Session 1

FISCAL STABILISATION

FISCAL RULES AND THE SCOPE FOR STABILISATION POLICY – THE CASE OF SWEDEN

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1 Introduction

The necessity of ensuring long-term sustainability in public finances is receiving substantial attention in a large number of countries.[1] A living memory of the rapid fiscal deterioration that can occur in unfavourable situations, together with an insight into the future burden on the public sector caused by an ageing population, have stimulated an interest in promoting fiscal discipline. One element of maintaining sound public finances is the existence of an appropriate institutional arrangement of the budget process. Concepts such as top-down budgeting, medium-term budgetary frameworks, independent fiscal institutions and numerical fiscal rules have been extensively explored in the literature. The discussion has, however, been somewhat one-sided, primarily focused on sustainability, without a thorough analysis of possible trade-offs in terms of difficulties in ensuring allocative effectiveness of public spending or possible limitations on running effective stabilization policies.

In Sweden, the budgetary framework was reformed in the 1990s, with the explicit objective of establishing a firmer control over fiscal development. Following an unprecedented increase in public expenditure, government deficit and debt ratio in the first half of the 1990s, it was observed that the Swedish budget process was ill-suited to ensure sustainable finances.[2] The reforms encompassed abolishing the use of open-ended appropriations, the introduction of top-down procedures for preparing the budget and new procedures for voting on the budget in Parliament. A cornerstone of the reformed budget process was the introduction of numerical fiscal targets in the shape of a multiannual ceiling on central government nominal expenditure and a surplus target for the general government net lending. Added to these fiscal targets, a balance requirement on local government finances was imposed.

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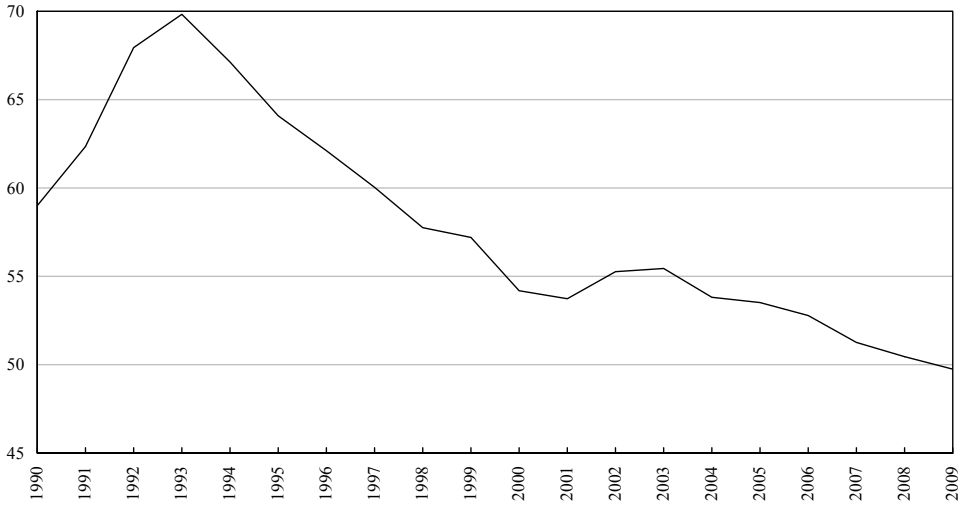
[1] See, for example, Shick (2005).

[2] Molander (2000).

Figure 1

General Government Expenditure, 1990-2008
(percent of GDP)



The results are striking. Following a rapid improvement of public finances through an ambitious consolidation program during the period from 1994 to 1998, the reformed budget process has contributed to maintaining a sound fiscal position, as indicated in Figure 1 and 2. The Government's and Parliament's control over the development of public finances has been greatly enhanced.

The effectiveness of the strict Swedish fiscal framework in general, and the fiscal targets in particular, in ensuring sustainable government finances is well established. A combination of a multiannual expenditure restriction and a target for general government net lending has proven to be an effective tool in controlling potentially destructive tendencies such as a fiscal illusion, a deficit bias and conflicting time horizons in public decision making.[3] In the context of the Swedish fiscal framework it is relevant to examine to what extent the restrictions on fiscal policy limit the possibilities of running countercyclical policies – both in terms of automatic stabilizers on the expenditure and revenue side of the budget, and in terms of discretionary fiscal policies.

This paper focuses on the conditions for stabilization policies in a strict fiscal framework, and puts forward some proposals for designing a balance target and an expenditure ceiling that will provide sufficient flexibility for countercyclical policies while maintaining fiscal discipline. The analysis is founded on cyclical

[3] For a comprehensive discussion of the existence of such characteristics of public decision making see, for example, Molander (2001).

Figure 2

General Government Net Lending, 1990-2008
(Budget Bill for 2007)
(percent of GDP)

situations that could be considered normal. Under a severe economic crisis, special clauses would have to be applied**.** The paper starts in Section 2 with a short overview of role of fiscal policy to stabilize the economy. Section 3 presents the Swedish fiscal framework. Section 4 discusses some of the problems with the surplus target. Countercyclical policies under the expenditure ceiling is the theme of Section 5. The paper ends in Section 6 with conclusions.

2 Fiscal Policy and Stabilization

A primary question in a discussion of whether or not countercyclical policy is constrained by strict numerical fiscal rules such as the ones applied in Sweden, should be to what extent stabilization policies are necessary or desirable. Unless there are convincing arguments for allowing government surplus and expenditure to vary with the cyclical variations, there is little reason to consider any trade-offs that have to be made between fiscal discipline and economic policy.

2.1 Arguments in favour of short term fiscal stabilization policies

Views on the need for and the possibility of stabilizing the economy in the

short and medium term have, as is well known, shifted substantially over the decades. In this paper we take a contemporary view as, for example, expressed by Andersen (2005). According to this position, fiscal policy can affect aggregate demand and, in this way, also the activity of the economy. By temporary discretionary changes in taxes and expenditures it is possible to support or dampen economic activity to smooth the cycle.

Demand-side arguments for fiscal stabilization policy are founded on the fact that economic activity is sub-optimal as a result of failures in price and wage adjustments. These effects of fiscal policy are independent of the factors determining the long run effects transmitted through the supply side of the economy. The scope for policies affecting aggregate demand is, however, dependent of the type of shock the economy is hit by. Important to point out is, moreover, that fiscal stabilization policy in this setting is only justified during the period in which the adjustment failure takes place.

Another case for countercyclical fiscal policy can be made on the grounds that a shifting composition of aggregate demand can stimulate economic activity.[4] In a dual economy in which one sector is open to international trade – tradables sector – and the other one is sheltered – non-tradables sector – there exists an alternative transmission mechanism for fiscal policy, even in situations where there are no adjustment failures. Changes in public consumption alter the ratio of demand for tradables to non-tradables. Even under the restriction of a balanced budget, the composition of demand, and consequently the general level of activity, will change.[5]

There may be yet another argument for government intervention to accelerate return to full-employment GDP levels. By relaxing the assumption of perfect capital markets, in which households can borrow against future income, the mechanisms through which Ricardian equivalence would eliminate the effects of fiscal policy may be ineffective. Liquidity constrained households will, in such situation, adapt their consumption and savings to changes in the tax system.

Stabilization policy can be seen as a form of insurance that dampens the effects of economic shocks on the income of individuals. Discretionary and temporary fiscal policy can in principle smooth production, employment and income. In that way, risk adverse individuals enjoy improved welfare. This mechanism is strengthened if there is heterogeneity among agents in the economy concerning their income and their position in the labour market.[6]

The effects of fiscal policy are not clear, and the range of the size of

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4 Andersen (2005), p. 516.

5 In the Swedish economic debate on stabilization policy prior to the referendum on adopting the Euro in 2003, fiscal policy measures effecting activity through composition effects played an important role. In particular, an *internal devaluation, i.e.* a balanced budget shift in payroll taxes and value added taxes, was seen as a possible, although far from complete, substitute to national monetary policy. See SOU 2002:16 and Calmfors (1998).

6 Lucas (1987) was an early critic of this view and claimed that welfare costs of the cyclical effects of incomes are marginal.

multipliers is wide. Hemming *et al.* (2002) conclude, by studying different macro models, that expenditure multipliers are in the range of 0.6 to 1.4 (one percentage increase in government consumption will increase GDP by 0.6 to 1.4 per cent). Tax multipliers are in the size between 0.3 and 0.8. These multipliers are of the same sign as old type Keynesian multipliers would suggest, but are substantially smaller.

2.2 Arguments against short term stabilization policies

According to theoretical and empirical knowledge about effects of temporary expenditure and tax changes given above, there could be scope for discretionary fiscal stabilization policy. However, in reality a number of obstacles make such policies difficult. An appropriate fiscal stance for stabilizing the cycle would as a background require substantial information about the economy – including forward-looking information – that finance ministries and their staff *de facto* do not have. In particular, some of the indicators used to guide fiscal policy, such as output gaps, structural balances and indicators of fiscal stance, are to a large extent uncertain, and their appropriateness as a basis for fiscal policy decisions could be questioned.[7] Other significant obstacles are the lags that characterize fiscal policy, more specifically information lags, decision lags and implementation lags. Further, at the time of decisions there are often uncertainty about the nature of economic shock and the extent to which shocks are permanent or transitory.[8]

Furthermore, there are also political economy aspects related to fiscal policy. Politically rational policymakers may conduct discretionary policies with a deficit bias in order to please the electorates. The objective of such behaviour could, for example, be to enhance chances of being reelected.[9]

In the case of Sweden there exists an additional reason why discretionary fiscal policy may have a limited role to play. The stabilization framework includes the national central bank (The Riksbank), conducting monetary policy aimed at price stability in a regime with a flexible exchange rate. The Riksbank's Executive Board makes its decisions on the instrumental interest rate independently from external influences. In this setting, monetary policy aimed at price stability indirectly affects production and employment, mostly in a countercyclical way. Such an argument for a modest use of discretionary policies does not, however, hold for national fiscal policy in regimes with fixed exchange rates or a participation in a monetary union.[10]

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7 See also Fischer and Boije (2006) for diverging calculations of structural balances for Sweden by different institutions and Hughes-Hallet, Katai, and Lewis, (2007) on the substantial differences between structural balances *ex ante* and *ex post*.

8 In the last years, uncertainty about the sustainability of positive productivity shocks has been in focus in the debate about the consistency with monetary frameworks of inflation persistently lower than inflation targets. Such debates has occurred both in Sweden and in Norway in the last years.

9 Kopits (2001).

10 SOU 2002:16.

2.3 Active countercyclical fiscal policy should be used with caution

In the end, the *pros* and *cons* of fiscal activism must be balanced against each other. The position in this paper is that, although there are arguments supporting activism, there are significant problems, something which calls for a cautious attitude. Consequently, discretionary fiscal stabilization policy should not be used in normal cyclical situations. In exceptional cases, when the economy is threatened by large unemployment, significant overheating, or when there is substantial inflation pressure, discretionary fiscal policy may have a role to support monetary policy and the automatic stabilizers.

3 The Swedish Fiscal Framework

The fiscal framework in Sweden is founded on three pillars – a) a surplus target for general government finances, b) a nominal expenditure ceiling for central government finances and c) a balance requirement for local governments. Through the fiscal targets, Parliament and the Government make an explicit commitment to long term sustainability of government finances, and are provided with instruments that enable them to make well-informed and conscious decisions on relevant fiscal parameters.

3.1 The surplus target

In order to ensure that an ageing population will not lead to deteriorating public finances, Sweden applies a surplus target for the general government sector, *i.e.* central government, the old-age pension system and the local government sector. According to the surplus target, the average annual net lending over a business cycle should correspond to 1.0[11] per cent of GDP. The rationale behind the surplus target is that government debt should be reduced for a period of 15-20 years before the strains on public finances, caused by a shifting age structure and a temporary higher dependency ratio, sets in. Surplus in the early years of this period will be offset in later years, and the ratio of government debt to GDP in 2000 is expected not to exceed the corresponding ratio in 2050, when the demographic challenge fades.[12] The long-term profile of consolidated gross debt under a surplus of 1.0 per cent of GDP for the period 2000-15 is illustrated by Figure 3.

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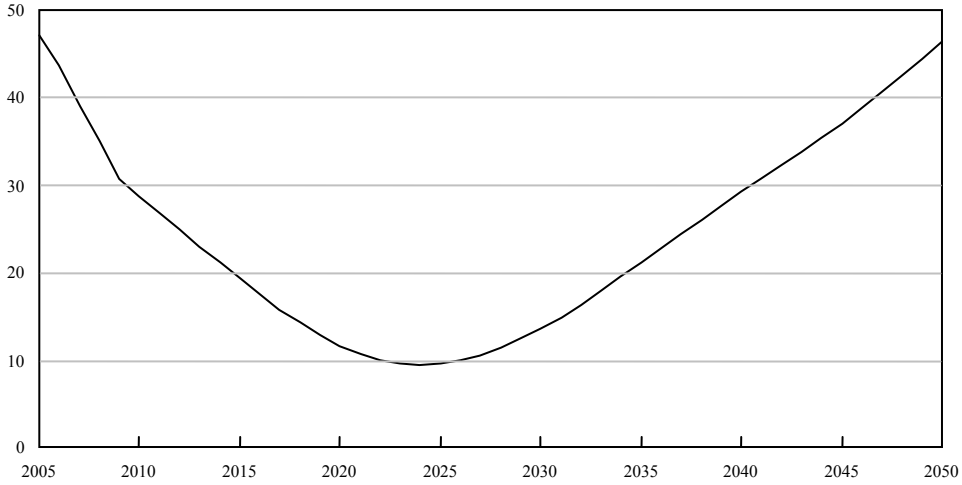
[11] In April 2007 the surplus target was reformulated from a surplus of 2.0 per cent of GDP on average over the cycle to a surplus of on average 1.0 per cent of GDP over the cycle. This was done as a response to Eurostat's decision that funded pension systems, such as the Swedish premium pension system, are reported in the household sector, rather than in the general government sector.

[12] For a thorough discussion on pre-funding versus structural reforms to manage demographic shifts, se Andersen (2006).

Figure 3

A Simulation of the Development of Central Government Debt 2005 to 2050 under a Surplus Target of 1.0 per cent of GDP Held up to 2015



Source: Swedish Updated Convergence Program, 2006.

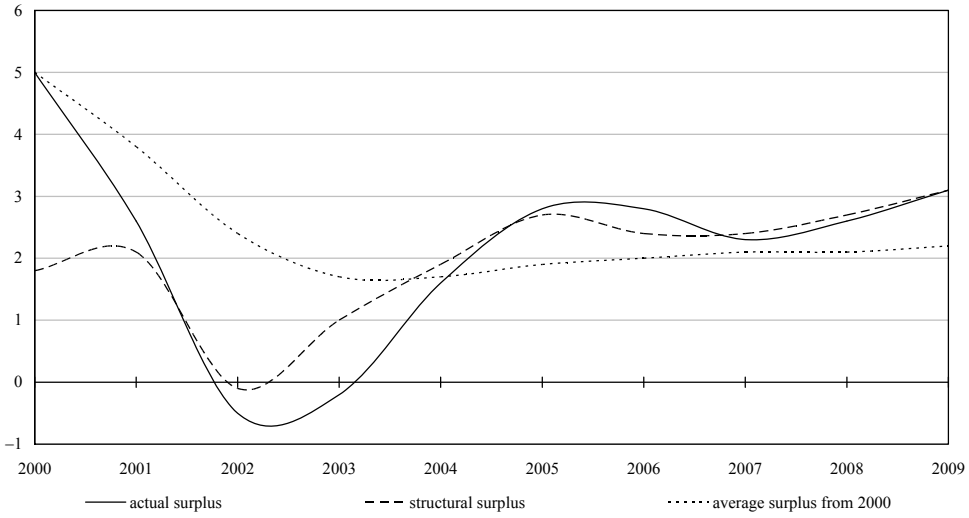
The surplus target is formulated in terms of an average over the business cycle. It is, consequently, fully in line with the target that the actual net lending for an individual year deviates from a level corresponding to 1.0 per cent of GDP. In this way, there is scope for allowing the automatic stabilizers on both the revenue and expenditure side of the budget to diminish net lending below the targeted average value. In addition to this, the formulation of the surplus target allows for discretionary expansionary fiscal policy, as long as there are compensating contractionary measures raising the average net lending to the required level during the same business cycle.

An obvious problem with allowing such large discretion to diverge from the targeted average is that actual policies may not to a sufficient degree be guided by the target. The possibility of offsetting future surplus may be used as an argument not to take full responsibility for the long-term impact of current policies.

One way of analyzing the consistency of the past, current and future policies with the surplus target is to look at the structural net lending. Unless the government actively pursues policies to accelerate a return to full employment, the structural surplus should be very close to the average targeted level, *i.e.* 1.0 per cent of GDP. In Figure 4 the actual, structural and average general government net lending for the period 2000-09 is presented. The figure is based on the definition of the public sector before the Eurostat's decision on funded pension systems, when the surplus target was lowered from 2.0 to 1.0 per cent of GDP.

Figure 4

General Government Net Lending 2000-09
(estimates for 2007 to 2009 are forecasts)
(percent of GDP)



Source: Budget Bill for 2007.

The fact that structural surplus consistently has departed from a level of 2.0 per cent of GDP clearly shows that the Swedish Government has been pursuing active fiscal policies for most years since the surplus target was introduced in 2000. Although the annual figures of the actual surplus have varied significantly over the years, the average figure – which is what is being targeted – has been brought back to a level corresponding to 2.0 per cent of GDP following the low surplus levels of the period 2002-04.

It is important to point out the perils of making structural adjustments of fiscal parameters. Any analysis, whether historical or forward looking, based on the non-observable concept of potential GDP is bound to be uncertain. This is the main reasons why the target is formulated as the average of the actual surplus over the business cycle, rather than in terms of structural surplus. The uncertainties associated with figures on the structural surplus also mean that the above analysis should be approached with some caution, especially for the forward looking period of 2007-09.

3.2 The Expenditure Ceiling

The Swedish fiscal framework is also founded on a multiannual nominal

expenditure ceiling for central government. The expenditure ceiling covers all expenditure on the budget together with the expenditure for old-age pensions, which is set up as an autonomous system outside the budget. The only expenditure that is excluded from the ceiling is interest payments on the government debt, since such expenditure, due to fluctuations in the interest rate and exchange rates, is volatile and outside the control of the Government. In addition, the Government has limited scope to influence the size of gross debt in the short term.

As a rule, the Government proposes, on a rolling basis, to Parliament an expenditure ceiling for the third additional year. This ceiling is constructed as a restriction on the outcome of expenditure, rather than a limit on budgeted or planned figures.[13] This naturally puts considerable pressure on the Government to make accurate projections for the development of expenditure, including an assessment of the impact of new expenditure programs. Since there is a ceiling not only for the upcoming fiscal year, but also for the second and third year, the Government also has to ensure that the medium-term outlook is consistent with previously determined expenditure ceilings. In addition, the Government has to monitor the development of ceiling restricted expenditure for the current year closely, and may be required to initiate measures to reduce expenditure in order to avoid breaching the ceiling.

The ceiling covers all items in the budget, except interest rates, including cyclically sensitive items such as unemployment benefits. It also covers entitlement programs such as health related benefits, student grants and child benefits. The ceiling is not adjusted due to an unfavourable development in these benefit systems. Since the ceiling is set in nominal terms, and not adjusted if inflation deviates from the level forecasted when the ceiling was initially proposed, there is an added degree of uncertainty that has to be managed. In order to absorb any increase in expenditure, the Government has to plan expenditure at a level lower than the ceiling. There is, consequently, a *budget margin* under the expenditure ceiling, which is an indication of the extent to which ceiling restricted expenditure can be augmented without the Government being forced to propose spending cuts. The size of the budget margin is not regulated, and the Government has to decide on the appropriate margin for the respective years, taking into account the degree of uncertainty in projected expenditure.

The expenditure ceilings enhance Parliament's and the Government's command over the size of the government sector. Through a decision on the total size of expenditure, largely separate from the process of evaluating expenditure proposals from various sector interest groups, decision making bodies are in a better position to ensure fiscal discipline. In addition, the expenditure ceiling is not affected by revised forecasts for revenue. Temporary high tax income cannot, hence, be used to expand expenditure, but would simply increase the surplus. The expenditure ceiling can, hence, work countercyclically in an economic upturn.

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[13] According to the Swedish Budget Act (1997:1059) the Government is required to take measures within its mandate or propose necessary measures to Parliament, if there is an indication that expenditure will exceed the ceiling.

3.3 Local self-government balance target

Local government, *i.e.* municipalities and county councils in Sweden is autonomous, with a constitutional right to decide on its own expenditure and to levy income tax on its citizens. Some 20 per cent of the revenue of local governments comes from grants on the central budget. In addition municipalities and county councils collect revenue from user charges. Local government is responsible for such areas as for primary and secondary education, child care, elderly care, local transport, public utilities and health care.

There is a legislated balance requirement on local governments. According to this, net lending is not allowed to be negative. In the case of under balanced finances, the municipality has to present a plan for consolidating its budget within a period of three years.

Accounting in the local self-government sector is on an accrual basis. In effect, this means that the balance target translates into a golden-rule requirement, *i.e.* net borrowing cannot exceed net investments.

3.4 The targets are interrelated

The three targets that make up the fiscal framework in Sweden are mutually supportive, and complement each other. The surplus target aims at ensuring that the overall fiscal position is sustainable over the period when the demographic composition changes. It should, therefore, be seen as a guide to medium to long term fiscal policy in terms of the relationship between revenue and expenditure. The surplus target is, however, problematic to use as an operational guide to the annual preparation of the central government budget. Firstly, net lending is the sum of revenue and expenditure – typically two large variables which are difficult to accurately forecast. In the case of Sweden, the surplus target has been defined as an average over a business cycle, and is not defined in terms of the annual surplus.[14] Secondly, the concept of net lending may not be ideal for enforcing compliance with the target. Incentives to respect a fiscal target are to a large extent related to the political costs associated with non-compliance. From this perspective, it is important that there is a wide understanding of the conceptual construction of the targeted parameters, and such a criteria may not be fulfilled for the surplus target. Furthermore, net lending is presented with a certain time-lag, and is typically revised for some time after the fiscal year. This complicates verification on an annual basis.

The surplus target aims at maintaining sustainable public finances, and is in this respect the key fiscal target in the framework. However in terms of actual impact on the Government's policies, and the amount of attention received in the

[14] For the period 2003 to 2007 the Government proposed annual targets for net lending. These targets could deviate from the medium term target, with a reference to the cyclical situation in the labour market. However, poor experiences from this prompted the Government to propose abandoning the use of annual targets for net lending prompted in the Spring Fiscal Policy Bill for 2007.

political debate and mass media the expenditure ceiling is the central target. This should not, however, be interpreted as there being an internal hierarchy in the fiscal framework. The significant focus on the expenditure ceiling is probably explained by the fact that it is an intuitively comprehendible concept, that it can be easily monitored and almost instantaneously evaluated, and that it has a direct impact on the process for preparing the Government's budget proposal. In order to ensure that policies are consistent with the surplus target, the expenditure ceiling has to be set at a level generating the required net lending, given projected revenues. There is, hence, a link between the surplus target and the expenditure ceiling. Since the surplus target is formulated for general government net lending according to ESA 95[15] and the expenditure ceiling for central government expenditure – which is on an accounting basis that differs from that of net lending – it is necessary to make adjustments before a targeted surplus can be transformed into a nominal expenditure ceiling.

There have been discussions, both nationally and internationally, about certain features of the fiscal framework.[16] The definition of the surplus target has been claimed to be unclear, which has made *ex post* evaluation difficult. The surplus target was for some years not met *ex ante*. The expenditure ceilings have to some extent been circumvented by the use of tax expenditures and by other accounting measures. Finally, the budget margin has not been sufficiently large to absorb cyclically-induced expenditure increases and random variations of expenditure around the structural level. This has focused on the question if the expenditure ceilings in practice have fostered pro-cyclical policies.

4 The surplus target and cyclical variations

As described above, the Swedish surplus target is formulated in terms of an average over the business cycle. There is, hence, full flexibility for countercyclical fiscal policies through automatic stabilizers. In addition to this, the surplus target gives room for discretionary fiscal policies, albeit with the restriction that expansionary policies should be counteracted by contractionary fiscal policies of the same size in other years during the same cycle. The flexible mechanism for automatic stabilizers is relatively uncomplicated, while sound discretionary fiscal policies are demanding to achieve, and could be undermined by time-inconsistent behavior.

4.1 The target as an average over the cycle

The problem with the formulation "on average over the cycle" is that there

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[15] European System of National Accounts.

[16] References: IMF (2005), EU Commission (2005), Hansson-Brusewitz and Lindh (2005), Boije and Fischer (2006) and the National Audit Office (2006).

exists no exact definition of the cycle. A forward looking, *ex ante*, determination of the length of the business cycle requires information that is not available, as discussed briefly in Section 2. Even historically the exact length of the business cycle may be open to interpretation. This ambiguity with regard to the length of the cycle constitutes an obstacle for the verification of the surplus target.

In the Swedish case, the economy in early 2007 probably has not elapsed through a full cycle since the surplus target was introduced in 2000. As seen in Figure 4 above, the *ex post* average of net lending 2000-06 is 2.0 per cent of GDP, and is expected to increase somewhat in the upcoming years. In spite of this encouraging result, it is important to emphasize the difficulties in determining whether or not net lending for individual years or periods within a business cycle are consistent with the surplus target.[17]

The definition of the surplus target clearly exposes the trade-off between firmness and flexibility in the Swedish fiscal framework. The surplus target is flexible enough to give room for countercyclical policy. At the same time it supports a fiscal policy aimed at long-term sustainability. But, is there an appropriate balance between the two?

4.2 Indicators of ex ante *evaluation of target fulfilment*

Conceptually, the surplus target could be defined as a cyclically adjusted, or structural, balance (CAB). With fiscal policy being limited to the automatic stabilizers, the surplus target of 1.0 per cent of GDP on average over the cycle is equivalent to a target for CAB of 1.0 per cent of GDP for each year. In other words, a CAB of 1.0 per cent of GDP is a sufficient but not necessary condition to comply with the surplus target. If, however, fiscal policy also includes some discretionary measures a CAB that varies around 1.0 per cent of GDP in such a way that it on average over the cycle is equal to 1.0 per cent of GDP, is also consistent with the overall target. A CAB varying around its targeted value has been the situation in Sweden for the period 2000-06, as seen in Figure 4 above. Expansionary policies have, however, been balanced by contractionary measures at other times.

In practice, there is no consensus on how to measure CAB. Boije and Fischer (2006) show that different institutions – the EU Commission, the European System of Central Banks (ESCB), the National Institute of Economic Research (NIER) and the Swedish Finance Ministry – all use different methods to calculate CAB for Sweden. These institutions come to surprisingly different results. On average, over the period 2000-05, ESCB calculates a low CAB of 1.3 per cent of GDP. According to this estimate, it is unlikely that the surplus target was fulfilled during that period. NIER, on the other hand, calculates over the same period a CAB

[17] During the period 2000-06 some positive one-off effects have affected net lending, among them unusually strong revenue from capital taxes and corporate income taxes.

Table 1

Averages of Net Lending for Different Time Periods in Budget Bills for 2003 to 2007

	Budget Bill 2003	**Budget Bill 2004**	**Budget Bill 2005**	**Budget Bill 2006**	**Budget Bill 2007**
5 years	2.3	1.3	0.6	1.6	2.7
7 years	2.5	1.3	0.7	1.1	2.5
9 years			1.4	2.0	1.8

Note: The averages are a combination of current, forward and backward looking years. The five and seven year averages are symmetrically forward and backward looking. The 9-years average consists of three forward and five backward looking years.
The averages for net lending are calculated including savings in the funded pension system. Hence, the figures should be compared to the old 2.0 per cent target.

reaching 2.4 per cent of GDP average.[18] A further problem with CAB is that there are often substantial revisions *ex post.* This problem has been discussed by Hughes-Hallet, Katai and Lewis (2007). They find the revisions *ex post* partly depend on revisions of the output gap and partly of revisions of net lending figures. As a conclusion they see problems of using CAB as indicators for fiscal surveillance.

Alternative indicators of fiscal policy and evaluation of surplus target compliance are averages of net lending over time periods within a business cycle. Such indicators are, however, not without problems. First, as discussed above, there are difficulties in defining a cycle. Second, it is an open question whether or not these averages should include both *ex ante* and *ex post* data. In Table 1 various options of averages of net lending, expressed as a ratio to GDP, are presented. The current cycle of the Swedish economy could roughly be assessed to have a length of 8 to 10 years.[19] The averages in the table are somewhat shorter, and are calculated so that the years t, t+1,…, t+3 are forecasts while the other years, *i.e.* t–1, t–2, t–3…, are *ex post* outcomes. The rationale for the forward-looking period of three years is that the medium-term fiscal framework in Sweden has that time horizon.

It is not possible to find perfect indicators for evaluation and surveillance of the surplus target, and consequently for guidelines for stabilization policy in a fiscal framework. To handle this problem a set of indicators could be used. In this paper, the view is taken that support for long-term sustainability is of significant importance, and a particular indicator should be chosen as the *leading indicator,* while a set of other indicator could give support to the evaluation of target compliance. In the Swedish case an average of a combination of *ex ante* and *ex post*

[18] These figures should be compared to the old 2.0 per cent target.

[19] Own calculations.

data could be such a choice. This could support fiscal policy to be directed towards long-term sustainability and to avoid pro-cyclical policies.

4.3 Supporting targets

The surplus target does not fully preclude the use of pro-cyclical policies. The target can in principle be fulfilled with small surpluses in good times and strict policies in economic downturns. Such a pro-cyclical policy, which gives rise to negative efficiency and welfare effects as discussed in Section 2, should naturally be avoided. For these reasons, there are arguments for a guiding intermediate annual target to support the overall target. It is of course possible to formulate a formal rule determining a target for the next year's net lending. Such a rule could be used for the Government's proposals for budget policy in Budget Bills, and it could as arguments include both the net lending position compared to the overall target and the cyclical position of the economy.[20]

Another possibility is to issue guidelines such that in normal cyclical situations, characterized by small deviations from full recourse utilization (for instance small GDP gaps), the position of the surplus related to the overall target should be the leading guide for fiscal policy. This could also include guidelines for the speed of adjustment towards the overall target over a specified forward looking time period. If the economic situation threatens to be more severe, with high unemployment or high inflation pressure, the cyclical situation should have stronger weight for the guidance of fiscal policy.

Supporting targets of these kinds could be elaborated further. However, the position taken in this paper is that intermediate targets of this type, used to guide short term fiscal policy, are very difficult to implement in practice. Forecasts on net lending depend on forecasts on tax receipts. The experiences from the last decade is that especially capital tax receipts are very volatile and problematic to forecast and, hence, affects the accuracy of net lending forecasts. The alternative to this type of annual targets is to see the surplus target in the medium term perspective, as it is formulated. In the Swedish system the fulfilment of the surplus target leans heavily on the fulfilment of the expenditure ceilings. A clear principal for how the level of the expenditure ceilings are determined, and how the surplus target is taken into account in the calculation, is therefore very important.

5 Countercyclical policies under the expenditure ceiling

The multi-annual expenditure ceiling has proven to be a very effective tool to ensure fiscal discipline. The political significance of complying with this fiscal

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[20] Such an annual target has been in effect in Sweden since 2002. The experience with the annual target has, however, been disappointing. Serious questions can be raised as to the impact the annual targets have had on fiscal policy.

target in Sweden is considerable, and presently it does not seem likely that any government would be prepared to breach the ceiling. An indication of this is the expenditure reducing measures that have repeatedly been imposed at times when fiscal forecasts have indicated that there is a risk of exceeding the expenditure ceiling.[21]

An important feature of the expenditure ceiling is that it can restrain pro-cyclical pressures in good times. Since the expenditure ceiling is set well in advance of the start of the budget year – typically at a time when there is no macroeconomic forecast of the cyclical position of the economy for that year – it does not take into account any temporary revenue effects. Deviations from the structural revenue growth, or the effect of one-off events on government revenue, will neither warrant higher nor lower expenditure levels. Higher than expected revenue will, in the short term, lead to a larger central government budget surplus, and to a higher general government net lending for that year. Conversely, lower revenue will cause net lending to decrease below its long-term level. Such variations are fully in line with the construction of the surplus target, which is formulated as an average over the business cycle. Worth noting is that these short-term effects on net lending, when the expenditure ceiling is a preset factor, comes through government revenue rather than government expenditure.

To a large extent, this analysis is appropriate in the sense that the main impact on government finances that stems from cyclical deviations from full-employment GDP levels is on the revenue side of the budget. It is estimated that the automatic stabilizers in Sweden work with ¾ on the revenue and only with ¼ on government expenditure. Although the most significant effect is on revenue, it is worth considering to what extent the expenditure ceiling is an obstacle to passive and active fiscal stabilizations policies in economic downturns, and how temporary variations in expenditure can be managed in a system of multi-annual nominal expenditure ceilings. The necessity of making this analysis is strengthened by the fact that apart from the cyclically-induced variations of expenditure around a trend expenditure level, there are other factors causing uncertainties about the actual expenditure outcome.[22]

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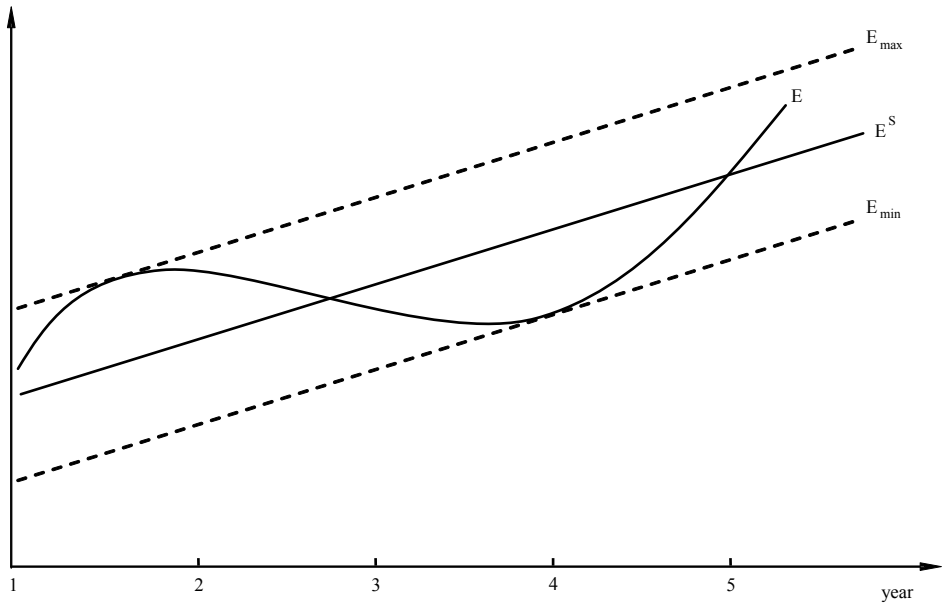
[21] These measures have been of different character. In some cases, the Government has introduced measures reducing expenditure through cuts in programs. For example, there were over-the-board reductions of administrative appropriations in 2003 and 2005 of 0.72 and 0.6 per cent respectively. More frequently, selected expenditure has simply been deferred to another fiscal year. Since the accounting of ceiling restricted expenditure is cash-based, the postponement of a payment reduces pressure on the ceiling for current year – but increases expenditure in the following year. A somewhat more disturbing development has been a growing tendency to resort to net-budgeting of user-fees and various kinds of tax expenditure and tax credit schemes. Such measures reduce accounted expenditure, but have no effect on net lending. For a discussion on the incentives to resort to one-off measures and creative accounting under a system of fiscal rules see Koen and van den Noord (2005).

[22] The expenditure of all transfer systems are covered by the expenditure ceiling. An increase in the number of individuals eligible for health related entitlements or child-care benefits has to be absorbed under the ceiling. In addition, government agencies have a certain ability to both transfer unspent appropriations to the following fiscal year and to borrow against future appropriations. Such carry-over facilities mean that expenditure outcome, which is what is restricted by the ceiling, can deviate from the level of appropriations. Finally, the ceiling must be able to absorb pure forecasting errors.

Figure 5

Cyclical Variations of Expenditure



A stylized illustration of the variations around an expenditure trend is given in Figure 5 above. The figure shows nominal expenditure outcome E for the structural level resulting from stable policies E^S in a scenario where actual GDP varies symmetrically with a given oscillation around a trend-GDP level.[23]

5.1 Managing cyclically-induced expenditure variations with a budget margin

The fundamental idea behind the concept of an expenditure ceiling is that there is an inherent pressure to increase government expenditure in public decision making, and that this tendency can be balanced by institutionalized fiscal restrictions.[24] By setting the level of expenditure in advance of the start of budget negotiations – and preferably based on available resources rather than expenditure

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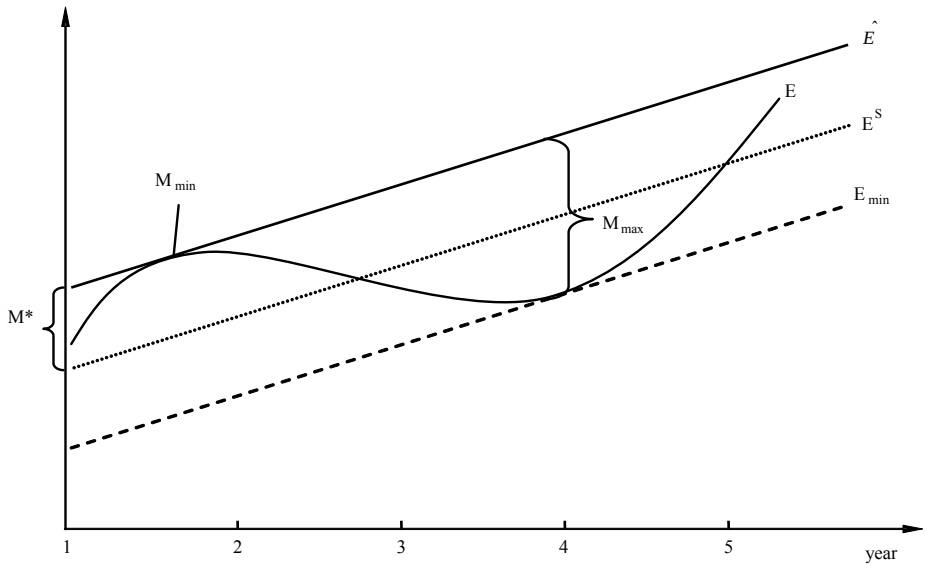
[23] The assumption of unchanged policies can be relaxed without changing the conclusion. The analysis in this section is based on an assumption that deviations from trend-GDP have a maximum limit, in the figure given by E_{max}. In essence, this is a question of determining the degree of certainty with which actual events will fall within the range of expenditure levels assumed to be necessary for stabilization policies, *i.e.* below the level of the expenditure ceiling.

[24] See, for example, Kopits and Symansky (1998).

Figure 6

Expenditure Ceiling with a Budget Margin



ambitions – the necessity of prioritizing between various policy options becomes evident, and overall fiscal discipline is facilitated. As discussed above, however, there are strong arguments to allow for expenditure variations to countercyclical variations in the economy and to ensure an effective implementation of government policies. These opposing perspectives have to be reconciled, and a balance between firmness and flexibility found.

One possibility of solving the need to allow for temporary variations of expenditure is to plan expenditure at a level below the expenditure ceiling.[25] Such a system of a *budget margin* is illustrated in Figure 6 above.

In this figure, the structural expenditure level considered consistent with fiscal sustainability[26] is given by the dotted line E^S. For reasons given above, actual expenditure outcome will fluctuate around this structural level, as illustrated by the

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[25] A system with an institutionalized budget margin was proposed by the Government Commission "Evaluation and further Development of the Budget Process", SOU:61, Stockholm 2000 (in Swedish with a short summary in English).

[26] In the case of Sweden, this would be interpreted as the level of expenditure that, given the level of revenue, would generate general government net lending in line with what is necessary to achieve an annual average of 1.0 per cent of GDP.

curve E. In order to avoid exceeding the expenditure ceiling $\hat{E}$ there is a budget margin M between planned – or structural – expenditure and the ceiling.

The budget margin can be interpreted in three ways, all relevant to the analysis. The first concept of a budget margin is the confidence interval for expenditure development for a particular structural level of expenditure. Based on an analysis of the sensitivity of expenditure to variations in the GDP level, it is possible to determine a budget margin, which – given the risk the Government is prepared to take that actual expenditure falls outside this range – will absorb expenditure levels above the structural level. In Figure 6 this *ex ante* notion of the budget margin is set at M^*.

A second interpretation of the budget margin is the relationship between the *ex post* outcome of expenditure and the expenditure ceiling. Variations in the expenditure level will lead to differing budget margins, assuming that any room under the ceiling is not immediately committed to new activities and programs, as discussed below. In Figure 6, the expenditure outcome results in margins from $M_{\min} = 0$ to $M_{\max} = 2 \times M^*$.

A third interpretation is the *ex ante* difference between forecasted expenditure and the expenditure ceiling. At the time the expenditure ceiling is set for the third additional year, this notion of the margin should be equal to M^* since projected expenditure will be equal to structural expenditure.[27] At the end of the current year, the forecasted margin will approach the *ex post* margin. In between these periods, however, the forecasted budget margin can fluctuate significantly, reflecting the constant reassessments that are made of the macroeconomic and fiscal development. In particular, a small – or even a negative – margin is an indication of an unsustainable expenditure development requiring government interventions.

5.2 A budget margin may introduce an expenditure risk

An institutionalized *ex ante* budget margin can be used to manage uncertainties in expenditure development in a system with a hard nominal limit on expenditure outcome, such as the expenditure ceiling used in Sweden. The construction of a budget margins recognizes that temporary variation around a structural expenditure level are likely to occur, and that these should be allowed for macroeconomic reasons and to ensure efficiency in the public administration. The purpose of the expenditure ceiling is to control the long-term – or structural – expenditure level, not temporary fluctuations.

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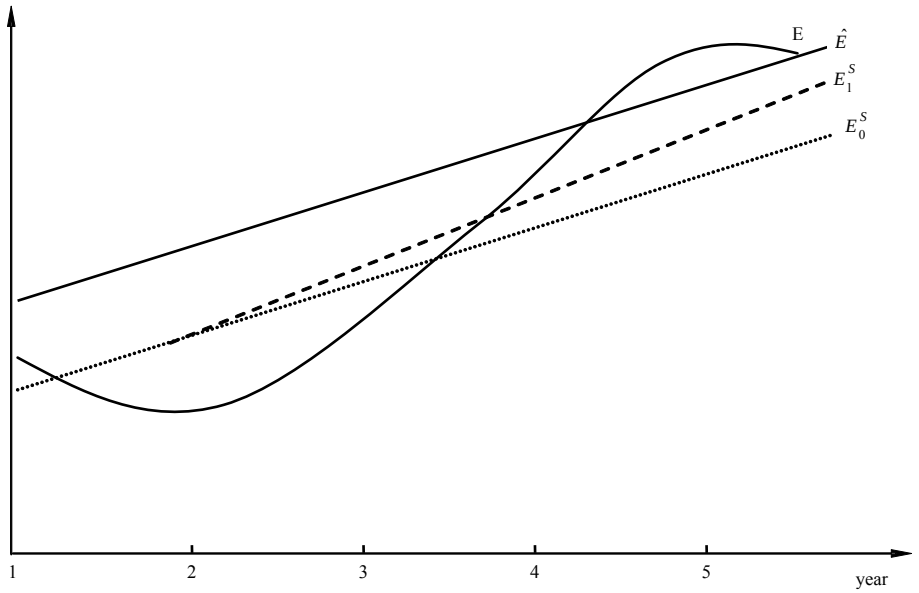
[27] In general, there is no forecast of the cyclical position of the economy in this perspective, given the uncertainties associated with such a time-horizon. Consequently, the base-line assessment of expenditure should coincide with the structural level of expenditure.

Figure 7

Expenditure Risk with a Budget Margin



It is not, however, evident how to decompose expenditure into structural and temporary factors. For this reason, there is – with the added degrees of freedom given by a budget margin – a risk of misjudging to what extent actual expenditure is consistent with the desired and sustainable level.

Apart from the problem arising because of imperfect information, a significant budget margin may be inconsistent with assumptions regarding public decision making. If a medium-term restriction is considered necessary in order to control short-term pressure to increase expenditure beyond a sustainable level there will be a significant risk that the budget margin will be abused. The flexibility set aside to absorb temporary increases will instead be used to expand permanent expenditure. Such a development can be illustrated by Figure 7.

In this situation, there is a significant room under the expenditure ceiling in year 2. This is misinterpreted – intentionally or unintentionally – as grounds for expanding government policies. Instead of continuing along the path of sustainable expenditure levels given by E_0^S there is a shift to a new path given by E_1^S. In the following cyclical downturn, the budget margin is insufficient to absorb the increased expenditure and the ceiling will be exceeded unless expenditure cutting measures are initiated.

The above picture describes well the development of government finances in Sweden in the early years of this decade. Strong pressures to expand existing policies resulted in small budget margins for the upcoming period. In the economic downturn in 2001–04 there was insufficient room to allow for growing expenditure for labour market policies, and the government had to initiate expenditure reducing measures. In addition to this, the pressure on the ceiling lead to some dubious accounting practices, and the introduction of measures financed by tax expenditure.

5.3 Institutional preconditions for a budget margin

The above situation highlights the fact that fiscal rules in no way eliminate the underlying forces that put an upwards pressure on public expenditure. In order for these arrangements to result in the desired outcome, attention has to be given to a broader institutional context consisting of accounting conventions, verification mechanisms and independent monitoring. In particular, an institutionalized budget margin that allows for temporary variations in expenditure requires an additional restriction on its use.

An important restraining factor for an inappropriate use of the budget margin is a full presentation of the composition of *ex ante* budgeted and planned expenditure and *ex post* outcome in relation to the expenditure ceiling. Through a high level of accountability with regards to the use of the budget margin there will be disincentives for the Government to commit the added flexibility under the ceiling for unintended purposes.

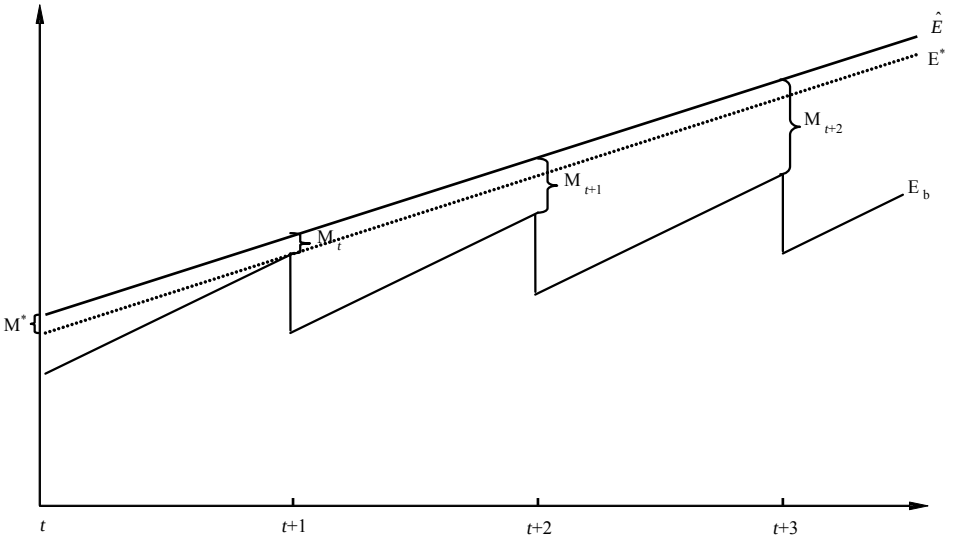
Full disclosure of the composition of government finances facilitates an evaluation of the performance in relation to the target as expressed by the expenditure ceiling. Information on the amount of resources allocated to cyclical expenditure is, however, only meaningful if set in relation to the state of the economy. Apart from the Government's forward looking assumptions and historical analysis of the macroeconomic development, it is valuable with independently produced forecasts, which can provide a second opinion on the necessity to allow for expenditure above or below the structural level.

5.4 An alternative model

The model outlined above assumes that it is possible to manage a significant budget margin, and that a situation where expenditure increases beyond what is sustainable in the longer run can be avoided. Alternatively, the cost of not being able to ensure complete fiscal discipline is considered to be less than the cost of not being able to pursue a countercyclical policy in an economic downturn. Such a stand is, however, not uncontroversial. Considering the severe fiscal imbalances experienced by many European countries in general and Sweden in particular, the importance attached sound public finances, and consequently the acceptable cost of enforcing expenditure discipline, may both be high.

Figure 8

A System with a Minimal Budget Margin



If fiscal discipline is seen as the primary objective, it may be desirable to avoid the flexibility introduced by introducing expectations of a significant *ex post* budget margin on average. Instead, it may be prudent to aim for a minimal discrepancy between expenditure outcome and the expenditure ceiling. Recognizing that it is still necessary to have a certain room for unexpected events, it is possible that the budgeted or planned level of expenditure is lower than the ceiling. The Government is, however, allowed to use any room under the ceiling not required for unexpected expenditure increases. Such a model can be illustrated by Figure 8.

This figure shows the outlook for an upcoming three year period at the start of the current fiscal year *t*. The only requirement in this model is that the budget margin, *i.e.* the difference between budgeted or planned expenditure E_b and the expenditure ceiling $\hat{E}$ at the end of the current fiscal year M_t should not be less than a certain preset value M^*, e.g. 0.5 per cent of the expenditure ceiling.[28] It may, however, be necessary for the Government to take into account the fact that future uncertainties about the expenditure development will be even larger, and therefore plan for budget margins for the outer years in the medium-term perspective that are larger than M^*. In the figure this is illustrated by the planned margins for *t*+1 and

[28] Naturally, the expenditure outcome cannot exceed the expenditure ceiling.

t+2, where $M_{t+2} > M_{t+1} > M^*$. It also becomes obvious that the Government has to plan expenditure reductions for future years in order to ensure that uncertainties can be managed under the expenditure ceiling. Such stop-and-go approach is not the most effective approach in public expenditure management, but may be considered a reasonable price to secure fiscal discipline.

6 Conclusions

The fiscal framework in Sweden has proven to be an effective tool in ensuring sustainable finances. The medium-term restrictions on net lending and central government expenditure, together with the balance requirement on local governments, have contributed to a strong fiscal position, and a promising prospect for meeting future strains from a shifting age structure of the population. With the restrictions on fiscal policy given by this framework, it is of interest to analyze to what extent the possibilities for countercyclical fiscal policies – dampening the variations in production and unemployment – are circumscribed in Sweden. Such a question is of particular interest given Sweden's historically high ambitions to curb unemployment.

In the economic literature, concern has been raised about the possibilities of conducting effective countercyclical policies. However, recent studies have given new fuel to the argument that fiscal policies can play a role in diminishing the welfare loss from temporary deviations from full employment levels of GDP. These studies emphasize imperfections in capital markets, the effect of expectations and adjustment paths. The view of this paper is that fiscal rules must allow for countercyclical fiscal policies. Such policies should, however, be limited to the automatic stabilizers unless the economy is hit by an exceptional shock, causing a significant deviation from full employment GDP. In such a case discretionary measures can be considered. Fiscal rules that contain enough flexibility to allow for severe imbalances will, however, hardly be restrictive enough in normal circumstances.

The Swedish surplus target is formulated for the annual average of general government net lending over a business cycle. There are, consequently, complete possibilities of conducting expansionary fiscal policies that reduce net lending for individual years as long as there is a corresponding higher-than-the-targeted average in other years during the same cycle. Such flexible definition requires instruments for verifying to what extent fiscal policies for an individual year is in line with the surplus target. The use of structurally adjusted net lending, *i.e.* CAB, could serve the role of such an indicator. Given the considerable uncertainties associated with this variable, especially for forward looking years, a CAB is not a suitable instrument to confirm compliance with the target. A second option is to use an average net lending based on both backward looking and forward looking years. In the case of Sweden, such an average could include a total of seven to nine years, consisting of the forecast for the three forward looking years in the medium-term framework (t+1, t+2

and *t*+3), a forecast for current year (*t*) and the outcome for three to five backward looking years This average could be adjusted to give more weight to years close to the current year. A third option for verifying compliance with the surplus target and to guide fiscal policy in the short term is an annual target based on a more complex analysis of the justified fiscal policy than a simple CAB. However, such an intermediate target would be difficult to implement in practice.

The construction of the multiannual expenditure ceiling does not explicitly give any room for countercyclical fiscal policies on the expenditure side of the budget. Depending on the relationship between the ceilings and budgeted and projected expenditure, there may not be sufficient room for allowing increased expenditure in an economic downturn. Such a problem can be remedied by ensuring a margin under the ceiling, which can absorb unexpected increases in ceiling-restricted expenditure. With the explicit introduction of a budget margin, however, it becomes necessary to consider the relationship between the ceiling and targeted structural expenditure level. Assuming that it is possible to preserve a margin not required by temporary expenditure variations, the ceiling could be set at a level higher than targeted expenditure level. On average over the cycle, this margin would not be used. Such a construction is, however, not consistent with an assumption of the existence of a short term fiscal illusion and a deficit bias. An alternative solution is, therefore, to set the ceiling at the level of targeted expenditure. A margin that can absorb unexpected expenditure increases is created by a successively decreased level of expenditure in the medium term. In this model, any unutilized room under the ceiling can be used for new reforms, given that the medium-term expenditure profile allows for a sufficient margin.

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THE CYCLICAL RESPONSE OF FISCAL POLICIES IN THE EURO AREA – WHY DO RESULTS OF EMPIRICAL RESEARCH DIFFER SO STRONGLY?

Roberto Golinelli[*] *and Sandro Momigliano*[**]

Whether discretionary fiscal policies in industrialized countries act counter- or pro-cyclically and whether their reaction is symmetric or asymmetric over the cycle are still largely unsettled questions. This uncertainty perdures when attention is restricted to euro-area countries, where these questions have important implications for the debate on European fiscal rules. We review the most recent empirical literature on these issues to try to understand why the results of the various studies differ so strongly. We find that differences are partly driven by the choices made in modelling fiscal behaviour. Results are also affected by a technical decision (whether or not controlling for common factors with time dummies) and by the selection of the data source and its vintage (ex post and real-time information). The choice of the time period seems relatively less important but we observe, contrary to other findings, a tendency towards pro-cyclicality when the sample moves forward, excluding the most distant years and including the most recent ones. Overall, we conclude that, with ex post information, the notion of pro-cyclical fiscal policies often upheld in the debate is not justified by the data, which tend to suggest either acyclicality or weak counter-cyclicality. If we use real-time information, we find clearer indications of counter-cyclical behaviour, especially if we progress from a very simplified "core" model to a more complex one, including at least the impact of fiscal rules. As for symmetry or asymmetry, we find that the answer varies across sources of data and time periods. When we move to a more complex model, indications of asymmetric behaviour are more robust. Whenever asymmetry is present, it entails shifts in all the parameters of the fiscal rule and not necessarily in the output gap parameter.

1 Introduction

Whether discretionary fiscal policies in industrialized countries act counter- or pro-cyclically and whether their reaction is symmetric or asymmetric over the cycle are still largely unsettled questions. They are important for a variety of reasons. First, answering them would enhance our understanding of past developments and, more generally, of macroeconomic fluctuations, with potential implications on the debate concerning the right model to account for them. Second,

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The opinions expressed do not necessarily reflect those of Banca d'Italia.

clarifying the actual behaviour of governments would represent a useful reference point for the theoretical debate, which is on-going since at least the Thirties but has become intense in recent years, on the need and scope for counter-cyclical stabilization policies. Finally, these answers represent a necessary starting point for proposals concerning fiscal rules and institutional reforms. The latter point is particularly relevant in the European context, where fiscal policy remains the only instrument against asymmetric shocks, since the use of monetary and exchange rate policies is no longer an option for individual countries.

Over the last decades, several empirical works have analysed the behaviour of budgetary policies over the cycle in industrialized countries. Focusing on relatively recent works and excluding studies concerned with individual economies, we reviewed a group of 21 studies, all either assessing the fiscal behaviour of EMU countries or presenting results for a group of countries where EMU countries are prominent.[1] While many studies conclude that policies tended to be pro-cyclical, there are almost as many pointing to acyclicality and a few suggest that policies were counter-cyclical. Furthermore, little consensus seems to exist on whether the behaviour has been symmetrical over good and bad times.

We then restricted our analysis to a more homogeneous subset of 12 studies that share the following characteristics: they include the output gap *in levels* as indicator of cyclical conditions and they measure discretionary policies (implicitly or explicitly) on the basis of the change in the cyclically adjusted primary balance.

On the basis of the first condition, we excluded from our analysis 7 studies[2] that include growth or similar measures (change in the output gap, difference between growth and trend growth) as indicators of cyclical conditions. The choice of the output gap *in levels* focuses on whether the position of the economy is above or below its trend (potential) level and on its distance from it, while the reference to growth or similar measures focuses on whether the economy is in an upturn or in a downturn and its intensity. It is outside the scope of this paper to judge which cyclical indicator is preferable.[3] We restricted our attention to the first group of studies as they represent the majority view in the literature on this issue.[4] On the basis of the second condition we excluded two studies,[5] which rely on a different concept of discretionary action.

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1 We restricted our attention to the studies that focus on industrialized countries. The prominent role of EMU countries in the samples is also a reflection of the availability of the data.

2 Fatás and Mihov, 2003; Hagen, Hallett and Strauch, 2002; Hallerberg and Strauch, 2002; Lane, 2003; Melitz, 2000; Mink and De Haan, 2006; OECD, 2003.

3 Both indicators carry useful information. In our opinion, they largely complement each other.

4 The literature on the cyclicality of US budgetary policies generally focuses on the output gaps in levels or on similar indicators (Auerbach, 2002; Bohn, 1998; Cohen and Follette, 2003; Taylor, 2000).

5 Buti and van den Noord (2004) construct an indicator for discretionary policies which aims to control for errors in forecasting. Giuliodori and Beetsma (2006), in a paper largely devoted to gauge the relevance of fiscal policy interdipendence in the European Union, estimate a fiscal rule that uses real-time data for the regressors. Concerning the dependent variable, instead of focusing on the effects of actual policies (proxied by the change in CAPB measured *ex post*) the authors point out that the latter are "polluted" with

(continues)

Even this set of 12 studies shows results that fully span the range of positions expressed in the whole literature. Table 1 reports, for each of these 12 studies, the indication concerning the sign and the symmetry of the reaction of discretionary policies to cyclical conditions and some characteristics of the specific regression we refer to.

There are many factors which could plausibly explain the differences in the results. The studies differ in several respects: the model of policy decisions used, the estimation procedures, the countries included in the sample, the periods of time analyzed, the sources of data (including different vintages of data from the same source).

In this paper we try to disentangle the relative role of these factors. However, we do not examine the role of slight variations in the specific countries included in the different samples. We base our analysis on data for a group of 11 EMU countries (only Luxembourg and Slovenia are excluded for lack of data).[6]

In Section 2 we assess the impact of the different choices in modelling fiscal behaviour. Abstracting from a number of specific characteristics pertaining to the individual analyses, in the 12 studies we find three basic specifications of the fiscal policy reaction function. We show that these three fiscal rules – which include among regressors only the initial conditions of public finances (debt and deficit) and the output gap – determine non negligeable differences in the estimates of the coefficient of the output gap. Compared to the first model, which is used in most empirical studies, the second one suggests a more countercyclical behaviour. The difference can be attributed to different notions of fiscal policy cyclicality embodied in the two fiscal rules. In the case of the third model, where the dependent variable includes the effects of both the fiscal policies and the automatic stabilizers, two alternative concepts of discretionary policy cyclicality are possible that lead to drastically different interpretations of the policy behaviour on the basis of the estimated parameter.

In the following Sections 3 and 4 we focus on the first model.

In Section 3 we examine the impact of varying time periods, sources and types of data (real-time or *ex post*) on the estimates of the fiscal reaction to cyclical conditions. We estimate rolling regressions with a fixed 15-year window over the period 1978-2006 for four alternative datasets: three of them are based on *ex post* data sources (OECD, AMECO, OECD data for primary deficit and debt with Hodrick-Prescott filter estimates of the output gap), the fourth dataset is largely based on real-time data (taken from Golinelli and Momigliano, 2006) and is available for the reduced 1988-2006 period. Results show that the different data

the reactions to events that take place after the budget is finalized and focus on government plans (proxied by the OECD forecast one-year-ahead for the CAPB).

[6] In Golinelli and Momigliano (2006) we find that the fiscal behaviour over the cycle of the group of OECD countries outside EMU for which data of sufficient time length are available (US, Japan, Australia, Canada, New Zealand, UK, Sweden and Denmark) is significantly different from that of EMU countries.

Table 1

The Cyclical Reaction of Fiscal Policies in a Homogeneous Group of Recent Studies[1]

Studies	Countries	Period	Data	Additional Variables	Asymmetry	Cyclicality
Annett (2006)	EMU-11	1980-2004 (272)	OECD	Fiscal governance and elections	n.a.	Pro-cyclical (ante-Maastricht) acyclical (post-Maastricht)[2]
Debrun & Kumar (2006)	OCSE-13	1990-2004 (224)	OECD	Fiscal rules and political variables	n.a.	Pro-cyclical (some specifications)[3]
European Commission (2006)	EMU-11	1980-2005 (251)	EC (AMECO)	dummies: >91 e >98	asymmetry[4]	Acyclical (o.gaps<0) pro-cyclical (o. gaps>0)[4]
Golinelli and Momigliano(2006)	EMU-11	1988-2006 (209)	real time	Maastricht variable and elections	symmetry	Counter-cyclical
Wyplosz (2006)	EMU-10	1980-2005	OECD	none[5]	n.a.	Pro-cyclical (ante-Maastricht) acyclical (post-Maastricht)
CEPII (2005)	EMU-10	1981-2005	OECD	none	symmetry	Acyclical
Balassone and Francese (2004)	EU, USA, JAP	1970-2000	EC (AMECO)	none	symmetry[6]	Pro-cyclical
Forni & Momigliano (2004)	EMU-10	1993-2003 (110)	real time	Maastricht variable	asymmetry	Counter-cyclical (o. gaps<0) acyclical (o. gaps>0)
IMF (2004)	EMU-11	1982-2003 (242)	OECD	Monetary gaps[7]	symmetry	Pro-cyclical (ante-Maastricht) acyclical (post-Maastricht)
Galì & Perotti (2003)	EMU-11	1980-2002 (238)	OECD	Monetary gaps	n.a.	Pro-cyclical (ante-Maastricht) acyclical (post-Maastricht)
Ballabriga and Martinez-Mongay (2002)	individual EMU-10	1979-1998	EC (AMECO)	none	n.a.	Acyclical(overall assessment of individual regressions)
Brunila and Martinez-Mongay (2002)	EU	1970-1997	EC (AMECO)	none [8]	n.a.	Pro-cyclical

[1] Highly preliminary, do not quote. We refer to the 5 percent level of significance in our assessment of the reported results. [2] We refer to the specification which includes country dummies in Table 5 of the paper. [3] We refer to Table 3 of the paper; other results presented by the authors tend to indicate, for most specifications, acyclicality. [4] The evidence of asymmetric behaviour and the assessment concerning cyclicality, in line with the conclusions drawn in the paper, take into account both the estimates for the constant and for the coefficient of the output gap. The coefficient for the output gap has roughly the same value irrespective of cyclical conditions (good or bad) and would indicate acyclicality. [5] We refer to column 3 of Table 2a of the paper. The specification does not include the lagged deficit. [6] Balassone and Francese (2004) conclude in favour of asymmetry on the basis of an equation with the overall balance as dependent variable. For the sake of comparability with the other studies we use the results of the equation with the primary balance (also reported by the authors), where the asymmetry is not significant. [7] We refer to the results of the upper part of Table 2a.8 of the Appendix 2.4. The study examines the role of other regressors in separate analyses. [8] We refer to Figure 6.7 (also published in European Commission, 2001) which shows the results of a regression involving, as dependent variable, the changes in CAPB, and as regressors, a constant and the output gap. The analysis refer only to episodes where over at least three years the absolute values of the annual average output gap and of the annual average change in the cyclically-adjusted primary balance were bigger than 0.25 per cent of trend GDP.

sources, even within the *ex post* data sets, determine sizeable shifts in the estimates of the output gap parameter. Independently of the data source, a slight tendency towards a pro-cyclical behaviour emerges over time.

In Section 4 we examine the impact of the same factors (time periods, sources of data) on determining whether fiscal policies have been symmetrical or asymmetrical over the cycle. We find contrasting results, depending on both *ex post* data sources and sample periods. Results suggest that the asymmetric behaviour of the discretionary policy, when present, entails shifts in all the parameters of the rule and not only in the output gap parameter.

In Section 5 we extend the basic fiscal rule adding, when feasible, the additional variables used and found significant in the 12 studies we focused on. While there is a remarkable increase of the explanatory power of the model, the results broadly confirm the conclusions reached in Sections 3 and 4. The only important differences are the following: a) policy asymmetry is found for all data sources; b) the evidence of counter-cyclical behaviour with real-time data becomes clearer. Section 6 concludes.

2 Modelling choices

If we focus on the "core" components of the fiscal rule – the dependent variable and the initial conditions of public finances – in the restricted set of 12 studies, we find three basic specifications of fiscal behaviour. None of the three specifications do justice to the richness of the studies we review, which often devote large part of their attention to determinants different from cyclical conditions. Nevertheless the analysis of the three models contributes significantly, in our opinion, to understand why there is no consensus on this issue in the literature.

2.1 The three models

Most studies estimate what we call a "CAPB Model" fiscal rule, in which the discretionary fiscal action, measured by the change in the cyclically-adjusted primary balance ($\Delta\ CAPB$),[7] is explained by the initial state of public finances

[7] Some authors, among which Galí and Perotti (2003), use as dependent variable the level of the CAPB, instead of its change. This specification is equivalent to that of eq. (1), as it gives the same estimates for all coefficients except for that of the lagged dependent variable, for which its estimate is equal to 1 plus the estimate obtained with eq. (1). It is largely a presentational issue, but we tend to prefer the specification in changes (eq. [1]) for two reasons. First, the explanatory power of the model and of the statistical significance of the coefficient of the lagged deficit are not artificially inflated by the component attributable to inertia (which, in turn, is largely an unexplained phenomenon). Second, in eq. (1) the dependent variable gauges, with some approximation, the effects of the government actions. Assuming that the policy-makers are more or less aware of these effects at the time of budgeting seems relatively uncontroversial. The specification in levels implicitly requires policy-makers to be able to adjust the budget balance for the effects of the cycle in the year following that of budgetary decisions, an assumption which we see as more demanding.

(measured by the cyclically adjusted primary balance and the debt of general government) and the cyclical conditions (measured by the level of the output gap):

$$\Delta\, CAPB_{i\,t} = \phi^{C}_{capb}\, CAPB_{\,i\,t-1} + \phi^{C}_{debt}\, DEBT_{\,i\,t-1} + \phi^{C}_{gap}\, GAP_{i\,(t\ or\ t-1)} + u_{it} \qquad (1)$$

The stability of equation (1) requires that ϕ^{C}_{capb} be negative and ϕ^{C}_{debt} positive. A positive value of ϕ^{C}_{gap} indicates a counter-cyclical policy, while a negative value points to pro-cyclicality. Some of the studies include the simultaneous output gap (*i.e.* at time t, the year in which budgetary actions have their effects); others include the lagged output gap (*i.e.* at time $t-1$, the year in which budgetary decisions are taken). The two variants of the CAPB Model (henceforth "CAPB-s Model" and "CAPB-l Model", respectively) lead to similar results (as we show in Section 3) since the values of the output gap are highly persistent.[8] Finally, the unobservable term $u_{it} = \mu_i + \lambda_t + \varepsilon_{it}$ may include (depending on the study) individual (μ_i), time (λ_t) and random (ε_{it}) components.

In a few studies authors estimate a broadly similar model, but assume that policy-makers react with a lag to the primary balance (PB_{t-1}) rather than to the cyclically adjusted primary balance ($CAPB_{t-1}$), as in the CAPB Model. Henceforth, we call this fiscal rule "CAPB/PB Model":

$$\Delta\, CAPB_{\,i\,t} = \phi^{C/P}_{pb}\, PB_{\,i\,t-1} + \phi^{C/P}_{i\,debt}\, DEBT_{i\,t-1} + \phi^{C/P}_{gap}\, GAP_{\,i\,(t\ or\ t-1)} + u_{it} \qquad (2)$$

The CAPB Model and the CAPB/PB Model are probably equally plausible. The CAPB Model is consistent with a fiscal rule where automatic stabilizers are left to operate fully (as discretionary actions do not react with a lag to their impact on the balance). This policy indication is very common in policy documents at the European level, especially after 1997, when the Stability and Growth Pact was introduced. CAPB/PB Model may be seen as more realistic, as policy-makers may be more concerned with headline figures; moreover, especially in the 1970s and 1980s, data on cyclically-adjusted balances were not available and even the concept of cyclical adjustment was not widespread.

Finally, other studies, which essentially focus on the issue of asymmetry in budgetary reactions, adopt a fiscal rule in which, compared with the CAPB/PB Model, the dependent variable $\Delta\, CAPB_{i\,t-1}$ is substituted by $\Delta\, PB_{i\,t-1}$.[9] Henceforth, we call this specification "PB Model":

$$\Delta\, PB_{i\,t} = \phi^{P}_{pb}\, PB_{i\,t-1} + \phi^{P}_{debt}\, DEBT_{i\,t-1} + \phi^{P}_{gap}\, GAP_{i\,(t\ or\ t-1)} + u_{it} \qquad (3)$$

---

[8] The variable $GAP_{i\,t-1}$ is a plausible alternative to $GAP_{i\,t}$, as policy-makers may react to current cyclical conditions or use them to forecast cyclical conditions in the following year. The inertia and complexity of the decision-making process may also justify the reference to the lagged output gap. A purely statistical reason for preferring $GAP_{i\,t-1}$ instead of $GAP_{i\,t}$ is that the latter requires recourse to instrumental variables, as the output gap is affected by fiscal policy, which opens up a number of equally acceptable alternatives with potential effects on the results.

[9] In the studies, the level of the PB, instead of its change, is used as dependent variable. As already mentioned in the case of the CAPB Model, this specification is equivalent to that of eq. (3), as it gives the same estimates for all coefficients except for that of the lagged dependent variable, for which its estimate is equal to 1 plus the estimate obtained with eq. (3).

The PB Model assumes a behaviour of fiscal authorities significantly different from that of the other two models, as the policy decision (dependent variable) includes the effects of both the discretionary actions and the automatic stabilizers.[10] This is shown by identity (4), in which the primary balance is decomposed into the cyclically adjusted primary balance and in a cyclical component, equal to the product of the output gap and a coefficient capturing the effects of automatic stabilizers.

$$PB_{i\,t} \equiv CAPB_{i\,t} + \omega_{i\,t} GAP_{i\,t} \tag{4}$$

The results for ϕ^{P}_{gap} in these studies are often interpreted in terms of the cyclical reaction of discretionary policies by subtracting from the coefficient of the output gap an average value (ω) of the individual coefficients $\omega_{i\,t}$ (which is generally assessed for the EMU countries at around 0.5; see Bouthvillain *et al.*, 2001). The use of an average value is justified by evidence of a limited variability of the coefficients across countries and time (see, e.g., Girouard and André, 2006).

$$\phi^{P(discr)}_{gap} \approx \phi^{P}_{gap} - \omega \tag{5}$$

2.2 Estimating the three models

In Table 2a we present estimates of the coefficient of the output gap based on the three models for the two variants (which include, respectively, the simultaneous and the lagged output gap). As most of the reviewed studies, we use *ex post* data. The source is OECD for all data except for public debt; for this variable, as OECD data are incomplete, the source is the AMECO database.[11] The full 1978-2006 sample is used.

Since all specifications are dynamic panels and embody fixed country effects (μ_i), their parameters are estimated by GMM-sys (see Blundell and Bond, 1998). This choice aims to avoid biased estimates with OLS applied to within-transformed data. Other instrumental estimators, such as the Anderson and Hsiao (1981, 1982) IV-lev approach and the Arellano and Bond (1991) GMM-dif, were discarded because potentially affected by the problem of weak instruments, *i.e.* scarcely correlated with the variables to be instrumented, as is typical with persistent data such as debt or the output gap (see Celasun and Kang, 2006, for a thorough discussion of alternative estimators in the context of fiscal reaction funtions, and the recent evidence reported in the analitical and simulation studies of Bun and Kiviet, 2006, and of Hayakawa, 2007).

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[10] There is an important difference between CAPB and CAPB/PB Models on one side and the PB Model on the other concerning the dependent variable, which suggests more caution when interpreting the results of the PB Model in terms of behaviour of fiscal authorities when *ex post* data are used. In the CAPB and CAPB/PB Models it can be assumed that budget authorities are able to predict fairly accurately the effects of their discretionary actions, as the latter are in principle largely independent of cyclical conditions. In Model PB, instead, the change in the balance is not independent from the output gap.

[11] Primary borrowing and debt are expressed as ratios of potential GDP.

Table 2a

Estimates of Alternative Fiscal Rules *with* Time Effects[1]

	Explanatory Output Gap in *t*			Explanatory Output Gap in *t*–1		
Model:	**CAPB-s**	**CAPB/PB-s**	**PB-s**	**CAPB-l**	**CAPB/PB-l**	**PB-l**
Dependent variable:	$\Delta CAPB_{i\,t}$	$\Delta CAPB_{i\,t}$	$\Delta PB_{i\,t}$	$\Delta CAPB_{i\,t}$	$\Delta CAPB_{i\,t}$	$\Delta PB_{i\,t}$
ϕ_{capb}	–0.203			–0.203		
	(0.035)			*(0.035)*		
	–5.81			*–5.73*		
ϕ_{pb}		–0.195	–0.206		–0.198	–0.191
		(0.036)	*(0.037)*		*(0.036)*	*(0.037)*
		–5.40	*–5.55*		*–5.52*	*–5.14*
ϕ_{debt}	0.009	0.009	0.010	0.009	0.009	0.009
	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*
	3.48	*3.35*	*3.60*	*3.47*	*3.45*	*3.32*
ϕ^{C}_{gap}	–0.042			–0.031		
	(0.040)			*(0.039)*		
	–1.06			*–0.79*		
$\phi^{C/P}_{gap}$		0.034			0.054	
		(0.040)			*(0.039)*	
		0.85			*1.39*	
ϕ^{P}_{gap}			0.093			–0.001
			(0.041)			*(0.040)*
			2.24			*–0.02*
average μ_i [2]	–0.145	–0.214	–0.092	–0.156	–0.179	–0.132
	(0.394)	*(0.397)*	*(0.407)*	*(0.396)*	*(0.396)*	*(0.410)*
	–0.37	*–0.54*	*–0.23*	*–0.39*	*–0.45*	*–0.32*
Observations = N×T	300	300	300	300	300	300
$\overline{T}$	27.27	27.27	27.27	27.27	27.27	27.27
Sargan' test[3]	0.0127	0.0138	0.0055	0.0152	0.0117	0.0036
Autocorrelation[4]	0.3921	0.3726	0.4032	0.3765	0.3954	0.3996
R^2 [5]	0.2971	0.2817	0.1584	0.2906	0.2900	0.1659
Time effects significance[6]	0.0242	0.0347	0.0000	0.0136	0.0156	0.0000
Implicit ϕ^{C-l}_{gap} [7]					–0.042	
					(0.040)	

[1] GMM-sys estimates, see Blundell and Bond (1998), over the 1978-2006 period. Below each point estimate, the corresponding standard error is in brackets and the Student's *t* is in italics. [2] Average of the 11 country-effects estimates. [3] Over-identifying restrictions test, *p*-values. [4] Residuals' 2nd order autocorrelation test, *p*-values. [5] Proxied by the squared correlation between actual and fitted values. [6] Test for the null hypothesis that all the 28 time dummies are jointly zero, *p*-values. [7] Obtained rearranging eq. (7c) using: $\phi^{P/B-l}_{pb}$ and ϕ^{P-l}_{pb} estimated above, and $\omega = 0.4825$, *i.e.* the sample average of $\omega_{i\,t}$ (the semi-elasticity of primary balance w.r.t. the output gap stemming from automatic stabilizers; source, see Girouard and André, 2007).

In the regressions, contrary to the most common practice of the reviewed studies, time effects (λ_t) are allowed (in all regressions presented in Table 2a they are found to be jointly significant). We include the time dummies (accounting for effects that are almost invariant to all countries and change over time) as, hopefully, they can reduce the omitted-variable bias stemming from the very simple specifications we are using.[12]

Four results stand out, which are largely independent of the sample used and the source of data:

a) Comparing the CAPB and CAPB/PB Models, the estimates of the cyclical reaction are relatively close but the latter suggests in all cases a more counter-cyclical behaviour.

b) The estimates of the cyclical reaction based on the PB Model are close to those of the other two models. This result is rather surprising, as the PB Model should include, in principle, also the effects of automatic stabilizers.

c) The estimates of the parameters of the initial fiscal conditions (debt and deficit) are largely constant across the three models, notwithstanding the fact that only in the CAPB Model the lagged deficit is cyclically adjusted.

d) The estimates of almost all parameters are not significantly affected by the choice between the simultaneous and the lagged output gap (this emerges by comparing the coefficients in columns 1-3 with the corresponding ones in columns 4-6); the only (partial) exception is the estimate of the cyclical reaction measured by the PB Model.

In the following two sections we try to understand why the CAPB/PB Model tends to suggest a slightly more counter-cyclical behaviour than CAPB Model (Section 2.3) and why the estimates of the cyclical reaction of Model PB are so close to those of the other two models, notwithstanding the different dependent variable (Section 2.4).

2.3 Comparing Model CAPB and Model CAPB/PB

Starting from the CAPB-l Model (*i.e.* equation [1], in the variant which includes the lagged output gap) we subtract and add $\phi^{C-l}_{capb}\, \omega_{i\,t-1}\, GAP_{i\,t-1}$ on the right side of the expression. Using also identity (4), we obtain the following equation, in which the CAPB/PB-l Model is expressed in terms of the CAPB-l Model parameters:

$$\Delta\, CAPB_{i\,t} = \phi^{C-l}_{capb}\, PB_{i\,t-1} + \phi^{C-l}_{debt}\, DEBT_{i\,t-1} + (\phi^{C-l}_{gap} - \phi^{C-l}_{capb} \times \omega_{i\,t-1})\, GAP_{i\,t-1} + u_{i\,t} \qquad (6)$$

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[12] Allowing time dummies determines a non-negligeable shift of all estimates of the cyclical reaction towards counter-cyclicality. Table 2b reports the results of the specifications without time dummies.

Table 2b

Estimates of Alternative Fiscal Rules *without* Time Effects[1]

	Explanatory Output Gap in *t*			**Explanatory Output Gap in *t–1***		
Model:	**CAPB-s**	**CAPB/PB-s**	**PB-s**	**CAPB-l**	**CAPB/PB-l**	**PB-l**
Dependent variable:	$\Delta CAPB_{i\,t}$	$\Delta CAPB_{i\,t}$	$\Delta PB_{i\,t}$	$\Delta CAPB_{i\,t}$	$\Delta CAPB_{i\,t}$	$\Delta PB_{i\,t}$
ϕ_{capb}	–0.201			–0.217		
	(0.032)			*(0.032)*		
	–6.35			*–6.73*		
ϕ_{pb}		–0.207	–0.223		–0.219	–0.170
		(0.034)	*(0.036)*		*(0.033)*	*(0.035)*
		–6.17	*–6.11*		*–6.67*	*–4.83*
ϕ_{debt}	0.011	0.011	0.014	0.011	0.011	0.011
	(0.003)	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*
	4.24	*4.09*	*4.79*	*4.23*	*4.24*	*3.88*
ϕ^{C}_{gap}	–0.105			–0.096		
	(0.030)			*(0.030)*		
	–3.53			*–3.18*		
$\phi^{C/P}_{gap}$		–0.030			0.001	
		(0.033)			*(0.032)*	
		–0.93			*0.03*	
ϕ^{P}_{gap}			0.069			–0.073
			(0.036)			*(0.034)*
			1.95			*–2.15*
average μ_i[2]	–0.559	–0.550	–0.669	–0.547	–0.556	–0.626
	(0.173)	*(0.175)*	*(0.190)*	*(0.176)*	*(0.176)*	*(0.188)*
	–3.23	*–3.15*	*–3.53*	*–3.12*	*–3.16*	*–3.33*
Observations = N×T	300	300	300	300	300	300
$\overline{T}$	27.27	27.27	27.27	27.27	27.27	27.27
Sargan' test[3]	0.0261	0.0288	0.0080	0.0391	0.0331	0.0048
Autocorrelation[4]	0.4293	0.3856	0.5207	0.3644	0.3737	0.5018
R^2 [5]	0.1969	0.1845	0.1395	0.1751	0.1766	0.1579
Implicit ϕ^{C-l}_{gap}[6]					–0.105	
					(0.031)	

[1] GMM-sys estimates, see Blundell and Bond (1998), over the 1978-2006 period. Below each point estimate, the corresponding error is in brackets and the Student's t is in italics. [2] Average of the 11 country-effects estimates. [3] Over-identifying restrictions test, *p*-values. [4] Residuals' 2nd order autocorrelation test, *p*-values. [5] Proxied by the squared correlation between actual and fitted values. [6] Obtained rearranging eq. (7c) using: $\phi^{P/B-1}_{pb}$ and ϕ^{P-1}_{pb} estimated above, and $\omega = 0.4825$, is the sample average of $\omega_{i\,t}$ (the semi-elasticity of primary balance w.r.t. the output gap stemming from automatic stabilizers; source, see Girouard and André, 2007).

By comparing equation (6) with the CAPB/PB-l Model (*i.e.* equation [2], in the variant which includes the lagged output gap), we identify the following three relationships between the parameters:

$$\phi^{C/P\text{–}1}_{pb} = \phi^{C\text{–}1}_{capb} \tag{7a}$$

$$\phi^{C/P\text{–}1}_{debt} = \phi^{C\text{–}1}_{debt} \tag{7b}$$

and, using also eq. (7a):

$$\phi^{C/P\text{–}1}_{gap} \approx (\phi^{C\text{–}1}_{gap} - \phi^{C\text{–}1}_{capb} \times \omega) = (\phi^{C\text{–}1}_{gap} - \phi^{C/P\text{–}1}_{pb} \times \omega) \tag{7c}$$

The first two equivalences indicate that in the CAPB and CAPB/PB Models the effects of the initial fiscal conditions (notwithstanding the different choice regarding the balance) are measured by the same parameters. The third relationship, which is not exact because we substitute the time- and country-specific coefficients measuring the effects of the automatic stabilizers $\omega_{i\,t-1}$ with their average value ω, indicates that the reaction to cyclical conditions estimated in the CAPB/PB Model is approximately equal to ϕ^{C-l}_{gap} (which measures the estimate of the reaction in the CAPB Model) *minus* the product of ω and the coefficient for the lagged deficit.

This latter component is negative, since $\omega > 0$ (otherwise, the automatic budgetary reactions would be destabilizing) and $\phi^{C/P\text{–}1}_{pb} = \phi^{C\text{–}1}_{capb} < 0$ (otherwise, we would observe exploding deficits). Therefore, the estimates of the coefficient of the output gap in the CAPB/PB-l Model are systematically more counter-cyclical than those obtained using the CAPB-l Model. On the basis of the estimated parameters of the regression for the CAPB/PB-l Model in Table 2a, the difference stemming from the modelling choice is 0.08, about twice the standard deviation of the estimate for the coefficient. A similar difference can be found when comparing the CAPB-s Model with the CAPB/PB-s Model.

The explanation of the result obtained above is rather intuitive. If the CAPB Model is assumed to be the "true" model, the CAPB/PB Model can be seen as constraining discretionary policies to react to the effects of the automatic stabilizers on the budget with the same coefficient of their reaction to the cyclically-adjusted deficit. This constrained reaction, which is stabilizing with respect to public finances, is pro-cyclical and determines a corresponding shift towards counter-cyclicality in the estimate of the coefficient of the output gap. Equivalently, if the CAPB/PB Model is used as reference point, it can be argued that the CAPB Model, by excluding the effects of automatic stabilizers from the initial fiscal conditions, lumps together the (pro-cyclical) reaction to these effects and the discretionary reaction to cyclical conditions measured by the CAPB/PB Model.

Summing up, the CAPB and CAPB/PB Models are basically a re-parameterization of one another (as such, data cannot discriminate between them) and lead to different estimates only for the parameter of the output gap. The differences in the latter can be attributed to a different notion of cyclicality (net or gross of the reaction to the lagged effects of automatic stabilizers). In the lower part of Table 2a we present the estimates of $\phi^{C\text{–}1}_{gap}$ obtained using the parameters

estimated with the CAPB/PB Model and the approximated relationship (7c). The results are almost identical to the estimates based on the CAPB Model, suggesting that our approximated relationship is validated by actual data.

2.4 Interpreting the cyclical reaction parameter in Model PB

In order to better understand why the estimates of the fiscal reaction to cyclical conditions of the PB Model are so close to those of the other two models, we subtract on both sides of the eq. (3) (in the variant which includes the simultaneous output gap; *i.e.* PB-s Model) the effects of the automatic stabilizers on the dependent variable ($\Delta [\omega_{i\,t}\, GAP_{i\,t}]$), obtaining:

$$\Delta PB_{i\,t} - \Delta(\omega_{i\,t}\, GAP_{i\,t}) = \phi^{P-s}_{pb}\, PB_{i\,t-1} + \phi^{P-s}_{debt}\, DEBT_{i\,t-1} + \\ + (\phi^{P-s}_{gap} - \omega_{i\,t})\, GAP_{i\,t} + \omega_{i\,t-1}\, GAP_{i\,t-1} + u_{it} \qquad (8)$$

From eq. (8) it emerges that in the PB-s Model the reaction of discretionary actions to the cyclical conditions, assuming that automatic stabilizers can be independently identified, includes two components: i) with respect to the simultaneous output gap, the estimated coefficient of the cyclical reaction (ϕ^{P-s}_{gap}) *minus* the coefficient gauging the automatic reaction ($\omega_{i\,t}$); ii) with respect to the lagged output gap, the coefficient gauging the automatic reaction. When estimating the PB-s Model we can only observe $\phi^{P-s}_{gap.}$ How can we recover the reaction to cyclical conditions of discretionary policies ($\phi^{P-s(discr)}_{gap}$)?

In eq. (5) the assessment of this reaction is restricted to the first component. On the basis of this notion of cyclicality, the estimates of the cyclical reaction shown for the PB Model in Table 2a point to a large pro-cyclical discretionary policy, a result which differs strongly from those obtained with the other two models.

An alternative option is to take into account both components of the cyclical reaction. To reach a synthetic assessment of the reaction, we can simply sum the two reactions, taking also into account that the output gap is highly persistent (with values of the autocorrelation coefficient for the different data sources ranging between 0.8 and 0.9), and we obtain the following expression:

$$\phi^{P-s(discr)}_{gap} \approx \phi^{P-s}_{gap} \qquad (9)$$

This suggest that, as an approximation, if we want to derive from the results of the PB-s Model an assessment of the reactions of discretionary policies to both the current and the lagged cyclical conditions, ω should not be substracted. The same conclusion can be reached starting from Model PB-s with the dependent variable in levels or if we focus on the variant of the PB Model including the lagged output gap, *i.e.* the PB-l Model. The second notion of cyclicality makes the estimates based on Model PB and reported in Table 2a broadly consistent with those of the other two models.

3 Time periods and sources of data

In this section we assess to what extent the estimates of the fiscal rule depend on the source of data (OECD against European Commission, henceforth EC), on the data vintage (*ex post* against real-time), and on the estimation period. We focus on the CAPB Model. In the initial part of the analysis we provide additional evidence of the broad equivalence between the results based on the CAPB-s and CAPB-l Models. Henceforth, we present results only for the CAPB-l Model. We include, when jointly significant, fixed time effects.

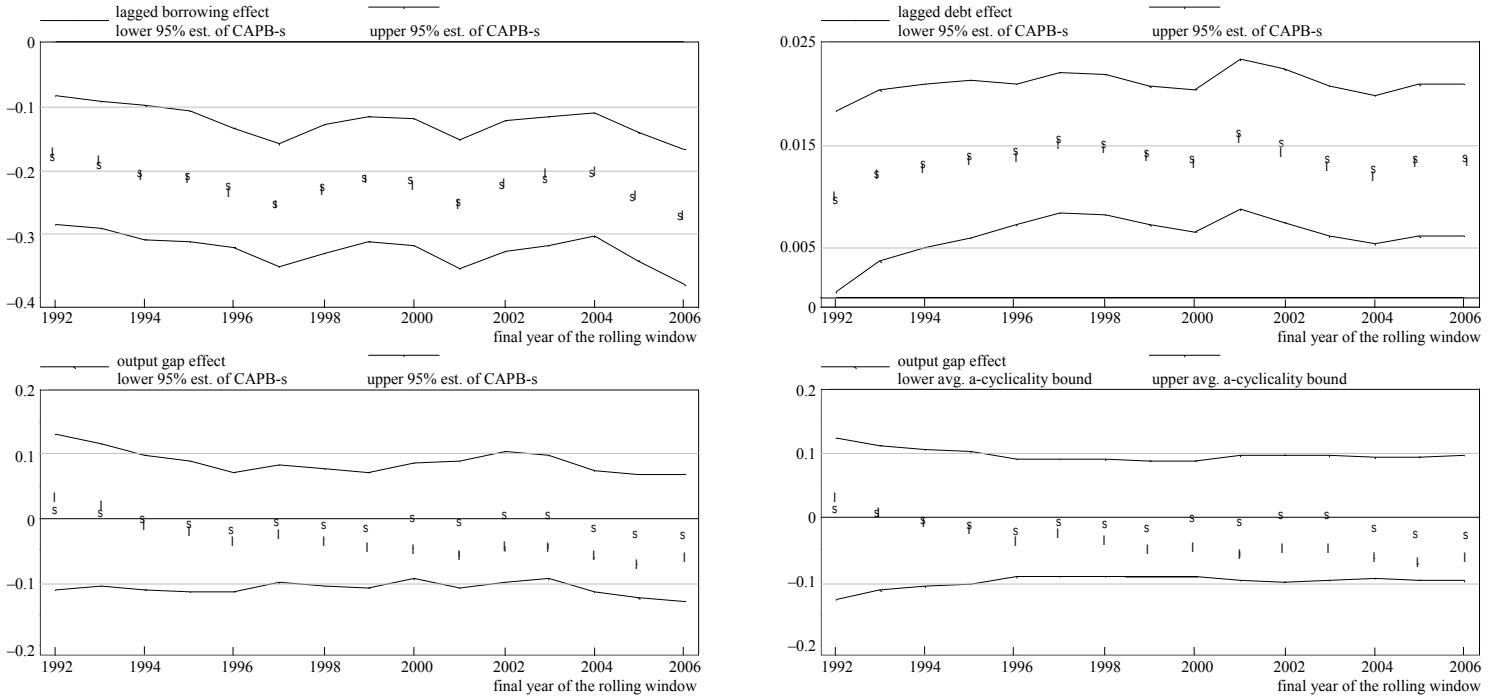
To avoid repetitions we do not estimate the CAPB/PB and PB Models. The results for these models are approximately equal to those of the CAPB Model for all parameters except for the one assessing the cyclical reaction. To recover the estimates of the cyclical reaction consistent with the CAPB/PB Model, those of the CAPB Model need to be shifted upward (toward counter-cyclicality) by approximately 0.1. As for the PB Model, using the second (ampler) notion of cyclical reaction, the estimates of the discretionary reaction tend to be in an intermediate position between those of the other two models for the variant with the lagged output gap and in line with those of the CAPB/PB Model when the simultaneous output gap is included.

Figure 3.1 compares across different samples (obtained by rolling regressions with a fixed window of 15 years over 1978-2006) the GMM-sys estimated (see Section 2.2) parameters using the CAPB-s Model with those using the CAPB-l Model, obtained with OECD *ex post* data. In this figure, four graphs are reported. The two in the upper row and the lower left-hand one allow us to assess the estimates of the parameters of, respectively, the lagged deficit (upper-left), the lagged debt (upper-right), and the output gap (lower-left). The points of each graph are marked with labels indicating the model used in the estimation (CAPB-s or CAPB-l). Each point corresponds to an estimate obtained over the sub-sample ending in the year indicated on the horizontal axis and starting 15 years before. For each estimation period, the 95 per cent confidence interval of the estimate obtained with the CAPB-s Model is plotted. The confidence interval shown in the lower right-hand graph is an average of the two confidence intervals based on the CAPB-s and CAPB-l Models; it is centred on zero: approximately, the ϕ^{A}_{gap} point estimates falling inside this zero-interval are not significantly different from zero.

As we found in Tables 2a and 2b, the estimated parameters of both lagged deficit and debt, plotted, respectively, in the first row of graphs, are indistinguishable. The ϕ^{C}_{gap} point estimates of the CAPB-l Model (in the lower left-hand graph) are always relatively close to those of the CAPB-s Model and fall well inside the latter confidence interval. This supports the view (based on the high persistence of the output gap) that the two variants are interchangeable. Finally, in the lower right-hand graph, ϕ^{C}_{gap} estimates with the CAPB-s and CAPB-l Models both fall inside the average 95 per cent confidence interval, indicating that using *ex post* OECD data the hypothesis of an acyclical policy cannot be rejected for all periods.

Figure 3.1

CAPB-s and CAPB-l Models Estimates with OECD *ex post* Data in Rolling Samples[1]



[1] The CAPB-s and CAPB-l Models estimates are indicated by *s* and *l* respectively. The first point estimates correspond to the 1978-1992 sample, the last to 1992-2006. All the sub-samples cover a fixed 15-year period. In the first three graphs the 95 per cent confidence intervals refer to the point estimate of the CAPB-s Model corresponding parameter. The fourth graph reports the zero-interval for both point estimates with the CAPB-s and CAPB-l Models (as such, it cannot use the standard error of only one model's estimate, but the average standard errors of both CAPB-s and CAPB-l Model estimates).

Figures 3.2-3.4 compare the CAPB-l Model parameter estimates across different samples (again obtained by rolling regressions with a fixed 15 year window) for four different data sources: OECD *ex post* data (labelled OECD), OECD *ex post* data for fiscal variables and estimates of the output gap based on *ex post* GDP and the Hodrick-Prescott filter (labelled HP), AMECO *ex post* data (labelled EC) and the real-time data computed in Momigliano and Golinelli (2006) on the basis of various issues of the OECD Economic Outlook (labelled RT).[13] Due to data unavailability, the starting point of the estimates based on real-time data is 1988, which corresponds to 2002 as final year. The structure of Figures 3.2-3.3 is the same as the one for Figure 3.1. Figure 3.4 focuses only on the parameter estimates of the cyclical reaction.

From Figures 3.2-3.3 it emerges that the ϕ_{capb} and ϕ_{debt} point estimates are not statistically different for all samples and across different data sources and vintages. Instead, differences emerge for ϕ^{C-s}_{gap} point estimates. As shown in Figure 3.4, OECD and HP based estimates suggest an acyclical behaviour; EC and RT estimates point to a weak, generally not significant, counter-cyclicality. To translate these results in terms of the CAPB/PB Model, all ϕ^{C-s}_{gap} estimates would need to be shifted upwards (towards counter-cyclicality) by approximately 0.1. In this case, most EC and RT estimates would become significant.

As the sample moves forward over time, excluding the furthest years and including the most recent ones, the estimates shift slightly in the direction of pro-cyclicality. This result contrasts with other papers, which find a shift from pro-cyclicality to acyclicality after the Maastricht Treaty (Wyplosz, 2006; IMF, 2004; Galí and Perotti, 2003).

In Table 3.1 we report the estimation results of the CAPB-l Model over the fixed 1988-2006 period[14] for the four different data sources and vintages. In all cases, the usual over-identifying restrictions and residuals' autocorrelation tests are always largely not rejected, while the time effects are always significant. The results broadly confirm the indications emerging from Figures 3.2-3.4.

Summing up, the results included in this section suggest the following remarks.

The significance of the fixed time effects is a common feature in all cases under scrutiny. This fact highlights the need of always including them in order to prevent biased estimates due to the omission of relevant factors influencing all countries at the same time (e.g., fluctuations in the prices of stocks and oil).

Independently of model, sample period, data source and vintage, the initial fiscal conditions (lagged borrowing and debt) always matter. This evidence suggests caution when using inferences on the cyclical response of fiscal policies based on models omitting these two regressors.

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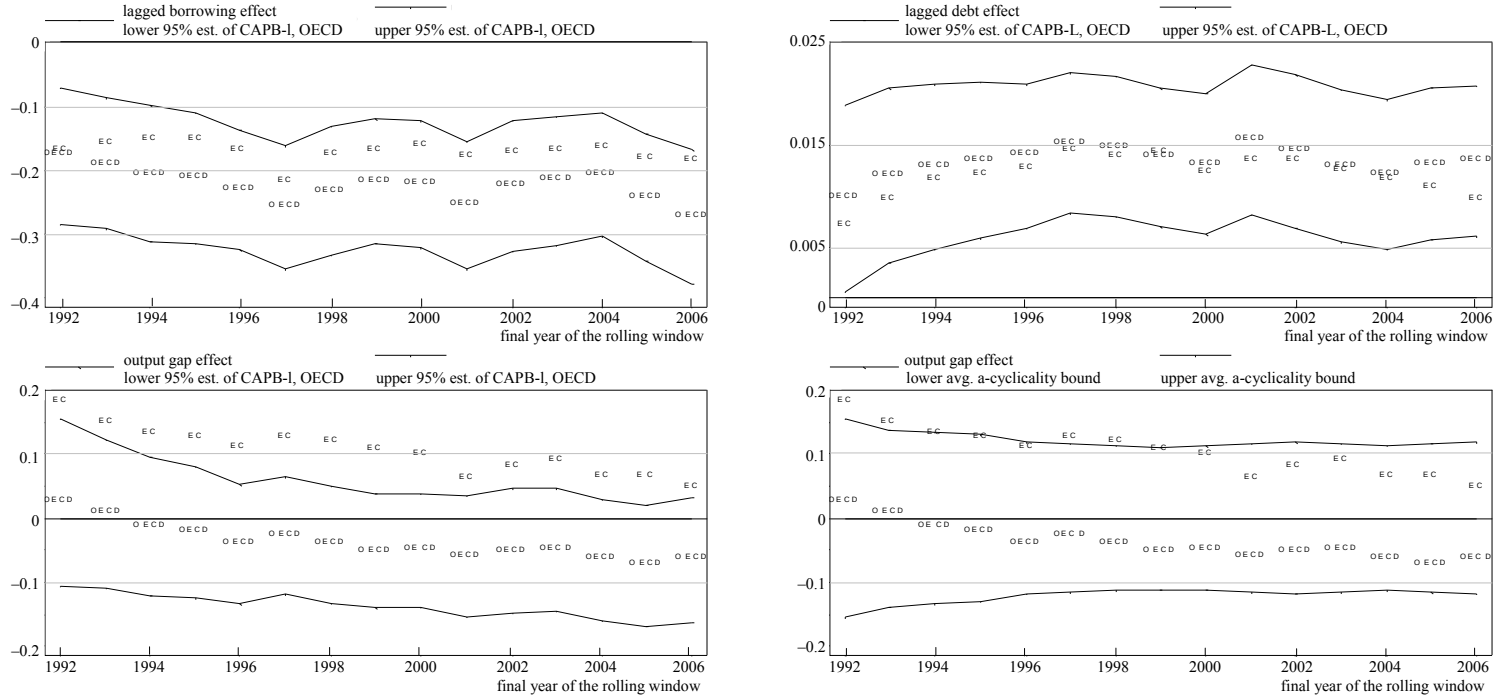
[13] As OECD data for public debt are incomplete, for this variable we always use AMECO data.

[14] The period 1988-2006 corresponds to the largest sample available for real-time data.

Figure 3.2

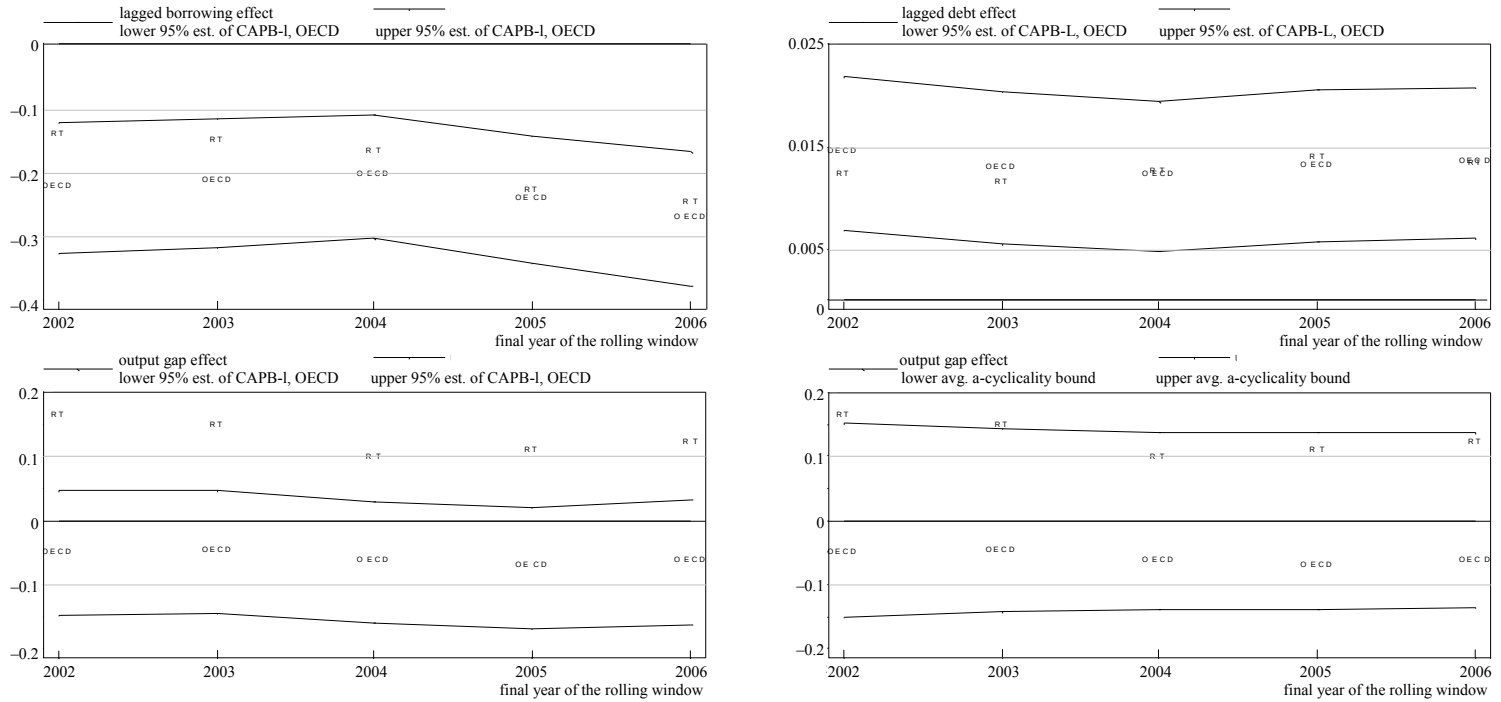
CAPB-l Model Estimates with OECD and EC *ex post* Data in Rolling Samples[1]



[1] The first point estimates correspond to the 1978-1992 sample, the last to 1992-2006. All the sub-samples cover a fixed 15-year period. In the first three graphs the 95 per cent confidence intervals refer to the corresponding parameter point estimate with OECD data. The lower right-hand graph reports the zero-interval for point estimates with both OECD and EC data sources (as such, it cannot use the standard error of only one estimate from one source, but the average standard error of the estimates with both sources).

Figure 3.3

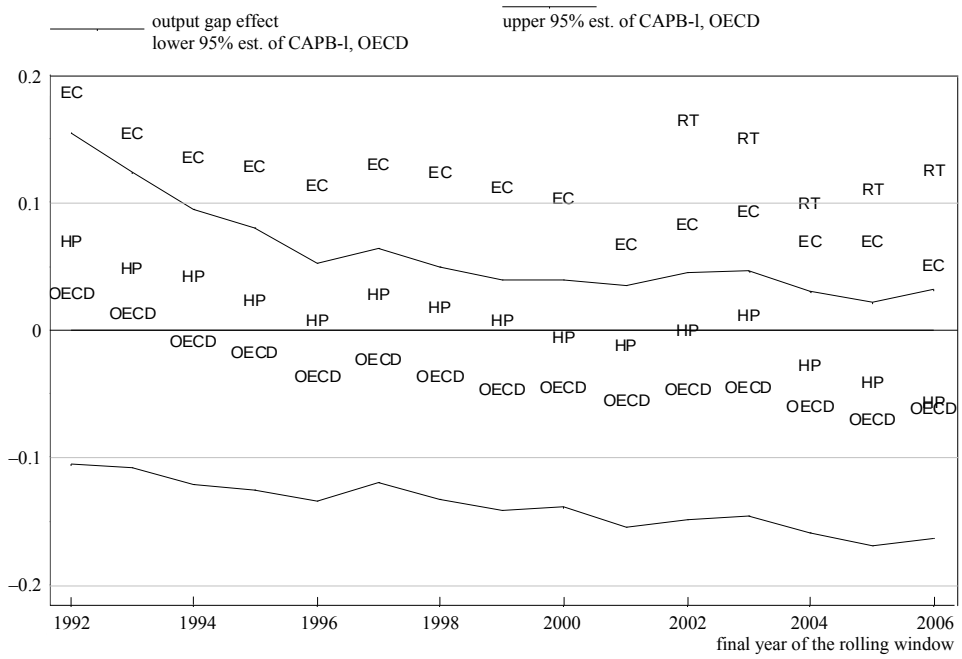
CAPB-l Model Estimates with *ex post* and Real-time OECD Data in Rolling Samples[(1)]



[(1)] The first point estimates correspond to the 1988-2002 sample, the last to 1992-2006. All the sub-samples cover a fixed 15-year period. In the first three graphs the 95 per cent confidence intervals refer to the corresponding parameter point estimate with *ex post* OECD data. The lower right-hand graph reports the zero-interval for point estimates with both *ex post* and real-time data (as such, it cannot use the standard error of only the estimate using *ex post* data, but the average standard error of the estimates with both *ex post* and real-time data).

Figure 3.4

Estimates of ϕ^{C-I}_{gap} with Alternative Data Sources and Vintages in Rolling Samples(1)



(1) The first point estimates correspond to the 1978-2002 sample, the last to 1992-2006. All the sub-samples cover a fixed 15-years period. The 95 per cent confidence intervals refer to ϕ^{C-I}_{gap} estimates with *ex post* OECD data.

Legenda: Source of data: OECD = OECD *ex post* data; HP = OECD *ex post* data for initial fiscal conditions and HP-filtered GDP for the output gap; EC = EC *ex post* data; RT = real-time OECD data.

Findings about cyclical conditions do not enjoy a comparable robustness. Point estimates of the cyclical reaction of discretionary policies tend to be influenced (and the sign reversed) by the use of alternative data sources and/or vintages. The sample selection is generally less important. The overall picture is that of acyclicality or weak counter-cyclicality in *ex post* data and counter-cyclicality (significant with the CAPB/PB Model and not significant with the CAPB Model) with real-time data.

4 Policy asymmetries

Two approaches can be followed when testing for asymmetries in fiscal

Table 3

CAPB-l Model Estimates with Alternative Data Sources[1]

	OECD	**HP**[2]	**EC**	**RT**[3]
ϕ_{capb}	–0.220	–0.205	–0.158	–0.167
	(0.045)	(0.045)	(0.042)	(0.047)
	–4.88	*–4.59*	*–3.75*	*–3.60*
ϕ_{debt}	0.011	0.011	0.009	0.010
	(0.003)	(0.003)	(0.003)	(0.003)
	3.51	*3.63*	*2.93*	*3.18*
ϕ^{C}_{gap}	–0.054	0.007	0.086	0.141
	(0.044)	(0.053)	(0.065)	(0.091)
	–1.22	*0.12*	*1.34*	*1.54*
avg. μ_i[4]	–0.555	–0.425	–0.384	–0.140
	(0.404)	(0.396)	(0.454)	(0.414)
	–1.37	*–1.07*	*–0.85*	*–0.34*
N×T	209	209	200	209
$\overline{T}$	19.00	19.00	18.18	19.00
R^2 [5]	0.2832	0.2836	0.2653	0.2910

[1] GMM-sys estimates, see Blundell and Bond (1998), over the 1988-2006 period. Below each point estimate, we report the corresponding standard error (in brackets) and the Student's *t*. [2] Data for the initial conditions are from OECD; data for output gap are obtained using HP filtered GDP levels. [3] Real-time data based on OECD Economic Outlook, see Golinelli and Momigliano (2006). [4] Average of the 11 country-effects estimates. [5] Proxied by the squared correlation between actual and fitted values.

behaviour. The sample can be split into two sub-samples (corresponding to "good" and "bad" times) and two distinct sets of estimates for the parameters of the fiscal rule are obtained. Alternatively, only the ϕ_{gap} parameter can be allowed to vary across the two states of nature. In what follows, we refer to the practice of splitting the sample as the "two-sample approach" (2SA) and to that of splitting only the ϕ_{gap} parameter as the "two-parameter approach" (2PA).

The first approach (2SA) is more general. If all parameters change across states, 2SA leads to consistent and efficient estimates of all the parameter shifts, while 2PA estimates are biased and inconsistent. If only the parameter ϕ_{gap} shifts, 2SA leads to still consistent but inefficient estimates, while 2PA is consistent and efficient.

In order to conduct efficient inferences with a parsimonious model without imposing invalid symmetry restrictions to ϕ_{capb} and ϕ_{debt} parameters and to the deterministic components of the model, we follow two sequential steps. First, the sample is split, following 2SA, and the joint significance of the shifts between states of nature in all model parameters *except* ϕ_{gap} is assessed. Second, if the null (*i.e.* parameters are symmetrical) of the previous test is rejected, the symmetry of the policy reaction to the economic cycle is assessed with the same test but including all model parameters. If the null is not rejected, the more efficient 2PA is carried out, and the symmetry of the policy reaction to the economic cycle is assessed by testing for the significance of the ϕ_{gap} shift between "good" and "bad" times.

In Figure 4.1 we present the results for the CAPB-l Model[15] of these two sequential steps across data sources and vintages and sample periods. In the upper part, we show whether the null of symmetry of all model parameters except ϕgap is rejected (black boxes) or not (grey boxes). In the lower part we show whether the null of policy rule symmetry is rejected (black boxes) or not (grey boxes) by using the most appropriate approach (either 2SA or 2PA, depending on the outcome of the upper part). The two diagrams are identical, indicating that, if the first test is not rejected, asymmetry in the cyclical reaction is never found and, if the first test is rejected, asymmetry for all parameters, including ϕ_{gap}, is always found. In other terms, when asymmetry exists, it always depends on a general shift in parameters of the rule and not on a specific shift of ϕ_{gap}. Indeed, when we restrict our attention to the final ϕ_{gap} parameters, independently of the result of the first test, they are never significantly different. This is shown for the specific period 1988-2006 in Table 4. Another indication emerging from Figure 4.1 is that the answer to whether policies are symmetrical or asymmetrical varies, with ex post information, across data sources and time periods. With real-time data, the indication is of symmetrical behaviour.

Figure 4.2 plots the differences between the ϕ^{C}_{gap} parameter in good and bad times. Though not significant, such differences are aways positive in all the samples ending later than 1995. A similar indication is also conveyed by the analysis of the constant term across states of nature.These results seem at odds the usual interpretation of asymmetry, *i.e.* that it arises because government action is pro-cyclical in good times.[16]

As an additional information, in order to give an insight into the level of the alternative ϕ^{C}_{gap} estimates, Figure 4.2 also reports two splines representing the

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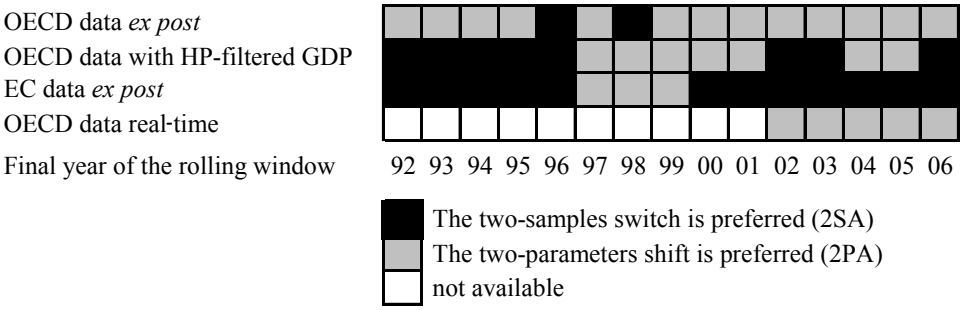
[15] CAPB-l and CAPB/PB-l models have the advantage, over CAPB-s and CAPB/PB-s models, of avoiding the risk of biased parameter estimates linked to an endogenous selection of good and bad times. In fact, in order to split either the whole sample or only the gap parameter, a zero-one indicator variable I_{it} must be defined. When the cyclical indicator is the output gap in levels, the usual practice is to set $I_{it} = 1$ if $GAP_{it} > 0$ ("good times"), and $I_{it} = 0$ if $GAP_{it} <$ or $= 0$ ("bad times"). However, this selection risks being endogenous, given the possible simultaneity between the idiosyncratic policy shock ε_{it} (see eq. [1] to [3] of Section 2) and the actual GAPit realisation that drives I_{it} If such endogeneity occurs, the selection based on the sign of the output gap at time t entails biased parameter estimates.

[16] See European Commission (2006).

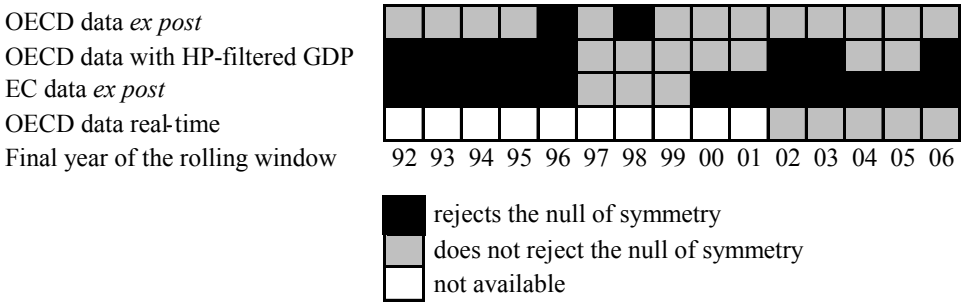
Figure 4.1

Policy Asymmetry over the Cycle in Rolling Samples – CAPB-l Model(1)

(a) Selection of the Most Appropriate Approach: Either Two-samples Switch (2SA) or Two-parameters Shift (2PA)(2)



(b) Policy Symmetry Test Outcomes Using the More Appropriate Approach, 2SA *vs* 2PA(3)



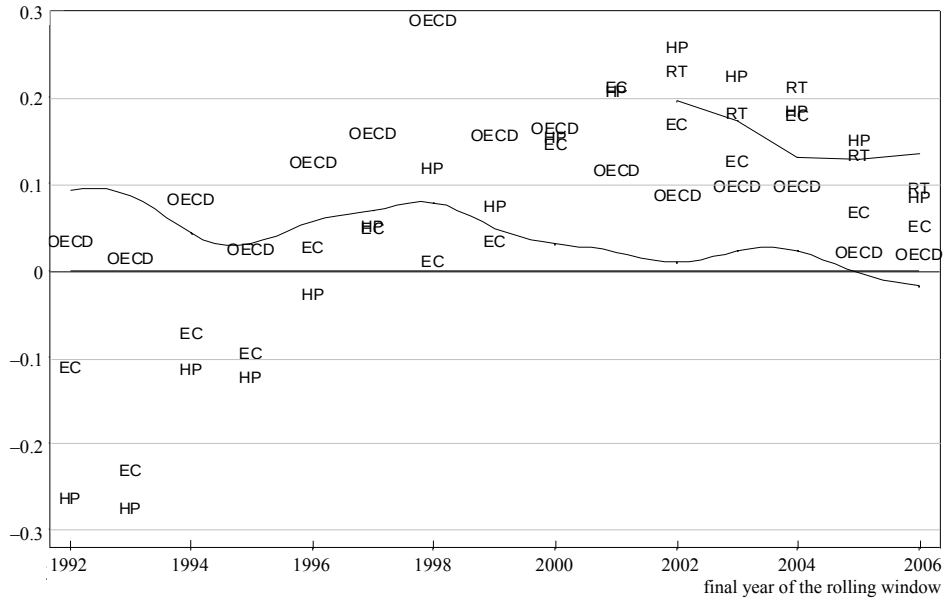
(1) The first point estimates correspond to the 1978-2002 sample, the last to 1992-2006. All the sub-samples cover a fixed 15-years period.
(2) The 2SA approach is appropriate at 5 per cent (then preferred) when the shifts in both initial fiscal conditions and all the model's deterministic components (country and time fixed effects) are jointly significant.
(3) The 5 per cent rejection of symmetric policies (under the null hypothesis) is based on the *p*-value of the most appropriate approach (either two-samples switch, 2SA, or two-parameters shift, 2PA, see panel above) using the indicated data source over the sample period ending in the corresponding year and starting 15 years before.

yearly average of the ϕ^{C}_{gap} parameters in good and bad times for the three sources of *ex post* data (from 1992) and for real-time data (from 2002).

To integrate the analysis carried out in Figures 4.1 and 4.2, in Table 4 we report the GMM-sys estimates of the CAPB-l Model for four alternative data sources and vintages over the same 1988-2006 period. For each source the final

Figure 4.2

Estimates of Parameter Difference in Good and Bad Times with Alternative Data Sources and Vintages in Rolling Samples(1)



(1) The first point estimates correspond to the 1978-2002 sample, the last to 1992-2006. All the sub-samples cover a fixed 15-years period. The lower spline (since 1992) measures the average of the ϕ^{C-I}_{gap} estimates with *ex post* data, the upper spline (since 2002) measures the average of the ϕ^{C-I}_{gap} estimates with real-time data.

Legenda: Source of data: OECD = OECD *ex post* data; HP = OECD *ex post* data for initial fiscal conditions and HP-filtered GDP for the output gap; EC = EC *ex post* data; RT = real-time OECD data.

outcome of the general-to-specific procedure outlined above is reported. If 2SA is appropriate, the estimates are reported in two columns (for good and bad times), while if 2PA proves to be valid, a single column suffices.

The lower part of Table 4, at the "no-switch" row, reports the *p*-value of the test whose null admits the restriction from 2SA to 2PA. Results clearly reject the null with EC data and with HP data.[17] Results with OECD and RT, instead, do not reject 2PA as a valid reduction of 2SA. Alone, the shift in the output gap effect is never the main cause of symmetry rejection, as shown by high *p*-values of the "no-shift" hypothesis, never rejected in the last row of the table.

[17] The lack of significance of time effects in good times and their significance in bad times may contribute to the no-switch rejection with EC and OECD-HP.

Table 4

***CAPB-l* Model Estimates in Good and Bad Times *with* Alternative Data Sources**[1]

Source:	**OECD** *ex post*		**EC** *ex post*		**OECD** with HP-GDP		**OECD** real-time	
Times:[2]	**bad**	**good**	**bad**	**good**	**bad**	**good**	**bad**	**good**
ϕ_{capb}	–0.216		–0.161	–0.171	–0.238	–0.186	–0.169	
	(0.039)		*(0.056)*	*(0.054)*	*(0.072)*	*(0.055)*	*(0.047)*	
	–5.56		*–2.85*	*–3.16*	*–3.30*	*–3.38*	*–3.62*	
ϕ_{debt}	0.012		0.011	0.009	0.016	0.011	0.011	
	(0.003)		*(0.004)*	*(0.005)*	*(0.005)*	*(0.005)*	*(0.003)*	
	3.75		*2.49*	*1.67*	*3.43*	*2.07*	*3.17*	
$\phi^{C-l}{}_{gap}$	–0.062	0.036	0.037	0.142	–0.047	0.09	0.105	0.214
	(0.050)	*(0.095)*	*(0.081)*	*(0.118)*	*(0.068)*	*(0.102)*	*(0.116)*	*(0.171)*
	–1.24	*0.38*	*0.46*	*1.20*	*–0.70*	*0.88*	*0.90*	*1.25*
avg. μ_i [3]	–0.384		–0.107	1.016	–0.630	0.560	–0.222	
	(0.413)		*(0.431)*	*(1.460)*	*(0.419)*	*(1.363)*	*(0.445)*	
	–0.93		*–0.25*	*0.70*	*–1.50*	*0.41*	*–0.50*	
N×T	209		110	90	113	96	209	
$\overline{T}$	19.00		10.00	8.18	10.27	8.73	19.00	
R^2 [4]	0.2856		0.3015	0.2767	0.3290	0.3046	0.2906	
Time eff.[5]	0.0372		0.0080	0.2447	0.0034	0.3650	0.0038	
No switch[6]	0.0985		0.0002		0.0236		0.0709	
Shift[7]	0.098		0.105		0.137		0.109	
	0.3953		0.4632		0.2638		0.8259	

[1] GMM-sys estimates, see Blundell and Bond (1998), over the 1988-2006 period. Below each point estimate, we report the corresponding standard error is (in brackets) and the Student's *t*. [2] Bad times: when $GAP \leq 0$; good times: when $GAP > 0$. [3] Average of the 11 country-effects estimates. [4] Proxied by the squared correlation between actual and fitted values. [5] Test for the null hypothesis that all the 18 time dummies are jointly zero, *p*-values. [6] *P*-values of the test for parameters (excluding $\phi^{\text{C-l}}_{\text{gap}}$) being equal in the two sub-samples of good and bad times, *i.e.* for the restrictions collapsing 2SA to 2PA. [7] First row: estimate of the difference ${}_{\text{g}}\phi^{\text{C-l}}_{\text{gap}} - {}_{\text{b}}\phi^{\text{C-l}}_{\text{gap}}$ in good and bad times; second row: *p*-values of the test for the corresponding difference being zero (*i.e.* for the "no-shift" hypothesis).

Results in the upper part of Table 4 confirm the findings of Section 3: the data source affects the estimates of the policy reaction to cyclical conditions. With OECD and HP the policy is weakly acyclical, while with EC and RT it is weakly counter-cyclical.

5 Extending the "core" model

In Sections 2-4 we abstracted from a number of specific variables included in our sample of 12 studies, in order to focus on what we called "core" components of the fiscal rule – the dependent variable and the initial conditions of public finances. In this Section we add, when feasible, the additional variables used and found significant in this group of studies. The aim is to understand, in a common framework, how important these variables are and to what extent they modify the conclusions reached in Sections 3-4.

In this version of the paper, we are able to include, in addition to the variables used in the regressions presented in Table 4, four groups of explanatory variables. First, in order to capture the impact of European fiscal rules on the behaviour of the countries in excessive deficit, we introduce a regressor, ϕ_m (referred to as the *Maastricht variable*) which defines a *benchmark* correction of the primary balance which is essentially a function of the excessive deficit and the number of years in which the latter needs to be eliminated.[18] Second, the relevance of the electoral cycle is assessed by using three dummy variables. They are equal to 1, respectively, in the year of regular elections (ϕ_{e1}), defined as those held at the end of a full term, in the year before (ϕ_{e2}), and in the year of unexpected (snap) elections (ϕ_{e3}).[19] Third, the *ex ante* real interest rate (measured by the nominal three-month interest rate minus the expected rate of inflation) is addedd in order to allow for the interaction of fiscal and monetary policies. In fact, this variable (labelled ϕ_{monpol}) can be considered as a simple proxy of the monetary conditions under the assumption that central banks control short-term interest rates (see, e.g., Faini, 2006). Finally, two dummy variables, for "commitment states" and "delegation states" (ϕ_{com} and ϕ_{del}), refer to a well known classification of budgetary institutions (as set out in Hallerberg, 2004), and a synthetic indicator (ϕ_{rule}) captures the overall set of national-level numerical fiscal rules.[20]

Table 5.1 presents a set of estimates analogous to that of Table 4, but includes the additional variables mentioned above. The results broadly confirm the conclusions drawn on the basis of Table 4. The main differences are:

a) The evidence of asymmetric fiscal behaviour becomes stronger; the null of policy symmetry is rejected for all data sources.
b) We find large asymmetries (often individually significant) in the coefficients of many of the additional explanatory variables. This strengthens the conclusion, already reached on the basis of the "core" model, that the asymmetric cyclical effects operate through a general shift of the model parameters.

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[18] See Golinelli and Momigliano (2006).

[19] Details concerning the election dummies are in Golinelli and Momigliano (2006).

[20] We wish to thank Alessandro Turrini and Laurent Moulin for kindly supplying the data concerning the overall (used in the regression) and more detailed indexes. For information concerning the original source and the aggregation methodology, see Ayuso-i-Casals *et al.* (2007).

c) The evidence of counter-cyclical behaviour with real-time data becomes clearer.
d) The (stabilizing) reaction to the lagged debt with *ex post* data is weaker.
e) Time effects are less significant (except for the results with real-time data).

Overall, though the inclusion of eight additional parameters in the splitted samples may entail some inefficient estimates, there is a remarkable increase of the explanatory power of the enriched rule, as documented by the increase of about 20-30 per cent in all the measures of goodness-of-fit. In order to improve the readability of the results, Table 5.1 reports in bold the estimates that are 10 per cent significantly different to zero. The increase to 10 per cent of the significance level of the *t*-tests tries to take in account the loss of efficiency due to the inclusion in the model of a number of (possibly) irrelevant explanatory variables. We refrained from "fine-tuning" the model specifications to allow full comparability between the enlarged specification adopted in this section with the "core" model used above.

More in detail, the significance of the inclusion of the regular electoral dummies (prevalently affecting policies in good times) is warranted by the results of a joint test for the presence of an electoral cycle; this finding is independent from the data used. Snap elections seem to exert some relevant effects only using *ex post* data.

The *Maastricht variable* is significant only in case of bad times; however, the limited number of cases of excess deficit in good times does not allow for valid inferences.[21] Table 5.2 reports the detail about data availability in good and bad times. Note that negative estimates of the Maastricht variable parameter suggest that a country in excess of deficit further adjusts its finances with respect to what would be implied by the parameters of the fiscal initial conditions.

The estimates of the parameter measuring the effect of the monetary policy stance vary in significance across different sources of data. The prevalently negative sign suggests (as in IMF, 2004 and in Galí and Perotti, 2003) that fiscal and monetary policies are substitutes: when monetary policy is tight, discretionary fiscal policy loosens with respect to what it would otherwise be. The small magnitude of the estimates implies that the fiscal policy is only a very slight substitute for monetary policy.

The results for the variables capturing the role exerted by budgetary institutions and fiscal rules seem to suggest that "commitment" strategies may be relatively more successful in solving the common pool problem inherent in budget preparation, but only in bad times.

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[21] The same can be said for snap elections.

Table 5.1

CAPB-l Model *with* Additional Explanatory Variables[1]

Times:[2]	OECD, *ex post* bad	OECD, *ex post* good	EC, *ex post* bad	EC, *ex post* good	OECD with HP-GDP bad	OECD with HP-GDP good	OECD, real-time bad	OECD, real-time good
Explanatory factors of the "core" model (initial fiscal conditions and output gap)								
ϕ_{capb}	**–0.158**	**–0.206**	**–0.165**	**–0.178**	**–0.176**	**–0.173**	**–0.217**	**–0.160**
	(0.053)	***(0.056)***	***(0.053)***	***(0.058)***	***(0.057)***	***(0.050)***	***(0.057)***	***(0.052)***
	–2.98	***–3.70***	***–3.11***	***–3.06***	***–3.08***	***–3.44***	***–3.83***	***–3.09***
ϕ_{debt}	**0.010**	0.002	**0.009**	0.004	**0.012**	0.008	**0.012**	**0.013**
	(0.004)	*(0.005)*	***(0.004)***	*(0.005)*	***(0.004)***	*(0.005)*	***(0.004)***	***(0.005)***
	2.48	*0.44*	***2.36***	*0.79*	***2.84***	*1.58*	***3.12***	***2.74***
ϕ^{C-l}_{gap}	–0.041	–0.084	0.065	0.037	–0.033	0.036	**0.169**	**0.315**
	(0.049)	*(0.104)*	*(0.0790)*	*(0.122)*	*(0.063)*	*(0.099)*	***(0.087)***	***(0.177)***
	–0.83	*–0.81*	*0.82*	*0.30*	*–0.52*	*0.37*	***1.94***	***1.78***
The effect of the electoral cycle (regular and snap elections)[3]								
ϕ_{e1}	**–0.479**	**–1.274**	**–0.465**	**–1.065**	–0.312	**–1.102**	–0.300	**–1.251**
	(0.232)	***(0.338)***	***(0.256)***	***(0.333)***	*(0.258)*	***(0.294)***	*(0.227)*	***(0.340)***
	–2.06	***–3.76***	***–1.82***	***–3.20***	*–1.21*	***–3.75***	*–1.32*	***–3.68***
ϕ_{e2}	–0.320	**–0.624**	–0.045	–0.509	–0.258	**–0.540**	–0.109	**–0.652**
	(0.229)	***(0.331)***	*(0.252)*	*(0.327)*	*(0.241)*	***(0.311)***	*(0.221)*	***(0.307)***
	–1.40	***–1.88***	*–0.18*	*–1.56*	*–1.07*	***–1.74***	*–0.49*	***–2.12***
ϕ_{e3}	–0.336	–0.519	**–0.453**	–0.416	–0.365	–0.378	–0.084	–0.339
	(0.277)	*(0.487)*	***(0.269)***	*(0.560)*	*(0.277)*	*(0.417)*	*(0.273)*	*(0.441)*
	–1.21	*–1.07*	***–1.68***	*–0.74*	*–1.32*	*–0.91*	*–0.31*	*–0.77*
The effect of the "Maastricht variable"[4]								
ϕ_m	**–0.652**	–1.153	**–0.611**	–0.717	**–0.658**	–0.456	**–0.574**	0.329
	(0.143)	*(0.849)*	***(0.143)***	*(0.542)*	***(0.139)***	*(0.329)*	***(0.140)***	*(0.877)*
	–4.54	*–1.36*	***–4.28***	*–1.32*	***–4.71***	*–1.39*	***–4.09***	*0.38*
The effect of the monetary conditions[5]								
ϕ_{monpol}	–0.050	–0.122	0.032	–0.014	–0.033	**–0.148**	**–0.112**	–0.048
	(0.054)	*(0.077)*	*(0.060)*	*(0.104)*	*(0.053)*	***(0.076)***	***(0.058)***	*(0.066)*
	–0.92	*–1.58*	*0.54*	*–0.13*	*–0.62*	***–1.94***	***–1.93***	*–0.72*

The role of fiscal institutions[6]								
ϕ_{com}[6]	**0.688**	–0.176	**0.582**	0.059	**0.639**	–0.128	0.300	–0.066
	(0.249)	*(0.339)*	***(0.290)***	*(0.379)*	***(0.253)***	*(0.339)*	*(0.249)*	*(0.312)*
	2.77	*–0.52*	***2.01***	*0.16*	***2.52***	*–0.38*	*1.20*	*–0.21*
ϕ_{del}[6]	0.110	**–0.760**	0.172	–0.579	0.169	**–0.570**	–0.137	–0.041
	(0.239)	***(0.331)***	*(0.256)*	*(0.385)*	*(0.246)*	***(0.339)***	*(0.240)*	*(0.336)*
	0.46	***–2.30***	*0.67*	*–1.50*	*0.69*	***–1.68***	*–0.57*	*–0.12*
ϕ_{rule}[6]	0.181	0.164	**0.257**	0.163	0.127	0.189	0.135	0.029
	(0.116)	*(0.167)*	***(0.119)***	*(0.178)*	*(0.115)*	*(0.157)*	*(0.105)*	*(0.165)*
	1.56	*0.98*	***2.16***	*0.92*	*1.11*	*1.20*	*1.29*	*0.18*
Other statistics								
avg. μ_i[7]	–0.769	0.643	–0.491	1.154	–0.852	0.654	–0.448	0.842
	(0.474)	*(1.139)*	*(0.479)*	*(1.689)*	*(0.440)*	*(1.441)*	*(0.447)*	*(1.626)*
	–1.62	*0.56*	*–1.02*	*0.68*	*–1.94*	*0.45*	*–1.00*	*0.52*
N×T	127	82	110	90	113	96	108	101
$\overline{T}$	11.55	7.45	10.00	8.18	10.27	8.73	9.82	9.18
R^2[8]	0.427	0.435	0.472	0.368	0.471	0.416	0.533	0.371
Time eff.[9]	0.109	0.186	0.017	0.453	0.086	0.199	0.001	0.081
Asymmetry tests outcomes								
No switch [10]	0.0112		0.0001		0.0115		0.0035	
Shift[11]	–0.043		–0.028		0.069		0.146	
	0.708		0.847		0.557		0.459	

[1] GMM-sys estimates, see Blundell and Bond (1998), over the 1988-2006 period. Below each point estimate, we report the corresponding standard error (in brackets) and the Student's t. In bold, estimates that are significantly different to zero at 10 per esempio. [2] Bad times: when $GAP \leq 0$; good times: when $GAP > 0$. Details about data availability over the cycle are in Table A1. [3] Election explanatory dummy variables: $e1_{it} = 1$ occurred in t; $e2_{it} = 1$ in $t+1$; $e3_{it} = 1$ snap elections. [4] Explanatory Maastricht variable, see Golinelli and Momigliano (2006). [5] Explanatory real short-term *ex ante* interest rate. [6] Fiscal governance form dummy variables: $com_{it} = 1$ committment; $del_{it} = 1$ delegation. Overall Index of national-level fiscal rules (ϕ_{rule}), see Ayuso-i-Casals *et al.* (2007). [7] Average of the 11 country-effects estimates. [8] Proxied by the squared correlation between actual and fitted values. [9] Test for the null hypothesis that all the 18 time dummies are jointly zero, p-values. [10] P-values of the test for parameters (excluding $\phi_{\text{gap}}^{\text{C-I}}$) being equal in the two sub-samples of good and bad times, *i.e.* for the restrictions collapsing 2SA to 2PA. [11] First row: estimate of the difference ${}_{\text{g}}\phi_{\text{gap}}^{\text{C-I}} - {}_{\text{b}}\phi_{\text{gap}}^{\text{C-I}}$ in good and bad times; second row: p-values of the test for the coresponding difference being zero (*i.e.* for the "no-shift" hypothesis).

Table 5.2

Size of Sub-samples across Data Sources (Full Sample: 1988-2006)

Data source:	OECD *ex post*	EC *ex post*	OECD with HP-GDP	OECD real-time
Total observations, of which:	209	200	209	209
- in good times	82	90	96	101
- in bad times	127	110	113	108
Regular elections in *t*, of which:	33	32	33	33
- in good times	13	19	18	17
- in bad times	20	13	15	16
Regular elections in *t*+1, of which:	38	36	38	38
- in good times	16	17	17	19
- in bad times	22	19	21	19
Snap elections in *t*, of which:	19	18	19	19
- in good times	6	4	6	9
- in bad times	13	14	13	10
Excess deficit cases, of which:	55	52	55	55
- in good times	7	8	13	2
- in bad times	48	44	42	53
Negative *ex ante* real interest rates, of which:	28	28	28	28
- in good times	13	15	12	9
- in bad times	15	13	16	19
Governance committment cases, of which:	67	67	67	67
- in good times	23	31	27	31
- in bad times	44	36	40	36
Governance delegation cases, of which:	68	68	68	68
- in good times	24	25	30	30
- in bad times	44	43	38	38

6 Conclusions

Whether discretionary fiscal policies act counter- or pro-cyclically and whether their reaction is symmetric or asymmetric over the cycle are still largely unsettled questions. The different results obtained by the empirical literature can in principle reflect the model of policy decisions used, the estimation procedures adopted, the countries included in the sample, the periods of time analyzed, the sources of data selected (including different vintages of data from the same source).

In this paper we restrict our attention to a subset of relatively homogeneous papers, presenting econometric evidence mainly about the euro-area countries, and assess the role of all the factors mentioned above in a common empirical context in order to disentangle their relevance.

In the first part of the paper we assess the impact of the different choices in modelling fiscal behaviour. We focus on the "core" components of the fiscal rule – the dependent variable and the initial conditions of public finances – finding in the reviewed studies three basic specifications of fiscal behaviour. We show that these three fiscal rules – which include among regressors only the initial conditions of public finances (debt and deficit) and the output gap – lead to differences in the estimates of the parameter measuring the reaction to cyclical conditions. In particular, comparing the first model – used in most empirical studies – with the second one, the latter suggests a more countercyclical behaviour. The difference can be attributed to the different notions of fiscal policy cyclicality embodied in the two fiscal rules (net or gross of the reaction to the lagged effects of automatic stabilizers).

In the case of the third model, where the dependent variable includes the effects of both the fiscal policies and the automatic stabilizers, two alternative concepts of discretionary policy cyclicality are possible and lead to drastically different interpretations of the policy behaviour on the basis of the estimated parameter. If the more restrictive notion is adopted, it suggests a far more pro-cyclical discretionary policy than the other two models.

In our opinion, there is often insufficient awareness of these issues when the estimates of the output gap parameter of the different studies/models are used in the policy debate.[22]

In the second part of the paper we focus on the first of the three models and examine the impact of varying time periods and sources of data on the estimates. In particular, we estimate rolling regressions with a fixed window of 15 years over the period 1978-2006 for four alternative datasets: three of them are based on *ex post* data sources (OECD, AMECO, OECD data for primary deficit and debt with Hodrick-Prescott filter estimates of the output gap); the fourth data set is largely

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[22] These issues are also relevant for other sectors of the literature on fiscal policy behaviour, for example that focusing on developing countries, as the same modelling choices are also followed there.

based on real-time data (taken from Golinelli and Momigliano, 2006) and is available for the reduced 1988-2006 period. The results suggest that:

a) The different data sources change the interpretation of the reaction of fiscal policy to cyclical conditions, but the notion of pro-cyclical fiscal policies often upheld in the debate[23] is not justified. In particular, weakly counter-cyclical policies emerge with AMECO and real time data, while the other *ex post* data sources broadly suggest acyclicality.
b) Independently of the data source we use, a slight tendency towards a pro-cyclical behaviour emerges over time. This result contrasts with other papers, which find a shift from pro-cyclicality to acyclicality after the Maastricht Treaty (Wyplosz, 2006; IMF, 2004; Galí and Perotti, 2003).
c) The effect on policies of the fiscal initial conditions (lagged debt and deficit) are strongly significant. This evidence suggests caution when using inferences on the cyclical response of fiscal policies based on models omitting these regressors.
d) As for the question concerning the symmetry of the fiscal behaviour, we find contrasting results, depending on both *ex post* data sources and sample periods. We also find that the asymmetric behaviour of the discretionary policy, when present, entails shifts in all the parameters of the rule and not only in the output gap parameter.

In the final part of the paper we try to enrich the basic model including the additional variables used and found significant in the group of studies we reviewed. This was possible only for some regressors, due to data limitations. Extending the model determines a sizeable increase of the explanatory power of the model, but the conclusions reached on the basis of the "core" fiscal reaction function are broadly confirmed. The only important differences are:

a) Policy asymmetry is found for all data sources.
b) The evidence of counter-cyclical behaviour with real time data becomes clearer.

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[23] An example can be found in the following, from OECD (2007): "Fiscal policy has not contributed to stabilising the cycle in the euro area. When the economy was above potential at the start of the decade several fiscal authorities did not allow the automatic stabilizers to operate fully as they used cyclical tax receipts to finance tax cuts and expenditure increases…( ) More systematic investigations using longer time series confirm the observation that fiscal policy tends to act pro-cyclically in euro area countries".

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SAFETY MARGINS IN EU BUDGETARY SURVEILLANCE: AN ASSESSMENT

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This paper deals with alternative approaches for deriving adequate budgetary safety margins. We highlight some critical features of the existing EU Commission's methodology and propose an alternative method for assessing the minimal benchmark, i.e. *the value of the deficit-to-GDP ratio that ensures compliance with the required safety margins. A number of empirical arguments lend support to this measurement approach, although our estimates of minimal benchmarks do not diverge extensively from those derived through the current methodology. We also provide estimates of safety margins by using a complementary approach based on stochastic simulations of a macroeconomic model. The findings are qualitatively very similar to those obtained with the other method. Moreover, we lend empirical support to the view that a fiscal structure with lower budget sensitivity to cyclical fluctuations is conducive to less ambitious safety margins.*

1 Introduction

As a result of the reform of the Stability and Growth Pact (SGP), which was agreed upon at the European Council of March 2005, the notion of safety margins has become crucial in the process of EU budgetary surveillance. Under the previous SGP each Member States had to pursue the attainment of a budgetary position close to balance or in surplus in the medium term. A key provision of the revised SGP is that medium-term budgetary objectives (MTO) may diverge from close to balance or in surplus and can differ across countries depending on country-specific economic conditions and risks to public finance sustainability. According to the new SGP, the MTOs are laid down with the primary aim of ensuring a safety margin with respect to the 3 per cent deficit limit in case of adverse cyclical developments. The size of this margin must take into account the country's past output volatility and the budgetary sensitivity to output. The minimal (or minimum) benchmark (MB) is the value of the deficit-to-GDP ratio that ensure compliance with such adequate safety margin (see European Commission, 2002 and 2006).

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Measures of MBs were first derived by the Commission in 2001, although even before estimates were made available in other works (see, e.g., IMF, 1998 and Buti *et al.*, 1998). Calculation of MBs requires preliminary estimation of budgetary sensitivities to output and representative negative output gaps. The latter are estimates of output gap levels which are likely to be observed under particularly unfavourable, yet still possible, cyclical conditions. According to the EU Commission's methodology, the representative output gap is derived by applying an algorithm. It is the simple mean between the lowest and the highest figures resulting from these three alternative indicators: a) the country-specific largest negative output gap; b) the unweighted average of the largest negative output gaps in each country; c) two times the country-specific standard deviation of the output gap taken with minus sign.

On 26 October 2005, Member States officially called for further methodological work to explore possible methodological improvements (European Commission, 2006). In our view, the EU Commission's existing methodology has some shortcomings, such as: a) the *ex ante* uncertainty on which pair of indicators, out of the three made available, is actually used; b) a non satisfactory way to tackle the issue of the short length of output gap time series, especially of New Member States (NMSs); and finally, c) the fact that, for being meaningful, one of the three indicators implicitly imposes the assumption of normality for the output gaps series.

In this paper, not only we provide arguments and produce evidence questioning the soundness of the existing methodology, but we also put forward an alternative methodology for deriving budgetary safety margins. The intuition underlying our approach is that countries with wider cyclical fluctuations should be more constrained by their MBs than countries whose business cycles are less volatile. Indeed, the higher is the volatility of a country's cyclical fluctuations, the more likely is the outcome of this country being hit by a sizeable recession.

We propose to compute representative output gaps through an identical algorithm for all Member States, that uses both a country-specific and a common component referred to all EU 27 Member States. This allows us to fully exploit the country-specific information, while, by supplementing this information with a common component, also limit the adverse implications of using output gap series not fully representative of typical cyclical developments. In our proposed approach, the country-specific and the 27 EU-wide common components of representative output gap are aggregated by using as weights the relative volatility of their business cycles.

In addition to proposing a new method still based on *ex post* information, we also employ an alternative *ex ante* approach for computing MBs. This alternative *ex ante* approach is based on stochastic simulations of a macroeconomic model. This approach was also adopted in other contributions such as those by Dalsgaard and de Serre (1999) and Artis and Onorante (2006).[1] We perform the stochastic simulations

[1] See also the studies by Dury and Pina (2003) and Roodenburg *et al.* (1998).

with the Italian Treasury Econometric Model (ITEM) (Department of the Treasury, 2007). In particular, we repeatedly simulate the model by using random drawings of stochastic disturbances that mimic macroeconomic turbulence. This allows us to derive an approximated distribution for the deficit-to-GDP ratio. Importantly for our purposes, this yields an estimated value of the budget balance-to-GDP ratio that would imply compliance with the 3 per cent boundary for a given time horizon and a given probability. We compare estimates of MBs obtained this way with the corresponding values obtained with the other method. We also argue that lower budget sensitivity to output fluctuations should imply less ambitious budgetary safety margins. This hypothesis lends itself to the empirical scrutiny. In particular, we perform stochastic simulations under two counterfactual scenarios, both characterised by a lower degree of budgetary sensitivity to output fluctuations and test whether budgetary safety margins are of lower size than those estimated under the baseline scenario.

Before going through the paper, it is important to highlight an important, and more general, issue that our paper does *not* address. This issue is how to reconcile the margins of uncertainty surrounding cyclically-adjusted budgetary figures with their prominent role in EU fiscal surveillance. Such uncertainty stems from data revisions of output gap series across different vintages, from imperfect estimates of tax elasticities and tax bases as well as from difficulties to appraise the budgetary effects of the changing composition of growth. Admittedly, tackling these issues would require a much broader perspective than the one taken in this paper. We therefore treat the commonly used approach for deriving cyclically-adjusted budget balances as a "maintained hypothesis" and focus our attention on a more limited issue.

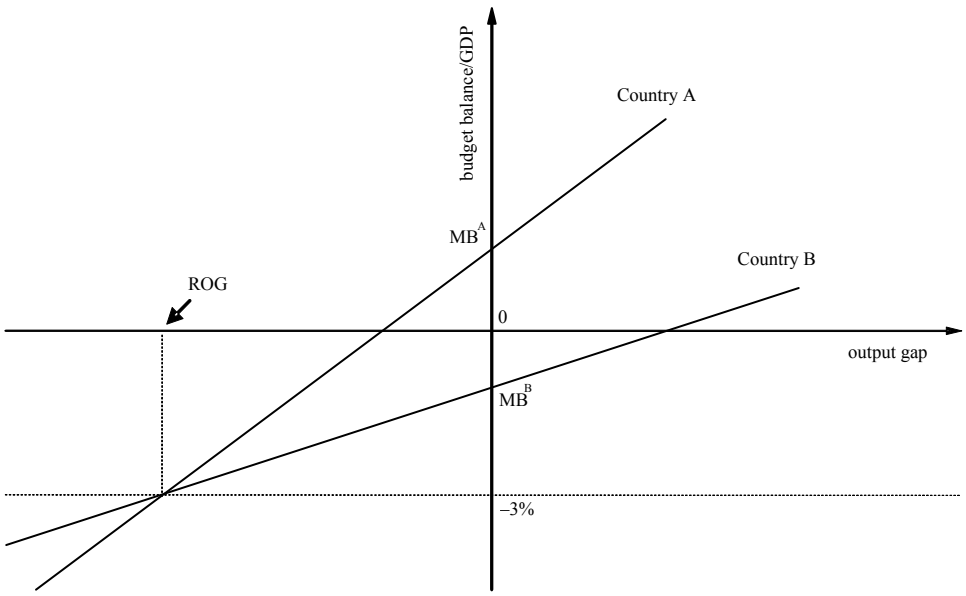
The remainder of the paper is organised as follows. Section 2 illustrates the concept of MB. Section 3 presents the data and the methodology used by the EU Commission for estimation. Section 4 addresses some critical issues pertaining to the existing methodology. In section 5, we outline our proposed methodology. In section 6, we apply it to actual data and compare the estimated values of MBs with those obtained with the existing method. Section 7 provides evidence on safety margins derived from stochastic simulations of a macroeconomic model. The final section draws some conclusions.

2 The definition of "minimal benchmark"

The MB is defined as the value of the cyclically-adjusted budget balance that allows a country to let automatic stabilisers work freely without risking to breach the 3 per cent deficit-to-GDP ceiling under normal cyclical circumstances. This indicator is relevant in the assessment of countries' stability and convergence programmes. It is obtained by subtracting from the 3 per cent ceiling a "cyclical safety margin" calculated as the product of the budgetary sensitivity to output fluctuations times a "representative output gap" (ROG) that captures by how much

Figure 1

The Minimal Benchmark for Two Countries with the Same Representative Output Gap



output would go below potential in case of particularly weak, yet still likely, cyclical conditions. In analytical terms,

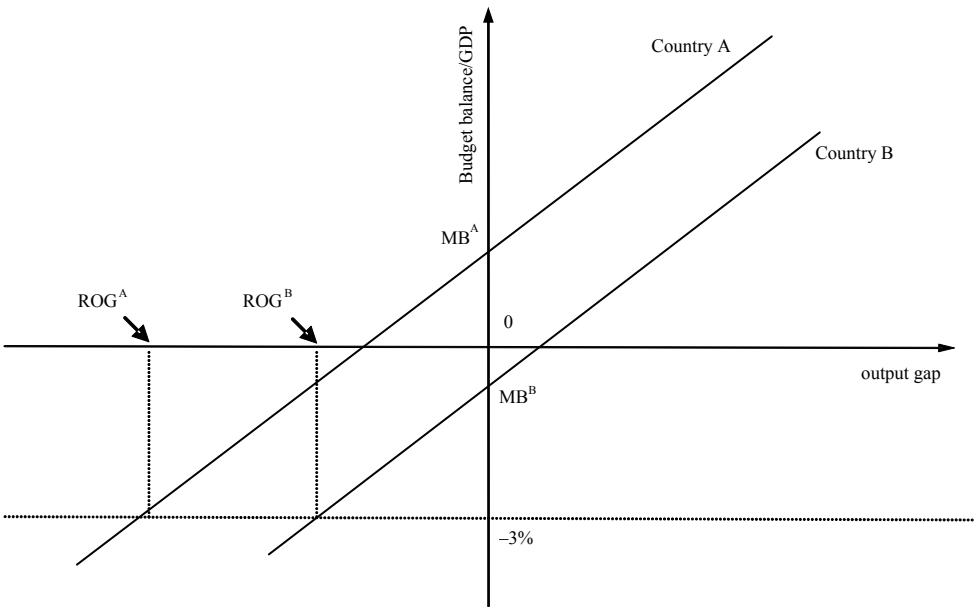
$$MB = -3 - \varepsilon \cdot ROG \quad (1)$$

where MB is the minimal benchmark, ε is the budgetary sensitivity to growth and ROG is the representative output gap. The latter variable measures the wedge between actual and potential output in the case of particularly severe, yet still possible, cyclical conditions. ε is measured as the change in the budget balance-to-GDP ratio in response to a unit percentage increase of output gap. Hence, the computation of MBs requires, for each Member State, (i) an estimate of the budgetary sensitivity to output fluctuations and (ii) the identification of a representative output gap for particularly weak cyclical conditions.

In Figure 1, we compare two countries, A and B, having the same ROG, with one of them (A) exhibiting a higher budgetary sensitivity to output gap with respect to the other (B). The slope of the two lines indicates the degree of such sensitivity. Given the definition of MB, although the two countries share the same ROG, for the country with a higher budgetary sensitivity (A) the required cyclical safety margin for the deficit-to-GDP ratio is larger than that for the other country. In particular, the

Figure 2

The Minimal Benchmark for Two Countries with the Same Budgetary Sensitivity



MB of the country with the higher budgetary sensitivity is positive (MB^A), suggesting that the safety margin for the budget balance has to be particularly sizeable.

Similarly, in Figure 2 we consider the situation in which two countries, A and B, exhibit the same budgetary sensitivity although they differ in the degree of volatility of their cycle as measured by the representative output gap. The country with the largest negative representative output gap (A) requires a safety margin for the budget balance-to-GDP ratio which is larger than that for the other country (B). In the example of the figure, the MB of the country with a higher (in absolute value) ROG is positive (MB^A), indicating that the safety margin is of a large size. Conversely, the MB is negative (MB^B) for the other country. Of course, it is straightforward to compare MBs of countries when both budgetary sensitivities and representative output gaps are different (see European Commission, 2002).

3 Data and the existing method

The EU Commission estimated MBs for EU-15 Member States for the first time in 2001 and then updated them in 2002 and the following years. Starting from

2005, measures of MBs were also made available for the New Member States (EU 10). As we have seen before, the notion of MB is inherently country-specific and for its computation the following information is needed for each Member State: (i) an estimate of the budgetary sensitivity to output fluctuations and (ii) an estimate of a representative output gap (ROG).

New and updated estimates of budgetary sensitivities are currently available for both the EU 15 and the New Member States, although official estimates for Bulgaria and Romania are not yet available.[2] The sample of output gap data used to estimate ROGs refers to the period 1980-2005 for the EU 15 countries.[3] By contrast, for the NMSs the starting period of output gap data is 1995 at the earliest. Despite the official dataset maintained by the Commission services (AMECO) contains data on output gap of the EU 15 countries starting from 1965 (except for Germany and Luxembourg), the entire sample is not used for computing ROGs as using time series that start far back in the past may increase the risk of dealing with past cyclical characteristics of the economy that are structurally different from those currently prevailing. For example, the economic cycle volatility of a specific country may have been higher over the past 20 years than it had previously been. Considering a time series dating back to 1965 may underestimate the size of a typical adverse cyclical outcome which is likely to occur in the future. This would erroneously lead to a lower-than-required budgetary safety margin.

This is also true for NMSs where available data on output gap starts quite recently. Because of a variety of structural shifts hitting these economies in the early nineties, using output gap data that go far back in the past would not be a correct strategy. Indeed, the cyclical patterns observed in these economies before the mid-1990s are likely to be profoundly different from those prevailing now. Hence, data on output gap before then are likely to be scarcely informative for identifying a representative unfavourable cyclical outcome as of today. Therefore, the EU Commission's approach to use a sub-sample of the available data rather than the whole sample seems to be reasonable. On the other hand, however, the resulting short length of the time series, especially for NMS, is problematic as the sole

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[2] The methodology for deriving budget sensitivities is the one developed by OECD and has recently undergone a number of revisions. The joint work of the OECD and Economic Policy Committes's output gap working group (EPC OGWG) has produced the new and updated budget sensitivities for the EU 25 countries which have been approved by the EPC. For each country, budget sensitivity is obtained from budget elasticities. On the revenue side of the budget, four different tax elasticities to output were estimated: on personal income tax, on corporate income tax, on indirect taxes and, finally, on social contributions. The four elasticities are then aggregated using as weights the share of each item on total current tax revenues. This provides an estimate of the elasticity of tax revenues to output. On the expenditure side, only the elasticity to output of unemployment-related transfers is considered. Both revenue and expenditure elasticities are converted into sensitivity parameters by multiplying the tax revenue and expenditure elasticities by, respectively, the share of current tax revenues on GDP and the share of current expenditure on GDP. Finally, the difference between the sensitivity of tax revenue to output and the sensitivity of expenditure to output provides the country-specific estimate of the sensitivity of the budget balance to output fluctuations.

[3] Germany and Luxembourg are the two exceptions: their samples start, respectively, in 1991 and 1982.

country-specific output gap data may not be sufficient to convey the necessary information.

The EU Commission methodology for estimating output gap has changed after the 2002 Council decision to endorse the production function approach for measuring potential output. The previous method was based on the application of the Hodrick-Prescott (HP) filter to estimate trend GDP. In 2003, the EPC OGWG refined the production function methodology and extended it to all EU countries, including the New Member States. Moreover, in 2006 a number of additional modifications have been introduced and a detailed description of the EU revised production function approach is presented in Denis, Grenouilleau, Mc Morrow and Röger (2006).[4]

According to the existing method, the sample of the output gap values used to calculate the ROG is first trimmed to exclude those observations that are not representative of standard cyclical fluctuations. The original version of the SGP provided a definition of a "severe and exceptional economic downturn" as a decline in GDP growth greater than 0.75 per cent. Thus, in the old SGP framework, output gap observations corresponding to such declines were considered outliers and excluded from the sample. Since 2005, all observations for which the output gap is below the 2.5th percentile or above the 97.5th percentile of the whole set of data are dropped. This methodology, without assuming any specific statistical distribution for output gaps, provides a solution to the problem arising from the removal of the reference to "severe economic downturn" in the new SGP.

Once outliers are excluded, ROGs are derived for each EU country by applying, in the period considered, the simple average of the minimum and the maximum values resulting from the following three alternative criteria:

(i) the largest negative output gap ever observed for the Member State concerned;

(ii) the simple average of the largest negative output gaps in EU Member States;

(iii) two times the country-specific standard deviation of the output gap taken with minus sign.

In October 2005, the Member States, whilst agreeing on the new release of data on MBs for the EU-25, invited the European Policy Committee to undertake methodological work to improve the current approach (European Commission, 2006). Indeed, the reform of the SGP and the EU enlargement make the notion of MB extremely important in EU budgetary surveillance. However, there are a

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[4] Potential output is derived within a Cobb-Douglas production function framework where the following inputs are considered: a) a capital stock series of the business sector constructed under the hypothesis that investment responds to potential output with a unit elasticity, b) a measure of trend labour input and c) a measure of trend TFP. Potential labour input stems from both potential employment and trend, average hours worked. Potential employment is obtained by combining an estimate of structural unemployment rate (NAIRU), working age population and an estimate of trend participation rate. The latter is obtained by applying the HP filter on participation rate data, whilst the NAIRU estimate stems from a Kalman filter approach where a Phillips curve relationship is used to identify the cyclical components of unemployment. The HP filter is applied to standard TFP estimates to derive its trend component (see Denis, Grenouilleau, Mc Morrow and Röger, 2006).

number of critical features in the current methodological approach. In the following sections we discuss them and argue in favour of a revision of the existing method.

4 Issues related to the current methodology

The existing MB method features three different indicators, although only two of them are relevant for each country, namely the ones providing the lowest and the highest value. The obvious implication of this algorithm is that the identification of an adverse cyclical outcome hinges on different indicators depending on the country concerned. Moreover, new data releases and/or revision may imply a switch, for a given country, from one pair of indicators to another, with unpleasant implications on the stability of outcomes. The *ex ante* uncertainty on which pair of indicators is used casts some doubts on the soundness of the existing approach.

Another relevant issue deals with the short length of output gap time series for the NMSs. In 2004, EPC OGWG decided not to use data before 1995 in computing output gaps for EU-10 countries. We have already discussed the reasons as to why the informative gains from increasing back into the past the NMS sample data would be more than offset by the drawbacks stemming from the structural transformations occurred in the early 1990s. However, considering a relatively short time series of output gap data is also problematic, as the country-specific data may not be sufficiently informative on the typical size of adverse cyclical developments. In Table 1 we report descriptive statistics of the output gap data for both the whole and the restricted samples. In general, if we compare figures in columns (3) and (5), they indicate country's standard deviations being larger when the longest sample is considered. The EU wide standard deviation is 2.30 for the whole sample (excluding Bulgaria and Romania), while it is 1.95 for the restricted sample. Moreover, if we look at figures in column (5) it turns out that in 9 cases out of 12, the country-specific standard deviation of output gap of the EU-12 (the NMS) is lower than the figure calculated on the whole sample (1.95). If we take the standard deviation of output gap as a measure of the intensity of business fluctuations, one might infer that cycles of NMS are inherently less volatile. However, if we compute the standard deviation of output gap over the entire EU 27 sample, but with observations only from 1995 onward, this value is 1.66. Importantly, such value is lower than the one obtained on the whole sample and no more is it systematically higher than the country-specific standard deviation of NMS. Hence, the evidence for the EU 27 over the period of interest seems to indicate that, with too short a sample of the output gap series, the degree of cyclical volatility might be underestimated and so would be the representative output gap. Should this happen, the ensuing budgetary safety margin against the risk of infringing the 3 per cent deficit-to-GDP ratio would be biased downward. One of the three indicators used in the existing methodology is not country-specific but common to all EU countries. It is the unweighted average of the largest negative output gap in Member States. The presence of this indicator is likely to mitigate the problem of ROG and safety margin underestimation in the case of too short output gap time series. Nevertheless, further

Table 1

Descriptive Statistics for the Output Gap Series

EU 27 Countries (1)	Whole Sample		Restricted Sample		
	Mean (2)	St. Dev. (3)	Mean (4)	St. Dev. (5)	5th Percentile (6)
AT	–0.10	1.57	–0.36	1.39	–2.10
BE	–0.18	1.73	–0.43	1.53	–2.43
BG	.	.	–0.14	1.83	–3.55
CY	0.10	1.55	0.09	1.57	–2.04
CZ	–2.40	0.98	–2.41	0.98	–3.61
DE	0.11	1.50	0.10	1.50	–1.29
DK	–0.30	2.01	–0.51	2.02	–4.13
EE	–2.10	2.51	–1.13	1.40	–4.39
EL	–0.26	2.80	–0.80	1.92	–3.72
ES	–0.41	2.78	–1.20	2.61	–4.83
FI	–0.39	2.99	–0.34	2.06	–3.22
FR	–0.09	1.48	–0.43	1.44	–2.18
HU	–0.33	1.07	–0.32	1.08	–1.25
IE	0.05	2.58	–0.56	2.58	–4.70
IT	–0.06	1.72	–0.25	1.63	–2.62
LT	–1.56	2.98	–0.56	2.20	–3.65
LU	–0.35	3.42	–0.88	2.73	–5.15
LV	–0.93	1.33	–0.93	1.32	–2.87
MT	0.16	2.59	–0.31	2.15	–3.18
NL	–0.27	1.60	–0.53	1.75	–3.32
PL	–1.15	1.67	–1.15	1.66	–4.95
PT	–0.01	3.63	–0.03	2.64	–4.06
RO	.	.	–1.23	2.53	–4.47
SE	–0.58	1.98	–0.85	2.08	–3.51
SI	–0.28	1.04	–0.28	1.03	–1.81
SK	–0.75	1.85	–0.76	1.85	–2.98
UK	–0.07	2.05	–0.58	2.10	–4.13
EU	–0.31	2.30	–0.58	1.95	–3.82

Legenda: The whole sample refers to the longer time series available from AMECO database. These series cover the period 1965-2005 for EU 15, excluding Germany and Luxembourg whose data start in 1991 and 1982, respectively. For the NMS, the first year of the sample varies between 1995 and 1997. The restricted sample refers to the sub-sample used for computing ROGs and MBs. It is 1980-2005 for EU 15, excluding Germany and Luxembourg. The statistics reported on columns (4) through (6) and referred to the restricted sample are computed after removing the outliers (see text).

methodological work is warranted so as to make MBs for NMSs more demanding than what they are with the existing approach.

An additional shortcoming stems from the criterion (iii) of the current methodology, the one that uses as indicator "two times the standard deviation of the output gap taken with minus sign". For being meaningful, this indicator implicitly requires the assumption that output gaps follow a normal distribution. According to the stylized facts about business fluctuations for industrialised countries, there are no large asymmetries between rises and falls in production. In other words, GDP growth tends to be distributed roughly symmetrically around its mean (Romer, 2005).[5] This would not be inconsistent with assuming normality of output gap. Such hypothesis, however, would be more likely to hold over the entire sample for which data have been constructed (1965-2005 for the EU 15). On the contrary, in computing the MBs, output gap data before 1980 are not considered for any EU country. Therefore, the assumption of symmetry and, *a fortiori*, of normality might fail to hold for the output gap series of some countries.

Thus, since the assumption of normality lends itself to the empirical scrutiny, we performed two different tests for normality on each of the EU 27 countries' time series of output gap. These tests are the Shapiro-Wilk and the test described in D'Agostino *et al.* (1990), which combines into a general test a pair of tests for normality each based, respectively, on skewness and kurtosis. The statistic for this second test is distributed as an adjusted χ^2. In Table 1 we report the results of these tests performed on the output gap data used for computing MBs.

It turns out that in about 20 per cent of the EU 27 countries, the hypothesis of normality of the output gap is rejected at standard level of confidence. In general, when the normality assumption is rejected this outcome is obtained no matter whether we include or exclude the outliers of the output gap dataset. The latter, we recall it, are identified as those values lower and greater than, respectively, the 2.5^{th} and 97.5^{th} percentiles of the whole EU 27 data set. Rejection of normality is not limited to data of the NMSs where, arguably, the lower length of the time series may render the tests for normality less informative. Indeed, evidence of departure from normality is found for output gap data of countries such as Spain and Germany (see Table 2).

In light of the above shortcomings, a reformulation of the current methodology for measuring MBs is appropriate. Thus, it would be important for a new method to be based on a unique indicator common to all countries, without *a priori* uncertainty on which one is used for each of the various countries. This would clearly enhance the degree of transparency. Second, an improvement over the existing algorithm would be a computation of MBs not affected by the limited cyclical volatility in NMSs that derives, as it was documented, from the short length

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[5] Romer (2005) argues convincingly that the asymmetry might be of a different type. In particular, real GDP tends to be characterised by relatively lengthy periods when it is a little bit above its usual path, interrupted by short periods when it is relatively far below (see also Acemoglu and Scott, 1997).

Table 2

Tests for Normality of Output Gap Data

Country	Sample Adjusted for Outliers					Sample Not Adjusted for Outliers				
	N. obs.	(1) adj-χ^2	(2) *p*-val.	(3) W	(4) *p*-val.	N. obs.	(5) adj-χ^2	(6) *p*-val.	(7) W	(8) *p*-val.
AT	26	2.60	0.27	0.94	0.10	26	2.60	0.27	0.94	0.10
BE	26	2.37	0.31	0.97	0.53	26	2.37	0.31	0.97	0.53
BG	9	2.73	0.26	0.86	0.10	11	5.37	0.07	0.88	0.12
CY	11	1.56	0.46	0.93	0.45	11	1.56	0.46	0.93	0.45
CZ	9	1.63	0.44	0.93	0.44	9	1.63	0.44	0.93	0.44
DE	15	6.05	0.05	0.83	0.01	15	6.05	0.05	0.83	0.01
DK	26	0.13	0.93	0.99	0.98	26	0.13	0.93	0.99	0.98
EE	9	8.47	0.01	0.78	0.01	11	3.60	0.17	0.79	0.01
EL	26	1.65	0.44	0.97	0.57	26	1.65	0.44	0.97	0.57
ES	26	6.72	0.03	0.93	0.06	26	6.72	0.03	0.93	0.06
FI	22	0.15	0.93	0.97	0.70	26	0.74	0.69	0.97	0.75
FR	26	4.21	0.12	0.94	0.11	26	4.21	0.12	0.94	0.11
HU	11	11.36	0.00	0.73	0.00	11	11.36	0.00	0.73	0.00
IE	24	0.42	0.81	0.97	0.74	26	0.43	0.81	0.98	0.87
IT	26	1.34	0.51	0.97	0.71	26	1.34	0.51	0.97	0.71
LT	9	3.02	0.22	0.88	0.15	11	1.50	0.47	0.92	0.28
LU	20	2.18	0.34	0.96	0.55	24	1.80	0.41	0.97	0.64
LV	11	1.03	0.60	0.97	0.90	11	1.03	0.60	0.97	0.90
MT	10	1.70	0.43	0.93	0.47	11	1.01	0.60	0.94	0.54
NL	26	1.52	0.47	0.95	0.21	26	1.52	0.47	0.95	0.21
PL	11	5.53	0.06	0.88	0.12	11	5.53	0.06	0.88	0.12
PT	23	1.94	0.38	0.97	0.57	26	1.19	0.55	0.97	0.54
RO	7	.	.	0.93	0.52	11	1.29	0.53	0.94	0.51
SE	26	0.01	0.99	0.98	0.77	26	0.01	0.99	0.98	0.77
SI	9	0.56	0.76	0.97	0.89	9	0.56	0.76	0.97	0.89
SK	10	1.38	0.50	0.90	0.20	10	1.38	0.50	0.90	0.20
UK	26	0.08	0.96	0.97	0.67	26	0.08	0.96	0.97	0.67

Legenda: adj. χ^2 is the distribution of the test statistic for the null hypothesis of normality (the degree of freedom are two). The associated *p*-values are reported. W is the Shapiro-Wilk statistic for testing the hypothesis of normality; again, the corresponding *p*-values are reported. The tests are performed for both the sample adjusted for outliers and the one not adjusted.

of their time series on output gap. Finally, it would be appropriate to disconnect the selected indicator from any implicit assumption of normality.

5 The proposed method

The methodology we put forward builds on the idea of computing the ROG by using both a country-specific and a common component referred to all EU 27 Member States. The algorithm used is the same for all Member States. Arguably, the use of a common component should reduce the adverse implications of using output gap observations not being fully representative of typical cyclical fluctuations. This issue deals with the relatively short length of time series data and is thus particularly relevant for NMSs.

Since shortened output gap series lacks significance and may not be representative of standard cyclical fluctuations, in shaping the methodology we use the available information for each country but we also supplement it with cross-countries information stemming from the EU 27 Member States.

We consider first the 5th percentile of the country output gap data over the entire period ($\boldsymbol{P}^{\boldsymbol{c}}_{5\%}$). Whilst the concept of representative output gap is inherently country-specific, in its computation we also include information from other countries' output gap. This information is abridged in the 5th percentile of the output gap data for the whole sample of EU 27 countries ($\boldsymbol{P}^{\boldsymbol{E}}_{5\%}$). The key issue is how to put the two pieces of information together in a sensible way. Our proposal is that of computing the ROG for a specific country, *c*, according to the following expression:

$$\boldsymbol{ROG}^{\boldsymbol{c}} = \frac{\boldsymbol{\sigma}_{\boldsymbol{c}}^{2}}{\boldsymbol{\sigma}_{\boldsymbol{c}}^{2} + \boldsymbol{\sigma}_{\boldsymbol{E}}^{2}} \boldsymbol{P}^{\boldsymbol{c}}_{\boldsymbol{i}5\%} + \frac{\boldsymbol{\sigma}_{\boldsymbol{E}}^{2}}{\boldsymbol{\sigma}_{\boldsymbol{c}}^{2} + \boldsymbol{\sigma}_{\boldsymbol{E}}^{2}} \boldsymbol{P}^{\boldsymbol{E}}_{\boldsymbol{j}5\%} \qquad (2)$$

where $P^{c}_{i5\%}$ is the 5th percentile for the country *c*'s output gaps over the period starting on the year (*i*) in which values become available for the country; $P^{E}_{j5\%}$ is the 5th percentile for the whole sample of EU 27 countries starting from the earliest possible year *j*. Moreover, $\boldsymbol{\sigma}_{\boldsymbol{c}}^{2}$ is the variance of country *c*'s output gaps calculated over the sample starting on the year (*i*) in which values become available for *c* and $\boldsymbol{\sigma}_{\boldsymbol{E}}^{2}$ is the variance for the whole sample of output gap data.[6]

In equation (2), the country-specific and the common component of ROGs, as measured by the country-specific and the EU 27-wide 5th percentiles respectively, are aggregated by using as weights the relative volatility of their business cycles. We

[6] Before applying equation (2), the preliminary exclusion of outliers from the dataset is carried out. Consistently with the currently used method, observations of the whole data set for which the output gap is below percentile 2.5 or above percentile 97.5 are dropped.

believe that any alternative way to weight the two percentiles – for example, by using 0.5 and 0.5 – would be quite arbitrary. Our argument is that relative volatility is a valuable piece of information for assessing the required budgetary safety margin. In particular, a country with a more volatile business cycle should be more constrained by its MB with respect to countries whose fluctuations are less dramatic.

The intuition underlying our approach is the following: the higher is the volatility of the business cycle of a given country the more likely is for that country's economy to experience a sizeable and severe downturn. In other words, if we take a country's output gap as the variable that suitably represents its cyclical conditions, it turns out that the larger is the variance of the output gap series, the larger (in absolute value) tends to be the representative (negative) output gap for this country. If we take the 5th percentile of the output gap series of a country as the statistic that measures the typical size of the country's cyclical downturn that is severe but yet not exceptional, it turns out that the size of this percentile is correlated with the degree of volatility of output gap. In particular, if the output gap of two countries, A and B, have different standard deviation (σ) with $\sigma_A > \sigma_B$, then, in general, the representative negative output gap, as measured by the 5th percentile of the time series is higher, in absolute value, for country A: $| \boldsymbol{P}_A^5 | > | \boldsymbol{P}_B^5 |$.

The important point is that this result holds under a variety of alternative hypotheses on distribution of output gap that are relevant for our purposes. In particular, if the output gaps of two countries have both a symmetric distribution around the same mean – not necessarily a normal one – then the distribution with the higher standard deviation (σ) is indeed the one with a larger wedge between the mean and the 5th percentile.[7] This is quite intuitive: if we compare two distributions that are symmetric, the one with a larger value of σ has a lower peak of its probability distribution function and is more concentrated around the mean. Indeed this distribution is relatively flat and is spread out more widely over the real line and the value of the 5th percentile is further away from the mean with respect to the 5th percentile of the less disperse distribution.

In general, one may argue that output gap figures are likely to be symmetrical around potential GDP over a long-run horizon. However, since the sub-samples used to compute MBs are relatively low-sized for reasons discussed in earlier sections, then it is possible that the distribution of output gaps is not symmetric in the sub-sample.

Yet, the above argument would continue to hold if the output gap of two countries has both an asymmetric distribution with skewness going in the same direction – either left or right – and with different standard deviation. That is, the country with the higher standard deviation of output gap would still be expected to have a larger value (in absolute value) of the (negative) 5th percentile.

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[7] As it is well known, if the distribution of a random variable is normal then the 5th percentile is equal to $1.96 \cdot \sigma$.

In order to lend support to the above statement, we have conducted Monte Carlo simulations on random samples drawn from a variety of asymmetric distributions. In particular, we considered the chi-square distribution with different degrees of freedom, the exponential distribution and the F-distribution with different degrees of freedom. Through our Monte Carlo simulations, 10,000 randomly generated samples of 100 observations are drawn every time from each of the above probability distributions, pre-specifying the value of the mean (always set equal to zero) and of the standard deviation. For each simulation, we thus obtain 10,000 values of the 5th percentile. The average of these values is the Monte Carlo approximation of the 5th percentile from its sampling distribution. If we take this value and perform other simulations with a similar probability distribution having, however, a different standard deviation and an unchanged mean, we can verify whether by increasing the variance of the distribution, there is a parallel increase of the wedge between the 5th percentile and the mean. It turns out that this positive relationship is systematically displayed (see Tables 6 and 7 in the Appendix).

By contrast, if the distributions of output gaps for two countries are asymmetric and with different standard deviation but with skewness going in the opposite directions, then the link between the higher standard deviation of output gap and the larger value (in absolute value) of the (negative) 5th percentile may not necessarily hold. In particular, if a country has a distribution of the output gap which is skewed left whilst the other has a distribution which is skewed right, then it might be the case that the (negative) 5th percentile of the former is higher (in absolute value) even if its output gap variance is lower. Again, the Monte Carlo simulations that we performed confirm the possibility of this outcome, as it is documented in Tables 6 and 7. This evidence suggest that under, a large array of hypotheses on output gap distribution, the positive link between its volatility and the (absolute value of) 5th percentile is obtained.

If we look at actual data on output gap for the EU-27 countries we note that the variance of output gaps significantly differs across countries with some having more pronounced cyclical swings with respect to others (see Table 1). We also note that the sample mean is not zero for the 27 countries. In Table 1, we can see that the time averages of each country's output gaps are different among each other, ranging from a value of 0.09 for Cyprus to a value of –2.41 for the Czech Republic. We can also see that if the sample considered were the largest one available (for example, 1965-2005 for the EU 15, except Germany and Luxembourg), then the time average would be, in general, much closer to zero.[8]

Because of these discrepancies in the output gap's sample means and because asymmetry in the countries' distribution of output gap can, in principle, go in both direction (left or right), we constructed some simple statistics to lend additional support to the contention that the higher the volatility of a country's output gap, the more likely it is that the output gap's 5th percentile is further away from zero. In

[8] For some countries, however, the sample means reported in column (2) of Table 1 continue to diverge from zero.

Table 3

Correlation between Standard Deviation and 5th and 10th Percentiles of Output Gap Data

	Sample Not Adjusted for Outliers		Sample Adjusted for Outliers	
	Correlation Coefficient	**Spearman's Rank Correlation Coefficient**	**Correlation Coefficient**	**Spearman's Rank Correlation Coefficient**
5th percentile and standard deviation	–0.83*	–0.84 (.00)	–0.70*	–0.67 (.00)
10th percentile and standard deviation	–0.77*	–0.77 (.00)	–0.63*	–0.64 (.00)

Legenda: see text.
* indicates significance at the 1 per cent level. In parentheses we report *p*-values for the test of the hypothesis that the 5th (or 10th) percentile and standard deviation are independent.

particular, we computed the correlation coefficient between the countries' standard deviation of output gap and the corresponding countries' 5th percentile of the same variable. The correlation coefficient is equal to –.83 and it is significant at better than the 1 per cent level. We also computed the Spearman's rank correlation coefficient between the same variables. The value of the statistic is –.84 and the hypothesis that the two variables are independent is strongly rejected (*p*-value: 0.00). We computed these statistics on the entire sample, *i.e.* the sample that includes outliers. We also considered the sample where output gap outliers are excluded. When we adjust the sample, the correlation coefficient between the countries' standard deviation of output gap and the 5th percentile is –.70 and, again, it is significant at better than the 1 per cent level. The Spearman's rank correlation coefficient between the same variables is –.67 and the hypothesis of independence of the variables is again strongly rejected. These findings are reported in Table 3, where the 10th percentile is also considered.

The way equation (2) is devised allows us to, at least partly, tackle the issue of the relative short length of output gap data for the NMSs. Since the lower degree of volatility of output gaps was shown to be associated with the limited length of their output gap series, this might downwardly bias the absolute value of the 5th percentile ($P^c_{5\%}$). Therefore, we assign a relatively low weight to this potentially biased piece of information. In particular, if we use the weights used in expression (2), based on the relative volatility of business cycles, a lower weight would be assigned to the country-specific information, $P^c_{5\%}$ when the latter is not enough informative. In principle this should reduce the risk of underestimating the country's representative output gap and its required budgetary safety margin.

6 The application of the methodology: some results

In this section the results obtained applying the proposed methodology are presented.[9] Consistently with what the Commission does, the treatment of outliers leads to the exclusion of observations below and above the 2.5th and 97.5th percentiles, respectively. Thus, all the values of output gap below –5.63 and above 4.12 are excluded from the sample. These figures are obtained by looking at EU 27 countries, including Bulgaria and Romania. With regard to the common component of the representative output gap the standard deviation of output gap for the whole EU 27 sample is 1.95 and the 5th percentile calculated on the same common sample is –3.82.

Table 4 documents the values of ROGs and MBs as obtained through the proposed approach. We compare these values with the corresponding figures resulting from the EU Commission existing methodology. Interestingly enough, the differences in MBs across the two approaches are not substantial. Based on the empirical findings we cannot conclude that one method systematically leads to more severe budgetary requirements in terms of cyclical safety margins. However, by comparing columns (3) and (5) it turns out that in the majority of cases (15 countries out of 10) the proposed method points to a higher required safety margin. For some countries, the estimated MB varies considerably depending on the methodology. By looking at Sweden and Finland, for example, the MBs obtained through the two methods diverge by 0.54 and 0.44 percentage points, respectively, with the existing method being more severe. Such divergence is 0.35 percentage points for the Czech Republic and Hungary and about 0.3 for Slovenia. For these NMS, it is the proposed method that requires a higher budgetary safety margin. By contrast, in countries like Denmark and Spain the divergence of MBs based on the two methods is almost zero.[10] We also computed the correlation coefficient between MBs of column (3) and those of column (5) and its value is .92.

As a sensitivity inspection of our findings, we introduced the following two alternative modifications. The first is to eliminate Bulgaria and Romania from the sample. So far, in computing the common component of ROGs we have considered data for all EU 27 countries, including the two countries that joined EU in January 2006. Not surprisingly, if we eliminate data for these two economies the results are virtually unchanged. The second modification is the following. In deriving the weights of equation (2) and, in particular, the variance of the common component, we computed the variance of output gaps on the whole sample of EU 27 countries but considering only observations whose first year coincides with the year in which data become available for the specific country, *c*. For example, let us consider Hungary, whose output gap data are available from 1995 onward. In calculating its

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[9] Output gap series are taken from the AMECO database, maintained by the European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN). Data are updated up to the 6th of November 2006.

[10] It is worth noting that MBs are not computed for Bulgaria and Romania because official estimates of their budgetary sensitivity parameters are not yet available.

Table 4

Representative Output Gap (ROG) and Minimal Benchmark (MB)

EU 27 Countries	Proposed Method Equation (2)		Commission's Actual Method	
	ROG	MB	ROG	MB
(1)	(2)	(3)	(4)	(5)
AT	–3.24	–1.48	–3.13	–1.53
BE	–3.29	–1.23	–3.37	–1.18
BG	–3.69	.	–3.61	.
CY	–3.12	–1.78	–2.86	–1.88
CZ	–3.78	–1.60	–2.82	–1.96
DE	–2.88	–1.53	–2.48	–1.73
DK	–3.98	–0.41	–4.00	–0.40
EE	–4.01	–1.80	–3.59	–1.92
EL	–3.77	–1.38	–3.90	–1.32
ES	–4.47	–1.08	–4.45	–1.09
FI	–3.50	–1.25	–4.38	–0.81
FR	–3.24	–1.41	–3.04	–1.51
HU	–3.21	–1.52	–2.46	–1.87
IE	–4.38	–1.25	–4.56	–1.18
IT	–3.33	–1.34	–3.42	–1.29
LT	–3.72	–1.99	–4.03	–1.91
LU	–4.70	–0.70	–4.65	–0.72
LV	–3.52	–2.01	–3.16	–2.12
MT	–3.46	–1.72	–3.74	–1.62
NL	–3.59	–1.02	–3.57	–1.04
PL	–4.29	–1.28	–4.13	–1.35
PT	–3.97	–1.21	–4.49	–0.98
RO	–4.23	.	–4.37	.
SE	–3.65	–0.88	–4.58	–0.34
SI	–3.38	–1.51	–2.74	–1.79
SK	–3.42	–2.01	–3.34	–2.03
UK	–3.98	–1.33	–3.94	–1.35

Legenda: see text.

ROG through equation (2), the variance of both the country-specific and EU 27-wide output gaps are computed using observations starting from 1995 at the earliest. Again, this modification in the way we compute the weights in equation (2) does not lead to significant changes in the broad picture.[11]

7 An alternative approach for deriving Minimal Benchmark

In this section we explore an alternative approach for assessing a safety margin for the fiscal imbalance with respect to the 3 per cent ceiling. We employ an econometric model of the Italian economy and perform stochastic simulations in order to derive estimates of MBs. Obtaining safety margins by using model simulations is not a new approach in the literature. Dalsgaard and de Serres (1999) estimate structural VARs and provide MBs for 11 EU member States. Similarly, Artis and Onorante (2006) use structural VARs and, by identifying fiscal shocks through long-run restrictions, estimate a simultaneous equation model that derives safety margins consistent with the budget requirements stemming from the revised SGP. Dury and Pina (2003) attempt to formalise the forward-looking provisions of the SGP and, by using a structural macroeconomic model (NiGEM), they estimate the probability of having deficits above 3 per cent of GDP and that of declaring deficits excessive. The approach based on stochastic simulations of a structural macroeconomic model cannot be used for multilateral surveillance. Still, it can provide useful insights on budgetary developments in different cyclical conditions and double-check estimates based on *ex post* data.

The model we use, ITEM (Italian Treasury Econometric Model), is a quarterly macro-econometric model estimated over the period 1982-2006. It features 36 behavioural equations and 211 identities. Both the supply and the demand side of the economy are designed in the model's structure and the public finance block is developed in detail with fiscal revenues and expenditure being disaggregated in a variety of different items (see Department of Treasury, 2007).

The MB model-based approach identifies the deficit-to-GDP ratio that is required to maintain the economy, at various confidence levels and at various time horizon, within the 3 per cent limit. For example, we are able to estimate a specific value of the budget balance-to-GDP ratio that would allow the ratio itself to be below the 3 per cent boundary for three years with a probability of 95 per cent. Through stochastic simulations we are able to mimic the macroeconomic turbulence that typically characterises the economy and assess the budget balance-to-GDP ratio that would guarantee fulfilment of the 3 per cent requirement even under adverse cyclical developments.

We solve the model repeatedly and use each time different draws of the stochastic components of the model itself. During each of the 1,000 repetitions that we performed, randomly drawn shocks are imparted to the model so that, for each

[11] The empirical findings of these two investigations are not reported for space constraints.

single repetition, a model simulation is obtained. Of course, we are particularly interested in tracking the budget balance-to-GDP endogenous variable. Hence, for each of the 1,000 simulations, a path is obtained for the budget balance-to-GDP ratio. For any period, we are able to rank the 1,000 values of the ratio in ascending order, from the most unpleasant ratio to the most favourable one. This generates a distribution and, of course, the budget balance-to-GDP ratio that ranks in 50th position from the bottom is an approximation for the 5th percentile of the budget balance-to-GDP ratio. This value can be interpreted as the budget balance-to-GDP ratio classified as the worst with a 95 per cent confidence level. Once this value is identified, the MB for that period becomes readily available and it is the following:

$$MB_t = \left(\frac{DEF}{PIL}\right)_t^{avg} - \left[\left(\frac{DEF}{PIL}\right)_t^{5th} - 3\right] \tag{3}$$

where $\left(\frac{DEF}{PIL}\right)_t^{avg}$ is the average value of the ratio in period t out of the 1,000 replications whilst $\left(\frac{DEF}{PIL}\right)_t^{5th}$ is the value corresponding to the 5th percentile.[12]

The value of MB calculated according to (3) can be interpreted as the value of budget balance-to-GDP ratio such that, even in unfavourable cyclical conditions, the probability of remaining within the 3 per cent limit is 95 per cent.

We first estimated the model up to 2006. Then we stochastically simulated the model over the following twelve and twenty quarters (2007-09 and 2007-11). In the simulation, the values of the exogenous public finance variables (public expenditures, tax and social contribution rates) are set equal to official projections at current legislation. International and demographic exogenous variables are set equal to the projections used in the benchmark forecasting scenario. We considered first a two-sided confidence interval of size .90 to get the 5th percentile of the approximated sampling distribution of the budget balance-to-GDP ratio. Combining this information with the average value in the interval, we can compute MBs for each period as in equation (3).

In Table 5 we report the key findings of our investigation. Column (2) shows the values of model-based MBs for three- and five-year horizons. These values represent the budget balance-to-GDP ratio required to avoid, with a probability of 95 per cent, a deficit higher than 3 per cent of GDP under unfavourable cyclical developments. The MB on a three-year horizon is equal to –1.33, a value almost identical to the one estimated with the other approach (–1.34 in Table 4). Not surprisingly, if we extend the length of the simulation horizon from three to five

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[12] Not surprisingly, the average value of the deficit-to-GDP ratio out of the 1,000 repetitions is always very closed to the value resulting from a deterministic simulation.

Table 5

Model-based Measures of Minimal Benchmark:
Results From Stochastic Simulations with the ITEM Model

Time Horizon (1)	Out-of-sample stochastic simulation (2)	In-sample stochastic simulation (3)	In-sample recursive stochastic simulation (4)	Stochastic simulation with a different fiscal structure: (A) (5)	Stochastic simulation with a different fiscal structure: (B) (6)
2001		–1.77	–1.86	–1.81	–1.85
2002		–1.39	–1.87	–1.51	–1.72
2003		–1.02	–1.84	–1.39	–1.38
2004		–0.53	–1.89	–0.99	–0.94
2005		0.36	–1.77	–0.36	–0.48
2007	–1.82				
2008	–1.67				
2009	–1.33				
2010	–1.24				
2011	–1.11				
MB 3-year horizon	–1.33	–1.02	–1.84	–1.39	–1.38
MB 5-year horizon	–1.11	0.36	–1.77	–0.36	–0.48

Legenda: see text.

years, the required budgetary safety margin becomes larger, as the size of cyclical swings tends to increase. The in-sample stochastic simulation (column 3) points to a slightly more restrictive value.

In order to gauge the implications of an increase in model uncertainty associated with a longer time horizon, we also performed stochastic simulations recursively over shorter horizons (column 4). The lower size of the required safety margins are simply explained by the lower degree of cyclical uncertainty which is, by construction, associated with a shorter time horizon of the simulation.

Finally, we try to assess the impact on budgetary safety margins of a change in the fiscal structure of the economy. To tackle this issue, we performed two stochastic simulations over the period 2001-05 under a counterfactual scenario. We assumed that the Italian fiscal structure is different from the actual one by considering a lower degree of cyclicality of fiscal revenues. Under the hypothesis (A), we assume that revenues from corporate income taxes are significantly lower than those actually observed and, at the same time, revenues from social security contributions paid by the employers are significantly higher. The assumed shift is *ex ante* neutral for the budget balance. In particular, fiscal revenues from corporate income tax are lowered by 4 percentage points of nominal GDP, through adjustment of the corporate income tax rates (both IRPEG and IRAP), and revenues from social contributions equally increased by adjusting the employers' social contribution rate. Typically, revenues from social contributions are less sensitive to cyclical fluctuations compared to other fiscal revenues, such as those from corporate income taxes (see Girouard and André, 2005). Therefore, we would expect that the fiscal structure that was counterfactually devised is such that the deficit-to-GDP ratio becomes less sensitive to business cycle and the required budgetary safety margin is lower than that computed under the baseline fiscal structure. This is exactly what we document in column (5) of Table 5. Indeed, if we compare the minimum benchmarks of column (3) and (5), those in the latter columns are less severe. For example, with a three-year horizon, the minimum benchmark ranges from –1.39 in the baseline case to –1.02 in the counterfactual scenario. Under hypothesis B, revenues from personal income taxes are reduced by 4 percentage points of nominal GDP through a cut in the corresponding tax rate.[13] Revenues from social contributions paid by employers are increased accordingly (column 6). MBs become even less restrictive than in the previous exercise.

The model-based approach represents a useful complementary analytical tool to the approach based on *ex post* information and discussed in previous sections. Although confined to the Italian economy and totally different from the *ex post* approach chosen by the EU Commission, the investigation provides results that are not too dissimilar.

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[13] These type of revenues are also considered quite sensitive to cyclical fluctuations, especially for the Italian economy, as it was documented by Girouard and André (2005).

8 Concluding remarks

This paper deals with alternative approaches for computing appropriate budgetary safety margins. It highlights some critical issues pertaining to the existing EU Commission's methodology, especially on the identification of a representative output gap (ROG). It provides evidence and arguments that cast some doubts on the soundness of the existing methodology.

Our proposed alternative method addresses the main issues. In particular, it features an identical algorithm for all Member States in computing ROGs, which uses both a country-specific and a common component referred to all EU 27 Member States. The two components are aggregated by using as weights the relative volatility of business cycles. The application of our method to EU 27 data does not yield estimates of MBs that diverge extensively from those derived through the EU Commission's current methodology. In the majority of cases (15 countries out of 10), however, the revised method leads to a higher required budgetary safety margin.

We also provide estimates of MBs through an alternative method that is complementary to the one based on *ex post* information. This approach is based on stochastic simulations of a structural macro-econometric model for the Italian economy. The findings from this approach are similar to those obtained with the other method. Moreover, simulations provide empirical evidence supporting the view that a fiscal structure that exhibits lower budget sensitivity to cyclical fluctuations is conducive to less ambitious safety margins.

These findings from the model-based approach point to the importance of budgetary sensitivity to output fluctuations in shaping the required budgetary margins. We believe that a more comprehensive assessment of budgetary sensitivities to business cycle is necessary even under the "institutional" method based on *ex post* information. For example, further research could provide country estimates of budgetary sensitivities to business cycle fluctuations that are conditional on specific shocks.

APPENDIX
ADDITIONAL TABLES

Table 6

Monte Carlo Approximations of the 5th Percentiles by Repeatedly Sampling from Chi-square (χ^2) Probability Distributions

(a) skewness right*

Probability Distribution	Repetitions on 100 Observation Samples	Mean	Variance	Monte Carlo Approximation of 5th Percentile
$\chi^2(1)$	10,000	0	2	–0.99
$\chi^2(2)$**	10,000	0	4	–1.89
$\chi^2(3)$	10,000	0	6	–2.63
$\chi^2(4)$	10,000	0	8	–3.27
$\chi^2(5)$	10,000	0	10	–3.83
$\chi^2(6)$	10,000	0	12	–4.34
$\chi^2(7)$	10,000	0	14	–4.80
$\chi^2(8)$	10,000	0	16	–5.24
$\chi^2(9)$	10,000	0	18	–5.64
$\chi^2(10)$	10,000	0	20	–6.03
$\chi^2(20)$	10,000	0	40	–9.10
$\chi^2(100)$	10,000	0	200	–21.96

(a) skewness left*

Probability Distribution	Repetitions on 100 Observation Samples	Mean	Variance	Monte Carlo Approximation of 5th Percentile
$\chi^2(1)$	10,000	0	2	–2.86
$\chi^2(2)$(**)	10,000	0	4	–4.01
$\chi^2(3)$	10,000	0	6	–4.83
$\chi^2(4)$	10,000	0	8	–5.49
$\chi^2(5)$	10,000	0	10	–6.07
$\chi^2(6)$	10,000	0	12	–6.58
$\chi^2(7)$	10,000	0	14	–7.07
$\chi^2(8)$	10,000	0	16	–7.51
$\chi^2(9)$	10,000	0	18	–7.92
$\chi^2(10)$	10,000	0	20	–8.30
$\chi^2(20)$	10,000	0	40	–11.39
$\chi^2(100)$	10,000	0	200	–24.29

* We recall that if X is a random variable drawn from a $\chi^2(n)$ distribution with n degrees of freedom, $E(X)=n$ and $\text{Var}(X)=2n$. Moreover, the transformations $X–n$ and $n–X$ are still distributed as $\chi^2(n)$ with mean equal to zero in both cases. In the first case, however, skewness is right whilst in the second skewness is left. These are exactly the cases considered here.

** the χ^2 distribution with two degrees of freedom is an exponential distribution.

Table 7

Monte Carlo Approximations of the 5th Percentiles by Repeatedly Sampling from F-probability Distributions

(a) skewness right*

Probability Distribution	Repetitions on 100 Observation Samples	Mean	Variance	Monte Carlo Approximation of 5th Percentile
F(3.5)	10,000	0	11.1	–1.55
F(4.5)	10,000	0	9.7	–1.50
F(5.5)	10,000	0	8.9	–1.46
F(6.5)	10,000	0	8.3	–1.43
F(7.5)	10,000	0	7.9	–1.41
F(8.5)	10,000	0	7.6	–1.39
F(9.5)	10,000	0	7.4	–1.37
F(10.5)	10,000	0	7.2	–1.36
F(11.5)	10,000	0	7.1	–1.35
F(12.5)	10,000	0	6.9	–1.34
F(20.5)	10,000	0	6.4	–1.33

(a) skewness left*

Probability Distribution	Repetitions on 100 Observation Samples	Mean	Variance	Monte Carlo Approximation of 5th Percentile
F(3.5)	10,000	0	11.1	–3.89
F(4.5)	10,000	0	9.7	–3.65
F(5.5)	10,000	0	8.9	–3.51
F(6.5)	10,000	0	8.3	–3.40
F(7.5)	10,000	0	7.9	–3.32
F(8.5)	10,000	0	7.6	–3.29
F(9.5)	10,000	0	7.4	–3.25
F(10.5)	10,000	0	7.2	–3.20
F(11.5)	10,000	0	7.1	–3.14
F(12.5)	10,000	0	6.9	–3.12
F(20.5)	10,000	0	6.4	–3.11

* We recall that if X is a random variable drawn from a $F(n_1, n_2)$ distribution with n_1 and n_2 degrees of freedom, $E(X)=n_2/(n_2-2)$ if $n_2>2$ and $\text{Var}(X)=2\,(n_2)^2\,(n_1+n_2-2)\,/\,n_1\cdot(n_2-2)^2\,(n_2-4)$ if $n_2>4$. Moreover, the transformations $X-E(X)$ and $E(X)-X$ are still distributed as $F(n_1, n_2)$ with mean equal to zero in both cases. In the first case, however, skewness is right whilst in the second skewness is left. These are exactly the cases considered here.

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PROCYCLICALITY, FISCAL DOMINANCE, AND THE EFFECTIVENESS OF FISCAL POLICY IN EGYPT

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This paper uses Structural Vector Autoregressive (SVAR) models to study the effectiveness of fiscal policy in stabilizing the real GDP. To do so, it first addresses the cyclicality of fiscal policy in Egypt since the early 1980s. Then, it tackles the fiscal dominance. Once the stage is prepared, it moves on to investigate the effectiveness of the fiscal policy. The paper concludes that the relationship between the fiscal policy and the economic activity is very week and it goes from the former to the latter while the relationship between the fiscal policy and the monetary policy is strong and it also goes from the former to the latter. This aggravated the economic instability and made the economy more prone to a boom/bust cycle.

1 Introduction

During the last three decades, the pattern of Egypt's economic performance exhibited considerable fluctuations. Only in the second half of the 1970s, mid-1990s, and mid-2000s did Egypt experience relatively high economic growth rates. This boom/bust cycle has always been associated with significant external shocks. The lack of countercyclical policies that can smooth such shocks made the economy more vulnerable to such a boom/bust cycle.

Some consensus emerged recently against using fiscal policy to smooth out the fluctuations in output. First, a countercyclical fiscal policy might have a much weaker fiscal multiplier effect in practice than mentioned in Keynesian models (Perotti, 2002). Second, the aggressive use of discretionary fiscal policy can contribute to higher volatility in output and lead to lower growth (Fatás and Mihov, 2003).

In addition, there is strong evidence that fiscal policy is procyclical in many developing economies (Gavin and Perotti, 1997, among others). This procyclical fiscal policy can aggravate macroeconomic instability, especially under fiscal dominance.

The objective of this study is threefold. The first is to document the procyclicality of fiscal policy in Egypt since the early 1980s. The second is to tackle the fiscal dominance issue that characterized the relationship between fiscal and

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monetary policies. The third is to quantitatively study the effectiveness of fiscal policy under fiscal procyclicality and fiscal dominance.

The paper proceeds as follows: In Section 2, we present an overview of fiscal accounts. In Section 3, we address the cyclicality of fiscal policy. Section 4 tackles the fiscal dominance. Section 5 studies the effectiveness of fiscal policy using structural VAR model. Section 6 concludes.

2 Overview of fiscal accounts

Table 1 presents the simple average of the main fiscal aggregates, as shares of GDP, during the whole period 1980/81-2004/05 and the three sub-periods 1980/81-1990/91, 1991/92-1997/98 and 1998/99-2004/05.[1]

The results show that the overall and primary deficits reached about 19 and 15 per cent respectively during the first sub-period. These deficits decreased dramatically in the second sub-period reaching about 8 and 1 per cent respectively[2].

In the third sub-period, the overall and primary deficits increased but remained far less than their levels in the first period. The average deficits over the entire period exceeded considerably those of the industrial and Latin American countries. On the other hand, the whole period witnessed a monotonic decrease in total revenues, total expenditures and primary expenditures, as shares of GDP.

2.1 The volatility of fiscal aggregates

Table 2 displays the average standard deviation of the rate of growth of total revenues, total expenditures and primary expenditures, deflated by the GDP deflator. For the overall and primary deficits, the table presents the average standard deviation of the first differences of the GDP shares.

The table displays two important stylized facts. First, the volatility of fiscal aggregates was dramatically high in the 1980s. It decreased considerably in the third sub-period. Second, the volatility of the change in overall and primary deficits was always lower than that of the other fiscal aggregates.

One cannot argue that the higher volatility of fiscal aggregates was mainly due to the adjustment to the underlying economic environment. In fact, we will show in Section 3 that most of this volatility can be attributed to the discretionary changes implemented by the policy maker.

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[1] See also Figure 4 in the Appendix.

[2] The second period witnessed the economic reform program with the International Monetary Fund. The program aimed to increase the competitiveness of the economy, and bring fiscal and current account deficits under control.

Table 1

Overview of Fiscal Aggregates in Egypt
(simple average, percent)

	Overall Deficit/GDP	Primary Deficit/GDP	Total Revenue/GDP	Total Expenditure /GDP	Primary Expenditure /GDP
1980/81-1990/91	18.71	15.02	36.47	55.18	51.48
1991/92-1997/98	8.13	1.23	31.97	40.1	33.2
1998/99-2004/05	10.37	4.72	23.49	33.86	28.21
1980/81-2004/05	13.41	8.27	31.57	44.99	39.85

Table 2

The Volatility of Fiscal Aggregates
(average standard deviation, percent)

	Overall Δ Deficit/GDP	Primary Δ Deficit/GDP	Total Revenue Growth	Total Expenditure Growth	Primary Expenditure Growth
1980/81-1990/91	6.49	6.65	15.57	16.78	17.52
1991/92-1997/98	1.96	2.72	15.65	11.60	12.19
1998/99-2004/05	1.12	1.06	0.58	3.43	3.94
1980/81-2004/05	4.26	4.44	11.58	12.12	12.80

3 Cyclicality of fiscal policy

In this section, we quantify the relationship between fiscal aggregates and economic growth to characterize the cyclicality of fiscal policy.

We begin by regressing each of the change in overall deficit and primary deficit, as a percentage of GDP, on an intercept and real GDP growth. We also regress each of the rate of change of total revenues and total expenditures, deflated by GDP deflator, on the same regressors. Table 3 displays the results of these regressions that we refer to as model 1.

Table 3

The Cyclicality of Fiscal Policy

	OLS Coefficients							
	Overall Deficit		**Primary Deficit**		**Government Expenditure**		**Government Revenue**	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Real GDP Growth	0.76		0.90**		1.07		–0.46	
	(–1.55)		*(–1.79)*		*(–0.74)*		*(–0.33)*	
Low Growth		0.07		–0.89		4.27		5.16
		(–0.04)		*(–0.54)*		*(–0.74)*		*(–0.85)*
High Growth		–1.74		–1.98		0.29		3.92
		(–1.07)		*(–1.12)*		*(–0.05)*		*(–0.6)*
Lagged Dependent Variable		–0.42***		–0.38**		–0.22		–0.07
		(–2.76)		*(–2.41)*		*(–1.08)*		*(–0.29)*
$\overline{R}^2$	0.06	0.21	0.09	0.16	–0.02	–0.07	–0.04	–0.11
DW	2.56	1.82	2.52	1.59	2.31	2.28	2.1	1.94
Degrees of Freedom	22	19	22	19	22	19	22	19

Notes: *t*-statistics are given in parentheses.

***, **, * indicate significance at 1, 5 and 10 per cent level respectively.

We interpret the coefficient on real GDP growth as the response of the fiscal instrument to changes in real GDP. This response includes the adjustment of these instruments to the changes in real GDP (*i.e.* due to the automatic stabilizer) and any discretionary policy measures taken by the policy maker (Gavin and Perotti, 1997).

The table shows that the coefficient is not statistically significantly different from zero, except for the change in primary deficit. A one per cent increase in the real GDP growth is associated with an increase in the primary deficit, as a percentage of GDP, of 0.9 per cent. Nevertheless, the adjusted R^2 is very low (0.09).

These results suggest that the fiscal policy is procyclical and mainly discretionary. Therefore, Egypt is not different from many of the other developing countries in this aspect (Gravin and Perotti, 1997).

To distinguish between the responses of the fiscal instruments during periods of low and high economic growth, we regress each of the dependent variables –

mentioned above – on two dummies and an intercept. The average economic growth over the entire period is 4.7 per cent. The dummy that represents low economic growth takes one when the economic growth is less than 3 per cent, and zero otherwise. The other dummy takes one when the economic growth is higher than or equal to 5.5 per cent. Furthermore, we examine the persistence of the fiscal instrument by adding the lagged values of the dependent variable to the regressors.[3] The results of these regressions, that we refer to as model 2 in Table 3, show that the coefficients of the two dummies are not statistically significantly different from zero. This suggests no asymmetry in the cyclical behavior of the fiscal policy during low and high growth periods.

3.1 Why is fiscal policy procyclical in Egypt?

Two important explanations can be provided. First, non-tax revenues, indirect taxes, and trade taxes, which are often procyclical and outside the control of the government, constitute the largest share of the total revenues (Panizza, 2001). On the other hand, the composition of total expenditures highlights the important role played by social polarization in explaining the procyclicality of fiscal policy. The wages and interest payments comprise about 18 and 13 per cent of the total expenditures respectively. The share of explicit subsidies is much lower (about 8 per cent). Nevertheless, the implicit subsidy, that artificially reduces the domestic fuel prices, represents a considerable share of total expenditures. The explicit and implicit subsidies reached about 35 per cent of total expenditure in 2005/06.[4] Again, the large share of wages, explicit and implicit subsidies, and interest payments limits the ability of conducting a countercyclical fiscal policy.

Second, the positive association between fiscal policy and the GDP growth could in fact reflect the effect of changes in fiscal policy on economic growth rather than the opposite. This explanation is supported by the results of the structural VAR model presented in Section 5. The SVAR results show that the structural coefficient that measures the effect of fiscal policy on economic growth is statistically significant, but relatively small while the structural coefficient that measures the effect of economic growth on fiscal policy is not statistically significantly different from zero.

4 Fiscal dominance

When the fiscal policy is procyclical, it can aggravate the macroeconomic instability. Under fiscal dominance, the fiscal policy can further paralyze the

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[3] The coefficient that measures this persistence is statistically significantly different from zero and negative implying no persistence.

[4] See Table 8 in the Appendix.

monetary policy. The reliance on seigniorage can be considered the simplest and most common manifestation of fiscal dominance (Masson *et al.*, 1997).

There has been a positive association between the overall deficit and the domestic credit going to the government, as shares of GDP, over the entire period 1980/81-2004/05.[5]

To obtain a measure of fiscal dominance, we estimate the following regression:

$$d\log DCG_t = \alpha + \beta dOVDEF_t + \varepsilon_t$$

where *d*log*DCG* denotes the rate of growth of real domestic credit going to government, deflated by the GDP deflator, and *dOVDEF* refers to the change in overall deficit, as a share of GDP. We correct for first order autocorrelation in the residuals.

$$d\log DCG_t = 3.33 + 1.026 dOVDEF_t$$

$$(0.75) \quad (2.97)$$

$$N=23 \qquad R^2 = 0.42 \qquad DW=1.92$$

The results show that the coefficient *ß* is statistically significant. A one percentage point increase in the overall deficit is associated with a one percentage point increase in the growth of real domestic credit going to the government.[6] Under these circumstances, the fiscal and monetary policies are reduced to just one policy.

5 The effectiveness of fiscal policy

This section studies the effectiveness of fiscal policy in stabilizing the real GDP. We use Structural Vector Autoregressive (SVAR) models to measure the effect of fiscal policy on the economic activity. The SVAR model also sheds lights on the relationship between fiscal and monetary policies, and how this relationship weakens the effect of the later on the economic activity.

5.1 Data, methodology, and research design

This sub-section discusses data sources, variable definitions, methodology, and research design.

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5 See Figure 5 in the Appendix.

6 Going forward, the fiscal dominance is no longer a critical issue. The unified banking law issued in 2003 explicitly stated that the monetary policy objective is "achieving price stability". The law also grants the Central Bank of Egypt (CBE) more independence. Moreover, the law restrains the government access to Central Bank financing. The Ministry of Finance is currently executing a fiscal consolidation plan that aims to bring the deficit down by one per cent of GDP annually to the range of 3-4 per cent of GDP over the next three years.

Table 4

Unit Root Tests

Constant Variables	**Numb. of Lags**	***t*-statistics**	**CV (5%)**	**CV (1%)**
OVDEF	0	–1.7	–3	–3.7
LRGDP	0	–2	–3	–3.7
LRESERM	0	–0.8	–3	–3.7
Constant and Trend Variables	**Numb. of Lags**	***t*–statistics**	**CV (5%)**	**CV (1%)**
OVDEF	0	–2.6	–3.6	–4.4
LRGDP	2	–2.9	–3.6	–4.4
LRESERM	0	–1.2	–3.6	–4.4

5.1.1 Data and variable definitions

We used annual data for the period 1980/81 through 2004/05.[7] We obtained the data from Ministry of Finance, Central Bank of Egypt, World Development Indicators, and International Financial Statistics.[8]

The transformed variables used in the VAR are: Δ*LRGDP*, Δlog of real GDP; Δ*OVDEF*, Δ of overall deficit (measured as a percentage of GDP); Δ*LRESERM*, Δlog of real monetary base, Δlog (M_0/P), where P is the GDP deflator. For convenience, all transformed variables are measured in units of percentage change.[9]

Unit roots test results are reported in Table 4. The test results indicate a failure to reject the unit root null hypothesis of the augmented Dickey-Fuller (ADF) test for all variables. Unit roots test results for the first difference of the variables unanimously reject the unit root null hypothesis. Hence, all VAR variables are considered $I(1)$.

Johansen (1991) tests for the number of cointegration vectors in the system (*LRGDP*, *OVDEF*, *LRESERM*) are presented in Table 5. Likelihood ratio tests suggest looking at lag length of 1. According to the maximum-eigen value test, there are no cointegration vectors. The results suggest estimating the VARs in first differences.

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7 We have been constrained by the availability of data.

8 The data on real GDP and GDP deflator have been obtained from the World Development Indicators; the fiscal data from Ministry of Finance; and the monetary data from International Financial Statistics and the Central Bank of Egypt.

9 When using the primary deficit first difference, as a percentage of GDP, instead of overall deficit first difference, as a share of GDP, we arrived at almost the same results. Therefore, we report only the results of the model that uses the overall deficit as the fiscal instrument.

Table 5

Cointegration Tests
(OVDEF, LRGDP, and LRESERM)

r	*λ*-Max Statistic	5% Critical Value	1% Critical Value
0	16.21	20.97	25.52
1	8.45	14.07	18.63
2	0.16	3.76	6.65

5.1.2 Methodology

We use structural VAR framework. The SVAR model allows us to identify the structural shocks that hit the system.

We can express the VAR system as a reduced form:

$$X_t = B(L)X_{t-1} + \mu + \upsilon_t \tag{1}$$

where $X = [\Delta LRGDP, \Delta OVDEF, \Delta LRESERM]$ is a vector of the endogenous variables, $B(L)$ is a lag operator of the order L, μ is a vector of constants, and υ is a vector of reduced-form residuals.

The structural form is given by:

$$A(0)X_t = A(L)X_{t-1} + A(0)\mu + \varepsilon_t \tag{2}$$

where $A(0)$ is the matrix of contemporaneous interactions, and ε_t is a vector of Niid structural errors.

The reduced-form residuals depend on the structural innovations and the contemporaneous relationships among the endogenous variables.

$$\upsilon_t = A(0)^{-1}\varepsilon_t = C(0)\varepsilon_t \tag{3}$$

If X contains n elements, identification requires imposing $n(n-1)/2$ restrictions on the $C(0)$ matrix. We impose the following restrictions. We assume that real GDP growth contemporaneously depends on the change in overall deficit and its own shock. The reason for the lack of a contemporaneous response of real GDP growth to reserve money growth is the fact that monetary policy affects the economic activity with a lag.

The change in the overall deficit is allowed to contemporaneously respond to the innovation in real GDP growth and its own shock. This is motivated by the procyclicality of fiscal policy.

Finally, we assume that reserve money growth reacts contemporaneously to the change in the overall deficit and its own shock. This is justified under the fiscal dominance.

$$C(0) = \begin{bmatrix} 1 & c_{12} & 0 \\ c_{21} & 1 & 0 \\ 0 & c_{32} & 1 \end{bmatrix} \tag{4}$$

5.1.3 Research design

We use the two dummies that have been created to differentiate between the low growth and high growth periods.

VAR specifications are selected by a sequential search using likelihood ratio tests modified by the small-sample correction of Sims (1980). Each of the reduced-form equations includes a constant as stated in (1). We test the null hypothesis of one lag versus two. We choose the VAR with one lag if we arrive at the test of one lag versus two and fail to reject the null. The number of lags selected is one.

We tested the hypothesis that the two dummies belong in the model using likelihood ratio test. The test indicated that the two dummies belong in the model.

We estimated the just identified structural model. Table 6 shows that the coefficient c_{21} is not statistically significantly different from zero. Hence, we estimated the overidentified model that further restricts c_{21} to be zero. Table 7 shows that the overidentified restriction is not rejected. Consequently we decided to use the overidentified model.

Table 6

The Structural Coefficients of the Just Identified Model

Variable	Coefficient	*t*-statistics	Significance
C_{12}	–0.107	–1.890	0.059
C_{21}	0.006	0.006	0.995
C_{32}	–1.196	–2.168	0.030

Table 7

The Structural Coefficients of the Overidentified Model

Variable	Coefficient	*t*-statistics	Significance
C_{12}	–0.107	–2.744	0.006
C_{32}	–1.196	–2.159	0.031
Number of Observations			23
Log Likelihood			–47.94
Log Likelihood Unrestricted			–47.26
Chi-Squared (1)			1.37
Significance Level			0.24

$$C(0) = \begin{bmatrix} 1 & c_{12} & 0 \\ 0 & 1 & 0 \\ 0 & c_{32} & 1 \end{bmatrix} \qquad (4')$$

5.2 The results and interpretations

The identification restrictions given in (4') are used to retrieve the structural dynamic system. Once the structural model is retrieved, variance decompositions and impulse responses, the hallmark of VAR analysis, are computed. The variance decompositions present the percentage of the error variance at various forecast horizons that attributed to each of the individual structural shocks. The impulse responses present the dynamic responses of the variables to one standard deviation shocks to the structural innovations. The variance decompositions for real GDP growth and real reserve money growth are presented in Table 10 in the Appendix.

5.2.1 The effect of fiscal policy on economic growth

Table 10 shows that the overall deficit changes account for about 29 per cent of the annual forecast error variance of GDP growth at 2-year time horizon. Figure 1 shows that a one standard deviation shock to the overall deficit (equal to 2.5 per cent) induces a contemporaneous increase in GDP growth of 0.27 per cent. This effect is quite small compared to the Keynesian models' prediction.

On the other hand, real reserve money growth explains less than 1 per cent of the movements in the economic growth at all time horizons (see Table 10). Figure 2

Figure 1

Response of GDP Growth to a Fiscal Policy Shock

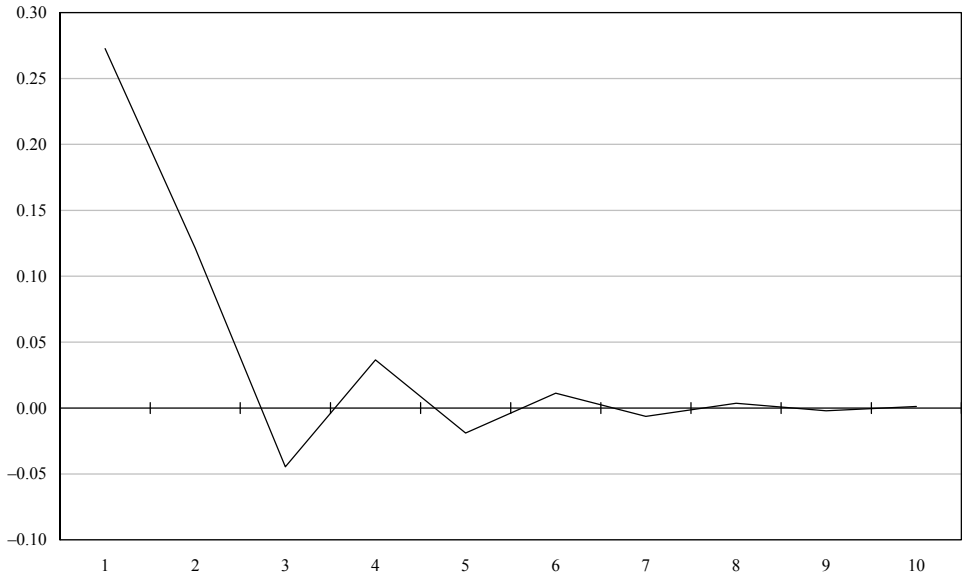


Figure 2

Response of GDP Growth to a Shock to Reserve Money Growth

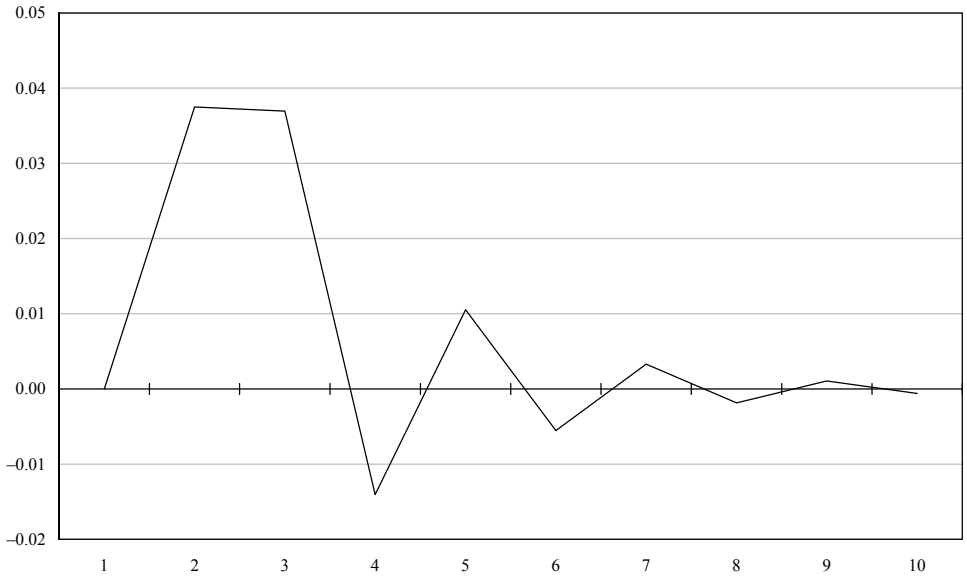
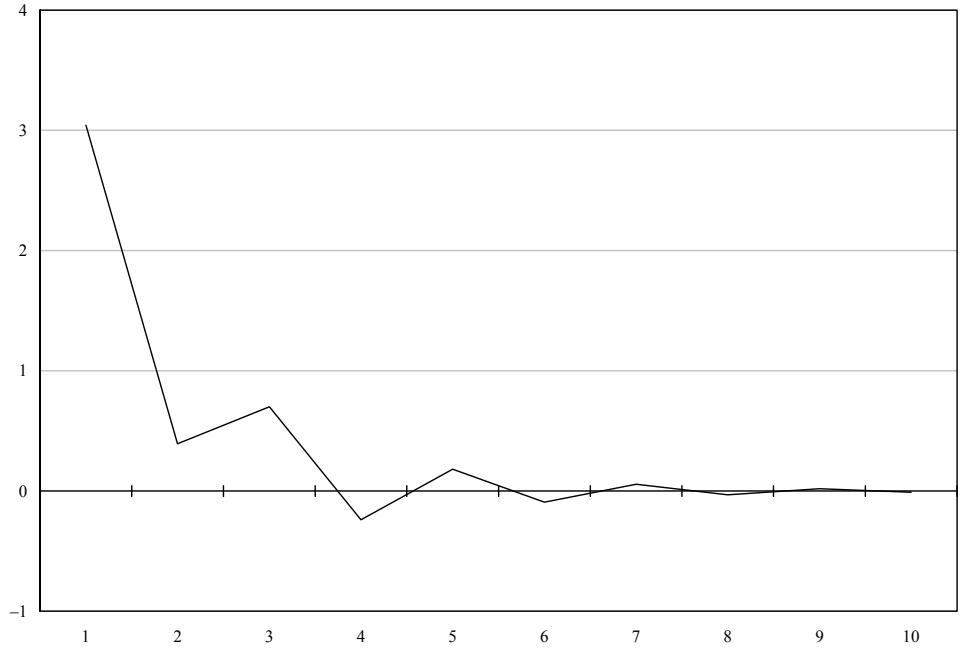


Figure 3

Response of Reserve Money Growth to a Fiscal Policy Shock



shows that a one standard deviation shock to real reserve money growth (about 7 per cent) causes economic growth to increase by less than 0.04 per cent at 2-year time horizon.

5.2.2 The effect of fiscal policy on reserve money growth

Do the overall deficit changes explain the movements in the real reserve money growth? Table 10 shows that overall deficit changes explain about 18 per cent of the annual forecast error variance of real reserve money growth at 2-year time horizon. Figure 3 shows that a one standard deviation shock to the overall deficit induces an increase in real reserve money growth of 3 per cent. This implies a slightly more than one to one relationship between fiscal and monetary instruments.

Overall, while the relationship between fiscal policy and the economic activity is very week and it goes from the former to the later, the relationship between fiscal policy and monetary policy is strong and it also goes from the former to the later.

6 Conclusions

The paper concludes that the relationship between fiscal policy and the economic activity is very week and it goes from the former to the later. The paper has also demonstrated how the fiscal dominance paralyzed the monetary policy. Consequently, the economic instability was aggravated and the economy was more prone to the boom/bust cycle.

The paper provides another evidence against using fiscal policy to stabilize the output fluctuations. In addition, it highlights the fact that without achieving a fiscal consolidation, the *de jure* independence of any central bank is most likely to be jeopardized.

APPENDIX

Table 8

Composition of Total Expenditure

Period	Wages	Subsidies*	Interest Payments	Others
1980/81	13.8	15	4.4	66.9
1981/82	13.7	20.1	3.5	62.7
1982/83	13.1	12.2	5.3	69.5
1983/84	15.1	11.4	6.4	67.1
1984/85	15.9	10.1	6.3	67.6
1985/86	14.2	12	6.3	67.5
1986/87	15	6.7	7.5	70.7
1987/88	13.7	9.5	6.9	69.9
1988/89	15.6	7.7	9	67.6
1989/90	17.7	5.7	10.7	65.9
1990/91	15.3	7.1	12.4	65.2
1991/92	12.8	6.8	13.2	67.1
1992/93	14.4	5.9	19.1	60.6
1993/94	13.8	4	18.4	63.7
1994/95	16.6	4.8	17.8	60.7
1995/96	19.3	5.8	18.8	56.1
1996/97	20.7	5.1	18	56.1
1997/98	21.7	4.9	15.2	58.1
1998/99	22.3	4.5	16.2	57
1999/00	22.4	4.5	16.6	56.5
2000/01	23.5	4.1	13.9	58.4
2002 Jan	22.7	4.4	16.1	56.8
2003 Feb	22.6	4.6	17.2	55.5
2004 Mar	22.6	6.3	18.5	52.6
2005 Apr	23.1	7.7	18.2	51.1

* Implicit subsidies are not included. The implicit subsidies (fuel subsidies) have been explicitly considered in the budget since 2005/06; they accounted for more than 60 per cent of total subsidies in this year.

Table 9

The Inputs of the Structural Model

Period	Δ Overall Deficit	Reserve Money Growth	GDP Growth
1981/82	11.92	41.65	9.45
1982/83	–6.19	9.77	7.14
1983/84	0.31	2.46	5.91
1984/85	0.12	8.69	6.39
1985/86	4.59	4.05	2.61
1986/87	–7.91	–18.51	2.49
1987/88	5.79	–11.97	5.17
1988/89	–7.6	–8.41	4.85
1989/90	–4.63	–4.2	5.55
1990/91	–2.55	13.4	1.07
1991/92	1.49	–9.49	4.34
1992/93	–3.4	8.45	2.84
1993/94	2.03	1.14	3.87
1994/95	0.03	6.02	4.56
1995/96	–1.1	0.29	4.89
1996/97	0.69	2.02	5.35
1997/98	–1.85	2.82	6.06
1998/99	1.17	11.75	5.92
1999/00	0.4	0.83	5.26
2000/01	1.42	18.98	3.44
2002 Jan	2.45	10.18	3.15
2003 Feb	0.52	19.59	3.05
2004 Mar	–1.07	1.93	4.11
2005 Apr	0	3.96	4.44

Table10

Variance Decompositions

Step	Standard Error	GDP Growth	Overall Deficit Change	Reserve Money Growth
Decomposition of Variance for GDP Growth				
1	0.54	74.87	25.13	0
2	0.56	71.01	28.54	0.45
3	0.56	70.26	28.86	0.88
4	0.56	69.93	29.14	0.94
5	0.56	69.82	29.21	0.97
6	0.56	69.79	29.23	0.98
7	0.56	69.78	29.24	0.98
8	0.56	69.77	29.24	0.98
9	0.56	69.77	29.25	0.98
10	0.56	69.77	29.25	0.98
Decomposition of Variance for Overall Deficit Change				
1	2.54	0	100	0
2	2.91	0.16	92.84	7.01
3	3.04	0.18	92.03	7.79
4	3.08	0.18	91.65	8.17
5	3.1	0.18	91.55	8.27
6	3.1	0.18	91.51	8.31
7	3.1	0.18	91.5	8.32
8	3.1	0.18	91.5	8.32
9	3.1	0.18	91.49	8.32
10	3.1	0.18	91.49	8.32
Decomposition of Variance for Reserve Money Growth				
1	7.38	0	17	83
2	7.55	2.35	16.51	81.13
3	7.58	2.37	17.22	80.41
4	7.59	2.37	17.29	80.34
5	7.59	2.37	17.34	80.3
6	7.59	2.37	17.35	80.28
7	7.59	2.37	17.35	80.28
8	7.59	2.37	17.35	80.28
9	7.59	2.37	17.35	80.28
10	7.59	2.37	17.35	80.28

Figure 4

Overall Deficit, Primary Deficit, Expenditure and Revenue
(percent of GDP)

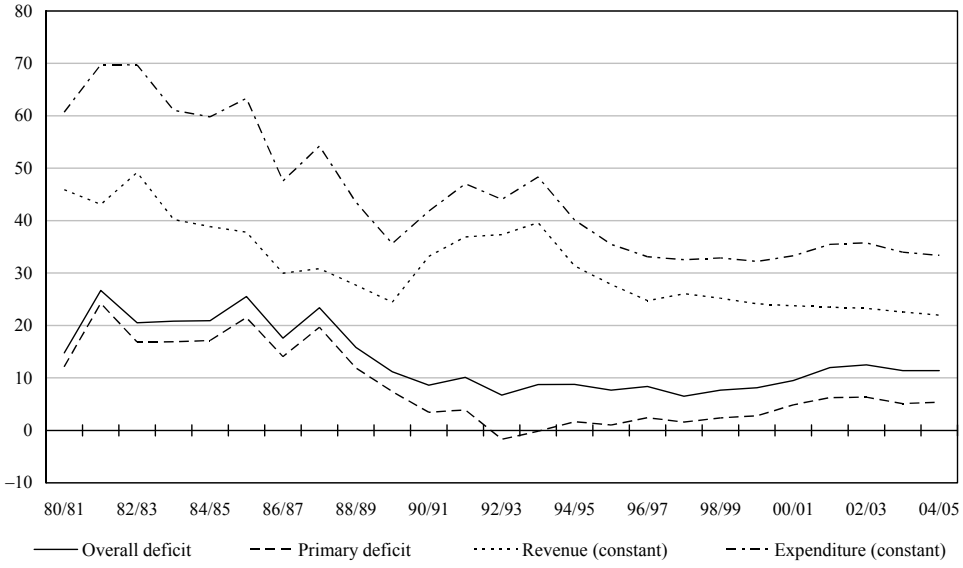
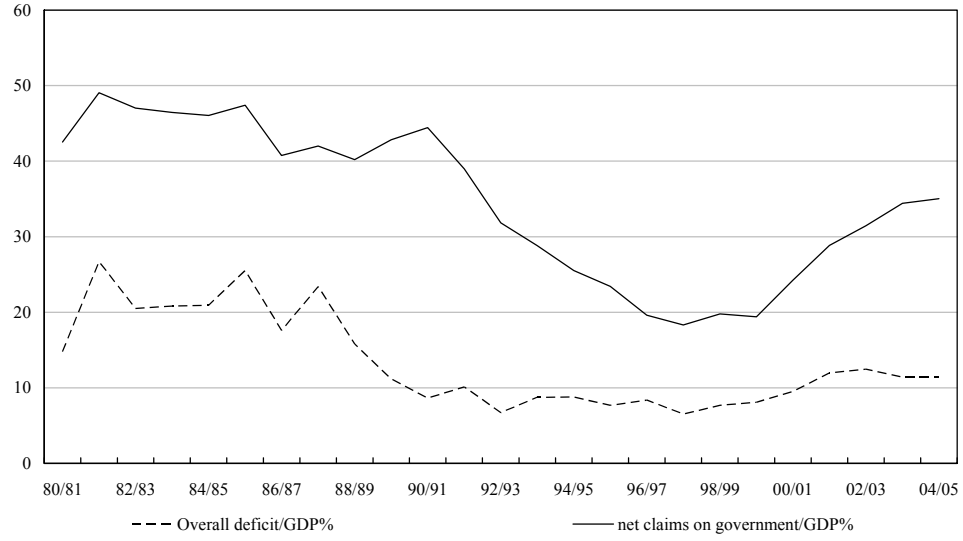


Figure 5

Overall Deficit vs. Government Domestic Credit
(percent of GDP)



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PUBLIC DEBT DYNAMICS IN SELECTED OECD COUNTRIES: THE ROLE OF FISCAL STABILISATION AND MONETARY POLICY

Harri Hasko[*]

Shocks to monetary and fiscal policy have played a major role in public debt developments since the mid-1970s. According to the applied VAR approach, together these shocks explained, on average, about half of the forecast error variation in the debt to GDP ratio while the share of shocks to GDP growth was close to 30 per cent. Instead, shocks to inflation and the debt ratio itself played in most cases a minor role. However, the inflation shocks were vital in initiating the public debt problems as the increase in actual inflation and particularly the persistence of high inflation expectations in the 1980s led to a prolonged period of high real interest rates. This gave rise to "some unpleasant fiscal arithmetic" which aggravated debt problems. In most countries fiscal policy has aimed at correcting the deterioration of fiscal balances, but the progress has in most cases been slow and delayed. Nevertheless, all individual country VARs are stable in the period under consideration. Finally, contrary to general beliefs, in the global financial markets of present day inflation makes debt problems worse through its adverse impact on interest rates.

1 Introduction

What has caused the marked increase in the public debt to GDP ratios in almost all OECD-economies after the mid-1970s? Is it due to the behaviour of fiscal authorities or exogenous economic shocks that have come as a surprise to policymakers? What has been the role of monetary policy in these developments? If the high debt ratios are caused by a mixture of all these factors, what has been their relative importance? These questions have gained new significance in the context of the European Monetary Union (EMU) where national governments do not have recourse to debt monetization, which has historically been the ultimate contingency solution in debt crises. Neither can the governments expect a bailout by the European Central Bank, as this is forbidden by the Treaty. This makes guaranteeing fiscal solvency of utmost importance in the EMU. Moreover, the demographic developments are expected to put heavy pressure on public finances in most OECD countries in the coming decades, mostly in the form of increasing pension and health

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The views expressed are those of the author and do not necessarily represent the views of Suomen Pankki.

care costs. To face these challenges, the OECD countries have to be capable of managing their fiscal developments and secure the solvency of their public finances in the long run.

Because of the complexity of the factors that affect public debt dynamics, our knowledge of the relative roles of unforeseen economic shocks and discretionary monetary and fiscal policy in shaping the evolution of public debt ratios is rather limited. The political economy literature has extensively studied the influence of fiscal policy and particularly political institutions on the growth of public sector indebtedness (e.g. Roubini and Sachs, 1989a, Alesina and Perotti, 1995). Roubini and Sachs conclude that much of the rise in budget deficits could be explained by the slowdown in economic growth and rise in unemployment after 1973. Moreover, in countries with multi-party coalition governments (as in Belgium and Italy) it has been difficult to find consensus on fiscal consolidation. Alesina and Perotti find out that since the mid-1960s cyclically adjusted budget deficits have been mainly the result of increases in government spending and increased interest expenditures. Masson and Mussa (1995) describe the role of wider economic developments, including population, productivity growth and inflation. They see that the deterioration in fiscal balance sheets is mainly due to rapidly extending expenditures on public pensions and health care programs. However, the significant slowdown in economic growth and increase in structural unemployment have been important contributing factors. As regards the role of inflation, Masson and Mussa point out that, in contrast to previous periods, actual inflation ran somewhat *below* anticipated inflation in 1980 to 1994. Consequently, some of the rise in the real value of public debts reflected the surprise element in disinflation as suggested by the relatively high levels of ex post real interest rates in many countries during the 1980s. Nevertheless, while this literature provides important evidence of the factors that have caused the high public debt levels, it has not tried to quantify the relative importance of these factors.

In this paper we apply a basic recursive, reduced form VAR model to seek tentative answers to the question, what have been the relative roles of unforeseen shocks to output, inflation, interest rates and the primary balance in public debt developments in selected OECD countries in the last three or four decades. Furthermore, we try to find out whether the response of fiscal policy to unforeseen economic shocks has been stabilising and to what extent monetary policy shocks have affected the fiscal outcomes. Although our focus is not in the structural identification of the VAR model, we discuss briefly how the model relates to common knowledge of key structural relationships.

The main conclusion of our study is that shocks to economic growth and monetary and fiscal policy have played a major role in public debt developments since the mid-1970s. Together these shocks explain, on average, about 80 per cent of the forecast error variation in the debt to GDP ratio while the average share of the policy shocks is more than 50 per cent. Instead, shocks to inflation and the debt ratio itself play in most cases a minor role. However, shocks to inflation were important in initiating the debt problems since the increase in actual inflation and particularly

the persistence of high inflation expectations in the 1980s led to a prolonged period of high real interest rates. This raised significantly the interest burden of public debts. It seems that in most OECD countries fiscal policy aimed at correcting the deteriorating fiscal balances by improving the primary balance, but the progress was in most cases slow and delayed, particularly when taking into account the large magnitude of the increase in the interest burdens. Finally, the high persistence of the impact of policy shocks to the debt to GDP ratio has contributed to the seriousness of public debt problems.

The plan of the paper is the following: Section 2 gives a brief overview the relevant literature, Section 3 describes the variables and the data and the overall macroeconomic background for the public debt dynamics since the mid-1970s. Section 4 reports the results of the impulse response functions and variance decompositions of the individual country VARs which illustrate the impact of the different shocks that have affected public debt dynamics, Section 5 discusses the results and Section 6 concludes.

2 Overview of the literature

There are some authors, who have applied the so called debt dynamics identity which defines the change in the public debt level in terms of the real interest rate, output growth and the primary balance to calculate the exact contribution of these variables on the evolution of public debts (e.g. Shigehara, 1995, and Hallett and Lewis, 2004). The problem, however, with this approach is that identities as such do not reveal the underlying economic relationships and conclusions based on them can be misleading. Examples of studies which have tried to quantify the impact of monetary and fiscal policy on macroeconomic variables like output, inflation and the interest rates using the VAR methodology are Blanchard and Perotti (2002), Christiano, Eichenbaum and Evans (1999), Fatas and Mihov (2002), Melitz (1995) and Moutford and Uhlig (2002). Furthermore, an increasing number of authors have started to model monetary and fiscal policy effects jointly in a VAR context (e.g. Favero, 2002, Marcellino, 2006). Yet, there are relatively few studies which have used the VARs in analysing public debt dynamics (Giannitsarou and Scott, 2006, Reade and Stehn, 2006).

Giannitsarou and Scott applied a log linearised version of the inter-temporal budget constraint to answer three questions: is current fiscal policy in OECD economies sustainable; how OECD governments have financed fiscal deficits in recent decades and; what implications rising deficits have for inflation. They found that, against historical background, fiscal policy is sustainable with the possible exception of Japan; major part of fiscal consolidation has come from changes in the primary balance with only a minor role for inflation, interest rates and growth – *i.e.* a result which is in a stark contrast with ours – and; fiscal imbalances had only a very weak role in forecasting future inflation.

Reade and Stehn apply the cointegrated VAR method to study the interaction of monetary and fiscal policy and its effect on the sustainability of public debt developments in the US in 1960-2005. They conclude that fiscal policy has ensured long-run debt sustainability by responding to the increase in debt in a stabilising way though the feedback has been moderate. However, according to their findings, discretionary fiscal policy has not ensured counter-cyclical behaviour. Moreover, monetary policy has followed a Taylor type rule and corrected disequilibrium both in the short and in the long run.

Melitz (1995) analyses the effect of monetary and fiscal policy on the public debt and deficits in 19 OECD countries from 1960/78 to 1995 using pooled data. He achieves several interesting results: First, fiscal policy reacts to the ratio of public debt in a stabilising manner as in our case. Second, loose fiscal policy leads to tight monetary policy and vice versa. Third, automatic stabilisation of fiscal policy is much weaker than generally perceived. Expansion raises tax receipts but also government expenditures.

Polito and Wickens (2005) examine the sustainability of fiscal policy of the US, the UK, and Germany over the last 25 years and carry out counter-factual experiments of the likely consequences on fiscal sustainability of using a Taylor rule to set monetary policy over this period. Among their findings is that the recent fiscal stance of the three countries is not sustainable, and that using a Taylor rule in the past would have improved the fiscal performance of the US and the UK, but not that of Germany. Polito and Wickens use a VAR including monetary policy and fiscal variables, as well as the deficit and debt ratios.

Marcellino (2006) studies the effects of non-systematic fiscal policy on macroeconomic variables in the euro area in a VAR also including both monetary policy and fiscal variables, but his focus is not strictly on debt dynamics, although the debt ratio is included in some simulations. Marcellino concludes that the systematic component of fiscal policy, which he defines as the impact of automatic stabilisers and budget plans, explains major part of the fiscal policy effects. Adding the public debt ratio in his basic VAR doesn't affect the results.

Benjamin Friedman (2006) analyses the persistence of the effects of fiscal shocks on deficit and debt developments in the US from 1960 to 2004 in four and five variable VAR models including GDP growth, inflation, public expenditure or revenue items or the actual deficit, and the debt to GDP ratio. He identifies the size and persistence of fiscal shocks to the evolution of debt and deficit ratios and finds a high persistence in the responses as in the present study.

3 The variables and the econometric methodology

3.1 The VAR

The discussion on the evolution and sustainability of public debt developments often starts with the definition of the government budget constraint:

$$B_t - B_{t-1} = rB_{t-1} - (T_t - G_t) \tag{1}$$

where B_{t-1} is general government debt at the end of year *t*–1, *r* is the real interest rate, T_t is total general government revenue during year *t*, and G_t is total general government expenditure during year *t* excluding interest payments on the debt. Normally the budget constraint is written in a form that expresses the evolution of the debt to GDP ratio in terms of the difference between the real interest rate and the output growth rate, and the ratio of the primary deficit to GDP:

$$b_t - b_{t-1} = (i_t - \pi_t - y_t)b_{t-1} - (t_t - g_t) \tag{2}$$

where *b* is the general government debt to GDP ratio, *i* is the nominal interest rate on general government debt, π is inflation, *y* is the real GDP growth rate; *t* is the share of public revenues in GDP and *g* is the share of government spending in GDP excluding interest payments on debt. Equation 2 which is an identity is also called the debt dynamics equation. According to this equation, a robust GDP growth and low real interest rates are vital in restraining the growth of public debts. Furthermore, the current fiscal position of the public sector, as measured by the primary balance, is a significant contributor. In fact, since monetary and fiscal authorities have less control over real interest rates and the growth rate of the economy, the primary balance is an important fiscal policy variable in the equation.

The variables most commonly included in a standard monetary policy VAR are some measure of output, inflation and the interest rate, implying that the central bank follows a sort of Taylor rule in the conduct of monetary policy.[1] The two other relationships in these now standard three equation models are the IS-Curve and the Phillips Curve. Instead, a standard fiscal policy VAR includes typically government revenue and expenditure and a measure of output. Since the debt dynamics equation contains, by definition, all these variables, we believe that by including the variables of the equation in our basic reduced form VAR model we can capture the interaction of monetary and fiscal policy in a VAR setting and, consequently, provide a rich macroeconomic framework for the study of public debt developments. However, since we are particularly interested in the relative importance of monetary and fiscal policy on debt dynamics, we replace the effective interest rate on general government debt – which is the relevant nominal interest rate in the debt equation – with an interest rate which is either the exact target rate of the monetary authorities or a close substitute for it. Figure 1 overleaf provides evidence of the connection of the short term interest rate and the effective interest rate on government debt to justify this choice.[2]

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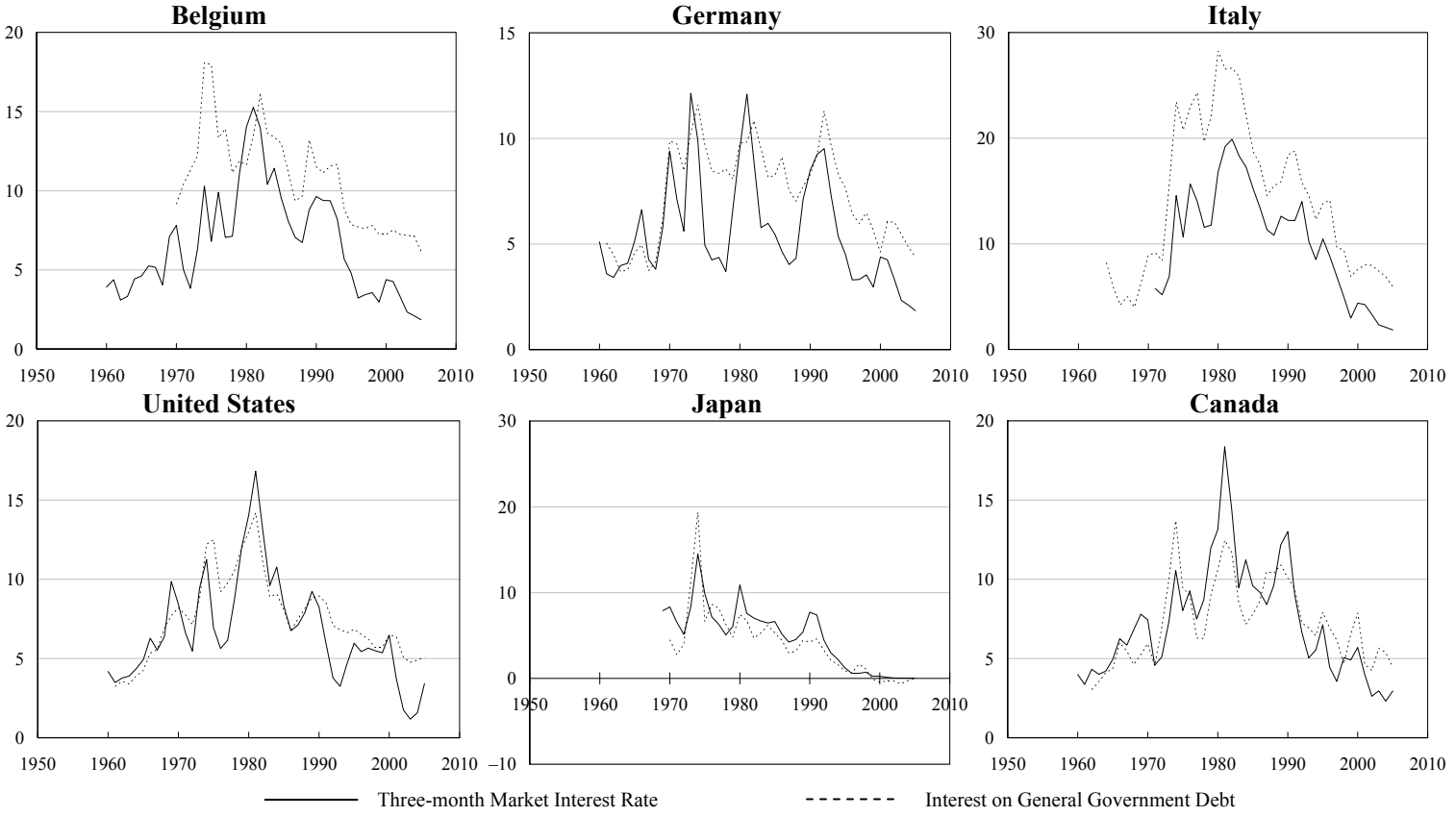
1 More sophisticated models often include some measure(s) of central bank reserves and a monetary aggregate.

2 A proxy for the effective interest rate on government debt is achieved by dividing the general government interest payments to GDP ratio by the general government debt to GDP ratio.

Figure 1

Three-month Market Interest Rate and the Interest on General Government Debt in Selected OECD Countries



Our choice of output growth instead of the output gap deviates from the standard practise of using the difference between output and potential output in monetary and fiscal policy VARs. Moreover, our version of the debt dynamics equation expresses the public debt, expenditures and revenues as shares of the GDP. This complicates the interpretation of the impulse response functions of the standard VAR analysis compared, for example, to using logarithmic levels of these variables. The main motivation for our choice is the fact that the rules of the Stability and Growth Pact for the critical levels of public debt and deficits are expressed as ratios to the GDP. Consequently, as we are also interested in assessing the reactions of these variables to economic, monetary and fiscal policy shocks, we use the same definitions as in the Pact.

One intricate questions regarding the VAR method is the interpretation given to the error terms of the equations. Ideally, they could be seen as providing information on deviations from policy rules, because it is thought that only when policy makers deviate from their rules, it becomes possible to collect interesting information on the response of macroeconomic variables to monetary and fiscal policy impulses (e.g. Bagliano and Favero, 1998). The problem with this interpretation is that the residuals of the equations are often correlated with each other and therefore it is difficult to attach them to particular monetary or fiscal policy actions. Consequently, to isolate shocks to one of the variables in the system it is necessary to decompose the residuals in such a way that they become orthogonal. One convenient, but also criticised way to do this is to apply the Choleski decomposition in the identification of the shocks.[3] The identifying assumption is that the variable that come earlier in the ordering affects the following variable contemporaneously, as well as with lags, while the variables that come later affect the previous variables only with lags. Despite its caveats, we believe that the Cholesky decomposition can to a certain extent be justified on economic grounds in our case, in other words, we believe that the structural relationships of the included endogenous variables are recursive, namely; first, a common way to separate a policy shock from non-policy shocks is to assume that policy shocks do not have contemporaneous effect on inflation and output (Favero, 2002). According to this assumption, output and inflation are ordered before the interest rate and the fiscal variables. Second, it is often assumed that monetary policy affects macroeconomic variables, including the fiscal variables, with a lag. This suggests that fiscal variables should come before the interest rate. Third, putting the debt to GDP ratio last is justified by the debt dynamics equation which specifies a contemporaneous effect of the other variables on the debt to GDP ratio. Thus, if this reasoning is relevant, the only ambiguous choice is what is the mutual ordering of output and inflation. However, as this choice only affects the relative importance of these two variables, we can try both orderings. Finally, especially the impulse responses

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[3] For example, Bernanke (1986) maintains that the Cholesky decomposition is equivalent to assuming that the structural model for the residuals is of a particular form, *i.e.* strictly recursive – which is usually not motivated by the relevant economic theory. For an assessment of different techniques used to tackle this problem, see, e.g., Christiano, Eichenbaum and Evans (1998).

functions of our basic VAR model seem to be almost invariant to different orderings. This downplays somewhat the importance of this matter.

Looking at the ordering of the variables in the studies we have mentioned, Favero (2002) and Favero and Marcellino (2005) use the ordering: inflation, output gap, short term interest rate and expenditure and revenue shares (and debt to GDP ratio in Favero, 2002). Favero (2006) has the ordering: total revenue, total expenses, output gap, inflation and interest rate. Friedman (2006) uses four and five variable VARs including GDP growth, inflation, public expenditure and revenue items or the actual deficit as share of the GDP, and the debt to GDP ratio, in this order (Friedman does not include the interest rate). Perotti's (2002) benchmark VAR includes expenditure and revenue shares, output growth, inflation and interest rate. Also Blanchard and Perotti (2002) put fiscal policy variables first when investigating specifically the effects of fiscal policy on output growth. Furthermore, many authors add structural inferences and identification schemes to overcome the ambiguities of the Cholesky ordering.

Our empirical results are based on a basic recursive, reduced-form VAR model of the form

$$A_0 X_t = \sum_{i=1}^{k} A_i X_{t-i} + \Phi D_t + \varepsilon_t \tag{3}$$

where *k* denotes the lag-order of the model, D_t is a vector of deterministic terms and $\varepsilon_t \sim N_p(0,\Omega)$ is a vector of mutually uncorrelated innovations. The yearly VAR includes one lag while the quarterly VAR displayed in Appendix 1 includes four lags. In the first specification, X_t denotes a vector which contains the variables in the order $X_t = (y_t, \pi_t, pribal_t, i_{st}, b_t)$, comprising the GDP growth rate y_t, the change in the Consumer Price Index π_t, the general government primary balance as a share of GDP $pribal_t$, the three month money market interest rate i_{st} and the general government gross financial liabilities as a share of GDP b_t. In the second specification we replace the primary balance by its components, total public expenditure g_t, and total public revenue t_t, as shares of GDP so that in the second specification $X_t = (y_t, \pi_t, g_{t,} t_t, i_{st}, b_t)$.

The coefficients of the A_0 matrix reflect contemporaneous relationships among the variables X_t. We assume that A_0 is a lower triangular matrix which is equivalent to estimating a reduced form VAR model and computing the Cholesky factorization of the VAR covariance matrix (Stock and Watson, 2001, Corsetti and Muller, 2006). Once the VAR is estimated, we generate impulse response functions and variance decompositions of the reduced form.

3.2 The data

One complicating factor in the empirical analysis of fiscal policy is the small number of observations which is due to the low frequency of fiscal data. This is related to the fact that the budget is set for the fiscal year. While discretionary reactions to business cycle movements or other shocks could be taken within the year, the long implementation lags involved imply that the number and importance of such decisions is in most cases limited. The yearly frequency is particularly problematic for the recursiveness assumption discussed above since it is more difficult to justify the assumption that there would be no contemporaneous interaction between the relevant variables within the year than within a quarter. However, the low frequency may also bring some advantages; there is less need for the correction of seasonal effects or the impact of outliers. Moreover, the quality of quarterly fiscal data, which is available only for a limited number of OECD-countries, is not always clear (Beetsma, Giuliodori and Klaassen, 2006). We assess the importance of this problem in Annex 1 by comparing the results of our basic VAR achieved by both yearly and quarterly data for the US and Germany. The conclusion we draw from this comparison is that, in spite of the low frequency, the results obtained by the yearly data are quite similar with the results obtained by using quarterly data. Therefore we believe that the low frequency of our data will not pose a major problem for the analysis and, anyway, in the majority of cases, only yearly data is available.

The OECD economic outlook 2006 data base provides yearly fiscal data on pubic debt, revenue, expenditure and primary balance for 20 countries and quarterly data for 9 countries.[4] However, the length of both yearly and quarterly time series differs widely. We have restricted our analysis to those OECD economies for which the yearly data starts at latest in 1978. There are 13 such countries: Belgium, Denmark, Germany, Spain, Greece, France, Italy, Austria, Finland, the UK, the US, Japan and Canada. The data sources are the OECD, the European Commission, and the IMF. The quarterly federal funds rate is from the IMF data base and the debt to GDP ratio of the EU countries is from the European Commission. All other data are from the OECD. We use the European Commission definition of the general government debt to GDP ratio since this is the official yardstick used for measuring the compliance with the Stability and Growth Pact. As this measure is available only for the EU countries, we have used the OECD definition for the US, Japan and Canada.

Time series of our main variables and some related series are displayed in Figures 2 through 4 overleaf. We have aggregated the euro area 12 and compared it with the US time series to stress the striking similarities of public debt dynamics in both continents. Moreover, the time series illustrate well the overall

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[4] Belgium, Germany, Spain, Greece, France, Italy, Austria, the Netherlands and Finland.

Figure 2

GDP Growth Rate and Inflation: the Euro Area and the US, 1960-2005

Output Growth
(percentage of change)

Inflation
(percent)

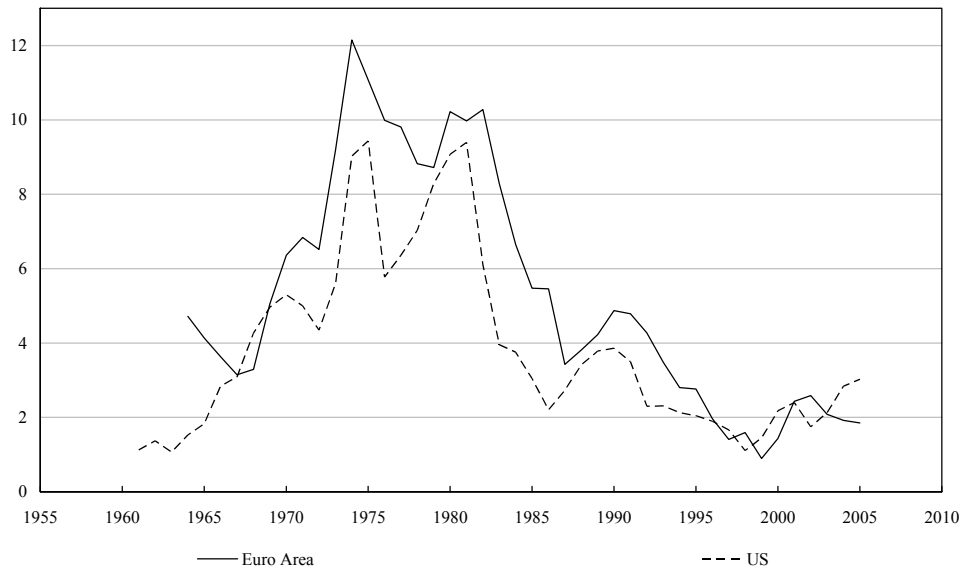
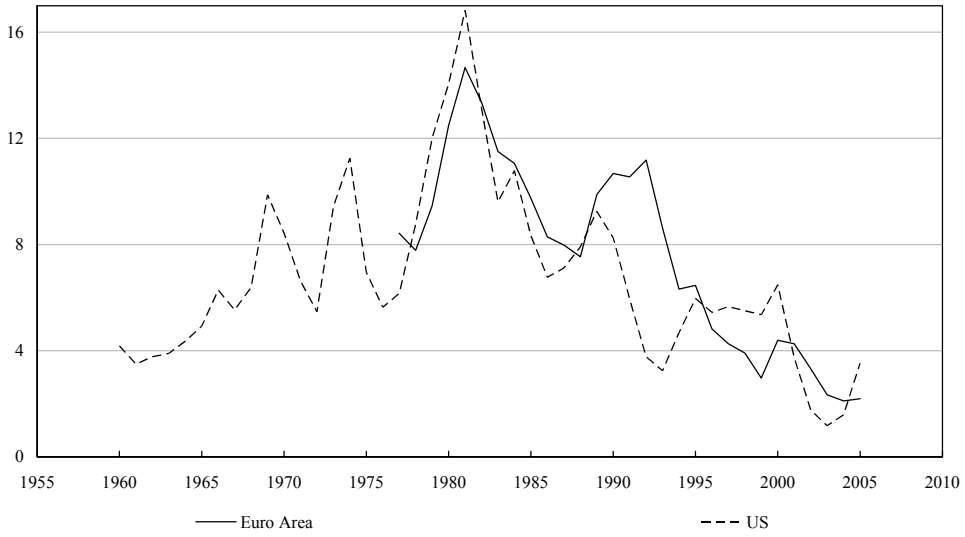


Figure 3

Three-month Nominal Money Market Interest Rate and the Long-term Real Interest Rate: the Euro Area and the US, 1960-2005

Three-month Nominal Money Market Interest Rate
(percent)



Long-term Real Interest Rate
(percent)

behaviour of monetary and fiscal variables in most OECD economies in 1960-2005.[5] As regards the statistical properties of the time series, according to Augmented Dickey-Fuller tests, the GDP growth rate is an I(0) process in all OECD-countries of our sample. The inflation rate and short term nominal money market interest rate are I(1) processes with only one borderline case.[6] The primary balance to GDP ratio is an I(1) process in the majority of the countries in our sample while it is an I(0) in the US, the UK, Germany, Denmark and Finland. Finally, the debt to GDP ratio is an I(1) process in eight of the sample economies, while it is an I(2) process in Belgium, Denmark, Spain, Japan and Canada. The inflation rate and the short term nominal money market interest rate show a "humped" shaped pattern with a peak at the end of the 1970s and at the beginning of the 1980s. The hump illustrates the consequences of escalating inflation rates since the late 1960s and the strong monetary policy reaction against this development in the beginning of the 1980s.

Perhaps the most dramatic change occurs in real long-term interest rates in the beginning of the 1980s, particularly in the US. Real interest rates had been at historically low levels all over the world in the high inflation years of the 1970s. However, there was an abrupt shift in the monetary policy emphasis between 1979 and 1980 in most OECD economies.[7] The hikes in long real rates ranged from 11 per cent in the UK in 1981 and 1982 to about three to four per cent in Germany (which meant doubling of the real rates in Germany).

As regards the behaviour of the fiscal variables shown in the Figure 4, there are again striking similarities between development in the US and the euro area. The primary balances fluctuated around zero over the cycle until the severe recession of 1975 (not visible in the shorter euro area series). In that year the primary deficits hit a record of minus four per cent of GDP both in the US and the euro area as a whole. There was a pursuit for an immediate consolidation in 1976 to 1979, but the second oil shock in 1979, the sharp increase in monetary policy rates and the ensuing deep recession marked a new deterioration in fiscal balances (OECD EO, 1981). Primary deficits were brought close to balance in the majority of OECD countries in the latter half of the 1980s, but because of the impact of the high and persistent real interest rates on the interest burden of the debt, actual deficits did not turn into surplus until in the turn of the millennium.

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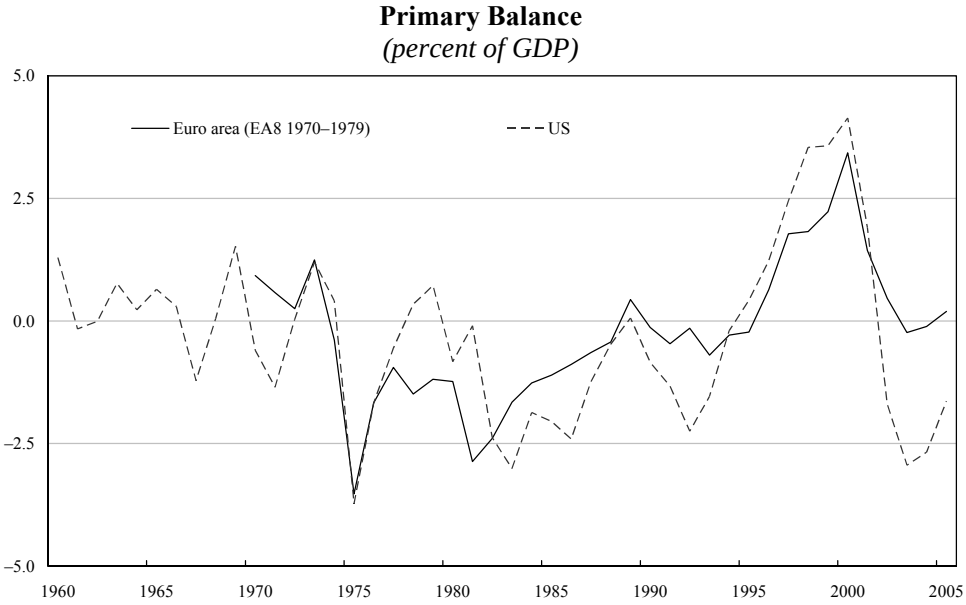
[5] The public debt history of Finland, the UK and Japan differ from this general picture (see Figure 10 in Appendix 3). The UK has had a *declining* trend in its debt to GDP ratio until the beginning of the 1990s; in Finland severe public debt problems emerged only for a short period in the 1990s because of a deep recession, and in Japan the collapse of the "bubble economy" has aggravated greatly debt problems. The VAR results of these three countries, to which we refer to as countries with "peculiar debt histories" often differ from the others and sometimes distort the scale of comparisons.

[6] According to the ADF-test, the short term money market interest rate is *I*(0) in Germany with the 95 per cent significance level but *I*(1) according to the Phillips-Peron test. A critical discussion on the relevance of using unit root tests, see, for example, Maddala and King (1998).

[7] According to Goodfriend (1995), in the US, "the announcement (by the new Fed Chairman Paul Volcker) on 6 October 1979 of the switch to non-borrowed reserve targeting officially opened the period of disinflation policy" (see also, for example, Huizinga and Mishkin, 1986, regarding the US, and Bagliano, Golinelli and Morana, 2002, regarding Europe).

Figure 4

General Primary Balance, Actual Balance, Revenue and Expenditure (excl. Interest Payments) and Debt: Euro Area and the US, 1960-2005



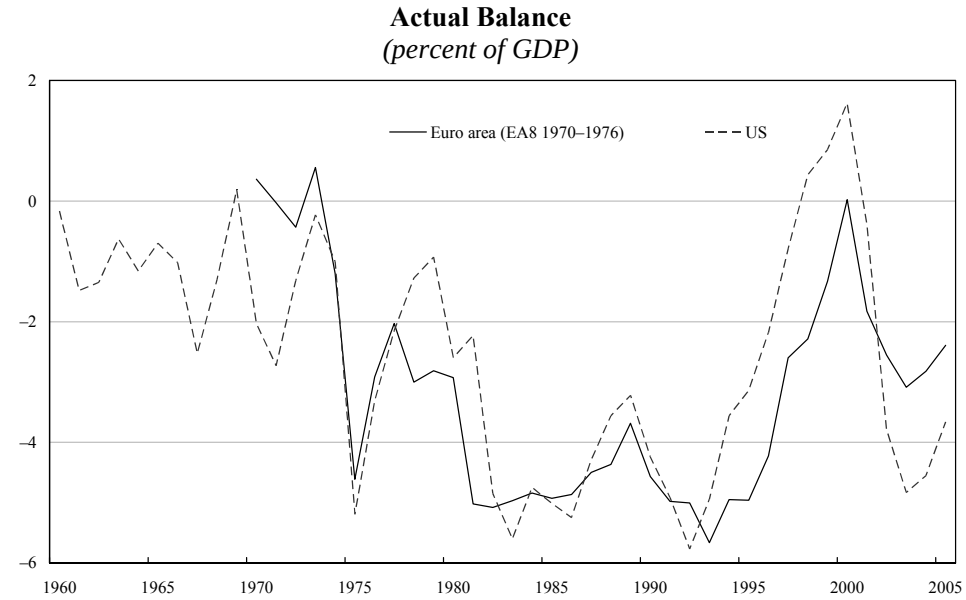
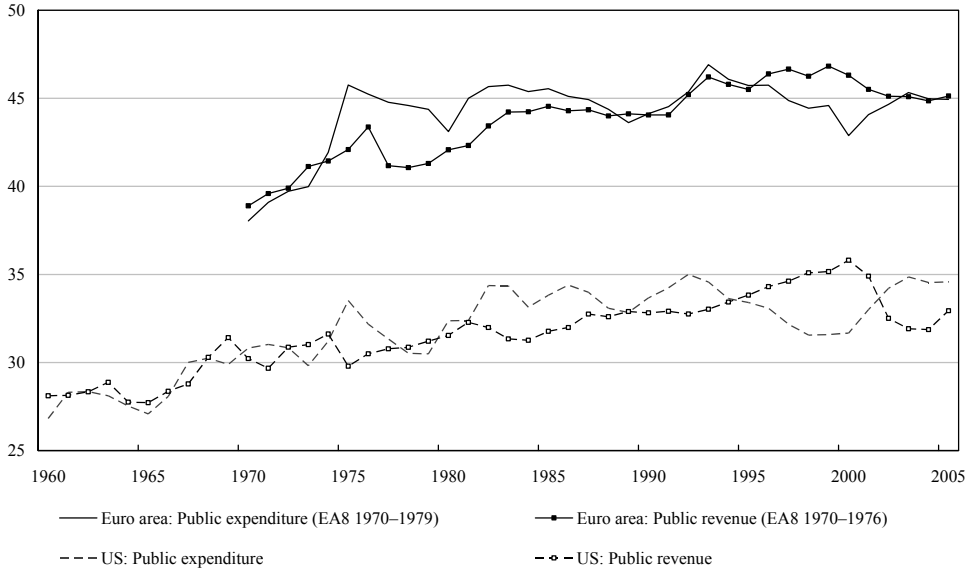


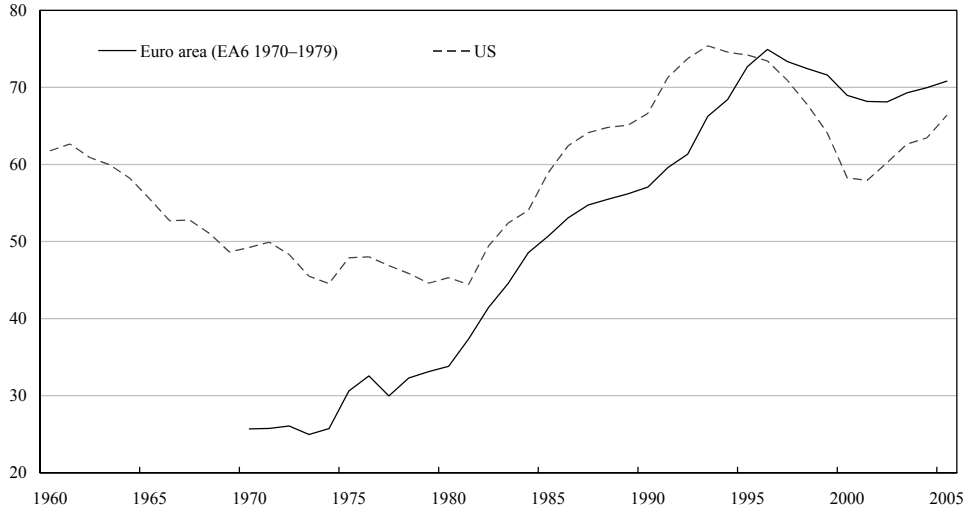
Figure 4 (continued)

General Primary Balance, Actual Balance, Revenue and Expenditure (excl. Interest Payments) and Debt: Euro Area and the US, 1960-2005

General Government Revenue and Expenditure
(percent of GDP)



General Government Debt
(percent of GDP)



Perhaps the only outstanding dissimilarity between the US and the euro area regarding fiscal variables is the large difference in the shares of public sector revenues and expenditure in GDP: in the euro area they are about 15 percentage points higher than in the US. Therefore, it is remarkable how similar the overall development of the fiscal variables is in both continents. In the US the significant increase in the debt to GDP ratios occurred in about ten years from 1982 to 1993 while in Europe the period was a few years longer. While many OECD countries, particularly the smaller ones, have got their debt to GDP ratios under control since the mid-1990s, the fiscal situation in the large euro area economies and the US is still worrying. The development of the debt to GDP ratio in the 13 OECD countries of our sample is presented in Appendix 3 together with dynamic forecasts estimated with the basic country VARs for the period 1998-2005.

4 The results of the recursive basic VAR model

4.1 The response of the debt to GDP ratio to innovations in the VAR variables

First of all, all country VARs are stable in the period under consideration.[8] In Figure 9 in Appendix 2 we display the impulse response functions based on yearly data of all countries of our sample.[9] The overall picture is that the sign and in most cases also the profile of the impulse responses are rather similar across countries while the magnitude of the responses differ from country to country. First, an unexpected positive shock to *output growth* initially decreases the debt to GDP ratio in all cases as one would expect and in the large majority this reaction is also statistically significant (the response of Belgium is clearly an anomaly). In Denmark, Spain, France, Finland and Japan the response is rather strong compared to others while it is weak in Germany, Greece, Italy and Austria. The UK, the US and Canada may be classified as intermediate cases. Second, as regards the influence of unexpected shocks to *inflation*, this is in most cases weak and almost in all cases statistically insignificant. In half of the cases (Denmark, Germany, Greece, Austria, the UK and the US) the accumulated impact is positive and in the other half negative (in Italy it is zero). The sum of the accumulated responses is close to zero. The negative responses are dominated by two high debt countries, Belgium and Japan. It is interesting to find out that in half of the cases an unexpected inflation shock increases the debt to GDP ratio. Namely, it is often thought that high inflation erodes the value of debt and is therefore often regarded as the ultimate contingency solution to debt crises. The likely reason for this result is that higher inflation leads to higher interest rates and, consequently, to larger interest payments on the debt.

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8 If we had chosen another period, say, from 1970s to the end of 1980s, several country VARs would have been unstable.

9 All shocks have been standardised by dividing them by the standard error of the equation of the variable. Accordingly, one standard deviation shock in the present context is always unity.

Concerning the impact of a positive innovation to the *primary balance*, in 12 cases the accumulated impact is negative while it is slightly positive only in Finland. The response is strongest in Japan and above average also in Belgium, Greece, France and Austria. The impact of unexpected fiscal policy shocks is weak in Denmark, Italy and the UK. Germany, the US and Canada are intermediate cases. An unexpected rise in the *short term interest rate* increases the debt ratio in 11 cases of 13 and in about half of the cases the response is statistically significant. The accumulated response is very large in Belgium and higher than average also in Denmark, Italy, Finland and Canada. The response is clearly weaker only in Greece and Austria. In the UK and Japan the accumulated response is negative but not statistically significant. In the case of Japan the "wrong" sign is probably due to the fact that there has at the same time been a strong trend decrease in the short term interest rates while the debt ratio has increased from 23 per cent to 134 per cent. Finally, the positive response of the debt ratio to a shock to itself is quite weak, though in most cases statistically significant.

All in all, shocks to output growth, the primary balance and the short term interest rate have the strongest and in accumulated terms almost equally strong influence on the debt to GDP ratio while shocks to inflation and the debt ratio itself have only a minor impact. In the great majority of cases the signs of the responses are as expected, but the responses of countries with peculiar debt histories often deviate from the common patterns. Regarding the persistence of the impact of the shocks to the debt to GDP ratio, in the large majority of cases the persistence is remarkably high. The responses are particularly large and persistent in the two high debt economies Belgium and Japan, while they are smaller but as persistent in Greece. Instead, in the fourth high debt country Italy the impulse responses are on average small and not particularly persistent compared to others. In Denmark, Spain, Finland and the UK the responses seem to die out sooner than average. On average, shocks to output growth and inflation are less persistent than the policy shocks.

4.2 The variance decompositions of the shocks

Table 1 displays the variance decompositions of the debt to GDP ratio for all countries of our sample. The table shows the decomposition in one and ten year horizons to highlight potential differences in the short and long run impact. Moreover, in the last two columns of the table we show the results of a variant of our basic VAR in which we have replaced the primary balance with its components, total public expenditure and revenue.

In general, the results of the variance decompositions are in accordance with what we have learned from the impulse response functions in that output growth, the primary balance and the short term interest rates are the most important factors affecting the debt to GDP ratio forecasting errors, particularly in the longer term. Shocks to output growth explain, on average, about 28 per cent, to inflation around 6.5 per cent, to the primary balance about 20 per cent, to the short term interest rate about 33 per cent and to the debt ratio itself about 13 per cent of the debt to GDP

Table 1

Variance Decomposition of the Debt-to-GDP Ratio in Selected OECD Countries, 1960-2005
(one and 10 year horizons, percentage points)

		S.E.	Y	INFL	PRIBAL	IS	B	EXPEN	REV
BE	1 year	1.5	7.9	31.7	10.2	2.3	48.0	4.5	8.1
	10 year	1.9	2.6	13.9	10.2	71.7	1.7	26.0	3.9
DK	1 year	1.1	51.8	11.3	2.6	9.9	24.4	0.1	1.4
	10 year	1.5	42.0	13.3	6.7	33.9	4.1	3.6	3.1
GE	1 year	1.6	48.3	2.4	14.0	0.3	35.0	5.1	9.7
	10 year	1.9	17.8	9.0	35.1	18.4	19.7	23.5	10.2
SP	1 year	1.0	34.0	5.4	17.5	12.1	31.1	16.6	7.0
	10 year	1.5	29.2	5.2	8.7	49.0	8.0	26.5	9.0
GR	1 year	2.2	5.7	1.2	17.6	0.0	75.6	9.3	0.6
	10 year	3.5	2.3	8.7	59.5	4.4	25.1	23.5	10.2
FR	1 year	1.1	23.6	0.1	37.9	4.7	32.6	27.1	18.9
	10 year	1.3	42.1	1.9	13.2	33.0	9.8	17.2	6.2
IT	1 year	1.7	26.4	5.6	1.2	2.5	64.3	0.0	2.2
	10 year	1.9	8.2	1.7	4.5	65.5	20.1	23.9	3.8
AT	1 year	2.1	32.8	6.7	9.3	0.3	51.0	23.6	8.9
	10 year	1.9	9.8	6.7	46.6	12.5	24.5	46.1	14.1
FI	1 year	2.1	32.8	6.7	9.3	0.3	51.0	0.9	13.8
	10 year	3.1	57.7	1.5	3.2	30.1	7.6	5.3	28.4
UK	1 year	1.6	2.9	0.2	0.0	11.7	85.2	17.8	20.7
	10 year	2.3	37.0	4.3	29.7	4.5	24.5	15.9	29.3
US	1 year	1.7	52.3	9.4	22.4	0.2	15.6	10.0	16.8
	10 year	2.2	39.9	6.4	21.2	26.6	5.9	13.8	5.7
JP	1 year	1.6	35.0	14.7	6.7	0.6	43.0	2.8	4.0
	10 year	1.8	62.0	12.4	11.2	12.2	2.1	1.2	12.2
CA	1 year	1.6	24.3	18.6	12.9	0.1	44.1	23.9	0.0
	10 year	2.3	7.6	3.0	6.6	69.7	13.2	15.8	25.0
Ave-	1 year	1.6	28.1	8.7	14.4	3.5	45.3	10.9	8.6
rage	10 year	2.1	27.6	6.4	20.1	33.3	12.7	18.6	12.4

ratio forecast error variation in the ten year horizon. However, especially the relative weights of shocks to output growth and the primary balance vary widely from country to country. Instead, monetary policy shocks explain consistently a large share in the forecast error variance in the large majority of the cases (the impact is weak in Greece and the UK).

The short and long term results deviate from each other mainly in that the short term interest rate exerts virtually no impact on the variance decomposition in the short run while shocks to the debt ratio itself explain about half of the forecasting error in one year horizon. However, the interest rate impact increases gradually by time and exerts the strongest effect among the VAR variables in the long run. The share of output growth is, on average, almost similar in both short and long term horizon. However, in most countries the impact of output is strong in the short run and then decreases gradually. This is clearly the case in Belgium, Germany, Italy, Austria and Canada. In contrast, in countries with peculiar debt histories and in France the impact of output growth increases over time. On average, the long term share of the primary balance in the variance decomposition is larger than in the short run but, again, the role of fiscal shocks differ widely from country to country.

As regards the large variance in the relative importance of output and primary balance shocks, one could perhaps conclude that in those countries where the output shocks explain a smaller than average share of the forecast error in the long run (Germany, Greece and Austria), the primary balance explains larger than average share and vice versa (Denmark, France, Finland and Japan). In addition, the share of output in the variance decomposition is small and the share of shocks to the short term interest rate very high in countries with high public debts (Belgium, Italy and Canada).

The fact that in Finland and Japan the share of shocks to output growth have a large share in the debt to GDP ratio variance decomposition is in accordance with the large drop in output in Finland in the beginning of 1990s and the sluggish growth performance of Japan also from the start of the 1990s, which explain the strong increase in the public debt to GDP ratio in these countries.

To attain information of the relative roles of public expenditure and revenue in public debt developments, we replaced the primary balance with total general government expenditure and revenue in our basic VAR model. The shares of these two components in the variance decomposition of the modified VAR are shown in the last two columns of Table 1. On average, the share of shocks to output, inflation and the debt ratio itself (not shown in Table 1) in the second VAR are close to those displayed in Table 1. However, the sum of the shares of shocks to expenditure and revenue in this second variance decomposition, about 30 per cent, is larger than the share of shocks to the primary balance of about 20 per cent in the basic VAR.

Shocks to expenditures have a larger influence in the variance decomposition than shocks to revenues which is in accordance with the common finding that fiscal consolidation measures that seek to restrain expenditure developments are more

efficient than actions on the revenue side. This would also be visible in the impulse response functions (not shown) where a negative shock to expenditure has an unambiguous and often statistically significant decreasing effect on the debt to GDP ratio while a shock to public revenue has more often an ambiguous effect and is in most cases statistically insignificant. Shocks to public expenditure have the largest share in the variance decomposition in Germany, Greece and Austria. Finally, the share of revenue is larger than expenditure in the three countries with peculiar debt histories, Finland, UK and Japan and, furthermore, in Canada.

4.3 Further remarks on the role of monetary and fiscal policy in public debt developments

What has become obvious from the above is that unexpected shocks to monetary and fiscal policy have played an important role in public debt developments in our sample countries. Together they explain, on average, more than half of the forecast error variation in the debt to GDP ratio, and the response of the debt ratio to these policy shocks shows considerable persistence which lead to large accumulated effects. As regards the role of fiscal policy, it may be difficult to point out any specific unforeseen economic or policy shocks that would have triggered the overall deterioration in fiscal balances other than the deep recession in the mid-1970s after the first oil crises, and the accommodative stance of both fiscal and monetary policy during the recession. Many authors see the fiscal problems as a consequence of the building up of welfare states during the 1960s and 1970s. This strongly increased the share of public expenditures in GDP in several OECD economies (Rubini and Sachs, 1989, Masson and Mussa, 1989). However, the large increase in public indebtedness seems to be largely independent of the share of public sector in the economy. Nevertheless, the build up of welfare states do play a role in public debt developments as it has been difficult to adjust the existing welfare schemes to changing economic circumstances. Moreover, it took quite long before even professional economists realised that the high output growth rates which prevailed in OECD economies until the beginning of the 1970s did not re-emerge soon. Because of – by hindsight – unrealistically optimistic economic forecasts fiscal targets were constantly undershot in the late 1970s and early 1980s.

As regards the role of unexpected monetary policy shocks in public debt developments, it is easier to date the largely unexpected and in economic terms quite dramatic change in the monetary policy regime that happened in the beginning of the 1980s. In the US the quarterly nominal federal funds rate increased from 9.8 per cent in the third quarter to 15.9 per cent in the fourth quarter of 1980 while in many European countries the increase in nominal short term interest rates was even larger than in the US. From the second panel of Figure 3 we saw that this resulted in a sudden unexpected increase of several percentage points in the real long term interest rates in the US in the beginning of 1980. This implied that – just to keep the debt to GDP ratio constant – there should have been a marked increase in the primary balance to GDP ratio. However, at the same time as real interest rates reached high levels, the output growth rates declined. There had been a commitment

to lower government deficits already before the second oil shock in 1979, but high interest rates, indexation commitments and unemployment related expenditures made it difficult to meet borrowing targets (OECD EO, Dec.1981). Mervin King described this dilemma vividly in the Federal Reserve Jackson Hole Conference in 1995 (King, 1995):

> *"One consequence of this change in monetary policy is that the attempt to bring inflation down – resulting in lower inflation than expected – led to a fiscal problem. A shift to a regime with a lower inflation rate but one in which the new policy does not have total credibility immediately raises the effective real interest rate on government debt. This creates a need for extra revenue to finance the higher debt-financing costs incurred in the transitional period during which credibility is being established …A successful policy of disinflation slows the growth of nominal GDP, but does not reduce the required interest payments on conventional debt until the new policy acquires credibility. Expected inflation will decline more slowly than inflation"* (King, 1995, pp. 176-77).

Consequently, the credibility of the new monetary policy regime posed a new problem both to monetary and fiscal authorities. King coined this dilemma "Some unpleasant fiscal arithmetic" in corollary to the famous Sargent-Wallace's argument on "Some unpleasant monetarist arithmetic" (Sargent and Wallace, 1981).

Did fiscal policy – in terms of an increase in the primary balance – react according to this "arithmetic" in the 1980s? As Figure 5 of selected OECD countries show, there has been a significant increase in the share of interest payments in GDP which started in the mid-1970s and got a strong boost in the beginning of the 1980s. According to Figure 5, there has been a gradual correction in the primary balance in Belgium, Germany and Italy but the reaction was delayed and, as the different scales of the left and right axes of the Figure 5 reveal, the increase in interest payments evidently surpassed the increase in the primary balance. This delayed reaction explains a major part of the rise in the debt to GDP ratio particularly in the high debt countries. Figure 5 also shows the importance of the marked decrease in interest rates after the mid-1990s for the decline of the interest burden on public debts.

To find more evidence of the response of fiscal policy to a deterioration of the debt ratio, we display in Figure 6 the response of the primary balance to a positive innovation in the debt to GDP ratio in our sample economies. In eight cases, out of 13, there is an immediate, albeit small, positive response of the primary balance. In five of these the reaction is also statistically significant. In all cases the accumulated response is positive.[10] In Belgium, Denmark, Spain, Greece, Italy and Canada, of which most still are or have been high debt economies, the positive response is somewhat larger than average while it is close to zero in Germany, France and

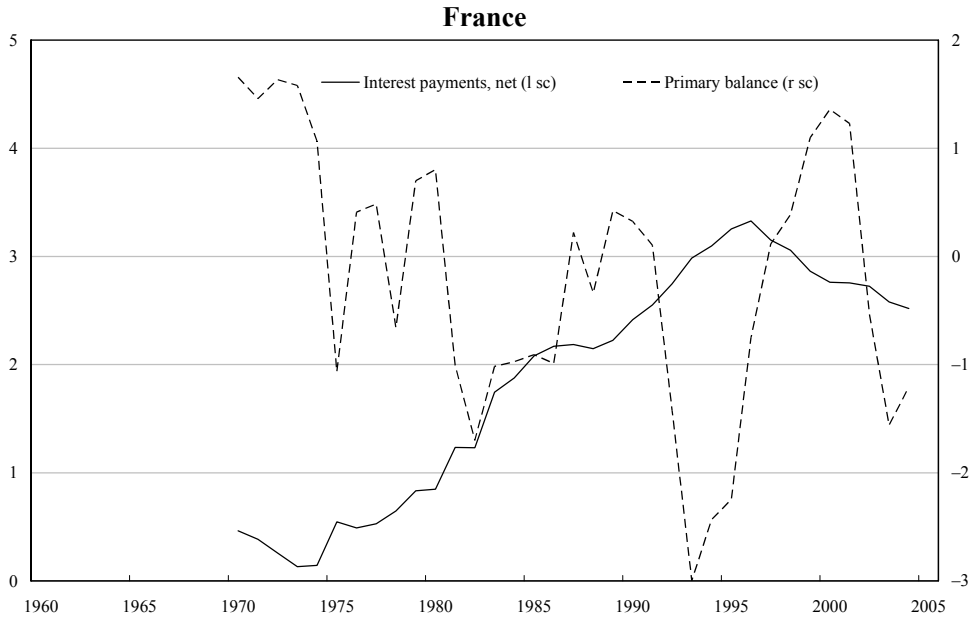
[10] Bohn (1998) argues that a strictly positive and at least linear response of the primary balance to changes in the debt to GDP ratio is a sufficient condition for debt sustainability, regardless of how interest rates and growth rates compare (p. 960–961). Since his analytical framework is different from ours, we are not sure if his reasoning applies here.

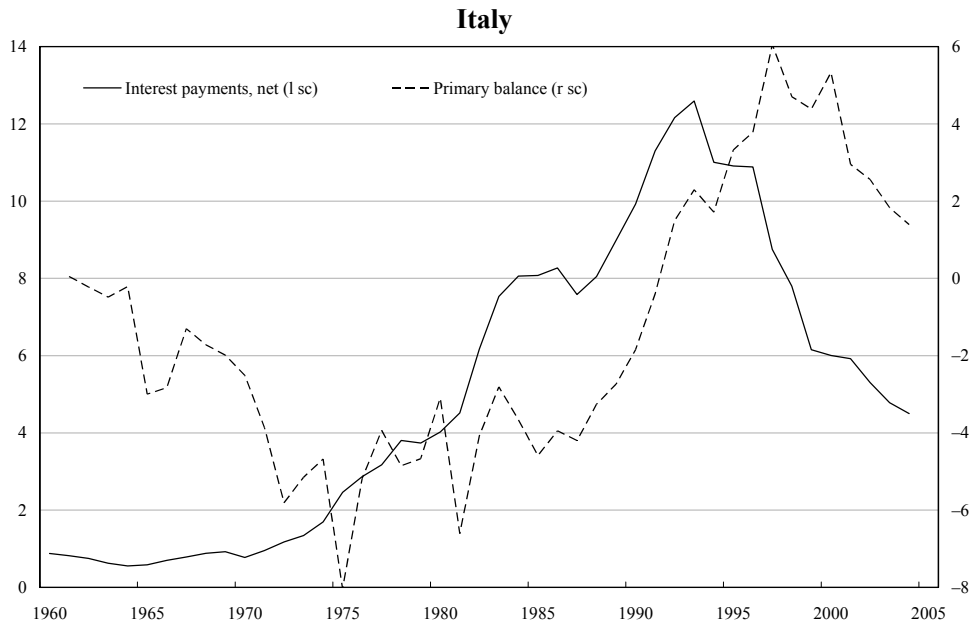
Figure 5

Share of Net Interest Payments (left scale) and Primary Balance (right scale), 1960-2004
(percent of GDP)

Figure 5 (continued)

Share of Net Interest Payments (left scale) and Primary Balance (right scale), 1960-2004
(percent of GDP)





Austria, of which the first two have had difficulties in stabilising their debt to GDP ratios. The positive reaction is also small in Japan while the US is an intermediate case. In Finland and the UK – both countries with peculiar public debt histories – the profile of the reaction is different from the rest and the accumulated response is close to zero.

There has been a lively debate of the potential non-Keynesian effects of fiscal policy among academic economists in recent years. In our basic VAR this would mean that a positive shock to the primary balance would have a positive effect on output. Figure 7 shows the reaction of output growth to an unexpected increase in the primary balance in our sample economies. While in nine cases the accumulated effect is negative, *i.e.* "Keynesian", all in all, the responses are small and rarely statistically significant. In four cases the accumulated impact is positive (Germany, Greece, Austria and Japan) but in all these cases the reaction is not statistically significant. If we compare our results with those obtained from a "pure" fiscal VAR including only output growth and the primary balance, the accumulated response of output growth to a fiscal policy shock is in most cases stronger than in our basic VAR.

So far we have only paid attention to the reaction of the primary balance to an unexpected shock to the debt to GDP ratio. Concerning the response of the other VAR variables to an unforeseen positive shock to the debt to GDP ratio, they are also are very small, although more consistent in that in the large majority of cases an unexpected shock to the debt to GDP ratio has a small negative impact on GDP growth, inflation and the short term interest rate. In less than half of the cases the response is statistically significant.

Finally, the impulse response functions of our two reduced form VARs confirm some stylized facts which are typical for many VAR studies including either monetary or fiscal variables or both: first, in the vast majority of cases, a positive expenditure shock boosts output growth and a positive revenue shock discourages growth in the short run. While in most cases inflation declines after a positive shock to the interest rate, in some countries there is a notable "prize puzzle", *i.e.* inflation initially increases after a hike in the short term interest rate before it starts to decline. In contrast, output responds negatively to a positive interest rate shock as one would expect. The short term interest rate responds positively to positive output and inflation shocks as the Taylor rule suggests and inflation reacts positively to a positive output shock as the Phillips curve would imply.

5 Discussion

In Chapter 3 we discussed the justification of the assumption that the structural relationships of the VAR variables are to a certain extent recursive. In the following we look briefly into the sensitivity of our results to the chosen ordering of the variables. As regards the *impulse response functions* of the base model, they are highly resistant to various different orderings, illustrating the same patterns in

Figure 6

Response of the Primary Balance to a Positive Shock in the Debt-to-GDP Ratio
(yearly data)

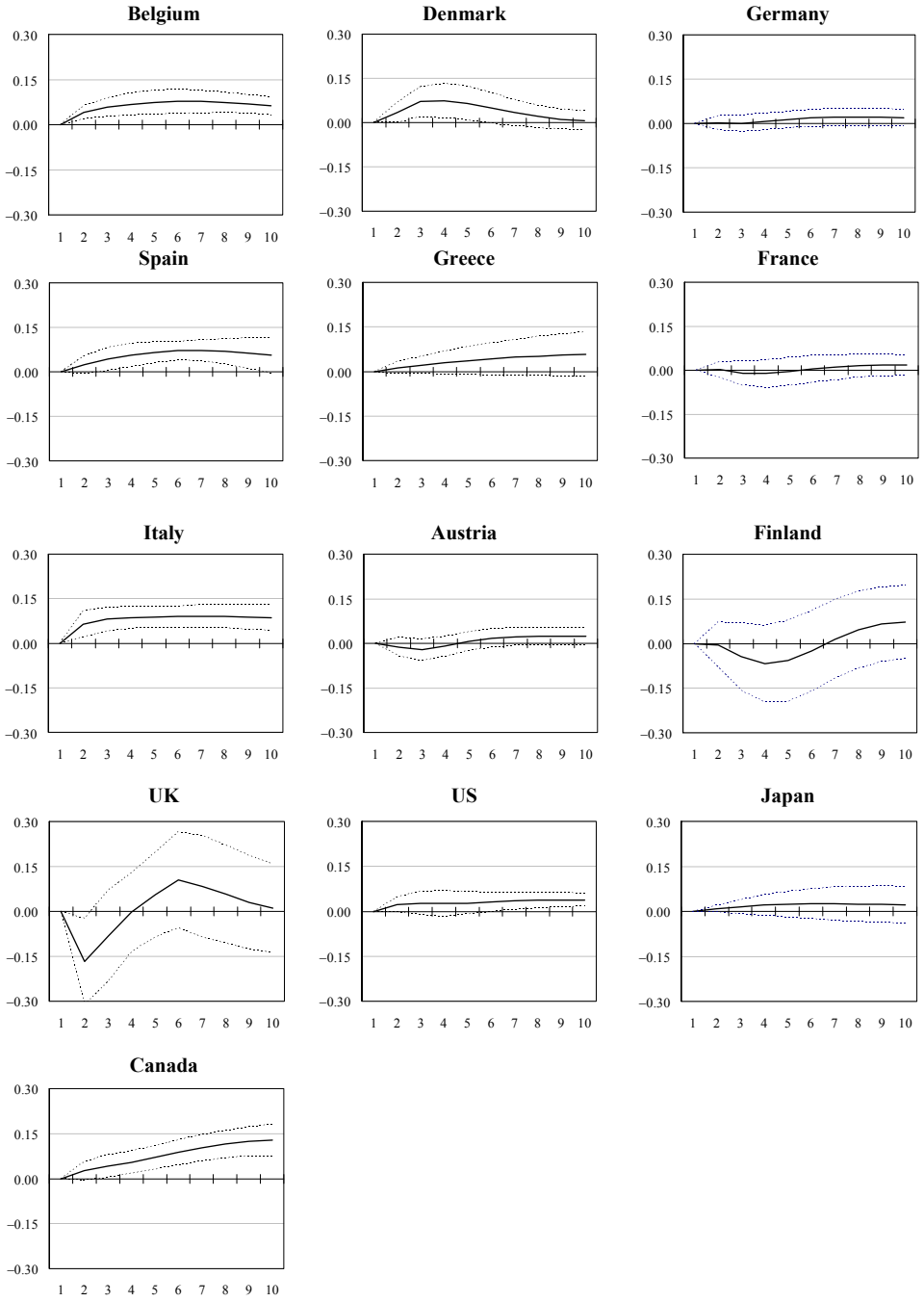
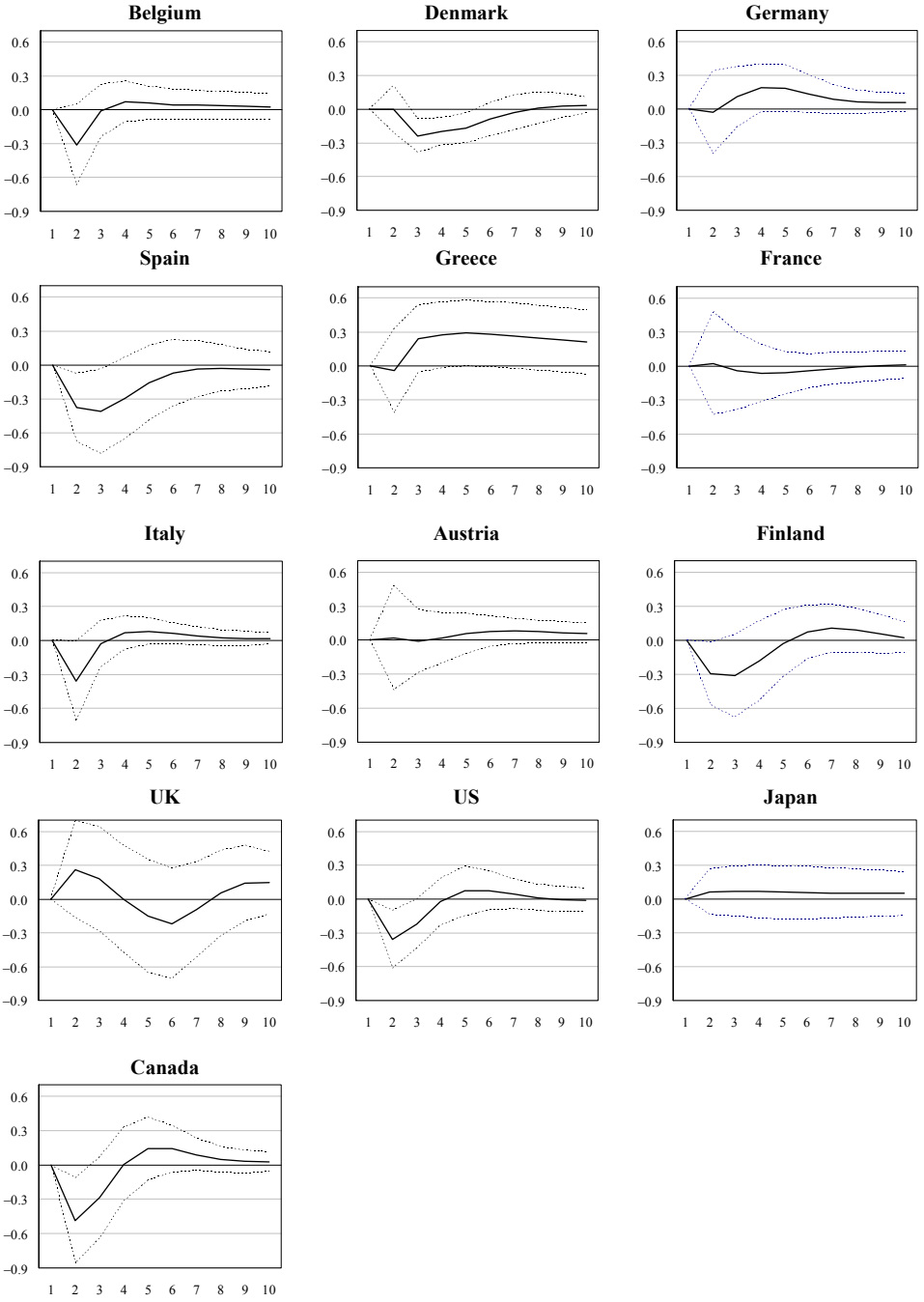


Figure 7

Response of Output Growth to a Positive Innovation in the Primary Balance
(yearly data)



almost all cases. When the unit responses are compared to non-Cholesky ordered unit responses, even their magnitudes are in many cases close to each other. However, the results of the *variance decompositions* are normally more sensitive to the ordering. Therefore, we discuss below some alternative orderings: As said, it is arguable whether one should order output before inflation, which is our choice, or the other way round. Nevertheless, as this has only minor effects on the relative importance of output and inflation, both orderings could be applied in our case.[11] A more intricate question is whether it is justified to have the short term interest rate after the fiscal variables; namely, if the short term interest rate is ordered before the primary balance, the long term impact of the short term interest rate in the variance decomposition declines significantly in some cases. The impact of fiscal policy would also become more prominent. However, the logic of the model would change too, since in that case the impact of automatic stabilisers would be felt in the residual, making the policy response unambiguous. Finally, if the short term interest rate would be ordered last, its significance would increase further and at the same time the share of shocks to the debt ratio itself would become very small. This last ordering could be justified if the effective interest rate on public debt reacts with a lag to a change in the monetary policy rate. The small average share of 3.5 per cent of the short term interest rate in the first year variance decomposition could be an indication of such delay (see also Figure 1).

In the following we present a simplified, small "semi-structural"[12] model in the spirit of Favero (2002) and Favero and Marcellino (2005) of the potential structural relationships of the five endogenous variables of our basic VAR. The system includes the following five equations:

$$y_t = \beta_1 y_{t-1} + \beta_2 (i_{s\,t-1} - \pi_{t-1}) + \beta_3 pribal_{t-1} + \varepsilon_{1t} \quad \text{IS-curve} \quad (4)$$

$$\pi_t = \beta_4 \pi_{t-1} + \beta_5 y_{t-1} + \varepsilon_{2t} \quad \text{Phillips curve} \quad (5)$$

$$pribal_t = \beta_6 pribal_{t-1} + \beta_7 y_{t-1} + \beta_8 b_{t-1} + \varepsilon_{3t} \quad \text{Fiscal rule} \quad (6)$$

$$i_{st} = \beta_9 i_{s(t-1)} + \beta_{10} \pi_{t-1} + \beta_{11} y_{t-1} + \varepsilon_{4t} \quad \text{Taylor rule} \quad (7)$$

$$b_t = \beta_{12} b_{t-1} + \beta_{13} y_{t-1} + \beta_{14} \pi_{t-1} + \beta_{15} pribal_{t-1} + \beta_{16} i_{st-1} + \varepsilon_{5t} \quad \text{Debt equation} \quad (8)$$

The first equation is a sort of IS-curve including the real interest rate (implying that the Fisher-effect holds in the long run) and the primary balance while the second equation is a Phillips curve in which output growth is used as an indicator for the overall level of activity instead of the more common unemployment or output gap. Equation 6 describes the automatic response of the primary balance to output shocks and a potential systematic reaction of fiscal policy to an increase in the public debt burden. Equation 7 is a sort of backward looking Taylor rule, where

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[11] The share of inflation shocks would increase slightly if inflation is ordered first.

[12] Favero and Marcellino use the term semi-structural to indicate that there are no forward looking variables.

the central bank reacts systematically to innovations in inflation and output. Finally, equation 8 is the debt equation of our basic VAR model. While it resembles the debt dynamics identity 2, it is important to note that it ignores the non-linear interaction terms between the level of the debt on the one hand, and the real interest rate and GDP growth rate on the other hand in the identity. There is no straightforward way to overcome this problem in a linear VAR setting.[13] Moreover, there are other reasons why equation 8 should *not* match the actual debt evolution *exactly*: First, our choice to use the monetary policy rate as a proxy for the interest rate on general government debt causes some discrepancy (see Figure 1). Second, we have omitted seigniorage income from the debt identity because its role has decreased significantly, but it may have exerted some influence particularly in the 1970s in countries with high inflation. Finally, the debt identity ignores the role of the so called stock flow adjustment which in some countries causes a marked discrepancy between the public debt figures achieved by the debt identity and actual statistical data on public debt.

By exploring the coefficients of the A_i matrix of equation 3 of the individual country VARs we find that in ten cases out of 13 there exists a statistically significant positive relationship between output and inflation as the Phillips curve suggests. Also in ten cases out of 13 there exists a significant positive relationship between output and the short term interest rate as suggested by the Taylor rule, while only in four countries (Greece, Italy, the UK and the US) there was in addition a significant positive relationship between inflation and the short term interest rate, as also suggested by the Taylor rule (moreover, in six cases there was a positive but not statistically significant reaction). As regards the IS-curve and the "fiscal rule", there is more variation. In six cases there was a statistically significant negative correlation of around –0.4 between the primary balance and output. These were Belgium, Spain, Italy, Finland, the US and Canada. Moreover, in six cases there was a significant negative correlation between the nominal short term interest rate and output of the order –0.2 to –0.5. As regards the existence of a "fiscal rule", in ten cases out of 13 there was a systematic positive response of the primary balance to an increase in the debt to GDP ratio but only in four cases (Belgium, Denmark, Italy and the US) the coefficient was statistically significant.

As regards the debt equation, in 12 cases the coefficient of GDP growth was negative and in ten cases the coefficient was statistically significant. In four cases there was a statistically significant negative coefficient for inflation. The coefficient of the primary balance was negative in all cases but significant only in six cases. Finally, the coefficient of the short term interest rate was in all cases positive and statistically significant in seven cases. As a conclusion, our basic VAR captures quite well some basic macroeconomic relationships typical for small macro economic models, although the coefficients – perhaps partly because of the limited number of observations – were not always statistically significant.

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[13] Giannitsarou and Scott (2006) give several references where this problem is discussed. See also Appendix 3.

If the error terms of our basic VAR model would be uncorrelated – as they more or less were in the case of the quarterly data – their economic interpretation as policy shocks would become more straightforward. However, because the error terms show larger correlation in the yearly data, we are more dependent on the relevance of the Cholesky decomposition, and therefore the interpretation of the error terms remain somewhat ambiguous without more specific structural identification schemes for the shocks. Therefore, an obvious extension of this study would be to aim at more structural identification of the monetary and fiscal policy shocks. Another natural extension would be to identify the cointegration relationships suggested by statistical tests and give them an economic interpretation. Hasko (2006) and Reade and Scott (2006) have followed (independently) this path and specified the cointegration relationships in the case of the US using quarterly data for the period 1960-2005. Both studies found two stable long-run relationships among the VAR variables which they interpreted as a sort of Taylor rule and a fiscal policy rule and which explained the sustainability of the public debt developments in the US. Similar experiments could be done for other OECD countries.

6 Conclusions

One of the main conclusions of our study on public debt dynamics is that shocks to monetary and fiscal policy have played a major role in public debt developments since the mid-1970s. Together these shocks explained, on average, about half of the forecast error variation in the debt to GDP ratio in the ten year horizon while the share of the shocks to GDP growth was close to 30 per cent. Instead, shocks to inflation and the debt ratio itself played in most cases a minor role. However, the inflation shocks were vital in initiating the public debt problems as the increase in actual inflation and particularly the persistence of high inflation expectations in the 1980s led to a prolonged period of high real interest rates. This raised significantly the interest burden of public debts. Thus, the new monetary regimes of the early 1980s gave rise to "some unpleasant fiscal arithmetic" which aggravated and prolonged debt problems. Nevertheless, monetary authorities had no choice but to attain control over the rapid inflation. An additional factor that contributed to the initial increase in public indebtedness – though not studied here – was that both economists and politicians of the time were overly optimistic of the resurgence of the economic growth rates of the preceding decades which delayed the necessary adjustment to the slower growth phase.

The reaction of the debt ratio to both monetary and fiscal policy shocks has shown considerable persistence which partly explains the current high debt levels. Nevertheless, it seems that, according to the impulse response functions and the basic VAR equations, in most countries of our study fiscal policy has aimed at correcting the deteriorating fiscal balances by improving the primary balance, but the progress has in most cases been slow and delayed. It is difficult to say whether this could partly explain the fact that all the country VARs are stable in the period under consideration.

While the large role of monetary policy shocks in debt developments has been quite uniform across the OECD economies, the longer term role of fiscal policy shocks and shocks to GDP growth differ among countries. However, it is difficult to distinguish any particular country profiles which could explain the differences. It is quite obvious that the debt development of countries with very high debt ratios like Italy and Belgium is very sensitive to interest rate shocks and at the same time, other shocks play a minor role.

Looking our results from a different perspective, we could also conclude that shocks to output growth, inflation and monetary policy explain together about two thirds of the forecast error variance in the public debt ratio while fiscal policy shocks explain only about 20 per cent of it in the longer term horizon. Could this be seen as an indication of the limited power of fiscal policy in affecting public debt evolution? So far we have not discussed the consequences of our results for the fiscal framework of the EMU. The remarkable similarity of the overall evolution of public debts and deficits in both the US and the euro area, shown in Figure 4, may be the result of the large shocks to economic growth and monetary policy which have been more uniform across the OECD countries than shocks to fiscal policy. If this was the case, we should probably give more weight to the assessment of these "exogenous" factors in the judgment of fiscal policy outcomes in the context of the Stability and Growth Pact. On the other hand, taking into account the success of the new monetary policy regimes in controlling price developments, it may be less likely that today's economies would confront real interest rate shocks of the magnitude seen in the 1970s and 1980s. Therefore, it is possible that monetary policy shocks play a smaller role in fiscal developments in the future. That said it should be clear that even lesser shocks than those seen in the mid seventies and early eighties could have detrimental effects on the public finances of most OECD economies, taken into account the current high public debt levels. Therefore, policy makers should continue to do their best to keep inflation in control and to consolidate fiscal balances, particularly amid the favourable economic circumstances of the day.

APPENDIX 1

COMPARISON OF THE RESULTS FROM QUARTERLY AND YEARLY DATA: THE US AND GERMANY

In this Appendix we compare the results of our basic VAR obtained by quarterly and yearly data in the case of the US and Germany. For the US the range of both yearly and quarterly data is 1960-2005. For Germany it is 1970-2005 because of the shorter range of the quarterly data. Figure 8 displays the response of the debt to GDP ratio in the US and Germany to a positive one unit shock[14] in the variables of the basic VAR. The quarterly impulse response functions are displayed on the first row and the yearly responses on the second row for each country.

In qualitative terms, the responses are rather similar in both quarterly and yearly data in both countries. In quantitative terms, the reaction of the debt to GDP ratio to shocks to output, inflation and the debt to GDP ratio itself in both countries, and to a shock in the primary balance in the US, are also quite similar. As regards an unexpected shock to the primary balance in Germany, and to the short term interest rate in both countries, the response is clearly larger in the quarterly data compared to that in the yearly data although the overall profile of the reaction is again rather similar. Furthermore, in the quarterly data the responses are in general somewhat less persistent than in the yearly data. Still, in most cases the difference is not that large: for example, as regards shocks to output growth, in the US the maximum response of –1.1 is achieved after 10 quarters in the quarterly data and of –1.3 in the third year in the yearly data. For Germany the corresponding figures are –0.8 after six quarters in the quarterly data and also –0.8 after two years in the yearly data.

As regards the comparison of the results from the variance decompositions, in general there are more differences. For example, as regards the US, the weights of shocks to output and the short term interest rates are higher in the yearly data than in the quarterly data. Finally, concerning the correlation of the error terms of the equations, in the quarterly data the correlations are clearly smaller than in the yearly data. In the German case the quarterly cross-correlations are mainly of the order of 0.05 to 0.2 while in the US they are somewhat larger. All in all, the results of the two data sets with different frequencies seem to be quite consistent in the case of both the US and Germany.

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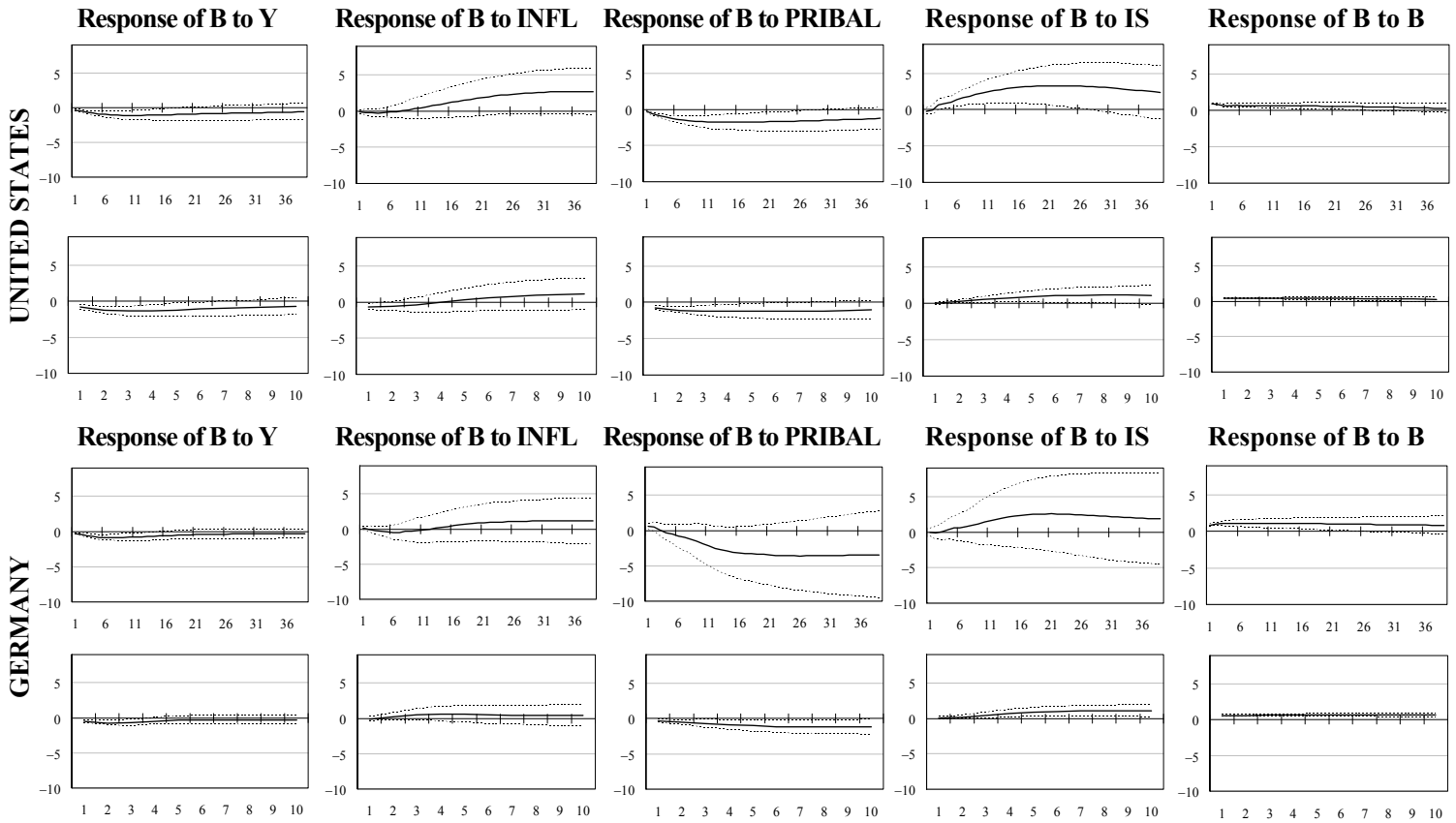
[14] All shocks have been standardised by dividing them by the standard error of the equation of the variable. Accordingly, one standard deviation shock in the present context is always unity.

Figure 8

Response of the Debt-to-GDP Ratio to Innovations to the VAR Variables in the US and Germany; Comparison of Results of Quarterly Data (First Row) with Yearly Data (Second Row)



APPENDIX 2

Figure 9

Response of the Debt-to-GDP Ratio to a One Unit Innovation in the VAR Variables – Yearly Data

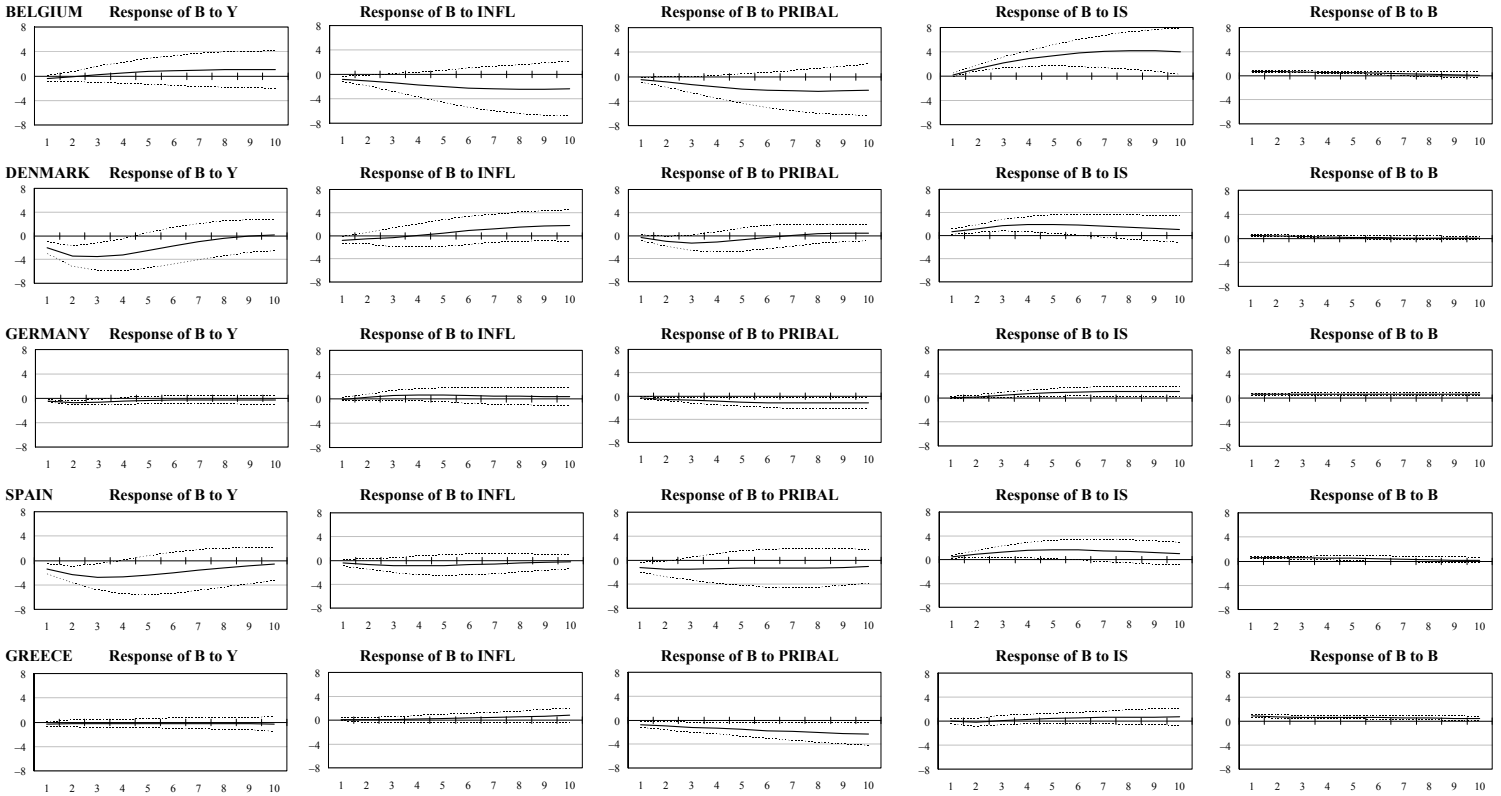


Figure 9 (continued)

Response of the Debt-to-GDP Ratio to a One Unit Innovation in the VAR Variables – Yearly Data

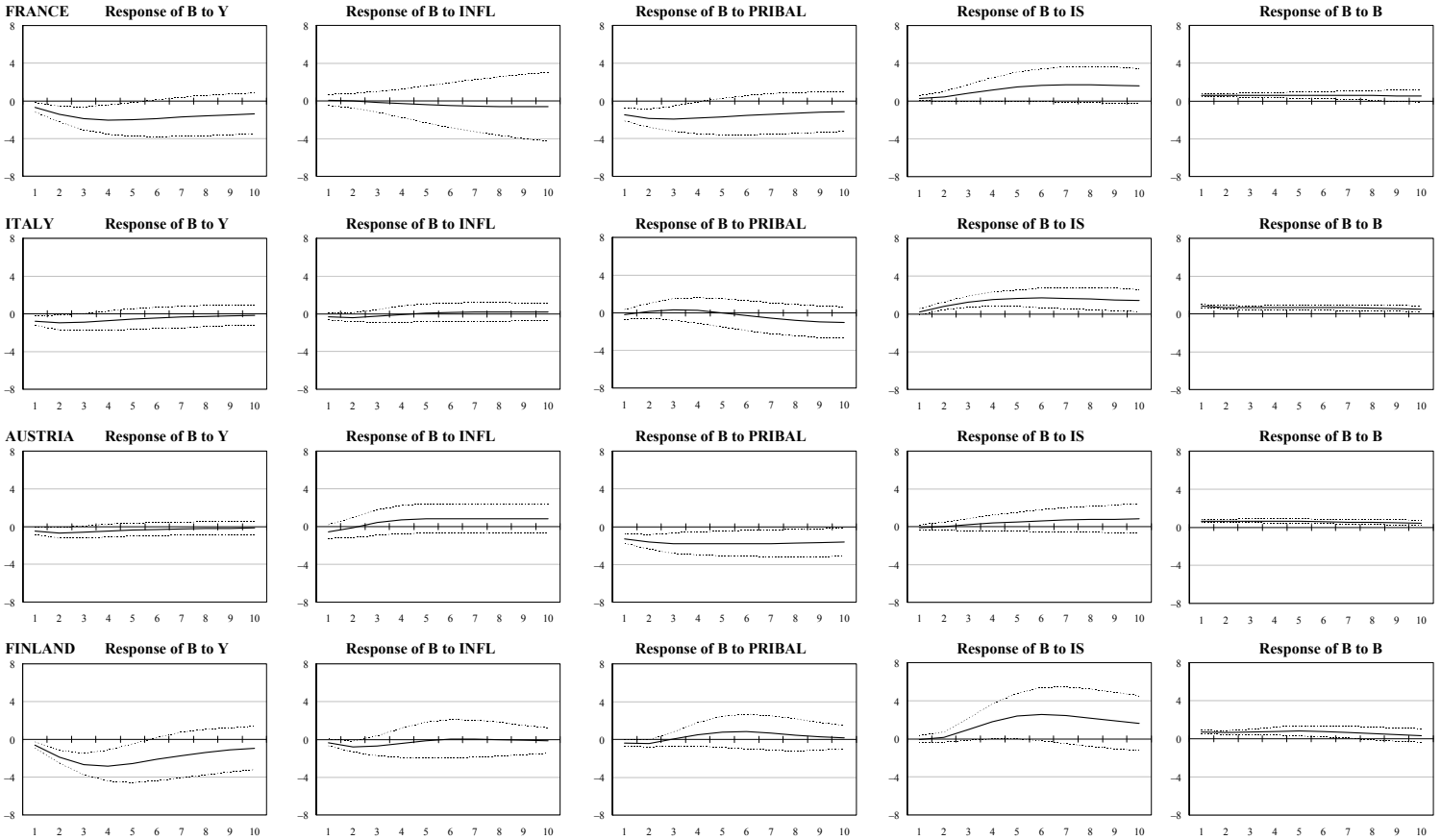
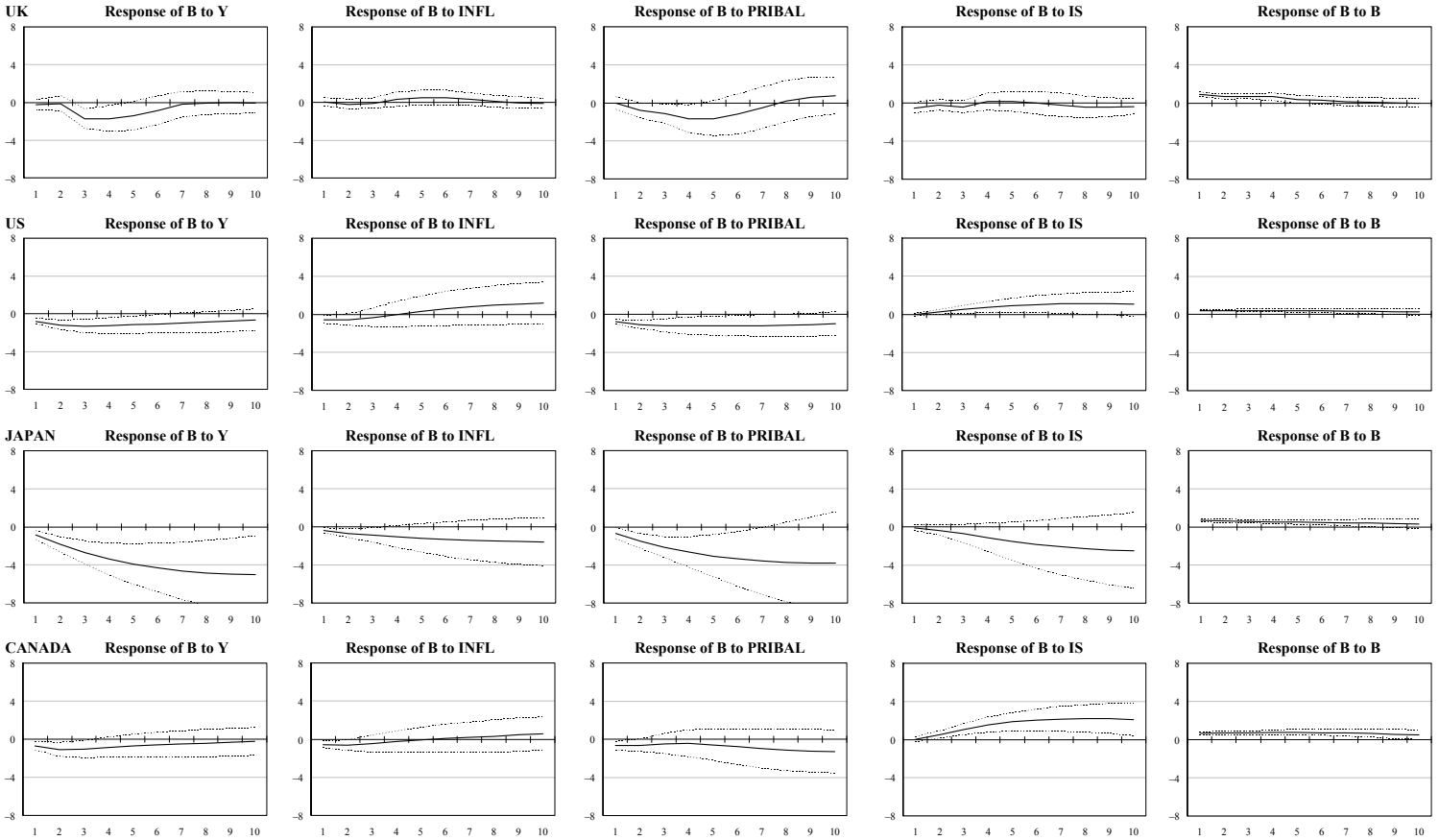


Figure 9 (continued)

Response of the Debt-to-GDP Ratio to a One Unit Innovation in the VAR Variables – Yearly Data



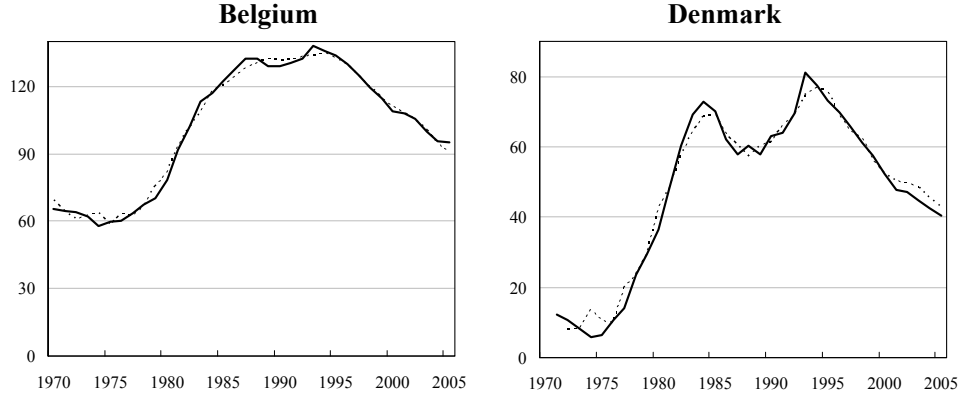
APPENDIX 3
DYNAMIC FORECASTS OF THE DEBT-TO-GDP RATIO

Figure 10 shows the dynamic forecasts of the debt-to-GDP ratio for the period 1998–2005 for the 13 OECD countries estimated by the individual country VARs.[15] The reason for making these forecasts was to find out whether the results would hint to any such non-linearity in the public debt dynamics which would clearly question the use of a linear approximation of the debt identity, *i.e.* the equation 8, in the basic VAR.

The forecasts seem to capture the actual debt developments with different degrees of precision. For some countries like Greece, Austria, the US and Japan the forecasts overestimate the degree of consolidation achieved for the forecast period while it underestimates it for Spain. For Japan this may be due to the special circumstances after the collapse of the "bubble economy", and as regards the US, it may be due to the radical loosening of fiscal policy in the beginning of the 2000s. However, for the majority of countries the forecast mimics quite well actual developments in 1998-2005.[16] Our conclusion from this is that, indeed, equation 8 seems to be a feasible approximation of the debt dynamics equation.

Figure 10

Dynamic Forecasts for the Debt-to-GDP Ratio for the Period 1998-2005
(actual: dark line, forecast: light line)



[15] The country VARs have been estimated from the first year there is data available for all variables until 1997. Using the estimated coefficients, dynamic forecasts have then been computed for the period 1998-2005.

[16] For some countries the debt dynamics "stabilise" rather early, so that, for example, for Italy the VAR forecast for period 1987-2005 and for the US for 1989-2005 are quite good.

Figure 10 (continued)

Dynamic Forecasts for the Debt-to-GDP Ratio for the Period 1998-2005
(actual: dark line, forecast: light line)

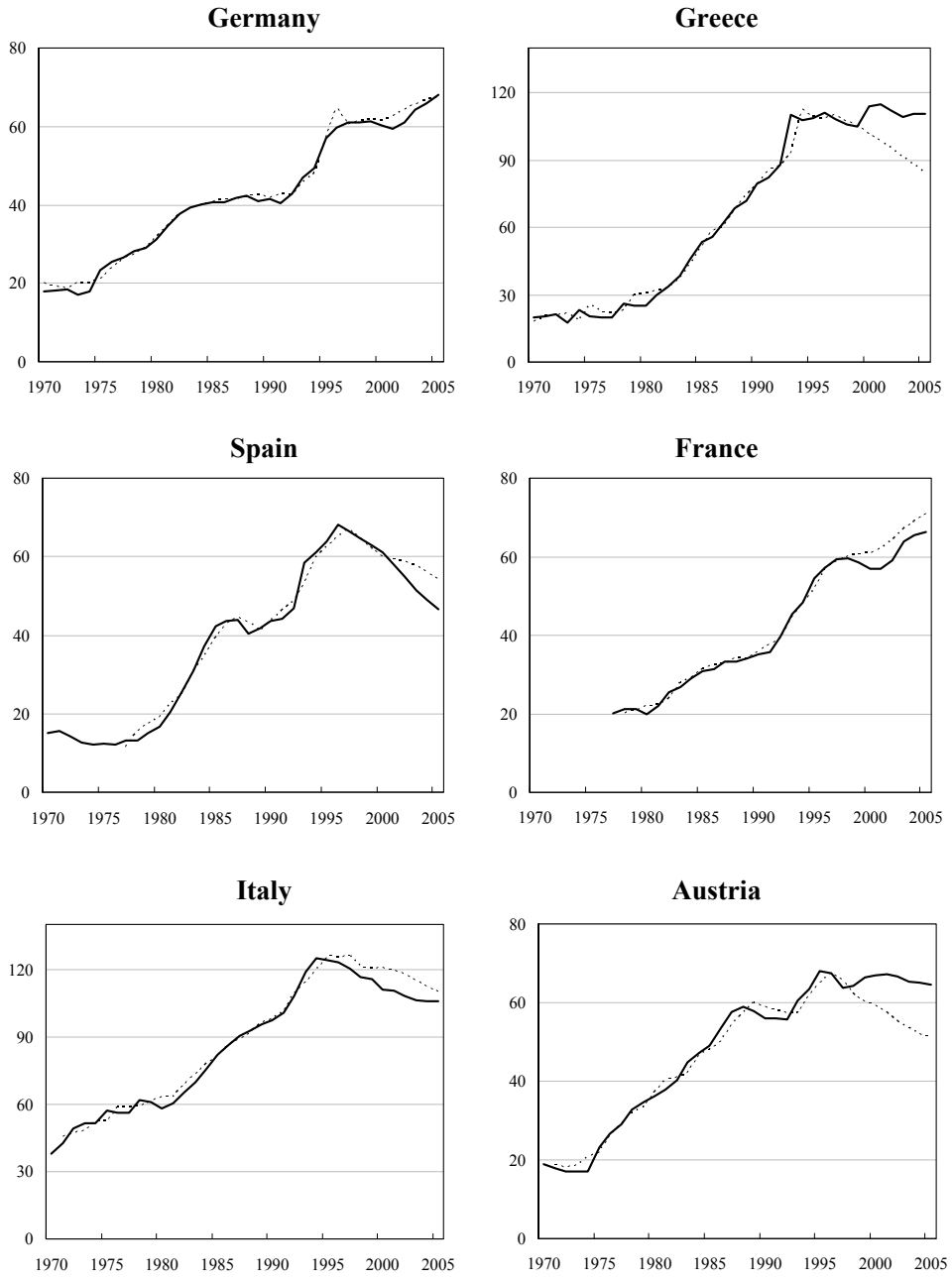
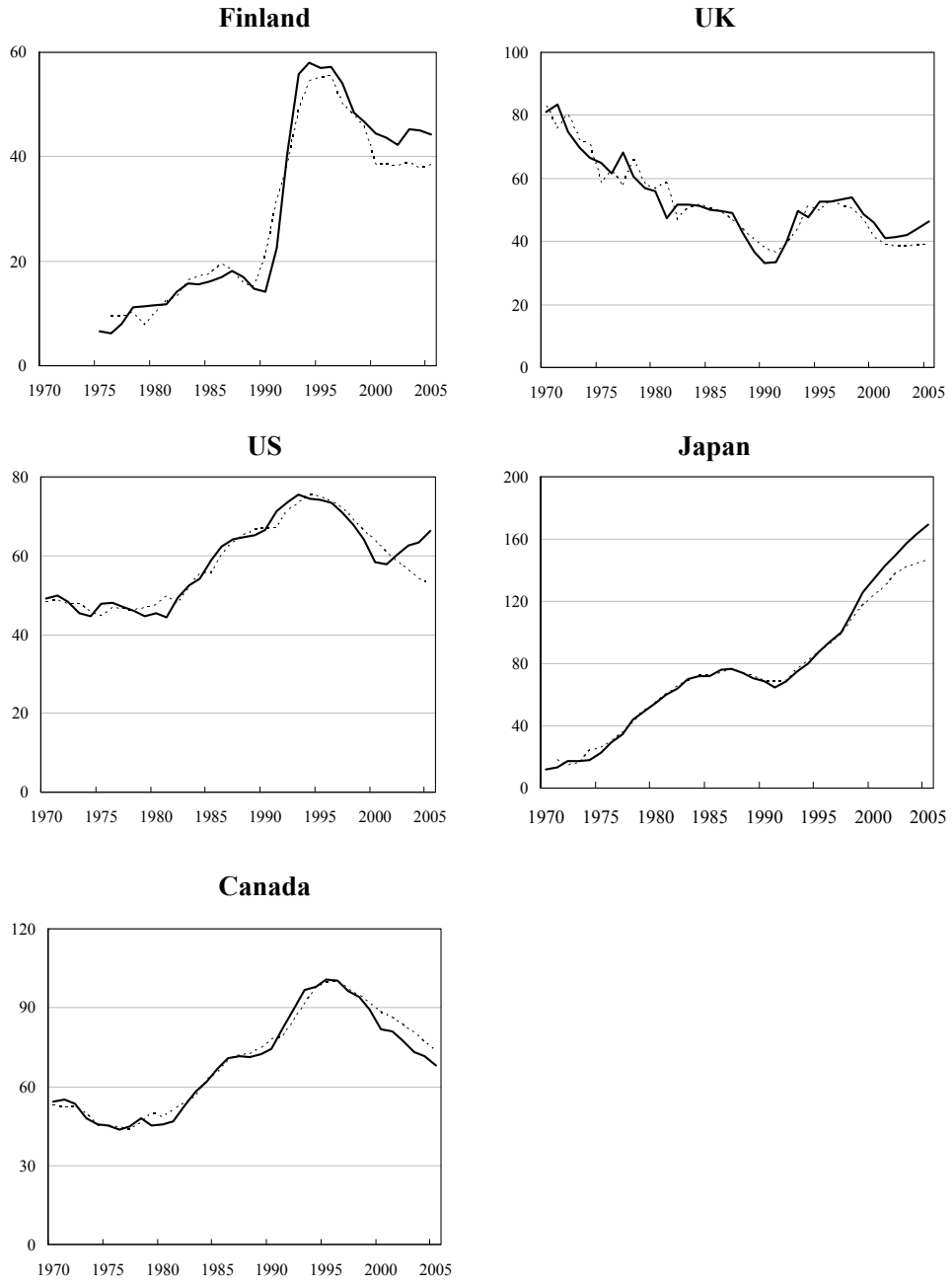


Figure 10 (continued)

Dynamic Forecasts for the Debt-to-GDP Ratio for the Period 1998-2005
(actual: dark line, forecast: light line)



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FISCAL PLANNING UNDER UNCERTAINTY – THE IMPLICATIONS OF ECONOMIC AND FISCAL UNCERTAINTY FOR BUDGET FORECASTS

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This paper presents an analysis of the uncertainty in projections of the federal budget balance arising due to uncertainty in economic, and government revenue and spending projections. Budget projections frequently differ from actual results due to an unavoidable level of uncertainty contained in the underlying economic projections as well as a relationship between economic inputs and fiscal projections that is often volatile. Using a stochastic simulation model that includes a detailed specification for the economy and federal government finances and random variables to proxy uncertainty in these variables, a probability distribution for the budget balance is generated and the probability of achieving a surplus is estimated given various assumptions for fiscal prudence.

1 Introduction

Budget projections frequently differ from actual results due to an unavoidable level of uncertainty contained in the underlying economic forecasts as well as a relationship between economic inputs and fiscal projections that is often volatile. Ensuring that budget forecast errors do not significantly undermine a government's budget planning process requires a careful assessment of these risks and uncertainties.

The Canadian experience of the past fifteen years provides an example of the impact that economic and fiscal forecast uncertainty can have on a country's fiscal position and budget planning practices. Consistently missed economic forecasts in the early part of the last decade contributed to the underestimation of budget deficits, resulting in an increase in the federal debt. To minimize the negative effects of economic and fiscal forecast uncertainty on the budget balance, a more prudent approach to budget forecasting was adopted and refined over time to further guard against deficit outcomes. More recently, federal fiscal forecasts have come under scrutiny for different reasons as the direction of forecast errors has been reversed and has led to persistent and often significant under-estimation of the federal surplus at budget time.

To assess the degree of uncertainty surrounding point estimates of the budget balance some studies have turned to stochastic simulation models. Stochastic

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simulation models provide a means of estimating a range of possible outcomes surrounding point estimate forecasts, given assumptions regarding the degree of uncertainty in forecast inputs. Such information provides policy makers with an increased awareness of the probability of achieving a particular outcome and can serve as an important input into fiscal planning decisions.

This paper presents estimates of the impact of forecast uncertainty on federal budget projections in Canada using a stochastic simulation that encompasses a modified version of Murchinson (2001) for the economy and a modified version of Hermanutz and Matier (2000) for the fiscal structure.

The structure of the paper is as follows. Section 2 provides a review of the relevant literature. Section 3 describes the model and its calibration. Section 4 presents updated estimates of the impact of forecast uncertainty on Canadian federal budget projections. Conclusions are discussed in Section 5.

2 Fiscal forecasting accuracy and stochastic simulation models

2.1 Fiscal forecasting accuracy

The accuracy of budget forecasts in Canada has been the focus of several studies. The most recent major study is a 2005 independent review led by Dr. Tim O'Neill, commissioned by the federal government. In his review, O'Neill assesses the basis for persistent, large federal forecast differences in Canada.

The O'Neill review includes a technical report authored jointly by the Policy and Economic Analysis Program at the University of Toronto and the Centre Interuniversitaire de Recherche en Analyse des Organisations (herein referred to as the report) that provides a quantitative analysis of federal fiscal accuracy from 1994 to 2004. The report provides an analysis of the Canadian government's forecast record over the period for economic and fiscal aggregates as well as the more detailed components. In order to assess forecast errors[1] based on forecasters' knowledge at the time budget projections were made, policy measures introduced post-budget are removed from the actual results and adjustments are made to ensure a consistent basis of accounting is used for forecast-to-actual comparisons throughout the review period. Based on their analysis, the authors conclude that the federal surplus was consistently and significantly under-estimated over the period. The report finds that for some of the fiscal components, such as federal revenues and public debt charges, forecast errors in the broad economic inputs (e.g. nominal GDP, GDP inflation, etc.) were important contributors to forecast errors over the period studied. However, it suggests that other factors, such as volatile tax bases, and lags in the receipt of historical revenue and spending data necessary for an accurate fiscal forecast were also important contributors.

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[1] Forecast errors are equal to the forecasted amount less the actual amount.

In his final assessment, O'Neill attributes much of the positive federal forecast error to the practice of forecasting under a stringent no-deficit rule while facing considerable economic and fiscal forecast uncertainty. In this environment, he notes that it is understandable that when considering a range of possible outcomes for specific revenue and spending items, forecasters would choose a point estimate at the low-end of the range for revenues and at the high-end for expenditures.

Fiscal projections are subject to two primary sources of uncertainty: uncertainty in the forecasts of the key macroeconomic variables, and uncertainty in the translation of economic forecasts into fiscal forecasts. It is indisputable that economic forecasts are subject to error. Contributing factors include uncertainty regarding: the nature and persistence of economic shocks, the economy's potential growth/level; relationships between economic variables; external developments (foreign economies and commodity prices); and the impacts of data revisions.

Even when economic projections are correct, forecast errors in fiscal components are conceivable. Federal tax revenues are particularly difficult to forecast given volatility in their relationship with underlying economic activity: tax revenues are highly sensitive to the composition and distribution of income, which can be difficult to predict. Furthermore, frequent changes to the tax structure and structural changes in the economy imply a volatile historical relationship between tax revenues and the economy that is of little help in predicting future tax elasticities.

On the spending side, uncertainty surrounding the valuation of liabilities and the appropriation of funds during the forecast year can be significant contributors to forecast errors. Fiscal forecasting is also made difficult as a result of information lags and, in the Canadian context, a full accrual basis of accounting.

2.2 Stochastic simulation models

Several studies in Canada have turned to stochastic simulation models in order to assess the uncertainty in budget projections and evaluate fiscal policy options in an environment of budget uncertainty. Stochastic models proxy the effects of forecast uncertainty by incorporating random variables into the forecasts of the economy and federal government finances. By simulating stochastic models repeatedly, one can generate a probability distribution that describes the range of possible outcomes for the economy and federal finances based on the degree of uncertainty assumed for each component of the model. Furthermore, stochastic simulation models allow one to study fiscal policy options in an environment of forecast uncertainty.

Robson (2006) uses a stochastic simulation model to illustrate an alternative option to point estimates for presenting budget projections and setting fiscal policy. Under Robson's approach to fiscal planning, the government begins its budget planning by deciding upon an acceptable probability of missing its fiscal target (e.g. zero-deficit, target debt-to-GDP ratio), and then chooses a path for spending and

taxes accordingly. Robson uses a simple model of the economy with standard errors calibrated to historical volatility, but also incorporates additional forecast uncertainty on the fiscal side through a stochastic term on the federal tax-to-GDP ratio. Robson then estimates the required growth in spending for a range of fiscal targets and desired probability of meeting each target.

Similar to Robson (2006), Tapp (2006) uses a stochastic simulation model to illustrate an alternative fiscal planning framework. Tapp focuses on a medium-term target for the debt-to-GDP ratio and assesses the probability of hitting that target under various scenarios for spending growth. Tapp's model incorporates two random shocks – a shock on real output growth and a shock on the tax-to-GDP ratio. Tapp assumes the government chooses a trend growth rate for government program spending but that realized program spending deviates from this path based on the impact of changing economic conditions on automatic stabilizers. In the model, a monetary authority is assumed to set the market interest rate. The effective interest rate on federal debt is modeled as a weighted average of the market interest rate (short-term rate) and a constant long-term rate. Tapp uses this model to assess the probability of lowering the federal debt-to-GDP ratio to 25 per cent by 2014-15[2] and 20 per cent in 2019-20. He finds that the targets are reachable in more than 95 per cent of model simulations.

Boothe and Reid (1998) use a stochastic simulation model of the federal budget to assess the probability of recording future deficits given the inclusion of a contingency reserve or buffer against unfavourable budget shocks in budget projections and varying amounts of flexibility in the government's fiscal rule. They employ a simple model of the economy that describes output growth by an AR(1) process and assume that the market interest rate follows a random walk. Both equations include stochastic disturbance terms with standard deviations and correlations determined from regression residuals for the historical period 1953 to 1997. The fiscal variables are assumed to fluctuate based on their relationship with nominal GDP growth and market interest rates. Boothe and Reid simulate their model over a four-year forecast horizon (fiscal years 2000-01 to 2003-04)[3] to assess the probability of realizing a federal deficit under various combinations of contingency reserves and fiscal rules. From their simulations, Boothe and Reid conclude that with a contingency reserve of between $6 and $9 billion, the probability of a federal deficit in Canada would be reduced to close to zero for any given year within the four-year time horizon considered.

Hermanutz and Matier (2000) modify the Boothe and Reid (1998) model to analyse the amount of unused fiscal room that would be required to achieve various probabilities of surplus over the medium term under alternative fiscal rules. Like the

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[2] Tapp's choice of targets for the federal debt-to-GDP ratio corresponds to federal government medium-term targets announced in the 2005 Economic and Fiscal Update. Since 2005, the medium-term targets have been revised. The current government target is to reduce the federal debt-to-GDP ratio to 25 per cent by 2012-13.

[3] In Canada, the federal government's fiscal year ends March 31.

Boothe and Reid (1998) model, their model includes simple stochastic processes for nominal GDP growth and the market interest rate. However, they calibrate the standard deviation of the disturbance term on nominal GDP to better reflect the low-inflation regime followed by the Bank of Canada since the early 1990s. In addition, Hermanutz and Matier model the effective interest rate such that only a portion of debt rolls over in each year. In contrast, Boothe and Reid assume that all debt rolls over at the current market interest rate, implying a wider range of possible outcomes for the effective interest rate on public debt. As in the Boothe and Reid (1998) model, fiscal variables in the Hermanutz and Matier model are a function of the economic variables and do not contain an idiosyncratic stochastic element, *i.e.* all variation in fiscal forecasts is assumed to be a result of uncertainty in the economic inputs. Using this model, they show that the use of a two-year fiscal planning horizon that allows for the addition of further fiscal measures if future forecasts imply an improved fiscal position, can mitigate some of the impact of uncertainty associated with budget projections relative to a rule that pre-commits the fiscal path several years in advance.

Broadly, these studies use relatively simple stochastic simulation models with varying assumptions and specifications to estimate the uncertainty in budget projections, and then assess various fiscal policy options. This paper builds on these studies by incorporating a more sophisticated model of the economy and by using federal and private sector forecasting records to assess forecast uncertainty and provide a basis for estimates of the dispersion in economic and fiscal shocks used in the model.

3 Specification and calibration of the model

The model used for this paper comprises a reduced-form model of the economy that feeds into the specification of the fiscal structure. The economic and fiscal forecasts are simulated over a five-year forecast horizon. The specifications for the key macroeconomic and fiscal variables are calibrated to reproduce forecasts presented in the November 2006 Economic and Fiscal Update (herein referred to as the November 2006 Update), the federal government's mid-year update of the state of the economy and the federal fiscal position (see Annex 1 for a description of federal fiscal forecasting process in Canada).

3.1 Economy

In the stochastic simulation studies mentioned in the previous section, the models of the economy underlying the simulated fiscal projections are, by design, highly simplified. The specifications of key economic variables are typically univariate, based on estimated stochastic processes. Over the simulation or planning horizon, the standard deviation of the stochastic disturbances are (in most cases) set

equal to the standard deviation of the residuals from the estimated processes and are normally, independently and identically distributed with mean zero.[4] This calibration methodology ensures that future economic outcomes over the planning horizon will deviate from each model's predicted outcome "as they have in the past, with about the same probability distribution of large and small differences".[5] Thus the uncertainty of future economic outcomes depends crucially on each model's (*ex post*) forecast accuracy over history: the smaller a model's historical prediction error, the narrower is the distribution of simulated outcomes in a given year of the planning horizon.[6]

This paper takes an alternative approach to model specification by using a reduced-form forecasting model of the Canadian economy. The approach to calibrating the stochastic disturbances follows previous studies. The model is also calibrated to reproduce economic forecasts from the survey of private sector forecasters used to produce fiscal forecasts presented in the November 2006 Update. Based on our specification and calibration, the distributions of key economic variables generated by our model over the planning horizon are consistent with the historical forecast accuracy of private sector surveys used for budget planning purposes.

The reduced-form model used in this paper is based on Murchison (2001), which was developed to produce quarterly macroeconomic forecasts. The current version of the model consists of six estimated behavioural equations that determine: real GDP growth (IS-curve), GDP inflation, core CPI inflation (Phillips curve), the real exchange rate and short- and long-term nominal interest rates. The model structure allows for correlations among the economic variables, which is an important feature since co-movements in, for example, nominal GDP and interest rates have somewhat offsetting impacts on the budget balance. However, unlike previous studies, for the key economic variables, these correlations are generated by the model itself and are not imposed through the stochastic disturbances. These key equations are as follows:

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4 In addition, correlations of the disturbance terms are imposed, calibrated to the correlation of the regression-based residuals. The stochastic processes are also calibrated to produce assumed steady-state values over the planning horizon.

5 "The Uncertainty of Budget Projections: A Discussion of Data and Methods", Congressional Budget Office, March 2007.

6 Over the period for which a given equation is estimated, the standard deviation of OLS-based residuals is equivalent to the root mean-squared (static) forecast error, after adjusting for the appropriate degrees of freedom.

Real output growth:

$$\Delta y_t^{CA} = 0.74\Delta yp_t^{CA} + 0.35\Delta YGAP_{t-1}^{CA} + 0.26\Delta y_t^{US} - 0.37\sum_{i=3}^{8}\Delta\left(r_{t-i}^{CA} - \pi_t^{CA}\right) +$$

$$+ 0.05\sum_{i=2}^{6}\Delta e_{t-i}^{CA} + 0.03\sum_{i=3}^{5}\Delta pcom_{t-i}^{XE} + \varepsilon_1 \qquad (1)$$

$R^2_{ADJ} = 0.42$ Std. Deviation of $\varepsilon_1 = 0.54$ Sample: 1976Q1-2006Q2

Output growth[7] (y^{CA}) is a function of potential output growth (yp^{CA}), the change in the output gap ($YGAP^{CA}$), U.S. output growth (y^{US}), the change in real short-run interest rates (defined as the three-month treasury bill rate r^{CA} less quarter-to-quarter logarithmic change in core consumer price inflation π), the real exchange rate e (the nominal Canada-U.S. exchange rate in Canadian dollars multiplied by the ratio of U.S. to Canada GDP inflation) and the production-weighted Department of Finance non-energy commodity price index[8] ($pcom^{XE}$).

Core inflation:

$$\pi_t^{CA} = 0.003\,D90_t^{CA} + 0.35\pi_t^{*CA} + 0.32\pi_{t-1}^{CA} + 0.13\pi_{t-2}^{CA} + 0.20\pi_{t-3}^{CA} +$$

$$+ 0.03\sum_{i=2}^{3} YGAP_{t-i}^{CA} + 0.03\sum_{i=3}^{4}\Delta e_{t-i}^{CA} + \varepsilon_2 \qquad (2)$$

R2ADJ = 0.48 Std. Deviation of ε2 = 0.27 Sample: 1976Q1-2006Q2

Core inflation is determined by the inflation target π^{*CA} (assumed to be 2 per cent, the midpoint of the 1 to 3 per cent inflation target range), adaptive inflation expectations (using three lags of core inflation), the level of the output gap $YGAP^{CA}$ and the change in the real exchange rate. A dummy variable equalling one from 1990Q1 on is included to capture the impact of the introduction of inflation targeting in the early 1990s.

GDP inflation:

$$\Delta py_t^{CA} = \pi_t^{CA} + 0.21\Delta cpcom_t + 0.16\Delta cpcom_{t-1} + \varepsilon_3 \qquad (3)$$

R2ADJ = 0.25 Std. Deviation of ε3 = 0.48 Sample: 1976Q1-2006Q2

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[7] Variables given by lower case letters represent natural logs; variables given by upper case letters are levels.

[8] Gaudreault, C. and R. Lamy, *Improvements To Finance's Commodity Price Index and New Commodity Price Indices By Province And Territory*, Department of Finance, 2001.

GDP inflation (py^{CA}) is determined by core inflation and growth in a trade-weighted index of commodity prices (*cpcom*). The latter serves both as a proxy for the food and energy items excluded from core inflation as well as to capture the impact of raw material prices on the terms of trade.

Monetary policy reaction function:

$$r_t^{CA} = 0.98 + 0.75 r_{t-1}^{CA} + 1.97 \sum_{i=0}^{6} \left(\pi_{t-i}^{CA} - \pi_{t-i}^{*CA} \right) + 0.44 \Delta r_t^{US} + \\ + 4.82 \Delta ne_t^{CA} + 1.67 \sum_{i=0}^{6} \left(\Delta YGAP_{t-i}^{CA} \right) + \varepsilon_4 \qquad (4)$$

R2ADJ = 0.92 Std. Deviation of ε4 = 0.40 Sample: 1993Q1-2004Q4

Short-term interest rates are a function of a moving average of the "inflation gap" (actual inflation less target inflation), the change in U.S. short-term interest rates r^{US}, the change in the nominal Canada-U.S. exchange rate *ne*, and a moving average of the change in the output gap. This specification represents a departure from a standard, forward-looking, reaction function: monetary policy reacts gradually to deviations of inflation from its target and to changes in the output gap, as opposed to the level of the output gap. These simplifying assumptions allow for much greater efficiency in simulation (as the model does not have to be solved sequentially one period at a time), and reduces the reliance on an uncertain measure of the output gap. Moreover, the specification describes the data well over the estimation period.

Real exchange rate:

$$\Delta e_t^{CA} = 0.24 \Delta e_{t-1}^{CA} - .005 \left(r_{t-1}^{CA} - r_{t-1}^{US} \right) - .55 \sum_{i=0}^{1} \Delta cpcom_{t-i}^{XE} + 0.12 \Delta e_t^{US} - \\ - 0.11 \left[e_{t-1}^{CA} - 0.40 + 1.93 cpcom_{t-1}^{XE} + 2.94 cpcom_{t-1}^{EN} - 0.29 e_{t-1}^{US} \right] + \varepsilon_5 \qquad (5)$$

R2ADJ = 0.42 Std. Deviation of ε5 = 0.016 Sample: 1976Q1-2006Q2

The real exchange rate equation[9] is modelled in an error correction framework, and is determined by trade-weighted non-energy ($cpcom^{XE}$) and energy ($cpcom^{EN}$) commodity prices, the real U.S. dollar exchange rate excluding Canada (e^{US}) and the U.S.-Canada short-term interest rate differential. The use of trade-weighted commodity price indices allows the equation to account for the variability in the importance of commodities in Canadian terms of trade over time.

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[9] The real exchange rate equation is based on Helliwell, J., R. Issa, R. Lafrance and Q. Zhang (2005), *NEMO: A Canadian-U.S. Dollar Exchange Rate Equation*, Canada and the Global Economy, proceedings of a conference held at the Bank of Canada, November 2004.

This is particularly important in the case of crude oil, as Canada has gone from being a modest net importer of oil in the early 1980s to being a significant net exporter at present. As a result, the impact of crude oil prices on the exchange rate has become much more significant in recent years.

10-year Government of Canada bond rate:

$$r10_t^{CA} = 0.81r10_{t-1}^{CA} + 0.13r10_{t-2}^{CA} + 0.07\left(rr10_t^{*CA} + \pi_{t-1}^{CA}\right) + 0.09\Delta r_t^{CA} + \\ + 0.07\Delta r_{t-1}^{CA} + 0.08\Delta r_{t-2}^{CA} + 0.78\Delta r10_t^{US} + \varepsilon_6 \quad (6)$$

R2ADJ = 0.95 Std. Deviation of ε6 = 0.26 Sample: 1976Q1-2006Q2

Long-term interest rates (the 10-year Government of Canada bond rate, $r10^{CA}$) are determined by short-term interest rates, U.S. long-term interest rates (the U.S. 10-year government bond rate $r10^{US}$) and a measure of a trend real long-term interest rate (*rr10**) plus core inflation.

Variables exogenous to the Canadian economy, such as U.S. real GDP growth and interest rates, are modelled using the following autoregressive stochastic process, estimated over the period 1990Q1-2006Q2:

$$\Delta z_t = \Delta z^* + \beta\left(\Delta z_{t-1} - \Delta z^*\right) + \varepsilon_z$$

where Δz^* is the average growth rate of variable *Z* over the sample period. To allow for correlations among the exogenous variables, a covariance matrix is constructed using the residuals ε_Z, which is then used to generate multivariate normal random variables for simulation.

The reduced-form model is first calibrated to reproduce the economic forecasts presented in the November 2006 Update.[10] Following previous studies, the standard deviations of the stochastic disturbances over the planning horizon are set equal to the standard deviations of their respective residuals, ensuring that the dispersion of economic outcomes over the planning horizon is consistent with the historical dispersion of the model's predicted outcomes. Moreover, for key economic variables, the model generates distributions over the planning horizon that are also consistent with the historical forecast record of the Department of Finance's survey of private sector forecasters, which has formed the basis for economic assumptions underlying the fiscal projections in budget planning. In other words, for a given Canadian macroeconomic variable, the standard deviation of its simulated distribution over the planning horizon is roughly in line with the (root-mean-square)

[10] Forecasts of the key economic variables based on the non-calibrated version of the model are in line with the private sector forecast presented in the November 2006 Update.

forecast error based on the average forecast from the private sector survey over the period 1994-2006.[11]

3.2 Fiscal structure

The economic results generated by the model feed into a simple fiscal structure derived from Hermanutz and Matier (2000) that produces annual forecasts of government revenues, spending and the budget balance.[12] The model modifies the fiscal structure used by Hermanutz and Matier (2000) by assuming the existence of fiscal forecast uncertainty in addition to that which can be explained by uncertainty in economic inputs.

3.2.1 Overview of Canada's fiscal structure

To facilitate interpretation of the model, it is useful to first review Canada's federal fiscal structure. The composition of federal revenues and spending in fiscal year 2005-06 is presented in Table 1 (see Annex 2 for a detailed decomposition).

Federal revenues are divided into three main components: Tax revenues, revenue from Employment Insurance premiums, and other revenues. Personal income tax, corporate income tax, and the Goods and Services tax (a value-added tax) represent the main components of tax revenues. Employment Insurance premiums are collected from Canadian workers and employers as part of the federal Employment Insurance program, which provides temporary financial assistance for unemployed Canadians while they look for work, as well as other employment benefits (e.g. parental leave). Employment Insurance premiums are determined using a rate-setting mechanism designed to match the level of expected premium revenues with the level of expected program costs. Other revenues include returns on investments, foreign exchange revenues, and revenues from consolidated crown corporations.

Federal spending is divided into four main categories: major transfers to persons, major transfers to other levels of government, direct program spending, and public debt charges. Transfers to persons comprise benefits for seniors under the Old Age Security program, Employment Insurance benefits, and benefits for children. Benefits for seniors and the majority of children's benefits are indexed to inflation, while Employment Insurance benefits (maximum insurable earnings) are indexed to growth in the average industrial wage. Transfers to other levels of government largely comprise major transfers to provinces: equalization payments to provinces, and block transfers in support of provincial health and social programs. Direct

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[11] Since the distributions of the simulated variables are centred on the forecasts presented in the November Update, their standard deviations are equivalent to the root-mean-square errors.

[12] This is in contrast to the economic forecasts, which are on a quarterly basis. Annual economic projections are derived from the quarterly results.

Table 1

Federal Revenues and Expenses, 2005-06

	Level *($ billions)*	**Share of GDP** *(percent)*
Revenues:		
Tax revenues	186.1	13.6
Employment insurance premium revenues	16.5	1.2
Other revenues	19.6	1.4
Total Revenues	**222.2**	**16.2**
Expenses:		
Major transfers to persons	52.6	3.8
Major transfers to other levels of government	40.8	3.0
Direct program spending	81.8	6.0
Public debt charges	33.8	2.5
Total Expenses	**209.0**	**15.2**
Budget Balance	**13.2**	**1.0**

Source: Annual Financial Report, Fiscal Year 2005-06.

program spending includes expenses for national defence, government enterprises, and departmental operating costs. Public debt charges consist of interest paid on the federal government's interest-bearing debt and other costs associated with servicing the debt.

In 2005-06, federal revenues exceeded federal program spending and public debt charges, resulting in a federal surplus at fiscal year-end of $13.2 billion, or 1.0 per cent of GDP.

3.2.2 Modeling federal revenues and program spending

The relationship between federal revenues (R) and program spending (PE), and the main economic variables[13] – real GDP growth (y_t^{CA}), GDP inflation (py_t^{CA}), and the short-term interest rate (r_t^{CA}) – are estimated using generalized rules of thumb for these relationships presented in the federal government's November 2006

[13] On an annual basis.

Update. Rules of thumb are established using the internal fiscal forecasting model of the Department of Finance and cover three economic shocks: (i) a one-year 1 percentage point decrease in real GDP growth driven equally by lower productivity and employment growth, (ii) a decrease in nominal GDP growth resulting solely from a one-year, 1 percentage point decrease in the rate of GDP inflation, and (iii) a sustained 100-basis point decrease in all interest rates. These rules of thumbs imply relationships for revenues and program spending as depicted below in equations (7) and (8).

$$\Delta \ln R_t = 1.02\Delta y_t^{CA} - 0.34\Delta y_{t-1}^{CA} + 1.05\Delta py_t^{CA} + 0.19\Delta r_t^{CA} + \varepsilon_7, \quad \varepsilon_7 \sim N(0, {\sigma_7}^2) \quad (7)$$

$$\Delta \ln PE_t = c_1 - 0.27\Delta y_t^{CA} + 0.32\Delta py_t^{CA} + \varepsilon_8, \quad \varepsilon_8 \sim N(0, {\sigma_8}^2) \quad (8)$$

Federal revenues grow approximately one-for-one with current real GDP and GDP inflation. The relationship between federal revenue growth and GDP growth is dictated by the relationship between tax revenues and their respective tax bases.

The previous year's real GDP growth influences revenue growth through the rate-setting mechanism for Employment Insurance premium rates. Under this arrangement, a positive shock to real GDP growth leads to higher employment, which leads to stronger growth in premium revenues in year one. However, because Employment Insurance benefits would decline in response to stronger GDP growth, revenue growth is reversed after the first period as the Employment Insurance premium rate is reduced to bring Employment Insurance revenues back to their break-even point with benefits.

Revenues are also a function of the market interest rate, reflecting revenue returns on government financial assets.

In the model, the government targets an annual growth rate for program spending that is in line with the average annual growth rate projected in the November 2006 Update. Deviations from this spending path occur as a result of program spending components whose growth is influenced directly by fluctuations in real GDP growth and GDP inflation. More specifically, growth in program spending is negatively correlated with real GDP growth, reflecting the inverse relationship between the economy and Employment Insurance benefits: stronger real GDP growth and a lower level of unemployment imply lower spending for benefits. Program spending growth increases with GDP inflation given the indexation of statutory programs such as Old Age Security to inflation.[14]

The specifications for both revenues and program spending include stochastic disturbance terms ε_7 and ε_8, assumed to be normally distributed with mean zero and constant standard deviations σ_7 and σ_8. The standard errors, σ_7 and σ_8 are calibrated such that the standard deviation of the simulated distributions for the forecasts of

[14] Indexation may not be exactly in line with GDP inflation due to differences between GDP inflation and CPI inflation. The latter is what is used for the indexation of government programs.

revenue growth and spending growth are consistent with the standard deviation of the federal finance department's revenue and spending forecast errors over the period 1994-2005.[15] Intuitively, ε_7 and ε_8 are intended to capture forecast uncertainty that arises from factors other than errors in economic forecasts.

The period 1994-2005 was chosen because it coincides with the 2004 O'Neill review of federal fiscal forecasting. In that study, series of the forecast errors[16] for the major economic and fiscal components were constructed to assess the federal forecast performance over the period 1994-2003.[17] Forecast errors were adjusted for unforeseen policies announced following the budget forecast, which alter the final result for the year but have no bearing on the forecast performance of the department, and therefore are best excluded from the calculation of forecast errors.

Another benefit of this time period is that fiscal forecasting practices similar to today's practices were in place for most years. For all years considered, the federal government set an annual target for the budget balance as its fiscal rule (deficit targets in the mid-1990s, followed by a target for the surplus once fiscal finances were consolidated) and incorporated some degree of prudence that was explicitly recognized into its budget forecasts. As well, for most years considered, government economic forecasts were based on the average of 15-20 private sector economic forecasts. Considering years with similar forecast practices increases the likelihood that forecast errors over the historical period are representative of forecast errors likely to occur in the future.

As noted in the previous section, the practice of linking future forecast uncertainty to historical forecast errors differs from previous stochastic simulation studies. As well, only a few studies have incorporated the impact of forecast uncertainty beyond that described by economic forecast uncertainty.[18] Those that have, have only considered additional uncertainty in federal revenue forecasts, and have typically relied on the historical series for the revenue-to-GDP ratio to estimate the standard deviation of the disturbance term, which may overstate the forecast uncertainty for revenues due to tax policy changes.[19] By using the federal finance department's historical forecast record rather than the historical series for realized federal revenues, our analysis avoids the issue of additional volatility in revenues

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[15] The standard deviation of the forecast errors was chosen over the root mean squared error due to the existence of non-zero means for the errors on the fiscal forecasts over the period considered. This methodology, coupled with the model assumption that fiscal forecast errors have mean zero, implies the expectation that going forward forecasts for revenues and program spending will show the same dispersion in errors as that for the historical period, but, unlike the historical period, are unbiased.

[16] The study reports one-year and two-year ahead forecast errors.

[17] For this paper, the series was extended to include 2005 and 2006.

[18] Examples of studies that do incorporate fiscal uncertainty include Hostland (2001), Robson (2006) and Tapp (2006).

[19] Robson attempts to correct for the impact of changing tax policies on the tax yield by considering the standard deviation of the tax yield for the full period (1996-2004) relative to the means of two different fiscal periods within the full sample.

due to tax policy changes. In addition, based on historical forecast accuracy, our model incorporates additional uncertainty in the program spending forecast.

Using the series for one-year ahead fiscal forecast errors from the O'Neill review, the standard deviation on the forecasts of revenue and program spending growth are estimated to be 3.7 and 2.7 percentage points respectively.[20] The implied standard errors for ε_7 and ε_8 are then estimated using equations (7) and (8), and the O'Neill series for the economic inputs.[21] This methodology yields standard errors σ_7 and $\sigma_{8,}$ of 2.7 and 2.6 percentage points respectively for the revenue and program spending growth forecasts.

3.2.3 Estimating non-economic errors for the program spending forecast

One might expect that after accounting for the economic contribution to program spending forecast errors, remaining forecast errors would be minimal given that the government, for the most part, chooses its spending path. However, the estimated standard error on program spending suggests that nearly all of the error on the program spending side is explained by non-economic factors. As such, a few more words on program spending forecast uncertainty and notes to the methodology applied in this paper are necessary to qualify the program spending result.

Uncertainty exists with respect to spending by government departments. Although spending initiatives may be announced, uncertainty still remains regarding whether or not funds will be fully appropriated and spent during the forecasted year. If programs are delayed, funds may lapse or be carried forward to the following year, leading to forecast errors.

Forecast uncertainty on the spending side also exists with respect to the valuation of certain government liabilities, such as liabilities for legal claims, land claims, public service pension plans and more recently, under a full accrual basis of accounting, environmental liabilities and bad debt expenses related to the creditworthiness of debt owed to the Government. When comparing one-year ahead forecasts to actual results, errors may arise due to unforeseen events for which new liabilities are recorded, but also as a result of the revaluation of existing liabilities. Since the value of government liabilities for a given year is determined at year-end after the budget forecast in that year, errors in forecasting program spending are not only conceivable when comparing one-year ahead forecasts to actual results, but

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[20] The original series were adjusted to accommodate the growth forecasts used for this paper. See Annex 3 for further details regarding computation of growth rates.

[21] O'Neill-calculated forecast errors for the key macroeconomic variables are larger and have greater variance than forecast errors based on the average forecast from the private sector survey for the period 1994 to 1998. This is due to the addition of explicit prudence to the average private-sector forecasts of nominal GDP growth and interest rates for budget planning in those years. When the economic standard errors generated by the model are applied to the fiscal structure, the simulated distribution for the revenue and program spending forecasts exhibit smaller variances than those that existed over the historical period. This methodology makes sense as it removes the impact of deliberate forecast errors from the estimate of forecast uncertainty.

also when comparing in-year forecasts to actual results. Unexpected adjustments to liabilities or the addition of new liabilities can significantly affect forecast accuracy.

Not only do these issues contribute to forecast uncertainty, but for some cases the impact of lapsed or delayed funding on forecast accuracy may not be accurately captured by our model. The use of growth rates in the model implies that errors in the spending level experienced in one year are carried forward to the level forecast for the following years. Unlike the revenue forecast, where this is an appropriate assumption given errors in forecasting the revenue base, on the spending side, forecast errors related to lapsed or delayed funding may not carry forward. For delayed programs, although the spending may not occur in the first year, unless the program is cancelled, some related spending will likely occur in the next year. Consequently, the expression of forecast errors using growth rates may misrepresent some components of program spending errors.

3.2.4 Modelling public debt charges and the budget balance

Public debt charges and the budget balance are modelled as described in Hermanutz and Matier.

As shown in equation (9), the effective interest rate on federal debt (i^D) is a function of the current short-term market rate (r^{CA}), lagged values of the market rate, and a constant rate applied to long-term debt ($\hat{\imath}$). This specification assumes that: a share of debt is short-term in nature and refinanced every year at the current market rate; a share of debt is medium-term debt that is re-financed every three years; and a share of debt is long-term debt that will not be re-financed during the time period covered by the model. Shares are based on the distribution of federal debt as reported for 2005-06. The standard deviation on the forecasted effective interest rate is 0.24 percentage points, and stems solely from the standard deviation on the simulated market interest rate.

$$i_t^D = 0.34 \cdot r_t^{CA} + 0.07 \cdot \left(r_{t-1}^{CA} + r_{t-2}^{CA}\right) + 0.52 \cdot \hat{\imath} \tag{9}$$

Equations 10 through 12 describe public debt charges (*PDC*), federal debt (*D*), and the budget balance (*BB*).

$$PDC_t = i_t^D \cdot D_{t-1} \tag{10}$$

$$D_t = D_{t-1} - 3 \tag{11}$$

$$BB_t = R_t - PE_t - PDC_t \tag{12}$$

Public debt charges are estimated by applying the effective interest rate on federal debt to last period's federal debt. For the purpose of estimating public debt charges, federal debt is assumed to be reduced each year by $3 billion. This practice is consistent with current budget planning practices.

The forecasted budget balance is equal to government revenues less program spending and public debt charges and represents the budget balance for planning

purposes, based on the policy outlook at the time of the forecast and before new measures are introduced.

When interpreting results, the characterization of the projected budget balance is an important consideration. The simulated five-year fiscal paths are based on the policy outlook at the time of the forecast being realized. In some simulations, the fiscal path may show significant deterioration or improvement in the government's fiscal position. Faced with such fiscal outlooks, the government would typically have the opportunity to respond by introducing new policies. For example in simulations where the fiscal position declines significantly over the forecast horizon, the government may chose to lower spending or increase taxes before the forecasted outcome is ultimately realized. As such, results should be interpreted as estimating the impact of uncertainty in budget projections, and not as an indication of the government's fiscal health over the period considered.

4 Model results

Using the November 2006 Update as the starting point for 2006, the model was simulated repeatedly, generating 5000 realizations of the economic and fiscal outcomes for the forecast period 2007 to 2011. The model is calibrated such that the median forecasts match the 2007 to 2011forecasts presented in the November 2006 Update.

4.1 Range of possible outcomes for key economic variables

Table 2 below presents descriptive statistics for key economic variables over the planning horizon 2007 to 2011.

Over the planning horizon (median) real GDP growth is projected to average 2.8 per cent with 90 per cent of the simulated outcomes ranging from 1.1 per cent to 4.3 per cent in 2007. The 90 per cent interval increases with the forecast horizon, ranging from 0.4 per cent to 5.4 per cent in 2011. GDP inflation is projected to average 1.9 per cent with 90 per cent of the outcomes falling within 1.6 percentage points of the median outcome in 2007, increasing to 2.6 percentage points in 2011. The projections of real GDP growth and GDP inflation translate into projected nominal growth averaging 4.6 per cent over the planning horizon with the 90 per cent interval ranging from 2.3 to 7.0 per cent in 2007, rising to 0.9 to 8.3 per cent in 2011. Short-term interest rates are projected to average 4.2 per cent over the planning horizon. The 90 per cent interval increases from 2.8 to 5.1 per cent in 2007 to 0.7 to 8.1 per cent in 2011.

The range and dispersion of outcomes for key economic variables appears "reasonable"; however, without reference to other studies or historical outcomes, it is difficult to gauge the degree to which the simulated distributions may overstate or

Table 2

Economic Outcomes Given in the November 2006 Economic and Fiscal Update

	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Nominal GDP *($ billions)*	1,440	1,507	1,580	1,653	1,731	1,809
95th percentile	-	*1,541*	*1,655*	*1,758*	*1,861*	*1,975*
5th percentile	-	*1,472*	*1,510*	*1,558*	*1,611*	*1,659*
Nominal GDP Growth *(percent)*	5.0	4.6	4.9	4.6	4.7	4.5
95th percentile	-	*7.0*	*8.4*	*8.2*	*8.3*	*8.3*
5th percentile	-	*2.3*	*1.6*	*1.2*	*1.1*	*0.9*
Real GDP Growth *(percent)*	2.8	2.7	2.9	2.9	2.9	2.9
95th percentile	-	*4.3*	*5.2*	*5.3*	*5.5*	*5.4*
5th percentile	-	*1.1*	*0.8*	*0.6*	*0.5*	*0.4*
GDP inflation *(percent)*	2.1	1.9	1.9	1.7	1.6	1.6
95th percentile	-	*3.5*	*4.2*	*4.1*	*4.2*	*4.2*
5th percentile	-	*0.3*	*–0.3*	*–0.7*	*–0.7*	*–0.9*
Short-term Interest Rate *(percent)*	4.1	4.0	4.2	4.2	4.3	4.3
95th percentile	-	*5.1*	*7.0*	*7.9*	*7.9*	*8.1*
5th percentile	-	*2.8*	*1.4*	*0.8*	*0.8*	*0.7*

understate the uncertainty facing fiscal planners. As a check on the reasonableness of our simulated economic outcomes over the planning horizon, for each year of the projection, we compare the root-mean-squared error of the simulated outcomes to the corresponding (root-mean-squared) forecast error based on the average forecasts from the Department of Finance surveys of private sector forecasters over the period 1994-2006 (Table 3). Over most of this period, these surveys have provided the basis for economic assumptions underlying the fiscal projections used for budget planning.

The distribution of possible outcomes for key economic variables in a given year of the planning horizon appears generally consistent with the accuracy of the average private sector forecast over the 1994-2006 period. For real GDP growth, the

Table 3

Dispersion in Simulated Outcomes Compared to Private Sector Forecasts
(percent)

		2007	2008	2009	2010	2011
Real GDP Growth	Simulated RMSE	0.99	1.34	1.42	1.52	1.56
	Survey-based RMSE*	1.44	1.52	1.66	1.31	1.48
GDP Inflation	Simulated RMSE	0.97	1.35	1.5	1.5	1.55
	Survey-based RMSE*	1.05	1.29	1.36	1.37	1.47
Nominal GDP Growth	Simulated RMSE	1.43	2.05	2.16	2.19	2.30
	Survey-based RMSE*	2.08	2.05	2.1	1.96	2.30
Short-term Interest Rate	Simulated RMSE	0.69	1.64	2.12	2.17	2.24
	Survey-based RMSE*	0.71	1.76	1.78	1.81	1.59

* Based on 2006Q4 National Accounts release.

model generates a distribution of outcomes over the planning horizon that is somewhat smaller than the 1-year ahead forecast error would imply.[22] The distribution of GDP inflation outcomes is in line with the dispersion implied by the average private sector forecast. In terms of nominal GDP growth, the distribution of outcomes in 2007 is smaller than the forecast error would imply however the distributions in the remaining years of the planning horizon are in line with the forecast errors at longer horizons. While the simulated root-mean-squared error for

[22] Interestingly, the 4- and 5-year ahead survey-based forecast errors for real GDP growth are smaller than the 2- and 3-year ahead forecast errors. This is also the case for the five-year ahead forecast of the short-term interest rate. We suspect that this result likely reflects changes in the number of survey participants providing longer-term forecasts: almost all participants provide forecasts for outcomes one to three years ahead; however, the sample size falls significantly as the forecast horizon is extended, which would affect the consistency and representativeness of the survey. In addition, while the overall sample size is small – a maximum of 13 observations for the period 1994-2006 – the sample size for 5-year ahead forecasts is limited to only six observations (instead of nine) because 5-year ahead forecasts were not collected in the surveys over the period 2001-03. As a result, the degree of uncertainty facing fiscal planners at longer-term horizons (*i.e.*, 4- and 5-years ahead) may not be adequately represented by the survey-based root-mean-squared forecast errors.

the short-term interest rate is close to the private sector forecast error in 2007 and 2008, its distribution at longer horizons is larger than what the forecast errors would imply. On balance, we suggest that the distributions of economic outcomes generated by our model and calibration appear "reasonable", *i.e.* in line with the historical forecast accuracy of private sector economic forecasts that have been used for budget planning purposes over a two-year time horizon.

4.2 Range of possible outcomes for fiscal variables

Table 4 presents simulated fiscal outcomes over the planning horizon 2007 to 2011.

Over the planning horizon, median budgetary revenues are projected to grow by 3.8 per cent on average with 90 per cent of the simulated outcomes falling between –1.3 per cent and 9.1 per cent in 2007 and –1.6 per cent and 11.1 per cent in 2011. The median forecast for growth in budgetary revenues is similar to that for nominal GDP growth – the underlying tax base. However, the model generates a wider range of possible outcomes for growth in budgetary revenues than that for nominal GDP. This reflects the inclusion in the model of additional variance on the revenue forecast to capture the impact of fiscal forecast uncertainty. The distribution allows for negative growth in revenues in approximately 10 per cent of the simulations. These outcomes appear reasonable given extreme situations where growth in nominal GDP remains low over the planning horizon.

The median forecast for program spending growth follows the path projected in the November 2006 Update. The 90 per cent probability interval ranges from 0.0 per cent to 9.0 per cent in 2007 and from –0.8 per cent to 8.2 per cent in 2011.

The median forecast of the effective interest rate on public debt, which is a function of the short-term interest rate, averages 7.3 per cent over the forecast horizon. It exhibits narrower probability bands than those for the short-term interest rate reflecting the model assumption that less than 100 per cent of government debt is rolled over at the current market interest rate. The median forecast for public debt charges assumes $3 billion in federal debt reduction per year. The range of possible outcomes generated by the model is dictated by the dispersion in outcomes of the forecasted effective interest rate.

The model yields a 90 per cent probability interval for the underlying budget balance of –$6.9 to $21.8 billion (–0.5 to 1.5 per cent as a share of nominal GDP) for 2007. From here, the range of possible outcomes for the underlying surplus grows over time, given growing probability intervals for the levels of federal revenues and program spending.

The end points of the 90 per cent probability interval represent extreme outcomes for the distribution. To provide a more complete picture of the range of possible outcomes, Figure 1 shows the distribution of model outcomes around the median surplus for the forecast horizon considered. The full shaded area represents 90 per cent of model outcomes. Each shaded band represents 10 per cent of model

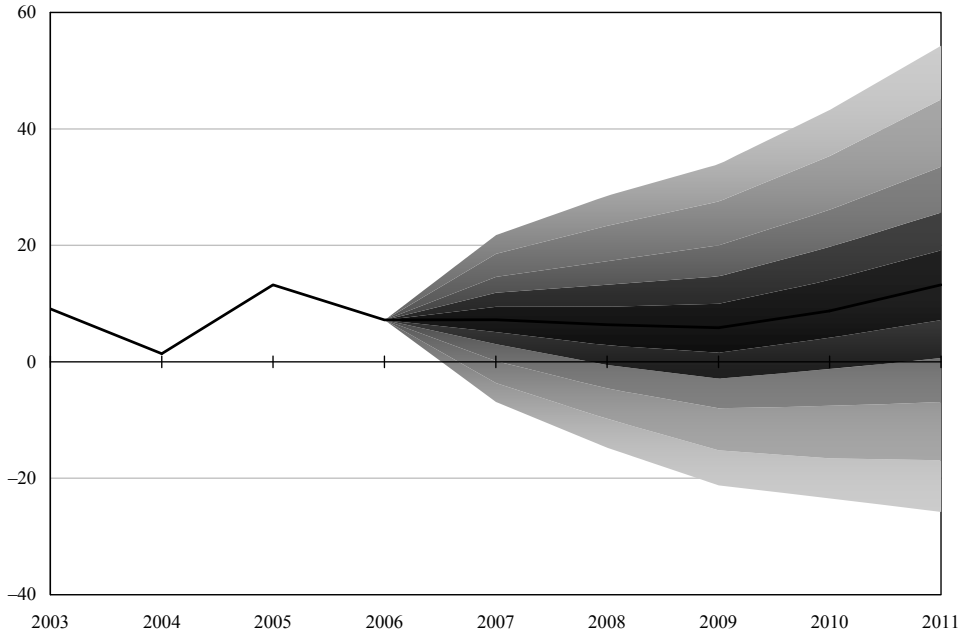
Table 4

Fiscal Outcomes Given in the November 2006 Economic and Fiscal Update

	2006	2007	2008	2009	2010	2011
Budgetary Revenues *($ billions)*	229.4	238.1	245.5	253.7	264.2	276.3
95th percentile	-	*250.3*	*266.1*	*281.0*	*296.5*	*315.8*
5th percentile	-	*226.4*	*227.0*	*230.7*	*236.1*	*241.9*
Budgetary Revenues *(percent of GDP)*	15.9	15.8	15.5	15.4	15.3	15.3
95th percentile	-	*16.5*	*16.6*	*16.7*	*16.7*	*17.0*
5th percentile	-	*15.1*	*14.6*	*14.2*	*13.9*	*13.8*
Growth in Budgetary Revenues *(percent)*	3.2	3.8	3.2	3.4	4.1	4.6
95th percentile	-	*9.1*	*9.3*	*9.6*	*10.4*	*11.1*
5th percentile	-	*–1.3*	*–2.4*	*–2.4*	*–1.9*	*–1.6*
Program Spendine *($ billions)*	187.6	196.0	204.4	213.2	220.6	228.6
95th percentile	-	*204.6*	*217.8*	*230.3*	*241.3*	*252.3*
5th percentile	-	*187.7*	*192.5*	*197.5*	*202.1*	*207.7*
Program Spendine *(percent of GDP)*	13.0	13.0	12.9	12.9	12.7	12.6
95th percentile	-	*13.6*	*14.0*	*14.2*	*14.3*	*14.4*
5th percentile	-	*12.4*	*12.0*	*11.7*	*11.4*	*11.1*
Growth in Program Spendine *(percent)*	7.1	4.5	4.3	4.3	3.5	3.5
95th percentile	-	*9.0*	*9.1*	*9.0*	*8.1*	*8.2*
5th percentile	-	*0.0*	*–0.1*	*–0.2*	*–1.1*	*–0.8*
Effective Interest Rate on Public Debt *(percent)*	7.2	7.3	7.3	7.3	7.4	7.4
95th percentile	-	*7.6*	*8.3*	*8.8*	*8.9*	*9.0*
5th percentile	-	*6.9*	*6.3*	*6.0*	*5.9*	*5.9*
Public Debt Charges *($ billions)*	34.6	34.7	34.6	34.7	34.6	34.5
95th percentile	-	*36.6*	*39.5*	*41.5*	*41.8*	*41.9*
5th percentile	-	*32.9*	*30.0*	*28.2*	*27.7*	*27.6*
Public Debt Charges *(percent of GDP)*	2.4	2.3	2.2	2.1	2.0	1.9
95th percentile	-	*2.4*	*2.4*	*2.4*	*2.3*	*2.2*
5th percentile	-	*2.2*	*2.0*	*1.8*	*1.7*	*1.6*
Underlying Budgetary Bilance *($ billions)*	7.2	7.2	6.4	5.8	8.8	13.2
95th percentile	-	*21.8*	*28.5*	*34.0*	*43.3*	*54.3*
5th percentile	-	*–6.9*	*–14.7*	*–21.2*	*–23.4*	*–25.8*
Underlying Budgetary Bilance *(percent of GDP)*	0.5	0.5	0.4	0.4	0.5	0.7
95th percentile	-	*1.5*	*1.8*	*2.1*	*2.5*	*3.0*
5th percentile	-	*–0.5*	*–1.0*	*–1.3*	*–1.4*	*–1.5*

Figure 1

Underlying Budgetary Balance
Range of Possible Outcomes
Given in the November 2006 Economic and Fiscal Update
(billion dollars)



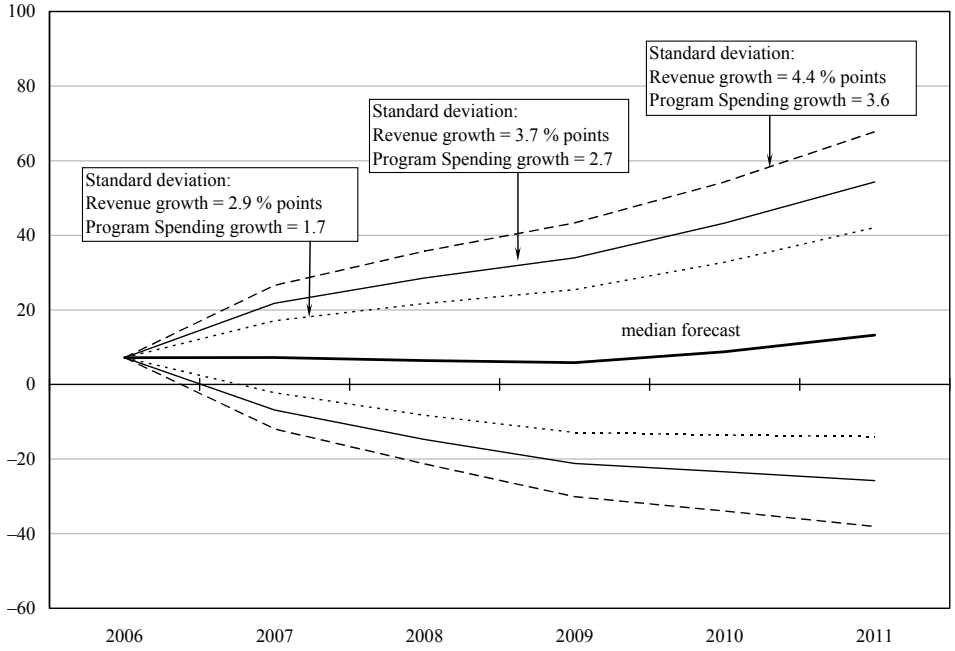
outcomes; with the farthest two bands each representing 5 per cent of outcomes. The narrower bands close to the middle of the distribution illustrate that the probability density is highest near the median forecast. More distant outcomes occur with less frequency, as illustrated by the wider bands farther from the median forecast. The first three bands on either side of the median together represent 60 per cent of possible outcomes. For 2007, this 60 per cent probability interval ranges from $0.2 to $14.6 billion (0 to 1.0 per cent of GDP).

4.3 Sensitivity analysis: revenue and program spending uncertainty

The ranges of possible fiscal outcomes are driven by the assumption that economic and fiscal forecast errors in the future will show similar dispersion as forecast errors over the historical period 1994 to 2005. Although this is a reasonable assumption, depending upon the time period chosen, the dispersion in forecast errors can change significantly. This is particularly true for fiscal forecast errors, which historically have often changed significantly from one year to the next. Furthermore, as discussed in Section 3, quantifying program spending uncertainty is not a

Figure 2

Forecasted Underlying Budgetary Balance
(90 per cent probability intervals given various scenarios for the dispersion of fiscal forecast errors)
(billion dollars)



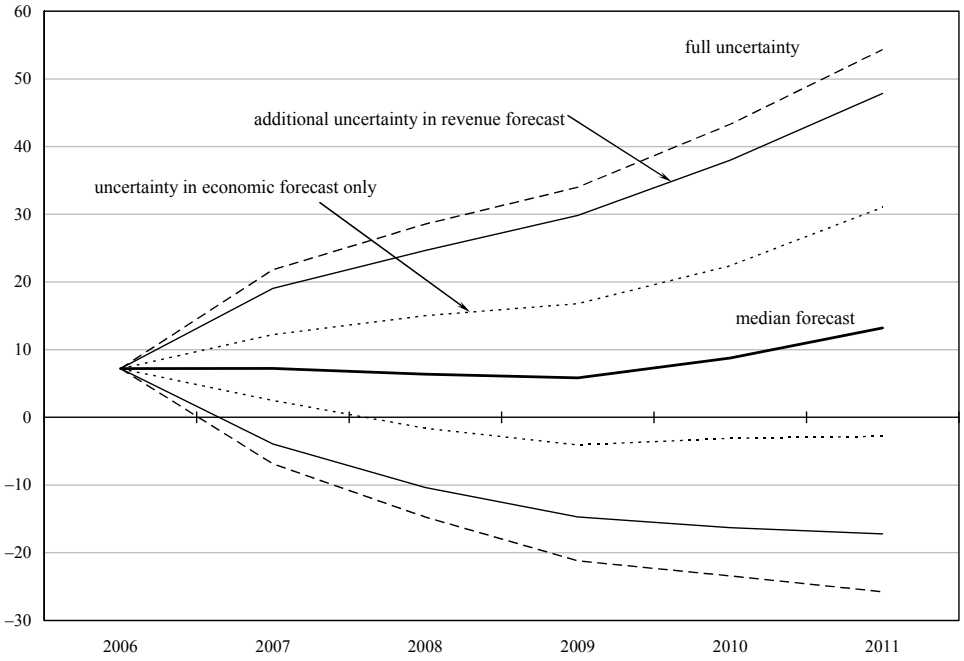
straightforward task. For these reasons, it is useful to provide a sense of the robustness of results under alternative assumptions for the degree of revenue and program spending forecast uncertainty. Figures 2 and 3 show the impact on the range of possible fiscal outcomes of different assumptions for fiscal dispersion.

Figure 2 shows the difference in the 90 per cent probability intervals surrounding the median forecast of the underlying budgetary balance from changing the standard error for the revenue and program spending equations by +/– 1 percentage point. Under these alternative assumptions, the implied standard deviations on the forecast of revenue growth would be approximately 4.4 and 2.9 percentage points respectively. The implied standard deviations on the forecast of program spending growth would be 3.6 and 1.7 percentage points respectively. The implied standard deviations change the total width of the probability interval on the underlying budgetary balance by approximately +/– $10 billion in 2007, increasing to +/– $25 billion in 2011.

Figure 3 shows the impact on the range of possible outcomes for the underlying budgetary balance of economic forecast uncertainty, as well as revenue

Figure 3

Forecasted Underlying Budgetary Balance
(90 per cent probability intervals under the different types of forecast uncertainty)



and program spending uncertainty beyond that which can be explained by economic forecast uncertainty. Based on our model, in an environment of uncertainty in only the economic forecasts, 90 per cent of possible outcomes for the underlying budgetary balance in 2007 would be within +/– $5 billion of the median forecast. This amount increases to +/– $17 billion in 2011.[23]

Uncertainty in the revenue forecast beyond that which is explained solely by economic inputs accounts for the majority of fiscal forecast uncertainty and roughly doubles the width of the probability interval relative to an environment of only economic uncertainty. Once additional uncertainty in the program spending forecast is included, Figure 3 shows that fiscal forecast uncertainty beyond that due to the economic forecast accounts for more than half of the total uncertainty in the fiscal forecast.

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[23] Since it is assumed that forecast errors are normally distributed around growth forecasts, the distribution around level forecasts is not quite symmetric. For the described scenario, the exact range around the median surplus is +$4.9 billion and –$4.8 billion in 2007-08 and +$17.9 billion and –$15.9 billion in 2011-12.

The model simulations illustrate that economic and fiscal forecast uncertainty influences the accuracy of budget forecasts considerably, and may imply a high probability of deficit outcomes if insufficiently addressed. In this environment the fiscal authority may need to take measures in order to ensure an acceptable fiscal outcome at year-end.

From a technical perspective, the probability of deficit may be reduced by one of two means: by decreasing the dispersion of the distribution of potential outcomes for the planning surplus, or by shifting the mean of the distribution. From a policy perspective, the former may be achieved by making improvements to forecast models and methodologies, or by improving the quality and/or timing of forecast data. The last two government-commissioned reviews of federal fiscal forecasting practices in Canada (the aforementioned O'Neill review in 2004 and the Ernst & Young review in 1994), made several recommendations of this nature, e.g. periodic reviews of federal forecasting models, examination of the causes for revisions to historical GDP data, etc. However, policy reforms of this sort are not always guaranteed to significantly improve forecast performance since a certain degree of uncertainty is unavoidable. An alternative course of action would be to shift the mean of the distribution for the forecasted surplus. This may be done by deciding to allocate less than 100 per cent of the planning surplus to new tax and spending measures, thereby leaving a portion of the forecasted surplus unallocated, *i.e.* targeting a minimum surplus, to guard against negative shocks to the fiscal forecast. Section 5 extrapolates from the model results in order to consider this approach in greater detail.

5 Fiscal planning under uncertainty

In this section, we extrapolate from the distribution for the underlying budgetary balance generated by the model to illustrate how knowledge of forecast uncertainty can be incorporated into governments' fiscal planning assumptions. Specifically we assume that the fiscal authority can target a minimum surplus of various sizes as its fiscal rule. Under this simple fiscal rule, the fiscal authority first sets its minimum surplus target based on an acceptable risk of deficit. It then establishes its unbiased forecast estimates for revenues, program spending, and public debt charges for the five-year period and sets new spending and tax measures, leaving an amount equal to the minimum surplus unallocated to protect against deficit outcomes.

We do not draw conclusions regarding what might constitute an acceptable risk of deficit for each year of the forecast horizon and as such, what might constitute an "optimal" choice for the minimum surplus target. Instead the surplus target is estimated at various probabilities of surplus. Several factors will influence a government's tolerance for deficit outcomes, such as the government's recent fiscal record or its policy goals.

Tables 5 and 6 show the minimum targeted surplus necessary for each of the scenarios presented in Figures 2 and 3 assuming a desired probability of surplus of 50, 60, 70, 80, and 90 per cent. By construction, under all scenarios targeting a balanced budget is required for a 50 per cent chance of achieving a surplus. As the desired probability of surplus increases, so too does the size of the necessary targeted surplus, leaving less room for new tax and spending measures. Although not shown, it is possible to plan for a deficit outcome and still achieve a surplus at year-end, although, based on our model, this will happen less than 50 per cent of the time.

For all scenarios, the necessary targeted surplus increases in the latter years, reflecting growing uncertainty over the forecast horizon. In the Canadian context, the first two years of the horizon are the most relevant, as they coincide with the federal government's budget planning horizon. As well, for later years of the forecast horizon, the fiscal authority has time to react to changes in the fiscal outlook. This, coupled with the two-year planning horizon makes the near-term the more relevant period for assessing the value of possible fiscal rules under forecast uncertainty.

Table 5 shows that incorporating the effects of additional uncertainty in fiscal forecasts beyond that due to uncertainty in economic forecasts significantly increases the targeted surplus necessary to ensure a surplus outcome. Focusing on the first two years, and a desired probability of surplus of 70 per cent, assuming only economic uncertainty, the government would need to set aside $1.6 billion in year one and $2.6 billion in year two. Assuming additional uncertainty in the revenue forecast implies that the targeted surplus increases to $3.7 billion and $5.4 billion for years one and two respectively. Finally, by incorporating further uncertainty in the program spending forecast, one increases the targeted surplus further to $4.2 billion and $6.9 billion for years one and two respectively.

Table 6 shows the impact on the targeted surplus from changing the standard errors (*i.e.* the standard deviation of the random variable) for the specifications of revenue and program spending growth. In other words, the table shows the impact of increasing or decreasing the range of possible outcomes for the underlying surplus. Assuming that a 70 per cent probability of surplus is desired, decreasing the standard errors on the fiscal variables by 1 percentage point reduces the size of the targeted surplus to $2.9 billion in the first year and $4.8 billion in the second year. Alternatively, if the standard errors were to increase, *i.e.* increased forecast uncertainty, then the size of the targeted surplus would increase to $5.7 billion in year one and $9.1 billion in year two.

Relating the results from Table 6 back to possible government policy responses to forecast uncertainty, the effect on the targeted surplus from reducing the standard errors on the fiscal forecasts could also be interpreted as the potential value of improved forecast accuracy, *i.e.* improved quality in forecast data, or improved forecast methodologies, to the fiscal planning exercise. For example, assuming a desired probability of 70 per cent, if the government were able to make

Table 5

Targeted Surplus under Various Scenarios for Forecast Uncertainty

Scenarios: Fiscal forecast uncertainty	Uncertainty in the economic forecast only					Additional uncertainty in the revenue forecast					Full forecast uncertainty				
	2007/08	2008/09	2009/10	2010/11	2011/12	2007/08	2008/09	2009/10	2010/11	2011/12	2007/08	2008/09	2009/10	2010/11	2011/12
Probability of surplus in each year	Targeted surplus *($ billions)*														
50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60%	0.8	1.3	1.5	1.7	2.4	1.9	2.7	3.4	3.9	4.5	2.1	3.5	4.2	4.6	6.0
70%	1.6	2.6	3.2	3.9	5.2	3.7	5.4	6.8	7.9	9.6	4.2	6.9	8.7	10.0	12.5
80%	2.5	4.1	5.1	6.2	8.3	5.8	8.6	10.6	13.0	15.4	7.0	10.9	13.8	16.3	20.1
90%	3.8	6.3	7.6	9.5	12.5	8.8	13.0	15.9	19.7	23.7	10.8	16.2	21.0	25.3	30.1

Table 6

Targeted Surplus under Various Scenarios for Forecast Uncertainty

Scenarios: Fiscal forecast uncertainty	Full forecast uncertainty					less 1 percentage point on standard errors for revenue and program spending growth					plus 1 percentage point on standard errors for revenue and program spending growth				
	2007/08	2008/09	2009/10	2010/11	2011/12	2007/08	2008/09	2009/10	2010/11	2011/12	2007/08	2008/09	2009/10	2010/11	2011/12
Probability of surplus in each year	Targeted surplus *($ billions)*														
50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60%	2.1	3.5	4.2	4.6	6.0	1.5	2.2	2.8	3.3	4.4	2.7	4.5	5.3	6.4	7.8
70%	4.2	6.9	8.7	10.0	12.5	2.9	4.8	6.0	7.2	8.9	5.7	9.1	11.4	13.2	16.4
80%	7.0	10.9	13.8	16.3	20.1	4.8	7.4	9.5	11.5	14.1	9.5	14.3	18.0	21.7	26.0
90%	10.8	16.2	21.0	25.3	30.1	7.5	11.3	14.4	17.9	21.5	14.5	21.3	28.0	33.5	39.5

improvements to the quality of forecast data and methodologies that resulted in a 1 percentage point reduction in the standard errors on the fiscal forecasts (*i.e.* the middle scenario in Table 6), it could free up $1.3 billion ($4.2 billion less $2.9 billion) worth of fiscal room that could be used to introduce new measures without increasing the risk of a deficit outcome. Alternatively, it could leave this extra fiscal room unallocated and increase the probability of surplus to nearly 80 per cent.

6 Conclusions

In this paper we use a stochastic simulation model to assess the effect of forecast uncertainty on federal budget projections. We also investigate the practice of leaving a portion of the planning surplus unallocated as a possible policy response to the existence of forecast uncertainty.

Results show that uncertainty related to both economic and fiscal forecasts imply a wide range of possible outcomes for the actual budgetary balance relative to its value projected at the time of the forecast. Our results also suggest that fiscal forecast uncertainty beyond that expected as a result of uncertainty in economic projections plays an important role, and could contribute more to the overall uncertainty in budget projections than that which can be explained by economic forecasts.

As a policy response, the fiscal authority could choose to mitigate the effects of forecast uncertainty by allocating less than 100 per cent of the planning surplus to new tax and spending measures. This could be done through a simple minimum surplus target as our analysis has illustrated, or other measures such as a ceiling on discretionary spending. Based on our results, an unallocated amount of between $4 billion and $7 billion would imply a probability of surplus of between 70 and 80 per cent in year one. To achieve this assurance of surplus in the second year of the forecast horizon, unused fiscal room would need to be increased to between $7 and $11 billion. Although assurance of a surplus at year-end would be greatly increased under such a policy response, it would come at the cost of reduced funding for new spending and tax measures.

Our results for the 2007-11 forecast horizon are based on the assumption that the federal government faces future forecast uncertainty that is similar to that of the past. It is conceivable that inputs into the forecast process may change in a manner that alters the behaviour of current forecasts compared to the past. In recognition of this possibility, on the fiscal side, we also consider the impact on our results of increasing or decreasing the degree of fiscal forecast uncertainty. Such an analysis also provides some insight into the potential impact of government policies aimed at reducing the degree of uncertainty in budget projections, e.g. model or data improvements.

Regardless of the government's specific choice of policy response, awareness of the degree of uncertainty in budget projections is a critical element of successful

budget planning. Analyses such as the one provided by this paper provide useful perspective for policymakers when developing budget projections and deciding upon new fiscal policies.

Going forward our stochastic model provides a framework for further analysis of fiscal policy in an environment of forecast uncertainty.

ANNEX 1
FEDERAL FISCAL FORECASTING IN CANADA

The federal government updates fiscal projections twice a year – in the federal budget, typically in the spring, and in the Economic and Fiscal Update in the fall. In addition, the fiscal outlook for the year in progress is updated again in June and September.

To ensure objective economic assumptions, fiscal forecasting begins with the use of private sector economic forecasts. The Department of Finance surveys about 20 private sector economic forecasters four times a year, following the release of the quarterly National Income and Expenditure Accounts by Statistics Canada. The average of the private sector economic forecasts from the survey forms the basis for the government's fiscal projections presented in the budget, the Economic and Fiscal Update, and on a quarterly basis.

The Economic and Fiscal Update, prepared in the fall, presents economic and fiscal projections for the year in progress and the next five years in order to show medium-term implications of current policies. These projections are presented alongside projections prepared by four private sector organizations. While the government's projections form the basis for fiscal planning, the fiscal forecasts produced by the private sector organizations allow for comparison of different views of the fiscal outlook.

In the spring, fiscal projections presented in the Economic and Fiscal Update are updated for the budget to reflect the most recent survey of private sector economic forecasters and the most recent financial results. Since a short planning horizon is appropriate for budget decisions, fiscal projections in the budget are presented for the year in progress and the first two years of the forecast horizon. Budget projections include planned annual debt reduction of $3 billion.

Since June 2006, the government has also presented quarterly updates of the government's fiscal forecast for the fiscal year in progress based on financial information regarding the previous fiscal year and information to date for the current fiscal year.

ANNEX 2
COMPOSITION OF FEDERAL FINANCES IN CANADA

Tables 7 and 8 present a decomposition of federal revenues and expenses for the fiscal year 2005-06.

Table 7

Federal Revenues, 2005-06

	Level *($ billions)*	**Share of Total** *(percent)*
Tax revenues		
Income tax		
Personal income tax	103.7	46.7
Corporate income tax	31.7	14.3
Other income tax	4.5	2.0
Total	139.9	63.0
Other taxes and duties		
Goods and services tax	33.0	14.9
Energy taxes	5.1	2.3
Customs import duties	3.3	1.5
Other taxes and duties	4.7	2.1
	46.2	20.8
Total tax revenues	**186.1**	**83.8**
Employment insurance premium revenues	16.5	7.4
Other revenues		
Crown corporation revenues	7.2	3.2
Foreign exchange revenues	2.0	0.9
Other program revenues	10.4	4.7
Total	19.6	8.8
Total revenues	**222.2**	**100.0**

Source: Annual Financial Report, Fiscal Year 2005-06.

Table 8

Federal Expenses, 2005-06

	Level *($ billions)*	**Share of Total** *(percent)*
Transfer payments		
Major transfers to persons		
Elderly benefits	29.0	13.9
Employment insurance benefits	14.4	6.9
Canada Child Tax Benefit	9.2	4.4
Total	52.6	25.2
Major transfers to other levels of government		
Support for health and social programs	27.2	13.0
Fiscal arrangements and other transfers	13.0	6.2
Other transfers	3.3	1.6
Alternative transfers for standing progran	–2.7	–1.3
Total	40.8	19.5
Direct program expenses		
Subsidies and other transfers	24.9	11.9
Other program expenses		
Crown corporations	7.2	3.4
National Defence	15.0	7.2
All other departments and agencies	34.7	16.6
Total	56.9	27.2
Total program expenses	**175.2**	**83.8**
Public debt charges	33.8	16.2
Total expenses	**209.0**	**100.0**

Source: Annual Financial Report, Fiscal Year 2005-06.

ANNEX 3
VARIATION IN REVENUE AND PROGRAM SPENDING FORECASTS

The variation in the forecasts of revenue and program spending growth used in the model was estimated based on O'Neill's 2005 Review of Canadian Federal Fiscal Forecasting. In that review, level forecast errors were estimated over the period 1994-95 to 2003-04 after first making adjustments for policy initiatives announced post-forecast and for accounting changes during the period.

For the purposes of the model used in this paper, it was necessary to translate these series into series of the forecast errors on growth forecasts. Forecasted growth is estimated as the percentage change in the one-year ahead forecast from the in-year forecast for the year before.[24] Actual growth is estimated as the percentage change in the actual level for the year in question adjusted for policy changes unforeseen at the time the forecast was made, from the actual (unadjusted) level for the year before. Actual levels are taken from the Annual Financial Report of the Government of Canada for the year in question. Taking 1994-95 as an example:

- Forecasted growth in revenues is set equal to the percentage change in the forecasted level for 1994-95 from the forecasted level for 1993-94, using forecasts from the February 1994 budget.
- Actual growth in revenues is set equal to the percentage change in the actual level for 1994-95, adjusted for unforeseen policy measures, from the actual (unadjusted) level for 1993-94, using levels as reported at the end of 1993-94 and 1994-95 in the Annual Financial Report.

For some years, accounting adjustments to actual levels were necessary to allow comparisons across years. For example, in 2002-03 and 2005-06 actual outcomes were presented in the Annual Financial Report on a different basis of accounting than the forecast. For these years, actual outcomes were adjusted to the same basis of accounting as that used at the time of the forecast.

The estimated forecast errors for program spending growth assume that the government knows the outcome for transfers to other levels of government with certainty. In the past, provincial/territorial fiscal arrangements (39 per cent of transfers to other levels of government) were formula-based and estimates frequently revised, resulting in payments that were volatile and difficult to forecast, yielding significant forecast errors. In 2004, the program was moved away from its original formula-based approach to ensure more predictable funding. Most importantly for the purposes of forecasting, total funding was legislated to grow by 3.5 per cent annually, implying zero forecast uncertainty. More recently the program has been moved back towards a more formula-based approach. However, unlike the original approach, which resulted in unpredictable and volatile payments, several reforms have been introduced under the new approach to ensure that future funding

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[24] One-year ahead forecasts refer to the forecast for the next fiscal year. In-year forecasts refer to the forecast for the year in progress. Taking 1994-95 as an example, the one-year ahead forecast was made in the February 1994 budget, while the in-year forecast was provided in the February 1995 budget.

Table 9

Estimated Dispersion in One-year Ahead Fiscal Forecast Errors

	Revenue Growth Error	Program Spending Growth* Error
	(percentage points)	
1994-95	1.7	2.1
1995-96	0.9	0.3
1996-97	–2.3	4.2
1997-98	–6.7	1.7
1998-99	0.5	1.2
1999-00	–6.5	4.3
2000-01**	–7.6	–1.9
2001-02	2.9	–0.7
2002-03**	2.3	2.7
2003-04	–1.4	–0.5
2004-05	–3.2	–5.2
2005-06**	–4.9	2.9
Mean	–2.0	0.9
Standard deviation	**3.7**	**2.7**
Root-mean squared error	4.1	2.8

Source: Review of Canadian Federal Fiscal Forecasting (June 2005), Federal Budgets and Annual Financial Reports, author's calculations.

* Impact of errors in the forecast of transfers to other levels of government excluded.

** Accounting adjustments made to actual levels.

remains stable and predictable. Since historical errors in the forecasts of transfers to other levels of government do not reflect the new regime, they are excluded from our calculations so as not to overestimate the uncertainty that exists in these programs going forward. Although this methodology may underestimate the uncertainty in program spending growth, it is difficult to assess to what extent, or if at all, without historical data under the new regime.

Table 9 presents the modified series from the O'Neill review, with two years added along with the mean, standard deviation, and root-mean-squared error. The model used for this paper is calibrated such that the standard deviations for revenue and program spending growth match the standard deviations for the errors in these forecasts over the period 1994-95 to 2005-06. The standard deviations were chosen over the root-mean squared error to eliminate the effect of forecast bias exhibited in these series (in particular the revenue series) over the historical period, *i.e.* future fiscal forecasts provide the government's "best guess" ex ante and do not contain implicit bias, *i.e.* mean error equals zero.

Going forward, it is possible that forecast bias might persist. For instance, faced with significantly higher tax elasticity than one would expect based on theoretical and empirical evidence, forecasters would likely not respond by adjusting revenue forecasts upwards immediately, but rather would adjust their forecasts gradually over time after gathering more information and knowledge of the source and persistence of the higher tax elasticity. If the higher tax elasticity were to persist, fiscal forecasts would accordingly show some bias for a period of time.

Incorporating the estimated bias going forward would shift the mean of the model-simulated distribution for federal revenue growth higher by 2 percentage points, and increase the estimated probability of surplus for each year of the forecast horizon.

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COMMENTS ON SESSION 1
FISCAL STABILISATION

Ranjana Madhusudhan[*]

I would like to thank Daniele Franco and Banca d'Italia for inviting me to participate at another great research Workshop on Public Finance in Perugia. He is to be congratulated for his choice of relevant topics dealing with important public finance policy issues for the 9th consecutive year! I have been assigned to primarily discuss the papers by Hasko and by Robbins, Torgunrud and Matier. Time permitting, I will also try to provide some comments on the paper by Hassan. I'll conclude my comments with some thoughts for future research. The papers cover important but different fiscal policy grounds. The first two papers, in particular, present good literature reviews, which I found very helpful.

1 "Public Debt Dynamics in Selected OECD Countries: The Role of Fiscal Stabilisation and Monetary Policy" by Harri Hasko

Using a basic recursive, reduced form VAR model, the paper tries to find out if the response of fiscal policy to unforeseen economic shocks has been stabilizing and the relative significance of different causal factors in the context of debt dynamics. The paper provides a good analysis of the results of the impulse response functions and variance decompositions to determine how the different types of shocks may have impacted the public debt dynamics.

One of the major conclusions of the Hasko paper is that shocks to economic growth and monetary and fiscal policies have played a major role in public debt developments since the mid-1970s. It would be interesting to investigate if the results of the analysis would change if "output gap" is used instead of "output growth"? Conducting a sensitivity analysis to show how sensitive the results are to the underlying specification and modifications used would be a useful exercise.

The paper reports that on average, shocks to output growth and inflation are less persistent than policy shocks but there is some ambiguity as to why that is the case. In general explaining the major results in clear, and perhaps non-technical, terms would make the analysis more useful to policy makers. Some additional discussion of the results presented in Section 4 would also improve the clarity of underlying findings. For instance, pointing out why or why not the share of revenue is larger than expenditure in the three countries with peculiar debt histories (Finland, UK and Japan) and in Canada while shocks to public expenditure have the largest

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[*] The New Jersey Department of Treasury. The views expressed are those of the discussant and does not necessarily reflect the views of the New Jersey Department of Treasury.

share in the variance decomposition in Germany, Greece and Austria. Also indicating how these factors vary by specific country attributes would be helpful.

Examining how the underlying fiscal federal structures affect the debt dynamics in the various countries would be an interesting extension of the paper. One way to highlight country specific differences may be to include an appendix showing major economic indicators along with fiscal and monetary trends for defined periods of time.

The paper shows that "unexpected shocks" to monetary and fiscal policy have played an important role in the developments of public debt in the sample countries. One potential extension of the analysis would be to examine how the public debt dynamics would be affected on account of "expected or anticipated shocks" to the system – growth in pension and heath care cost due to changes in the demographic profile of the population, changes in federal mandates, court-decision related changes etc.

A very important and useful conclusion that emerges from the paper is that shocks to expenditures have larger share in the variance decomposition which is in line with the common finding that "fiscal consolidation measures that seek to restrain expenditure developments are more efficient than actions in the revenue side". This is particularly meaningful, certainly in the US context, given the growing resistance to new taxes and the limited room to increase tax rates.

The paper should include some discussion on why only 40 percent of the thirty OECD countries were chosen in the sample? It may be useful to extend the analysis to other member countries since fiscal imbalance or public debt management is a serious policy concern in most countries.

Another extension would be to consider the role of accounting practices such as the treatment of transfer funds in the context of public debt dynamics. The way the US Social Security trust fund for the Old Age and Survivors Insurance (OASI) account, for instance, is treated accounts for the gap between reported federal deficit and change in total public debt.[1]

2 "Fiscal Planning under Uncertainty – The Implications of Economic and Fiscal Uncertainty for Budget Forecasts" by Jenna Robbins, Brian Torgunrud and Chris Matier

This paper analyses the uncertainty in projections of the federal budget balance arising due to uncertainty in economic, and government revenue and spending projections. Using a stochastic simulation model (SSM), the paper presents estimates of the impact of forecast uncertainty on federal budget projections in Canada. The paper provides a good literature review on previous applications of the

[1] For a more detailed discussion refer to Pakko, M. (2006), "National Economic Trends", Federal Reserve Bank of St. Louis.

SSM before laying out its own model specification. The Appendix section contains very useful information, particularly, it clearly lays out the federal fiscal forecasting process and timeline in Canada.

A striking result indicated in the paper is the $13.2B in federal surplus for FY06, which was the ninth consecutive year that federal revenues exceeded federal program spending since FY98! The paper should include some information on the Canadian experience with budget deficits in the years prior to the period under consideration and its current public debt situation such as debt level as percent of GDP. It should also include some discussion on the move to surplus targeting following the consolidation of fiscal finances from the deficit targets of the mid-1990s.

Deliberating on what should be the size of the minimum surplus would be useful. Various probabilities are indicated but the desired level is left open to the discretion of the policy maker. It would be helpful to indicate as to which level of surplus would support long term fiscal balance. The paper should also consider including some discussion on what portion of the planning surplus should be left unallocated to address the issue of forecast uncertainty. I would suggest elaborating on the mechanics of how the effects of forecast uncertainty can be mitigated by changing the allocation of the planning surplus to new tax and expenditure measures.

The methodology used in the paper to avoid additional volatility in revenue estimates due to tax policy changes by considering the federal finance department's historical forecast record rather than the historical series for realized federal revenues makes a lot of sense, as supported by the improved results on standard errors. In New Jersey, the baseline growth rate is used to make revenue projections for the out years with adjustment for policy changes.

In Section 4, model results are discussed based on descriptive statistics for key economic variables over the planning horizon FY08 to FY12. Unlike the presentation of the results for real and nominal GDP variables, the interpretation of GDP inflation results are not clear from the numbers posted in Table 2. Also Table 4, which discusses the range of possible outcomes for fiscal variables, shows that the underlying budgetary balance remains positive, ranging from $7.2B to $13.2B or 2.6 percent (FY09) to 4.8 percent (FY12). It is not clear why the results are showing negative budgetary balances for the 5th percentile, which is also consistently growing over the forecast period?

Another point of clarification pertains to why the public debt charges remain at a constant level of $34B+ with the median forecast for public debt charges assumed to go down by $3B in federal debt reduction per year? In general, the results are discussed in terms of median budgetary revenues and spending forecasts. How do they compare with average forecast values?

An important inference noted in the paper is that a certain degree of uncertainty is unavoidable no matter how sophisticated the forecasting process. After all forecasting is not yet an exact science and who can predict the role of the

invisible hand in the economic arena! In fact the suggestion about targeting a minimum surplus to guard against negative shocks to the fiscal forecasts or the role of rainy day fund is a useful measure for fiscal planning under uncertainty. In the U.S. the policies with regard to rainy day fund varies across states. In general, 50 percent of the amount by which actual revenues exceed anticipated revenues is transferred to a surplus revenue fund in New Jersey with a cap set at 5 percent of anticipated revenues.

It would be useful to include some discussion about limitations with using historical trends in the forecasting process – how are extraordinary years treated, e.g., the post-equity bubble period, or government amnesty programs (Canadian experience)? Major changes in tax or expenditure policies? Extending Table 9 of the Appendix to layout major policy changes and economic trends in these years and indicating any major data revisions would also be helpful.

In this paper the focus of fiscal planning centers on uncertainty in the forecasting process, the efficiency of which can be improved by lowering the associated standard errors through improvements in the quality of forecast data and with improved forecast methodologies. I would suggest extending the analysis to discuss other areas of addressing fiscal planning under fiscal uncertainty. For instance, checking if the existing revenue sources are keeping pace with changing economic trends. Is the current tax base capturing say e-commerce? In the US, several states are attempting to extend their sales tax base to services and remote sales. Tax avoidance under the corporation business tax is another case in point, which adds uncertainty to the forecasting process.

3 "Procyclicality, Fiscal Dominance, and the Effectiveness of Fiscal Policy in Egypt" by Mohamed Hassan

Hassan's paper on the fiscal policy experience in Egypt, based on a structural vector autoregressive (SVAR) model, indicates that the relationship between fiscal policy and economic activity is weak. The paper provides a good overview of fiscal accounts in Egypt in the last twenty four years since the eighties and suggests that fiscal policy is procyclical and mainly discretionary.

The paper explains this in terms of certain characteristics in the Egyptian system (large share of wages and interest payments), which limit the ability of conducting counter cyclical fiscal policy.

Some detailed description of the expenditure composition would be helpful in understanding the policy dynamics in the Egyptian context. For instance, what is in the "other" component that accounted for over fifty percent of total share in 2005? Also, it is not clear why the share of subsidies declined by nearly half from 15 percent in 80/81 to 7.7 percent in 04/05?

One suggestion for future work would be to do a comparative analysis using the OECD experience. Another alternative may be to focus on similar economies or

countries with similar fiscal systems and then compare their results with those for Egypt. As noted in the paper, that differences in the infrastructure base explain why developed countries can use fiscal policy for countercyclical purposes relatively successfully.

Given globalization, economic events and business cycles in one country would affect others. It would be useful to explore the implications of recognizing this factor explicitly and attempt to identify how Egypt's deficit situation has been affected by recent regional trends.

I would like to conclude by pointing out that it is important to (i) identify all the pieces of the puzzle both on the revenue side and the expenditure side; and (ii) distinguish between cyclical and structural deficits. In particular, it is important to recognize the realities of today – all most everywhere the demographic developments are expected to put heavy pressure on public finances mostly in the form of increasing pension and health care costs. Retirees for instance are living longer. These trends are contributing to serious problems resulting from fiscal imbalances and rising public debt. Facing these challenges, would require all countries, OECD and others, to manage their fiscal stabilization policies efficiently and to ensure the soundness of their public finances both in the short and long run.

COMMENTS ON SESSION 1
FISCAL STABILISATION

Jean-Pierre Vidal[*]

The Banca d'Italia public finance workshop typically brings together a wealth of excellent research papers, with the right blend of theory, empirics and practice. Participating is in this workshop is a stimulating and intellectually rewarding experiment, and I would like to thank Daniele Franco and the Banca d'Italia for giving me this year the opportunity to discuss this first session on fiscal stabilisation.

Reading the seven excellent papers covering most key issues in fiscal stabilisation, the first question that came to my mind was: what do economists really know about fiscal policy and economic fluctuations? I also came to the conclusion that there is quite a difference between theory and practice when dealing with fiscal stabilisation. Reflecting on my own experience and background as a theorist rather than an applied economist, I would qualify my learning process as an unpleasant journey from theory to practice.

Theory certainly is an economist's seventh heaven, in which economic developments are easy to explain. Automatic fiscal stabilisation mainly results from features of taxation and social transfers, which are built into tax codes and social legislation. The resilience of the main government spending components with respect to economic fluctuations, which are precommitted in annual budgets or even in multi-annual expenditure rules, also contributes to smoothing out economic fluctuations. Chart 1 depicts an imaginary economy – one that is typically analysed by theorists – with cyclical fluctuations of real GDP growth around trend and shows how macroeconomic fluctuations translate into a cyclical pattern of the budgetary balance. In this example, the underlying budgetary position – the so-called structural or cyclically-adjusted budget balance – reflected by the thick line is unchanged and balanced by assumption. This would be a government's fiscal position in the absence of economic fluctuations. The shaded area indicates the impact of automatic stabilisers on the actual budgetary balance marked by a "cyclical breathing" around the balanced position. Automatic stabilisers thus cause the budgetary balance to follow the same pattern as output growth.

There is a clear and unequivocal distinction between discretionary fiscal policy and automatic stabilisation in theory. A fiscal consolidation strategy aimed at achieving a close-to-balance budgetary position can easily be represented on a similar chart. On Figure 2, the thick line reflects the consolidation path, which leads to medium term balanced budgets, while the thin line reflects a possible example of the nominal annual budget targets. The latter also takes into account automatic stabilisation following the cyclical conditions as reflected in Figure 1. The bracket

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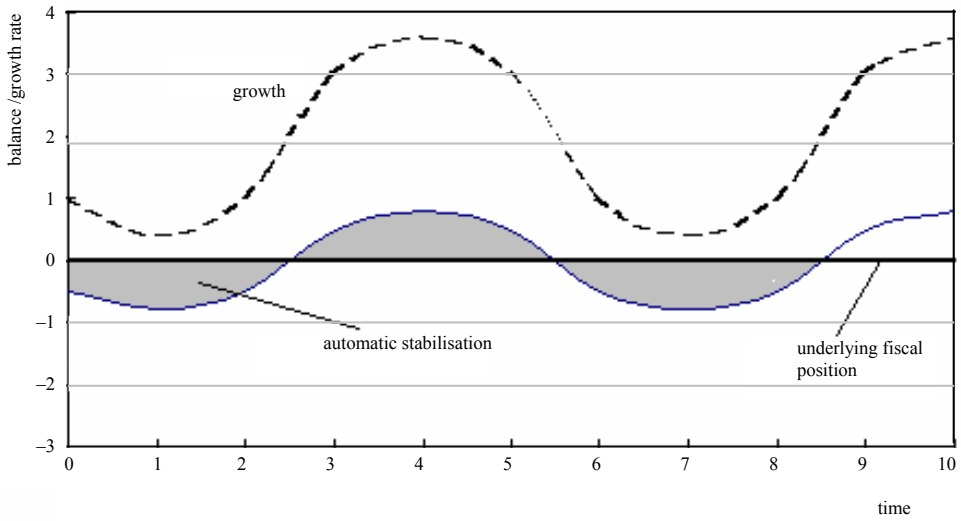
[*] European Central Bank. The views expressed in this comment are my own and do not necessarily reflect those of the European Central Bank.

Figure 1

Automatic Fiscal Stabilisation



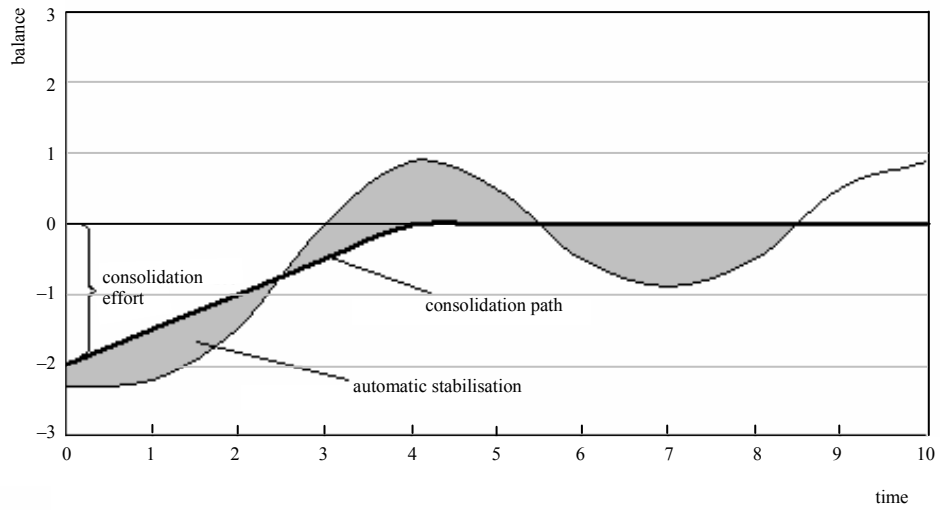
Source: ECB, Monthly Bulletin, April 2002.

indicates the necessary consolidation effort, while the grey area again depicts the effect of expected cyclical developments on the actual budgetary position. The example illustrates a linear consolidation path and shows that the annual nominal adjustment is smaller in times of low growth (here at the beginning of the adjustment period) and greater when growth is near or above trend. What is of course remarkable on this theoretical example of a fiscal consolidation strategy is the clear distinction between consolidation effort and the budgetary impact of the cycle.

Let me now move from theory to practice, and briefly review the economists' toolkit for fiscal policy analysis and surveillance. Fiscal surveillance requires disentangling the role of discretionary fiscal policy measures from the budgetary impact of economic cycles. The contributions to this session provide a rather comprehensive list of tools used in fiscal policy analysis, ranging from regression models and VARs to model-based simulations. When reading them, I felt at crossroads. The different contributions to this session to some extent reflect the tension between the difficulty to reach an unequivocal assessment of actual fiscal policies with the help of the economist's toolkit and the willingness to further refine this toolkit with a view to making such an assessment. This also raises another important question: to which extent should one trust the economist's toolkit in fiscal surveillance?

Figure 2

Discretionary Fiscal Policy and Automatic Stabilisers



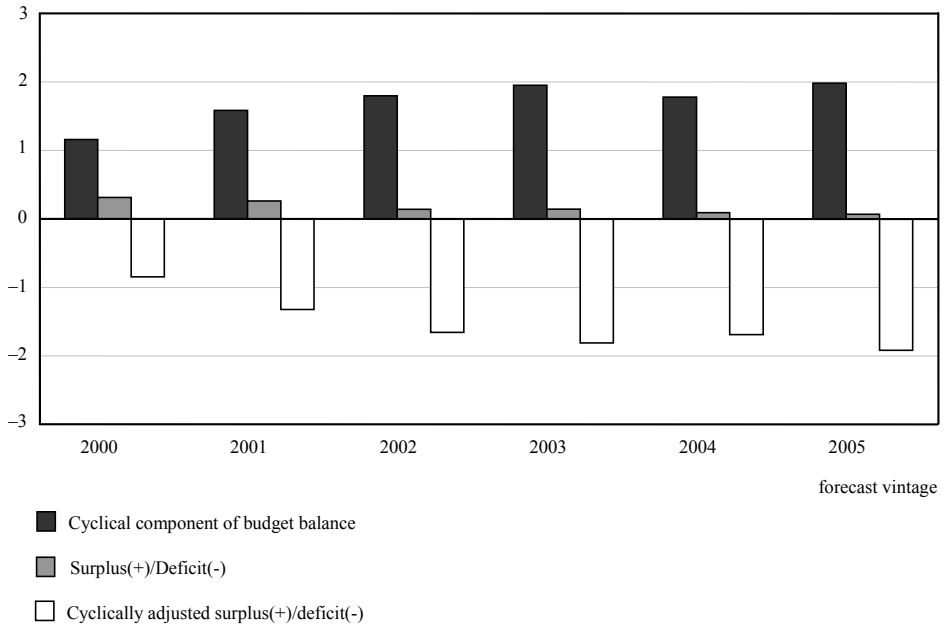
Source: ECB, Monthly Bulletin, April 2002.

Are estimates of underlying budgetary positions reliable in real time? Reliability of cyclically-adjusted budgetary indicators can be easily assessed on the basis of a visual inspection of Figure 3. Figure 3 shows the successive Commission's estimates of the euro area cyclically-adjusted balance (CAB) for 2000. In 2000 the euro area cyclically-adjusted deficit was estimated at 0.8 percent of GDP. Five years later, in 2005, the 2000 cyclically-adjusted deficit was estimated to be just below 2 percent of GDP. This difference is mainly attributable to revisions in the estimates of the cyclical component of the 2000 budget balance, ultimately to revisions in output gap estimates, with a limited impact from revisions in government finance statistics.

While the year 2000 was perhaps exceptional – being a turning point in the business cycle – uncertainty related to measurement in real time may also be rooted in more systematic measurement errors. Chart 4 suggests that there could be a systematic underestimation of output gaps in real time, mechanically leading to an overestimation of CABs in real time. One should certainly not conclude from this that real time indicators are useless for fiscal policy surveillance. However, they should be assessed with caution, and complemented with expert judgment.

Figure 3

Euro-area Cyclically-adjusted Budget Balance, 2000
(percent of GDP)



Source: European Commission, Ameco database.

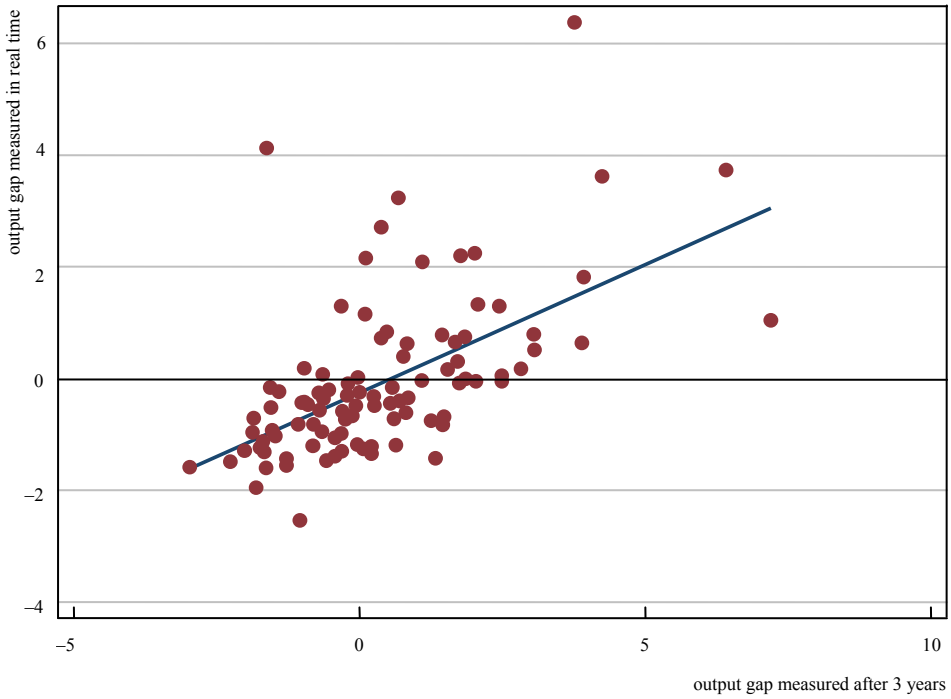
When assessing fiscal policy, one should be aware that in practice fiscal experts are confronted with a wealth of uncertainties. To calculate cyclically-adjusted budget balances, for example, one also needs estimates of budgetary sensitivities, which measure the impact of macroeconomic developments on budget balances. Budgetary sensitivities may well be imperfect estimates of the budgetary impact of economic fluctuations. Imperfection calls for refinements and exploration of new research avenues. Calculating cyclically-adjusted balances based on output gaps ignores the budgetary effects of the composition of growth. To account for such effects Bouthevillain *et al.* (2001)[1] have proposed a disaggregated method for the calculation of cyclically-adjusted budget balances. Macroeconomic tax bases also are very imperfect proxies, and could be refined by accounting for asset price developments (Morris and Schuknecht, 2007).[2] When confronted with

[1] Bouthevillain, C., P. Cour-Thimann, G. van den Dool, P. Hernández de Cos, G. Langenus, M. Mohr, S. Momigliano and M. Tujula (2001), "Cyclically-adjusted Budget Balances: An Alternative Approach", ECB, Working Paper, No. 77, http://www.ecb.int/pub/pdf/scpwps/ecbwp077.pdf

[2] Morris, R. and L. Schuknecht (2007), "Structural Balances and Revenue Windfalls: The Role of Asset Prices Revisited", ECB, Working Paper, No. 737, http://www.ecb.int/pub/pdf/scpwps/ecbwp737.pdf

Figure 4

Real-time and *ex post* Output Gaps of Euro-area Countries, 1996-2003



Source: ECB calculations, based on European Commission's Ameco database.

the limitations of indicators, a natural inclination is to call for further refinements. Refinements may however bring about more complexity.

I would like to conclude this discussion by stressing that this call for further refinements and increased complexity of tools used in fiscal surveillance might unfortunately come at a cost. This cost stems from the traditional trade-off between enforcement and complexity. From the standpoint of economic analysis, I have no doubt that more refined, sophisticated indicators are needed and would ultimately increase our understanding of fiscal policies. In real time, cyclically-adjusted indicators are by nature surrounded by significant uncertainty. They are therefore not able to give unambiguous signals on the underlying fiscal positions or the fiscal stance. In a rules-based framework, ambiguous indicators, which are subject to significant revisions ex post, presumably raise monitoring costs and reduce pressure on fiscal policy makers to comply. In this respect headline government finance statistics are more transparent and easier to understand for the public at large than cyclically-adjusted budgetary figures; they are also less subject to revisions. This

lends support to the prominent role of the government deficit and debt reference values of 3 and 60 percent of GDP, respectively, as nominal anchors in EU budgetary surveillance.

The papers, and research results presented in this session, point to four key challenges for EU fiscal surveillance, which I would like to put forward as issues for discussion:

How to reconcile the wide margins of uncertainty surrounding cyclically-adjusted budget indicators and their role in EU fiscal surveillance;

Can further refinements to cyclically-adjusted budget indicators improve their reliability in real time?

Can expert judgment alleviate the shortcomings of cyclically-adjusted budget indicators?

Overall, the key question is, how to make the best use of the economist's toolkit in real-time fiscal surveillance? This implies to find the right trade-off between the sophistication of economic analysis and enforcement of fiscal rules.