Unclassified **ECO/WKP(2006)13**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development **13-Jun-2006**

English - Or. English

ECONOMICS DEPARTMENT

ECO/WKP(2006)13
Unclassified

Cancels & replaces the same document of 22 May 2006

BRAZIL'S FISCAL STANCE DURING 1995-2005: THE EFFECT OF INDEBTEDNESS ON FISCAL POLICY OVER THE BUSINESS CYCLE

ECONOMICS DEPARTMENT WORKING PAPERS No. 485

By
Luiz de Mello and Diego Moccero

JT03210564

English - Or. English

ABSTRACT/RÉSUMÉ

Brazil's fiscal stance during 1995-2005: The effect of indebtedness on fiscal policy over the business cycle

Brazil's fiscal adjustment since the floating of the *real* in 1999 has been impressive, even in periods of lacklustre growth. This suggests a remarkable fiscal effort to ensure public debt sustainability. To better gauge the magnitude of this adjustment effort, this paper applies the methodology used by the OECD Secretariat to distinguish changes in the fiscal stance that are due to policy action from those that are related to the automatic stabilisers built into the tax code, the social security system and unemployment insurance. The paper's main finding is that discretionary action tends to be essentially pro-cyclical in downturns, underscoring the presence of a strong "sustainability motive" in the conduct of Brazilian fiscal policy. Spending on mandatory items, such as personnel, are pro-cyclical in upturns too, which can create a "ratcheting-up" effect on government spending over time, an issue that will have to be addressed to improve the quality of on-going fiscal adjustment. An increase in the debt-to-GDP ratio by 1 percentage point is associated with a decrease in discretionary federal spending by 0.33 percentage point during 1997-2005. This responsiveness appears to have become stronger after the floating of the *real* in 1999. This Working Paper relates to the 2005 OECD *Economic Survey of Brazil* (www.oecd.org/eco/survey/brazil).

JEL classification: E32, E62, H60
Key words: Brazil, fiscal policy, debt sustainability, business cycle

* * * * *

Orientation de la politique budgétaire au Brésil sur la période 1995-2005: L'effet de l'endettement

L'ajustement budgétaire du Brésil depuis l'adoption d'un régime de taux de change flottant en 1999 a été impressionnant, malgré la morosité de la croissance pendant ces années. Cela suggère un remarquable effort budgétaire pour assurer la soutenabilité de la dette publique. Pour mieux évaluer l'ampleur de cet effort d'ajustement, ce document applique la méthodologie utilisée par le Secrétariat de l'OCDE pour distinguer les changements dans la position budgétaire liés à l'orientation de la politique discrétionnaire de ceux liés aux stabilisateurs automatiques du code des impôts, du système de sécurité sociale et de l'assurance chômage. Les calculs sont utilisés pour estimer la sensibilité des initiatives de la politique discrétionnaire à un changement de la dette publique. La politique budgétaire discrétionnaire est essentiellement procyclique dans les phases de basses conjonctures, ceci est la principale conclusion rapportée dans ce document. Cela souligne que la conduite de la politique budgétaire Brésilienne est fortement motivée par la soutenabilité de la dette publique. Les catégories de dépenses obligatoires, comme les dépenses en personnel, sont également procycliques dans les périodes de reprise. Ceci crée un effet rattrapage en « dents de scie » des dépenses publiques, une question qui devra être abordée pour améliorer la qualité de l'ajustement budgétaire progressif. Une augmentation du ratio de la dette publique sur le PIB de 1% est associé à une baisse de 0.33 point de pourcentage dans les dépenses discrétionnaires au niveau fédéral. Cette réponse paraît s'être renforcée après l'adoption d'un régime de taux de change flottant en 1999. Ce Document de travail se rapporte à l'Étude économique de l'OCDE du Brésil, 2005 (www.oecd.org/eco/etudes/bresil).

JEL classification : E32, E62, H60
Mots-clés : Brésil, politique budgétaire, soutenabilité de la dette, cycle des affaires

Table of contents

Tables

Figures

Brazil's fiscal stance during 1995-2005: The effect of indebtedness on fiscal policy over the business cycle

By
Luiz de Mello and Diego Moccero[1]

1. Introduction and summary

Brazil's fiscal adjustment since the floating of the *real* in 1999 has been impressive.[2] The consolidated budget shifted from a primary deficit of almost 0.2% of GDP per year in 1995-98, when GDP grew on average by 2.6% per year in real terms, to a surplus of almost 4% of GDP on average during 1999-2005, a period when average real GDP growth fell to just over 2% per year and was more volatile. The primary budget surplus targets have been raised over time – and often exceeded – to ensure the sustainability of the public debt dynamics, even in periods of lacklustre growth. This makes fiscal effort all the more remarkable. But, to evaluate this effort, it is important to assess the evolution of Brazil's fiscal stance by distinguishing changes in the budget balance that are due to discretionary policy action from those that are associated with the automatic stabilisers built into the tax code, the social security system and unemployment insurance. To do so, the main budget aggregates need to be re-calculated on a cyclically-adjusted basis; that is, controlling for the impact of business cycle-related fluctuations in economic activity on public finances based on unchanged policies. These series are nevertheless not readily available. To bridge this methodological gap in the current policy debate, this paper applies to Brazil the methodology used by the OECD Secretariat for cyclically adjusting the budget aggregates of its Member countries.[3] It then goes on to assess the impact of indebtedness on the behaviour of fiscal policy over the business cycle during 1997-2005. To our knowledge, this is the first time the OECD methodology is applied to Brazilian data.

The main findings of the paper are as follows:

- Although the sensitivity of Brazil's budget balance to changes in the business cycle is relatively low compared to the OECD average, it is likely to be high for an emerging-market economy. This is because, at about 31% in 2004, against 40% on average in the OECD area, primary

1. The authors thank, without implicating, Val Koromzay, Vito Tanzi, Vincent Koen, Christophe André, Angelo Duarte, Fábio Giambiagi, Joaquim Levy, Nathalie Girouard and Ana Paula Vescovi for helpful comments and discussions, Anne Legendre for research assistance and the calculation of the output gap series, and Mee-Lan Frank for excellent technical assistance.

2. See OECD (2005; 2006, Chapters 1 and 4), de Mello (2006a and b), and Giambiagi and Ronci (2006) for more information and analysis.

3. See van den Noord (2000) and Girouard and André (2005) for more information and an update of the calculations for the OECD countries.

general government spending accounts for an already high, and rising, share of GDP by emerging-market standards. It is known that the budget's sensitivity to the business cycle increases with the size of government (OECD, 1999, Chapter 4). At the same time, although the share in total revenue of business cycle-sensitive tax bases, such as income and consumption, is lower than in the OECD area on average, the personal income tax is fairly progressive, essentially on account of a relatively high exemption threshold (OECD, 2005).

- Discretionary policy action (*i.e.* changes in the fiscal stance that are not associated with the business cycle through built-in stabilisers) was used predominantly in support of fiscal retrenchment during 1997-2005. Federal spending (on mandatory and non-mandatory programmes) was estimated to be pro-cyclical in downturns, but non-mandatory outlays were found to be pro-cyclical in upturns too, although to a lesser extent, contributing to the "ratcheting up" of government expenditure over the years.

- As in the OECD area, sustainability considerations associated with public indebtedness are a key determinant of the behaviour of discretionary policy action over the business cycle. As the dynamics of debt accumulation become, or come to be perceived as, unsustainable, fiscal consolidation may become necessary, regardless of the economy's position in the business cycle. An increase in the debt-to-GDP ratio by 1 percentage point was estimated to be associated with a decrease in discretionary federal spending by 0.33 percentage point during 1997-2005. This responsiveness appears to have become stronger after the floating of the *real* in 1999, suggesting that the new exchange rate regime has been underpinned by greater fiscal effort.

The paper is organised as follows. Section 2 presents the OECD methodology for cyclically adjusting the budget balance. Section 3 reports the results of the estimation of the elasticities of revenue and expenditure to the business cycle. The cyclically-adjusted primary and headline budget balances for Brazil are presented in Section 4, along with the assessment of the behaviour of discretionary action over the business cycle. Section 5 concludes.

2. An overview of the methodology

The cyclically-adjusted budget balance is computed to assess the government's underlying fiscal position by excluding automatic movements in revenue and expenditure that are associated with the business cycle through built-in stabilisers. As such, it is calculated at the level of government revenue and expenditure that would be consistent with output at its trend level, given the potency of the stabilisers built into the tax code, the social security system and unemployment insurance. In practice, the cyclically-adjusted budget balance is computed by decomposing current government revenue and expenditure into cyclical and a-cyclical components.

The methodology used for computing the cyclically-adjusted balance for the OECD Member countries focuses on the four revenue items (the personal income tax (PIT), the social security (SS) contributions, the corporate income tax (CIT) and the indirect taxes) and a single expenditure item (the unemployment-related transfers) which are most sensitive to the business cycle. As the share in total spending of cyclically-dependent expenditure is generally low compared to that of sensitive tax receipts in total revenue, the budget balance is mainly affected by economic activity primarily through short-term fluctuations in tax revenue (Giorno *et al.*, 1995).

The ratio of the cyclically-adjusted balance to potential GDP at any time is defined as:

$$b^* = \left[\sum_{i=1}^{4} T_i^* - G^* + X \right] \Big/ Y^* , \quad (1)$$

where b^* is the budget balance, T_i^* is revenue from item i, G^* is primary spending, X is revenue and spending that is not sensitive to the business cycle, and the asterisk identifies the cyclically-adjusted items, which are defined in percent of potential GDP (Y^*).

The cyclically-adjusted components of the budget balance are calculated assuming that the ratios of potential to actual revenue and expenditure are proportional to the ratio of potential to actual output:

$$\frac{T_i^*}{T_i} = \left(\frac{Y^*}{Y} \right)^{\varepsilon_{T_i,Y}} \text{ and} \quad (2)$$

$$\frac{G^*}{G} = \left(\frac{Y^*}{Y} \right)^{\varepsilon_{g,Y}} , \quad (3)$$

where $\varepsilon_{Ti,Y}$ is the elasticity of revenue item i with respect to the output gap, and $\varepsilon_{g,Y}$ is the elasticity of expenditure with respect to the output gap.

Elasticity $\varepsilon_{Ti,Y}$ can be decomposed into two components measuring the response of revenue to its base (ε_{T_i,tb_i}) and that of the base with respect to the business cycle ($\varepsilon_{tb_i,y}$), so that $\varepsilon_{T_i,Y} = \varepsilon_{T_i,tb_i}\varepsilon_{tb_i,Y}$. The same decomposition can be computed for expenditure in Equation (3), bearing in mind that, because the unemployment-related transfers are the only expenditure item assumed to be sensitive to the business cycle, its elasticity is used to compute that of total primary spending, which can be written as $\varepsilon_{g,Y} = \varepsilon_{g,U}\varepsilon_{U,Y}$, where $\varepsilon_{g,U}$ is the elasticity of primary expenditure with respect to the unemployment rate and $\varepsilon_{U,Y}$ is the elasticity of the unemployment rate with respect to the business cycle.

Finally, Equation (1) can be re-written using Equations (2) and (3) as follows:

$$b^* = \left[\sum_{i=1}^{4} T_i \left(Y^*/Y \right)^{\varepsilon_{T_i,Y}} - G\left(Y^*/Y \right)^{\varepsilon_{g,Y}} + X \right] \Big/ Y^* . \quad (4)$$

3. Calculating the tax and expenditure elasticities

Personal income tax (PIT) and social security (SS) contributions

The first step to compute the relevant elasticities consists of calculating the average and marginal rates for the PIT and SS contributions for an "average" household at various points of the income distribution.[4] These rates depend on the specific provisions of the tax code, including the existence of tax

4. Both the marginal and average rates are needed for the calculations because the elasticity of any variable y with respect to any variable x, defined as the ratio of the percentage change in y over x ($\varepsilon_{y,x} = \frac{\Delta y}{y} \Big/ \frac{\Delta x}{x}$)

credits, rebates, ceilings and allowances for a dependent spouse and children, for example. As the Brazilian tax code does not allow married couples to file their income taxes jointly, the provisions applying to individuals are used as the basis for computing the elasticities for the average household. Information on actual collections and taxable income at various points of the income distribution, already taking into account the provisions of the tax code and the social security system, are available from the ministries of Finance and Social Security for 1999, based on the PIT filed with respect to the 1998 fiscal year and the social security contributions paid in 1999.[5]

The average PIT and SS contribution rates were computed for a distribution ranging from one-half to four times (considering half-point increments) the average personal earnings.[6] The marginal rates were computed by approximation, such that $MA^i_j \approx \left[Y_j AV^i_j - Y_{j-1} AV^i_{j-1}\right] / \left(Y_j - Y_{j-1}\right)$, where MA^i_j denotes the marginal rate for tax *i*, Y_j is the income level and AV^i_j is the average rate for tax *i*, all measured at the *jth* point of the personal earnings distribution. A log-normal distribution was used to match the personal earnings distribution (for which the average and marginal tax rates are calculated) to the population's underlying income distribution.[7] The fit was made on the basis of the ratio of income of the first to the fifth (median) income deciles in 1999, and it was kept constant over time.[8]

Based on these calculations, the elasticity of PIT and SS contributions with respect to earnings (the tax base) (ε_{T_i,tb_i}) was calculated for an average individual as $\varepsilon_{T_i,tb_i} = \left(\sum_{j=1}^{N} \gamma_j MA^i_j\right) \Big/ \sum_{j=1}^{N} \gamma_j AV^i_j$, where γ_j is the weight of level *j* in total earnings obtained from the first-moment distribution, and MA^i_j and AV^i_j are, respectively, the marginal and average rates of PIT and SS contributions measured at point *j* of the earnings distribution.

The results reported in Table 1 show that, while Brazil's elasticity of SS contributions with respect to earnings is comparable to those calculated for the OECD Member countries on average, the PIT

---

can be rewritten as the ratio of the marginal rate to the average rate ($\varepsilon_{y,x} = \frac{\Delta y}{\Delta x} \Big/ \frac{y}{x}$).

5. The information on social security contributions covers the private-sector workers in all sectors, thereby excluding the civil servants (all levels of government), who have their own social security regimes, as well as those private-sector workers employed in firms that have opted for paying their taxes and social security contributions under a presumptive tax regime for smaller enterprises (SIMPLES).

6. For the OECD countries, the income distribution used in the analysis ranges from one-half to three times the average income of a household/individual. In the case of Brazil, given that the country's income distribution is more skewed than those of most OECD countries, this range would include only almost 80% of income, against nearly 99% for the OECD countries. Interpolation methods were used to match the average rates to the income distribution. Information on average earnings refers to those employed in industry and is available from IBGE's *Monthly Employment Survey*.

7. Log-normal distributions are useful in this case because they satisfy two properties. They are positive-definite, in contrast to the Gaussian distribution, making them useful for representing quantities that cannot have negative values. They also allow for more extreme events than a Gaussian distribution, because they are skewed toward larger values.

8. It is important to note that the weights cannot be derived directly from the log-normal, but rather from its associated "first-moment" distribution. The former measures the proportion of the population not exceeding a certain income level, and the latter measures the proportion of total income obtained by those not exceeding a certain income level. Both have the same standard deviation (σ), while the mean of the first-moment distribution is equal to that of the log-normal (μ) plus its variance (σ2).

elasticity is far higher, suggesting that Brazil's PIT is more progressive (column A). This can be attributed to the fact that the PIT exemption threshold is relatively high in Brazil, as discussed in OECD (2005), at 1.3 times the average wage. To illustrate, the other country in the sample with a very high PIT exemption threshold is Luxembourg, at 1.05 times the average income, resulting in a comparatively high elasticity (2.5). The elasticity of the wage bill with respect to the business cycle is also reported (column B), based on the estimations presented in Annex A1. The elasticity computed for Brazil (0.8) is in line with the OECD average (0.7), indicating a less-than-proportional shift in the wage bill for a given change in the output gap.

To compute the overall elasticity of PIT and SS contributions with respect to the output gap, it is necessary to combine the estimates of the elasticity of the PIT and SS with respect to the tax base ($\varepsilon_{T_i,w}$) and of the elasticity of the tax base with respect to the business cycle ($\varepsilon_{w,Y}$), such that $\varepsilon_{T_i,Y} = \varepsilon_{T_i,w}\varepsilon_{w,Y}$.

Table 1. **Elasticity of PIT and SS contributions: Brazil and OECD countries**

	Elasticity with respect to earnings		Elasticity of the wage bill with respect to the business cycle	Elasticity with respect to the business cycle	
	PIT per worker	SS contributions per worker		PIT	SS contributions
	A		B	C = A x B	
Brazil	**3.4**	**0.8**	**0.8**	**2.7**	**0.7**
United States	1.9	0.9	0.7	1.3	0.6
Japan	1.9	0.9	0.6	1.2	0.5
Germany	2.3	0.8	0.7	1.6	0.6
France	1.7	1.1	0.7	1.2	0.8
Italy	2.0	1.0	0.9	1.8	0.9
United Kingdom	1.7	1.3	0.7	1.2	0.9
Canada	1.6	0.8	0.7	1.1	0.6
Australia	1.5	0.0	0.7	1.0	0.0
Austria	2.2	1.0	0.6	1.3	0.6
Belgium	1.6	1.1	0.7	1.1	0.8
Czech Republic	1.7	1.1	0.7	1.2	0.8
Denmark	1.4	1.0	0.7	1.0	0.7
Finland	1.5	1.0	0.6	0.9	0.6
Greece	2.0	0.9	0.9	1.8	0.9
Hungary	2.4	0.9	0.7	1.7	0.6
Iceland	1.4	1.0	0.6	0.9	0.6
Ireland	2.1	1.3	0.7	1.4	0.9
Korea	2.3	0.9	0.6	1.4	0.5
Luxembourg	2.5	1.3	0.6	1.5	0.8
Netherlands	2.4	0.8	0.7	1.7	0.6
New Zealand	1.3	0.0	0.7	0.9	0.0
Norway	1.5	1.1	0.7	1.0	0.8
Poland	1.4	1.0	0.7	1.0	0.7
Portugal	1.7	1.0	0.9	1.5	0.9
Slovak Republic	1.0	1.0	0.7	0.7	0.7
Spain	2.1	0.8	0.9	1.9	0.7
Sweden	1.3	1.0	0.7	0.9	0.7
Switzerland	1.8	1.2	0.6	1.1	0.7
Memorandum item					
OECD Average	1.8	1.0	0.7	1.3	0.7

Source: Authors' calculations for Brazil and Girouard and Andre (2005) for the elasticities for the OECD countries.

The estimate of $\varepsilon_{T_i,Y}$ for Brazil (column C), is comparable to the OECD average (0.7) for the SS contributions but much higher for the PIT: 2.7 for Brazil against 1.3 on average for the OECD area. Again, this is due to the progressivity of the Brazilian PIT code, which owes much to the high exemption threshold. In any case, it should be noted that the calculated elasticities may change over time, because the Brazilian tax code does not provide for the indexation of the PIT brackets for inflation. Changes the provisions for tax credits and exemptions, for example, would also affect the estimated elasticities.

Corporate income tax (CIT)

The elasticity of CIT with respect to the tax base (profits) is assumed to be unitary. Therefore, the overall CIT elasticity is that of its base with respect to the business cycle ($\varepsilon_{T_i,Y} = \varepsilon_{tb_i,Y}$), which is derived from that of the wage bill with respect to the business cycle as follows:

$$\varepsilon_{T_i,Y} = \varepsilon_{tb_i,Y} = \frac{\partial Z}{\partial Y}\frac{Y}{Z} = \frac{\partial (Y-W)}{\partial Y}\frac{Y}{Z} = \left(1-\frac{\partial W}{\partial Y}\right)\frac{Y}{Z} = \left(1-\left(1-\frac{Z}{Y}\right)\frac{\partial W}{\partial Y}\frac{Y}{W}\right)\frac{Y}{Z}, \quad (5)$$

where Z is the tax base (defined as the difference between national income and the wage bill, $Z = Y - W$).

Letting $PS = Z/Y$ (profit share), the CIT elasticity can be written as $\varepsilon_{T_i,Y} = \left(1-\left(1-PS\right)\varepsilon_{w,y}\right)\frac{1}{PS}$, where $\varepsilon_{w,Y}$ is the elasticity of the wage bill with respect to the output gap. The estimated elasticity for Brazil (1.2), reported in Table 2, is somewhat lower than the average for the OECD Member countries (1.5).[9]

Indirect taxes

The elasticity of indirect taxes with respect to their base (consumer expenditure) and that of the base with respect to the business cycle are conventionally assumed to be unitary.[10] This is consistent with the methodology used for cyclically adjusting the budget aggregates for the OECD countries.

Primary government expenditure

The only expenditure item that is considered to be sensitive to the business cycle through built-in stabilisers in the OECD Secretariat's methodology is the unemployment-related transfers. Total primary expenditure (G) can therefore be decomposed as $G = GU + \overline{G}$, where GU denotes the

9. Brazil's profit share is high, comparable only to that of Greece in the OECD area, due in part to the treatment of income of own-account and informal-sector workers as capital income in national accounts. As noted in Annex A2, the profit share falls to about 40% when these items are excluded from capital income.

10. To be sure, these elasticities were computed for Brazil using data for the federal and state value added taxes (IPI and ICMS, respectively), which accounted for over one-half of tax collection on average during 1995-2005, and private consumption, defined as the difference between total consumption and public consumption in the national accounts. The results are available upon request, but the parameter estimates were not found to be stable over time.

unemployment-related transfers, which are assumed to depend on the unemployment rate and hence on the business cycle, and $\overline{G}$ denotes spending that is not affected by the business cycle. The estimation of the elasticity of unemployment-related transfers to the business cycle is presented in Annex A1.

The sensitivity of spending to the business cycle is estimated to be low in Brazil in comparison with the OECD average (Table 3). This is because of a comparatively low elasticity of the unemployment rate to the business cycle (column A), despite a relatively high share of unemployment-related transfers in

Table 2. **Elasticity of CIT: Brazil and OECD countries**

	Elasticity of CIT to profits	Profit share in GDP	Output elasticity of wages	Output elasticity of profits	Output elasticity of CIT
	A	B	C	E = (1 - (1 - B) C) / B	F = A x E
Brazil	**1.0**	**53.8%**	**0.8**	**1.2**	**1.2**
United States	1.0	36.1%	0.7	1.5	1.5
Japan	1.0	38.2%	0.6	1.6	1.6
Germany	1.0	36.1%	0.7	1.5	1.5
France	1.0	33.7%	0.7	1.6	1.6
Italy	1.0	44.9%	0.9	1.1	1.1
United Kingdom	1.0	31.3%	0.7	1.7	1.7
Canada	1.0	35.3%	0.7	1.5	1.5
Australia	1.0	40.1%	0.7	1.4	1.4
Austria	1.0	36.8%	0.6	1.7	1.7
Belgium	1.0	34.4%	0.7	1.6	1.6
Czech Republic	1.0	43.7%	0.7	1.4	1.4
Denmark	1.0	31.6%	0.7	1.6	1.6
Finland	1.0	38.4%	0.6	1.6	1.6
Greece	1.0	55.2%	0.9	1.1	1.1
Hungary	1.0	40.5%	0.7	1.4	1.4
Iceland	1.0	27.1%	0.6	2.1	2.1
Ireland	1.0	49.9%	0.7	1.3	1.3
Korea	1.0	43.3%	0.6	1.5	1.5
Luxembourg	1.0	34.9%	0.6	1.7	1.7
Netherlands	1.0	36.5%	0.7	1.5	1.5
New Zealand	1.0	44.8%	0.7	1.4	1.4
Norway	1.0	41.7%	0.7	1.4	1.4
Poland	1.0	43.6%	0.7	1.4	1.4
Portugal	1.0	37.1%	0.9	1.2	1.2
Slovak Republic	1.0	48.6%	0.7	1.3	1.3
Spain	1.0	39.9%	0.9	1.2	1.2
Sweden	1.0	27.7%	0.7	1.8	1.8
Switzerland	1.0	33.8%	0.6	1.8	1.8
Memorandum item: OECD Average	1.0	38.8%	0.7	1.5	1.5

Source: Authors' calculations for Brazil and Girouard and Andre (2005) for the elasticities for the OECD countries.

Table 3. **Elasticity of current primary expenditure: Brazil and OECD countries**

	Output elasticity of unemployment	Share of unemployment related spending in total current primary expenditure	Output elasticity of current primary expenditure
	A	B	C = A x B
Brazil	**-2.0**	**3.1%**	**-0.06**
United States	-5.3	1.8%	-0.09
Japan	-3.3	1.5%	-0.05
Germany	-5.0	3.5%	-0.18
France	-3.3	3.3%	-0.11
Italy	-3.3	1.3%	-0.04
United Kingdom	-5.3	0.9%	-0.05
Canada	-5.3	2.3%	-0.12
Australia	-5.3	3.0%	-0.16
Austria	-3.3	2.4%	-0.08
Belgium	-3.3	4.4%	-0.14
Czech Republic	-3.3	0.7%	-0.02
Denmark	-8.0	2.6%	-0.21
Finland	-5.8	3.2%	-0.18
Greece	-3.3	1.3%	-0.04
Hungary	-3.3	1.0%	-0.03
Iceland	-3.3	0.5%	-0.02
Ireland	-5.3	2.2%	-0.11
Korea	-5.8	0.7%	-0.04
Luxembourg	-1.9	1.0%	-0.02
Netherlands	-8.0	2.9%	-0.23
New Zealand	-5.3	2.8%	-0.15
Norway	-5.8	0.9%	-0.05
Poland	-5.8	2.4%	-0.14
Portugal	-3.3	1.6%	-0.05
Slovak Republic	-5.8	1.0%	-0.06
Spain	-3.3	4.6%	-0.15
Sweden	-8.0	1.9%	-0.15
Switzerland	-7.9	2.4%	-0.19
Memorandum item			
OECD Average	-4.9	2.1%	-0.10

Source: Authors' calculations for Brazil and Girouard and Andre (2005) for the OECD countries.

total current primary spending (column B).[11] This can be attributed at least in part to a sizeable informal sector, which absorbs the workers laid off during cyclical downturns, hence attenuating the sensitivity of formal unemployment to business cycle fluctuations.

11. The unemployment-related transfers exclude withdrawals from FGTS accounts but include spending on the Salary Bonus (*Abono Salarial*). As discussed in OECD (2005), the main unemployment insurance programme is financed predominantly by taxes on enterprise payroll, which have now been converted into value added-type taxes. To be eligible for unemployment insurance in the event of "unfair" dismissal, the worker must have been insured for 6 months and have no resources to support himself/herself or his/her family. The unemployment insurance is capped at 50% of the last wage and can be paid for up to five

4. The behaviour of fiscal policy over the cycle

Computing the cyclically-adjusted budget balance

The cyclically-adjusted primary and headline budget balances were calculated for Brazil on the basis of Equation (4) using the tax and expenditure elasticities reported above (summarised in Table 4) and the annual series for potential GDP estimated in Annex A2.[12] A sensitivity analysis is presented in Annex A3 to account for cyclical-dependence in interest payments and to allow for different lag structures in the response of tax revenue to fluctuations in economic activity.

Table 4 shows that the overall estimated elasticity of the budget balance with respect to the business cycle is lower in Brazil (0.32) than in the OECD area on average (0.44). Brazil's overall elasticity is comparable to that of Japan and the United States in the OECD area, but lower than that of the European countries, reflecting the higher share of cyclically-dependent revenue and expenditure in relation to GDP in the latter countries on average. When the effect of the business cycle on public finances is taken into account, given the size of the stabilisers built into to the tax code, the social security system and unemployment insurance, Brazil's actual primary budget surplus exceeded its cyclically-adjusted level slightly during 2000-01, but fell short of it in 1999 and 2002-04 (Figure 1). This is consistent with a counter-cyclical fiscal stance, given that the output gap is estimated to have been positive during 2000-01 and negative in 1999 and 2002-04. The increase in the primary surplus target by 0.25 percentage points to 4.5% of GDP in mid-2004, in line with better-than-expected growth and the closing of the output gap, is illustrative of efforts towards greater policy counter-cyclicality when the economic outlook is auspicious.

The primary (cyclically unadjusted) budget balance illustrates the fiscal adjustment that has taken place since the floating of the *real* in 1999. The primary surplus targets have been raised successively – and often exceeded – to ensure the sustainability of the public debt dynamics (OECD, 2005; de Mello, 2006a). The headline (cyclically unadjusted) budget balance has also improved, but remains volatile, due essentially to the composition of Brazil's traded debt stock, which has a preponderance of securities paying floating interest rates and, until recently, indexed to the exchange rate. Coupled with relatively short maturities, the public debt dynamics has therefore been sensitive to changes in financial market conditions and the monetary stance. The increase in the headline budget deficit in 2002 is a case in point. The depreciation of the exchange rate as a result of a confidence shock in the run-up to the presidential election in October led to an increase in the debt-to-GDP ratio as a consequence of the revaluation of outstanding exchange rate-indexed and foreign currency-denominated liabilities. Owing to this, and the concomitant monetary tightening, outlays on interest payments increased substantially, leading to a deterioration of the headline budget balance in 2002-03, despite the maintenance of a robust primary surplus.

---

months. The minimum benefit is equivalent to one minimum wage and the maximum benefit is equivalent to three minimum wages. FGTS is a privately-run fund of individual accounts for formal-sector workers financed through employers' contributions. In the case of "unfair" dismissal, the balance accumulated during the employment contract is paid to the employee, together with a severance indemnity. The Salary Bonus is a monthly salary paid on an annual basis to formal-sector workers earning up to two minimum wages.

12. Due to data constraints, the annual series for potential GDP calculated on the basis of a production function are used to calculate the ratios of the cyclically-adjusted budget balances to potential GDP, whereas the tax and expenditure elasticities were calculated using the monthly series of industrial production and its HP-filtering to perform the cyclical adjustment. This is essentially due to the fact that information on the relevant budget aggregates is not available for a long enough time series.

Table 4. **Summary of elasticities: Brazil and OECD countries**

	Revenue				Expenditure (current primary expenditure)	Total[1]
	PIT	SS contributions	CIT	Indirect taxes		
Brazil	**2.70**	**0.67**	**1.17**	**1.00**	**-0.06**	**0.32**
United States	1.30	0.64	1.53	1.00	-0.09	0.34
Japan	1.17	0.55	1.65	1.00	-0.05	0.33
Germany	1.61	0.57	1.53	1.00	-0.18	0.51
France	1.18	0.79	1.59	1.00	-0.11	0.53
Italy	1.79	0.86	1.12	1.00	-0.04	0.53
United Kingdom	1.18	0.91	1.66	1.00	-0.05	0.45
Canada	1.10	0.56	1.55	1.00	-0.12	0.38
Australia	1.04	0.00	1.45	1.00	-0.16	0.39
Austria	1.31	0.58	1.69	1.00	-0.08	0.47
Belgium	1.09	0.80	1.57	1.00	-0.14	0.52
Czech Republic	1.19	0.80	1.39	1.00	-0.02	0.39
Denmark	0.96	0.72	1.65	1.00	-0.21	0.59
Finland	0.91	0.62	1.64	1.00	-0.18	0.48
Greece	1.80	0.85	1.08	1.00	-0.04	0.47
Hungary	1.70	0.63	1.44	1.00	-0.03	0.47
Iceland	0.86	0.60	2.08	1.00	-0.02	0.37
Ireland	1.44	0.88	1.30	1.00	-0.11	0.38
Korea	1.40	0.51	1.52	1.00	-0.04	0.22
Luxembourg	1.50	0.76	1.75	1.00	-0.02	0.47
Netherlands	1.69	0.56	1.52	1.00	-0.23	0.53
New Zealand	0.92	0.00	1.37	1.00	-0.15	0.37
Norway (mainland)	1.02	0.80	1.42	1.00	-0.05	0.53
Poland	1.00	0.69	1.39	1.00	-0.14	0.44
Portugal	1.53	0.92	1.17	1.00	-0.05	0.46
Slovak Republic	0.70	0.70	1.32	1.00	-0.06	0.37
Spain	1.92	0.68	1.15	1.00	-0.15	0.44
Sweden	0.92	0.72	1.78	1.00	-0.15	0.55
Switzerland	1.10	0.69	1.78	1.00	-0.19	0.37
Memorandum item						
OECD Average	1.26	0.71	1.50	1.00	-0.10	0.44

1. Refers to the elasticity of the budget balance to changes in the business cycle. It is calculated as the difference between the sensitivity of the four revenue items and that of expenditure, weighted by their respective 2003 shares in GDP.

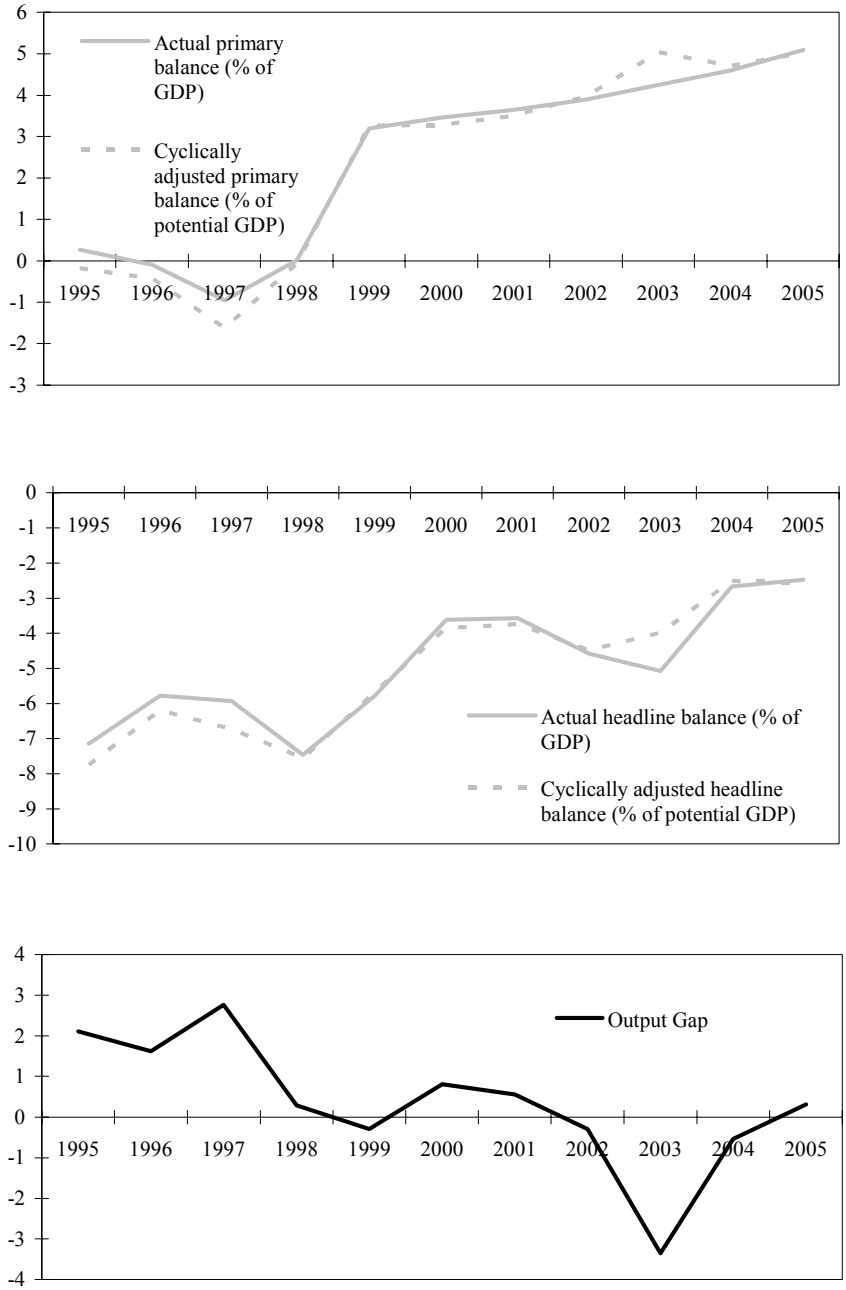
Source: Authors' calculations for Brazil and Girouard and Andre (2005) for the OECD countries.

Discretionary policy action over the business cycle

The only business cycle-sensitive primary expenditure item in the baseline calculations, following the OCDE Secretariat's methodology, is the unemployment-related transfers. But other primary expenditure items, such as outlays on personnel and on non-mandatory programmes, may also be sensitive to the business cycle, not through built-in stabilisers, but as a result of discretionary policy action. Fiscal activism may therefore exacerbate or thwart the effect of automatic stabilisers on public finances, making the fiscal stance pro-cyclical when expenditure is cut (raised) during a cyclical downturn (upturn). In principle, pro-cyclicality is destabilising (*i.e.* it exacerbates business cycle fluctuations), unless non-Keynesian forces are at play, as when, for example, the debt dynamics is perceived to be unsustainable. In this case, fiscal retrenchment in a recession may turn out to be expansionary, because it restores confidence on debt sustainability.[13]

13. See de Mello, Kongsrud and Price (2004) for more information and evidence for the OECD countries. Also, Giavazzi *et al.* (2000) and Alesina and Ardagna (1998), among others, show that fiscal contractions may be expansionary in indebted countries and that the composition of adjustment, via tax increases and/or expenditure cuts, affects the expansionary potential of fiscal retrenchment.

Figure 1. **Brazil: Actual and cyclically-adjusted budget balances, 1995-2005**[1]
In %



1. Based on preliminary data for 2005.
Source: Authors' calculations.

To assess the sensitivity of discretionary action to the business cycle, closed-form elasticities were estimated for two additional spending categories (other than unemployment-related transfers): primary federal spending on personnel and on non-mandatory programmes (identified in budget

documentation as "other current and capital outlays", other OCCs). These spending items may be sensitive to short-term fluctuations in economic activity, not through built-in stabilisers, as noted above, but as a result of fiscal activism. The estimations use monthly data available from the National Treasury for the period 1997:1 to 2005:10 as follows:

$$\log\left(\frac{G_i}{G_i^{HP}}\right)_t = a_0 + \sum_{j=1}^{11} a_{1j} Dum_j + \sum_{j=1}^{12} a_{2j} \log\left(\frac{G_i}{G_i^{HP}}\right)_{t-j} + \sum_{j=0}^{12} a_{3j} \log\left(\frac{IPI}{IPI^{HP}}\right)_{t-j}, \quad (6)$$

where G_i denotes real federal spending on personnel (*PW*) and on non-mandatory programmes (*NMS*), and IPI is the industrial production index. The *HP* superscript identifies the HP-filtered series.

Estimation of Equation (6), reported in Table 5, yields a long-term elasticity of 2.3 for PW and 1.6 for NMS (columns A and C), suggesting that both spending categories are pro-cyclical. The higher elasticity for PW than for NMS is surprising since spending on non-mandatory programmes (which includes both current and capital outlays) has been much more volatile than federal spending on personnel (Figure 2).[14] Cross-country evidence suggests that public investment, which is an important component of discretionary spending, is one of the most pro-cyclical expenditure items in the OECD area (Lane, 2003).

Trends in spending on non-mandatory programmes and on personnel contrast sharply with the gradual increase in outlays on private-sector pensions. This is because the government is required to set the minimum wage, to which the minimum pension is linked, every year at a level that preserves its purchasing power. There is no cap on increases in the minimum wage/pension above inflation, which, coupled with the downward rigidity associated with the requirement to preserve its purchasing power, creates a "ratcheting-up" effect on spending, especially as a result of the fact that the minimum wage has tended to rise faster in real terms in good years than in bad years.[15] This effect is important because private-sector pensions account for approximately one-third of federal primary expenditure (excluding the assistance benefits classified under "other OCCs").

In addition, fiscal activism may be asymmetrical over the business cycle. The estimated closed-form elasticities may therefore differ between business-cycle upturns and downturns, a hypothesis that can be tested as follows:

$$\log\left(\frac{G_i}{G_i^{HP}}\right)_t = a_0 + \sum_{j=1}^{11} a_{1j} Dum_j + \sum_{j=1}^{12} a_{2j} \log\left(\frac{G_i}{G_i^{HP}}\right)_{t-j} + \sum_{j=0}^{12} a_{3j} \log\left(\frac{IPI}{IPI^{HP}}\right)_{t-j} + \sum_{j=0}^{12} a_{4j} D_{t-j} * \log\left(\frac{IPI}{IPI^{HP}}\right)_{t-j} \quad (7)$$

14. This may be due to the fact that there are programmes classified under "other OCCs" that are not discretionary, such as means-tested income transfers for the elderly and the disabled (RMV and LOAS). Excluding these outlays would make NMS even more volatile and most probably more pro-cyclical. See Giambiagi (2006) for more information on trends in government spending.

15. The simple correlation between the rate of increase in the minimum wage in real terms and the output gap is about 0.7 and statistically significant at the 10% level during 1995-2004.

where D is a dummy variable which takes the value of 1 for positive changes in the 6-month moving average of $\log\left(\frac{IPI}{IPI^{HP}}\right)$ relative to the previous period, and zero otherwise.

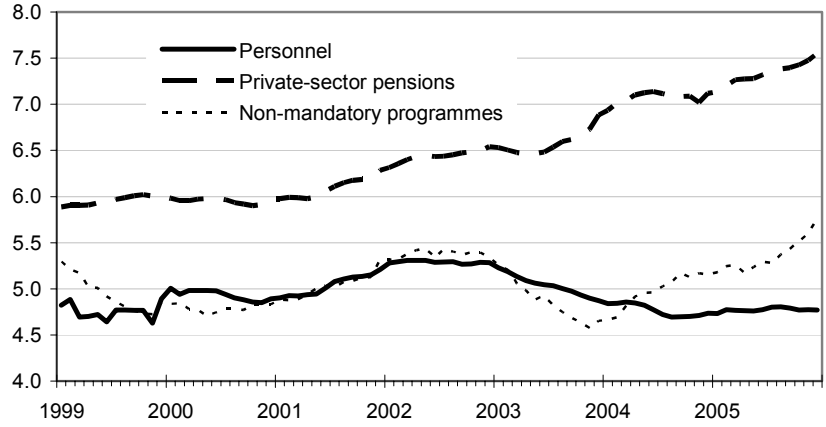
Table 5. **Elasticity of PW and NMS with respect to the business cycle**

	PW		NMS	
	No asymmetry	Asymmetric responses	No asymmetry	Asymmetric responses
	A	B	C	D
Sum of lagged values of $\log\left(\frac{PW}{PW^{HP}}\right)$	-0.01	-0.21		
Sum of lagged values of $\log\left(\frac{NMS}{NMS^{HP}}\right)$			0.52	0.55
Sum of contemporaneous and lagged values of $\log\left(\frac{IPI}{IPI^{HP}}\right)$	2.34	3.55	0.77	1.42
Sum of contemporaneous and lagged values of $D*\log\left(\frac{IPI}{IPI^{HP}}\right)$		-1.72		-1.42
Implied long-term elasticities	2.31	…	1.60	…
In upturns		1.51		0.00
In downturns	…	2.93	…	3.18
R^2	0.75	0.74	0.83	0.85
F Test	9.74***	10.96***	28.53***	24.03***
LB(6)	2.29	3.00	6.43	4.87
ARCH(6)	7.51	15.60**	2.67	0.96

Note: All variables are statistically significant at the 10% level. The *F* statistic tests the overall significance of the model; LB(*X*) is the Ljung-Box test of the absence of autocorrelation of order *X*; ARCH(*X*) is the LM test of the absence of ARCH disturbances of order *X*. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. Seasonal dummies are included in the regressions but not reported. The sample spans the period 1997:1 to 2005:10.

Source: Data available from the Central Bank of Brazil and authors' calculations.

Figure 2. **Selected expenditure items, 1999-2005**
Federal government, 12-month accumulated flows in % of GDP



Source: National Treasury.

Estimation of Equation (7), also reported in Table 5, suggests that discretionary policy action was more pro-cyclical in downturns than in upturns over the period of analysis. This is the case for both expenditure categories – PW and NMS – for which the implied long-term elasticities are higher for downturns than for upturns (columns B and D).[16] The case of non-mandatory spending is particularly interesting, because it was found to be pro-cyclical in downturns while exhibiting no sensitivity to the business cycle during upturns. This suggests that the government was able to resist pressure for destabilising activism in good times, while retrenching non-mandatory programmes in bad times as a result of the need to ensure debt sustainability (discussed below). By contrast, outlays on personnel were found to be pro-cyclical, albeit by a smaller amount, during upturns too, which may be due to the government's inability to resist pressure for more generous wage increases in good years (Talvi and Vegh, 2000; Lane, 2003). Unlike pensions, the government is under no obligation to preserve the purchasing power of civil servants' compensation, which likely explains to a large extent greater pro-cyclicality in downturns than in upturns.

In this regard, the experience of Brazil is at odds with that of the OECD countries, where fiscal tightening during downturns is somewhat less likely to occur in the presence of expenditure rigidities (OECD, 2003; Chapter 4). This is the case when, for example, outlays on personnel, which are harder to retrench than capital spending, account for a large share of government spending and when the government is a sizeable employer relative to the private sector. In any case, the OECD experience also suggests that the benefits for short-term stability that arise from expenditure being inflexible in a downward direction

16. The results are reasonably robust to alternative definitions of upturns other than the 6-month moving average. The estimated elasticity remains lower in upturns than in downturns when 3- and 12-month moving averages are used in the case of PW outlays but not when the level of $\log\left(\frac{IPI}{IPI^{HP}}\right)$ is used. For discretionary spending, however, the asymmetry is reversed with 3- and 12-month moving averages, but remains unchanged with the level of $\log\left(\frac{IPI}{IPI^{HP}}\right)$.

have to be set against the fact that there is no evidence of corresponding counter-cyclicality in upturns in the OECD area. Pro-cyclicality in the upturn may lead to the "ratcheting up" of aggregate public spending over the longer term, an issue that is of relevance to the Brazilian experience of stabilisation based on revenue hikes against a background of rising current expenditure over the years. This is consistent with recent empirical evidence suggesting that the federal government has followed a spend-and-tax policy to ensure the sustainability of public indebtedness since the late 1990s (de Mello, 2006a).

Discretionary action: The sustainability motive

Downward budget rigidity is due in the case of Brazil essentially to widespread revenue earmarking, the indexation of the minimum pension to the minimum wage, discussed above, and the introduction of aggregate minimum spending floors for several programmes, including health care, often through constitutional provisions (OECD, 2005; Chapter 1). However, notwithstanding these rigidities, discretionary policy action was found to have been essentially pro-cyclical during downturns, which may be due to the need to ensure the sustainability of public indebtedness, especially as a result of the fact that access to international capital markets for budget financing tends to be more restricted during downturns than upturns in the case of emerging-market economies. Public indebtedness is a key determinant of the behaviour of discretionary action over the business cycle in the OECD area (OECD, 2003; Chapter 4). To test this hypothesis monthly data were used over the period 1997:1 to 2005:10 to regress a measure of discretionary federal action (DA) on the public debt-to-GDP ratio as follows:

$$DA_t = a_0 + \sum_{j=1}^{11} a_{1j} Dum_j + \sum_{j=1}^{12} a_{2j} DA_{t-j} + \sum_{j=0}^{12} a_{3j} \Delta d_{t-j} , \qquad (8)$$

where d is the debt-to-GDP ratio and DA denotes discretionary action, which is measured as the difference between the cyclically-adjusted budget balance calculated by Equation (4), b^*, and that calculated as $\hat{b} = \left[\sum_{i=1}^{4} T_i \left(Y^*/Y\right)^{\varepsilon_{T_i,Y}} - \sum_{i=1}^{3} G_i \left(Y^*/Y\right)^{\varepsilon_{g_i,Y}} + X \right] \Big/ Y^*$, where G_i represents outlays on unemployment-related transfers, personnel and discretionary programmes. [17]

By Equation (8), a_3 is expected to be positively signed, so that an increase in the debt ratio would lead to a reduction in discretionary action. The equation is estimated in levels, because the data do not seem to exhibit unit roots.[18] The results reported in Table 6 (baseline estimation) show that discretionary action exhibited relatively little persistence over the period of analysis, as expected, and was responsive to changes in indebtedness, as hypothesised. An increase in the debt-to-GDP ratio by 1 percentage point was associated with a reduction in discretionary action by 0.33 percentage point ($0.33 = 0.22/(1-0.34)$).

The hypothesis that the responsiveness of discretionary action to changes in indebtedness changed over time was also tested. To this end, two models were estimated allowing for different responses after the floating of the *real* in January 1999 and after the enactment of the Fiscal Responsibility

17. As the output gap was used to construct $\hat{b}$ and b^*, and then *DA*, it is not included as a regressor in the estimation of Equation (8).

18. The Phillips-Perron (PP) test was used to test for the presence of unit roots in the discretionary action series and the Schmidt-Phillips (SP) test was used for the debt-to-GDP ratio, which has a trend. The SP test allows for testing the hypothesis that the series is difference-stationary with drift against the alternative that it is trend-stationary.

Law in May 2000. The Fiscal Responsibility Law is considered a landmark in the process of strengthening the institutions for fiscal policymaking, imposing hard-budget constraints at all levels of government (de Mello, 2006a and 2006b). The estimating equations are as follows:

$$DA_t = a_0 + \sum_{j=1}^{11} a_{1j} Dum_j + \sum_{j=1}^{12} a_{2j} DA_{t-j} + \sum_{j=0}^{12} a_{3j} \Delta d_{t-j} + \sum_{j=0}^{12} a_{4j} D_{t-j} * \Delta d_{t-j} \quad (9)$$

where *D* takes the value of 1 for the floating exchange rate or the post-FRL periods, and zero otherwise.

The results reported in Table 6 suggest that the floating of the *real* was followed by greater fiscal effort, as evidenced by a higher responsiveness of discretionary action to changes in indebtedness after February 1999 $(0.36 = (0.07 + 0.15)/(1 - 0.40))$ than before $(0.25 = 0.15/(1 - 0.4))$ (Model 1). By contrast, the enactment of the Fiscal Responsibility Law does not appear to have resulted in a significant change in the responsiveness of discretionary action to indebtedness (Model 2). This may be due, as discussed in de Mello (2006a), to the fact that most of the FRL-induced stabilisation may have taken place prior to the actual enactment of the law, including as a result of the introduction of specific legislation setting ceilings on debt and personnel spending in the late 1990s, and that the post-2000 period was characterised by considerable macroeconomic volatility.

Table 6. **Response of discretionary action to changes in government debt**
(Dep. Variable: Discretionary action, *DA*)

	Baseline	Model 1	Model 2	Model 3
Lagged values of *DA*	0.34	0.40	0.19	0.09
Present and lagged values of Δd	0.22	0.15	0.27	0.24
Present and lagged values of $D * \Delta d$		0.07	-0.14	
D98				-0.41
Implied long-term responsiveness to change in debt	0.33	…	…	0.27
Before floating of the *real* or enactment of the FRL	…	0.25	0.33	…
After floating of the *real* or enactment of the FRL	…	0.36	0.16	…
Implied long-term responsiveness to *D98*	…	…	…	-0.45
Dummy variables (*D*)		Identifies the floating exchange rate period (after February 1999)	Identifies the period after the enactment of the Fiscal Responsibility Law (May 2000)	Indicates the years with a presidential election
R^2	0.88	0.89	0.90	0.89
F Test	36.24***	33.96***	29.10***	32.39***
LB(6)	14.78***	1.68	4.74	3.62
ARCH(6)	15.72**	8.95	5.14	2.80

Note: All variables are statistically significant at the 10% level. The dummy variable for 2002 was included in the regression but not found to be statistically significant. The *F* statistic tests the overall significance of the model; LB(*X*) is the Ljung-Box test of the absence of autocorrelation of order *X*; ARCH(*X*) is the LM test of the absence of ARCH disturbances of order *X*. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. Seasonal dummies are included in the regressions but not reported. The sample spans the period 1997:1 to 2005:10.

Source: Data available from the Central Bank of Brazil and authors' calculations.

However, the enactment of the FRL does seem to have been associated with an attenuation of the effect of the electoral cycle on fiscal policy in Brazil. Country experiences differ significantly and are not

easy to generalise, but pro-cyclical retrenchment is less common in election years in the OECD area (OECD, 2003; Chapter 4). Instead, pro-cyclical retrenchment tends to be more prevalent following elections, perhaps owing to the fact that the benefits of fiscal consolidation, as of a reformist agenda in general, take some time to come to fruition. In the case of Brazil, the sample under consideration contains two presidential elections, 1998 and 2002, which allow for testing the electoral cycle hypothesis in conjunction with the role the enactment of the FRL in 2000 might have played through the introduction of constraints on discretionary spending in the six months prior to elections. In particular, the FRL bans the creation of new spending commitments that cannot be executed before the end of the incumbent's term in office, as well as the recording of these as unspent commitments in the two quarters prior to the end of the incumbent's term in office, unless there are sufficient cash balances to cover them at the end of the fiscal year.[19]

The equation estimated to test the electoral cycle hypothesis is as follows:

$$DA_t = a_0 + \sum_{j=1}^{11} a_{1j} Dum_j + a_2 D98 + a_3 D02 + \sum_{j=1}^{12} a_{4j} DA_{t-j} + \sum_{j=0}^{12} a_{5j} \Delta d_{t-j} \,, \qquad (10)$$

where D98 and D02 take the value of 1 for the period April-October 1998 and April-October 2002, respectively, and zero otherwise.

The results reported in Table 6 (Model 3) suggest that discretionary spending rose by 0.45 percentage point over the 6-month period prior to the 1998 elections. Instead, the 2002 dummy turned out to be statistically insignificant. Although other factors were at play, it is likely that the fiscal rule contributed to changing the responsiveness of fiscal policy to the electoral cycle, at least as far as gauged by the 1998 and 2002 presidential elections.

5. Conclusion

By applying for the first time to Brazilian data the methodology used by the OECD Secretariat for calculating the government's fiscal position on a cyclically-adjusted basis for its Member countries, this paper contributes to the current policy debate in Brazil in two main areas. *First*, it allows for the assessment of fiscal effort since macroeconomic stabilisation in 1994 by distinguishing changes in the fiscal stance that are related to built-in stabilisers from those that reflect discretionary policy action. This is important because Brazil's fiscal adjustment since 1999 has been impressive, even under adverse economic conditions. *Second*, it identifies long-term fiscal sustainability considerations as a main determinant of the sensitivity of the fiscal stance to the business cycle, which is consistent with the recent empirical literature on debt sustainability, reviewed in de Mello (2006a).

The paper's main finding is that high indebtedness introduces a pro-cyclical bias in fiscal policy, making corrective tightening in bad times difficult to avoid. This policy effort needs to compensate for the fact that some expenditure items, such as payroll, are somewhat pro-cyclical in upturns too, leading to a "ratcheting up" of expenditure over the years. The empirical findings reported above suffer from the usual methodological shortcomings. Elasticities change over time according to revisions in the tax code, amendments to the provisions of social security and unemployment insurance, and changes in the distribution of income and earnings. Also, the output gap is measured with some uncertainty, especially in a volatile macroeconomic environment. Notwithstanding these considerations, the calculation of budget aggregates on a cyclically-adjusted basis is a powerful tool for assessing the impact of fiscal policy on the economy.

19. See de Mello (2006b) for more information.

Two main policy recommendations emerge from the empirical analysis. *First*, a sustained reduction in public indebtedness is a pre-requisite for eliminating policy pro-cyclicality during cyclical downturns. At the same time, to the extent that the level of Brazil's public debt continues to be perceived as a source of vulnerability, effort to reduce indebtedness will make the economy more resilient to external shocks, allowing fiscal policy to play a more stabilising role in short-term demand management. Therefore, a reasonable medium-term objective would be to bring the public sector borrowing requirement into balance over the business cycle, underpinned by robust primary surpluses and resulting in a sustainable decline in real interest rates. As discussed in OECD (2005), this would create room for manoeuvre as economic conditions improve, allowing the fiscal stance to be more counter-cyclical while ensuring a steady reduction in indebtedness.

Second, it is imperative to constrain expenditure growth. This can be done by reducing downward budget rigidity, which would likely make the fiscal stance less pro-cyclical in upturns. In the interim, as recommended in OECD (2005), a comprehensive assessment of existing revenue earmarking and mandated spending requirements against the achievement of their intended policy objectives would contribute to the policy debate. More emphasis should also be put on rationalising the largest items of current spending, including through further pension reform, to improve the quality of on-going fiscal consolidation and the cost-effectiveness of public spending. The time seems opportune to make headway into these policy areas because there appears to be widespread recognition that rigidities in the budget adversely affect the quality of fiscal adjustment.[20] Another option for consideration, of a more institutional nature, would be to complement the existing fiscal rules enshrined in the Fiscal Responsibility Law by introducing a nominal cap on expenditure growth, which may act to prevent a pro-cyclical upward drift in spending during upturns.

20. See Alesina and Ardagna (1998).

Bibliography

Alesina, A. and S. Ardagna (1998), "Tales of Fiscal Contractions", *Economic Policy*, Vol. 27.

de Mello, L., P.M. Kongsrud and R. Price (2004), "Saving Behaviour and the Effectiveness of Fiscal Policy", *OECD Economics Department Working Paper*, No. 397, OECD, Paris.

de Mello, L. (2006a), "Estimating a Fiscal Reaction Function: the Case of Debt Sustainability in Brazil", *Applied Economics*, forthcoming.

de Mello, L. (2006b), "Fiscal Responsibility Legislation and Fiscal Adjustment: The Case of Brazilian Local Governments", *Policy Research Working Paper*, No. 3812, World Bank, Washington, D.C.

Giambiagi, F. (2006), "A política Fiscal do Governo Lula em Perspectiva Histórica: Qual é o Limite para o Aumento do Gasto Público?", *Working Paper*, No. 1169, IPEA, Brasília.

Giambiagi, F. and M. Ronci (2006), "The Brazilian Fiscal Adjustment: Structural Change and Policy Continuity, 1995-2004", *Challenges to Fiscal Adjustment in Latin America: The Cases of Argentina, Brazil, Chile and Mexico*, OECD, Paris.

Giavazzi, F., T. Jappelli and M. Pagano (2000), "Searching for Non-Linear Effects of Fiscal Policy: Evidence from Industrial and Developing Countries", *European Economic Review*, Vol. 44, pp. 1259-89.

Giorno, C., P. Richardson, D. Roseveare and P. van den Noord (1995), "Estimating Potential Output, Output Gaps and Structural Budget Balances", *OECD Economics Department Working Paper*, No. 152, OECD, Paris.

Girouard, N. and C. Andre (2005), "Measuring Cyclically-Adjusted Budget Balances for OECD Countries", *OECD Economics Department Working Paper*, No. 434, OECD, Paris.

Lane, Philip R. (2003), "The Cyclical Behaviour of Fiscal Policy: Evidence from the OECD", *Journal of Public Economics*, Vol. 87.

OECD (1999), *OECD Economic Outlook*, No. 66, OECD, Paris.

OECD (2003), *OECD Economic Outlook*, No. 74, OECD, Paris.

OECD (2005), *Economic Survey of Brazil*, OECD, Paris.

OECD (2006), *Challenges to Fiscal Adjustment in Latin America: The Cases of Argentina, Brazil, Chile and Mexico*, OECD, Paris.

Talvi, E. and C.A. Vegh (2000), "Tax Base Variability and Procyclical Fiscal Policy". *NBER Working* Paper, No. 7499, National Bureau of Economic Research, Cambridge, MA.

Van den Noord, P. (2000), "The Size and Role of Automatic Fiscal Stabilizers in the 1990s and Beyond", *OECD Economics Department Working Papers*, No. 230, OECD, Paris.

Annex A1

Estimating the revenue and expenditure elasticities

Revenue

The sensitivity of the wage bill with respect to the output gap ($\varepsilon_{tb_i,y}$) was estimated as follows, based on monthly data spanning the period 1994:1 to 2005:10:

$$\log\left(\frac{W}{W^{HP}}\right)_t = a_0 + \sum_{j=1}^{11} a_{1j} Dum_j + \sum_{j=1}^{12} a_{2j} \log\left(\frac{W}{W^{HP}}\right)_{t-j} + \sum_{j=0}^{12} a_{3j} \log\left(\frac{IPI}{IPI^{HP}}\right)_{t-j}, \qquad \text{(A1.1)}$$

where W denotes real wages in the industrial sector, Dum_j is a seasonal dummy, IPI is the industrial production index, and the superscript HP identifies the HP-filtered series. Data on real wages in industry and the industrial production index are available from IBGE.

The results of the Phillips-Perron (PP) test for all the variables used in the estimation of the revenue and expenditure elasticities and for the sensitivity analysis are presented in Table A1.1. Since monthly data are used, the possible seasonal effects were extracted from the data by regressing each variable on seasonal dummies.[1] The PP test is then applied to the seasonally-adjusted variables. In Table A1.1, Tau is the test statistic of the null hypothesis that α = 0 in $\Delta\hat{\varepsilon}_t = \alpha\hat{\varepsilon}_{t-1} + \mu_t$, $\hat{\varepsilon}_t$ is the estimated residual and μ_t is an error term that can be serially correlated and heteroscedastic.[2]

The number of lags used to estimate Equation (A1.1), as well as in the other estimations reported below, was selected on the basis of a general-to-specific modelling strategy. The methodology consists of consecutively eliminating the non-significant variables at the 10% level, until all the remaining variables are statistically significant. The estimation results are reported in Table A1.2. The error terms do not seem to be serially correlation or heteroscedastic, which suggests that the lag structure was correctly specified. Based on the estimation results, the elasticity of the tax base with respect to the output gap was computed

1. Only a constant and the seasonal dummies were included in the regression, because none of the variables are trend-stationary.

2. There is no deterministic term in the equation since they were included in the regression to seasonally adjust the series. The number of lags was selected on the basis of the Newey-West truncation lag selection criteria. This is based on the number of observations used in the test regression, and consists of choosing the largest integer not exceeding 4*(T/100)^(2/9). The Newey-West truncation lag was set to 4.

Table A1.1. **Unit root tests: Phillips-Perron (PP) statistics**

Variable	Periodicity and sample	Lag	Tau	Prob < Tau
$\log\left(\frac{IPI}{IPI^{HP}}\right)$	Monthly [1985:1 – 2005:10]	4	-7.8139	0.00
$\log\left(\frac{W}{W^{HP}}\right)$	Monthly [1994:1 – 2005:10]	4	-5.2023	0.00
$\log\left(\frac{U}{U^{HP}}\right)$	Monthly [1985:1 – 2005:10]	4	-5.0422	0.00
$\log\left(\frac{i}{i^{HP}}\right)$	Monthly [1995:1 – 2005:10]	4	-9.6162	0.00
$\log\left(\frac{PW}{PW^{HP}}\right)$	Monthly [1997:1 – 2005:10]	4	-8.3656	0.00
$\log\left(\frac{NMS}{NMS^{HP}}\right)$	Monthly [1997:1 – 2005:10]	4	-5.8284	0.00

Note: IPI is the industrial production index (2002 average = 100); W is the average real wage in industry (January 2003 = 100); U is the unemployment rate; i is real interest payments (R$ of august 2004); PW is spending on personnel and NMS is discretionary spending. The *HP* superscript identifies HP-filtered series.

Source: Data available from IBGE, Central Bank of Brazil and National Treasury, and authors' calculations.

Table A1.2. **Elasticity of the wage bill with respect to the business cycle**

	Sum of coefficients
Lagged values of $\log\left(\frac{W}{W^{HP}}\right)$	0.70
Present and lagged values of $\log\left(\frac{IPI}{IPI^{HP}}\right)$	0.24
R^2	0.78
F Test	33.86***
LB(6)	10.58
ARCH(6)	1.37

Note: All variables are statistically significant at the 10% level. The *F* statistic tests the overall significance of the model; LB(*X*) is the Ljung-Box test of the absence of autocorrelation of order *X*; ARCH(*X*) is the LM test of the absence of ARCH disturbances of order *X*. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. Seasonal dummies are included in the regressions but not reported. The sample spans the period 1994:1 to 2005:10.

Source: Data available from IBGE and authors' calculations.

by assuming a steady-state relationship between the variables, such that Equation (A1.1) could be re-written as follows:[3]

$$\log\left(\frac{W}{W^{HP}}\right) = a_0^* + \sum_{j=1}^{11} a_{1j}^* Dum_j + a_3^* \log\left(\frac{IPI}{IPI^{HP}}\right), \qquad \text{(A1.2)}$$

Primary government expenditure

The elasticity of primary government expenditure with respect to the rate of unemployment ($\varepsilon_{g,U}$), is calculated by differentiating G with respect to the unemployment rate, such that $\frac{\partial G}{\partial U} = \frac{\partial GU}{\partial U} + \frac{\partial \overline{G}}{\partial U} = \frac{\partial GU}{\partial U}$, where $\partial \overline{G} / \partial U = 0$. Multiplying both sides by U/G and the right hand-side by GU/GU yields $\varepsilon_{g,U} = \frac{\partial G}{\partial U}\frac{U}{G} = \frac{\partial GU}{\partial U}\frac{U}{GU}\frac{GU}{G} = \varepsilon_{GU,U}\frac{GU}{G} = \frac{GU}{G}$, where $\varepsilon_{GU,U}$ is the elasticity of unemployment-related transfers with respect to the unemployment rate, which was assumed to be unitary. The elasticity of primary government expenditure with respect to the unemployment rate was computed using the share of unemployment-related transfers in total primary spending.

The sensitivity of the unemployment rate to the business cycle ($\varepsilon_{U,Y}$) was estimated by regressing the cyclical component of the unemployment rate (U/U^{HP}) on the output gap (IPI/IPI^{HP}), as follows:

$$\log\left(\frac{U}{U^{HP}}\right)_t = a_0 + \sum_{j=1}^{11} a_{1j} Dum_j + \sum_{j=1}^{12} a_{2j} \log\left(\frac{U}{U^{HP}}\right)_{t-j} + \sum_{j=0}^{12} a_{3j} \log\left(\frac{IPI}{IPI^{HP}}\right)_{t-j}, \qquad \text{(A1.3)}$$

where the variables are defined as above.

Because the series $\log\left(U/U^{HP}\right)$ and $\log\left(IPI/IPI^{HP}\right)$ were found to be stationary, Equation (A1.3) was estimated in levels. The estimations were conducted for monthly data spanning the period 1985:1 to 2005:10. The error terms of the estimated equation do not seem to be serially correlated or conditionally heteroscedastic, suggesting that the lag structure was correctly specified (Table A1.3). As above, the elasticity was computed by assuming a steady-state relationship between the variables.

3. By a steady-state relationship between the variables it is meant that

$$\log\left(\frac{W}{W^{HP}}\right)_t = \log\left(\frac{W}{W^{HP}}\right)_{t-1} = \ldots \quad \text{and} \quad \log\left(\frac{IPI}{IPI^{HP}}\right)_t = \log\left(\frac{IPI}{IPI^{HP}}\right)_{t-1} = \ldots \quad .$$

Table A1.3. **Elasticity of unemployment with respect to the cycle**

	Sum of Parameters
Lagged values of $\log\left(\frac{U}{U^{HP}}\right)$	0.62
Present and lagged values of $\log\left(\frac{IPI}{IPI^{HP}}\right)$	-0.76
R^2	0.86
F Test	68.17***
LB(6)	2.26
ARCH(6)	7.10

Note: All variables are statistically significant at the 10% level. The *F* statistic tests the overall significance of the model; LB(*X*) is the Ljung-Box test of the absence of autocorrelation of order *X*; ARCH(*X*) is the LM test of the absence of ARCH disturbances of order *X*. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. Seasonal dummies are included in the regressions but not reported. The sample spans the period 1985:1 to 2005:10.

Source: Data available from IBGE and authors' calculations.

Annex A2

Estimating Brazil's potential GDP

This Annex calculates Brazil's potential GDP using a production function approach akin to that used by the OECD Secretariat for its Member countries.[1]

As a first step, total factor productivity was calculated as follows:

$$\ln(TFP)_t = \ln(Y_t) - 0.49\ln(\overline{K}_t) - 0.51\ln(\overline{L}_t), \qquad \text{(A2.1)}$$

where Y_t denotes real GDP; $\overline{K}_t = \gamma_t K_t$ is the utilisation-adjusted capital stock, where γ_t denotes a coefficient of utilisation of installed capacity, K_t; $\overline{L}_t = (1-u_t)\overline{F}_t$ is utilisation-adjusted labour, where $\overline{F}_t$ denotes the labour force and u_t is the rate of formal unemployment; $\ln(.)$ denotes the natural logarithm; and *t* is a time indicator. The share of capital in GDP is obtained from the national accounts and is in line with previous literature (Silva Filho, 2001; Souza Junior and Jayme Junior, 2004; and Souza Junior, 2005).[2] Due to methodological changes in the unemployment series over time, the rate of unemployment was calculated as $u_t = (1-E_t)/\overline{F}_t$, where E_t is the employed population.

Finally, potential GDP was calculated as follows:

$$\ln(Y_t^*) = \ln(TFP_t)^* + 0.49\ln(K_t^*) + 0.51\ln(L_t^*), \qquad \text{(A2.2)}$$

where $\ln(TFP_t)^*$ is the HP-filtered TFP series calculated by Equation A2.1; $K_t^* = \overline{\gamma}_t K_t$, $\overline{\gamma}_t$ is the HP-filtered series computed for γ_t, proxying for the non-accelerating inflation capital utilisation (NAICU); and $L_t^* = (1-\overline{u}_t)\overline{F}_t$, where $\overline{u}_t$ is the HP-filtered series computed for u_t, proxying for the non-accelerating inflation rate of unemployment (NAIRU). Forecasts of $\ln(TFP_t)$, γ_t and u_t using an AR model were computed for 2006-08 and used to calculate the HP trends in order to minimise the end-point bias associated with HP filtering. Direct estimation of NAIRU and NAICU does not yield stable parameters because of structural breaks in the series.

1. The main advantage of the production function approach over other methodologies for calculating potential output (such as using a linear or HP trend) is that it considers structural constraints and limitations on production through the availability of factors of production and changes in productivity. See Giorno *et al.* (1995) for more information.

2. It can be argued that a capital share of over 50% is high by international comparison, which is due to the fact that Brazilian national accounts treat the income of own-account and informal-sector workers as capital income. A capital-ratio of 40% has also been used in growth accounting exercises (Gomes *et al.*, 2003).

Annual data are used in the calculations for the period 1980-2005. The labour force and employed population series are available from IBGE for the metropolitan regions, the stock of physical capital is available from IPEA in billions of 1999 *reais*, the index of utilisation of installed capacity is available from the *Getúlio Vargas Foundation*, and GDP is available from IBGE.[3]

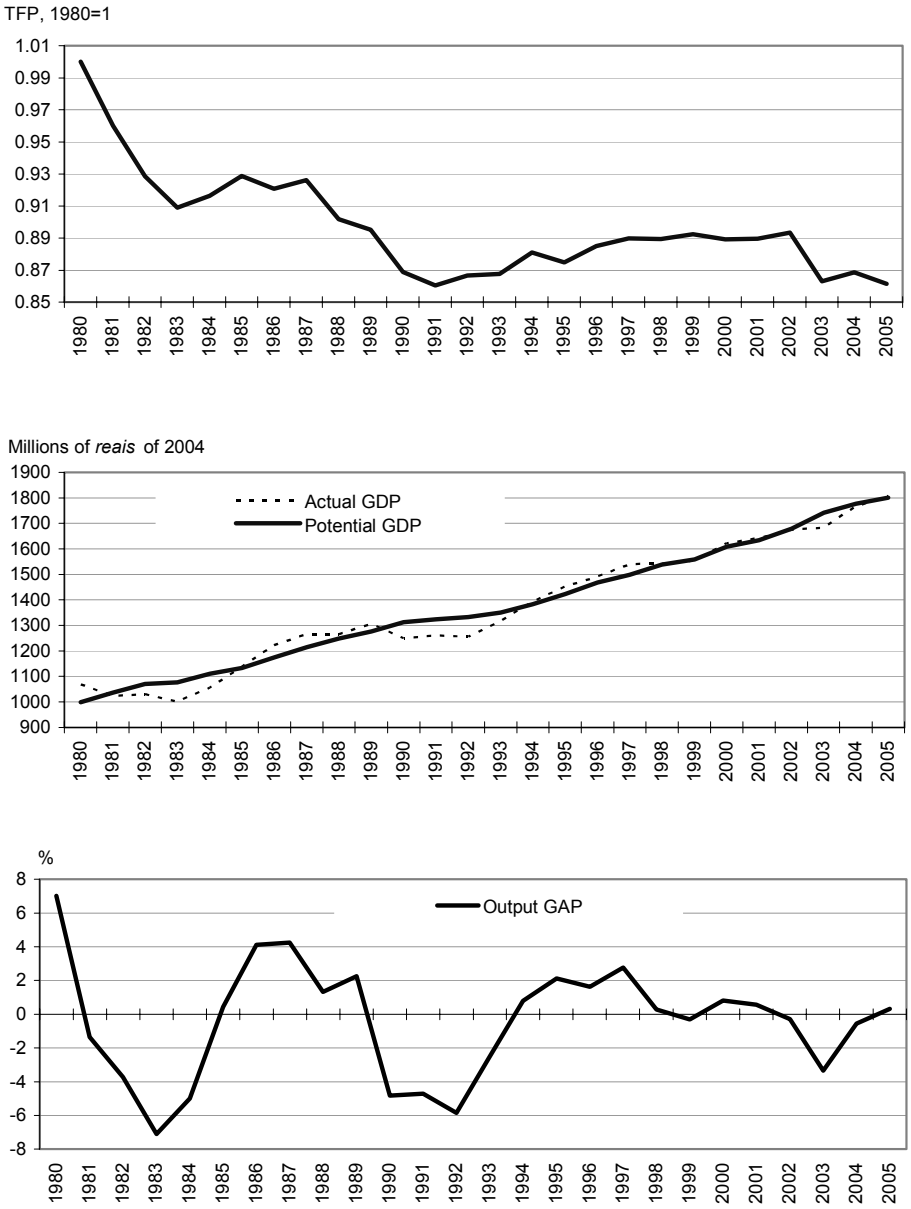
Based on the methodology above, total factor productivity appears to have trended downward until the early 1990s and subsequently bounced back, especially after 1992 (Figure A2.1). This pattern of TFP growth is consistent with previous calculations using aggregate data,[4] and with the industry-level evidence available to date (Pinheiro *et al.*, 2001). The calculations show that potential GDP growth averaged about nearly 3% per year during the 1980s. It fell to about 1% per year at the beginning of the 1990s and then picked up again and stabilised at about 2.5% per year on average since 2000.

The calculations are reasonably robust to setting $\overline{u}$ at a constant level of 5.5%, in line with the empirical literature (Silva Filho, 2001; Muinhos and Alves, 2003), given the uncertainty surrounding the estimation of NAIRU in a volatile macroeconomic environment. Nevertheless, growth accounting has obvious limitations. The main caveat is that the measurement of the TFP component of GDP growth is sensitive to measurement errors because it is calculated by definition as a residual (*i.e.* the difference between output growth and a weighted average of the growth rates of the utilisation-adjusted factors of production). A correction is made for factor utilisation, because estimates of TFP growth would be pro-cyclical if the underutilisation of inputs during cyclical downturns were not taken into account. But factor quality is treated as uniform over time. As a result, TFP will be overestimated if improvements in the quality of capital or labour are underestimated: failure to account for improvements in educational attainment tends to overestimate the contribution of TFP to growth.

3. In the case of the employment and labour force series, the data are available on a monthly basis. The annual series were calculated by splicing the data using the new and old methodologies.

4. See Souza Junior (2005) for a recent survey.

Figure A2.1. **Trends in TFP, and actual and potential GDP, 1980-2005**



Source: OECD calculations.

Bibliography

Giorno, C., P. Richardson, D. Roseveare and P. van den Noord (1995), "Estimating Potential Output, Output Gaps and Structural Budget Balances", *OECD Economics Department Working Paper*, No. 152, OECD, Paris.

Gomes, V., S.A. Pessoa and F.A. Veloso (2003), "Evolução da Produtividade Total dos Fatores na Economia Brasileira: Uma Análise Comparativa", Unpublished manuscript, Getúlio Vargas Foundation, Rio de Janeiro.

Muinhos, M.K. and S.A.L. Alves (2003), "Medium-Size Macroeconomic Model for the Brazilian Economy", *Working Paper No. 64*, Central Bank of Brazil, Brasília.

OECD (1999), "The Size and Role of Automatic Fiscal Stabilisers", *OECD Economic Outlook*, No. 66, OECD, Paris.

Pinheiro, A.C., I.S. Gill, L. Servén and M.R. Thomas (2001), "Brazilian Economic Growth, 1900-2000: Lessons and Policy Implications", Unpublished manuscript, World Bank, Washington, D.C.

Silva Filho, T.N.T. (2001), "Estimando o Produto Potencial Brasileiro: Uma Abordagem de Função de Produção", *Working* Paper, No. 17, Central Bank of Brazil, Brasília.

Souza Junior, J.R.C. and Jayme Junior, F.G. (2004), "Constrangimentos ao Crescimento no Brasil: Um Modelo de Hiatos (1970-2000)", *Revista de Economia Contemporânea*, Vol. 8.

Souza Junior, J.R.C. (2005), "Produto Potencial: Conceitos, Métodos de Estimação e Aplicação à Economia Brasileira", *Working Paper*, No. 1130, IPEA, Brasília.

Annex A3

Sensitivity analysis

This Annex reports the results of the sensitivity analysis of the baseline results to account for cyclical-dependence in interest payments and to allow for different lag structures in the response of tax revenue to fluctuations in economic activity.

The cyclicality of interest payments

The elasticity of interest payments with respect to the output gap was estimated using monthly data for real interest payments and for the industrial production index for the period 1995:1 to 2005:10, as follows:

$$\log\left(\frac{i}{i^{HP}}\right)_t = a_0 + \sum_{j=1}^{11} a_{1j} Dum_j + \sum_{j=1}^{12} a_{2j} \log\left(\frac{i}{i^{HP}}\right)_{t-j} + \sum_{j=0}^{12} a_{3j} \log\left(\frac{IPI}{IPI^{HP}}\right)_{t-j} . \qquad \text{(A3.1)}$$

The series $\log\left(i/i^{HP}\right)$ and $\log\left(IPI/IPI^{HP}\right)$ were found to be stationary; therefore, Equation (A3.1) was estimated in levels. The estimation results are reported in Table A3.1. The estimated elasticity indicates that, for a 1% increase in economic activity from trend, there is a reduction in interest payments by 2.5% with respect to trend.

Table A3.1. **Elasticity of interest payments with respect to the business cycle**

	Sum of coefficients
Lagged values of $\log\left(\frac{i}{i^{HP}}\right)$	0.25
Present and lagged values of $\log\left(\frac{IPI}{IPI^{HP}}\right)$	-1.85
R2	0.24
F Test	7.11***
LB(6)	1.86
ARCH(6)	21.67***

Note: All variables are statistically significant at the 10% level. The *F* statistic tests the overall significance of the model; LB(*X*) is the Ljung-Box test of the absence of autocorrelation of order *X*; ARCH(*X*) is the LM test of the absence of ARCH disturbances of order *X*. (***), (**) and (*) denote significance at the 1%, 5% and 10% levels, respectively. Seasonal dummies are included in the regressions but not reported. The sample spans the period 1995:1 to 2005:10.

Source: Data available from the Central Bank of Brazil and IBGE, and authors' calculations.

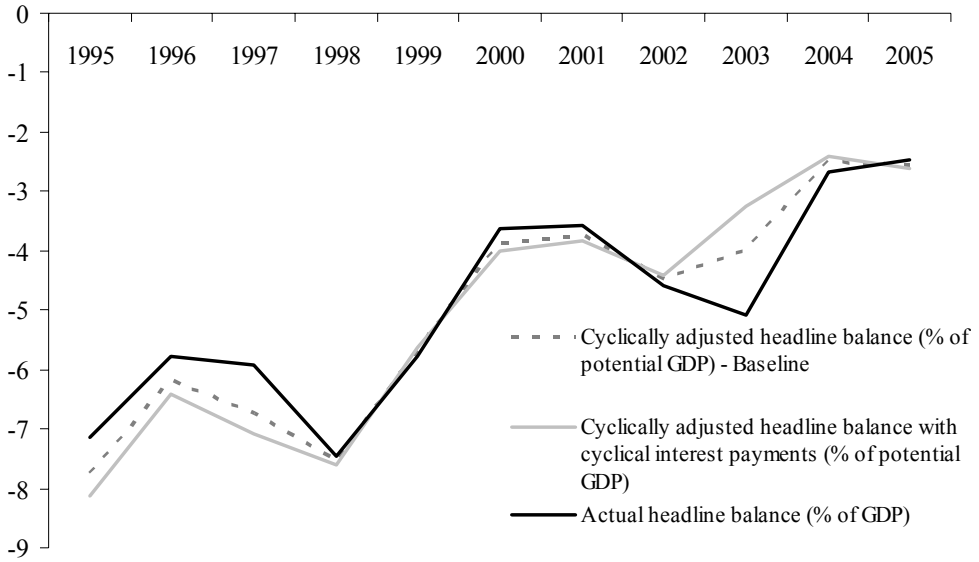
The same elasticity was computed for the OECD countries using quarterly data. The estimation period differs from country to country, depending on data availability. The results presented in Table A3.2 suggest that interest payments are pro-cyclical in five out of ten cases, a-cyclical in only one case and countercyclical in the remaining cases. However, even where they were found to be countercyclical, the elasticities are much lower in absolute value than in the case of Brazil. Taking the sensitivity of the interest bill to the business cycle into account suggests that the calculated cyclically-adjusted headline budget balance is lower than in the baseline case (Figure A3.1). The gap with regard to the baseline can be sizeable, due to the high share of interest payments in government spending and the magnitude of the estimated elasticity.

Table A3.2. **Elasticity of interest payments with respect to the cycle in OECD countries**

	Elasticity
United States	-0.21
Germany	0.00
France	-1.57
United Kingdom	2.07
Austria	-0.31
Czech Republic	3.95
Finland	2.20
Korea	0.52
Netherlands	-0.40
Sweden	1.16

Source: Data available from the OECD Economic Outlook database and authors' calculations.

Figure A3.1. **Robustness analysis: The effect of cyclical interest payments, 1995-2005**[1]
In %



Source: Authors' calculations.

Real interest rates and country risk tend to be counter-cyclical in emerging-market economies, falling in cyclical upturns and rising in downturns.[5] This is related to "debt intolerance", whereby access to international capital markets for budget financing is more difficult and costlier in bad times, constraining tax smoothing. To the extent that the interest rate paid on the public debt is correlated with the business cycle, and because of the high share of securities paying floating interest rates in Brazil's traded debt stock, the interest bill is also likely to be more sensitive to the business cycle than in most OECD countries. This sensitivity is important because Brazil's interest bill is high, at about 8% of GDP on average since 1999, against 1.8% of GDP for the OECD area on average.

The lag structure of selected tax receipts

The elasticities of tax revenue with respect to the business cycle may have more complex lag structures than considered in the baseline estimations. This is most likely to be the case with the PIT and the CIT because of, for example, rules that allow taxpayers to carry losses forward, as well as slow responses of wages and profits to changes in economic conditions, among other factors. The lag structure of these responses may also change over time, due, for instance, to changes in the tax code. As a result, the baseline elasticities have been re-estimated allowing for a 2-year adjustment process, such that Equation (4) can be re-written as follows:

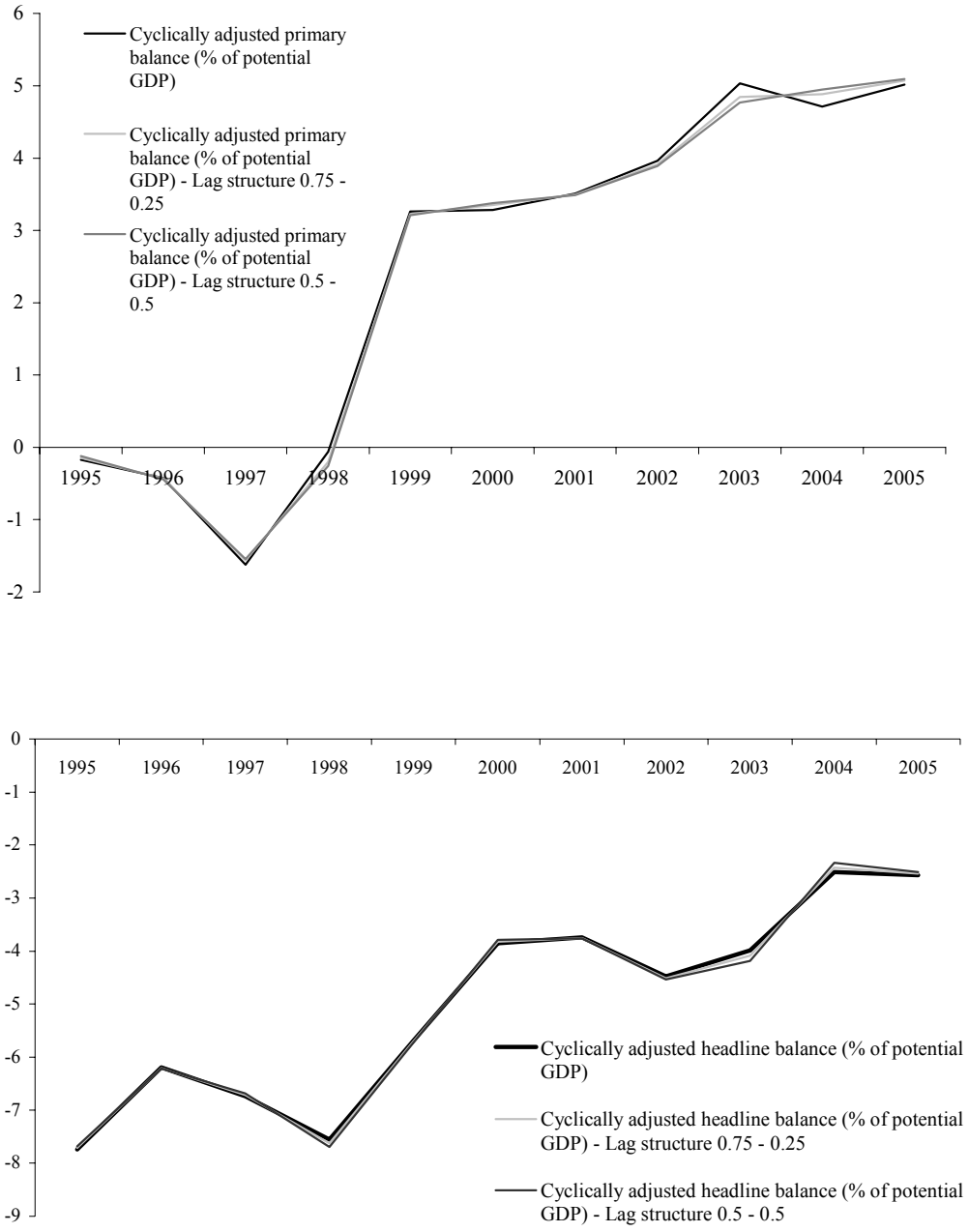
$$b_t^* = \left[\sum_{i=1}^{2} T_i \left[\gamma \left(Y^*/Y \right)_t^{\varepsilon_{T_i,Y}} + (1-\gamma) \left(Y^*/Y \right)_{t-1}^{\varepsilon_{T_i,Y}} \right] + \sum_{i=1}^{2} T_i \left(Y^*/Y \right)_t^{\varepsilon_{T_i,Y}} - G \left(Y^*/Y \right)_t^{\varepsilon_{g,Y}} + X_t \right] \Big/ Y_t^* \,, \quad \text{(A3.2)}$$

where γ is the share of taxes collected at period t and hence affected by the contemporaneous output gap, and (1-γ) is the share of taxes also collected at period t but affected by the output gap in period t-1. Two sets of weights are considered: $\gamma = 0.75$ and $\gamma = 0.5$.

The results of the estimations, reported in Figure A3.2 for the cyclically-adjusted primary and headline budget balances, suggest that the baseline calculations are robust to this alternative lag structure. The estimated cyclically-adjusted primary balances are somewhat higher in 2000 and 2004 for the more complex lag structure. The reason is that these years followed periods in which actual GDP was close to potential (*i.e.* 1999 and 2003), thereby reducing the difference between actual and cyclically-adjusted revenue when a longer lag structure is taken into account.

5. See Grandes (2005), Uribe and Yue (2003) and Neumeyer and Perri (2004) for more information.

Figure A3.2. **Robustness analysis: The effect of more complex lag structures, 1995-2005**[1]
In %



1. Based on preliminary data for 2005.
Source: Authors' calculations.

Bibliography

Grandes, M. (2005), "Convergence and Divergence of Sovereign Bonds Spreads: Theory and Facts from Latin America", Latin American Economic Association, October, Paris.

Neumeyer, P.A. and F. Perri (2004), "Business Cycles in Emerging Economies: the Role of Interest Rates", *CEPR Discussion Paper*, No. 4482, CEPR, London.

Uribe, M. and V.Z. Yue (2003), "Country Spreads and Emerging Countries: Who Drives Whom?", *NBER Working Paper*, No. 10018, National Bureau of Economic Research, Cambridge, MA.

WORKING PAPERS

The full series of Economics Department Working Papers can be consulted at www.oecd.org/eco/Working_Papers/

484. *Realising The Oil Supply Potential of the CIS: The Impact of Institutions and Policies* (May 2006) Rudiger Ahrend and William Tompson

483. *Summary of a workshop on global convergence scenarios: structural and policy issues* (May 2006) Nick Vanston

482. *Revised OECD methods for supply-side and medium-term assessment: a capital services approach* (Forthcoming in June) Pierre-Olivier Beffy, Patrice Ollivaud, Pete Richardson and Frank Sédillot

481. *Balancing health care quality and cost containment: the case of Norway* (February 2006) Alexandra Bibbee and Flavio Padrini

480. *The ageing challenge in Norway: ensuring a sustainable pension and welfare system* (February 2006) Benoît Bellone and Alexandra Bibbee

479. *Strengthening innovation in the Netherlands: Making better use of knowledge creation in innovation activities* (February 2006) David Carey, Ekkehard Ernst, Rebecca Oyomopito and Jelte Theisens

478. *How to sustain growth in a resource based economy? The main concepts and their application to the Russian case* (February 2006) Rudiger Ahrend

477. *Projecting OECD health and long-term care expenditures: What are the main drivers?* (February 2006)

476. *Alternative measures of well-being* (January 2006) Romina Boarini, Åsa Johansson and Marco Mira D'Ercole

475. *Recent house price developments: the role of fundamentals* (January 2006) Nathalie Girouard, Mike Kennedy, Paul van den Noord and Christophe André

474. *Reforming federal fiscal relations in Austria* (January 2006) Andrès Fuentes, Eckhard Wurzel and Andreas Wörgötter

473. *Product market competition and economic performance in France*
Concurrence sur les marchés de produits et performance économique en France
(January 2006) Jens Høj and Michael Wise

472. *Product market reforms and employment in OECD countries* (December 2005) Giuseppe Nicoletti and Stefano Scarpetta

471. *Fast-falling barriers and growing concentration: the emergence of a private economy in China* (December 2005) Sean Dougherty and Richard Herd

470. *Sustaining high growth through innovation: reforming the R&D and education systems in Korea* (December 2005) Yongchun Baek and Randall Jones

469. *The labour market in Korea: enhancing flexibility and raising participation* (December 2005) Randall Jones

468. *Getting the most out of public-sector decentralization in Korea* (December 2005) Randall Jones and Tadashi Yokoyama

467. *Coping with the inevitable adjustment in the US current account*
(December 2005) Peter Jarrett

466. *Is there a case for sophisticated balanced-budget rules?*
(December 2005) Antonio Fatás

465. *Fiscal rules for sub-central governments design and impact*
(December 2005) Douglas Sutherland, Robert Price and Isabelle Joumard

464. *Assessing the robustness of demographic projections in OECD countries*
(December 2005) Frédéric Gonand

463. *The Benefits of Liberalising Product Markets and Reducing Barriers to International Trade and Investment in the OECD*
(December 2005)

462. *Fiscal relations across levels of government in the United States*
(November 2005) Thomas Laubach

461. *Assessing the value of indicators of underlying inflation for monetary policy*
(November 2005) Pietro Catte and Torsten Sløk.

460. *Regulation and economic performance: product market reforms and productivity in the OECD*
(November 2005) Giuseppe Nicoletti and Stefano Scarpetta.

459. *Innovation in the Business Sector*
(November 2005) Florence Jaumotte and Nigel Pain

458. *From Innovation Development to Implementation: Evidence from the Community Innovation Survey*
(November 2005) Florence Jaumotte and Nigel Pain

457. *From Ideas to Development: the Determination of R&D and Patenting*
(November 2005) Florence Jaumotte and Nigel Pain

456. *An Overview of Public Policies to Support Innovation*
(November 2005) Florence Jaumotte and Nigel Pain

455. *Strengthening Regulation in Chile: The Case of Network Industries*
(November 2005) Alexander Galetovic and Luiz de Mello

454. *Fostering Innovation in Chile*
(November 2005) José-Miguel Benavente, Luiz de Mello and Nanno Mulder

453. *Getting the most out of public sector decentralisation in Mexico*
(October 2005) Isabelle Joumard

452. *Raising Greece's Potential Output Growth*
(October 2005) Vassiliki Koutsogeorgopoulou and Helmut Ziegelschmidt

451. *Product Market Competition and Economic Performance in Australia*
(October 2005) Helmut Ziegelschmidt, Vassiliki Koutsogeorgopoulou, Simen Bjornerud and Michael Wise

450. *House Prices and Inflation in the Euro Area*
(October 2005) Boris Cournède