I. INTRODUCTION

In reaction to the 2009 global financial crisis, most industrialised and several emerging economies enacted Keynesian-type fiscal packages (from personal income tax cuts and indirect taxes reductions, to higher infrastructure spending and transfers to local governments, families, and firms) to mitigate the collapse of domestic demand.

Several Latin American economies faced the international crisis on relatively solid domestic macroeconomic grounds, both monetary and fiscal. On the fiscal front, most countries in the region displayed higher budget surpluses and lower debt-to-GDP levels, giving them apparently unprecedented fiscal margins to pursue sustainable counter-cyclical fiscal policies, of a similar size of those in OECD countries (see OECD, 2009b)[2].

But, is Latin America's resilience in 2009 a permanent change in paradigm? The success of these counter-cyclical fiscal policy responses in Latin American economies is still unclear, and will largely depend on both the size of the programmes actually implemented (generally smaller and with greater lags than announced) and their effective impact (opening, once again, the debate on multipliers). Besides, at the wake of the international financial crisis there was no consensus on the cyclical or structural nature of still recent fiscal improvements[3].

Our paper joins the latter debate. We present updated original estimates of cyclically-adjusted fiscal balances for a number of Latin American countries: Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru and Uruguay. We track these balances since the early nineties to 2009, implementing the standardised OECD methodology (Girouard and André, 2005, and Van den Noord, 2000), but adding the fiscal impact of commodity prices (following basically the IMF approach in Vladkova and Zettelmeyer, 2008). In order to estimate the output gap, we opt for an unobserved components model to decompose shocks into permanent, cyclical and transitory. With these estimates, we can then measure the size of automatic stabilisation tax

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[2] This strength was in stark contrast with previous episodes. See Gavin and Perotti (1997) and Gavin and Hausmann (1008) for Latin America, and Talvi and Vegh (2005), Kaminsky *et al*. (2006), and Ilzetzki and Vegh (2008) for emerging markets in general.

[3] Izquierdo and Talvi (2008), from the Inter-American Development Bank, argued that if revenues from the seven largest economies in Latin America countries were adjusted using the implicit Hodrick-Prescott filter parameter for Chile (i.e. the smoothing coefficient on revenues that would render a structural surplus of one per cent of GDP since 2001), structural fiscal balances in the region, with the exception of Chile, did not differ significantly from their situation at the onset of the 1998 Russian crisis. Using a different methodological approach, Vladkova-Hollar and Zettelmeyer (2008), from the International Monetary Fund, observed an improvement in structural balances in most countries, although they point out that commodity prices added a significant layer of uncertainty.

policies and the size and cyclicality of discretional fiscal policy. These measures are compared with those in OECD countries and used to discuss the cyclicality of discretionary fiscal policy in the region, differentiating countries and periods. Additionally, based on these numbers we perform standard debt sustainability exercises. We conclude underlining the importance of output gap estimates, the inclusion of commodity prices and the consideration of automatic fiscal responses in the design of sustainable fiscal policies over the business cycle in the region.

II. CYCLICALLY ADJUSTED BUDGET BALANCES IN LATIN AMERICA

II.1. OECD approach to estimation of cyclically-adjusted fiscal revenues

As a starting point, we apply the OECD approach to account for the automatic impact of the business cycle on public accounts, as presented in detail by Girouard and André (2005) for OECD countries, and De Mello and Moccero (2006) for Brazil. This method computes separately the cyclical component of unemployment-related transfers and of public receipts from four types of taxes: personal income tax (PIT), social security contributions (SSC), and corporate income tax (CIT), and indirect taxes (IT), and of unemployment-related transfers.

Focusing on public revenues, the cyclical response of each tax to the business cycle is calculated as the product of two elasticities: the elasticity of tax receipts to the tax base, and the elasticity of the tax base to the economic cycle.[4] On the expenditure side, the adjustment is usually made at the level of total primary spending as time-series data on unemployment-related expenditure are not available across countries. Girouard and André (2005) use several OECD instruments, publications and databases, especially the *Annual National Accounts*, the *Economic Outlook* database, national *Labour Force Surveys*, the *Taxing Wages* model, and *Revenue Statistics*. Next, we describe the methodology more in depth while explaining the approach we follow for Latin American economies.

Personal income tax and social security contributions

To calculate the elasticity of income tax and social security contributions with respect to the tax base, the marginal and the average tax rates of a representative household are calculated for several points in the earnings distribution. We stick to the OECD methodology, defining a representative household as a full-time, two-earner married couple with two children, with the secondary earner receiving 50 per cent of the wage of the principal earner.

We proxy the distribution of potential tax payers using the latest available National Household Surveys[5] in Argentina (referred to 2006), Brazil (2006)[6], Chile (2006), Colombia (2008),

[4] See Daude et al., (2010) for more details.

[5] *Encuesta Permanente de Hogares* in Argentina, *Pesquisa Nacional por Amostra de Domicilios* in Brazil, *Encuesta de Caracterización Socioeconómica Nacional* in Chile, *Gran Encuesta Integrada de Hogares* in Colombia, *Encuesta de Hogares y Propósitos Múltiples* in Costa Rica, *Encuesta Nacional de Ocupación y Empleo* in Mexico, *Encuesta Nacional de Hogares* in Peru and *Encuesta Continua de Hogares* in Uruguay. We are aware of the

Costa Rica (2006), Mexico (2006), Peru (2006), and Uruguay (2005). We restrict our analysis to labour income (dependent and self-employed workers)[7], and limit the sample to households with at least some labour income[8]. We calculate the 'adjusted first earner income' distribution taking into account household composition (if two earners exist, the first earner is assigned two thirds of household income while second earner is assigned the rest). Given the high levels of informality and income inequality in the region, we analyze an extended income interval, covering from 0.05 times average labour income (i.e. almost from the first peso/sol/real of labour income) to more than six times average income (wider than the OECD conventional range, from 0.5 to 3 times the average).

Focusing on the distribution of labour income earners, data shows a high concentration of workers below the average labour income: between 60 and 70 per cent of labour income earners earn less than the national average (Figure 1). The Peruvian income distribution represents an outlier, given the concentration of income earners at lower levels. This fact has a very significant impact on the number of effective tax payers and fiscal revenues.[9]

These national labour income distributions provide the weighs to compute the overall average and marginal personal income and social security tax rates. We calculate the effective tax burden for representative households, assuming they only differ in their income level (from 0.05 to more than 6 times the national average)[10]. Chilean and Uruguayan figures were provided by the respective Ministries of Finance, while Mexican rates were calculating using the OECD *Taxing Wages* simulator. For other countries, we calculated the fiscal figures based on the legislation in place during the corresponding fiscal year.

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potential limitations from using survey data, in contrast to administrative records, but, on the other hand, household surveys are more generally available. As a future extension of this research, we will test the robustness of the results using alternative income distribution sources.

[6] Brazilian elasticities come from De Mello and Moccero (2006).

[7] Already established in the OECD method, this does not represent a significant bias for Latin America, since capital income is usually not taxed by the personal income tax.

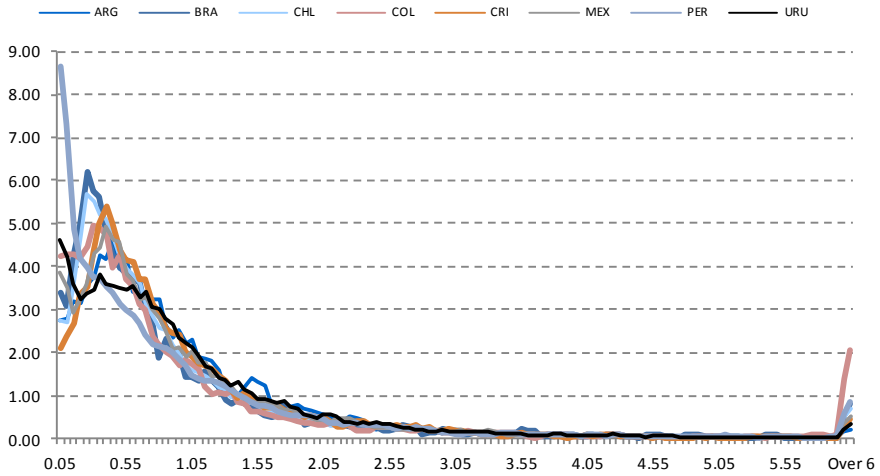
[8] According to our calculations based on the National Household Surveys, between 8 and 26 per cent of households in the selected Latin American countries do report no labour income (26.1 in Argentina, 15.6 in Brazil, 11.4 in Chile, 11.5 in Colombia, 15.0 in Costa Rica, 7.7 in Mexico, 9.2 in Peru, and 22.0 in Uruguay).

[9] In absolute terms, average annual labour income level ranges from 7.700 $ PPP in Peru, to nearly 14.600 $ PPP in Chile. Workers in the ninth decile earn more than twice the average in all countries, while low earners vary significantly (in Peru, those in the first decile earn 20 times less than the average income, while only five times less in Costa Rica).

[10] To be precise, we liquidate these two taxes for 121 levels of income. We grouped all households that earn more than six times the national average (this last bracket earns between eight times the average in Uruguay, to 11 times in Chile).

Figure 1. **Labour income distribution in Latin American countries**

(Percentage)



Note: Percentage of people by household labour income level. 1 represents the national average
Source: Authors' calculations based on National Household Surveys

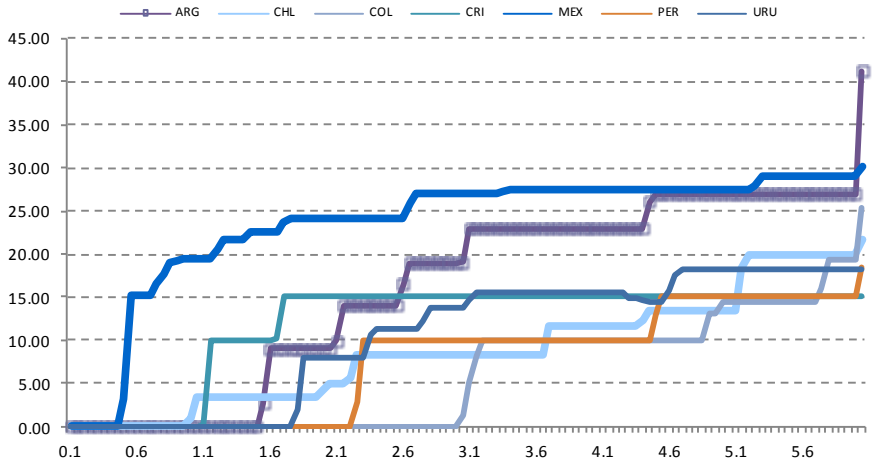
Calculations are referred to 2006 due to data availability (several of the household surveys available are from that year), and since it corresponds to a relatively neutral year in cyclical terms (in the case of Colombia, we deflated the data referred to 2008 with the national CPI). The only exception is Uruguay, in which we updated survey figures with observed CPI up to 2009 to incorporate the new personal income tax established in 2008. In those cases where fiscal legislation allows individual and household declaration, we chose the one more beneficial to tax payers, including allowances for both espouse and children, if existing[11]. Figures 2 and 3 show the effective marginal and average personal income tax rates by income levels.

As shown in Figure 3, the personal income tax in all these Latin American countries is formally progressive, since average tax rates increase with income levels. Second, with the exception of Mexico (due to the interaction of exempted income, individual declarations and tax credits), labour income earners are net payers of the PIT starting at levels ranging from the average income in Chile to three times the average income in Colombia. Together with informality, these high levels imply that only a small share of households with labour income is a net PIT payer.

[11] Tax declarations are at the individual level in Chile, Colombia, Peru and Uruguay, and by households in Argentina, Costa Rica and Mexico. Argentina and Mexico figures incorporate spouse and children allowances. Brazilian figures, taken from De Mello and Moccero (2006), are on an individual basis. Therefore, we fix both income distribution and tax legislation, as stated in the OECD methodology. As a future extension, we plan to test the effects on tax elasticities of changes in the tax code, and of variations of income distribution.

Figure 2. **Marginal personal income tax by income levels**

(Percentage)

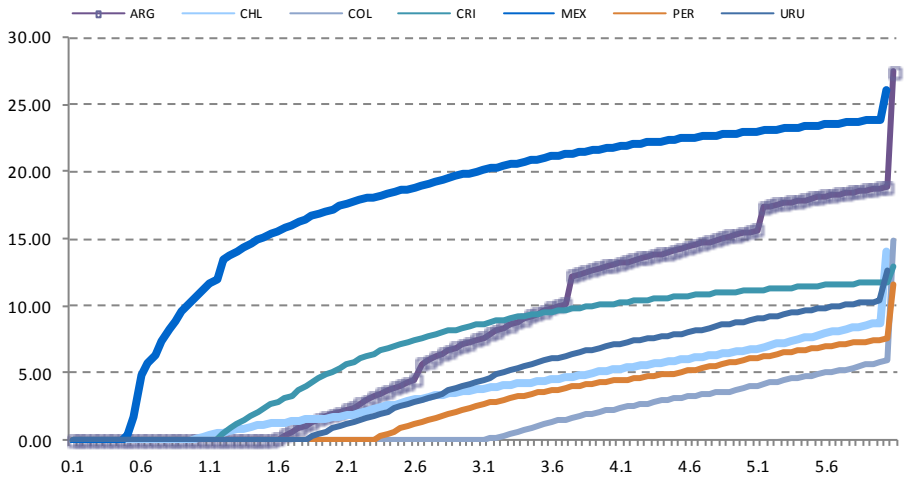


Note: Marginal tax rate by household labour income level. 1 represents the national average

Source: Authors' calculations based on OECD Taxing Wages (Mexico), Ministries of Finance (Chile and Uruguay) and own elaboration (Argentina, Colombia, Costa Rica and Peru)

Figure 3. **Average personal income tax by income levels**

(Percentage)



Note: Average tax rate by household labour income level. 1 represents the national average

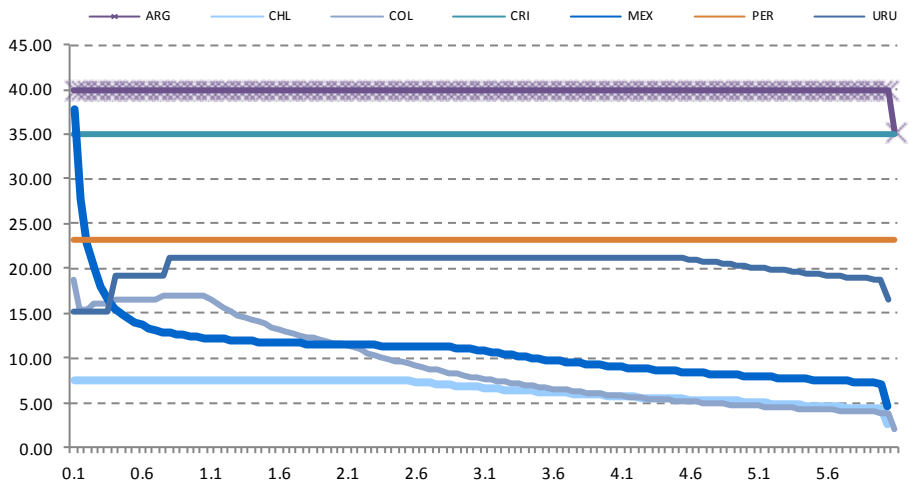
Source: Authors' calculations based on OECD Taxing Wages (Mexico), Ministries of Finance (Chile and Uruguay) and own elaboration (Argentina, Colombia, Costa Rica and Peru)

By contrast, as shown in Figure 4, social security contributions tend to be flat taxes, or even slightly regressive given the existence of minimum contributions in Mexico. Chile and

Mexico are the only two countries with a fully privatised pension system, where social contributions mainly finance health benefits[12].

Figure 4. **Average social security contributions by income levels**

(Percentage)



Note: Average tax rate by household labour income level. 1 represents the national average

Source: Authors' calculations based on OECD Taxing Wages (Mexico), Ministries of Finance (Chile and Uruguay) and own elaboration (Argentina, Colombia, Costa Rica and Peru)

The wage elasticity of PIT and SSC is calculated as the ratio between the weighted marginal tax rate, and the weighted average tax rate (included in fifth and sixth columns in Table 1). With the exception of Mexico, PIT elasticities are between 2.5 and 3.3. These levels are higher than those observed in OECD countries, and slightly lower than the 3.4 found for Brazil in De Mello and Moccero (2006). In other words, formal progressivity of the PIT is higher in Latin America. On the other hand, SSC elasticities are very much in line with OECD estimates, except Mexico and Colombia, where they are significantly lower.

To calculate the overall elasticities, the second step involves the econometric estimation of the sensitivity of the relevant tax bases with respect to the output gap. As in Girouard and André (2005), the cyclical sensitivity of the wage base (PIT and SSC tax base) has been estimated using an equation that links directly the cyclical component of the wage bill to the output gap. We regress the share of the real wage bill in potential GDP (constructed with active population from the *Penn World* tables, and unemployment and urban workers wages from ECLAC) on the output gap (estimated using unobserved components model on real chained GDP series from *Penn World* tables) and a constant, in logs with annual data from 1981 to 2007 (see Daude et al., 2010 for more details). The estimated responsiveness of the wage bill for Uruguay, Colombia

[12] Mexican contributions cover sickness, disability and nursery, while Chilean rates cover health and unemployment. In the other cases contributions finance both health and pensions. In the case of parallel public-private compulsory pension systems (Argentina, Colombia, Peru and Uruguay), we assumed that the worker is affiliated to the public scheme.

(taken from Lozano and Toro, 2007) and Argentina (around 1.0) are slightly above the OECD average (0.7 according to Girouard and Andre, 2005), and Brazil (0.8 reported by De Mello and Moccero, 2006), while elasticities for the rest are significantly above previous estimates (up to 2.0 in Peru).

Table 1

Marginal and Average Tax Rates

	Marginal tax rate		Average tax rate		Real wage elasticity of	
	PIT	SSC	PIT	SSC	PIT	SSC
	X		Y		Z = X / Y	
Argentina	**2.9**	**39.3**	**0.9**	**40.0**	**3.3**	**1.0**
Brazil	**---**	**---**	**---**	**---**	**3.4**	**1.8**
Chile	**1.7**	**6.9**	**0.7**	**7.5**	**2.5**	**0.9**
Colombia	**0.9**	**5.7**	**0.3**	**10.9**	**2.5**	**0.5**
Costa Rica	**3.4**	**34.3**	**1.3**	**35.0**	**2.6**	**1.0**
Mexico	**13.7**	**8.8**	**7.0**	**17.5**	**2.0**	**0.5**
Peru	**1.1**	**22.6**	**0.4**	**23.3**	**2.7**	**1.0**
Uruguay	**1.6**	**20.0**	**0.5**	**19.0**	**3.2**	**1.1**
Canada	28.6	7.8	18.3	9.7	1.6	0.8
France	13.9	34.9	8.2	30.7	1.7	1.1
Germany	26.2	23.9	11.4	31.1	2.3	0.8
Italy	26.3	26.5	13.2	27.6	2.0	1.0
Japan	9.6	18.7	4.9	20.5	1.9	0.9
Korea	8.5	11.2	3.6	13.1	2.3	0.9
Spain	20.2	18.3	9.5	24.1	2.1	0.8
United Kingdom	22.8	13.6	13.5	10.4	1.7	1.3
United States	19.1	11.6	10.3	12.8	1.9	0.9
OECD	21.8	19.0	12.7	18.8	1.7	1.0

Notes: Marginal and average rates are weighted by the distribution of tax payers across income levels. OECD unweighted average, excluding Chile and Mexico

Source: Authors' calculations for Argentina, Chile, Colombia, Costa Rica, Mexico, Peru and Uruguay, de Mello and Moccero (2006) for Brazil, and Girouard and André (2005) for the rest

Finally, we multiply both elasticities to obtain the overall tax elasticities. Table 2 collects the output elasticity of PIT and SSC in our selected Latin American countries, compared to those in selected OECD economies and Brazil. Given the higher elasticities of the wage bill to output gap, output elasticities of PIT are much larger in Latin America than those observed in OECD countries (3.5 on average vs. 1.2), and less in the case of SSC elasticities (1.2 on average vs. 0.7).

Corporate income tax

Concerning corporate taxes, we strictly apply the OECD methodology. The cyclical sensitivity of the corporate tax base (proxied by corporate profits) is also a function of the elasticity of the wage bill relative to the output, and profit shares. Profit share in output is proxied by the ratio of the gross operating surplus over GDP, and are taken from OECD *Annual National Accounts* in the case of Chile, from the national central banks in Costa Rica and Uruguay, and from national statistics institutes in Argentina (INDEC), Colombia (DANE), Mexico (INEGI)

and Peru (INEI). As shown in Table 3, output elasticities of CIT vary from 0.3 in Costa Rica to 1.2 in Uruguay, therefore lower than in OECD countries.

Table 2

Elasticities of Personal Income Tax and Social Security Contributions					
	Real wage elasticity of		Output elasticity	Output elasticity of	
	PIT	SSC	of wages	PIT	SSC
	A		B	C = A X B	
Argentina	**3.3**	**1.0**	**1.1**	**3.6**	**1.1**
Brazil	**3.4**	**1.8**	**0.8**	**2.7**	**1.4**
Chile	**2.5**	**0.9**	**1.4**	**3.5**	**1.3**
Colombia	**2.5**	**0.5**	**1.1**	**2.6**	**0.6**
Costa Rica	**2.6**	**1.0**	**1.7**	**4.5**	**1.7**
Mexico	**2.0**	**0.5**	**1.5**	**3.0**	**0.8**
Peru	**2.7**	**1.0**	**2.0**	**5.3**	**1.9**
Uruguay	**3.2**	**1.1**	**0.9**	**2.8**	**0.9**
Canada	1.6	0.8	0.7	1.1	0.6
France	1.7	1.1	0.7	1.2	0.8
Germany	2.3	0.8	0.7	1.6	0.6
Italy	2.0	1.0	0.9	1.8	0.9
Japan	1.9	0.9	0.6	1.2	0.5
Korea	2.3	0.9	0.6	1.4	0.5
Spain	2.1	0.8	0.9	1.9	0.7
United Kingdom	1.7	1.3	0.7	1.2	0.9
United States	1.9	0.9	0.7	1.3	0.6
OECD	1.7	1.0	0.7	1.2	0.7

Notes: Change in tax revenues as a per cent of GDP for a 1 percentage-point change in the output gap. Based on weights for 2003 for OECD, and 2005-2006 in Latin America. OECD unweighted average, excluding Chile and Mexico.

Source: Authors' calculations for Argentina, Chile, Costa Rica, Mexico, Peru and Uruguay, de Mello and Moccero (2006) for Brazil, and Girouard and André (2005) for the rest. Output elasticity of wages in Colombia is taken from Lozano and Toro (2007).

Other revenues, expenditures and overall balance

The output elasticity of the indirect tax base with respect to the economic cycle is set to unity for all countries, as in Girouard and André (2005). Finally, due to the lack of data and given the absence of unemployment benefits in many countries in the region, we suppose that current expenditures do not respond automatically to the cycle at all.

The cyclical budget response, as a share of GDP, can be expressed as the weighted sum of the four different tax revenues elasticities (based on the tax structure in the reference year, 2006). According to our calculations, the sensitivity (semi elasticity in GDP percentage points) of government budget balances to a 1 percentage point change in the output gap is 0.21 (unweighted average of the six Latin American economies), ranging from 0.12 in Mexico and 0.14 in Colombia, to 0.24 in Argentina and Uruguay, 0.25 in Brazil (De Mello and Moccero, 2006), and 0.26 in Costa Rica. This regional average is almost half the OECD average, and is explained by significantly lower automatic stabilisation from PIT (Figure 5).

Table 3

Elasticities of Corporate Income Tax	Profits elasticity of CIT	Profit share in GDP	Output elasticity of wages	Output elasticity of profits	Output elasticity of of CIT
	A	B	C	E = (1 - (1 - B) C) / B	F = A x E
Argentina	**1.0**	**0.38**	**1.1**	**0.8**	**0.8**
Brazil	**1.0**	**0.54**	**0.8**	**1.2**	**1.2**
Chile	**1.0**	**0.54**	**1.4**	**0.7**	**0.7**
Colombia	**1.0**	**0.59**	**1.1**	**1.0**	**1.0**
Costa Rica	**1.0**	**0.49**	**1.7**	**0.3**	**0.3**
Mexico	**1.0**	**0.62**	**1.5**	**0.7**	**0.7**
Peru	**1.0**	**0.62**	**2.0**	**0.4**	**0.4**
Uruguay	**1.0**	**0.36**	**0.9**	**1.2**	**1.2**
Canada	1.0	0.35	0.7	1.5	1.5
France	1.0	0.34	0.7	1.6	1.6
Germany	1.0	0.36	0.7	1.5	1.5
Italy	1.0	0.45	0.9	1.1	1.1
Japan	1.0	0.38	0.6	1.6	1.6
Korea	1.0	0.43	0.6	1.5	1.5
Spain	1.0	0.40	0.9	1.2	1.2
United Kingdom	1.0	0.31	0.7	1.7	1.7
United States	1.0	0.36	0.7	1.5	1.5
OECD	1.0	0.39	0.7	1.5	1.5

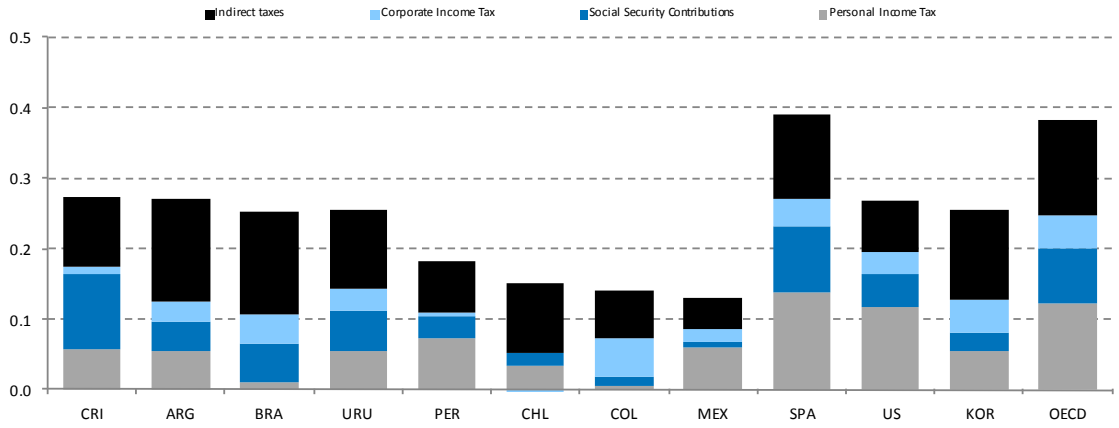
Notes: Change in tax revenues as a per cent of GDP for a 1 percentage-point change in the output gap. Based on weights for 2003 for OECD, and 2005-2006 in Latin America. OECD unweighted average, excluding Chile and Mexico

Source: Authors' calculations for Argentina, Chile, Costa Rica, Mexico, Peru and Uruguay, de Mello and Moccero (2006) for Brazil, and Girouard and André (2005) for the rest. Output elasticity of wages in Colombia is taken from Lozano and Toro (2007)

These estimates of the cyclical response of budget balance are positively correlated with the size of the government, as stated in the literature on fiscal macroeconomic stability in industrialised economies (see for instance Gali, 1994 and Fatas and Mihov, 2001). Nonetheless, as shown in Figure 6, some of the biggest economies in Latin America (notably Brazil, Colombia and Mexico) deviate significantly from their "expected" trends as automatic stabilisers are significantly lower than the government size (in part due to the high non-tax revenues).

Figure 5. **Tax semi-elasticities to output**

(Percentage points of GDP)

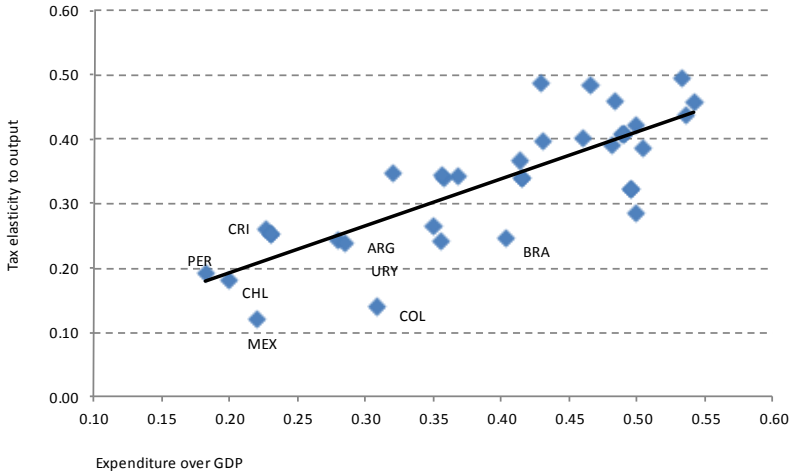


Note: OECD unweighted average, excluding Chile and Mexico

Source: Authors' calculations for Argentina, Chile, Colombia, Costa Rica, Mexico, Peru and Uruguay, de Mello and Moccero (2006) for Brazil, and Girouard and André (2005) for the rest

Figure 6. **Government size and tax automatic stabilisers in OECD and Latin America**

(Percentage points of GDP)



Source: Authors' calculations for Argentina, Chile, Colombia, Costa Rica, Mexico, Peru and Uruguay, de Mello and Moccero (2006) for Brazil, and Girouard and André (2005) for the rest.

II.2. Adjustment of tax and non-tax revenues for commodity prices

A special feature of several Latin American countries is the importance of commodity prices for its fiscal accounts, whether it is due to a significant share of taxation linked to rents in natural resource extraction, or the utilities of state-owned enterprises in these sectors. Not only are commodity-linked revenues important as a source of revenue, but they also tend to be very

volatile, primarily due to large fluctuations in prices. For example, copper revenues in Chile went from less than 0.5 per cent of GDP in 1999 up to more than 12 per cent of GDP in 2006. Compared with total revenues, these revenues are more than five times more volatile (copper revenues have a coefficient of variation of 1.01 versus 0.18 for total revenues). Thus, it is necessary to separate this source of income in countries where commodities are important for fiscal revenues and perform a special adjustment for commodity price fluctuations, as they represent a particular risk for fiscal sustainability and macroeconomic stability (Avendaño et al., 2008)[13].

Unfortunately, the OECD methodology is silent regarding this issue.[14] Therefore, we follow a similar methodology to the Chilean fiscal rule (see Marcel et al., 2001 and Rodríguez et al., 2007) and recent IMF work on this topic in Latin America and the Caribbean (e.g. Vladkova-Hollar and Zettelmeyer, 2008). The adjustment is made for Argentina, Chile, Mexico and Peru.[15] In Argentina, we consider export taxes on agricultural goods introduced in 2002. For Chile, we consider revenues transferred to the central government from the public copper company (CODELCO) and revenues from specific taxes on private mining firms.[16] In the case of Mexico, we use international oil price data to adjust the value of transfers from the public oil firm (PEMEX) to the federal government, royalties and revenues of specific taxes on oil and petrol derivatives. It is important to point out that there are differences – due to data availability restrictions – between how we treat public enterprises in the commodity sector for Chile and Mexico. While for Chile we consider the general government, which implies that we do consider only the transfers and income taxes paid by CODELCO, for Mexico we used the non-financial public sector. Finally, in the case of Peru, we consider royalties and income taxes of the mining and fishing industries, adjusted by a weighted average (according to their share in revenues) of international copper, gold and fishmeal prices.

In terms of the adjustment, we first separate revenues (tax and non-tax) into revenues related to commodities and non-commodity revenues. The latter are adjusted as indicated in the section II.1 by the business cycle. For commodity-related revenues, we proceed as follows.

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[13] These authors show that the macroeconomic response to the latest Asian-driven commodity boom of exporting countries in Africa and Latin America has been fairly positive. In contrast to the nineties, during 2000-2005 African commodity-exporters have shown a more counter-cyclical fiscal stance, displaying various positive macroeconomic developments (notably, reserves accumulation, exports diversification, and improved credit profile). Results are more modest in Latin America.

[14] For Norway, OECD exercises are carried out using Norway-mainland fiscal and national accounts that exclude the oil and natural gas sector in a consistent way. There is no such information available for Mexico or Chile.

[15] Commodity prices are also important in the other countries studied here, but their impact on the fiscal accounts is mainly through the business cycle rather than an autonomous effect for these economies. For the case of Colombia, it is important to point out that energy and mining related revenues represent close to 1 per cent of GDP, but are expected to play an important role in the near future (see Comité Técnico Interinstitucional, 2010).

[16] Although other metals like molybdenum, gold and silver are also produced in Chile, copper remains by far the most important source of revenues.

Considering a spot price of p and a long-run price of the relevant commodity price p^*, structural commodity-linked revenues (as a share of GDP) at time t are given by:

$$R_{s,t}^{c} = R_{t}^{c}\left(\frac{p_{t}^{*}}{p_{t}}\right)^{\gamma} .$$

As Marcel et al. (2001) and Vladkova-Hollar and Zettelmeyer (2008), we consider a unitary elasticity, such that $\gamma = 1$. For p^*, we considered four different options, depending on available information: future prices, five-year-ahead forecasts, a 10-year moving average or a reference price set by a panel of experts (the case of copper in Chile). For the case of copper, a 10-year moving average coincides roughly with the forecasts of the experts' panel, with the exception of 2009. For the latest year, it seems that experts consider a larger fraction of the recent rise in copper prices to be persistent. We discard future markets, as they prove to be relatively small and shallow (probably with the exception of oil futures), and prices tend to be very volatile. In what follows, we report our results based on the 10-year moving average price. Commodity revenues are not separately adjusted by the output gap, given that commodity prices are already significantly linked to the business cycle.

As shown in of Table 4, as of 2007 a large fraction of observed revenues linked to commodities were likely to be transitory. For Chile, around two thirds of the 11.2 percentage points of GDP linked to copper revenues were due to copper prices above its long-run price. The results for Argentina and Peru indicate that around half of commodity revenues could be considered transitory in 2007, although the absolute magnitudes are smaller than for Chile or Mexico. For the case of Mexico, it would be around one third of the oil revenues that are linked to the oil price cycle (almost 4 percentage points of GDP). This table also shows that the global economic crisis, and the consequent decline in commodity prices due to the collapse of global demand, had an important effect on some of the commodity-linked revenues in the region, but the effect is not homogenous. In fact, while in 2009 commodity revenues in Chile declined significantly, in the other three countries the effect was considerably milder.

Table 4. **Commodity-linked revenues**

	Argentina	Chile	Mexico	Peru
as percentage of GDP (1)				
1998	0.0	0.5	6.1	2.1
2003	2.5	1.3	7.4	2.5
2007	2.5	11.2	7.9	5.0
2009	2.9	3.4	7.4	3.8
as percentage of total revenues (2)				
1998	0.0	2.1	29.8	11.1
2003	10.3	5.7	33.3	14.0
2007	8.6	37.9	35.4	23.7
2009	9.0	11.4	31.0	18.2
Structural commodity revenues (per cent of GDP) (3)				
1998	0.0	0.7	9.9	3.4
2003	2.3	1.5	5.7	2.3
2007	1.5	4.0	3.9	2.5
2009	2.1	2.3	5.9	2.6
Difference (3) - (1)				
1998	0.0	0.2	3.8	1.3
2003	-0.1	0.2	-1.7	-0.2
2007	-1.0	-7.2	-4.0	-2.5
2009	-0.8	-1.0	-1.5	-1.2

Source: Authors' calculations based on national sources, IMF and ECLAC-ILPES and IDB data

II.3. Output gap computation

The OECD methodology decomposes production through classical Solow factor decomposition of capital constructed though perpetual inventory methods, labour (hours worked) and multifactor productivity (MFP). Potential output is then constructed as the counter-factual production arising from full capital utilisation[17], unemployment rate equal to the NAIRU, and MFP given by its long-run trend. Although we follow the above criteria to construct potential output in the Latin American countries, we could not follow OECD methodology by further disaggregating factors by their specific types, by the sectors of the economy where they are being used, or by their rate of utilization. In particular, restrictions on data availability for several Latin American countries forced us to construct capital from aggregate investment figures, using the perpetual inventory method with infinite lifespan and a constant depreciation rate of eight percent.

For the implicit Cobb-Douglas production function we assume a capital share of 0.5 for all countries. This is significantly different from the standard approximation of one third, but closer to the average obtained in the literature that covers emerging markets (see for example Gollin, 2002 for country–specific measures of this parameter for a wide range of countries).

We de-trend the resulting MFP series using the unobserved components model suggested by Harvey (1998). We use this state-space estimation method to estimate unexpected shocks to the MFP series, decomposing these shocks into three components: shocks that have a permanent effect on MFP, cyclical shocks with an estimated frequency, and time decay, and transitory

[17] OECD latest revision to potential output uses total capital rather than a filtered series of such series (OECD, 2008).

'white noise' shocks. Permanent shocks determine the trend while the two latter shocks determine the gap to potential output. 1980s dummies are used to account for any large permanent reduction in MFP's growth rates after the debt crisis.[18]

II.4. Main results

Adjusted budget balances

Adjusted budget balances can now be derived by putting together all the elements discussed above. In particular, we consider the share of each tax in GDP for general governments from ELAC-ILPES and IDB public sector databases of 2006 (except for Colombia and Uruguay, where we used central government data for 2006 and 2008 respectively). The adjusted balance b^* (as a share on potential output) is given by:

$$b^* = \frac{\left(\sum_{i=1}^{4} T_i (Y^*/Y)^{\varepsilon t_i, y}\right) - G + X}{Y^*} + R_c^s$$

where G are current primary government expenditures, the expression in parenthesis is the cyclically-adjusted receipts from taxes (PIT, SSC, CIT and indirect taxation) excluding those directly related to commodities, X are non-tax revenues not related to commodities minus capital and net interest spending, Y^* is the level of potential output, and R_c^s are the structural revenues related to commodities from.

Figure 7 shows the evolution of the primary budget balance (excluding interests) in the selected Latin American economies, the estimated impact of the economic cycle on revenues (automatic stabilisation) with the price of commodities (for Argentina, Chile, Mexico and Peru), and the resulting "adjusted primary balance".

According to our estimates, at the onset of the crisis, adjusted primary balances were in equilibrium or surplus in a majority of countries (1 p.p of GDP in Peru, 2 p.p. in Uruguay, 2.5 p.p. in Brazil, almost 3 p.p. in Chile and Colombia, and 5 p.p. in Costa Rica; -1.0 p.p. in Argentina and -3.6 p.p. in Mexico). So, even taking into account the positive economic and commodity price cycles, these figures confirm that the region faced the crisis in relatively good shape. The figure also highlights the significant impact of the economic cycle; especially in Argentina and Uruguay (automatic stabilisers via revenue contributed more than 4 p.p. of GDP to sustain aggregate demand). Finally, commodity prices (copper, gold and oil) contributed significantly to improve fiscal positions in latest years (around 1 p.p. in Argentina, 2 p.p. in Mexico, 3 p.p. in Peru and over 6 p.p. in Chile). Obviously, 2009 figures reflect a generalised deterioration, driven by cyclical, commodity related and discretionary factors[19].

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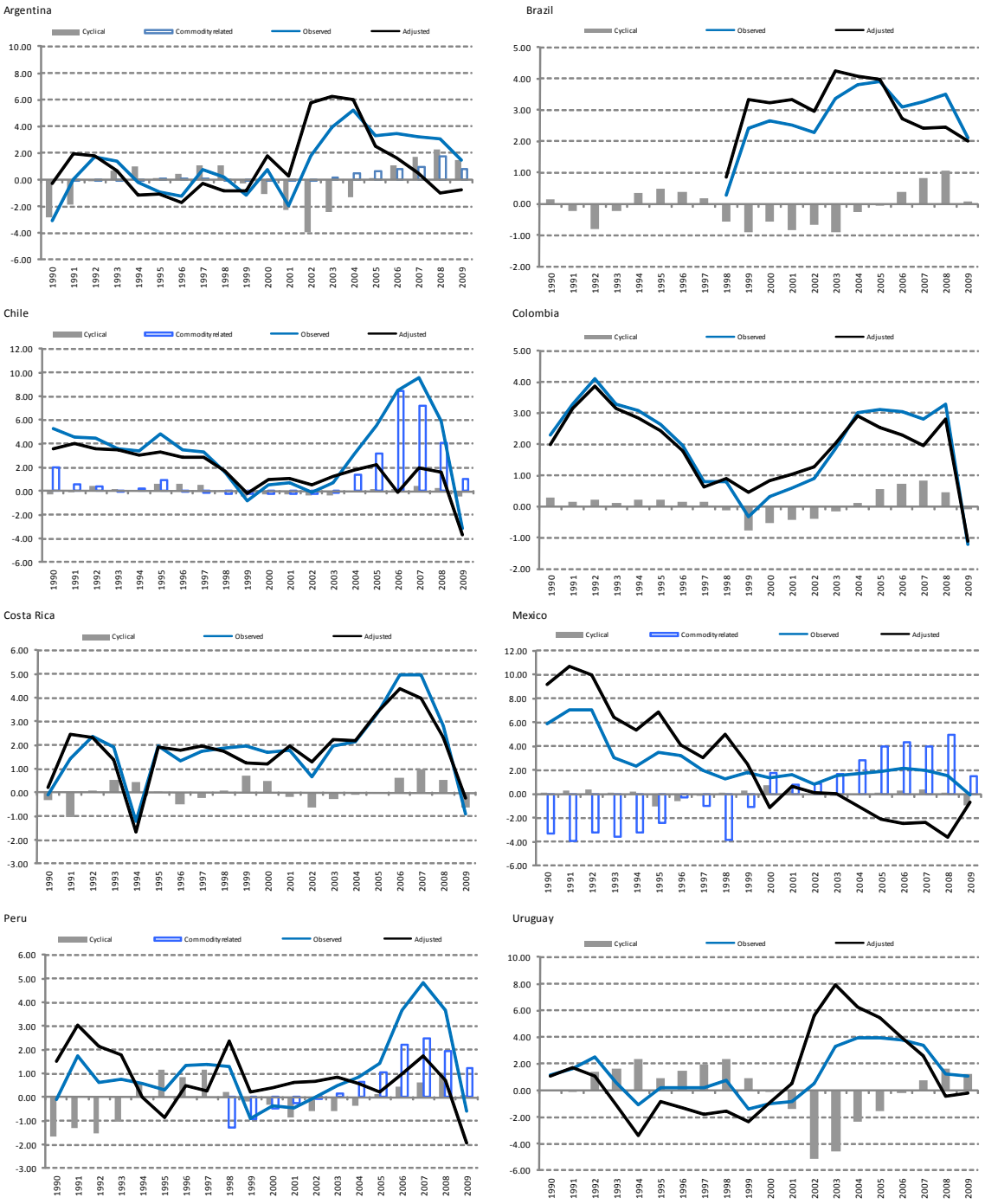
[18] See Daude et al. (2010) for more details.

[19] 2009 budget figures are preliminary for most economies. Data for Argentina, Costa Rica, Colombia and Peru where taken from the respective Central Bank databases, for Mexico and Uruguay from Ministry of Finance databases, and Brazil and Chile from OECD *Economic Outlook* projections (May 2010).

Figure 7. **Adjusted primary budget balance**
(Percentage points of GDP)



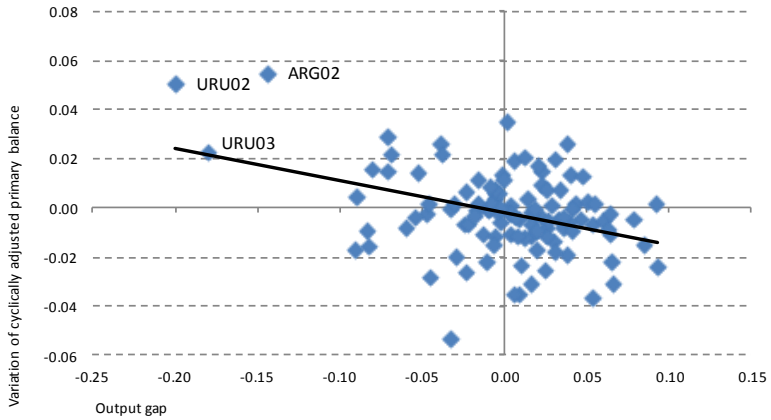
Notes: Primary budget balance is adjusted for deviations of GDP and commodity prices (for Argentina, Chile, Mexico and Peru) around their trends, as explained in sections II.1 and II.2. Non-financial public sector figures in Argentina, Colombia, Mexico and Uruguay, and general government figures for Brazil, Chile, Costa Rica and Peru, from ECLAC-ILPES and IDB databases

Source: Authors' calculations

Discretionary fiscal policy

Next, we explore the pro-cyclicality of discretionary fiscal policy in the standard way, comparing the variation of the adjusted primary balance and the output gap level. Fiscal policy is defined as counter-cyclical if the surplus increases (deficit decreases) in a year with positive output gap, or if the deficit increases (surplus decreases) when the output gap is negative. As represented in Figure 8, in the last two decades discretionary fiscal policy in Latin America has tended to be pro-cyclical (the correlation coefficient is –0.37 and in more than 60 per cent of cases, 53 out of the 144 cases, discretionary fiscal policy was not stabilising).

Figure 8. **Output gap and change in adjusted budget balance**
(Percentage points of GDP)



Source: Authors' calculations

From a national perspective, no country has benefited from sustained countercyclical discretionary fiscal policy, and in all cases, countries show a majority of pro-cyclical fiscal impulses (the most favourable cases are Brazil and Mexico, with 46 and 47 per cent of stabilising episodes, respectively). In spite of that, based on the correlations of the variation of the adjusted budget balance and output gap level, Chile shows to some extent a countercyclical patter (0.35), while in Colombia and Peru discretionary fiscal policy has been fairly neutral (coefficients of correlation of 0.01 and -0.07 respectively). Argentina and Uruguay show the highest pro-cyclically, driven mainly by the impact and policy response to the 2002 crisis (if this episode is excluded, Uruguayan fiscal policy has been fairly neutral). Additionally, we find no clear progress in this field in the last decade. From 2000, fiscal policy has been more pro- cyclical (-0.49 from 2000 vs. -0.22 from 1990 to 1999) or as pro-cyclical at best (-0.18 when controlling for the 2002 crisis). With these criteria, good practices stem again from Costa Rica, where discretionary fiscal policy has turned counter-cyclical, and Chile (where it was maintained throughout the period analysed).

We also test whether these results are symmetric along the economic cycle. Using this simplified approach, discretionary fiscal policy seems to be more pro-cyclical in the crisis, when output gap remains negative (correlation of -0.44) than in booms (-0.15). So, apparently, the pro-cyclicality of fiscal policy in the region is not explained by the existence of profligate

governments, but with either internally or externally credit rationed countries, as dramatically shown in 2002 crisis, where a huge fiscal adjustment was implemented in a deep crisis environment in Argentina and Uruguay. Excluding this big shock, no significant difference remains between booms and (regular) busts, an issue that should be borne in mind when setting fiscal rules and institutions. Of course, if the fiscal authorities in the country are aware of the potential impact of such large negative shocks, one could still make the argument that it would be optimal to save more during the good times. However, when it comes to design fiscal rules, it is important to take into account that emerging markets might lose exogenously access to finance during times of turmoil.

Debt sustainability

While the main focus of this paper is on the cyclicality of fiscal policy in Latin America and the estimation of structural balances, the issue of fiscal sustainability has been of importance for the region, given its recurrent debt problems. Overall, in recent times there has been a reduction of debt-to-GDP levels in the region. However, there are considerable differences within the region. On the one hand, Chile, Costa Rica, Mexico (after the "tequila crisis"), and Peru reduced their debt-to-GDP levels over the last decade and more. Peru and Chile had debt levels of almost 80 per cent of GDP in the early 1990s, while nowadays exhibit levels around 25 per cent of GDP. Less pronounced, but still significant, has been the debt burden reductions in Costa Rica and Mexico from close to 50 per cent of GDP in the mid-1990s to less than 30 per cent in 2008. On the other hand, Argentina and Uruguay have suffered both a debt crisis during the collapse of their fixed exchange rate regimes and associated banking crises in 2001-2002. Since then, in part due to debt restructuring, but also due to economic growth and fiscal surpluses they have reduced their debt levels down to around 50 per cent of GDP, which are higher levels than ten years ago. Brazil is closer to the case of Argentina and Uruguay, with still high levels of debt (at least in gross terms) and a somewhat slower reduction than the first group.

Debt sustainability depends on a series of factors such as long-term economic growth perspectives, the cost of funds (interest rate), and the composition of debt; but also things much harder to measure such as expectations (Calvo, 1988) and institutional/political characteristics affecting a country's ability and willingness to service its sovereign debt. Furthermore, exogenous shocks to each of these variables are hard to identify, making debt sustainability analysis a challenging topic. Therefore, in this section we explore some aspects of debt dynamics in the region using standard techniques in the literature, rather than making a precise judgement regarding the need and size of fiscal adjustment in each country.

Although it is not obvious how to establish a benchmark for safe debt levels, one way to approach this issue is to compute the primary surplus required to stabilise debt to GDP ratios at their current level, and compare this required surplus with both actual and structural balances. Here we consider debt to potential output ratios, correcting debt stocks for valuation effects due to potential misalignment in the real exchange rate (in particular vis-à-vis the US dollars, as this is the main foreign currency in which debt is issued).[20] Thus, under an appreciated real

[20] See Daude et al (2010) for more details.

exchange rate, the valuation-corrected debt-to-GDP ratio will be greater than the observed ratio. This implies that the required primary surplus to stabilise this ratio, will also be higher, given that a depreciation of the currency vis-à-vis the dollar would be expected in the transition to the steady state. Vice versa, if the currency is depreciated (above the equilibrium exchange rate), the adjusted debt level will be less than the observed one.

In practical terms, we measure the equilibrium real exchange rate to be measured by the average bilateral real exchange rate vis-à-vis the US dollar, considering CPI prices over the period 1990 – 2008. Furthermore, as proxy for the share of foreign currency debt in total debt, we use data on the markets where debt was issued; assuming that all external debt is in US dollars and all domestic debt is indexed to the domestic price level.

It should be recognised that this definition has some limitations. First, it does not say anything regarding the initial debt-to-GDP ratio, which might be too high and therefore an additional fiscal effort to reduce it to a safe level would be required. Second, this 'accounting approach' does not consider underlying correlations and endogeneity of variables. For instance, in the presence of default risk, interest rates would increase with the debt burden and with net financing needs if liquidity risks are also present. Growth could in turn depend negatively on the cost of funding and the debt burden (if there is a debt overhang problem, where private investment is lower because economic agents incorporate the prospects of higher future taxes to service the debt).

The main results for the eight countries for 2009 are reported in Table 5.[21] As discussed above, in 2009, most countries present a considerably lower structural balance in 2009 than in previous years, given the automatic and discretionary fiscal expansion in response to the economic crisis. However, all countries (except Argentina) have been able during the last decade to exhibit fiscal balances above those required to sustain their current debt levels, such that they could be expected to reverse expansionary policies without major difficulties. In terms of the difference between the adjusted balance and the required balance to keep debt levels at their current values, while Brazil is the only country with a structural balance above the required surplus, for several countries the difference is below two percent (Costa Rica, Uruguay, Colombia, Mexico and Peru).

Argentina and Chile are the exceptions, with a difference of 3.9 and 3.7 p. p. of GDP, respectively. However, Argentina and Chile are in very different situations. First, Chile took discretionary measures with a fiscal impulse of around 5.6 p. p. of GDP (comparing 2007 with 2009), while the impulse in Argentina was much smaller (1.3 p. p. of GDP). Thus, countercyclical fiscal policy was much stronger in Chile than Argentina. This impulse was taken from a very strong position (debt-to-GDP of only around 6 per cent of GDP) in Chile, which is also reflected in the low fiscal surplus required to balance debt levels at their current value; meanwhile Argentina requires a much higher fiscal primary surplus (and has higher levels of debt, 47.1 per cent of GDP, adjusting for the real exchange rate and the business cycle). In more general terms, the level of the structural balances (as well as the fiscal impulse during 2007 – 2009) is highly

[21] For each country we considered the current yields (average 2010) on sovereign debt bonds (JP Morgan's EMBIG) as the relevant interest rate. Observed and trend growth rates in 2009 are estimated according to the methodology explained in section III.

correlated with the initial debt position. Countries with higher levels of debt were in a more solid position to have higher structural deficits and larger fiscal impulses (the correlation coefficients with the debt levels are 0.90 and 0.48, respectively).

Table 5. **Debt sustainability analysis**

Country	Adjusted primary balance (2009)	Observed primary balance (2000 - 2009)	Required surplus (baseline)	Required surplus (IMF forecasts)
Argentina	-0.8	2.1	3.1	3.5
Brazil	2.0	3.0	1.3	1.0
Chile	-3.7	2.8	0.1	0.0
Colombia	-1.1	1.6	0.5	0.3
Costa Rica	-0.2	2.3	0.8	0.4
Mexico	-0.7	1.5	1.2	0.4
Peru	-1.9	1.2	-0.1	-0.1
Uruguay	-0.2	1.6	0.9	1.2

Notes: Required surplus corresponds to equation (14) with debt-to-GDP ratios adjusted by the real exchange rate and the business cycle. Observed primary balance is the average of observed fiscal balances as percentage of GDP over the last ten years. IMF forecasts refer to the WEO April 2010 forecast of real GDP growth in 2015

Source: Authors' calculations

III. CONCLUSIONS AND POLICY IMPLICATIONS

This paper aims to contribute to the debate on fiscal policy in Latin America by measuring cyclicality of fiscal balances using a common methodology. At the onset of the international financial crisis in 2008-2009, many indicators suggested that Latin American economies were facing the crisis in a much better macroeconomic position that in the past; with positive budget surpluses, lower debt-to-GDP levels and a more credible monetary policy thanks to inflation targeting regimes. Solid macro balances were the new reality in a region where fiscal fragility had been at the root of past protracted crises, such as the dramatic debt crisis of the 1980s.

We track fiscal balances since the early nineties for a set of Latin American economies, implementing both standardised cyclical-adjustment OECD methodology and regional specific adjustments for the impact of commodity prices. These estimations allow measuring the size of automatic stabilisers embedded in tax policies, and the cyclicality of discretionary fiscal policy in the region as a whole. Additionally, we perform debt sustainability exercises to analyse how far from a potential benchmark current fiscal balances are.

Our main messages can be summarised as follow. First, there is a great degree of uncertainty concerning output gap estimates in Latin America. Compounded with highly volatile cyclical shocks, there is evidence of highly volatile trends for potential output. Second, commodity cycles may be as relevant to countercyclical policy as economic cycles, because of the former's significance in total fiscal revenues. Third, tax automatic stabilisers are significant, although fairly small. Primary budget balances respond automatically around 0.2 p.p. for each percentage point of output gap in the region, half the OECD average (although with significant regional differences). Forth, since the early nineties, discretionary fiscal policy has been pro-cyclical in Argentina, Brazil, Costa Rica, Mexico and Uruguay, while neutral in Chile, Colombia and Peru. Fifth, pro-cyclicality of discretionary fiscal policy is probably explained by lack of access to credit during deep crises, rather than by profligate spending. And sixth, from a structural perspective, both cyclically-adjusted balances and debt sustainability analysis confirm the better position enjoyed by most countries in the region before the crisis.

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