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Structural Fiscal Balance Estimates for the Economy of Cyprus

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Summary

This paper provides estimates for the structural fiscal balance for the economy of Cyprus. The calculation of the structural fiscal balance is useful since it provides a clearer picture of the underlying fiscal situation in an economy by abstracting from the impact of the business cycle. As a result, it can be used to guide fiscal policy analysis. The entry of Cyprus into the European Union has increased the importance of knowing the structural fiscal balance figures as this can provide valuable information used in EU surveillance procedures such as the Stability and Growth Pact.

The estimated values of the elasticities of the various categories of tax revenues with respect to the level of output, on which the calculation of the structural fiscal balance is based, are in agreement with what one would expect from economic theory and from the tax structure of Cyprus. The results indicate that the structural budget balance expressed as a percentage of the nominal GDP tends to follow a path similar to the corresponding year's actual overall balance expressed as a percentage of the nominal GDP. As expected the structural fiscal balance figures fluctuate in a slightly narrower band than the current balance figures, with the 'budget sensitivity' for the economy of Cyprus being equal to 0.3.

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CONTENTS

I. INTRODUCTION 1

II. METHODOLOGY 3

II.1. Government Revenue Elasticities 5

II.2. Expenditure elasticities 7

II.3. Sensitivity of structural budget balance to the elasticity estimates 7

III. EMPIRICAL RESULTS 9

III.1 Governent Revenue Elasticities with Respect to Output 9

III.2 Structural Fiscal Balance 10

III.3 The Budget Sensitivity to the Output Gap 13

III.4 Stability and Growth Pact 14

III.5 Sensitivity of Structural Fiscal Balance to the Elasticity Estimates 17

IV. CONCLUSION 20

REFERENCES 21

APPENDIX A: ESTIMATING THE GOVERNMENT REVENUE ELASTICITIES 22

APPENDIX B: THE STANDARD ERRORS OF ELASTICITIES 24

APPENDIX C: PARAMETER ESTIMATES AND DIAGNOSTIC TESTS 26

I. INTRODUCTION

The structural or cyclically adjusted fiscal balance is defined as the fiscal balance that would prevail, if output was at its potential level and therefore not reflecting cyclical aspects in economic activity. Hagemann (1999) defines the structural fiscal balance, "as the residual balance after purging the actual balance of the estimated budgetary consequences of the business cycle". Government revenues and to a lesser extent expenditures are affected by the cyclical position of the economy largely due to the effect of automatic stabilisers. For example a recession that brings with it increased unemployment will force the government to pay out more in unemployment benefits. At the same time tax revenues can be reduced if, say, the recession reduces the amount paid in income tax by lowering household income. Therefore, the calculation of the structural fiscal balance is useful, as it provides a clearer picture of the underlying fiscal situation by abstracting from the impact of the business cycle. As a result, it can be used to guide fiscal policy analysis.

In the case of Cyprus, the structural fiscal balance has gained increased importance after entry into the European Union: the Economic and Monetary Union (EMU) does not allow member-states to follow an independent monetary policy and use exchange rate instruments at the national level to aid the stabilisation of their economies facing asymmetric shocks. This implies a greater role for automatic fiscal stabilisers, and fiscal policy in general, in the economic stabilisation process. Consequently, the structural fiscal balance can and does play a key role in the EU surveillance procedures, especially in the Stability and Growth Pact[1]. The condition of the Pact concerning the ratio of government deficit to GDP refers to the actual rather than the structural deficit and the issue of whether the Pact should concentrate more on the structural fiscal balance has been the cause of many discussions. Canzoneri and Diba (2000) argue that the

[1] The third stage of the EMU started from 1 January 1999, with the irrevocable fixing of the exchange rates and the introduction of the single currency on the foreign exchange markets and for electronic payments. This was followed by the introduction of the euro notes and coins from 1 January 2002. The Stability and Growth Pact was adopted at the Amsterdam European Council in June 1997 and it began on 1 January 1999. Its aim is to ensure that the Member States continue their budgetary discipline efforts after the start of the third stage of the EMU. The criteria for the budgetary discipline are that, the ratio of government deficit to gross domestic product (GDP) must not exceed 3% and that the ratio of government debt to GDP must not exceed 60%.

Pact's "excessive deficit" procedure is likely to constrain counter-cyclical fiscal efforts, as was proven by the recent case with Germany and France both violating the Pact's condition, unless the structural deficits are brought into balance. They therefore recommend that the focus of the Pact changes away from limits on actual deficits, and towards limits on structural deficits and/or debt levels. An interesting point examined in this paper is how Cyprus' structural fiscal balance position compares with the criteria of the Stability and Growth Pact.

In October 2002 the Eurogroup decided to commit itself to a reduction in the level of budget deficit as a percentage of GDP by 0.5% of GDP annually starting from 2003. The reasoning behind this move was the achievement of a budgetary position close to balance or in surplus which would then allow the Eurozone countries to respond to asymmetric recessions by fiscal expansion (even if just through automatic stabilisers) without violating the Pact's conditions. In March 2003, the ECOFIN Council recommended that the achievement of and the progress towards budgetary positions of close to balance or in surplus should be assessed using structurally adjusted terms. It is clear, therefore, that the structural fiscal balance can provide valuable extra information about the fiscal position of governments and, in this way, can contribute to the EU surveillance procedures.

The methodology used for the estimation of the structural fiscal balance in this paper is similar to that developed in Giorno et.al. (1995).This approach involves the estimation of elasticities with respect to output for the various government revenue and expenditure categories. These elasticities, together with the estimated gap between the potential and actual output, are then used to calculate the structural (free of cyclical effects) tax revenues and expenditures.

The structure of the paper is as follows. Section 2 outlines the methodology used for the estimation of the structural fiscal balance. Section 3 describes the Cyprus data used in the application of this methodology and reports and discusses the empirical results. Section 4 draws the main conclusions of the paper.

II. METHODOLOGY[2]

We denote actual budget balance in year t by B_t. This consists of a cyclical ($B_{c,t}$) and a structural ($B_{s,t}$) component. In the case where the output gap is zero, that is when the actual level of output equals the potential, then the structural and the actual overall balances should coincide (the cyclical component of the budget balance is zero).

Based on the above definition, the structural fiscal balance is given by

$$B_t = B_{c,t} + B_{s,t}\,. \tag{1}$$

The above can be expanded into

$$B_t = (R_{c,t} - E_{c,t}) + (R_{s,t} - E_{s,t})\,, \tag{2}$$

where the R variables denote tax revenues and the E variables government expenditures. In each case the c and s subscripts indicate whether the variable is the cyclical or the structural component, respectively.

The structural fiscal balance is then given by

$$B^* = \sum T_i^* - G^*\,, \tag{3}$$

where: B* = structural fiscal balance;

T_i* = structural tax revenues for the ith category of tax;

G* = structural government expenditures.

Equations (2) and (3) simply state that the structural budget balance is the difference between the structural revenues and the structural expenditures of the government. Structural revenues (expenditures) are defined as the revenues (expenditures) that the government would receive (spend) when output is at its potential level. As such they do not include cyclical revenues (expenditures).

[2] The description of the methodology for the calculation of the structural fiscal balance in this section draws heavily on Giorno et.al. (1995)

It follows from above that it is necessary to identify the components of the actual overall balance that are affected by the cyclical position of the economy. The overall balance is the sum of tax, non tax and capital revenues and grants from which net lending and current and capital expenditures are excluded.

The categories of tax revenue affected by the cyclical position of the economy are: corporate taxation, direct taxation (excluding corporate taxation), social security contributions, and indirect taxation. This is because the revenue raised by these taxes depends on the value of economic transactions and the level of economic activity in the economy. Therefore the structural (and hence the cyclical) components of the above mentioned four categories of tax revenues need to be calculated. For the calculation of the structural component of government expenditure, only social security payments are normally affected by cyclical movements in the economy: when the output is below its potential level, the government spending on social security increases due to rise in the number of unemployment claimants.[3]

The actual government expenditures and tax revenues are used for the estimation of the components of the structural fiscal balance. Use is made of the property that each component of the budget is adjusted proportionately to the ratio of potential output to actual output, as determined by its elasticity. This can be observed in the equation

$$\frac{T_i^*}{T_i} = \left[\frac{Y^*}{Y}\right]^{\alpha_i}, \qquad \frac{G^*}{G} = \left[\frac{Y^*}{Y}\right]^{\beta}, \tag{4}$$

where: T_i = actual tax revenues for the ith category of tax;

G = actual government expenditures;

Y = level of actual output at constant 1995 prices;

3 These are standard assumptions in empirical estimates of the fiscal deficit. It is worth noting, however, that the Congressional Budget Office (CBO) also calculates the Standardized-Budget Surplus (or Deficit) which excludes not only cyclical but also other effects from factors that are "clearly short-lived and that are unlikely to affect real income significantly in the short run". Such factors include "unusually large discrepancies between tax payments and liabilities, swings in collections of capital gains taxes, changes in the inflation component of the government's net interest payments, and temporary legislative changes in the timing of revenues and outlays" (Congressional Budget Office 2004).

Y* = level of potential output at constant 1995 prices;

α_i = elasticity of the i^{th} tax category with respect to output; and

β = elasticity of current government expenditures with respect to output.

From the above equations it follows that the structural fiscal balance is given by

$$B^* = \sum_{i=1}^{4} T_i \left[\frac{Y^*}{Y}\right]^{\alpha_i} - G\left[\frac{Y^*}{Y}\right]^{\beta}, \quad \text{where} \quad \alpha_i>0,\ \beta<0. \tag{5}$$

The key elements in equation (5) that need to be estimated in order to proceed with the calculation of the structural fiscal balance are the potential level of output and the various government revenue and expenditure elasticities. For the potential level of output we use the estimates obtained by Haroutunian et.al. (2003).The estimation of the government revenue and expenditure elasticities is explained in the subsections II.1 and II.2 below.

II.1. Government Revenue Elasticities

As indicated above, there is the need to calculate the elasticities of four tax revenue categories with respect to the level of output:

- corporate taxes,
- indirect taxes,
- other direct taxes (excluding corporate taxes), and
- social security contributions.

The methodology used is similar to that which appears elsewhere (e.g. Giorno et.al. 1995). In the text below we highlight the main features of the methodology, as applied in our analysis, while in Appendix A we describe the standard approach to estimating the government revenue elasticities.

Regarding corporate taxation, the standard approach to calculating the corporate taxation elasticity is by regressing the log of corporate tax revenues on the log of the level of output, both in current prices. The coefficient of the log of the level of output variable then gives (by definition) the elasticity of that particular tax revenue with respect to the level of output. This method results in an 'average' elasticity over the whole period and is not appropriate when changes in the

corporate tax revenues are caused by structural changes (such as corporate tax reforms) rather than the automatic stabiliser effects.

We alter this approach to allow for changes in the corporate tax elasticity with respect to the level of output through the introduction of interactive (multiplicative) dummy variables. More specifically we estimate the equation

$$LogCT_t = c + \alpha LogY_t + \beta D * (LogY_t) + D74 + \gamma LogCT_{t-1} + \varepsilon_t \qquad (6)$$

where *c* is an intercept term, CT_t is corporate tax revenue in period t, Y_t is nominal GDP in period t, *D* is a dummy variable that takes the value 1 in the last three years of our sample and 0 otherwise and *D74* is an intercept dummy that takes the value 1 in the years 1974 and 1975 (the years that government receipts and expenditures were affected by the Turkish invasion) and 0 otherwise. The one-period lag of the dependent variable (CT_{t-1}) is included to account for autoregressive behaviour in the data. The error term ε_t is assumed to be normally and independently distributed with zero mean and constant variance. The average short-run elasticity of corporate tax revenue with respect to output for the whole period is given by α whereas the short run elasticity for the last three years will be given by $\alpha+\beta$ provided that β is significant. The long-run elasticity, which is what interests us most, is given by $\alpha/(1-\gamma)$ and $(\alpha+\beta)/(1-\gamma)$ respectively.

The elasticity of indirect taxation with respect to the level of output is also calculated using an equation similar to (6), however, the dummy variable *D* takes the value 1 for the years 1992 onwards and 0 otherwise. This is because after 1992 there were changes in the structure of indirect taxation due to the introduction of VAT.[4]

For the calculation of the elasticity of direct taxes (excluding corporate taxation) and the elasticity of revenue from social security contributions with respect to

[4] This year is also somewhere in the middle of period 1987-1996 during which tariffs were gradually harmonised with the EU as part of the Customs Union agreement with the EU. The increases in the general VAT rate in 1993 and 2000 are not modelled as multiplicative dummies since they do not constitute a change in the tax structure and hence do not affect the value of the elasticity. They would have constituted a change in the tax structure if there was a change in the categories of goods and services covered by VAT. As will be seen in the results, the elasticity for the period 1985 to 1991 was different from that of 1992 to 2001.

output, an equation similar to (6) is also used, with the dummy variable *D* this time defined to take the value 1 in the year 2002 because of the changes in the income tax system in this year.

II.2. Expenditure elasticities

In general, government expenditures are less responsive to the cyclical position of the economy, except for the unemployment benefits. In the case of Cyprus, however, this category of government expenditure can also be assumed to be independent of the cyclical position of the economy since the unemployment rate appears to be stable, close to the NAIRU estimates[5]. Consequently, in the analysis here it is assumed that the elasticity of government expenditure with respect to output is zero.

It is worth noting here that Giorno et.al. (1995) base the expenditure elasticities on the elasticity of the unemployment rate with respect to output (which is the reciprocal of the Okun coefficient[6]) multiplied by the elasticity of the unemployment benefits with respect to unemployment. This provides the elasticity of the amount paid out in unemployment benefits with respect to output. It is assumed that this can then be applied for all categories of current government expenditure.

II.3. Sensitivity of structural budget balance to the elasticity estimates

Given the importance of the elasticity estimates in the calculation of the structural fiscal balance, we investigate the extent to which the statistical error affects the final outcome of this calculation by defining a range within which the estimated structural fiscal balance is expected to be with a 95% probability. This range is calculated using the estimated elasticity plus or minus 1.96 times its standard error, approximated by the square root of the variance of the elasticity,

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[5] For the actual values and the methodology used for the breakdown of the unemployment rate into its trend (NAIRU) and cyclical components please refer to table A3 in the Appendix and section III of Haroutunian et.al. (2003).

[6] Okun's coefficient shows the percentage decline in the annual growth rate of GDP as a result of a one-percentage-point increase in the rate of unemployment. Okun's coefficient varies through time with the original being 3 and the current being 2.

$$Var(e) \cong \begin{pmatrix} \frac{\partial e}{\partial \alpha} & \frac{\partial e}{\partial \gamma} \end{pmatrix} \begin{pmatrix} Var(\alpha) & Co\,\mathrm{var}(\alpha,\gamma) \\ Co\,\mathrm{var}(\gamma,\alpha) & Var(\gamma) \end{pmatrix} \begin{pmatrix} \frac{\partial e}{\partial \alpha} \\ \frac{\partial e}{\partial \gamma} \end{pmatrix}, \quad (7)$$

where e is the estimated elasticity. Equation (7) is based on a Taylor expansion, the derivation of which is provided in Appendix B.

In the case of the long-run elasticity, given by $(\alpha+\beta)/(1-\gamma)$, the variance is approximated by the expression

$$Var(e) \cong \begin{pmatrix} \frac{\partial e}{\partial \alpha} & \frac{\partial e}{\partial \beta} & \frac{\partial e}{\gamma} \end{pmatrix} \begin{pmatrix} Var(\alpha) & Co\,\mathrm{var}(\alpha,\beta) & Co\,\mathrm{var}(\alpha,\gamma) \\ Co\,\mathrm{var}(\beta,\alpha) & Var(\beta) & Co\,\mathrm{var}(\beta,\gamma) \\ Co\,\mathrm{var}(\gamma,\alpha) & Co\,\mathrm{var}(\gamma,\beta) & Var(\gamma) \end{pmatrix} \begin{pmatrix} \frac{\partial e}{\partial \alpha} \\ \frac{\partial e}{\partial \beta} \\ \frac{\partial e}{\partial \gamma} \end{pmatrix}. \quad (8)$$

III. EMPIRICAL RESULTS

The data used for the empirical analysis were kindly supplied to us by the Ministry of Finance in the form of annual time series over the period 1970 to 2002. The variables included in the data are corporate tax revenues, indirect tax revenues, direct tax revenues excluding corporate tax revenues, social security contribution revenues, non-tax revenues, capital revenues, grants, net lending, current government expenditure and capital expenditure.[7]

III.1 Government Revenue Elasticities with Respect to Output

Table 1 shows the values of the elasticities that were obtained from the estimation of equation (6) and its modification described in the previous section. The full set of estimation results and diagnostic tests of the equations used in the calculation of the elasticities are indicated in Appendix C.

Table 1: Estimated government revenue elasticities with respect to output

Government revenue	Output elasticity
Corporate tax	1.40
Direct tax (excluding Corporate tax)	1.12
Social security contributions	1.17
Indirect tax: up to and including 1991	1.05
from 1992 onwards	1.07

The values of the elasticities that are obtained conform to expectation, given the tax system of Cyprus. More specifically, the corporate tax revenue elasticity with respect to output is considerably lower than the corresponding elasticity estimates of other countries given the flat corporate tax rate in Cyprus. This, of course, does not mean that the elasticity of this tax with respect to the level of output is neat unity because corporate profits tend to be more cyclical than the level of output (i.e. a change in the level of output leads to proportionately bigger

[7] Due to the fact that potential output figures are only available for the period 1985 to 2001 and actual tax revenue figures are only available up to 2002 it was not possible at this stage to estimate the structural fiscal balance for the period after 2001.

change in the level of corporate profits). This is reflected in the estimated elasticity of corporate tax revenue with respect to output of 1.4.

Direct tax (excluding corporate tax) revenue with respect to output is estimated to be 1.12. One would expect this elasticity to be higher than the corresponding elasticity of corporate profits on the grounds that personal income taxation is more progressive than corporate profits taxation. This, however, is not normally the case because, unlike corporate profits, labour income tends to be less cyclical than the level of output. In the case of Cyprus, another factor contributing to the relatively low elasticity of direct tax (excluding corporate tax) revenue with respect to output is the limited progressivity of the personal income tax system.

The elasticity of government revenue from the social security contributions with respect to output is estimated to be 1.17. Like corporate profits, social security payments are procyclical because reductions (increases) in the level of output reduce (increase) the number of people in employment. For example, in recession the social security payments are reduced not only due to the reduced income of those in employment but also because less people are employed. Therefore, the elasticity of government revenue from the social security contributions with respect to output is above unity, in spite of the flat rate on the basis of which these contributions are paid.

The elasticity of indirect tax revenues with respect to output are very close to one, given the proportionality of VAT, the most important component of these taxes. The fact that this elasticity is slightly above unity reflects partly the exemption from VAT of some items of low income elasticity (predominantly food) and partly the high special taxes and excises duties on some ‘luxury’ goods (e.g. expensive cars, petrol etc).

III.2 Structural Fiscal Balance

Using the above estimated elasticities, the structural budget balance was calculated through equation (5). Recall that the structural fiscal balance is the summation of the non tax revenues, capital revenues, grants and the structural components of the tax revenues from which the net lending, capital expenditure and the structural component of current government expenditure, which coincides with the actual current government expenditure due to the assumption

for zero elasticity, are deducted. Non tax revenues, capital revenues, grants, net lending and capital expenditure are assumed not to be affected by the cyclical position of the economy (i.e. consist of only structural components).

The calculated structural budget balance figures for Cyprus over the period 1985-2001 are reported in Table 2. They are expressed as percentages of nominal GDP for comparison with the conditions of the Stability and Growth Pact of the EU. In addition to the structural fiscal balance figures, the actual overall balance figures are also reported. To obtain a clearer picture of the cyclical position of the economy, which in turn will help in making the analysis clearer, we also include the output gap figures expressed as percentages of potential output.[8]

Table 2: Actual and structural budget balance

YEAR	Output Gap as % of Potential Output	Overall budget balance		Structural budget balance	
		in mill CY£	% of GDP	in mill CY£	% of GDP
1985	0.84	-71.09	-4.80	-73.96	-4.99
1986	-1.85	-54.81	-3.43	-47.74	-2.98
1987	-1.15	-102.17	-5.74	-97.40	-5.47
1988	0.55	-94.55	-4.75	-97.19	-4.88
1989	1.44	-65.97	-2.92	-74.04	-3.28
1990	2.36	-136.08	-5.32	-150.71	-5.90
1991	-2.24	-182.39	-6.82	-167.78	-6.27
1992	1.26	-147.56	-4.76	-157.27	-5.07
1993	-2.24	-77.82	-2.38	-57.42	-1.75
1994	-0.46	-51.85	-1.42	-46.99	-1.29
1995	1.97	-39.87	-1.00	-62.04	-1.55
1996	0.01	-142.05	-3.41	-142.20	-3.42
1997	-1.41	-231.22	-5.29	-213.92	-4.89
1998	-0.73	-257.59	-5.48	-247.81	-5.27
1999	-0.24	-201.29	-4.00	-197.70	-3.93
2000	0.35	-150.48	-2.73	-156.31	-2.84
2001	-0.07	-166.51	-2.83	-165.11	-2.81

As it can be seen from Table 2 the years 1991 and 1993 were characterised by the biggest negative output gaps during the period under consideration. Both

[8] These figures are obtained from Haroutunian et. al. (2003).

years were marked by falls in tourism, an extremely important sector of the Cyprus economy. The first fall in tourism was due to the First Gulf War, whereas the second was most probably caused by the appreciation of the Cyprus Pound against the UK Sterling by about 7% during the period 1992 to 1993 when the Pound Sterling was suspended from the Exchange Rate Mechanism due to speculative attacks on the UK currency. The UK constitutes the biggest source of tourism for Cyprus.

Given that tourism, constituting about 20% of the economy of Cyprus, fell by around 11% and 8% in 1991 and 1993, respectively, the output gap figures, calculated using the production function approach method, for those particular years appear exactly as would be expected on the basis of the information provided above. A negative output gap implies that actual tax revenues would be higher at the potential level of output compared to tax revenues at the lower actual level of output. This implies a negative cyclical component to the budget. In turn, through equation (1), this implies that the structural fiscal balance will be greater in value that is less negative or more positive, than the actual overall balance. This is exactly what is observed in our results.

As far as the extent of the deviation between the actual and structural budget balance is concerned, given the fact that tax revenues expressed as percentages of nominal GDP were around 29% and 32% for the years 1991 and 1993, respectively, one would expect that a negative output gap of the magnitude of 2% would be associated roughly with a reduction of tax revenues equal to 0.6% of nominal GDP. This shows that the estimated structural fiscal balance (and, hence, the implied cyclical components of the budget) fit well with developments in the Cypriot economy.

The same line of reasoning applies to the years 1989, 1990, 1992 and 1995 characterised by relatively big positive output gaps: as the actual level of output was greater than the potential level by a considerable margin the structural revenues in these years were lower than the actual revenues. This, in turn, leads to the structural budget balance being more negative (or less positive) than the current balance in each of these years.

The last three years of our sample period are characterised by a very small output gap, indicating that the economy was very close to its potential level of

output during this period. This is supported by the fact that these years are also characterised by stable unemployment and a low inflation level (the higher inflation in 2000 was most likely the result of the increase in the VAT rate).

III.3 The Budget Sensitivity to the Output Gap

Using the elasticities presented in Table 1 it is possible to calculate the budget sensitivity to the output gap. This sensitivity indicates the percentage change in the budget balance as a percentage of GDP when the output gap changes by 1%. In the case of Cyprus this value is calculated using the methodology proposed by the European Commission (2000). Given the assumption that the elasticity of government expenditures with respect to output is zero the budget sensitivity for Cyprus is simply given by the overall revenue elasticity[9]. This, in turn, is the weighted average of the four revenue elasticities, where the weights are given by the average value of the ratio of each category of revenue to GDP for the period 1997 to 2001. The weighted average was calculated for this instead of the whole period because Cyprus experienced major changes in its tax structure in the early 1990s, due to the introduction of the VAT and the gradual abolition of the customs duties. Therefore, the more recent data give more representative weights of the various tax revenue categories.

The calculated value of the budget sensitivity to the output gap for Cyprus is 0.3, meaning that when the output gap changes by 1% then the budget balance changes by 0.3%. This figure is similar to that for Austria, Portugal and Greece but lower than the 0.5 average for the EU-15 countries. The budget sensitivity to the output gap figures of the EU-15 as calculated by the European Commission are provided in Table 3 overleaf.

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[9] According to Bouthevillain et al (2001), the more accurate calculation of the sensitivity of the budget balance to the business cycle is that of taking the difference of the overall revenue and overall expenditure elasticities (it should be noted that the expenditure elasticity should be negative, since less unemployment benefits are paid out as output increases) and deducting from it the ratio of the budget balance to GDP. However, since the European Commission calculates the sensitivity using only the overall revenue and expenditure elasticities, we also do the same for Cyprus for reasons of comparability. As pointed out by the ECB the bias implied by the non subtraction of the deficit ratio term is small if the deficit ratio is small. In the case of Cyprus the deficit ratio has been small for the years 1999 to 2001, but not that small for the years 1997 and 1998.

The relatively low budget sensitivity to the output gap for Cyprus is attributed to the fact that the government expenditure elasticity with respect to output is assumed to be zero due to the persistently low unemployment level. In other countries this elasticity is negative, reflecting the fact that the amount paid in unemployment benefits decreases with the level of output.

Table 3: Budget sensitivity to the output gap figures: 1980-1998 for the EU-15 countries and 1997-2001 for Cyprus

Countries	Budget Sensitivity	Countries	Budget Sensitivity
Belgium	0.7	Portugal	0.3
Germany	0.5	Finland	0.7
Spain	0.4	Denmark	0.9
France	0.4	Greece	0.3
Ireland	0.4	Sweden	0.8
Italy	0.4	UK	0.5
Netherlands	0.8	**EU-15**	0.5
Austria	0.3	Cyprus	0.3

III.4 Stability and Growth Pact

An important reason for calculating the structural budget balance as a percentage of GDP is the comparison with the conditions laid out in the Stability and Growth Pact of the EU. The latter states that the ratio of government deficit to GDP should not exceed 3%. The issue of whether the Pact's focus should switch away from limits on actual deficits, and towards limits on structural deficit and/or debt levels has been the cause of many discussions. Canzoneri and Diba (2000) argue that the Pact's "excessive deficit" procedure is likely to constrain counter-cyclical fiscal efforts, as was proven by the recent case where Germany and France both violated the Pact's condition.

In a typical EU country, budget deficits tend to rise by about 0.5% of GDP when output falls by 1%. Given that a typical recession is associated with an output gap of about 3%, the EU countries should aim for structural deficits lower than 1.5% of their GDP to allow them to pursue countercyclical policies without violating the 3% of GDP actual budget deficit. The probability of violating this condition is reduced if the targets turn to a balanced or in surplus structural budget.

In response to such considerations in October 2002 the Eurogroup decided to commit itself to a reduction in the level of budget deficit as a percentage of GDP by 0.5% of GDP annually starting from 2003 with the aim to achieve a budgetary position close to balance or in surplus. In March 2003, the ECOFIN Council recommended that the achievement of and the progress towards budgetary positions of close to balance or in surplus should be assessed using structurally adjusted terms. Therefore, it is clear that the structural budget balance figures can provide valuable information for the EU surveillance procedures.

Given that the Stability and Growth Pact came into effect in 1999, Cyprus fulfils this particular condition of the Pact for the years 2000 and 2001 on the basis of the calculated values of the structural balance, although it has to be pointed out that the figures are very close to the limit. As far as the preceding period of 1996 to 1999 is concerned, the performance of Cyprus is not within the bound of the Stability and Growth Pact. More interestingly, for the years following 2001 Cyprus is likely to also violate the Pact's conditions, especially in the years 2003 and 2004, when the actual budget deficit is expected to be over 5%. Without drastic measures to reduce this deficit Cyprus will not be able to achieve its declared objective to enter the Eurozone in 2007.

It is also interesting to compare the structural budget balance figures of Cyprus with the corresponding figures of the member states of the EU-15 and some of the other countries acceded to the EU in May 2004. The structural budget balance figures of the EU-15 member states expressed as percentages of their GDPs are presented in Table 4. It has to be noted that the method used by the European Commission for the calculation of the structural budget balance figures for the period under observation differs slightly from the method used in this paper. More specifically: (a) the potential output figures in the European Commission study are obtained using the Hodrick-Prescott filter rather than the production function method that has been used in this paper;[10] and (b) the European Commission calculates the structural fiscal balance using the budget sensitivity of revenue and expenditure to the output gap instead of adjusting each

[10] It has to be noted that the Commission has recently also started using the production function approach for the measurement of the potential level of output.

component of the budget using the separate elasticities for each of the relevant categories of tax revenue and government expenditure.

Table 4: Structural budget balances as % of nominal GDP

Countries	1997	1998	1999	2000	2001
Belgium	-1.6	-0.7	-0.3	-1.1	-0.4
Germany	-2.0	-1.2	-0.3	-1.6	-2.5
Spain	-2.6	-2.3	-1.1	-1.1	-0.7
France	-2.1	-2.1	-1.3	-1.7	-1.6
Ireland	0.3	1.2	0.8	2.4	-0.1
Italy	-2.5	-2.5	-1.3	-1.9	-1.5
Netherlands	-0.7	-0.5	0.7	-0.1	-0.3
Austria	-1.5	-2.2	-1.7	-2.5	-0.2
Portugal	-2.3	-2.0	-1.8	-2.6	-3.2
Finland	-1.2	0.6	1.9	4.0	3.6
Denmark	-0.9	-0.3	2.4	1.3	2.6
Greece	-4.1	-3.0	-1.6	-0.9	-0.7
Sweden	-0.6	2.9	2.0	2.1	4.2
UK	-2.3	0.2	1.3	1.2	0.6
EU-15	-2.0	-1.2	-0.2	-0.7	-0.9
Cyprus	-4.9	-5.3	-3.9	-2.8	-2.8
Czech Republic	n.a.	n.a.	n.a.	n.a.	-5.3
Latvia	n.a.	n.a.	n.a.	n.a.	-1.9
Malta	n.a.	n.a.	n.a.	n.a.	-6.8
Poland	n.a.	n.a.	n.a.	n.a.	-3.6
Slovak Republic	n.a.	n.a.	n.a.	n.a.	-3.9
Slovenia	n.a.	n.a.	n.a.	n.a.	-1.8

We do not, however, think that these differences limit the comparability of the figures reported in Table 4. It has been generally observed that both the production function and Hodrick-Prescott filter methods tend to give similar results as far as the level of potential output is concerned. Simply, the production function method is considered superior because it is founded on economic theory and its results have more meaningful interpretation.[11] Regarding the use of separate elasticities for each of tax revenue and government expenditure

[11] For more detail discussion on the Hodrick-Prescott and Production Function methods interested readers are referred to Economic Policy Committee (2001), "Report on Potential Output and the Output Gap", ECFIN/EPC/670/01/en, October 2001.

components, this can be argued to improve the accuracy but cannot be argued to bias the resulting estimates of the structural budget balances.

From the results presented in Table 4, it can be seen that for the entire period from 1997 to 2001 the structural budget balance figures of Cyprus are substantially higher than those of the EU-15. Only Greece and Portugal appear to violate the Pact's condition on "excessive deficit" in 1997 and 2001 respectively, although in the case of Greece the Pact was not in effect yet. More recently, however, the budget deficits of both Germany and France have become considerably higher. It is also clear from Table 4 that for the year 2001 the structural budget balance figure for Cyprus vis-a-vis the Pact's conditions is better than the corresponding average figure for the other countries acceded to the EU in May 2004 mentioned in the table, a few of which appear to be violating the "excessive deficit" condition of the Pact. The best performers among the countries acceded to the EU in May 2004 are Latvia and Slovenia.

III.5 Sensitivity of Structural Fiscal Balance to the Elasticity Estimates

In order to investigate the sensitivity of the structural fiscal balance calculations to the statistical error of the elasticity estimates, we calculate the 95% confidence interval of these estimates (defined as the calculated value of the elasticity plus or minus 1.96 times its standard error) using equations (7) and (8). The calculated upper and lower bounds of the elasticities are reported in Table 5. The wider 95% confidence interval appears in the elasticities of direct taxation and social security contribution with respect to output, reflecting the large standard errors of the corresponding parameter estimates (see Tables in Appendix C).

Table 5: Upper and lower bounds for the government revenue elasticities with respect to output

Government revenue	Upper bound	Lower bound
Corporate tax	1.71	1.09
Direct taxation (excluding corporate tax)	1.51	0.73
Indirect tax: (up to and including 1991)	1.11	0.99
(from 1992 and onwards)	1.12	1.02
Social Security contribution revenue	1.73	0.61

Table 6 reports the 95% confidence interval values of the structural fiscal balances expressed as percentages of nominal GDP, obtained by using the upper and lower elasticity estimates given in Table 5. The actual values of the calculated structural fiscal balances are given in Appendix D. As it can be seen from Table 6 the series obtained by using the upper and lower elasticity estimates are very close to each other.

These results conform to expectation in the sense that they highlight the nature of the dependence of the structural fiscal balance on the relationship between the actual and potential levels of output. Since each of the tax revenue components of the budget are adjusted proportionately to the ratio of potential output to actual output, as determined by the respective elasticities, in the years when the economy has positive output gaps (the actual level of output is above the potential level) the structural revenues are lower than the actual revenues. In fact, this is more so when the structural fiscal balance is calculated using the upper bound values of the elasticities, since by definition the responsiveness of tax revenues to the level of output is higher in this case. This can be seen in the years of positive output gaps (1985, 1988, 1989, 1990, 1992, 1995, 1996 and 2000). In the years when the output gap is at its peak (1989, 1990, 1992 and 1995) the structural fiscal balance calculated using the upper bound values of the elasticities is more negative (or less positive) than the corresponding figures obtained using the lower bound values of the elasticities. The opposite is true in the years where we have a negative output gap (1991, 1993 and 1997), when the structural fiscal balances calculated using the upper bound elasticity values are less negative (or more positive) than the ones calculated using the lower bound elasticity values.

In the case where the upper bound values of the elasticities are used to compute the structural fiscal balance the budget sensitivity is 0.36; whereas in the case where the lower bound values of the elasticities are used this drops to 0.23. These figures indicate that a 1% change in the output gap leads to the budget balance changing by 0.36% and 0.23%, respectively. The higher responsiveness of the budget is thus once again observed in the case where the higher elasticitiy values apply. Even so, however, the budget sensitivity value at this upper bound elasticity values is still lower than the corresponding figure for the EU-15.

Table 6: Structural budget balance as % of nominal GDP

YEAR	Calculated with the upper bound elasticity estimates	Calculated with the lower bound elasticity estimates
1985	-5.04	-4.94
1986	-2.88	-3.09
1987	-5.40	-5.53
1988	-4.91	-4.85
1989	-3.36	-3.20
1990	-6.03	-5.76
1991	-6.14	-6.41
1992	-5.14	-5.00
1993	-1.61	-1.89
1994	-1.26	-1.32
1995	-1.67	-1.43
1996	-3.42	-3.42
1997	-4.80	-4.98
1998	-5.23	-5.32
1999	-3.91	-3.95
2000	-2.86	-2.81
2001	-2.80	-2.81

IV. CONCLUSION

In this paper we have used regression techniques to calculate the elasticities of the various categories of tax revenue with respect to the level of output. To avoid estimating elasticities that do not reflect the current situation in the economy we include dummy variables in the regression to allow for changes in elasticities over time.

Overall the values of the elasticities obtained conform to expectation, as formed by economic theory and the tax structure of Cyprus. Moreover, only the elasticity of indirect taxation with respect to the level of output has changed over time. Again, this is not surprising, given that the only substantial change in the tax structure of Cyprus during the period under investigation was the abolition of import duties and the introduction of VAT. More changes in the elasticities are likely to have happened after the end of sample period, given the many changes in the tax system in the period 2002-2004.

As far as the calculated values of the structural fiscal balances are concerned, our empirical results suggest that the structural budget balance, expressed as a percentage of the nominal GDP tends to follow a path similar to the corresponding year's actual overall balance, also expressed as a percentage of the nominal GDP. As expected the structural fiscal balance figures fluctuate in a slightly narrower band than the overall balance figures indicating that the cyclical component of the budget or the effect of the automatic stabilisers is small. This is also reflected in the relatively low estimated budget sensitivity figure.

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APPENDIX A: ESTIMATING THE GOVERNMENT REVENUE ELASTICITIES

The usual approach to estimating the elasticity of government revenues with respect to output adopted by the OECD is described by Giorno et.al. (1995) and is reproduced below. The approach used in our analysis differs from that described below. It has to be noted that it is the elasticity of the income tax (as opposed to direct tax excluding corporate tax) revenues with respect to output that is calculated by Giorno et.al. (1995). The procedure used for the calculation of the income tax and social security contributions elasticities is identical. The first step consists of calculating the marginal and average tax rates (contribution rates) of a representative household at various points on the distribution of gross earnings. It has to be noted that the average and marginal tax rates at different levels of gross earnings depend on the various features of the tax system such as the tax progression, tax credits and allowances. Given that the income tax structure has changed (in fact it has changed more than once) in the case of Cyprus in the period that we are calculating the structural fiscal balance, it is necessary to calculate the marginal and average tax rates for each of the tax structures that exist over that period. As a second step, there is the need to calculate a weighted average value for the marginal and average tax rates (contribution rates) for an "average" household, where the weights are derived from the income distribution function of the Cypriot economy. Using the above information it is possible to calculate the weighted earnings elasticity of income taxes or social security contributions, using equation (A.1) shown below:

$$\varepsilon = \frac{\sum \gamma_i \frac{dt_i}{dy_i}}{\sum \gamma_i \frac{t_i}{y_i}} \qquad \text{(A.1)}$$

where:

ε = the earnings elasticity of income taxes or social security contributions;

γ_i = the weight of earnings level i in total earnings;

t_i = income tax payments (social security contributions) per household at earnings level i;

y_i = earnings per household at earnings level i;

dt_i/dy_i = the marginal tax rate (contribution rate) at point i on the earnings distribution;

t_i/y_i = the average tax rate (contribution rate) at point i on the earnings distribution.

The above steps allow us to obtain the earnings elasticities, whereas what are of interest for the calculation of the structural fiscal balance are the output elasticities. Output growth does not necessarily lead to an equiproportionate increase in the level of earnings in the economy since according to Giorno et.al. (1995) there are a number of "leakages" that need to be taken into account. For example it is expected that an increase in the level of output will not increase employment by an equal proportion due to the presence of hoarded labour within firms. Moreover, an increase in employment usually produces a less than proportional increase in the level of earnings per household since the number of households earning income from employment increases. The earnings elasticities are converted to output elasticities using equation (A.2) shown below:

$$\alpha = EE(EW.\varepsilon + 1) = EE.EW.\varepsilon + EE \qquad \text{(A.2)}$$

where: α =the output elasticity of income taxes or social security contributions;

$\varepsilon =$ the earnings elasticity of income taxes or social security contributions;

EE = the output elasticity of employment;

EW = the employment elasticity of wages.

According to Giorno et.al. (1995), the above equation indicates that the impact of a one percent increase in the level of output on taxation revenues can be broken into two parts which are: i) an increase in the earnings per worker leading to them moving to a higher income and tax bracket and hence an increase in government proceeds; and ii) an increase in the number of workers in each earnings bracket.

It is clear from the above approach that it is necessary to estimate the output elasticity of employment and the employment elasticity of wages in our attempt to calculate the output elasticities of income taxes and social security contributions. In order to calculate EE one can regress the log of employment on the log of output, the coefficient of the log of output variable will then give the elasticity that we are interested in. A similar procedure will be used in the case of the calculation of EW.

APPENDIX B: THE STANDARD ERRORS OF ELASTICITIES

The long run elasticity of a particular category of tax revenue with respect to the level of output, as derived by the coefficients of an equation such as equation (B.1) below is given by $e = \frac{\alpha}{1-\gamma}$ or by $e = \frac{\alpha+\beta}{1-\gamma}$ in the case that the β coefficient is significant.

$$LogT_t = INPT + \alpha LogY_t + \beta(Dummy) * (LogY_t) + Dummy74 + \gamma LogT_{t-1} + \varepsilon_t \qquad \text{(B.1)}$$

It is possible to estimate the variance of e by using the Taylor expansion. This is shown below for the case where $e = \frac{\alpha}{1-\gamma}$. The method described can be easily extended for the case where $e = \frac{\alpha+\beta}{1-\gamma}$.

According to the Taylor expansion, an approximate value of e(α,γ) is given by

$$e(\alpha,\gamma) = e(\hat{\alpha},\hat{\gamma}) + \frac{\partial e}{\partial \alpha}(\hat{\alpha}-\alpha) + \frac{\partial e}{\partial \gamma}(\hat{\gamma}-\gamma) + \frac{1}{2}\frac{\partial^2 e}{\partial \alpha^2}(\hat{\alpha}-\alpha)^2 + \frac{1}{2}\frac{\partial^2 e}{\partial \gamma^2}(\hat{\gamma}-\gamma)^2 + \ldots \qquad \text{(B.2)}$$

By definition the variance of e is given by equation

$$Var(e) = E[e - E(e)]^2$$

$$= E[e(\hat{\alpha},\hat{\gamma}) + \frac{\partial e}{\partial \alpha}(\hat{\alpha}-\alpha) + \frac{\partial e}{\partial \gamma}(\hat{\gamma}-\gamma) + \frac{1}{2}\frac{\partial^2 e}{\partial \alpha^2}(\hat{\alpha}-\alpha)^2 + \frac{1}{2}\frac{\partial^2 e}{\partial \gamma^2}(\hat{\gamma}-\gamma)^2 + \ldots -$$

$$E(e(\hat{\alpha},\hat{\gamma}) + \frac{\partial e}{\partial \alpha}(\hat{\alpha}-\alpha) + \frac{\partial e}{\partial \gamma}(\hat{\gamma}-\gamma) + \frac{1}{2}\frac{\partial^2 e}{\partial \alpha^2}(\hat{\alpha}-\alpha)^2 + \frac{1}{2}\frac{\partial^2 e}{\partial \gamma^2}(\hat{\gamma}-\gamma)^2 + \ldots)]^2 \qquad \text{(B.3)}$$

The following are also known:

$$E(\hat{\alpha}) = \alpha$$

$$E(\hat{\gamma}) = \gamma$$

$$E(e(\hat{\alpha},\hat{\gamma})) = e(\hat{\alpha},\hat{\gamma})$$

Using the above and by dropping out all the derivatives of order greater or equal to two, allows us to approximate the variance of e through equation (B.4) below.

$$Var(e) \cong E[\ \frac{\partial e}{\partial \alpha}(\hat{\alpha}-\alpha)+\frac{\partial e}{\partial \gamma}(\hat{\gamma}-\gamma)\ ]^2$$

$$\cong E[\ \frac{\partial^2 e}{\partial \alpha^2}(\hat{\alpha}-\alpha)^2+2\frac{\partial^2 e}{\partial \alpha \partial \gamma}(\hat{\alpha}-\alpha)(\hat{\gamma}-\gamma)+\frac{\partial^2 e}{\partial \gamma^2}(\hat{\gamma}-\gamma)^2] \quad \text{(B.4)}$$

The above can be written in matrix notation as indicated by

$$Var(e) \cong \begin{pmatrix} \frac{\partial e}{\partial \alpha} & \frac{\partial e}{\partial \gamma} \end{pmatrix} \begin{bmatrix} E(\hat{\alpha}-\alpha)^2 & E[(\hat{\alpha}-\alpha)(\hat{\gamma}-\gamma)] \\ E[(\hat{\gamma}-\gamma)(\hat{\alpha}-\alpha)] & E(\hat{\gamma}-\gamma)^2 \end{bmatrix} \begin{pmatrix} \frac{\partial e}{\partial \alpha} \\ \frac{\partial e}{\partial \gamma} \end{pmatrix} \quad \text{(B.5)}$$

which, in turn, is the same as equation (7)

$$Var(e) \cong \begin{pmatrix} \frac{\partial e}{\partial \alpha} & \frac{\partial e}{\partial \gamma} \end{pmatrix} \begin{pmatrix} Var(\alpha) & Co\,\mathrm{var}(\alpha,\gamma) \\ Co\,\mathrm{var}(\gamma,\alpha) & Var(\gamma) \end{pmatrix} \begin{pmatrix} \frac{\partial e}{\partial \alpha} \\ \frac{\partial e}{\partial \gamma} \end{pmatrix} \quad \text{(B.6)}$$

APPENDIX C: PARAMETER ESTIMATES AND DIAGNOSTIC TESTS

Table C1: Corporate tax revenues

Ordinary Least Squares Estimation			
Dependent variable is **LNCT** 32 observations used for estimation from 1971 to 2002			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio (Prob)**
INPT	-1.7170	0.64382	-2.6669 (0.013)
LNY	0.35027	0.11997	2.9195 (0.007)
DLASTLNY	0.0094090	0.015834	0.59423(0.557)
D74	-0.27322	0.16108	-1.6962 (0.101)
LNCT(-1)	0.75007	0.091223	8.2223 (0.000)
R-Bar-Squared	0.98481		
Diagnostic Tests			
Test Statistics	**LM Version**		**F Version**
A:Serial Correlation	CHSQ(1)= 1.4124[.235]		F(1, 26)= 1.2005[.283]
B:Functional Form	CHSQ(1)= 1.0984[.295]		F(1, 26)= .92415[.345]
C:Normality	CHSQ(2)= 2.8306[.243]		Not applicable
D:Heteroscedasticity	CHSQ(1)= 2.1529[.142]		F(1, 30)= 2.1639[.152]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

The above estimated equation passes all the diagnostic tests.

Key: LNCT= log of corporate tax revenues

INPT= intercept

LNY= log of output

Dummy= dummy variable that takes the value one in the years 2000 to 2002

DLASTLNY= Dummy*LNY

D74= intercept dummy that takes value of 1 in 1974 and 1975

LNCT(-1)= 1 period lag of LNCT

Table C2: Direct tax revenues (excluding corporate tax revenue)

Ordinary Least Squares Estimation			
Dependent variable is **LNDTXCT** 32 observations used for estimation from 1971 to 2002			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio (Prob)**
INPT	-0.60413	0.73076	-0.82672 (0.416)
LNY	0.20901	0.16750	1.2478 (0.223)
D02LNY	-0.012157	0.012847	-0.94631 (0.352)
D74	0.020905	0.089853	0.23266 (0.818)
LNDTXCT(-1)	0.81404	0.12039	6.7619 (0.000)
R-Bar-Squared	0.99415		

Diagnostic Tests

Test Statistics	**LM Version**	**F Version**
A:Serial Correlation	CHSQ(1)= 3.3135[.069]	F(1, 26)= 3.0032[.095]
B:Functional Form	CHSQ(1)= 1.8002[.180]	F(1, 26)= 1.5499[.224]
C:Normality	CHSQ(2)= 7.5827[.023]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 4.3920[.036]	F(1, 30)= 4.7725[.037]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

The above estimated equation does not pass the Normality of residuals and heteroscedasticity tests. The presence of heteroscedasticity will not bias the estimates of the parameters but it will underestimate the standard errors of the coefficients which in turn will mean that the standard statistical tests will be misleading. Since we are at this point only interested in the value of the estimated elasticity, we do not worry much about the problems of non normality and heteroscedasticity of residuals.

Key: LNDTXCT= log of direct tax revenues excluding corporate tax revenues

INPT= intercept

LNY= log of output

D02LNY= Dummy that takes value of 1 in 2002 multiplied with LNY

D74= intercept dummy that takes value of 1 in 1974 and 1975

LNDTXT(-1)= 1 period lag of LNDTXCT

Table C3: Indirect tax revenues

Ordinary Least Squares Estimation			
Dependent variable is **LNIT** 32 observations used for estimation from 1971 to 2002			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio (Prob)**
INPT	-1.8389	0.44586	-4.1244 (0.000)
LNY	0.72749	0.14044	5.1800 (0.000)
D74	-0.18936	0.066062	-2.8664 (0.008)
D92LNY	0.010780	0.0039573	2.7241 (0.011)
LNIT(-1)	0.30946	0.12111	2.5553 (0.017)
R-Bar-Squared	0.99801		

Diagnostic Tests		
Test Statistics	**LM Version**	**F Version**
A:Serial Correlation	CHSQ(1)= .65428[.419]	F(1, 26)= .54270[.468]
B:Functional Form	CHSQ(1)= .98910[.320]	F(1, 26)= .82928[.371]
C:Normality	CHSQ(2)= 1.0051[.605]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .96212[.327]	F(1, 30)= .92994[.343]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

The above estimated equation passes all diagnostic tests.

Key: LNIT= log of indirect tax revenues

INPT= intercept

LNY= log of output

D74= intercept dummy that takes value of 1 in 1974 and 1975

D92LNY= step dummy from 1992 onwards multiplied with LNY

LNIT(-1)= 1 period lag of LNIT

Table C4: Revenue from social security contributions

Ordinary Least Squares Estimation			
Dependent variable is **LNSSC** 32 observations used for estimation from 1971 to 2002			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio (Prob)**
INPT	-0.73505	0.95560	-0.76921 (0.448)
LNY	0.21753	0.19495	1.1158 (0.274)
DLASTLNY	-0.0038106	0.011732	-0.32479 (0.748)
D74	-0.24978	0.11597	-2.1538 (0.040)
LNSSC(-1)	0.81475	0.12669	6.4310 (0.000)
R-Bar-Squared	0.99185		

Diagnostic Tests

Test Statistics	**LM Version**	**F Version**
A:Serial Correlation	CHSQ(1)= 2.8452[.092]	F(1, 26)= 2.5373[.123]
B:Functional Form	CHSQ(1)= 14.4629[.000]	F(1, 26)= 21.4422[.000]
C:Normality	CHSQ(2)= 304.17[.000]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 1.2205[.269]	F(1, 30)= 1.1895[.284]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

The above estimated equation does not pass the Normality and Ramsey Reset tests suggesting that some misspecification in the functional form may be present.

Key: LNSSC= log of social security contribution revenues

INPT= intercept

LNY= log of output

Dummy=dummy variable that takes the value of one for the period 2000 to 2002

DLASTLNY= Dummy*LNY

D74= intercept dummy that takes value of 1 in 1974 and 1975

LNSSC(-1)=1 period lag of LNSSC

Appendix D: Structural fiscal balances (in CY£million)

YEAR	Calculated with the upper bound elasticity estimates	Structural budget balance	Calculated with the lower bound elasticity estimates
1985	-74.65	-73.96	-73.27
1986	-46.02	-47.74	-49.44
1987	-96.22	-97.40	-98.57
1988	-97.81	-97.19	-96.56
1989	-75.92	-74.04	-72.14
1990	-154.18	-150.71	-147.20
1991	-164.17	-167.78	-171.35
1992	-159.44	-157.27	-155.08
1993	-52.75	-57.42	-62.04
1994	-45.91	-46.99	-48.07
1995	-66.79	-62.04	-57.25
1996	-142.23	-142.20	-142.16
1997	-209.90	-213.92	-217.91
1998	-245.55	-247.81	-250.05
1999	-196.87	-197.70	-198.52
2000	-157.62	-156.31	-154.99
2001	-164.79	-165.11	-165.43

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