

**Was This Time Different?**  
**Fiscal Policy in Commodity Republics\***

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June 2011

\*Paper prepared for the BIS 10<sup>th</sup> Annual Conference, Lucerne, Switzerland, June 23-24, 2011

## I. 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.<sup>1</sup> 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 (1995) and Sinnott (2009), among others, document that governments save too 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 1999, Arreaza et al 1999, Lane 1999 and 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.

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 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 is different”, with fiscal policy

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<sup>1</sup> This is not the same, however, as government spending being countercyclical. In the neoclassical model, spending should be acyclical (that is to say, smoothed across the cycle) if the representative agent’s utility function is separable in private and public consumption. Public spending can optimally be counter-cyclical (procyclical) if private and public consumption are substitutes (complements).

behaving less procyclically –and perhaps even countercyclically– in the recent commodity boom episode, as commodity-producing nations have improved the rules and institutions that determine their fiscal policies.

We begin by constructing a commodity price index for a group of 50 economies, using information on the importance of each commodity in the total commodity output 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. For almost every country under study we identify two boom episodes: one taking place in the 1970s and early 1980s, and another taking place in the years prior to 2008.

Next we study the behavior of key fiscal variables surrounding these commodity boom episodes with particular focus on fiscal variables. In particular, we study how real government expenditures, real government revenues and the fiscal balance behave over the commodity price cycle.

For those countries with sufficiently abundant fiscal data 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 episodes. 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 (1995-2008) and the previous episodes. 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, suggesting there are hardly any countries whose fiscal policy seems to have been overtly procyclical in the recent episode. Behind this is an improvement in the cyclical behavior of revenues, but the behavior of expenditure does not seem to change very much across the cycles.

Among the striking examples of nations that had procyclical policies in the past, but which seem to have behaved quite countercyclically in the recent episode most of the Latin nations – with the glaring exception of Venezuela–, 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 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 IV, 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 V then analyzes the role of a few institutional and political variables in trying to explain the changed pattern of fiscal behavior. Finally, section VI concludes.

## **II. 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.

**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

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 and other 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 during 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 during recent years –as has been used in the literature– would be a completely inappropriate measure of prices for the first half of the 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 that comparability over time is more difficult, and that the index will reflect changes in production quantities that might not be completely exogenous to local 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.

**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.

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 Passche 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:

$${}_k\text{COMBI}_t^i = \sum_j s_k^j \left( \frac{p_t^j}{\bar{p}^j} \right),$$

where  $s_k^j = \frac{1}{30} \sum_{t=k}^{k+30} \frac{p_t^j q_t^j}{\sum_i p_t^i q_t^i}$  is commodity  $j$ 's share of total commodity production in country  $i$ , averaged over the 30-year base period beginning in year  $k = \{1900, 1930, 1960, 1990\}$ ;  $\bar{p}^j$  is the average price of commodity  $j$  over the period of 1930-1990;  $p_t^j$  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.<sup>2</sup> 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:

$$\begin{aligned} \text{COMBI}_t^i &= {}_k\text{COMBI}_t^i && \text{for } k = 1990 \text{ and } t \geq 1990 \\ &= \left( \frac{{}_k\text{COMBI}_t^i}{{}_{k+30}\text{COMBI}_t^i} \right) {}_{k+30}\text{COMBI}_t^i && \text{for } k = \{1900, 1930, 1960\} \text{ and } (k \leq t < k + 30) \end{aligned}$$

The indices are then normalized such that  $\text{COMBI}_{2010}^i = 100 \forall i$ . Finally, the index is deflated using the producer price index for the United States.

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<sup>2</sup> Note that prices have been normalized in order to eliminate unit and scale effects.



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 of 1970 to 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 starting around 2004 that runs all the way to 2008. As can be seen in Table 3, only Costa Rica, the Dominican Republic, Honduras, Jamaica, Nicaragua and Paraguay experience only one commodity boom (in the 1970s) and none in recent years. And only New Zealand experiences 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 recently. 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 was 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.

**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 beginning of the episode until its maximum value during the episode.

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 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.

### **III. 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 the times of commodity booms. The characterization in this section is descriptive and informal. The next section contains an estimation of the relevant cyclical elasticities.

Table 7 shows the behavior of the fiscal balance. We have the average fiscal deficit or surplus, as a share of GDP, for each year of the episode. We compare that to the same variable averaged over the 2 years previous to the episode. The result is striking: during the 1970s boom, fiscal balances improved on average only 0,3 percentage points of GDP. In contrast, during the recent episode they improved on average by 3,6 percentage points of GDP.

Of course, these averages mask substantial heterogeneity. There are the countries such as Ghana, where the deficit widened during 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 no reason for celebration.

Then there are countries where, 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 21<sup>st</sup> century. One such case is Chile, where a cut in the deficit of 1,9 percentage points of GDP four decades ago changed into an increase in the surplus of 5,4 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 Argentina, a nation not usually associated with prudent fiscal management. Nonetheless, 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.

What explains the changing behavior of the fiscal balance across episodes? Not the behavior of revenues. Table 8 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 behind the averages. In a number of countries where revenues were broadly stable or even fell in the 1970s, 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 Table 9. 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.

**Table 7: Fiscal balance around commodity boom episodes\***  
(% GDP)

		Average value		
		Before	During	Increase
ARG1973	Argentina	-3,3%	-5,6%	-2,4%
ARG2004	Argentina	-10,0%	-1,8%	8,2%
AUS1972	Australia	-0,7%	-2,5%	-1,9%
AUS2004	Australia	1,8%	0,3%	-1,6%
BOL1973	Bolivia	-2,3%	-2,7%	-0,4%
BOL2003	Bolivia	-7,8%	-0,7%	7,1%
BRA1973	Brazil	-6,9%	-8,0%	-1,1%
BRA2004	Brazil	-4,0%	-2,8%	1,2%
CAN1974	Canada	0,0%	-2,8%	-2,8%
CAN2003	Canada	0,3%	0,9%	0,6%
CHL1966	Chile	-3,7%	-1,8%	1,9%
CHL2004	Chile	-0,8%	5,5%	6,4%
CMR1974	Cameroon	0,2%	1,2%	0,9%
CMR2004	Cameroon	0,7%	2,8%	2,1%
COL1973	Colombia	-2,8%	-1,9%	0,8%
COL2004	Colombia	-2,7%	-0,6%	2,1%
CRI1976	Costa Rica	-0,4%	-2,5%	-2,1%
DOM1972	Dominican Republic	-1,1%	-1,4%	-0,3%
ECU1974	Ecuador	-0,8%	-1,2%	-0,4%
ECU2004	Ecuador	1,3%	1,6%	0,3%
GHA1973	Ghana	-1,7%	-7,5%	-5,8%
GHA2004	Ghana	-3,9%	-4,9%	-1,0%
GTM1973	Guatemala	-1,8%	-1,8%	0,0%
GTM2004	Guatemala	-1,8%	-1,6%	0,3%
HON1973	Honduras	-2,8%	-3,6%	-0,8%
IDN1974	Indonesia	-1,3%	1,6%	2,9%
IDN2003	Indonesia	-1,8%	-0,4%	1,4%
IND1973	India	-6,5%	-8,1%	-1,6%
IND2004	India	-9,0%	-6,1%	2,8%
IRN1973	Iran	-7,6%	-6,4%	1,1%
IRN2004	Iran	0,9%	1,1%	0,2%
JAM1972	Jamaica	-5,6%	-8,5%	-2,9%
KWT1973	Kuwait			
KWT2004	Kuwait	18,3%	32,1%	13,8%
MEX1973	Mexico	-3,5%	-6,2%	-2,7%
MEX2004	Mexico	-2,9%	-1,3%	1,6%
MYS1973	Malaysia	-7,7%	-3,2%	4,5%
MYS2003	Malaysia	-4,5%	-3,4%	1,1%
NGA1973	Nigeria	1,8%	3,6%	1,8%
NGA2004	Nigeria	-0,6%	6,5%	7,1%
NIC1973	Nicaragua	-2,4%	1,2%	3,6%
NOR1974	Norway	4,7%	2,7%	-2,0%
NOR2003	Norway	11,3%	14,8%	3,6%
NZL1971	New Zealand			
NZL1977	New Zealand	-0,6%	-1,3%	-0,7%
NZL2003	New Zealand	2,7%	2,9%	0,2%
PER1974	Peru	-3,4%	-4,3%	-0,9%
PER2004	Peru	-1,9%	1,1%	3,0%
PRY1971	Paraguay	0,2%	-0,5%	-0,7%
RUS1973	Russia	0,6%	1,4%	0,7%
RUS2003	Russia	2,0%	5,7%	3,8%
SAU1973	Saudi Arabia	11,9%	15,0%	3,1%
SAU2003	Saudi Arabia	1,1%	21,8%	20,7%
TTO1973	Trinidad & Tobago	-6,5%	3,4%	9,8%
TTO2003	Trinidad & Tobago	-2,5%	4,3%	6,8%
URY1968	Uruguay			
URY1977	Uruguay	-0,6%	-1,3%	-0,7%
VEN1974	Venezuela	2,4%	6,1%	3,7%
VEN2003	Venezuela	-0,7%	-0,1%	0,6%
ZAF1973	South Africa	-5,8%	-4,3%	1,4%
ZAF2004	South Africa	-1,5%	0,1%	1,6%
Episodes before 2000		-1,8%	-1,6%	0,2%
Episodes after 2000		-0,6%	3,0%	3,6%

(\*): Up to max corresponds to the average value of the government balance as % of GDP from the beginning of the episode until its maximum value during the episode.



**Table 8: Government revenue around commodity boom episodes\*  
(% GDP)**

		Average value		
		Before	Up to max	Increase
ARG1973	Argentina	15,7%	19,5%	3,8%
ARG2004	Argentina	24,5%	30,7%	6,1%
AUS1972	Australia	25,6%	28,3%	2,7%
AUS2004	Australia	36,0%	35,1%	-0,9%
BOL1973	Bolivia	9,4%	8,8%	-0,6%
BOL2003	Bolivia	24,8%	31,6%	6,7%
BRA1973	Brazil	10,6%	9,8%	-0,8%
BRA2004	Brazil	34,4%	35,9%	1,5%
CAN1974	Canada	36,4%	39,9%	3,5%
CAN2003	Canada	41,5%	40,6%	-0,9%
CHL1966	Chile	15,8%	26,8%	10,9%
CHL2004	Chile	22,8%	26,6%	3,8%
CMR1974	Cameroon	14,5%	15,5%	1,0%
CMR2004	Cameroon	16,3%	18,7%	2,4%
COL1973	Colombia	9,3%	13,5%	4,1%
COL2004	Colombia	24,8%	26,4%	1,6%
CRI1976	Costa Rica	18,3%	17,2%	-1,1%
DOM1972	Dominican Republic	16,4%	16,8%	0,4%
ECU1974	Ecuador	12,3%	10,8%	-1,5%
ECU2004	Ecuador	24,9%	27,9%	2,9%
GHA1973	Ghana	16,5%	12,6%	-3,8%
GHA2004	Ghana	15,1%	17,0%	2,0%
GTM1973	Guatemala	8,7%	9,2%	0,5%
GTM2004	Guatemala	12,7%	12,4%	-0,3%
HON1973	Honduras	11,7%	12,8%	1,1%
IDN1974	Indonesia	13,7%	20,8%	7,2%
IDN2003	Indonesia	18,6%	19,7%	1,1%
IND1973	India	17,0%	17,9%	0,9%
IND2004	India	17,3%	19,4%	2,1%
IRN1973	Iran	26,7%	36,2%	9,5%
IRN2004	Iran	23,5%	28,4%	5,0%
JAM1972	Jamaica	17,0%	18,5%	1,6%
KWT1973	Kuwait			
KWT2004	Kuwait	57,8%	64,9%	7,2%
MEX1973	Mexico	20,4%	20,8%	0,4%
MEX2004	Mexico	20,1%	21,1%	1,0%
MYS1973	Malaysia	26,6%	27,8%	1,2%
MYS2003	Malaysia	25,6%	24,9%	-0,7%
NGA1973	Nigeria	13,5%	19,2%	5,7%
NGA2004	Nigeria	32,5%	33,7%	1,2%
NIC1973	Nicaragua	12,5%	13,9%	1,4%
NOR1974	Norway	46,3%	47,9%	1,6%
NOR2003	Norway	55,0%	57,6%	2,6%
NZL1971	New Zealand			
NZL1977	New Zealand	30,2%	31,7%	1,5%
NZL2003	New Zealand	33,9%	34,8%	0,9%
PER1974	Peru	15,6%	15,6%	0,0%
PER2004	Peru	17,5%	19,6%	2,2%
PRY1971	Paraguay	11,8%	11,0%	-0,8%
RUS1973	Russia	55,1%	60,8%	5,7%
RUS2003	Russia	37,0%	38,8%	1,8%
SAU1973	Saudi Arabia	38,8%	60,6%	21,8%
SAU2003	Saudi Arabia	38,5%	55,1%	16,6%
TTO1973	Trinidad & Tobago	19,6%	32,4%	12,8%
TTO2003	Trinidad & Tobago	25,7%	32,8%	7,1%
URY1968	Uruguay		23,2%	
URY1977	Uruguay	22,8%	24,3%	1,5%
VEN1974	Venezuela	22,4%	29,8%	7,4%
VEN2003	Venezuela	30,9%	34,9%	4,0%
ZAF1973	South Africa	19,7%	21,2%	1,6%
ZAF2004	South Africa	24,0%	27,1%	3,0%
Episodes before 2000		20,3%	23,5%	3,2%
Episodes after 2000		28,3%	31,4%	3,1%

(\*): Up to max corresponds to the average value of the government revenues as % of GDP from the beginning of the episode until its maximum value during the episode.

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. This is quite remarkable, given that in every single one of those countries the price of the commodities it produces increased sharply.<sup>3</sup>

Last in this section, consider the behavior of the real exchange rate during these two commodity boom episodes. This is an important variable in the context of commodity booms, 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 Table 10 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 experiences. And individual performances have to be conditioned on the actual change in commodity prices affecting each country to be more revealing. That is precisely what we do in the section that follows.

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<sup>3</sup> Of course, in these countries government spending rose, but it did so more slowly than output.

**Table 9: Government expenditure around commodity boom episodes\***  
(% GDP)

		Average value		
		Before	Up to max	Increase
ARG1973	Argentina	19,0%	25,1%	6,1%
ARG2004	Argentina	34,5%	32,4%	-2,1%
AUS1972	Australia	26,2%	30,8%	4,6%
AUS2004	Australia	34,2%	34,8%	0,6%
BOL1973	Bolivia	13,9%	17,4%	3,6%
BOL2003	Bolivia	32,6%	32,3%	-0,3%
BRA1973	Brazil	17,5%	17,8%	0,4%
BRA2004	Brazil	38,4%	38,7%	0,3%
CAN1974	Canada	36,4%	42,8%	6,4%
CAN2003	Canada	41,2%	39,6%	-1,6%
CHL1966	Chile	19,5%	28,5%	9,1%
CHL2004	Chile	23,7%	21,1%	-2,5%
CMR1974	Cameroon	14,3%	14,3%	0,0%
CMR2004	Cameroon	15,6%	15,9%	0,3%
COL1973	Colombia	12,1%	15,4%	3,3%
COL2004	Colombia	27,5%	27,0%	-0,6%
CRI1976	Costa Rica	18,7%	19,7%	1,0%
DOM1972	Dominican Republic	17,4%	18,1%	0,7%
ECU1974	Ecuador	13,1%	12,0%	-1,1%
ECU2004	Ecuador	23,6%	26,3%	2,7%
GHA1973	Ghana	18,2%	20,2%	2,0%
GHA2004	Ghana	19,0%	22,0%	3,0%
GTM1973	Guatemala	10,5%	11,0%	0,5%
GTM2004	Guatemala	14,5%	13,9%	-0,6%
HON1973	Honduras	14,5%	16,4%	1,9%
IDN1974	Indonesia	15,0%	19,2%	4,2%
IDN2003	Indonesia	20,4%	20,0%	-0,3%
IND1973	India	23,5%	26,0%	2,5%
IND2004	India	26,3%	25,5%	-0,8%
IRN1973	Iran	34,3%	42,7%	8,4%
IRN2004	Iran	22,5%	27,3%	4,8%
JAM1972	Jamaica	22,6%	27,0%	4,5%
KWT1973	Kuwait	3,5%	13,9%	10,5%
KWT2004	Kuwait	39,5%	32,8%	-6,6%
MEX1973	Mexico	23,9%	26,9%	3,1%
MEX2004	Mexico	23,0%	22,4%	-0,7%
MYS1973	Malaysia	34,3%	31,0%	-3,3%
MYS2003	Malaysia	30,1%	28,3%	-1,8%
NGA1973	Nigeria	11,7%	15,6%	3,9%
NGA2004	Nigeria	33,1%	27,2%	-5,8%
NIC1973	Nicaragua	15,0%	12,7%	-2,3%
NOR1974	Norway	41,6%	45,2%	3,6%
NOR2003	Norway	43,7%	42,8%	-0,9%
NZL1971	New Zealand			
NZL1977	New Zealand	30,7%	32,9%	2,2%
NZL2003	New Zealand	31,2%	31,9%	0,7%
PER1974	Peru	19,0%	19,9%	0,9%
PER2004	Peru	19,4%	18,5%	-0,9%
PRY1971	Paraguay	11,8%	11,5%	-0,3%
RUS1973	Russia	54,4%	59,4%	5,0%
RUS2003	Russia	35,0%	33,0%	-2,0%
SAU1973	Saudi Arabia	26,9%	45,6%	18,7%
SAU2003	Saudi Arabia	37,4%	33,3%	-4,1%
TTO1973	Trinidad & Tobago	26,1%	29,0%	2,9%
TTO2003	Trinidad & Tobago	28,3%	28,6%	0,3%
URY1968	Uruguay			
URY1977	Uruguay	25,7%	24,1%	-1,6%
VEN1974	Venezuela	20,0%	23,7%	3,7%
VEN2003	Venezuela	31,6%	35,0%	3,4%
ZAF1973	South Africa	25,4%	25,5%	0,1%
ZAF2004	South Africa	25,5%	27,0%	1,5%
Episodes before 2000		21,7%	24,9%	3,2%
Episodes after 2000		28,9%	28,4%	-0,5%

(\*): Up to max corresponds to the average value of the government expenditure as % of GDP from the beginning of the episode until its maximum value during the episode.

**Table 10: Real effective exchange rate around commodity boom episodes\***

		Average value		
		Before	Up to max	% Increase
ARG1973	Argentina	78,7	83,6	6,3%
ARG2004	Argentina	43,5	40,1	-7,7%
AUS1972	Australia	150,6	154,2	2,4%
AUS2004	Australia	116,1	129,0	11,1%
BOL1973	Bolivia	0,0	0,0	-4,8%
BOL2003	Bolivia	0,0	0,0	-16,6%
BRA1973	Brazil	121,3	112,7	-7,1%
BRA2004	Brazil	72,6	96,9	33,6%
CAN1974	Canada	151,0	135,9	-10,0%
CAN2003	Canada	96,6	122,9	27,2%
CHL1966	Chile	561,2	278,7	-50,3%
CHL2004	Chile	82,0	86,0	4,8%
CMR1974	Cameroon	0,0	0,0	23,4%
CMR2004	Cameroon	108,7	110,1	1,3%
COL1973	Colombia	151,7	147,0	-3,1%
COL2004	Colombia	87,7	100,5	14,5%
CRI1976	Costa Rica	156,0	163,3	4,7%
DOM1972	Dominican Republic	0,0	0,0	11,3%
ECU1974	Ecuador	145,9	173,6	19,0%
ECU2004	Ecuador	112,9	106,9	-5,3%
GHA1973	Ghana	0,0	0,0	130,7%
GHA2004	Ghana	100,8	107,4	6,5%
GTM1973	Guatemala	0,0	0,0	3,6%
GTM2004	Guatemala	0,0	0,0	9,3%
HON1973	Honduras	0,0	0,0	-6,1%
IDN1974	Indonesia	289,9	375,0	29,3%
IDN2003	Indonesia	105,1	124,7	18,6%
IND1973	India	299,0	253,5	-15,2%
IND2004	India	97,8	102,6	4,9%
IRN1973	Iran	0,0	0,0	38,3%
IRN2004	Iran	97,5	104,8	7,5%
JAM1972	Jamaica			
KWT1973	Kuwait	4,4	4,7	8,3%
KWT2004	Kuwait	105,2	102,6	-2,4%
MEX1973	Mexico	96,8	98,0	1,2%
MEX2004	Mexico	100,1	93,2	-6,9%
MYS1973	Malaysia	170,3	167,4	-1,7%
MYS2003	Malaysia	105,6	94,2	-10,8%
NGA1973	Nigeria	0,0	0,0	48,6%
NGA2004	Nigeria	107,8	122,2	13,3%
NIC1973	Nicaragua			
NOR1974	Norway	107,3	110,0	2,5%
NOR2003	Norway	107,8	108,6	0,7%
NZL1971	New Zealand	121,2	128,8	6,3%
NZL1977	New Zealand	113,1	114,1	0,9%
NZL2003	New Zealand	103,4	131,4	27,1%
PER1974	Peru	55,0	43,6	-20,7%
PER2004	Peru	99,3	91,9	-7,4%
PRY1971	Paraguay	0,0	0,0	-17,3%
RUS1973	Russia			
RUS2003	Russia	118,2	147,3	24,6%
SAU1973	Saudi Arabia	0,3	0,5	88,9%
SAU2003	Saudi Arabia	94,6	82,2	-13,1%
TTO1973	Trinidad & Tobago	0,1	0,1	17,5%
TTO2003	Trinidad & Tobago	106,9	110,9	3,7%
URY1968	Uruguay	86,9	86,7	-0,2%
URY1977	Uruguay	81,9	85,2	4,1%
VEN1974	Venezuela	0,0	0,0	-1,8%
VEN2003	Venezuela	114,1	112,0	-1,9%
ZAF1973	South Africa	184,8	161,3	-12,7%
ZAF2004	South Africa	85,8	99,2	15,7%
Episodes before 2000				9,3%
Episodes after 2000				5,9%

(\*): Up to max corresponds to the average value of the reer from the beginning of the episode until its maximum value during the episode.

#### IV. The cyclical behavior of fiscal policy across commodity boom episodes

In order to obtain measures of the cyclicity of fiscal policy variables we estimate country-by-country regressions of the form:

$$d(\log(F_{it})) = \alpha_i + \beta_i d(\log(I_i)) + \varepsilon_{it}$$

where  $I_{it}$  is the commodity price index for country  $i$ ,  $F_{it}$  is a fiscal variable in country  $i$ , and the coefficient  $\beta_i$  is our index of cyclicity for this particular variable: it measures the elasticity of  $F$  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  $\beta_i$  implies procyclical behavior.

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

$$d(B_i) = \alpha_i + \beta_i d(\log(I_i)) + \varepsilon_{it}$$

where  $B_i$  is the fiscal balance measured as a percentage of GDP. In this case,  $\beta_i$  must be interpreted as a semi-elasticity.

In contrast to what happens when cyclicity is estimated with respect to output, here there are no issues of feedback and endogeneity, since the prices of commodities are clearly exogenous to the conduct of domestic fiscal policy.

This is the same approach to measuring cyclicity 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, to 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.<sup>4</sup>

Table 11 shows the results of this estimation. Consider first the cyclical behavior of the fiscal balance. For the earlier episode there is suggestive evidence of procyclicality. Of the 28 estimated semi-elasticities, 8 are negative. This means that when commodity prices increased, 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 28 estimated elasticities are statistically significant at the 10% level or better. This also suggests a weak relationship between the fiscal balance and movements in commodity prices.

What could cause this pattern of behavior of the fiscal balance? Begin with revenues. The same table reveals that, on average, the revenue elasticity for the early episode is 0.2, so that a 10% increase in commodity prices induces a 2% increase in government revenues. Somewhat surprisingly, there are 8 countries with a negative elasticity, suggesting a fall in revenues at the time of the commodity boom. Notice also that 14 out of the 28 elasticities are significant at the 10% level or better, suggesting a fairly tight association between revenues and commodity prices.

By contrast, the behavior of expenditures in the first episode is only very 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. Moreover, 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.

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<sup>4</sup> In some cases, due to data availability, we estimate these relationships using a shorter sample period.

**Table 11: Cyclicity of fiscal balance 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	1965-1985	-0,12	-0,05		0,02		
Australia	1995-2009	-0,19	***	-0,08	0,02	*	
Bolivia	1965-1985	-0,36	0,21		0,10	*	
Bolivia	1995-2009	0,02	0,18		0,05		
Brazil	1965-1985	0,03	-0,36		-0,03		
Brazil	1995-2009	-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	1965-1985	-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	1965-1985	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	1965-1985	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	1965-1985	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	1965-1985	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	1965-1985	-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	1965-1985	0,03	0,04		-0,01		
Norway	1995-2009	-0,02	0,35	***	0,17	***	
New Zealand	1965-1985	-0,04	-0,07		-0,01		
New Zealand	1995-2009	0,08	0,20	***	0,03	*	
Peru	1965-1985	-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	1965-1985				0,00		
Russia	1995-2009	0,00	0,49	***	0,12	***	
Saudi Arabia	1965-1985	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	1965-1985	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	
Episodes before 2000 (average)		0,08	0,20		0,03		
Episodes after 2000 (average)		0,11	0,46		0,10		

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

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

The situation is 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.

This improved fiscal behavior is driven by changes in both revenue and expenditure. Now the average revenue elasticity is 0.47 (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, Kuwait, 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.

On the expenditure side, the average elasticity is now 0.11 (up slightly from the earlier episode). In this estimation, only six of the individual elasticities are statistically significant. Countries with particularly large drops (changes of over 0.2 in the relevant elasticity) are Argentina, Chile, Guatemala, Iran, Kuwait and Saudi Arabia. Mexico and Trinidad & Tobago are right behind, with drops between 0.15 and 0.20. 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.

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:

$$\Delta(\text{Fiscal Balance as \% GDP}) = \alpha + \beta * (\text{Cyclical component commodity price})$$

$$\Delta(\text{Fiscal Balance as \% GDP}) = \alpha + \beta * (\text{Cyclical component commodity price}) + \gamma * (\text{output gap})$$



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, with the cyclical component of commodity prices computed by applying an HP filter to the raw index.

Table 12 contains the results, which are broadly congruent with the earlier set of results. To begin with consider the first equation. In the earlier episode we find 11 negative coefficients, suggesting strong procyclicality of the fiscal balance in those countries. The average of the  $\beta$  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  $\beta$  coefficients is 0.12, and only 4 are negative (and very near zero in absolute value). In this case, 17 of them are significant at the 10% level or better.

As Table 13 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 13 shows that 17 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 same equation but control for the output gap. For the early episode the average of the  $\beta$  coefficients barely budges from 0.01 to 0.02, with only 6 of the new coefficients being significant. For the later episode the average of the  $\beta$  coefficients goes from 0.12 to 0.11 –again a very marginal change. In this case 18 of the estimated coefficients are significant at the 10% level or better.

For the output gap, in the early episode the average of the  $\gamma$  coefficients is just 0.02, again very close to zero. Here 11 of the estimates are significant. 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 when output was above its natural rate.

**Table 12: Cyclicity of fiscal balance to commodity price index**

		(1)		(2)		
		Commodity price		Commodity price	Output gap	
Argentina	1965-1985	-0,02		0,00		-0,10
Argentina	1995-2009	0,10		0,12	**	0,46 ***
Australia	1965-1985	0,02		0,01		0,34 **
Australia	1995-2009	-0,03		-0,03		-0,02
Bolivia	1965-1985	-0,02		-0,01		-0,09
Bolivia	1995-2009	0,09	**	0,11	***	0,47 **
Brazil	1965-1985	-0,09		-0,01		-0,66 *
Brazil	1995-2009	0,08	**	0,08	*	0,04
Canada	1965-1985	0,03		0,00		0,58 ***
Canada	1995-2009	0,01		0,00		0,11
Chile	1965-1985	0,10		0,18	**	-0,27 **
Chile	1995-2009	0,21	***	0,21	***	0,01
Cameroon	1965-1985	0,01		0,01		-0,06
Cameroon	1995-2009	0,10	**	0,10	*	-0,83
Colombia	1965-1985	-0,03		-0,02		-0,06
Colombia	1995-2009	0,06	***	0,06	***	-0,02
Costa Rica	1965-1985	-0,05		0,00		-0,24
Dominican Republic	1965-1985	0,01		-0,01		0,36 **
Ecuador	1965-1985	-0,04		-0,04		-0,19
Ecuador	1995-2009	0,09	*	0,09	**	-0,21
Ghana	1965-1985	0,00		0,00		-0,01
Ghana	1995-2009	-0,03		-0,02		-0,18
Guatemala	1965-1985	0,02		0,06	**	-0,28 **
Guatemala	1995-2009	0,03		0,02		0,01
Honduras	1965-1985	0,09	*	0,14	**	-0,18
Indonesia	1965-1985	0,01		0,00		0,33
Indonesia	1995-2009	0,04		0,04		0,08
India	1965-1985	0,01		0,01		0,03
India	1995-2009	-0,01		-0,01		0,02
Iran	1965-1985	0,00		0,03		0,26 ***
Iran	1995-2009	0,10	**	0,12	**	-0,30
Jamaica	1965-1985	-0,11	**	-0,10	*	0,00
Kuwait	1965-1985					
Kuwait	1995-2009	0,34	**	0,47	***	-0,20
Mexico	1965-1985	-0,04		0,00		-0,44 ***
Mexico	1995-2009	0,06	**	0,03		0,29 ***
Malaysia	1965-1985	-0,01		0,03		-0,51
Malaysia	1995-2009	0,03		-0,04	*	0,41 ***
Nigeria	1965-1985	0,06		0,05		0,32 **
Nigeria	1995-2009	0,39	**	0,39	**	0,11
Nicaragua	1965-1985	0,06		0,07		0,07
Norway	1965-1985	0,01		0,01		0,34
Norway	1995-2009	0,21	***	0,19	***	0,14
New Zealand	1965-1985	-0,01		-0,01		0,04
New Zealand	1995-2009	0,00		0,00		0,30 *
Peru	1965-1985	0,09		0,01		0,77 *
Peru	1995-2009	0,10	***	0,11	**	-0,08
Paraguay	1965-1985	0,02		0,02		-0,01
Russia	1965-1985	0,01				
Russia	1995-2009	0,20	***	0,10	*	0,55 ***
Saudi Arabia	1965-1985	-0,10		-0,19		0,61
Saudi Arabia	1995-2009	0,71	***	0,44	*	2,44
Trinidad & Tobago	1965-1985	0,06		0,09	*	-0,48 **
Trinidad & Tobago	1995-2009	0,25	***	0,18	***	0,45 **
Uruguay	1965-1985	0,04		0,05		0,19
Venezuela	1965-1985	0,10	**	0,11	**	-0,41 *
Venezuela	1995-2009	0,12	*	0,14	*	-0,21
South Africa	1965-1985	0,05	**	0,04	**	0,25
South Africa	1995-2009	-0,07	*	-0,12	***	0,47 ***
Episodes before 2000 (average)		0,01		0,02		0,02
Episodes after 2000 (average)		0,12		0,11		0,17

(1) corresponds to the value  $\beta$  of the regression  $\Delta(\text{Fiscal Balance as \% GDP}) = \alpha + \beta * (\text{Cyclical component commodity price})$

(2) corresponds to values  $\beta$  and  $\gamma$  of the regression  $\Delta(\text{Fiscal Balance as \% GDP}) = \alpha + \beta * (\text{cyclical component commodity price}) + \gamma * (\text{output})$

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

**Table 13: Changes in Fiscal Balance Cyclicity**

	Elasticity fiscal balance in period 1965-1985	Elasticity fiscal balance in period 1995-2009	Difference	
Argentina	-0,02	0,10	0,11	***
Australia	0,02	-0,03	-0,05	***
Bolivia	-0,02	0,09	0,10	***
Brazil	-0,09	0,08	0,17	***
Canada	0,03	0,01	-0,02	*
Chile	0,10	0,21	0,11	***
Cameroon	0,01	0,10	0,09	***
Colombia	-0,03	0,06	0,09	***
Ecuador	-0,04	0,09	0,13	***
Ghana	0,00	-0,03	-0,03	**
Guatemala	0,02	0,03	0,00	
Indonesia	0,01	0,04	0,03	***
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	0,39	0,33	***
Norway	0,01	0,21	0,19	***
New Zealand	-0,01	0,00	0,01	
Peru	0,09	0,10	0,01	
Russia	0,01	0,20	0,19	***
Saudi Arabia	-0,10	0,71	0,81	***
Trinidad & Tobago	0,06	0,25	0,19	***
Venezuela	0,10	0,12	0,02	
South Africa	0,05	-0,07	-0,12	***
	0,01	0,11	0,10	

Elasticity corresponds to the value  $\beta$  of the regression  $\Delta(\text{Fiscal Balance as \% GDP}) = \alpha + \beta * (\text{Cyclical component commodity price})$   
 (\*\*\*)/(\*\*)/(\*) corresponds to rejection of the null hypothesis of equal coefficients at significance levels of 1%,5% and 10% respectively.

The situation changes significantly during the more recent episode. The average of the  $\gamma$  coefficients moves up to 0.17 and 12 of the coefficients are significant. In several of the countries where the coefficient was negative in the early episode, it turns positive in the later episode.

In short, 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.

## VI. What caused the change in fiscal behavior?

Why is fiscal policy so often procyclical? One common explanation is that in bad times governments –particularly in emerging markets—are credit-constrained. When times improve such constraints are presumably lifted, and governments are free to go on a debt-financed spending spree

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

But borrowing constraints that do not bind in good times are not sufficient in themselves to explain fiscal pro-cyclicality. 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 political economy 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).<sup>5</sup> 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 witness a higher degree of fiscal procyclicality relative to a unitary system. This is what Stein et al (1999) and Lane (2002) 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

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<sup>5</sup> See also Velasco (1998) and (2003) for applications of that model to a fiscal framework.

spending, external debt and default risk in autocracies, but have smaller such effects in democracies.

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.

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

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

where  $\beta_i$  corresponds to the cyclicity measures estimated in the previous section. The vector  $Z_i$  contains an index of power dispersion (POLCON), an index of exchange rate flexibility (FLEX), trade openness (OPEN), an index of central bank independence (CBI) and a dummy that takes value 1 if a fiscal rule was in place in the estimation period (FR).

The index of power dispersion corresponds to the index of political constraint constructed by Henisz (2000). This index counts the number of veto points in the political system and the distribution of preferences across and within the different branches of the government. As discussed by Lane (2002), a higher value for this variable can be associated to a more procyclical fiscal stance as a higher number of groups may exercise effective influence over the fiscal process. The exchange rate flexibility index corresponds to the one reported by Ilzetzki, Reinhart and Rogoff (2008). A higher value for this index is associated to a more flexible exchange rate. The measure of CBI corresponds to the average number of changes in the central bank governor per year in each decade obtained from Cukierman, et al., (1992), Crowe and Meade (2007) and Dreher, et al. (2008). Trade openness corresponds the sum of exports and imports as a percentage of GDP. The fiscal rule dummy is constructed from information reported by the IMF (Fiscal Rules-Anchoring Expectations for Sustainable Public Finances). We expect that countries that have implemented a fiscal rule exhibit a more countercyclical fiscal performance.

**Table 14: Determinants of fiscal cyclicity**

Explanatory variable	Dependent variable					
	FBC1	FBC1	FBC1	FBC1	FBC1	FBC1
OPEN	0,0008 (1,63)*					0,0006 (1,32)
FLEX		0,004 (0,32)				
FR			0,041 (1,09)			0,08 (2,15)**
POLCON				-0,038 (-0,72)		
CBI					-0,04 (-0,54)	-0,03 (-0,46)
R2	0,05	0,0019	0,02	0,0093	0,0082	0,17
Number of observations	57	56	58	58	37	37
F test	2,66*	0,1	1,18	0,52	0,29	2,2*

All regressions are estimated using a constant.

The results for the estimation of the cross-section regression are presented in Tables 14 and 15. FBC1 corresponds to the (semi) elasticity of fiscal balance as a % of GDP with respect to the cyclical component of the commodity price index (see Table 12). Finally, GEC correspond to the elasticity of real government expenditures with respect to the commodity price index (see Table 11).<sup>6</sup>

**Table 15: Determinants of fiscal cyclicity**

Explanatory variable	Dependent variable					
	GEC	GEC	GEC	GEC	GEC	GEC
OPEN	0,002 (1,84)*					0,002 (1,85)*
FLEX		-0,006 (-0,20)				
FR			-0,09 (-1,03)			-0,09 (-1,06)
POLCON				-0,14 (-1,18)		
CBI					0,021 (0,09)	
R2	0,06	0,001	0,02	0,02	0,002	0,08
Number of observations	58	57	58	58	37	58
F test	3,4**	0,04	1,06	1,4	0,01	2,26*

All regressions are estimated using a constant.

<sup>6</sup> t-statistics are presented in parentheses. \*\*\*, \*\*, \* denote significance at the 10, 5 and 10 percent levels respectively.

In most of the cases the explanatory variables are not statistically significant in explaining the cyclicity level of fiscal balance (see Table 14). Nevertheless, there is evidence that countries with fiscal rule are more (less) countercyclical (procyclical) than no fiscal rule countries. Also, more open economies appears to be more countercyclical. The results for the elasticity of government expenditure with respect to the commodity price index are similar to the ones just described (see Table 15).

**Table 16: Determinants of changes in fiscal cyclicity**

Explanatory variable	Dependent variable					
	$\Delta$ FBC1	$\Delta$ FBC1	$\Delta$ FBC1	$\Delta$ FBC1	$\Delta$ FBC1	$\Delta$ FBC1
$\Delta$ OPEN	-0,0008 (-0,67)					-0,0008 (-0,86)
$\Delta$ FLEX		-0,047 (-1,48)				
$\Delta$ FR			-0,028 (-0,48)			0,08 (1,21)
$\Delta$ POLCON				-0,08 (-0,42)		
$\Delta$ CBI					-0,096 (-0,48)	
Previous Boom						0,15 (3,63)***
R2	0,02	0,09	0,01	0,01	0,03	0,41
Number of observations	24	23	25	25	12	24
F test	0,45	2,19*	0,16	0,18	0,02	4,67***

All regressions are estimated using a constant.

A final exercise we develop is to try to explain changes in the cyclicity of fiscal policy for those countries that experience two commodities boom in our sample. The results are presented in Table 16. In addition to our explanatory variables we put in a variable that captures the magnitude of the first episode (Previous Boom). In particular, this variable corresponds to the average increase of the commodity price index in the episode pre-2000. Our result indicate that countries that experienced a higher increase in commodity price index in the 1970 -1980 episode applied a more countercyclical fiscal policy in recent years.

## V. 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 that learning may have played a role, in the sense that countries who had a bigger drop after the earlier commodity price boom seem to have varied their behavior more this time around. The presence of fiscal rules also seems to have made a difference: countries that use them displayed a larger shift toward fiscal counter-cyclicity between the two episodes, but the evidence in this regard is not strong.

One pending question is what happened to fiscal policy in these countries since the end of the second commodity boom. When the crisis arrived many of the nations studied here put in place 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 fast growth path, theory would also prescribe 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 procyclicity.



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