural rate.

The situation changes significantly during the more recent episode. The average of the φ coefficients moves up to 0.18. 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 6 and 7. 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 6 and 7. 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 happenned under the alternative specification—and the quality of the estimates also rises. By contrast, very few of the estimates for the output gap coeffcient 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.

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.

5.   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:

$$\beta_i = \delta + \lambda Z_i + \varepsilon_i,$$

where β_i corresponds to the cyclicality measures estimated in the previous section. The vector Z_i contains an index of institutional quality, an index of exchange rate flexibility, a dummy that takes value 1 if a fiscal rule was in place in the estimation period (FR) and a dummy that takes value of 1 if the country under analysis is a significant oil producer and 0 otherwise.[11] 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. The exchange rate flexibility index is the one reported by Ilzetzki, Reinhart and Rogoff (2008). A higher value for this index indicates a more flexible exchange rate. The fiscal rule dummy is constructed from information reported by the IMF (Fiscal Rules – Anchoring Expectations for Sustainable Public Finances). Other things equal, we would expect countries that have implemented a fiscal rule to exhibit a more countercyclical fiscal performance.

The results for the estimation of the cross-section regression are presented in Table 10. We use measures of fiscal ciclicality analogous to those used by Gavin and Perotti (1997) and Alesina et al (2008).[12]

In most cases, the right-hand variables are statistically significant in explaining the cyclicality of the fiscal balance. The institutional quality index is positively correlated with fiscal balance counter-cyclicality, suggesting that countries with higher institutional quality have a more countercyclical fiscal policy, as predicted by our theoretical framework. Exchange rate flexibility is positively correlated with fiscal balance counter-cyclicality, in a manner similar to

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[11]   We define significant oil producer as a country for which the share of oil production in total production is higher than 5%.

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

the results in Tornell and Velasco (2000). The dummy for oil producer is significant in the fiscal balance estimation.

The results for the determinants of the cyclicality of government expenditures are similar to the ones for the case of the fiscal balance cyclicality. However, in this case the fiscal rule dummy is found to be a significant determinant of fiscal cyclicality.

6.   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 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 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, also may have affected the cyclical behavior of fiscal policy.

One pending question is what happened to fiscal policy in these countries since the end of the second commodity boom. When the 2007-00 world financial crisis arrived, many of the nations studied here 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 loosening 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: Principal commodity production and share of primary commodities in total production 1990-2008

Country	Comm 1	Comm 2	Comm 1	Comm 2	Total
Argentina	crudeoil	beef	3,88	3,83	15,04
Australia	hardcoal	beef	2,29	1,24	6,39
Austria	beef	wheat	0,27	0,11	0,66
Belgium	beef	wheat	0,33	0,11	0,51
Bolivia	natgas	crudeoil	11,49	6,01	27,38
Brazil	beef	sawnwood	2,81	2,09	9,13
Cameroon	crudeoil	bananas	9,46	3,36	17,63
Canada	sawnwood	natgas	4,82	3,03	13,34
Chile	copper	sawnwood	7,40	4,39	13,85
China	rice	hardcoal	5,71	4,89	17,16
Colombia	crudeoil	beef	6,28	2,37	12,95
Costa Rica	bananas	coffee	7,75	2,40	12,48
Cuba	sugar	crudeoil	2,95	1,25	5,65
Denmark	crudeoil	wheat	1,61	0,47	2,53
Dominican Republic	beef	bananas	1,31	1,19	3,80
Ecuador	crudeoil	bananas	20,12	13,07	37,29
France	wheat	beef	0,42	0,30	0,90
Germany	beef	wheat	0,19	0,17	0,65
Ghana	gold	aluminum	8,81	3,03	14,88
Guatemala	coffee	bananas	3,06	2,38	9,19
Hungary	wheat	maize	1,53	1,23	4,52
India	rice	gold	7,96	7,27	21,18
Indonesia	rice	crudeoil	7,24	6,65	20,34
Iran	crudeoil	natgas	30,92	6,50	40,08
Italy	beef	natgas	0,25	0,16	0,71
Jamaica	bauxite	bananas	4,83	0,75	6,90
Kuwait	crudeoil	natgas	49,78	2,85	52,64
Malawi	tobacco	maize	17,76	9,58	38,06
Malaysia	crudeoil	natgas	8,18	5,77	21,32
Mexico	crudeoil	natgas	6,26	0,93	8,65
Netherlands	natgas	beef	2,47	0,33	2,97
New Zealand	beef	natgas	2,61	1,04	4,58
Nicaragua	beef	coffee	5,88	4,22	15,59
Nigeria	crudeoil	natgas	40,51	2,93	47,23
Norway	crudeoil	natgas	14,06	3,88	19,20
Paraguay	soybeans	beef	10,98	8,82	23,12
Peru	crudeoil	copper	2,03	1,36	4,92
Poland	hardcoal	wheat	2,37	1,05	5,17
Portugal	beef	maize	0,24	0,07	0,42
Romania	natgas	crudeoil	4,64	2,90	13,38
Russia	natgas	crudeoil	19,52	17,27	41,91
Saudi Arabia	crudeoil	natgas	45,34	3,63	49,29
South Africa	hardcoal	gold	4,03	3,56	10,56
Spain	beef	wheat	0,24	0,14	0,62
Trinidad & Tobago	natgas	crudeoil	24,59	15,14	40,12
United Kingdom	crudeoil	natgas	1,33	0,75	2,56
Uruguay	beef	rice	7,29	1,52	9,69
Venezuela	crudeoil	natgas	31,83	3,58	38,67
Average					15,95

Table 2: Principal commodity exports and share of primary commodities in total exports 1999-2006

Country	Comm 1	Comm 2	Comm 1	Comm 2	Total
Argentina	crudeoil	soymeal	13,74	9,12	57,00
Australia	crudeoil	aluminium	9,80	7,06	56,00
Austria	aluminium	crudeoil	1,39	1,12	6,00
Belgium	crudeoil	aluminium	5,65	0,68	11,00
Bolivia	natgas	soymeal	13,78	11,70	65,00
Brazil	iron	soybeans	5,94	4,50	36,00
Cameroon	sawnwood	cocoa	50,78	12,14	92,00
Canada	crudeoil	natgas	5,92	5,57	22,00
Chile	copper	sawnwood	38,28	3,08	55,00
China	crudeoil	hardcoal	1,41	1,05	6,00
Colombia	crudeoil	hardcoal	29,57	8,62	56,00
Costa Rica	bananas	coffee	10,10	4,12	20,00
Cuba	ni	sugar	29,95	29,82	64,00
Denmark	beef	aluminium	5,16	0,45	15,00
Dominican Republic	crudeoil	sugar	18,32	7,81	37,00
Ecuador	crudeoil	bananas	41,63	18,83	75,00
France	crudeoil	wheat	1,29	0,68	6,00
Germany	crudeoil	aluminium	0,90	0,79	5,00
Ghana	gold	cocoa	26,20	25,46	74,00
Guatemala	coffee	sugar	16,10	8,67	44,00
India	crudeoil	shrimp	3,97	1,76	16,00
Indonesia	crudeoil	natgas	12,04	10,16	40,00
Iran	crudeoil	natgas	85,80	1,06	88,00
Italy	crudeoil	aluminium	1,82	0,64	6,00
Jamaica	aluminium	sugar	60,66	6,28	73,00
Kuwait	crudeoil	natgas	94,00	87,33	92,90
Malawi	sugar	tea	12,77	8,86	27,00
Malaysia	crudeoil	natgas	5,66	3,55	17,00
Mexico	crudeoil	copper	9,08	0,36	11,00
Netherlands	crudeoil	natgas	6,21	0,88	13,00
Norway	crudeoil	natgas	47,25	11,90	70,00
New Zealand	beef	aluminium	5,28	3,36	32,00
Nicaragua	coffee	beef	19,26	10,68	60,00
Paraguay	soybeans	soymeal	36,11	7,64	78,00
Peru	gold	copper	19,32	15,11	69,00
Poland	hardcoal	copper	2,99	1,83	10,00
Portugal	crudeoil	aluminium	1,72	0,63	5,00
Romania	crudeoil	sawnwood	5,75	3,12	14,00
Russia	crudeoil	natgas	33,43	15,56	61,00
Saudi Arabia	crudeoil	ni	89,60	0,09	90,50
South Africa	hardcoal	crudeoil	6,17	4,28	21,00
Spain	crudeoil	aluminium	2,50	0,67	8,00
Trinidad & Tobago	crudeoil	natgas	47,06	13,39	62,00
United Kingdom	crudeoil	natgas	7,00	0,74	10,00
Uruguay	logs	crudeoil	12,40	7,14	39,00
Venezuela	crudeoil	aluminium	81,52	3,31	87,00

Total corresponds to the sum of the shares of all commodities exports in total exports.

Table 3: Commodity boom episodes

Episode	Country	Start	End	Duration
ARG1973	Argentina	1973	1985	13
ARG2004	Argentina	2004	2008	5
AUS1972	Australia	1972	1984	13
AUS2004	Australia	2004	2008	5
BOL1973	Bolivia	1973	1985	13
BOL2003	Bolivia	2003	2008	6
BRA1973	Brazil	1973	1984	12
BRA2004	Brazil	2004	2008	5
CAN1974	Canada	1974	1985	12
CAN2003	Canada	2003	2008	6
CHL1966	Chile	1966	1984	19
CHL2004	Chile	2004	2008	5
CMR1974	Cameroon	1974	1985	12
CMR2004	Cameroon	2004	2008	5
COL1973	Colombia	1973	1985	13
COL2004	Colombia	2004	2008	5
CRI1976	Costa Rica	1976	1983	8
DOM1972	Dominican Republic	1972	1981	10
ECU1974	Ecuador	1974	1985	12
ECU2004	Ecuador	2004	2008	5
GHA1973	Ghana	1973	1988	16
GHA2004	Ghana	2004	2008	5
GTM1973	Guatemala	1973	1983	11
GTM2004	Guatemala	2004	2008	5
HON1973	Honduras	1973	1983	11
IDN1974	Indonesia	1974	1985	12
IDN2003	Indonesia	2003	2008	6
IND1973	India	1973	1984	12
IND2004	India	2004	2008	5
IRN1973	Iran	1973	1985	13
IRN2004	Iran	2004	2008	5
JAM1972	Jamaica	1972	1982	11
KWT1973	Kuwait	1973	1985	13
KWT2004	Kuwait	2004	2008	5
MEX1973	Mexico	1973	1985	13
MEX2004	Mexico	2004	2008	5
MYS1973	Malaysia	1973	1985	13
MYS2003	Malaysia	2003	2008	6
NGA1973	Nigeria	1973	1985	13
NGA2004	Nigeria	2004	2008	5
NIC1973	Nicaragua	1973	1981	9
NOR1974	Norway	1974	1985	12
NOR2003	Norway	2003	2008	6
NZL1971	New Zealand	1971	1974	4
NZL1977	New Zealand	1977	1982	6
NZL2003	New Zealand	2003	2008	6
PER1974	Peru	1974	1985	12
PER2004	Peru	2004	2008	5
PRY1971	Paraguay	1971	1981	11
RUS1973	Russia	1973	1985	13
RUS2003	Russia	2003	2008	6
SAU1973	Saudi Arabia	1973	1985	13
SAU2003	Saudi Arabia	2003	2008	6
TTO1973	Trinidad & Tobago	1973	1985	13
TTO2003	Trinidad & Tobago	2003	2008	6
URY1968	Uruguay	1968	1974	7
URY1977	Uruguay	1977	1983	7
VEN1974	Venezuela	1974	1985	12
VEN2003	Venezuela	2003	2008	6
ZAF1973	South Africa	1973	1988	16
ZAF2004	South Africa	2004	2008	5
Average duration episodes before 2000				11,7
Average duration episodes after 2000				5,4

Table 4: Commodity price index around commodity boom episodes
(2000=100)

		Average value				
		Before	During	After	% Increase	% Fall
ARG1973	Argentina	77,1	100,8	77,9	30,7%	-22,7%
ARG2004	Argentina	100,7	150,5		49,5%	
AUS1972	Australia	81,3	116,3	89,8	43,0%	-22,8%
AUS2004	Australia	118,9	150,1		26,2%	
BOL1973	Bolivia	62,2	106,7	81,6	71,6%	-23,5%
BOL2003	Bolivia	94,7	144,0		52,1%	
BRA1973	Brazil	130,6	165,7	129,1	26,9%	-22,0%
BRA2004	Brazil	107,3	145,7		35,7%	
CAN1974	Canada	50,0	86,0	67,7	72,1%	-21,2%
CAN2003	Canada	92,0	143,8		56,3%	
CHL1966	Chile	107,1	133,4	104,0	24,6%	-22,0%
CHL2004	Chile	96,8	167,9		73,5%	
CMR1974	Cameroon	74,0	146,2	98,1	97,5%	-32,9%
CMR2004	Cameroon	94,9	165,8		74,8%	
COL1973	Colombia	80,9	130,3	100,9	61,2%	-22,6%
COL2004	Colombia	97,0	160,4		65,4%	
CRI1976	Costa Rica	173,8	191,6	138,6	10,3%	-27,7%
DOM1972	Dominican Republic	170,4	247,5	144,8	45,2%	-41,5%
ECU1974	Ecuador	69,2	131,2	88,4	89,4%	-32,6%
ECU2004	Ecuador	95,3	167,6		76,0%	
GHA1973	Ghana	112,8	174,9	146,2	55,1%	-16,4%
GHA2004	Ghana	110,9	160,5		44,7%	
GTM1973	Guatemala	144,0	188,6	134,8	31,0%	-28,5%
GTM2004	Guatemala	93,7	145,6		55,4%	
HON1973	Honduras	157,2	173,5	129,8	10,3%	-25,2%
IDN1974	Indonesia	46,5	108,5	72,6	133,5%	-33,1%
IDN2003	Indonesia	91,8	148,8		62,0%	
IND1973	India	88,6	159,8	121,6	80,4%	-23,9%
IND2004	India	105,7	156,4		48,0%	
IRN1973	Iran	29,8	107,8	69,4	261,6%	-35,6%
IRN2004	Iran	96,5	167,5		73,5%	
JAM1972	Jamaica	179,7	212,0	143,9	18,0%	-32,1%
KWT1973	Kuwait	28,8	114,6	73,6	298,0%	-35,8%
KWT2004	Kuwait	94,7	173,1		82,8%	
MEX1973	Mexico	51,1	114,8	77,7	124,4%	-32,3%
MEX2004	Mexico	96,5	165,9		72,0%	
MYS1973	Malaysia	41,0	98,2	68,3	139,3%	-30,4%
MYS2003	Malaysia	91,2	148,5		62,8%	
NGA1973	Nigeria	39,7	114,5	75,1	188,6%	-34,4%
NGA2004	Nigeria	95,3	171,1		79,6%	
NIC1973	Nicaragua	186,9	222,2	149,9	18,9%	-32,6%
NOR1974	Norway	53,6	113,6	84,5	111,9%	-25,6%
NOR2003	Norway	89,9	154,0		71,3%	
NZL1971	New Zealand	70,8	94,8	59,1	34,0%	-37,7%
NZL1977	New Zealand	59,1	104,3	87,5	76,6%	-16,1%
NZL2003	New Zealand	97,5	136,7		40,2%	
PER1974	Peru	71,0	133,6	90,9	88,0%	-32,0%
PER2004	Peru	95,7	167,2		74,7%	
PRY1971	Paraguay	147,6	170,8	133,6	15,7%	-21,8%
RUS1973	Russia	37,0	86,9	65,0	135,0%	-25,3%
RUS2003	Russia	92,7	147,6		59,2%	
SAU1973	Saudi Arabia	28,4	112,7	72,3	296,6%	-35,9%
SAU2003	Saudi Arabia	95,1	157,7		65,9%	
TTO1973	Trinidad & Tobago	23,0	82,2	55,7	256,9%	-32,3%
TTO2003	Trinidad & Tobago	92,3	147,7		60,1%	
URY1968	Uruguay	135,0	170,5	98,8	26,3%	-42,1%
URY1977	Uruguay	98,8	163,1	113,3	65,0%	-30,5%
VEN1974	Venezuela	37,3	121,3	73,8	224,9%	-39,2%
VEN2003	Venezuela	95,7	155,9		63,0%	
ZAF1973	South Africa	91,2	154,6	129,6	69,5%	-16,1%
ZAF2004	South Africa	107,1	153,3		43,1%	
Episodes before 2000		86,7	138,7	98,5	59,9%	-29,0%
Episodes after 2000		97,7	155,9		59,6%	

Table 5: Commodity boom episodes*

Episode	Country	Start	Max	Years from start to max
ARG1973	Argentina	1973	1980	8
ARG2004	Argentina	2004	2008	5
AUS1972	Australia	1972	1979	8
AUS2004	Australia	2004	2008	5
BOL1973	Bolivia	1973	1980	8
BOL2003	Bolivia	2003	2008	6
BRA1973	Brazil	1973	1980	8
BRA2004	Brazil	2004	2008	5
CAN1974	Canada	1974	1980	7
CAN2003	Canada	2003	2008	6
CHL1966	Chile	1966	1980	15
CHL2004	Chile	2004	2008	5
CMR1974	Cameroon	1974	1979	6
CMR2004	Cameroon	2004	2008	5
COL1973	Colombia	1973	1980	8
COL2004	Colombia	2004	2008	5
CRI1976	Costa Rica	1976	1977	2
DOM1972	Dominican Republic	1972	1974	3
ECU1974	Ecuador	1974	1979	6
ECU2004	Ecuador	2004	2008	5
GHA1973	Ghana	1973	1980	8
GHA2004	Ghana	2004	2008	5
GTM1973	Guatemala	1973	1977	5
GTM2004	Guatemala	2004	2008	5
HON1973	Honduras	1973	1977	5
IDN1974	Indonesia	1974	1980	7
IDN2003	Indonesia	2003	2008	6
IND1973	India	1973	1980	8
IND2004	India	2004	2008	5
IRN1973	Iran	1973	1980	8
IRN2004	Iran	2004	2008	5
JAM1972	Jamaica	1972	1974	3
KWT1973	Kuwait	1973	1979	7
KWT2004	Kuwait	2004	2008	5
MEX1973	Mexico	1973	1980	8
MEX2004	Mexico	2004	2008	5
MYS1973	Malaysia	1973	1980	8
MYS2003	Malaysia	2003	2008	6
NGA1973	Nigeria	1973	1979	7
NGA2004	Nigeria	2004	2008	5
NIC1973	Nicaragua	1973	1973	1
NOR1974	Norway	1974	1980	7
NOR2003	Norway	2003	2008	6
NZL1971	New Zealand	1971	1973	3
NZL1977	New Zealand	1977	1980	4
NZL2003	New Zealand	2003	2008	6
PER1974	Peru	1974	1980	7
PER2004	Peru	2004	2008	5
PRY1971	Paraguay	1971	1973	3
RUS1973	Russia	1973	1980	8
RUS2003	Russia	2003	2008	6
SAU1973	Saudi Arabia	1973	1980	8
SAU2003	Saudi Arabia	2003	2008	6
TTO1973	Trinidad & Tobago	1973	1980	8
TTO2003	Trinidad & Tobago	2003	2008	6
URY1968	Uruguay	1968	1973	6
URY1977	Uruguay	1977	1980	4
VEN1974	Venezuela	1974	1980	7
VEN2003	Venezuela	2003	2008	6
ZAF1973	South Africa	1973	1980	8
ZAF2004	South Africa	2004	2008	5
Average duration episodes before 2000				6,5
Average duration episodes after 2000				5,4

(*): Max corresponds to the year in which the commodity price index reached its maximum value during episode.

Table 6: Commodity price index around commodity boom episodes*
(2000=100)

		Average value		
		Before	Up to max	% Increase
ARG1973	Argentina	77,1	102,1	32,5%
ARG2004	Argentina	100,7	150,5	49,5%
AUS1972	Australia	81,3	119,1	46,5%
AUS2004	Australia	118,9	150,1	26,2%
BOL1973	Bolivia	62,2	105,1	69,1%
BOL2003	Bolivia	94,7	144,0	52,1%
BRA1973	Brazil	130,6	167,1	28,0%
BRA2004	Brazil	107,3	145,7	35,7%
CAN1974	Canada	50,0	85,1	70,3%
CAN2003	Canada	92,0	143,8	56,3%
CHL1966	Chile	107,1	134,7	25,8%
CHL2004	Chile	96,8	167,9	73,5%
CMR1974	Cameroon	74,0	139,6	88,6%
CMR2004	Cameroon	94,9	165,8	74,8%
COL1973	Colombia	80,9	132,8	64,2%
COL2004	Colombia	97,0	160,4	65,4%
CRI1976	Costa Rica	173,8	222,2	27,9%
DOM1972	Dominican Republic	170,4	282,7	65,9%
ECU1974	Ecuador	69,2	123,8	78,7%
ECU2004	Ecuador	95,3	167,6	76,0%
GHA1973	Ghana	112,8	180,4	60,0%
GHA2004	Ghana	110,9	160,5	44,7%
GTM1973	Guatemala	144,0	199,6	38,6%
GTM2004	Guatemala	93,7	145,6	55,4%
HON1973	Honduras	157,2	182,7	16,2%
IDN1974	Indonesia	46,5	109,9	136,5%
IDN2003	Indonesia	91,8	148,8	62,0%
IND1973	India	88,6	164,1	85,3%
IND2004	India	105,7	156,4	48,0%
IRN1973	Iran	29,8	97,2	226,1%
IRN2004	Iran	96,5	167,5	73,5%
JAM1972	Jamaica	179,7	247,3	37,6%
KWT1973	Kuwait	28,8	93,6	224,9%
KWT2004	Kuwait	94,7	173,1	82,8%
MEX1973	Mexico	51,1	109,8	114,6%
MEX2004	Mexico	96,5	165,9	72,0%
MYS1973	Malaysia	41,0	92,1	124,3%
MYS2003	Malaysia	91,2	148,5	62,8%
NGA1973	Nigeria	39,7	97,8	146,5%
NGA2004	Nigeria	95,3	171,1	79,6%
NIC1973	Nicaragua	186,9	265,4	42,0%
NOR1974	Norway	53,6	106,9	99,4%
NOR2003	Norway	89,9	154,0	71,3%
NZL1971	New Zealand	70,8	97,3	37,4%
NZL1977	New Zealand	59,1	106,1	79,6%
NZL2003	New Zealand	97,5	136,7	40,2%
PER1974	Peru	71,0	139,5	96,3%
PER2004	Peru	95,7	167,2	74,7%
PRY1971	Paraguay	147,6	190,9	29,3%
RUS1973	Russia	37,0	79,9	116,2%
RUS2003	Russia	92,7	147,6	59,2%
SAU1973	Saudi Arabia	28,4	100,5	253,5%
SAU2003	Saudi Arabia	95,1	157,7	65,9%
TTO1973	Trinidad & Tobago	23,0	73,3	218,3%
TTO2003	Trinidad & Tobago	92,3	147,7	60,1%
URY1968	Uruguay	135,0	170,5	26,3%
URY1977	Uruguay	98,8	179,9	82,1%
VEN1974	Venezuela	37,3	113,9	205,1%
VEN2003	Venezuela	95,7	155,9	63,0%
ZAF1973	South Africa	91,2	154,6	69,6%
ZAF2004	South Africa	107,1	153,3	43,1%
Episodes before 2000		86,7	141,9	63,7%
Episodes after 2000		97,7	155,9	59,6%

(*): Up to max corresponds to the average value of the commodity price index from the beggining of the episode until its maximum value during the episode.

Table 9: 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	*
Guatemala	0,02	0,04	0,02	**
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 10: Determinants of fiscal cyclicality

	Dependent variable										
	Fiscal balance cyclicality							Government expenditure cyclicality			
Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Institutional quality	0,013 (1,30)	0,021 (1,76)*						-0,014 (-2,02)**		-0,01 (-1,44)	-0,012 (-1,83)*
Fiscal rule							0,043 (1,42)		-0,035 (-1,87)*		
Oil producer			0,058 (2,18)**	0,054 (2,48)**	0,042 (1,76)*	0,056 (2,58)**	0,063 (2,35)**				0,016 (1,04)
Exchange rate flexibility						0,021 (2,12)**				-0,012 (-1,72)*	
R2	0,03	0,09	0,08	0,13	0,12	0,23	0,11	0,07	0,06	0,12	0,09
Number of observations	56	48	58	56	48	53	58	57	59	54	57
F test	1,68	3,08*	4,76**	3,99**	3,16**	4,77***	3,43**	4,07**	3,49*	3,52**	2,58*
Sample	All	Developing	All	All	Developing	All	All	All	All	All	All

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

Figure 1a: Fiscal balance around commodity boom episodes

(Average fiscal balance in commodity boom episode *i* minus average fiscal balance in 2 years previous to the boom episode, % GDP)

- Episodes before 2000
- Episodes after 2000
- Average episodes before 2000 (0.2%)
- Average episodes after 2000 (3.6%)
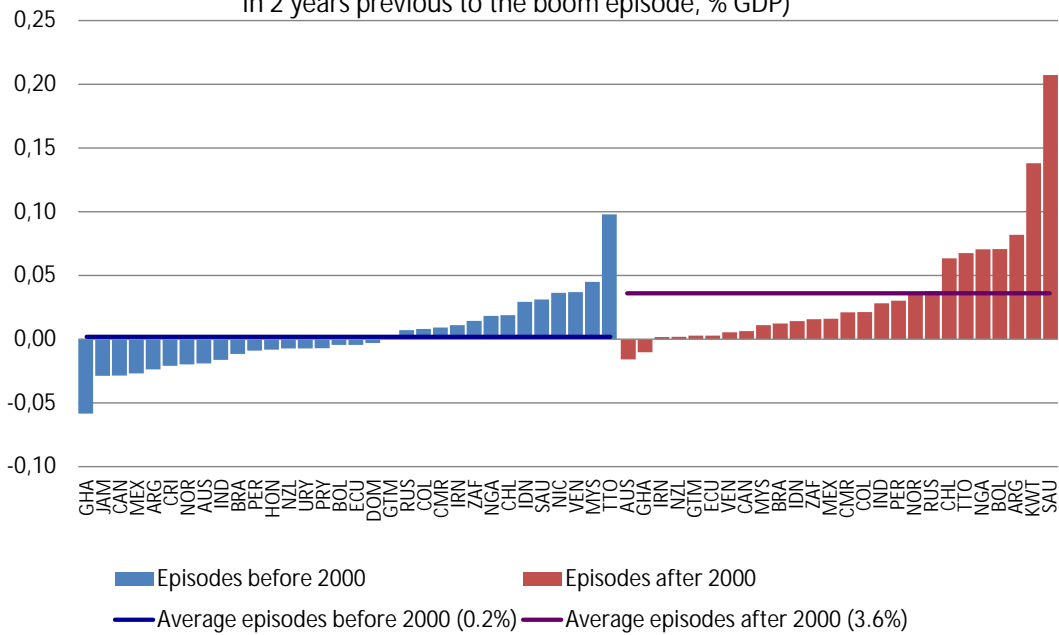

Figure 1b: Fiscal balance around commodity boom episodes

(Change in the change of fiscal balance between country episodes)

- Increase in fiscal balance in country epidose after 2000 minus increase in fiscal balance in country episode before 2000
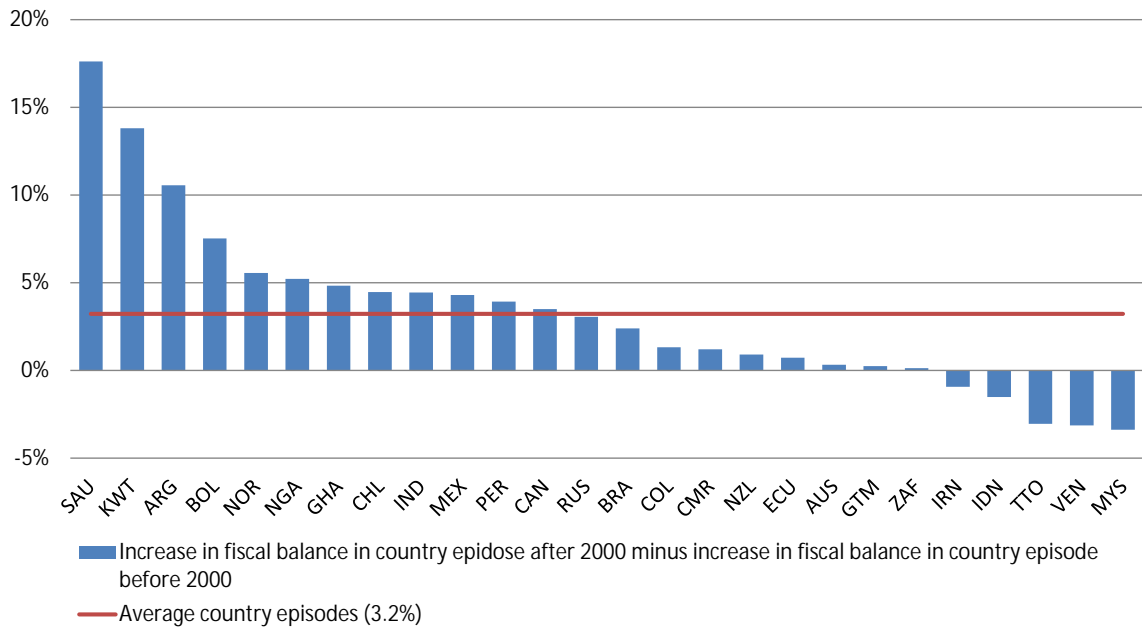- Average country episodes (3.2%)

Figure 2a: Government revenues around commodity boom episodes

(Average government revenues in commodity boom episode *i* minus average government revenues in 2 years previous to the boom episode, % GDP)

Episodes before 2000
Episodes after 2000
Average episodes before 2000 (3.2%)
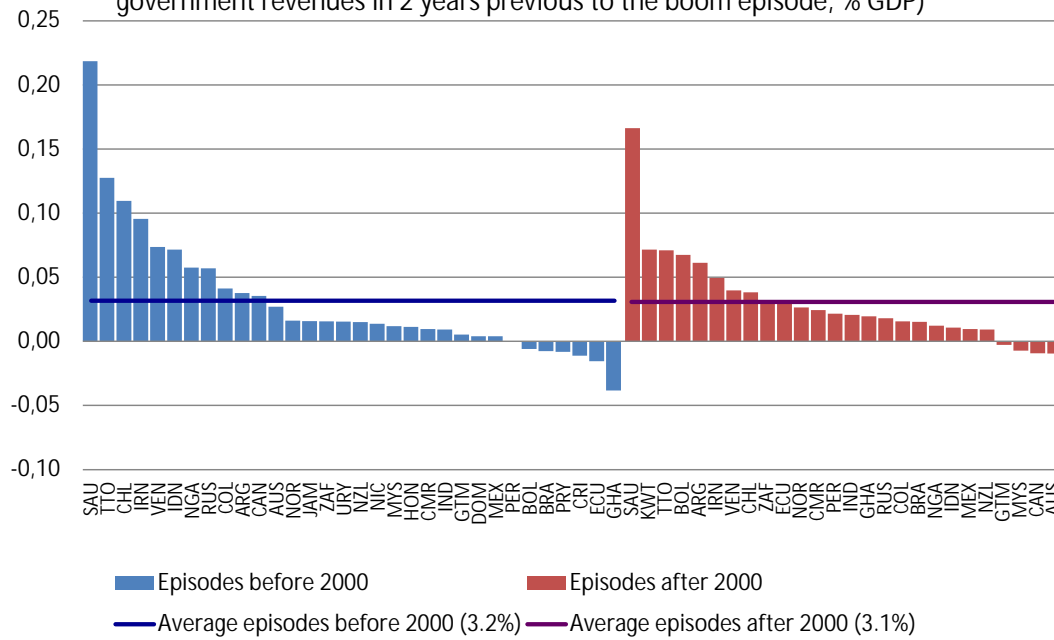Average episodes after 2000 (3.1%)

Figure 2b: Government revenues around commodity boom episodes

(Change in the change of government revenues between country episodes)

Increase in government revenues in country epidose after 2000 minus increase in government revenues in country episode before 2000
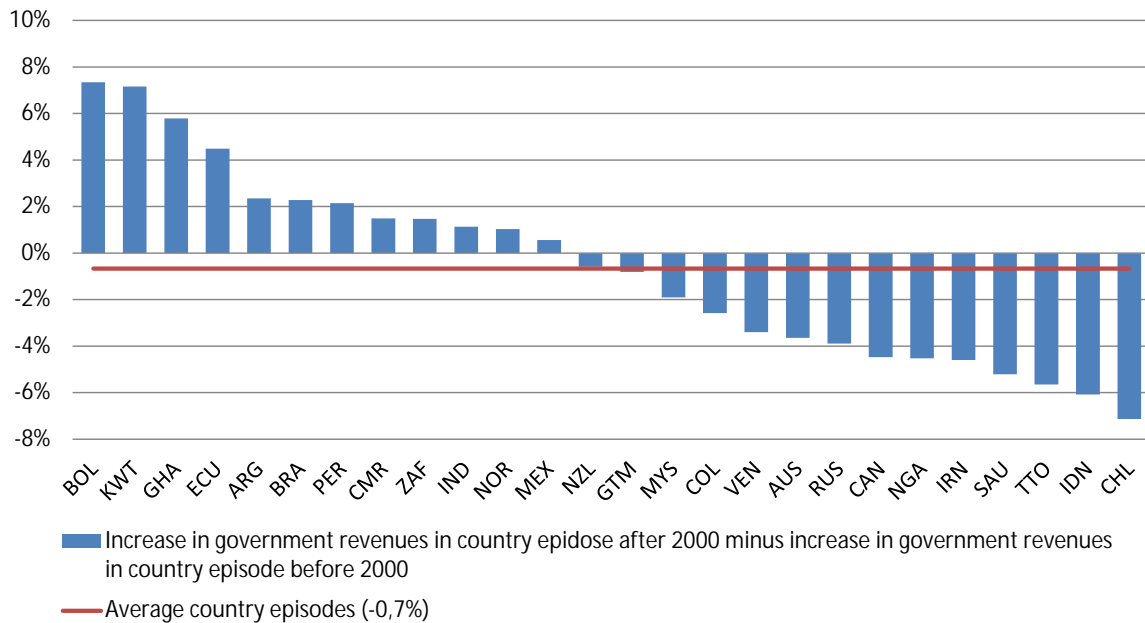Average country episodes (-0,7%)

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Figure 3a: Government expenditures around commodity boom episodes

(Average government expenditures in commodity boom episode *i* minus average government expenditures in 2 years previous to the boom episode, % GDP)

Episodes before 2000 — Episodes after 2000

Average episodes before 2000 (3.2%) — Average episodes after 2000 (-0.5%)
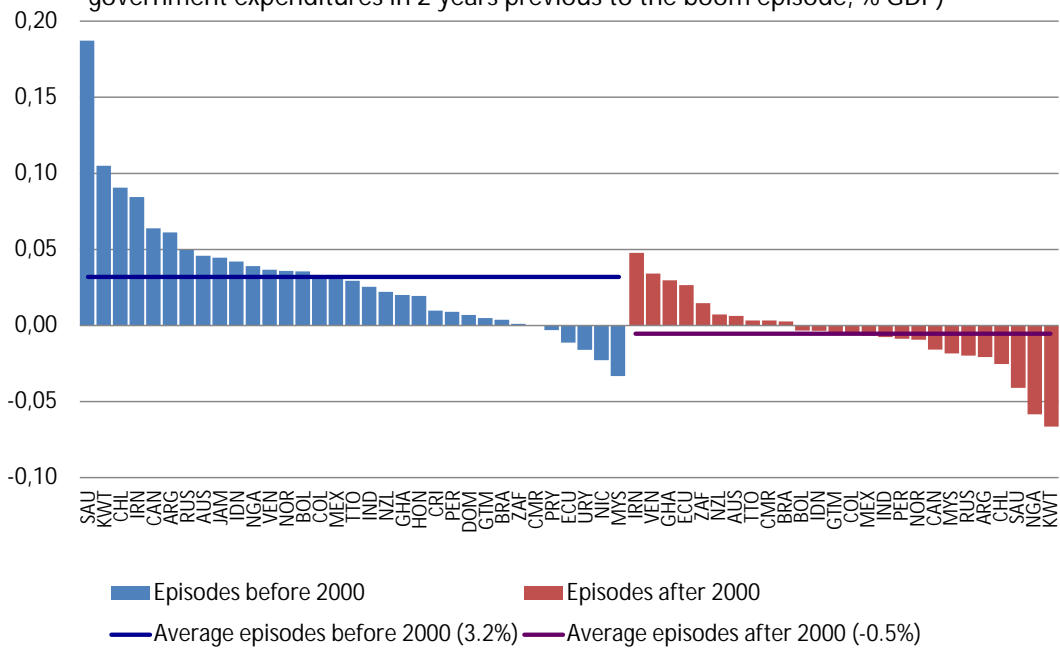
Figure 3b: Government expenditure around commodity boom episodes

(Change in the change of government expenditure between country episodes)

Increase in government expenditure in country epidose after 2000 minus increase in government expenditure in country episode before 2000

Average country episodes (-4.3%)
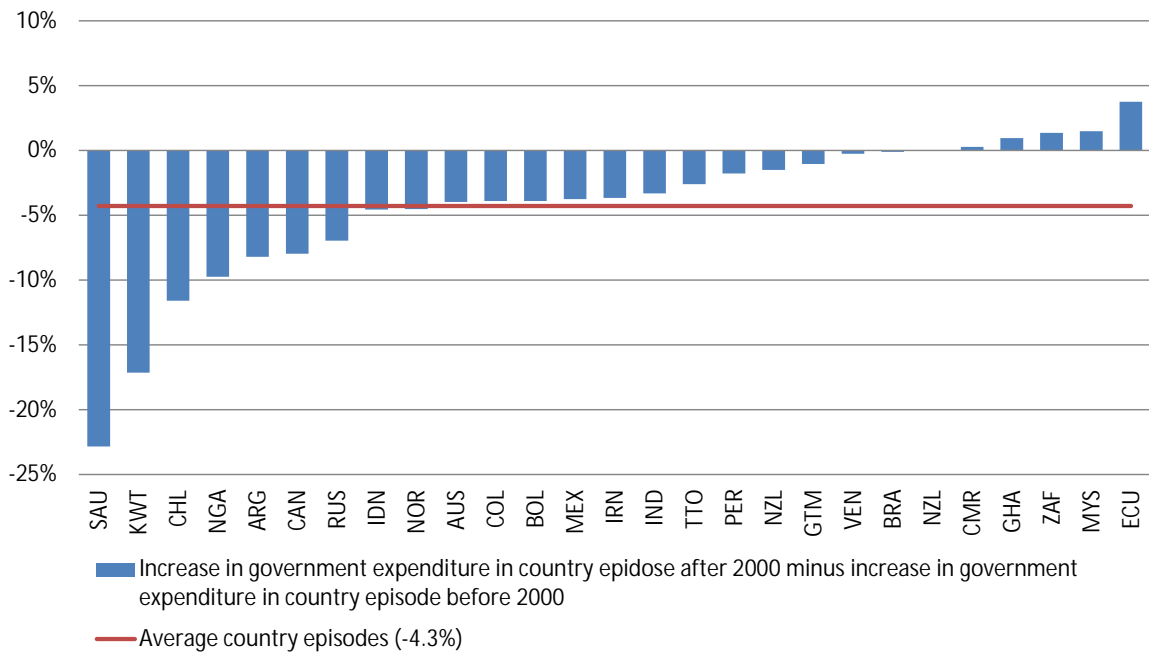
Figure 4: Real effective exchange rate around commodity boom episodes

(Change in real exchange rate in commodity boom episodes)

Episodes before 2000
Episodes after 2000
Average episodes before 2000 (9.3%)
Average episodes after 2000 (5,9%)
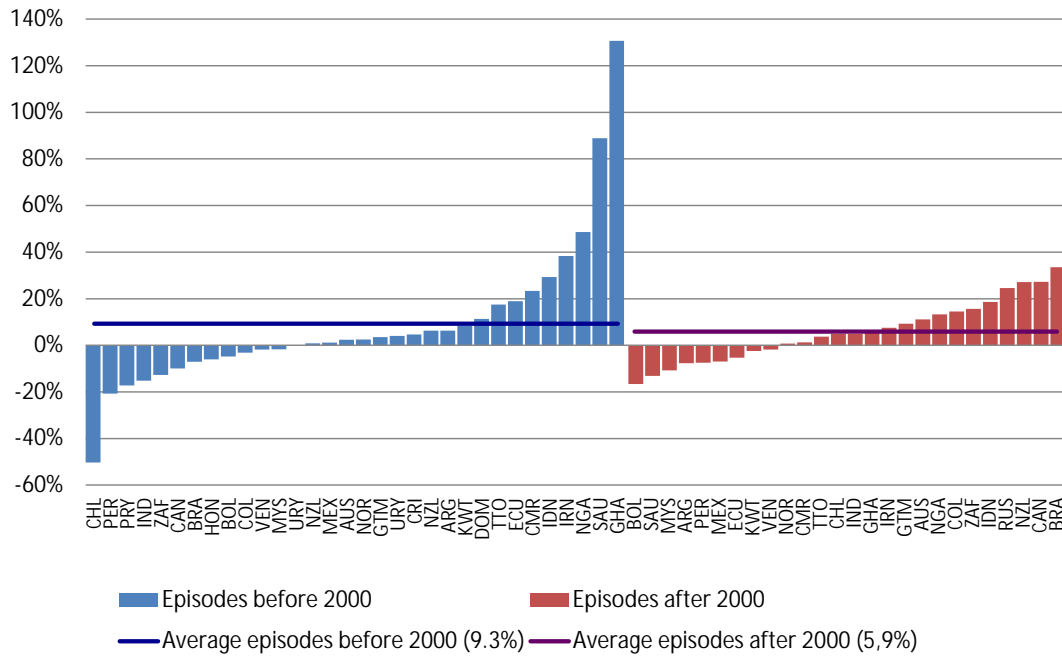
Figure 5: Cyclicality of fiscal variable to commodity prices

A. Fiscal balance

B. Government revenues

C. Government expenditures

Figure 6: Cyclicality of fiscal variable to commodity prices
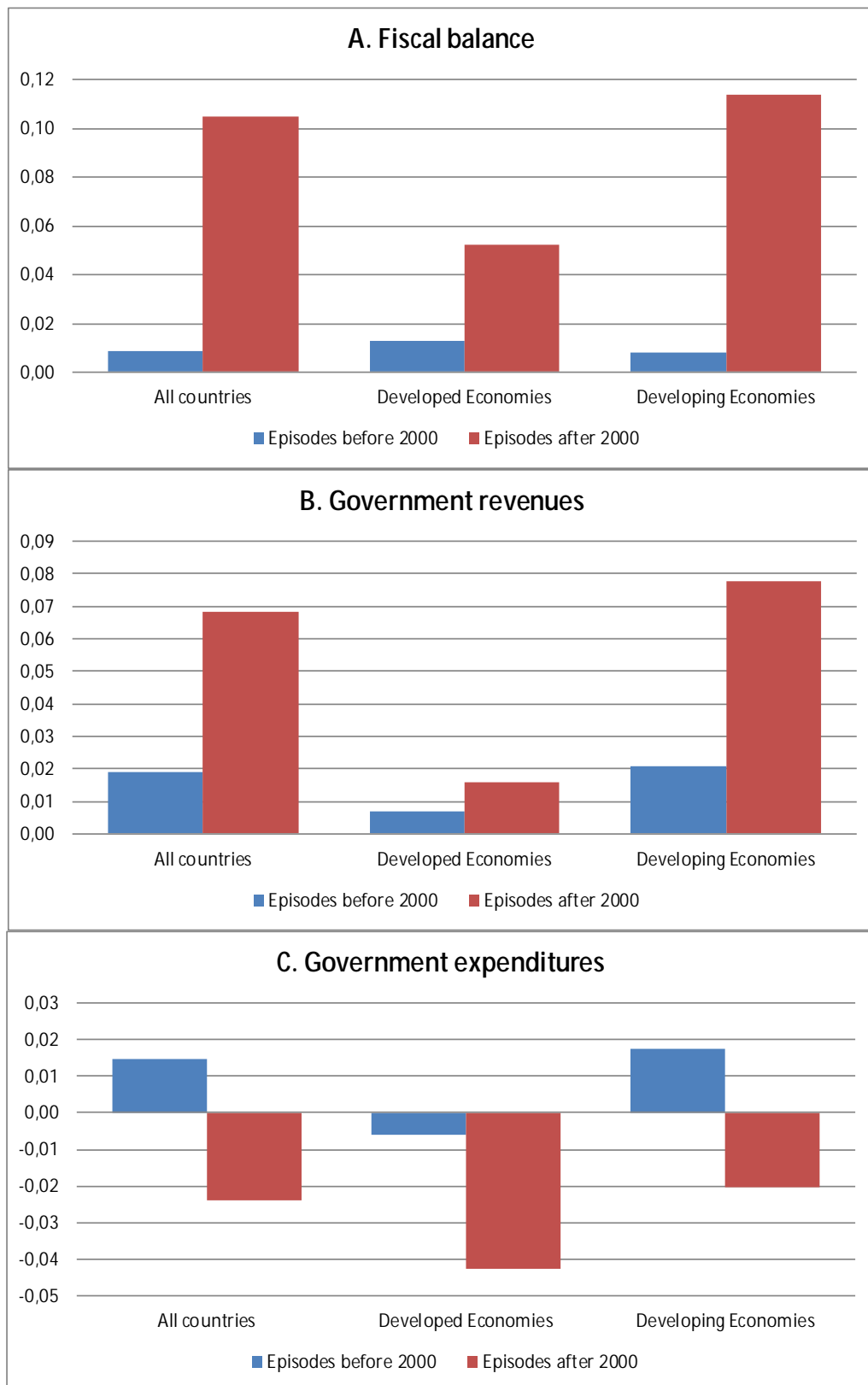
Figure 7: Cyclicality of fiscal variable to output gap

A. Fiscal balance

B. Government revenues

C. Government expenditures

Table A: Cyclicality of fiscal variable to commodity price index

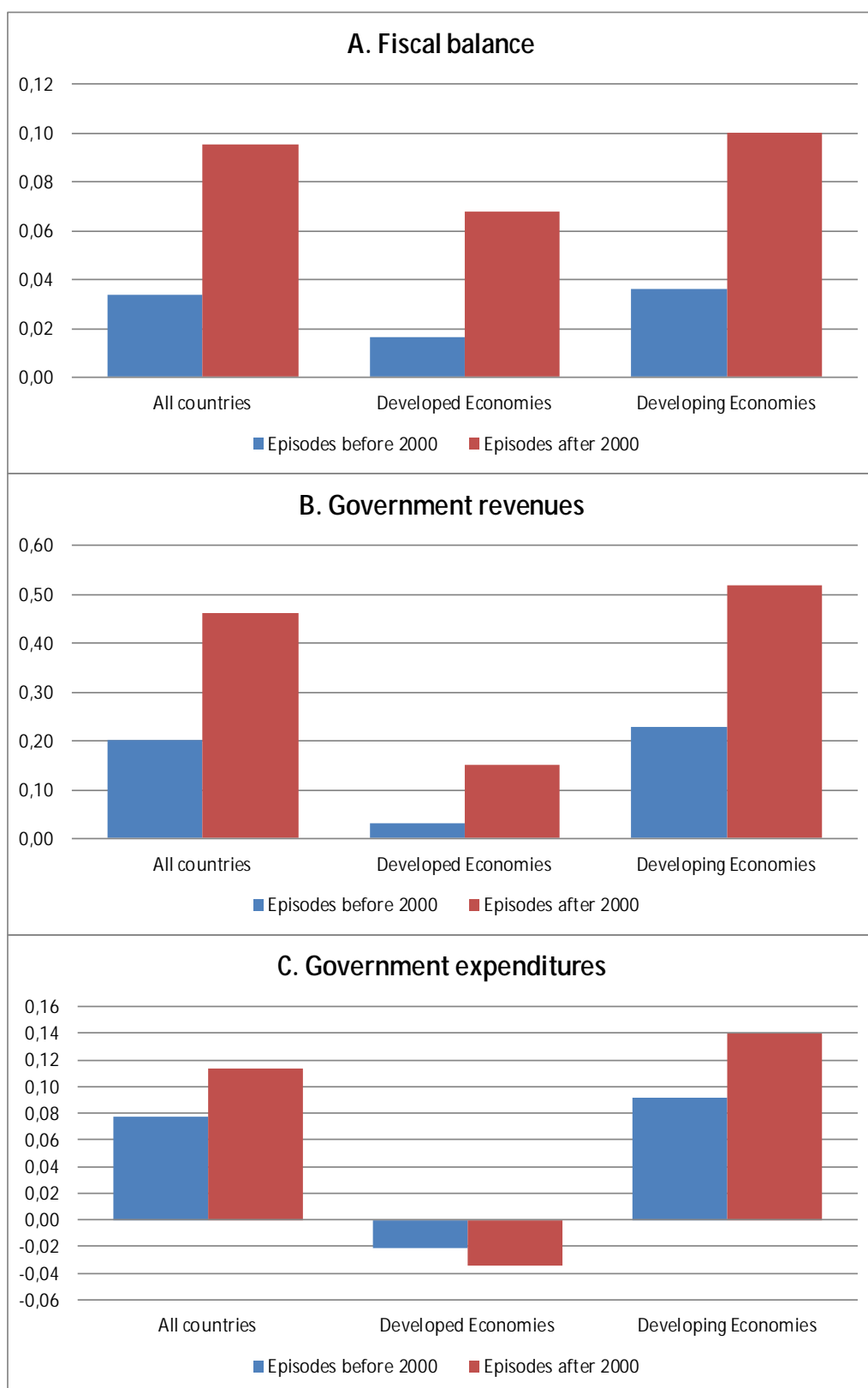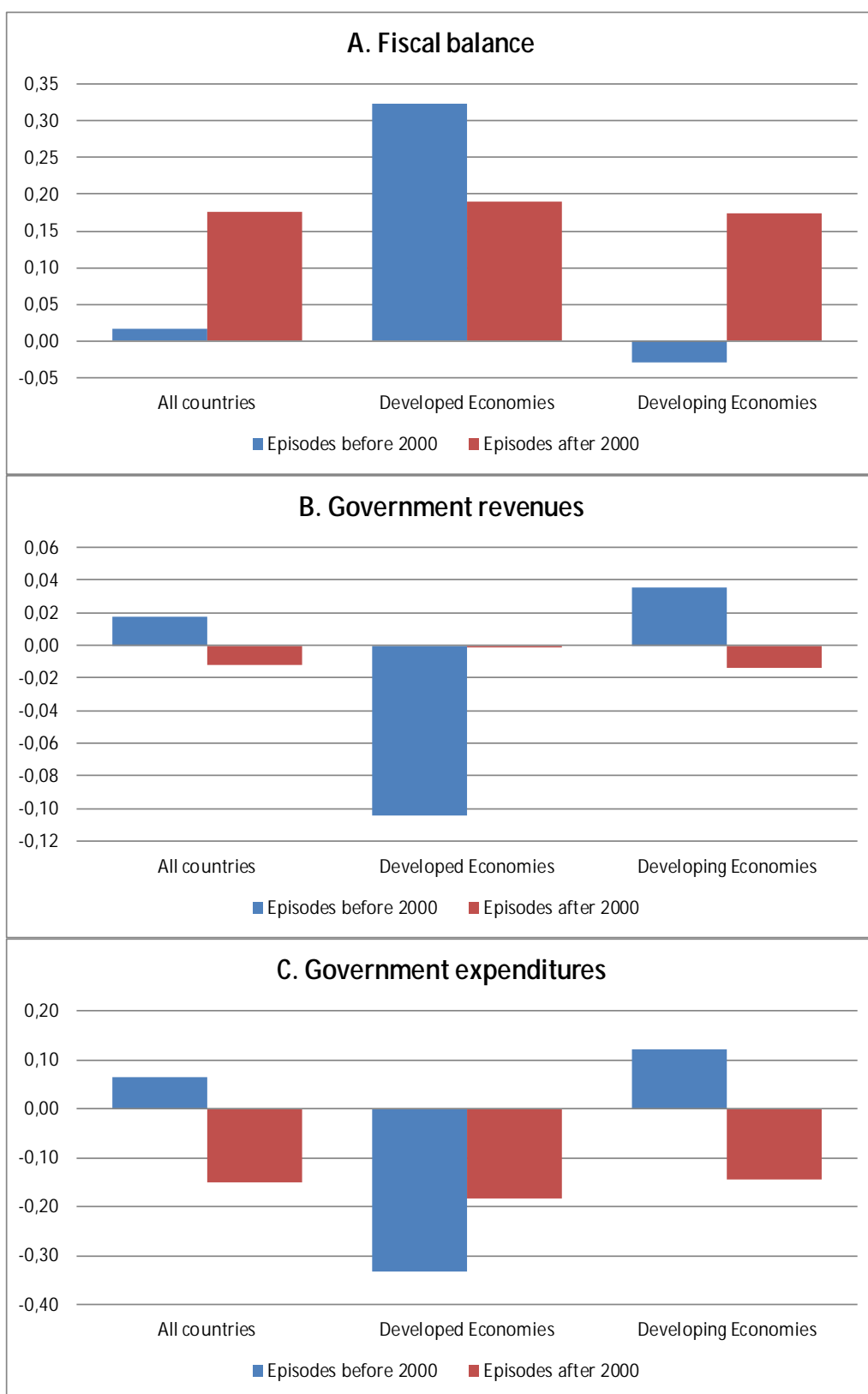|		Elasticity of fiscal variable to commodity price index*					
		Government expenditures		Government revenues		Fiscal balance	
Argentina	1965-1985	0,07		0,29		0,03	
Argentina	1995-2009	-0,24		0,14		0,06	
Australia	1970-1985	-0,12		-0,05		0,02	
Australia	1995-2009	-0,19	***	-0,08		0,02	*
Bolivia	1970-1985	-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	
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	
Guatemala	1995-2009	-0,07		0,19		0,02	
Honduras	1965-1985	0,02		0,31	**	0,07	**
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 Δ(ln(Fiscal variable))=α+β*Δ(ln(Commodity price index)), where Fiscal variable corresponds to the levels of real government expenditure and real government revenues. In the case of the fiscal balance we run the regression (Fiscal balance(% GDP))=α+β*Δ(ln(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) Commodity price		(b) Commodity price		Output gap		(a) Commodity price		(b) Commodity price		Output gap		(a) Commodity price		(b) 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	
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	**
Guatemala	1995-2009	-0,04		-0,06	**	0,24	*	-0,01		-0,02		0,20	**	0,04	*	0,05	*	-0,04	
Honduras	1965-1985	-0,05		-0,04		-0,02		0,01		0,04		-0,13		0,09	*	0,14	**	-0,18	
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		0,01		0,00		0,06		0,02		0,02		0,02		0,01		0,02		0,02	
Average episodes after 2000		-0,02		-0,02		-0,15		0,07		0,07		-0,01		0,10		0,10		0,18	

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

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

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

Comments on Andres Velasco's paper "Was This Time Different? Fiscal Policy in Commodity Republics"

Choongsoo Kim[13]

Velasco's paper makes a useful contribution to the discussion on fiscal policy behaviour in commodity-rich countries (or "commodity republics," as the author refers to them). It constructs a commodity price index for a group of 50 economies during the period 1900-2010 and analyzes the data to see how fiscal policy behaviour has evolved over time. It finds as a result that fiscal balances improved by 3.6% on average during the recent commodity boom in the 2000s. This is in contrast to the previous boom in the 1970s and early 1980s when the change was negligible.

Graph 1
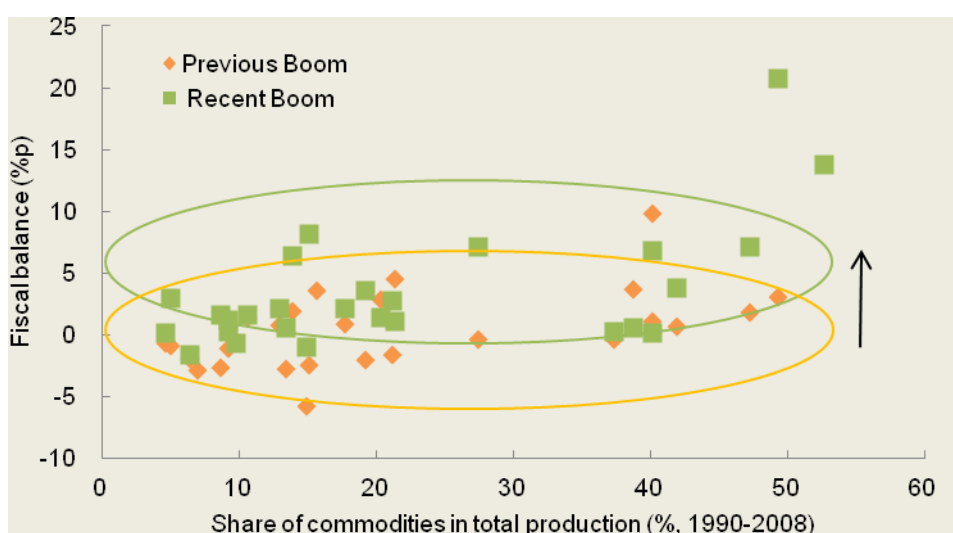
It then explains that fiscal policy for the countries concerned has become less procyclical due to the presence of fiscal rules that limit excessive government expenditure and to the learning-by-doing effect from the previous boom. Although these determinants are identified in a simple regression model, and robust analytical results are not obtained (partly because of the small sample size and possible selection bias[14]), this explanation still gives us meaningful policy implications regarding fiscal cyclicality.

Using the data provided in this paper, we can draw a statistically significant relationship between the commodity price elasticity of fiscal balances and the share of commodities in total production: stronger counter-cyclical responses were found in countries with greater

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[13] Governor, The Bank of Korea.

[14] Only 32 of the 48 economies that the author initially studied could be labelled as "commodity republics" due to data unavailability as well as the low percentages of commodity exports in their output – less than 10 per cent. The sample size was then reduced further to 26 as these are the countries that experienced both commodity booms in the 1970s and the 2000s. A selection bias problem might have arisen in doing so, negatively affecting the regression's robustness.

dependence on commodities during the recent boom, in line with the paper's conclusion – "this time is different."

Graph 2
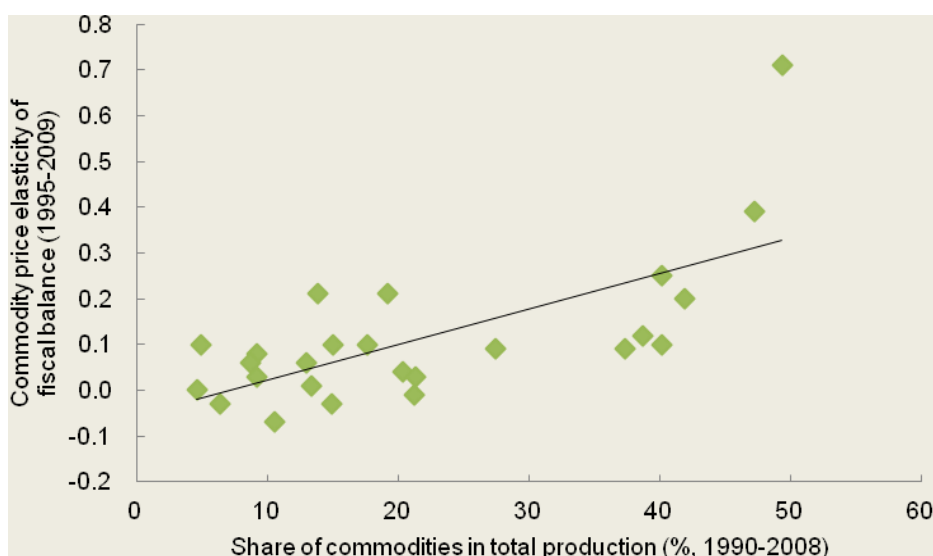
In fact, the number of emerging market economies with fiscal rules has increased markedly since the end of the 1990s, and stood at 33 in 2009.[15] This reinforces the argument that the main determinant of fiscal cyclicality change is the presence of fiscal rules. However, it is important to also keep in mind the studies suggesting that the presence of fiscal rules is not closely correlated with fiscal balance improvement (Ossowski et al. (2010)). In this case, the dummy variable for fiscal rules used in the paper's regression model is not sufficient to reflect the quality of the fiscal rules, and other variables such as the IMF's Index of Strength of Fiscal Rules[16] might well be added to improve the model's explanatory power.

Other issues such as a cross-sectional risk-sharing problem could also be taken into account when analyzing fiscal cyclicality. Countries with greater economic openness – that is, greater vulnerability to external shocks – are said to have governments with huge amounts of expenditure due to their risk-reducing role (Rodrik (1998)). The same logic can be applied to the case for commodity republics. During a commodity boom, increased capital inflows to commodity republics lead to real exchange rate appreciations, intensifying the imbalances between commodity-related industries and other exporting industries including manufacturing. Political pressures from the negatively affected industries in consequence mount, which tends to increase expenditure to support such industries. In addition to this, market structural change could have some relationship to this paper's findings. International commodity markets might have become more competitive recently, and if this is the case, the greater competition would have reduced commodity republics' price setting power.

Concerning fiscal policy in Korea, it has not adopted any explicit fiscal rule. Nevertheless, Korea has successfully maintained fiscal sustainability, with a public debt ratio currently

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[15] IMF Fiscal Rules Database, 2009.

[16] The Index of Strength of Fiscal Rules published by the IMF is an indicator that numerically measures a fiscal rule's quality in consideration of eight dimensions including coverage, enforcement, flexibility, supporting procedures, etc. The scores are weighted using a principal component analysis to create an index standardized to have a zero mean and a standard deviation of one.

standing at about 30%. Such fiscal policy played a pivotal role in Korea's overcoming disinflation in the early 1980s and two financial crises since the 1990s. In the 2000s, the Korean government introduced medium-term fiscal plans – each with a term of five years – and as a result fiscal sustainability and counter-cyclicality have been much strengthened. Going into greater detail, fiscal policy was acyclical between 1970 and 1982, procyclical between 1983 and 1996 under the expenditure-within-revenue rule, and finally countercyclical between 1997 and 2010 under the medium-term fiscal plans.[17] Looking ahead, Korea faces greater challenges in preserving its fiscal sustainability, especially given its aging population and increasing demand for social welfare.

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[17] The correlations with GDP (HP-filtered) are as follow:

	1970-1982	1983-1996	1997-2010
Expenditure	−0.14	0.40	−0.41
Revenue	0.44	0.72	0.72

Comments on "Was this Time Different? Fiscal Policy in Commodity Republics"

Guillermo Calvo[18]

Societies are gluttonous. Unheeding biblical advice, they get fat during the fat years. The interesting paper by Luis Felipe Céspedes and Andrés Velasco looks at this issue by examining commodity producers' fiscal policies during boom periods "then" and "now" – where "then" is around the 1970s and early 1980s and "now" is the recent episode that reached its climax in 2008 and is still gathering force after the Lehman impasse.

Most of the economies in the sample could safely be assumed to be "small" in the sense of being price takers. Under those conditions, commodity prices can be claimed to be invariant with respect to policy response in individual commodity-producers in the sample. This ensures that the empirical analysis is free from double-causality problems, a major nuisance. As the authors remind us, this is a great advantage over much of the previous literature that examines pro-cyclicality with respect to *domestic* variables (eg gdp), which are unquestionably not invariant with respect to domestic policy.

The paper claims that policy pro-cyclicality has declined by showing that variables like the fiscal deficit tended, in response to commodity boom, to increase less "now" than "then." This is crystal clear for the case of Chile and it, indeed, needs no sophisticated econometrics. It turns out that professor Velasco was at the helm of Chile's Finance Ministry during the "now" episode, and valiantly resisted strong political forces that vied for the government to spend a large share of the copper bonanza. The copper fund grew phenomenally. Moreover, to prevent that this generated a domestic credit boom, funds were deposited offshore, out of the cat's reach. The policy proved highly successful. During the Lehman episode, Chile was able to increase fiscal deficit by about 8 percent of gdp (from 2007 to 2009), without resorting to international assistance and without fuelling inflation. This stands in sharp contrast with Chile's experience "then," and dramatically shows a case in which pro-cyclicality was decisively dethroned (at least, temporarily).
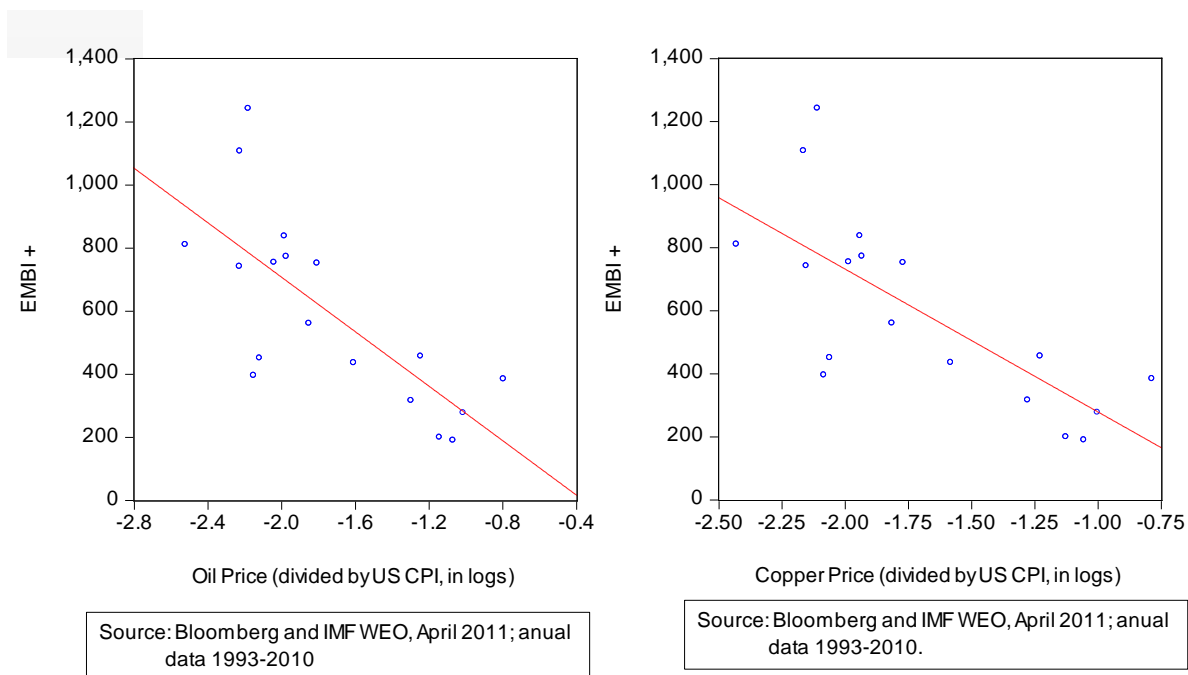
The empirical evidence in the paper points to a similar trend for a large sample of commodity producers, although, as in most econometric exercises, it leaves some room for disbelievers. For instance, the method applied in the paper abstracts from expectations: a boom is just defined as a price increase exceeding 25 percent. There is no control for factors like "expected boom sustainability." Supposedly, a boom that is expected to be highly sustainable or durable will give rise to greater fiscal profligacy than a mere blip in commodity prices. For example, I would conjecture that the rise in oil prices "then" is likely to have been perceived as more durable than that prior the Lehman episode ("now"), because the price rise "then" resulted from the formation of an oil cartel – a structural and very visible policy move – while "now" the price boom occurred in the midst of the Great Recession and for reasons that are still not well understood. Thus, the oil price rise "now" has a greater chance of being seen as a blip or, at least, less permanent than "then." This gives some ground for believing that the trend towards less policy pro-cyclicality might stem from different expectations about price durability rather than a change in policymakers' behaviour (as seems to be claimed in the paper).

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An implicit assumption in the paper is that pro-cyclical policy is suboptimal, there is too much of that. Thus, the trend to less pro-cyclicality is portrayed as better policymaking on the part of commodity producers. But, is that so? It is a well-known fact that commodity prices are highly persistent. It is even hard to reject the hypothesis that they follow a "random walk," ie that expected tomorrow's price is equal to today's price. If that were the case, it may be sensible for a country to consume most of the price bonanza, unless individuals are highly risk averse. Moreover, as shown in Figure 1 high commodity prices tend to coincide with low interest rates, as measured by the EMBI+ (ie the JP Morgan Emerging Markets Bond Index). Lower interest rates make borrowing more attractive, especially for economies that are net debtors, as most emerging markets are. Thus, this may even justify spending in excess of the price-rise bonus, eg increasing fiscal deficit during a boom in commodity prices. Under this perspective, there is nothing wrong about pro-cyclical policy. The trend detected by the authors goes in the wrong direction!

Figure 1

Oil/Copper Price and EMBI+

Source: Bloomberg and IMF WEO, April 2011; anual data 1993-2010

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Don't get me wrong. I do not intend to rub off the shine from Velasco's armor. I think Chile's policy was admirable, but to justify it as "good policy" in terms of standard economic theory one would have to argue that it reflects policymakers' higher *risk aversion* or *risk perception* "now" than "then." Higher risk aversion would correspond to better policymaking if it better matched the population's risk preferences. This is very hard to check. More interesting is the possibility that lower pro-cyclicality is a result of greater uncertainty and consequent higher risk perception on the part of policymakers, especially if one can find objective evidence showing that, for instance, volatility has gone up. I conjecture that this is, in fact, the case. In contrast with advanced economies during the Great Moderation, emerging markets have been buffeted by large financial crises that have no obvious links to domestic conditions. The Asia/Russia 1997/8 crisis stands out in this respect. It resulted in a massive collapse in emerging market bond prices. For many emerging economies, especially in Latin America, this crisis was totally unexpected and seemed to bear little relationship with their

fundamentals. Latin America's average growth rate, for example, dropped from almost 4.5 percent per year since the beginning of the 1990s to zero when the Asia/Russia crisis hit, in the blink of an eye; and output stayed flat for several years after.[19] Chile, the region's star performer, never recovered the vigour displayed prior to that episode. Therefore, I surmise that there are solid grounds for rationalizing the surge of policymakers' risk perception. This helps to explain the direction towards less pro-cyclicality but not the extent of the policy change. In that respect, it would be interesting to explore how big the surge in risk perception should be in order to be able to rationalize the remarkable prudence displayed in Chile "now," and the decline in pro-cyclicality showed in the paper's sample economies. Can this change in policy stance be rationalized by realistic risk perception alone, or one should also appeal to changes in risk aversion? I believe these are interesting questions that are worth further analysis.

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[19] See, for example, my paper "Crisis in Emerging Market Economies: A Global Perspective," in K. Cowan, S. Edwards, and R. Valdes (editors), *Current Account and External Financing*; Santiago, Chile: Central Bank of Chile 2008. Also NBER Working Paper 11305, April 2007.