CYCLICALLY ADJUSTED PRIMARY BALANCE: THE CASE OF TURKEY

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Abstract

It is well known that the budgetary performance plays a crucial role in assessing and formulating fiscal policies. The actual primary balance may be a misleading indicator since it also reflects the temporary effects of the cyclical deviations of output from its underlying trend. In order to disentangle these temporary influences of output gap on the government's primary balance and get a clear picture of the budgetary performance several techniques have been developed. In this paper most commonly used traditional methodology is used on aggregated basis to calculate the cyclically adjusted primary balance of Turkey over the period from 1979 to 2002.

The results point out that recession periods together with the tight fiscal policies have significant effects on 'would-be' primary budget balance had the economy managed to produce at its potential. Overall the year 2002 is expected to be a restrictive year on the fiscal side and the output level is expected to be well below its potential level. The estimation outcome implies that the cyclically adjusted primary budget balance surplus will be much higher than the targeted primary budget surplus in 2002.

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Keywords: Cyclically adjusted primary budget balance, potential output, cointegration.

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Contents

Figures and Tables

1. Introduction

Asking why there is such an interest to estimate the cyclically adjusted primary balance yields the following answer: Cyclically adjusted primary balance is one of the tools useful in the analysis of fiscal policy in that estimated cyclically adjusted budget figures give a better picture for the performance of the govermental authority in charge of the fiscal policy managment. Consequently, there is a continuing strong interest in partitioning the budget into a cyclical component, which measures the automatic responses of receipts and expenditures to economic fluctuations, and a cyclically adjusted or structural component, which measures discreationary fiscal policy and other noncyclical factors affecting the budget (Leeuw and Holloway (1985)).

Many institutions, including the European Commission, the IMF and the OECD produce estimates of cyclically adjusted budget balance figures for a number of countries. Their main motive behind estimating budget balance figures which are distilled from the influences of short-run fluctuations in the economic activity is to evaluate the fiscal performance of those countries on much more "normalised" grounds.

The empirical findings show that different methodologies for measuring cyclically adjusted budget balance may yield completely different estimates, which in a sense suggests that that there is no perfect standard method for structural budget balance estimations (see Bouthevillain et al. (2001), Bradner et al. (1998)). The centerpiece of those various approaches revolves around a standard four-step procedure that is also followed by the European Commission, the IMF and the OECD (Hagemann, 1999).

In this study we followed the standard procedure in estimating the cyclically adjusted primary budget balance for Turkey. The structure of this paper is as follows: In section 2, the standard four-step methodology for estimating cyclically adjusted primary budget balance is discussed. In section 3, two statistical trend estimation methods to estimate potential output are explored. In section 4, cointegration approach to calculate long-run income elasticity of budgetary categories is examined and relevant long-run sensitivities of budget categories to GDP are calculated on the Johansen Methodology basis. In section 5, our empirical findings for cyclically adjusted primary budget balance figures for Turkey are reported. Section 6 concludes.

2. Methodology for Adjusting the Budget Balance Cyclically

2.1. Data

We collected the data for GDP, for revenue categories of the budget– namely direct taxes, indirect taxes and other revenues-, and for primary expenditure category of the budget from electronic data dissemination system of the Central Bank of the Republic of Turkey (CBRT). All data sets are deflated to 1987 millions Turkish liras using GDP deflators of Turkish State Institute of Statistics (SIS). We collected government's primary budget balance target (in terms of as percentage to GDP) for 2002 from the database of the General Directorate of Public Accounts, Turkish Ministry of Finance.

2.2. The Methodology

To construct a cyclically adjusted primary budget balance, the essential steps are (1) choosing a reference trend for GDP free from short-run fluctuations - i.e. the potential GDP - , (2) determining the responsiveness of each budget category of revenues and expenditures, which react automatically to cyclical GDP fluctuations, to short-run movements in GDP, (3) applying these responses to gaps between potential GDP and actual GDP, and (4) adding the expenditures and revenues 'cyclical factors' from step 3 to the actual budget figures to obtain a cyclically adjusted or structural budget balance.

The methodology defined above in steps is the standardised one, which can be applied for the case of any country so as to disentangle the cyclical movements from actual budget figures. However, as each country's budget system has some idiosyncratic features, budgetary categories of different countries must be carefully reviewed and those categories which react automatically to cyclical fluctuations must be identified prior to measuring responsiveness of budget categories to short-run movements in GDP. For the case of Turkey, for instance, to our knowledge, there is not any expenditure category in the budget which automatically stabilises the impacts of recessionary or expansinory states of the economy. As a result, in our analysis, we only let budget categories of revenues react to short-run GDP fluctuations.

Cyclically adjusted - or structural – primary budget balance is traditionally extracted from the actual budget balance figures on aggregated basis using the estimation of output gap and the estimation of weighted budget categories' sensitivities to the change in GDP in the framework of equations (1) and (2), which are given as follows:

$$CABB = BB - e * GAP \quad (1)$$

$$e = \frac{\sum e_i B_i}{\sum B_i} \quad (2)$$

where:

CABB : Cyclically adjusted budget balance (as percentage to GDP) e : Weighted elasticities of relevant budget categories

GAP : Output gap (as percentage to GDP)

e_i : Individual elasticities of relevant budget categories which react automatically to GDP fluctuations.

B_i : Relevant budget categories which react automatically to GDP fluctuations.

The same methodology described above is used in this study. The aforementioned most popular and commonly used methodology to calculate cyclically adjusted budget balance requires two separate estimations: Estimation of potential output - thus, output gap- and estimation of budget categories' sensitivities to the change in GDP. Accuracy of these estimates affects the results for structural budget balances considerably. As a result, a special care should be taken to accuracy of those estimates to ensure to obtain reliable cyclically adjusted budget balances.

3. Determining Potential Output

For the cyclically adjustment methodology we used in this study, as mentioned above, it is highly crucial to accurately estimate potential output, and thus output gap, since output gap is taken as a proxy indicating the economy's cyclical position. The difficulty with assessing the output gap is that since potential output is not directly observable, neither is the output gap.

Potential output level for an economy gives the economy's sustainable growth rate. Given that potential output can be described as a measure of the aggregate supply of an economy (Slevin, 2001), examining the concept of potential output provides a better understanding of the supply-side of the economy.

Although the concept of potential output is widely used in economic analysis, there has been a considerable divergence of opinion as to its precise definition and as to the best method of measuring it. As pointed out by Gibbs (1995), the terms "potential growth rate" and "sustainable growth rate" are often used interchangeably. Gibbs argued that:

> *"Taken literally, (potential output) means the maximum possible output of an economy if all of its resources are fully employed. For example, at one extreme we could define potential output as the level of GDP that could be produced if everbody of working age worked 24 hours per day, every day of the year. Alternatively, the term could be defined as some 'normal' level of production given 'average' factor utilisation rates."*

The term of *full-employment* is a loose one in that factors of production can not possibly be fully employed in physical sense all the time. That is, full-employment of factors of production in the definition of the potential output should be taken as an economic, not a physical, concept[1]. (Dornbusch and Fischer (1994), p.14) For the sake of clarity, in this study, the term of potential output should be understood as the output level that can be achieved by processing the factors of production at some reasonable average utilisation rates within the existing level of technology constraint Thus, potential output is a summary measure of the production capacity of the economy.

The actual level of output produced in the economy is measured by the level of real GDP. Output gap, on the other hand, stands for the deviation of the actual output from its potential level and represents the cyclical position of the economy. Output is not always at its potential level. Rather output fluctuates around its trend potential depending on the existence of excess demand or excess

[1] Physically, labour is fully employed if everyone is working 24 hours per day all year. In economic terms, there is full employment of labour when everyone who wants a job can find one within a reasonable amount of time. Capital, similarly, is never fully employed in a physical sense; for instance, office buildings, which are part of the capital stock, are used only part of the day. (Dornbusch and Fischer (1994), p.14)

supply. That is, were the actual output below its potential level, i.e. negative output gap, that would imply that the economy was going through a recessionary state in which unemployment increases and less output is produced than can in fact be produced with the existing resources and technology. Output level above the potential, i.e. positive output gap, whereas, would imply that economy was experiencing an expansionary state in which employment of factors of production increases beyond some ‘normal’ level of employment consistent with the existing amount of resources available in the economy and level of technology.

3.1. Estimating Potential Output

There are two pervasively used approaches to estimate potential output: Production function approach and trend smoothing approach. In this study, assuming that productive potential of the Turkish economy grows at a fairly steady state, two of the statistical trend estimation methods are applied to estimate the potential output – HP filter and split linear time trend. One important empirical finding from the previous studies is that potential output estimates can vary considerably amongst different approaches (see Gibbs (1995), Cronin and McCoy (1999)). The reasons for such a high variation of potential output estimates from different methodologies are beyond the scope of this paper.

We only applied two different types of trend smoothing approaches to estimate the potential output level for Turkey over the period from 1968 to 2005[2]. These are a split time trend and a Hodrick-Prescott filter (under the assumption of setting the smoothing parameter equal to 100 for annual estimations). Alongside these trend smoothing approaches, so as to estimate potential output level, a Cobb-Douglas production function based potential output estimations are also applied in the literature. For the case of Turkey, however, since there is not any

[2] We assumed that GDP will grow 4% in the year 2002 and 5% each year thereafter throughout the period from 2003 to 2005.

available data sets for capital stock series, we prefered not to attempt to estimate potential output by using Cobb-Douglas production function approach. Because had we applied this production function approach, potential output estimates would have relied on constructed capital stock estimates under various sets of assumptions. More technical discussion about different methodologies to estimate potential output can be found in Gibbs(1995).

Hodrick-Prescott Filtering Methodology

While the HP filter has been frequently criticised in the statistical literature, it continues to be the most commonly used filter in empirical studies and policy analysis to identify trend components in all kinds of macroeconomic series. (ECB Working Paper, 2001)

Hodrick and Prescott (1980) propose an optimisation procedure to calculate the trend of a given series of y where the objective is to minimise the sum of squared deviations of the actual data series around its trend subject to a constraint on the variation of the growth rate of this trend.

The HP filter calculates the trend as the solution to the following minimisation problem:

$$\underset{(y_t^P)}{\text{Min}} \sum \left[(y_t - y_t^P)^2 + \lambda \left[(y_{t+1}^P - y_t^P) - (y_t^P - y_{t-1}^P) \right]^2 \right] \tag{3}$$

Where y_t and y_t^P are the logs of real GDP and trend output, respectively. $(y_t - y_t^P)^2$ represents the sum of squared deviations of actual output from its trend. $\lambda\left[(y_{t+1}^P - y_t^P) - (y_t^P - y_{t-1}^P)\right]^2$ represents a penalty function which penalises the squared deviations in the growth rate of the trend component. λ is the weighting factor that controls how smooth the resulting trend line is. (Slevin 2001) The minimisation problem yield smoother trends as λ increases. A low value of λ will produce a trend line that follows actual output very closely, whereas a high value of λ will produce an estimate of potential output series which follow a more ragged path . For λ =0, for instance, the trend line will coincide with the actual series. Although there is not any commonly agreed value for the smoothness parameter, the industry standard for annual data is to set the value of λ equal to 100.

There are a number of problems in applying the HP filter. First, HP filter methodology suffers from the so-called 'end-point bias'. If the begining and the end of the data set do not reflect similar points in the cycle, then the trend will be pulled upwards or downwards towards the path of actual data for the first few and last few observations (Giorno et al., 1995). Since this phenomenon especially occurs for the last three or four observations, one possibility to correct for this bias is to extend the data set by adding GDP forecasts over a range of three to five years. To alleviate this problem in this study, GDP growth assumptions have been used, which extends the sample out to 2005. The second drawback of HP filtering methodolgy is that it can not reflect the impacts of structural breaks that may have occured. Like all trend calculations based on two-sided moving average, HP filter is not able to detect and reflect sudden breaks of trends. Although this problem becomes less severe the smaller the value of λ used, there is not any satisfactory way to get rid of misestimations in HP filtering methodology caused by structural breaks. To this end, it is worth noting that, in the recent past, some structural breaks in GDP growth rates for Turkey were observed.

Split Time Trend Methodology

Since HP filtering methodology is not able to catch the affects of structural breaks and there is no easy way to overcome this problem in HP filtering framework itself, the HP filtering approach for estimating potential output that fits a trend through all the observations of real GDP ragardless of any structural breaks may not be appropriate for Turkey. As a result, to solve the structural breaks problem to some extent, we also applied split time trend approach to model potential output. This approach uses time trends by allowing discrete breaks in the trend line to the plot of GDP growth rates (Slevin, 2001). The drawback of this approach, however, is that it requires substantial subjective judgement in the choice of segment endpoints. Besides, this approach allows the estimated trend growth to change between cycles, but not within each cycle (Giorno et al., 1995)

As can be seen from Figure 1, Turkish GDP growth rates displayed significant variation over the period 1969-2001. We allowed for a break in the trend in 1976, 1980, 1987, 1999 and 2002.

(Insert Figure 1)

The regression equation to be estimated is in line with the specification and methodology proposed by Slevin (2001), which is given as follows:

$$\ln(GDP_t) = \alpha_1 W_{1t} + \alpha_2 W_{2t} + \alpha_3 W_{3t} + \alpha_4 W_{4t} + \alpha_5 W_{5t} + \alpha_6 W_{6t} + \text{constant} \quad (4)$$

where $W_{1t} = T$

and $W_{2t} = 0$ if $T \leq a$, $W_{3t} = 0$ if $T \leq b$, $W_{4t} = T \leq c$, $W_{5t} = T \leq d$, $W_{6t} = T \leq e$

thus

$$W_{2t} = T - a \text{ if } a < T,\ W_{3t} = T - b \text{ if } b < T,\ W_{4t} = T - c \text{ if } c < T,$$
$$W_{5t} = T - d \text{ if } d < T,\ W_{6t} = T - e \text{ if } e < T$$

With the break years chosen as 1976, 1980, 1987, 1999 and 2002, a = 8, b = 12, c = 19, d = 31 and e = 34. The estimated equation is given as follows[3]:

$$\ln(GDP_t) = \underset{(16.62)}{0.059W_{1t}} - \underset{(-5.59)}{0.049W_{2t}} + \underset{(4.83)}{0.042W_{3t}} - \underset{(-2.39)}{0.011W_{4t}} - \underset{(-5.09)}{0.053W_{5t}} + \underset{(3.42)}{0.066W_{6t}} + \underset{(574.12)}{10.32} \qquad (5)$$

$$R = 0.996 \qquad DW = 1.76$$

The fit of the regression is very high, and all the coefficents are highly significant. Between 1968 and 1976, the growth rate of potential output is estimated to have been (α_1) 5.9 percent, and decreased to ($\alpha_1 + \alpha_2$) 0.9 percent between 1976 and 1980. Between 1981 and 1987, the potential output growth rate of the economy rose to ($\alpha_1 + \alpha_2 + \alpha_3$) 5.1 percent, and then fell to ($\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4$) 4 percent between 1988 and 1999. From 2000 to 2002, the growth rate of potential output is expected to decrease sharply to ($\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 + \alpha_5$) –1.2 percent and then to rise to ($\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 + \alpha_5 + \alpha_6$) 5.4 percent between 2003 to 2005.

Since there are a number of empirical methods that are used to calculate potential output and all yield significantly different results, policymakers should not place too great reliance on the potential outcome measure from one single measurement method when these estimates are used to guide macroeconomic policy decisions. As Laxton and Tetlow (1992) noted, regardless of the method used, estimates of potential output should be interpreted with caution, since the confidence bands around such estimates are quite wide.

[3] The reported regression estimation is obtained from E-Views and corresponds to 35 observations.

4. Determining Income Elasticity of Budgetary Categories[4]

Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary, or I(0), linear combination exists, the non-stationary (with a unit root), time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship between the variables. In this study, we applied Johansen methodology to identify the long-run equilibrium (cointegrating) relationships of budget categories with GDP, and hence obtained the long-run income elasticities of budget categories.

The procedure proposed by Johansen (1988) and Stock and Watson (1988) tests the existence of cointegration relationship among variables in the vector autoregressive (VAR) representation. This methodology gives maximum likelihood estimators of the unconstrained cointegration vectors. It is superior to Engle-Granger's (1987) two step procedure in the sense that it allows one to estimate and test for the presence of multiple cointegrating vectors. The estimated form of the model VAR(p) is

$$x_t = \alpha + \gamma_1 x_{t-1} + \gamma_2 x_{t-2} + \ldots + \gamma_p x_{t-p} + \varepsilon_t \qquad (6)$$

where

x_t = the ($n \times 1$) vector of variables

α = ($n \times 1$) vector of constants

γ_i = ($n \times n$) matrices of coefficients

ε_t = ($n \times 1$) vector of error terms

this equation can be rewriten in the form given below:

[4] All regression results are obtained from E-Views.

$$\Delta x_t = \alpha + \sum_{i=1}^{p-1} \Gamma_i \, \Delta x_{t-i} + \Gamma \, x_{t-p} + \varepsilon_t \tag{7}$$

where

$\Gamma \quad = -(I - \sum_{i=1}^{p} \gamma_i)$

$\Gamma_i \quad = -(I - \sum_{j=1}^{i} \gamma_j)$

The key feature to note in equation (7) is that the term $\Gamma \, x_{t-p}$ constitutes the error correction factor and the rank of the long-run matrix Γ is equal to the number of independent cointegrating vectors. Since there are n explanatory variables which constitute the x_t vector, if rank(Γ) is equal to n, the matrix Γ is said to be of full rank which implies that all variables in x_t are I(0) processes. If rank(Γ) is equal to $r<n$, there are r linearly independent combinations of the x_t sequences that are stationary (Enders, (1995)). The test for the number of charasteristic roots that are insignificantly different from unity can be conducted using the following two test statistics:

$$\lambda_{trace}(\text{r}) = -\text{T} \sum_{i=r+1}^{n} \ln(1-\hat{\lambda}_i) \tag{8}$$

$$\lambda_{\max}(\text{r,r+1}) = -\text{T} \ln(1-\hat{\lambda}_{r+1}) \tag{9}$$

where

$\hat{\lambda}_i$ = the estimated values of the characteristic roots (also called eigenvalues) obtained from the estimated Γ matrix

T = the number of observations

The first statistic tests the null hypothesis that the number of distinct cointegrating vectors is less than or equal to r against a general alternative. It is clear that λ_{trace} equals zero when all λ_i = 0 and the further the estimated characteristics roots are from zero, the larger the λ_{trace} statistics. The second statistic tests the null hypothesis that the number of cointegrating vectors is r against the alternative r+1.

Given that the series of *ln Dtax*, *ln Indtax*, *ln Othrev* and *ln GDP* are I(1) processes (see Table 1), we estimated three different VAR systems using annual data of observed revenue budget categories and GDP over the period from 1979 to 2001 and determined the ranks of the three different matrices of Γ. The lag lengths for three different VAR systems are selected using multivariate generalization of the AIC (see Table 2). While the optimum lag length is indicated as two for *ln Othrev*, for the variables of ln Dtax and *ln Indtax,* the optimum lag lengths appear to be one.

(Insert Table 1 and 2)

So as to determine the appropriate deterministic trend assumptions, we chose the one amongst the five different possibilities considered by Johansen (see Johansen, 1995, pp. 80–84 for details) which indicates that there is one cointegrating equation in the system. In this study, assuming that all of the revenue categories of budget - *ln Dtax*, *ln Indtax* and *ln Othrev* - have no deterministic trends and the cointegrating equations do not have intercepts appears to be appropriate to have a single cointegrating equations in the VAR systems used for those three variables.

The results of both maximum eigenvalue and trace statistics support the hypothesis that there is one cointegrating relationship between each budget revenue category and GDP (see Table 3).

(Insert Table 3)

The normalized cointegrating coefficients drived from cointegrating equations represent the elasticity of each budgetary category with respect to GDP.

5. Empirical Results

Looking at Table 4, for the most commonly used traditional methodology, it can be observed that estimated cyclically adjusted primary budget figures are highly sensitive to (1) income elasticity of budget categories and (2) calculated output gaps, and consequently the estimated potential output path of the economy. Given this fact, a special care should be taken to ensure the reliability of estimates for relevant elasticities to GDP and potential output

(Insert Table 4)

Our empirical findings based on weighted income elasticity of budget categories and two different sets of output gap measures are reported in Table 4. As can be seen from the last two columns of Table 4, CAPB measures can differ significantly depending on different output gap series obtained from two different methodologies used in this study. As a result, measured cyclically adjusted primary balance figures should be approached with some caution as they depend on the estimated cyclical position of the economy, which is relatively uncertain. In addition, as CAPB projections for the coming years are concerned, differences in underlying macroeconomic and fiscal projections can be counted as other factors which have significant impacts on CAPB projections. In this study, we used the government's primary balance target for 2002, which is 5.6 as percentage to GDP, GDP growth assumption for 2002, which is taken as 4 percent. Thus, CAPB projection for 2002 is given under the assumptions that primary budget target for 2002 will be achieved and that GDP will grow 4 percent in 2002. Our findings indicate that CAPB will be 9.5 as percentage to GDP on the basis of output gap estimates from HP filtering methodology and 9.9 as percentage to GDP on the basis of output gap estimates from split time trend methodology. It is worth to stress out that point estimates produced using any one method should be seen as indicative rather than precise estimates.

Supposing that observed movement in cyclically adjusted primary balance figures is only due to output gap, i.e. that how much economy produces below or above the potential, and therefore that actual primary balance figures are sterilised from the impacts of other temporary influences such as unexpected expenditure increases within a given year or structural reforms such as tax reforms, we have two similar expectations given as follows:

Expectation 1: Given that the economy is producing above its trend potential level and that primary balance is in deficit ***(surplus)***, we expect that primary budget deficit ***(surplus)*** would happen to rise ***(decrease)*** if production level of the economy fell back onto its trend potential.

Expectation 2: Given that the economy is producing below its trend potential level and that primary balance is in deficit ***(surplus)***, we expect that primary budget deficit ***(surplus)*** would happen to decrease ***(rise)*** if production level of the economy could be risen up to its trend potential.

In order to test the realisation of these expectations under aforementioned very restrictive assumption, we investigated the movements of actual primary balance, of cyclically adjusted primary balance, and of output gap (all in terms of as percentage to GDP) over the period from 1979 to 2002. Our findings are depicted in Figure 2, 3 and 4:

(Insert Figure 2, 3 and 4)

As can be seen from Figure 2 and 3, our findings live up to our expectations.

6. Conclusion

Cyclically adjusted primary balance figures indicate what would have been the primary balance if the economy had managed to produce at its potential. The actual primary balance may be a misleading indicator since it also reflects the temporary effects of the cyclical deviations of output from its underlying trend. In order to disentangle these temporary influences of output gap on the government's primary balance and get a clear picture of the budgetary performance several techniques have been developed. In this paper most commonly used traditional methodology is used on aggregated basis to calculate the cyclically adjusted primary balance of Turkey over the period from 1979 to 2002.

The results point out that recession periods together with the tight fiscal policies have significant effects on 'would-be' primary budget balance had the economy managed to produce at its potential. Overall the year 2002 is expected to be a restrictive year on the fiscal side and the output level is expected to be well below its potential level. The estimation outcome implies that the cyclically adjusted primary budget balance surplus will be much higher than the targeted primary budget surplus in 2002.

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Figures and Tables

Figure 1: Real GDP Growth

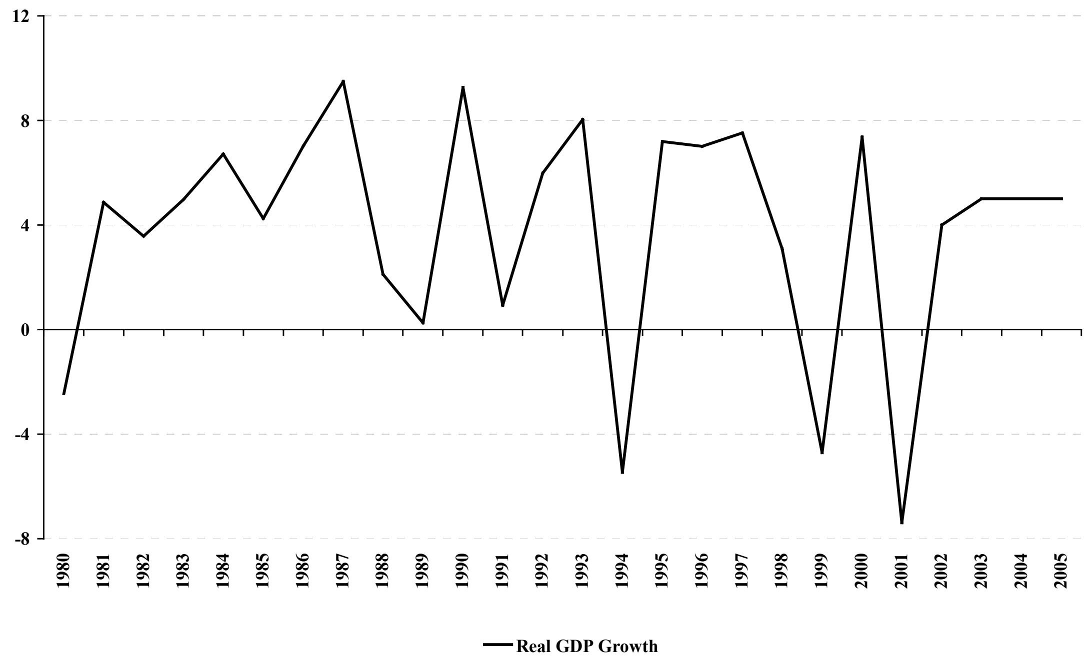

Figure 2: Cyclically Adjusted Primary Balance

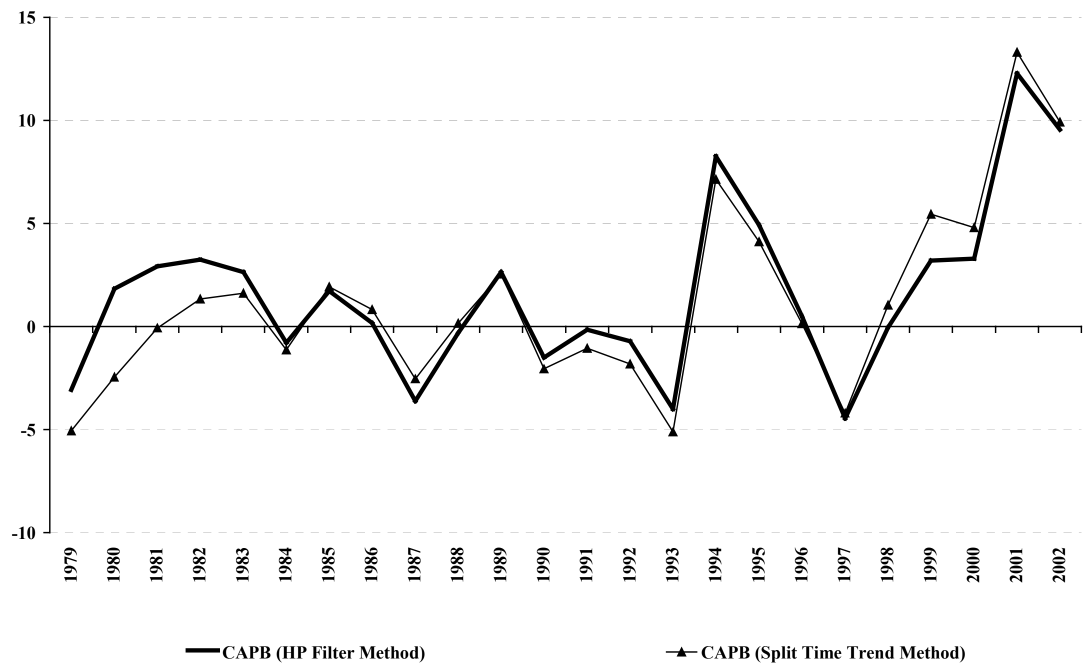

Figure 3: Cyclically Adjusted Primary Balance

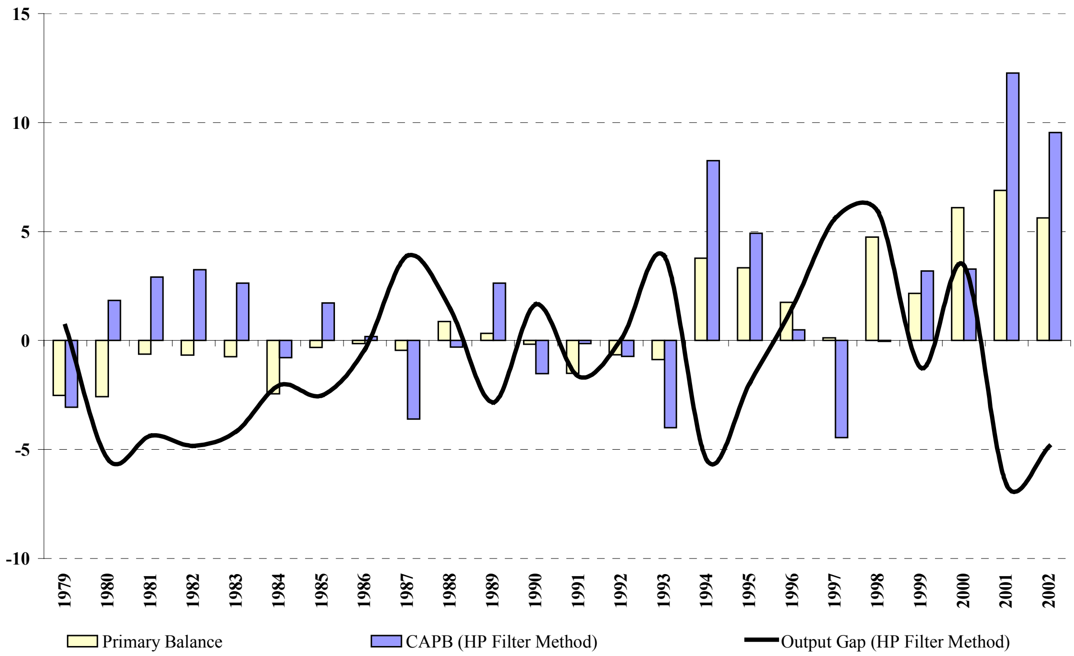

Figure 4: Cyclically Adjusted Primary Balance

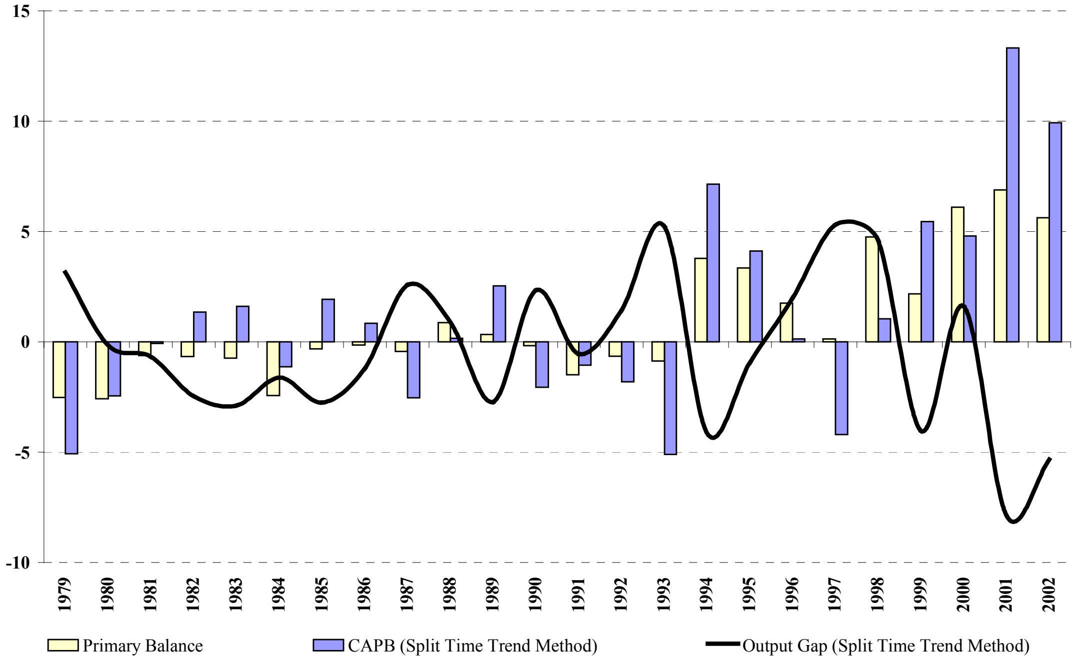

Table 1: Unit Root Test Results

Variables	ADF Tests	First Difference ADF Test
ln (GDP)	-1.656	-3.165 *
ln (Dtax)	-0.084	-3.510 *
ln (Indtax)	1.190	-3.216 *
ln (Othrev)	0.338	-3.720 *

Critical values of ADF statistic for levels and for first differences at 1% and 5% significance are -3.786, -3.011 and -3.807, -3.02 respectively.

*** Rejection of the hypothesis of a unit root.**

Table 2: Model Selection Criteria

Determination of the optimum lag length

Alternative Models	*ln* (Dtax)	*ln* (Indtax)	*ln* (Othrev)
VAR (1)	-4.683768 *	-4.642545 *	-3.378678
VAR (2)	-4.393626	-4.476958	-3.63641 *
VAR (3)	-4.609609	-4.479005	-3.425349
VAR (4)	-4.405937	-4.544296	-3.276961

Multivariate Generalization of Akaike Information Criterion

Table 3: Long-run Relationship between budget categories and GDP

$$ln\,(Dtax_{t}) = \beta\; ln\,(GDP_{t}) + u_{t}$$

Long-run relationship between direct taxes and GDP(-1)

rank	Eigenvalue	l_{max}	l_{trace}	5 Percent Critical Value	1 Percent Critical Value	Hypothesized number of cointegrating equation(s)	β
0	**0.491**	**14.8**	**16.4**	**12.53**	**16.31**	**None ***	**0.80**
1	**0.069**	**1.6**	**1.6**	**3.84**	**6.51**	**At most 1**	

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

$$ln\,(Indtax_{t}) = \alpha\; ln\,(GDP_{t}) + e_{t}$$

Long-run relationship between indirect taxes and GDP

rank	Eigenvalue	l_{max}	l_{trace}	5 Percent Critical Value	1 Percent Critical Value	Hypothesized number of cointegrating equation(s)	α
0	**0.422**	**12.1**	**13.5**	**12.53**	**16.31**	**None ***	**0.84**
1	**0.064**	**1.4**	**1.4**	**3.84**	**6.51**	**At most 1**	

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

$$ln\,(Othrev_{t}) = \phi\; ln\,(GDP_{t}) + \varepsilon_{t}$$

Long-run relationship between other revenues and GDP

rank	Eigenvalue	l_{max}	l_{trace}	5 Percent Critical Value	1 Percent Critical Value	Hypothesized number of cointegrating equation(s)	ϕ
0	**0.57**	**18.7**	**18.8**	**12.53**	**16.31**	**None ****	**0.78**
1	**0.01**	**0.1**	**0.1**	**3.84**	**6.51**	**At most 1**	

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

Table 4: Cyclically Adjusted Primary Balance

	Primary Balance	Weighted Budget Elasticity with respect to GDP	Output Gap (HP Filter Method)	Output Gap (Split Time Trend Method)	CAPB (HP Filter Method)	CAPB (Split Time Trend Method)
1979	-2.5	0.810	0.7	3.1	-3.1	-5.1
1980	-2.6	0.809	-5.5	-0.2	1.8	-2.5
1981	-0.6	0.810	-4.4	-0.7	2.9	-0.1
1982	-0.7	0.812	-4.8	-2.5	3.3	1.3
1983	-0.7	0.811	-4.2	-2.9	2.6	1.6
1984	-2.4	0.811	-2.0	-1.6	-0.8	-1.1
1985	-0.3	0.814	-2.5	-2.8	1.7	1.9
1986	-0.1	0.813	-0.4	-1.2	0.2	0.8
1987	-0.4	0.815	3.9	2.6	-3.6	-2.5
1988	0.9	0.812	1.4	0.9	-0.3	0.1
1989	0.3	0.812	-2.8	-2.7	2.6	2.5
1990	-0.2	0.812	1.7	2.3	-1.5	-2.1
1991	-1.5	0.812	-1.7	-0.5	-0.1	-1.1
1992	-0.7	0.812	0.1	1.4	-0.7	-1.8
1993	-0.9	0.811	3.9	5.2	-4.0	-5.1
1994	3.8	0.812	-5.5	-4.1	8.3	7.1
1995	3.3	0.813	-1.9	-0.9	4.9	4.1
1996	1.8	0.816	1.5	2.0	0.5	0.1
1997	0.1	0.816	5.6	5.3	-4.5	-4.2
1998	4.7	0.812	5.9	4.6	0.0	1.0
1999	2.2	0.813	-1.3	-4.0	3.2	5.5
2000	6.1	0.814	3.4	1.6	3.3	4.8
2001	6.9	0.813	-6.6	-7.9	12.3	13.3
2002	5.6	0.806	-4.9	-5.3	9.5	9.9

* All variables except elasticity are defined as percentage to GDP.