The framework of the public sector equations in the South African Reserve Bank's econometric model

By M.M. Smal

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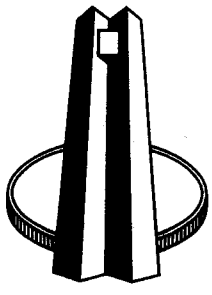

South African Reserve Bank
Suid-Afrikaanse Reserwebank

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1. Introduction

Economic policy analyses should preferably be supported by a systematic quantitative framework. Better knowledge concerning dynamic relationships and response-lags of policy measures can be invaluable elements in the armoury of policy-makers. The aim of this study is to construct a fairly detailed model for government finances which will be suitable for the simulation of the effects of fiscal policy on the South African economy, and to incorporate this model into the South African Reserve Bank's econometric model. This model is used primarily for forecasting purposes, but it also provides for the evaluation of the impact of alternative monetary and budgetary proposals on the economy.

This study firstly outlines the main features of the fiscal sub-model. This is followed by a description of the functions pertaining to the different types of government revenue. The study then deals with the different equations for government expenditure, government financing requirements and debt accumulation, followed by a short discussion of the linkages between the fiscal functions and the main model. A multiplier analysis is then used to demonstrate the impact of a policy shock and the inter-activeness of the model. Finally, some concluding remarks are made.

2. The main features of the fiscal sub-model

There are three different theoretical approaches to the specification of tax revenue equations[2]. The first procedure is to specify a specific tax receipt as a function of one or more independent variables which are significantly correlated with it. Mathematically this approach can be illustrated by $T=f(V_1;....;V_z)$, where T represents the specific tax receipt and V_1 through V_z portrays the selected independent variables.

In the second approach only one dependent variable is specified which represents the tax base of the specific tax receipt. This is multiplied by the appropriate statutory tax rate to determine the amount of tax received. Mathematically this approach can be represented by $T = \tau B$, where the specific tax receipt is represented by T and B depicts the appropriate tax base, with τ the statutory tax rate. This is perhaps the simplest way of calculating tax receipts. This identity will be valid when the exact tax base can be determined, the statutory tax rate(s) is available and the tax recovery rate is one hundred per cent.

This approach can still be used when no simple statutory tax rate can be determined, but the statutory rate must now be approximated and the equation be adjusted to $T = \alpha B$, where α can be interpreted as the effective tax rate, representing a combination of the implied statutory tax rate(s) and a tax recovery rate.

If the tax base cannot be calculated accurately, this approach will still be valid, but the implied effective tax rate will be affected. The tax rate will now reflect the statutory tax rate, the recovery rate and any discrepancy between the utilised tax base and the "true" tax base.

A third approach that can be followed is one which embodies the essential complexities of the tax structure. This comprehensive approach allows the tax laws and specifications to be incorporated in both the tax rate and the tax base. The more complex the tax structure of a country is, the more difficult it becomes to represent it in a model structure. This is also true in the South African situation. Although a model developed according to this approach may have some practical and long-term advantages, it is expected that the forecasting results will not diverge significantly from models constructed on the first two approaches mentioned above. The marginal forecasting accuracy improvement that could be achieved through this more concerted model development effort will not, however, substantiate any deviation from the general defining process that can be followed in the second approach above.

The main emphasis in the research detailed below has been on explaining the endogenous government revenue variables by means of tax-rate parameters and tax-base variables. On the other hand, the components of government expenditure, with the exception of interest payments on government debt, have been treated primarily as exogenously specified policy instruments.

The equations were estimated with ordinary least squares (OLS), using seasonally adjusted quarterly data as calculated and published by the South African Reserve Bank[3]. Where applicable, autocorrelation was

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[1] The author is indebted to the staff of the Econometric Analysis Division for helpful comments and suggestions, especially Mr J.N. Blignaut, who made a substantial contribution during the early stages of the project. However, the opinions expressed in this document are those of the author and do not necessarily reflect those of the South African Reserve Bank.

[2] Helliswell J.F. and others: "Government sector equations for macroeconomic models", *Bank of Canada Staff Research Studies*, Number 4, 1969, p6.

[3] In examining the graphs, it may appear as if some seasonality is present in certain variables. However, tests performed by the Business Cycle Division of the South African Reserve Bank indicated that seasonality is in fact removed from all the data.

removed using the Cochrane-Orcutt method. The period of estimation is from the first quarter of 1985 to the fourth quarter of 1994. The fiscal sub-model consists of 21 equations, of which 10 are stochastic behavioural equations and 11 are identities.

3. Description of the equations of the model

Before estimating the equations of the model, it is necessary to discuss the exclusion of the constant term from the tax revenue equations. The underlying principle in excluding the constant term is that no taxes will be collected by the government should the tax base be zero. If it is assumed that any type of tax revenue is the product of a tax rate and a tax base, the tax revenue will be zero if the tax base is equal to zero. Should the constant term be included and it is greater than zero, one would expect tax payments to the government, notwithstanding the fact that the tax base equals zero. However, should the constant term be negative, it would be indicative of a situation where the government subsidises the respective tax categories in situations where the tax base is zero. The significance of a constant term was tested during the econometric estimation of the tax equations in the fiscal sub-model. With the exception of provisional tax payments and assessments paid by individuals, the constant term was never found to be statistically significant and was therefore omitted from the tax equations.

A discussion of the treatment of the estimated effective tax rate in certain equations is also necessary. Normally, an exogenously specified statutory tax rate can be manipulated to perform alternative policy scenarios. However, in some of the tax revenue equations the tax rate is represented by an estimated coefficient and it is therefore not permissible, under normal circumstances, to manipulate such an expression in alternative policy scenarios other than by changes to the added error terms. To overcome this limitation, a dummy variable with a value equal to 1 has been introduced in the relevant equations. Should an alternative policy scenario with a change in the estimated effective tax rate be requested, the dummy variable can be adjusted accordingly. The incorporation of dummy variables in these equations has increased the flexibility of these equations without introducing any conceptual changes.

3.1 Receipts of the National Revenue Fund

Taxes received by the National Revenue Fund are shown in Table 1. The contribution of gold mines to total direct tax receipts has declined considerably from 7,4 per cent in 1985 to only 1,1 per cent in 1994. The contribution of non-gold-mining also declined from 18,3 per cent in 1985 to 12,5 per cent in 1994. Consequently, the ratio of taxes paid by the corporate sector to total direct taxes received by the government declined from 25,7 per cent in 1985 to 13,7 per cent in 1994. In contrast, the contribution of individuals to direct taxes received by the government increased from 29,5 per cent in 1985 to 38,9 per cent in 1994, indicating the increased tax burden on individual taxpayers. Despite these changes in the composition of direct taxes, the distribution between direct and indirect taxes has fluctuated in a relatively narrow band around 53 per cent.

3.1.1 Direct taxes

3.1.1.1 Direct taxes paid by individuals

Individuals in South Africa are subject to income tax in respect of income arising from sources within South Africa. Taxable income includes all amounts received for services rendered, including bonuses, allowances, tax reimbursements and fringe benefits such as the use of a car. However, a taxpayer may deduct certain business expenses that are not of a capital nature but which were incurred in the production of income, for example business-related travel, car and entertainment expenses. A taxpayer may also deduct certain non-business expenses (including pension-fund and retirement-annuity contributions, subject to certain maximums, where such funds are registered in South Africa), and charitable donations to specified organisations, subject to a maximum amount. Individuals are also entitled to a

Table 1 Taxes received by the National Revenue Fund and percentage contribution to total taxes received

	1985		1990		1994	
	R millions	%	R millions	%	R millions	%
Gold mines	2 110	7,4	830	1,2	1 197	1,1
Companies, excluding gold mines	5 247	18,3	14 579	20,9	13 107	12,5
Corporate sector	7 357	25,7	15 409	22,0	14 304	13,7
Individuals	8 466	29,5	22 108	31,6	40 724	38,9
Total direct taxes	15 823	55,2	37 517	53,7	55 028	52,6
Indirect taxes	12 846	44,8	32 384	46,3	49 673	47,4
Total taxes received	**28 669**	**100,0**	**69 901**	**100,0**	**104 701**	**100,0**

personal allowance in the form of tax rebates, which are deductible from the tax payable. The government has at times imposed a surcharge or a loan levy, which may be refundable at a later stage, on the amount of tax payable by individuals.

There is a pay-as-you-earn (PAYE) withholding tax on salaries in South Africa. However, individuals who trade in their own name or practise a profession are liable for provisional tax payment.

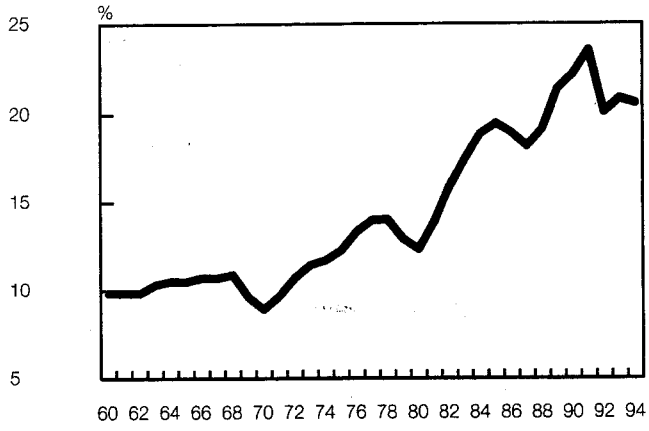
The income of individuals is taxed at progressive rates. Taxpayers in the lower income groups therefore pay a smaller percentage of their income in taxes than those in the higher tax groups. For example, for the fiscal year ended on 31 March 1994 married persons in the first taxable income category of R0 to R5 000 were liable for a marginal tax rate of 17 per cent for each rand of income received, while in the highest income category of more than R80 000 a marginal tax rate of 43 per cent on every rand exceeding the taxable income of R80 000 was applicable. There are ten such income categories.

3.1.1.1.1 PAYE employees' tax receipts

The system of PAYE withholding tax on salaries incorporates a so-called Standard Income Tax on Employees (SITE). SITE is an alternative method for determining liability for normal tax, and where SITE/PAYE deductions are made from remuneration, these deductions constitute nothing more than advance payments towards liability for normal tax. The main objective of SITE is to ensure that advance payments are as far as possible equal to the final normal tax liability. SITE is applicable to an employee's net remuneration and is payable on an annual income not exceeding R50 000. For taxpayers with a low income, SITE represents the full and final amount of income tax they will pay. For taxpayers with a higher income, SITE constitutes the minimum amount of income tax to be paid.

To determine the average rate at which individuals are taxed, a weighted average tax rate was calculated based on the number of taxpayers and tax received. The Directorate of Inland Revenue publishes the number of taxpayers in the different income categories as well as the total amount of tax received in each income category. A distinction is also made between married and unmarried persons. The taxable income in each category is computed as the mean of the lower and upper limits of that category, multiplied by the number of taxpayers in that specific category. The average tax rate for each income category is then calculated by dividing the income tax collected by the income received in that category. The calculated average tax rate in each income category is subsequently weighted with the number of taxpayers in that category in order to obtain an average tax rate for married as well as unmarried persons. To calculate the weighted average tax rate for all individuals, the average tax rates for married and unmarried persons are weighted according to the relative contribution of the two groups to total taxable income. It must be noted, however, that the incomes used in the calculations are gross figures, while the tax figures are net amounts, i.e. after provision for deductions and rebates. Graph 1 shows the average weighted tax rates for all individual taxpayers for the period 1960 to 1994. This rate has increased almost consistently and in 1991, the year before the introduction of SITE, reached its highest level ever, viz. 23,5 per cent.

Graph 1: Average tax rate for individuals



An important factor influencing the tax on individuals is the so-called "tax through inflation" or bracket creep. Bracket creep is the combined result of the progressiveness of the personal tax scales and inflation. Taxpayers enter higher tax brackets as a result of higher income (adjusted according to inflation) where the marginal tax rate is higher. The average tax rate on individuals is therefore increased mainly as a result of inflation. Bracket creep is captured in the model by adjusting the average tax rate on individuals (τ_p) with the change in the remuneration of employees in the non-agricultural sector (W_{nas})[4]. The income elasticity of tax on individuals (ε) was calculated as 1,68 with the aid of cross-section data[5]. The following identity was consequently introduced in the model:

$$\tau_p = \tau_{p-1} * (W_{nas-1}/W_{nas}) * (1 + \varepsilon * ((W_{nas} - W_{nas-1})/W_{nas-1}))$$

Owing to the fact that income tax is paid on

[4] Note that if the change in total remuneration of employees is due only to a change in employment, the average tax rate on individuals may be overestimated.

[5] The total income and tax liability of individuals is computed from the cross-section data for the 1993/94 fiscal year. Assuming that every taxpayer moves to a higher income bracket, a revised estimate of total income and tax liability can be obtained. A comparison of these revised estimates with the original estimate indicates that for every 1 per cent increase in personal income an increase of 1,68 per cent in personal tax liability can be expected.

remuneration received by individuals, it is clear that a close relationship should exist between total remuneration of employees and PAYE income tax received. In view of the income tax collection system, there should also be a very short time-lag between the accrual of the income and the payment of tax.

Based on the above *a priori* reasoning, PAYE personal taxes (T_{paye}), the dependent variable, are determined by an average tax rate (τ_p) and a tax base, calculated as the weighted average[6] of the total remuneration of employees in the non-agricultural sector (W_{nas}). The equation is also multiplied by a surcharge on personal tax payable by individuals (h_p). The estimated equation is as follows:

$$T_{paye} = [0,51(\tau_p*(0,67*W_{nas} + 0,33*W_{nas-1}))]*(1 + h_p)$$
$$(52,35)$$

R^2 = 0,94
D-W = 1,48
RHO = 0,70
Estimation period: 1985Q1 – 1994Q4

The correlation between the estimated equation and the actual data is illustrated in Graph 2.

3.1.1.1.2 Provisional tax payments and assessments paid by individuals

Since provisional taxes are payable on income accrued, a close correlation should exist between income and tax paid, but the time-lag is expected to be longer than the one estimated with PAYE tax payments. Provisional tax payments are based largely on the latest income assessment of individuals. This means that taxes paid in the previous fiscal year exert a significant influence on provisional taxes paid in the current fiscal year.

Provisional tax payments and assessments paid by individuals (T_{prov}) are expressed as an equation of the average personal tax rate (τ_p) and a weighted lag structure on income received by individuals. Income from the property of households is added to the total remuneration of employees in the non-agricultural sector to calculate the tax base of individuals (B_{prov}) because many individuals pay provisional tax on income received from sources other than salaries and wages. Income from the property of households includes income such as dividend receipts, net interest receipts, net rent receipts, mortgage interest, provision for depreciation and the profits of unincorporated business enterprises (such as farmers) after provision for depreciation and after inventory valuation adjustment. Although many tax law technicalities surround these components, they are all to some extent taxable. As with PAYE employees' tax receipts, the equation is multiplied by a variable to provide for the payment of a surcharge (h_p). As the bulk of provisional tax payments by individuals is received in the second quarter of each year, a dummy variable (DUM_{prov}) was included in the equation to allow for this seasonality. The following equation[7] was estimated:

$$T_{prov} = [0,84*T_{prov-4} + 0,03*(0,11*\tau_p*B_{prov}$$
$$(7,34) \qquad (2,39)$$
$$+ 0,18*\tau_{p-1}*B_{prov-1} + 0,21*\tau_{p-2}*B_{prov-2}$$
$$+ 0,21*\tau_{p-3}*B_{prov-3} + 0,18*\tau_{p-4}*B_{prov-4}$$
$$+ 0,11*\tau_{p-5}*B_{prov-5})$$
$$+ 275,3*DUM_{prov}]*(1 + h_p)$$
$$(2,49)$$

R^2 = 0,88
D-W = 1,67
Estimation period: 1985Q1 – 1994Q4

The correlation between the estimated equation and the actual data is illustrated in Graph 3.

3.1.1.1.3 Total direct personal taxes paid

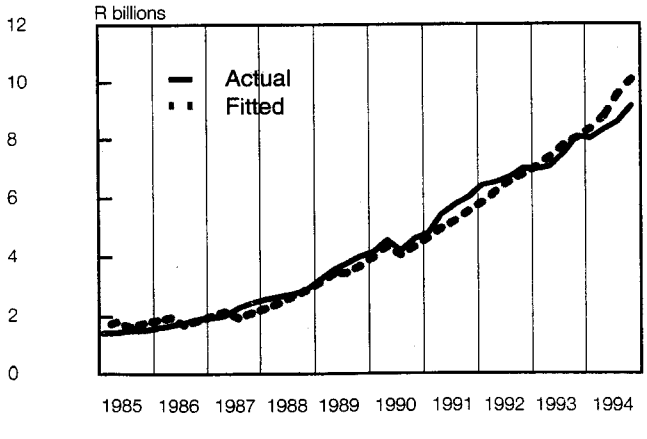
Total direct personal taxes paid (T_p) are calculated in the model by adding PAYE employee's tax receipts (T_{paye}) to the provisional tax payments and assessments paid by individuals (T_{prov}). The identity for total direct personal taxes received is:

$$T_p = T_{paye} + T_{prov}$$

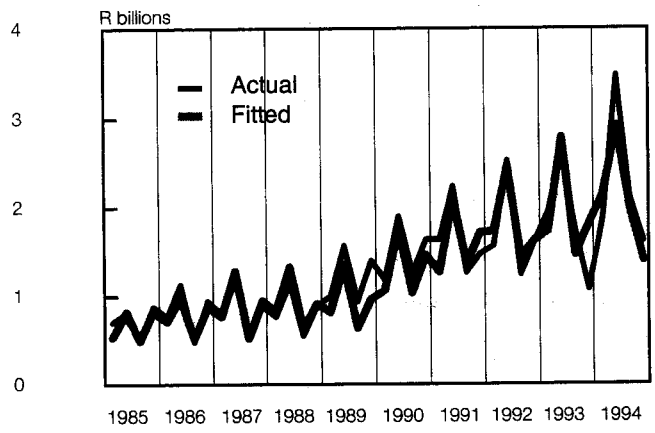
[6] The weights attached to the variables were determined by running a separate regression of the dependent variable on the explanatory variable.

[7] The weights attached to the lagged variable were determined by running a separate regression of the dependent variable on the explanatory variable. The coefficients of the lagged variable were constrained to follow a second-degree polynomial with both end-points restricted to zero.

Graph 2: PAYE employees' tax receipts



Graph 3: Provisional tax payments and assessments paid by individuals



3.1.1.2 Direct taxes paid by companies[8]

Taxable income of all companies earned from sources in South Africa is subject to a flat taxation rate. A system of provisional tax payments applies to companies and the year of assessment corresponds with the financial year of the companies. Three provisional payments can be made: a compulsory first payment, which is half of the estimated tax liability for the year, within six months of the beginning of the year of assessment; a second compulsory payment representing the balance of the estimated tax liability, before the end of the year of assessment; and a third payment, although not compulsory, consisting of the difference between the estimated and actual tax liability, within six months of the end of the year of assessment. This third payment is usually made by companies to avoid a non-deductible interest penalty. Balancing payments may be required on final assessment of tax payable for the year by the Directorate of Inland Revenue. Large tax payments by companies are normally made in February and August of each year.

Gold-mining companies do not pay the same type of tax as non-mining companies. They are taxed on the basis of a formula, which is discussed in a following section. From January 1994 gold-mining companies have had a choice between paying corporate taxes on the same basis as other companies or according to the formula. Taxable income from diamond-mining companies, natural oil and gas-mining companies and other mining companies is also taxed at rates differing from those of non-mining companies. However, for this analysis all mining companies, excluding gold-mining companies, are included in a category designated as non-gold-mining companies.

Depreciation and depletion allowances may be deducted on movable assets used for the purpose of trade by companies. There are no statutory provisions relating to rates of wear and tear and the taxpayer is entitled to deduct an amount that the Directorate of Inland Revenue considers fair and reasonable. The rates of wear and tear are normally calculated on the diminishing-balance method, but the Directorate of Inland Revenue may agree to the straight-line method, provided that the estimated life of the asset is acceptable to them. However, larger depreciation allowances are permitted by the Directorate of Inland Revenue as "capital incentives", for example, the 50%-30%-20% depreciation allowance formula. Book depreciation, as recorded in the national accounts, may therefore not agree with the wear and tear recorded for tax purposes.

Other special deductions from income earned by companies are also permitted. These include allowances for manufacturing operations in economic development areas, investment allowances, labour-training allowances and exporters' allowances. These deductions and allowances result in an effective company tax rate that is markedly less than the "standard" statutory rates announced by the government. To get an indication of the effective tax rate on companies, the direct taxes received from incorporated business enterprises are expressed as a percentage of the estimated net operating surplus of companies (before the payment of direct taxes and dividends) as recorded in the national accounts statistics[9]. However, it must be noted that the net operating surplus in the national-accounts statistics is the net result after profits are reduced by losses. The calculation of direct tax payments in this way therefore overestimates the effective tax rate on companies.

Graph 4 indicates that the effective tax rate on companies is notably less than the statutory tax rate and that the gap increased nearly consistently until 1992. Although a reduction in the statutory tax rate in 1993 and 1994 reduced the gap slightly, the effective tax rate adjusted downwards in accordance with the change in the statutory tax rate.

3.1.1.2.1 Corporate income tax on non-gold-mining companies

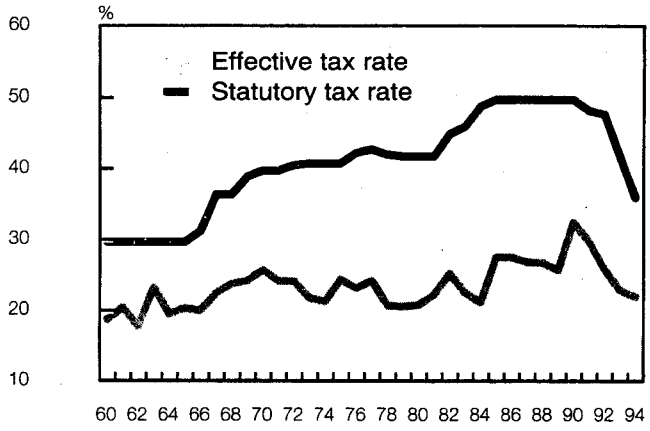
Since companies are allowed to use their latest year of assessment as basis for the determination of their current provisional tax payments, a relatively long time-lag can be expected to exist between the tax payment and the income on which those payments are based. The length of this time-lag is also dependent on how soon the Receiver of Revenue can process assessments.

Corporate profits (B_{ngc}) are calculated as the total nominal gross domestic product at factor cost, excluding the value added by the agricultural, government and

[8] Yost, G.J. (ed.): *1993 International tax summaries, A guide for planning and decisions*, Coopers & Lybrand International Tax Network, John Wiley and sons, 1993.

[9] These figures include companies that are taxed according to a formula, such as gold-mining companies.

Graph 4: Effective and "standard" statutory corporate tax rates



gold-mining sectors, less labour remunerations paid and depreciation allowances of these sectors. The standard statutory tax rate on non-gold-mining companies (τ_{ngc}) is included in the equation as an exogenous variable to allow for manipulation of the tax rate in alternative policy scenarios. A structural break was determined at the end of 1989 and two dummy variables ($DUM1_{ngc}$, with 1 until 1989 and 0 thereafter, and $DUM2_{ngc}$, with 0 until 1989 and 1 thereafter) were included in the equation to indicate the structural change. As the bulk of tax payments by non-gold-mining companies is received in the third quarter of each year until 1992 ($DUM3_{ngc}$) and thereafter in the first quarter of each year ($DUM4_{ngc}$), dummy variables were included in the equation to allow for this seasonality. Since the 1993/1994 tax year, non-gold-mining companies must also pay a withholding tax on dividends paid. The national-accounts data for dividends paid by incorporated business enterprises, excluding those paid by gold-mining companies (DIV_{ibe}), are used as a proxy for actual dividends paid by these companies. A secondary tax rate (τ_{sec}) of 25 per cent is currently levied on dividends paid by companies and this rate is exogenously specified in the equation[10]. Provision for a surcharge on non-gold-mining companies (h_{ngc}) is also made. The estimated equation is as follows[11]:

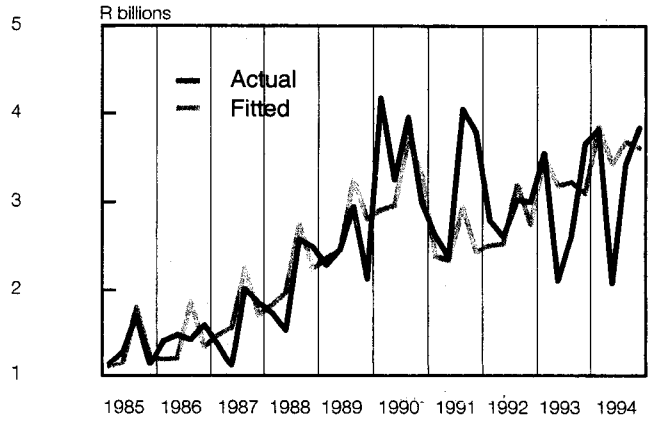
$$
\begin{aligned}
T_{ngc} = {} & \{0,56*[0,2*\tau_{ngc}*B_{ngc} + 0,3*\tau_{ngc-1}*B_{ngc-1} \\
& \quad (16,16) \\
& + 0,3*\tau_{ngc-2}*B_{ngc-2} + 0,2*\tau_{ngc-3}*B_{ngc-3}] \\
& *DUM1_{ngc} \\
& + 0,39*[0,2*\tau_{ngc}*B_{ngc} + 0,3*\tau_{ngc-1}*B_{ngc-1} \\
& \quad (18,09) \\
& + 0,3*\tau_{ngc-2}*B_{ngc-2} + 0,2*\tau_{ngc-3}*B_{ngc-3}] \\
& *DUM2_{ngc} \\
& + 542,88*DUM3_{ngc} + 638,06*DUM4_{ngc} \\
& \quad (2,68) \qquad\qquad (3,37) \\
& + (\tau_{sec}*DIV_{ibe})\}*(1 + h_{ngc})
\end{aligned}
$$

R^2 = 0,65
D-W = 1,58
Estimation period: 1985Q1 – 1994Q4

The correlation between the estimated equation and the actual data is illustrated in Graph 5.

3.1.1.2.2 Income tax on gold-mining companies[12]
A formula which reduces or increases the tax rate according to the relationship between taxable mining income and gross mining revenue, is applied to taxable income from gold-mining operations. Changes in the South African taxation system over the years have effectively placed gold mines into four separate general categories: old mines which were established prior to 28

Graph 5: Corporate income tax on non-gold-mining companies



[10] Because of the deficiency in available data due to the short period of time since this type of tax was introduced, the variable is incorporated in the function without an estimated coefficient. As soon as statistically sufficient data become available, this function should be re-evaluated.

[11] The weights attached to the lagged variable were determined by running a separate regression of the dependent variable on the explanatory variable. The coefficients of the lagged variable were constrained to follow a second-degree polynomial with both end-points restricted to zero.

[12] "Lease payments and taxation", *Mining Journal*, Quarterly Review of South African Gold Shares, 1981, Volume 25, Number 2, p71.

February 1946; mines established between 1946 and August 1966; new mines established after August 1966; and government-assisted mines. However, pre-1966 and post-1966 mines are taxed on the same formula from 1992. Payments to the government by gold-mining companies consist of two independent parts, income tax payments and lease payments (until 1994). Lease payments are discussed in a later section.

Income tax payments take the form of a conventional corporate tax. In addition, no tax is payable until cumulative profits exceed cumulative capital expenditure; as soon as this requirement is met, capital expenditure is treated as an expense as and when incurred. The special capital allowances for tax purposes fall away in the year in which the liability for taxation is first incurred.

The current taxation formula for gold mines is Y=49-244/X, where X is the ratio of profit (less lease payments and redemption allowances - including as much of the redemption allowances as are attributable to the capital allowance in the years preceding that in which taxation is first incurred), to revenue expressed as a percentage. Y is the percentage of profits (less redemption allowance, lease payment and, where applicable, capital allowance) payable as income tax. In addition to the tax payable under this formula, a surcharge could also be applicable. Additional non-mining income is taxed at the standard corporate tax rate.

From January 1994 gold-mining companies have been given the option to be taxed on the same basis as ordinary non-mining companies. A few gold-mining companies have elected to be still taxed according to the old formula. Naturally, this "dual" tax system for gold-mining companies will complicate the future estimation of a single tax equation for gold mines. This will be made even more difficult because lease payments are no longer payable by gold-mining companies from January 1994.

Profits by gold-mining companies (B_g) are calculated as the nominal gross value added by gold-mining companies at factor cost less remuneration of employees in gold-mining companies, less all new investments in gold-mining companies (capital expenditure is regarded as a deductible expenditure for tax purposes) and less lease payments (gold-mining companies do not pay tax on such payments). Based on the pre-1966 tax formula[13], a calculated effective tax rate on gold-mining companies (τ_g) is included in the equation as an exogenous variable to make a manipulation of the tax rate in alternative policy scenarios possible. A structural break was determined at the end of 1989 and two dummy variables, ($DUM\ 1_g$, with 1 until 1989 and 0 thereafter, and $DUM2_g$, with 0 until 1989 and 1 thereafter) were included in the equation to indicate the structural change. Since 1992 the bulk of tax payments by gold-mining companies is received in the second quarter of each year and a dummy variable ($DUM3_g$) was included in the equation to allow for this seasonality. Additionally, since a surcharge is payable by gold-mining companies, a variable signifying this was included in the equation (h_g).

The estimated equation is as follows[14]:

$$
\begin{aligned}
T_g \;=\; & \{[0{,}84(0{,}2*(\tau_{g-1}*B_{g-1}) + 0{,}3*(\tau_{g-2}*B_{g-2}) \\
& \quad (22{,}84) \\
& + 0{,}3*(\tau_{g-3}*B_{g-3}) + 0{,}2*(\tau_{g-4}*B_{g-4}))]*DUM1_g \\
& + [0{,}31*(0{,}2*(\tau_{g-1}*B_{g-1}) + 0{,}3*(\tau_{g-2}*B_{g-2}) \\
& \quad (6{,}10) \\
& + 0{,}3*(\tau_{g-3}*B_{g-3}) + 0{,}2*(\tau_{g-4}*B_{g-4}))]*DUM2_g \\
& + 208{,}38*DUM3_g\}*(1 + h_g) \\
& \quad (3{,}97)
\end{aligned}
$$

R^2 = 0,76
D-W = 1,84
Estimation period: 1985Q1 – 1994Q4

The correlation between the estimated equation and the actual data is illustrated in Graph 6.

3.1.1.2.3 Total direct corporate taxes paid
The taxes paid by non-gold-mining companies (T_{ngc}) are added to those paid by gold-mining companies (T_g) to determine the total direct taxes paid by the corporate

[13] Since 1992 pre-1966 and post-1966 gold mines have been taxed on the same formula.

[14] The weights for the lagged variable were determined by running a separate regression. The coefficients were constrained to follow a second-degree polynominal with both end-points restricted to zero.

Graph 6: Income tax on gold-mining companies

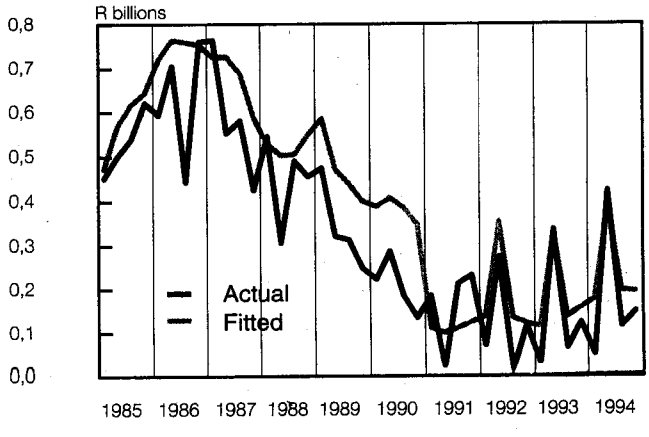


Table 2 Indirect taxes received by the National Revenue Fund and percentage contribution to total taxes received

	1985		1990		1994	
	R millions	%	R millions	%	R millions	%
Customs duty and surcharge	1 463	11,4	4 675	14,4	5 345	10,8
Excise duty	1 825	14,2	2 980	9,2	5 569	11,2
Fuel levy	0	0	4 110	12,7	8 154	16,4
Other customs and excise duties	92	0,7	323	1,0	9	0
Less: Payments in terms of Customs Union Agreements	732	5,7	1 676	5,2	3 244	6,5
Customs and excise duties	2 648	20,6	10 412	32,2	15 833	31,9
GST/VAT	7 444	57,9	17 299	53,4	27 873	56,1
Other*	2 754	21,4	4 673	14,4	5 967	12,0
Total	**12 846**	**100,0**	**32 384**	**100,0**	**49 673**	**100,0**

* Including stamp duties and fees, transfer duties, interest and dividends and other inland revenue.

sector in South Africa (T_c). The identity in the model is as follows:

$$T_c = T_{ngc} + T_g$$

3.1.1.3 Total direct taxes paid

To calculate the total direct taxes paid, the total direct personal taxes paid (T_p) are added to those paid by the corporate sector (T_c). The identity is as follows:

$$T_d = T_p + T_c$$

3.1.2 Indirect taxes

All taxes imposed on goods, services and transactions are classified as indirect taxes. In its standardised classification of tax receipts, the International Monetary Fund (IMF) differentiates between domestic taxes on goods and services and taxes on international trade and transactions. The different indirect taxes currently imposed by the government in South Africa are tabulated in Table 2. From this information it is apparent how the composition of indirect taxes has been dominated by general sales tax, which was replaced by value-added tax in October 1991. Although general sales tax/value-added tax contributed 56,1 per cent to indirect taxes received in 1994, its contribution has declined from a level of almost 58 per cent in 1985. The contribution of customs and excise duties to indirect taxes increased from 20,6 per cent in 1985 to 31,9 per cent in 1994, mainly as a result of a rise in the relative importance of the fuel levy (introduced in August 1987), which in 1994 contributed 16,4 per cent to indirect tax receipts of the government.

All tax collections specified in the model are equations of the tax rate at which the specific tax is levied and the size of the tax base on which the tax is levied. However, the determination of the tax base for indirect taxes is much more difficult than for direct taxes. A large number of goods and services are subject to this type of tax, especially excise duties, and these goods and services are not necessarily summarised under one total in the national accounts. In all the equations for indirect tax receipts a proxy, as close to the actual tax base as possible, has been specified.

3.1.2.1 General sales tax/value-added tax receipts[15]

Ever since its introduction in 1978, general sales tax (GST) has provided a large proportion of government revenue. Introducing general sales tax in 1978, the Minister of Finance stated in his Budget speech that the rate must be as low and the tax base as broad as possible[16]. Since its inception the Sales Tax Act, No. 103 of 1978, has undergone amendments in almost every fiscal year. Amendments and other important changes to the structure included the expansion of the definition of taxable services and various exemptions in respect of goods and services. There were also increases in the rate from the original 4 per cent to 5 per cent with effect from 1 March 1982, to 6 per cent with effect from 1 September 1982, to 7 per cent with effect from 1 February 1984, to 10 per cent with effect from 1 July 1984, to 12 per cent with effect from 25 March 1985, and finally to 13 per cent with effect from 8 May 1989. After the approval of the Margo Commission's recommendation[17] the general sales tax system was replaced with an invoice-based value-added tax (VAT) system on 30 September 1991. At the same time, the tax rate was reduced to 10 per cent and a zero tax rate on a number of basic food items became applicable.

[15] Kleu M., Prinsloo J.W. and Venter L.P.: "Notes on the value-added tax base of South Africa", *Quarterly Bulletin* of the South African Reserve Bank, June 1993.

[16] *Budget Speeches 1978/1979*, Government Printer, Pretoria, 1978, p18.

[17] *Report of the Commission of Inquiry into the Tax Structure of the Republic of South Africa*, RP34/1987, 1987.

The tax rate was increased to 14 per cent with effect from 7 April 1993.

In a general sales tax system, which is a retail sales tax, tax is levied only when goods or services are sold to the so-called end-user. In a value-added tax system, tax is levied on each disposal of goods in the chain from primary producer or importer through the various intermediaries, such as wholesalers and retailers, to the end-user. To avoid escalation and to ensure that, for a given rate, a value-added tax system produces roughly the same amount of revenue as the general sales tax system, each trader is refunded the value-added tax on his purchases and he pays value-added tax on his sales, the net effect being that the difference between the two amounts represents tax on the value that has been added.

In the model provision was made for this constantly changing tax base and tax system by constructing a time series for the tax base (B_{vat}), utilising and weighting the main expenditure components[18] of the nominal gross domestic product on which general sales tax was or value-added tax is payable, i.e. nominal private consumption expenditure (C), nominal government consumption expenditure (excluding remuneration of employees) (G_g), nominal gross domestic fixed investment (I), and the value of exports of goods and non-factor services (X). However, various adjustments had to be made to these aggregates to allow for changes in the tax system. Firstly, gross domestic fixed investment had to be adjusted with the introduction of the value-added tax because only fixed investment expenditure on private residential buildings and non-residential buildings (I_{prb}) and structures furnished by the government to provide community, social and personal services (I_{csp}) are subject to this tax. Secondly, since the introduction of the value-added tax system, exports of goods and services have not been taken into account in the calculation of the tax base. On the other hand, imported goods, which are subject to VAT, are covered by the domestic expenditure variables included in the base. Fourthly, services on which general sales tax was payable are approximated in the calculation of the tax base as an estimated percentage of nominal gross domestic product (Y). Finally, since net indirect tax payments (indirect taxes less subsidies) are included in the national accounts' expenditure aggregates at market prices which are utilised to calculate the tax base, the indirect tax component had to be removed from the base. The sum of the weighted expenditure components was therefore divided by the tax rate applicable over the calculation period.

Each time the structure of the system was changed, the weights were re-calculated and the components multiplied by a dummy variable, specified as 1 for the period over which the structure was in operation and 0 otherwise. The first period over which the general sales tax structure was in operation, was from its inception in 1978 until 31 June 1984. A dummy variable (DUM1), with 1 over this period and 0 otherwise, was created to calculate the tax base over this period. A second dummy variable (DUM2) was created for the period 1 July 1984 until 29 September 1991, with 1 over this specified period and 0 otherwise, to indicate the second period over which the changed tax structure was valid. The third dummy variable (DUM3) was created with 1 from 30 September 1991 until the present time, and 0 otherwise, to indicate the change in the tax structure from a general sales tax system to a value-added tax system.

The weights for the expenditure components were determined by calculating the percentage of each component subject to general sales tax or value-added tax[19]. The final tax base was therefore calculated as follows:

$$
\begin{aligned}
B_{vat} = {} & ((0{,}761*C + 0{,}739*I + 0{,}684*G_g + 0{,}029*X \\
& + 0{,}059*Y)/(1 + \tau_{vat}))*DUM1 + ((0{,}656*C \\
& + 0{,}728*I + 1{,}0*G_g + 0{,}040*X + 0{,}075*Y) \\
& /(1 + \tau_{vat}))*DUM2 + ((0{,}705*C + 1{,}0*G_g \\
& + 1{,}0*(I_{csp} + I_{prb}))/(1 + \tau_{vat}))*DUM3
\end{aligned}
$$

This tax base was utilised in the equation for general sales tax or value-added tax collections (T_{vat}). Owing to time lags in the tax collection process, the tax base (B_{vat}) has been lagged as well. The tax rate (τ_{vat}) is exogenously specified. The estimated equation is as follows[20]:

$$
\begin{aligned}
T_{vat} = {} & 0{,}93*[0{,}6*(\tau_{vat}*B_{vat}) + 0{,}4*(\tau_{vat-1}*B_{vat-1})] \\
& (46{,}78)
\end{aligned}
$$

R^2 = 0,88
D-W = 1,30
RHO = 0,25
Estimation period: 1985Q1 – 1994Q4

The correlation between the estimated equation and the actual data is illustrated in Graph 7.

3.1.2.2 Other indirect tax receipts of the government

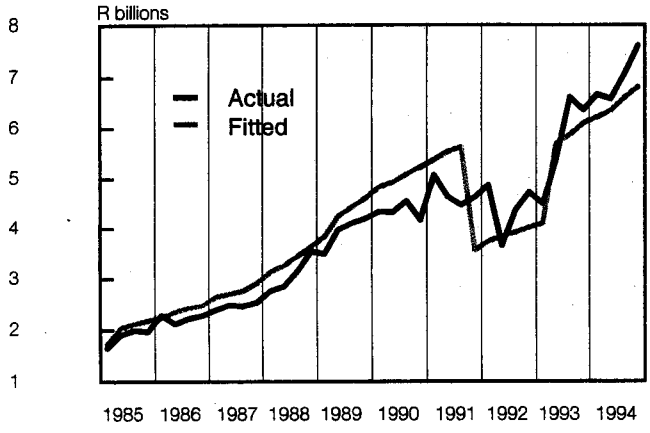
Other indirect tax receipts of the government include tax on shareholders, interest payments to foreigners, and

[18] The base is derived from the expenditure side of the standard national accounts and not from the production side to recognise that a VAT-type of taxation is a tax on domestic expenditure rather than a tax on value added in the true sense of the national-accounting interpretation of this concept.

[19] For example, with regard to private consumption expenditure, the weights of the component were based on various consumer spending surveys and consumer price index "basket" information.

[20] The weights attached to the lagged independent variable were determined by running a separate regression of the dependent variable on the explanatory variable.

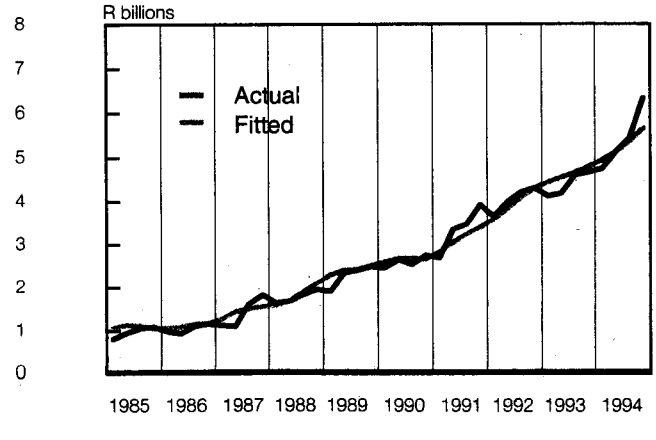
Graph 7: General sales tax/value-added tax receipts



corporate profits not subject to dividends, estate duties, stamp duties, royalties and tax on gifts. As a proxy for all these taxes, income from property of households (Y_{prop}) is used as the base for the estimation of the equation. Since the average tax rate is estimated as the coefficient in the equation, a dummy variable (DUM_{ocg}) was included to enable the manipulation of the estimated effective tax rate in alternative policy scenarios. The following equation was estimated:[21]

[21] The weights of the lagged variables were determined by running a separate regression. The coefficients were constrained to follow a second-order polynomial regression with both end-points restricted to zero.

Graph 8: Other indirect tax receipts of the government



$$T_{ocg} = (0,35*DUM_{ocg})*(0,20*Y_{prop} + 0,30*Y_{prop-1} + 0,30*Y_{prop-2} + 0,20*Y_{prop-3})$$
(54,74)

R^2 = 0,95
D-W = 1,74
RHO = 0,47
Estimation period: 1985Q1 – 1994Q4

The correlation between the estimated equation and the actual data is illustrated in Graph 8.

3.1.2.3 Indirect tax receipts of provincial and local authorities

Indirect taxes are paid to provincial administrations on items such as motor licences and motor racing. Local governments collect taxes on property and levies paid to the regional services councils. As a proxy for these items, the nominal private consumption expenditure on services (C_s) was used as the tax base. Only the services component of private consumption expenditure was utilised as these taxes are levied primarily on services rendered and not on goods traded.

As in the case of previous equations where the effective tax rate was derived as the estimated coefficient of the tax base variable, a dummy variable ($DUM1_{pl}$) was included in the equation to enable manipulation of the estimated tax rate in alternative policy scenarios. Since a large part of this tax is usually paid to the provincial and local authorities in the second quarter of each year, a dummy variable ($DUM2_{pl}$) has been included in the equation. The estimated equation is:

$$T_{pl} = (0,09*DUM1_{pl})*((C_{s-1} + C_{s-2} + C_{s-3} + C_{s-4})/4 + 178,59*DUM2_{pl})$$
(22,41) (1,91)

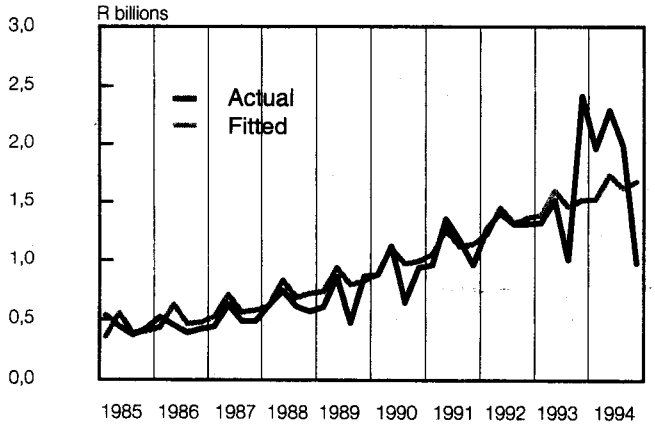
R^2 = 0,77
D-W = 1,58
Estimation period: 1985Q1 – 1994Q4

The correlation between the estimated equation and the actual data is illustrated in Graph 9.

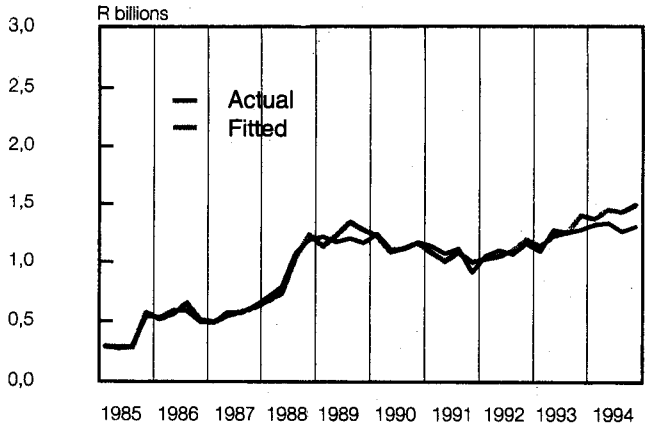
3.1.2.4 Custom duties and surcharge on imports

In the model custom duties and the surcharge on imports are added together and estimated in one equation. As custom duties and surcharges are payable on imported goods, the tax base for this type of tax was specified as the value of merchandise imports, excluding oil imports (M_{xo}). Custom duties are payable within one month of the arrival of the goods in South Africa, and the tax base variable was consequently specified without a lag structure. An average surcharge rate was derived by dividing the total surcharge on imported goods received

Graph 9: Indirect tax receipts of provincial and local authorities



Graph 10: Custom duties and surcharge on imports



by the value of merchandise imports, excluding oil imports. The surcharge rate (τ_{sc}) was specified exogenously in the model and could therefore be manipulated with ease. A dummy variable (DUM_{cd}) was once again included in the customs duty component to be able, if necessary, to manipulate the effective tax rate because the rate is the estimated coefficient of the tax base. The estimated equation is as follows:

$$T_{cd} = (0{,}06*DUM_{cd})*M_{xo} + \tau_{sc}*M_{xo}$$
$$(52{,}91)$$

R^2 = 0,90
D-W = 1,31
RHO = 0,25
Estimation period: 1985Q1 – 1994Q4

How well the estimated equation correlates with the actual data, is illustrated in Graph 10.

3.1.2.5 Lease payments by gold-mining companies[22]
Mineral rights to diamonds, gold and other precious metals are vested in the government and, prior to 1992, a new mining venture had to obtain a mining lease in respect of such minerals. Such leases usually provided for a lease consideration payable to the government, which was permissible as a deduction in determining taxable income. These mining lease agreements were discontinued from January 1994.

Lease payments had to be made annually and within two months of the end of the gold-mining companies' financial years. Lease payments, like income tax payments, were calculated according to a specific formula.

The profit assessment for the purpose of estimating lease payments was the working profit of the mine less the capital expenditure redemption (or amortisation) allowances. No lease payment was charged until cumulative profits exceeded cumulative capital expenditure; capital expenditure was therefore treated as an expense as and when incurred.

An additional interest allowance was also calculated on any unredeemed balance of capital expenditure. For leases granted before October 1967 this had been calculated at 5 per cent single interest, and for leases granted after this date at 6 per cent compound interest.

The lease payments of certain old mines were also subject to special features. There was an Offset Clause which gave relief in the event of increased income tax, while in some cases a minimum payment was fixed, regardless of formula assessment.

The lease payment was calculated before the tax payment, as it was allowed as a charge against profits for the purpose of tax calculations. Each mine had its own formula, of which Y=15-90/X was a typical example, where X is the ratio of profit (less redemption allowances) to revenue expressed as a percentage, and Y represents the percentage of profits (less redemption and capital allowances) payable to the government.

For purposes of the model, the taxable income of the gold mines (B_g) was calculated as the nominal gross value-added by gold mines less remuneration of employees and gross new fixed investment by the gold-mining sector, multiplied by the tax rate on gold mines (τ_g) (calculated as described in a previous section). The surcharge payable is indicated by the variable h_g. Two dummy variables, $DUM1_{glp}$ and $DUM2_{glp}$, were included in the equation to indicate a

[22] "Lease payments and taxation", *Mining Journal*, Quarterly Review of South African Gold Shares, 1981, Volume 25, Number 2, p71.

structural break in 1990. The equation is furthermore multiplied by a dummy (DUM_{glp}) with values of 1 before 1994 and 0 from 1994 onwards to incorporate the abolition of lease payments to the government in the model. The estimated equation[23] is as follows:

$$T_{glp} = [0{,}22*(0{,}17*\tau_{g-1}*B_{g-1} + 0{,}27*\tau_{g-2}*B_{g-2} \quad (27{,}12)$$

$$+ 0{,}30*\tau_{g-3}*B_{g-3} + 0{,}26*\tau_{g-4}*B_{g-4})*DUM1_{glp}$$

$$+ 0{,}12*(0{,}17*\tau_{g-1}*B_{g-1} + 0{,}27*\tau_{g-2}*B_{g-2} \quad (8{,}72)$$

$$+ 0{,}30*\tau_{g-3}*B_{g-3} + 0{,}26*\tau_{g-4}*B_{g-4})*DUM2_{glp}]$$

$$*(1 + h_g)*DUM_{glp}$$

R^2 = 0,80
D-W = 1,91
Estimation period: 1985Q1 – 1993Q4

The correlation between the estimated equation and the actual data, is illustrated in Graph 11.

3.1.2.6 Total indirect taxes received
Total indirect taxes received (T_I) were calculated as an identity. This consists of the sum of general sales tax/value-added tax receipts (T_{vat}), other indirect tax receipts of the government (T_{ocg}), indirect tax receipts of provincial and local authorities (T_{pl}), custom duties and the surcharge on imports (T_{cd}) and lease payments by gold-mining companies (T_{glp}). However, payments in terms of the Customs Union Agreements (CUA), which were specified exogenously in the model, were subtracted from this total. The identity is as follows:

$$T_I = T_{vat} + T_{ogc} + T_{pl} + T_{cd} + T_{glp} - CUA$$

3.1.3 Total Exchequer receipts
To calculate Exchequer receipts (E_R), the amounts received for direct (T_D) and indirect taxes (T_I) were added together. There is, however, a slight discrepancy between the direct and indirect taxes received as recorded in the National Accounts and those recorded in the National Revenue Account. The direct and indirect taxes estimated in the model are based on national-accounts data. To allow for the discrepancy in the model, another variable (O_R) was included. This was exogenously specified to the Exchequer receipts' identity to transform the national-accounts data to national-revenue-fund data. The identity obtained is therefore:

$$E_R = T_D + T_I + O_R$$

3.2 Exchequer issues
3.2.1 Interest paid on government debt
The interest paid on government debt in the current period was estimated as an equation of the actual government debt in the previous period (GD), less the gold and foreign exchange contingency reserve account (CRA), and the deficit before borrowing incurred in the current period (DBB), multiplied by a weighted average of the long-term interest rate in the secondary market (i_e) and the short-term interest rate (i_{tb}). Since the deficit before borrowing is calculated as revenue less expenditure and has consistently had a negative sign, this variable was multiplied by -1 so that the sign, as used in this specific equation, could be corrected. The estimated equation is as follows[24, 25].

$$R_{gd} = 471{,}0 + 0{,}02*(GD_{-1} - CRA_{-1}) \quad (4{,}19) \quad (16{,}64)$$

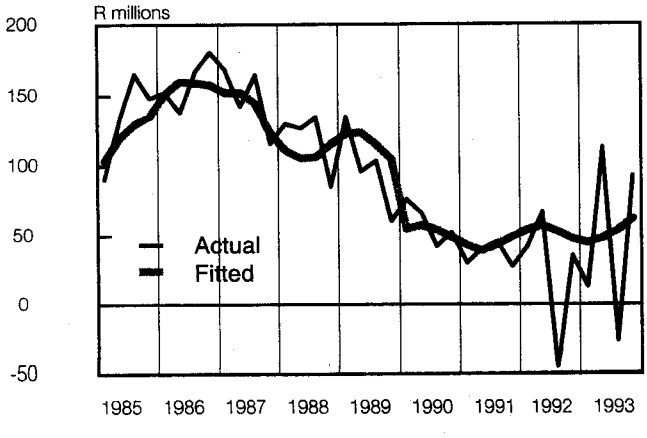
$$+ 1{,}06*(-1)*DBB*(0{,}15*i_e/100 + 0{,}85*i_{tb}/100) \quad (5{,}06)$$

R^2 = 0,95
D-W = 2,11
RHO = 0,39
Sample period: 1985Q1 – 1994Q4

The correlation between the estimated equation and the actual data is illustrated in Graph 12.

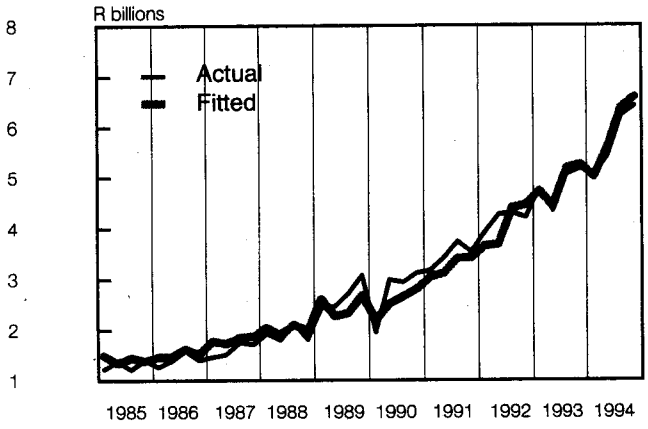
[23] The weights attached to the lagged variable in the function were determined by running a separate regression of the dependent variable on the explanatory variable. The coefficients of the lagged variable were constrained to follow a straight line polynomial with start-point restrictions.

Graph 11: Lease payments by gold-mining companies



[24] This function implies an average fixed interest rate of approximately 10 per cent per annum on government debt.
[25] The weights attached to the variables were determined by running a separate regression of the dependent variable on the explanatory variable.

Graph 12: Interest paid on government debt



3.2.2 Total Exchequer issues

Exchequer issues (E_I) were calculated as the sum of nominal consumption expenditure by the general government (G), nominal fixed investment expenditure on community, social and personal services (calculated from the exogenously specified real fixed investment expenditure on these services, I_{csp}, multiplied by the endogenously determined price deflator for fixed investment expenditure, P_I), subsidies paid by the government (S) and current transfers of the government (CT) (which are both exogenously specified), and interest payments on government debt (R_{gd}). An additional variable, O_I, was added to the identity to ensure that the data determined on a national-accounts basis correspond with the data determined on the national-revenue-fund basis. The identity in the model is then:

$$E_I = G + I_{csp}*P_I + S + CT + R_{gd} + O_I$$

3.3 Deficit before borrowing

To determine the deficit before borrowing (DBB), exchequer issues (E_I) were subtracted from exchequer revenue (E_R). The identity is:

$$DBB = E_R - E_I$$

3.4 Government debt

The accumulation of government debt (interest-bearing and non-interest-bearing debt) (GD) is approximated in the model by adding the deficit before borrowing to the government debt in the previous period. The debt before borrowing is calculated with a negative sign in the model and this is corrected in the equation by multiplying the variable DBB by -1. The identity is:

$$GD = GD_{-1} + (-1)*DBB$$

3.5 Government expenditure

General government consumption expenditure (G) is treated in the model as an exogenous variable. Assumptions are made for the nominal consumption expenditure by the general government on goods and services, excluding remuneration of employees (G_g), remuneration per general government employee (W_g), and employment by the general government (L_g). The identity is as follows:

$$G = G_g + (W_g*L_g)$$

Real gross domestic fixed investment by public authorities is treated as an exogenous variable in the model, which is subsequently added to the endogenously determined real gross domestic fixed investment by private business enterprises to determine the total real gross domestic investment expenditure.

4. Linkages of the public sector sub-model to the main model

The main channel through which the defined public sector sub-model operates is public expenditure, and any fluctuation in this economic entity not only influences domestic production, but also employment levels, inflation and other variables, provided that the economy is not operating at full production capacity. Under full employment conditions, any further increase in government expenditure results only in higher inflation.

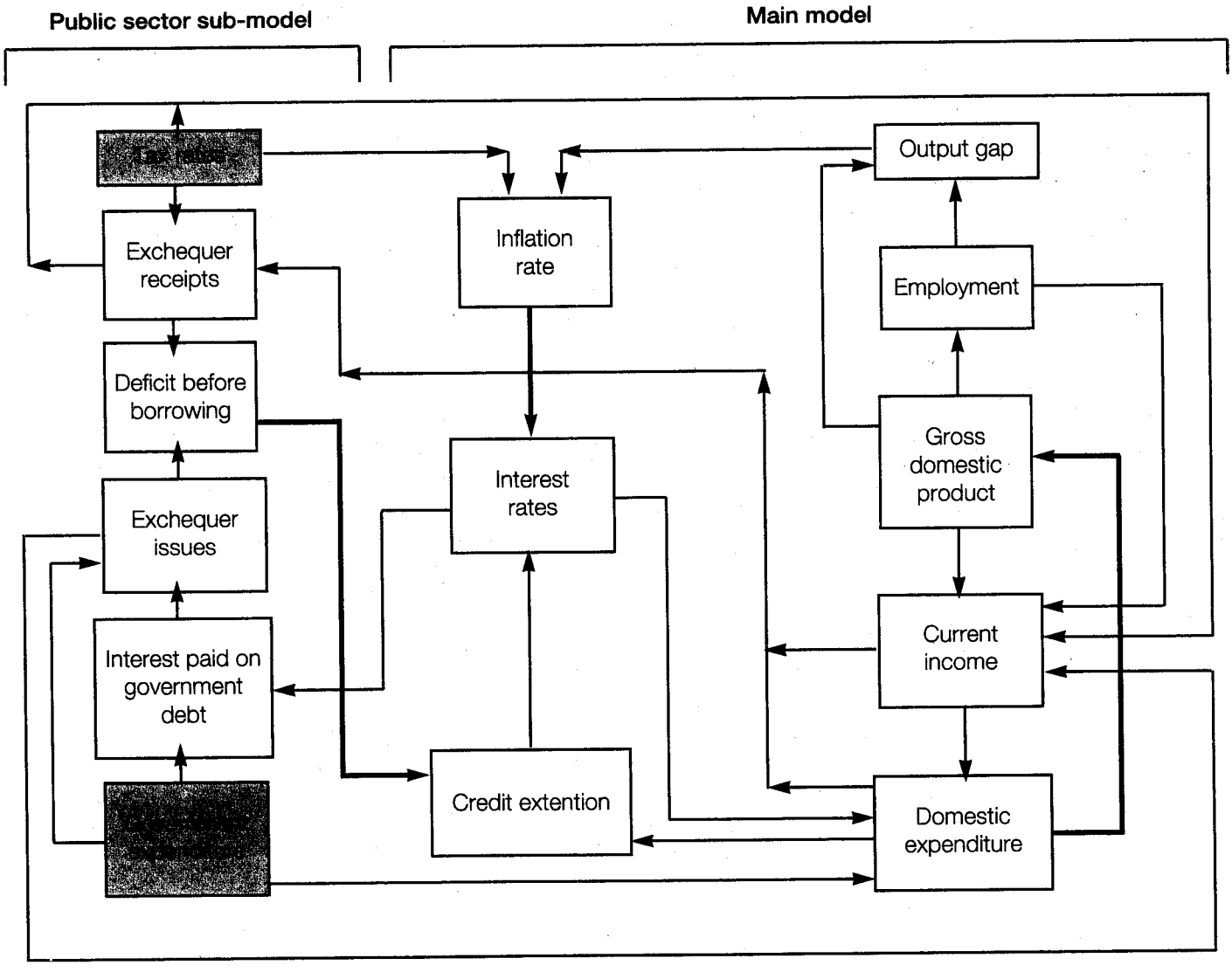
Taxes, which constitute the largest portion of government revenue, influence current income in conjunction with exchequer issues in the form of subsidies and transfer payments. Any change to the purchasing power capacity of economic participants inevitably leads to a change in domestic expenditure. The changing expenditure environment has, in turn, further secondary implications in that exchequer revenues change in accordance with the altered purchasing capacity of the economy.

Changes in government debt exert pressure on the money and capital markets and this situation changes the prevailing level of interest rates. Interest rate behaviour, as determined by the supply of and demand for loanable funds, has a further impact on the accrued interest rate that is to be paid on government debt. The interest rate fluctuation, depending on the direction of movement, is channelled through to domestic expenditure by means of a stimulus or disincentive to expand private consumption expenditure and gross domestic investment.

The inflationary effect in the model is partly driven by the consequential changes of the statutory indirect tax rates that have been necessitated by the burden of

DIAGRAM 1

FLOW CHART OF THE LINKAGES OF THE PUBLIC SECTOR SUB-MODEL TO THE MAIN MODEL



Dark areas indicate prespecified assumptions.

financing government expenditure through increased public sector tax revenue.

In conclusion, all appropriate tax bases relevant to the public sector sub-model are generated by the interaction of the model's primary components.

5. Simulations with the model

A multiplier experiment utilising the main econometric model of the South African Reserve Bank and incorporating the sub-model above, was carried out by first running a twenty-quarter baseline simulation from 1990 to 1994. Actual values of the exogenous variables were used and the least squares residuals of the stochastic equations were added back to each equation to ensure that the model duplicates the actual values of the endogenous variables. Next, a shock to the baseline simulation was implemented in an effort to demonstrate the interactiveness of the model and to evaluate the model structure. The alternative simulation was performed by increasing the level of nominal consumption expenditure by general government, excluding the remuneration of employees, by a sustained 10 per cent over the aforementioned period. The results of the simulations

Table 3 The effect of a ten per cent increase in the nominal consumption expenditure by the general government, excluding remuneration of employees

Year	Real government consumption expenditure* %	Real gross domestic product* %	Employment in the non-agricultural sector# Number	Inflation rate# %	Balance on the trade account# R millions	Deficit before borrowing# R millions
1	+3,8	0,0	-250	+0,14	-225	+1 480
2	+3,8	0,0	-1100	+0,06	-200	+2 060
3	+3,9	0,0	-1 950	+0,02	-140	+2 500
4	+4,0	-0,1	-3 100	+0,02	-140	+3 270
5	+4,0	-0,1	-4 950	-0,01	-125	+3 790
Average	+3,9	-0,1	-2 270	+0,05	-172	+2 620

* Calculated as the difference between the baseline and alternative simulation as a percentage of the baseline results.
\# Calculated as the difference between the results of the baseline and the alternative simulation.

were then compared to determine the multipliers.

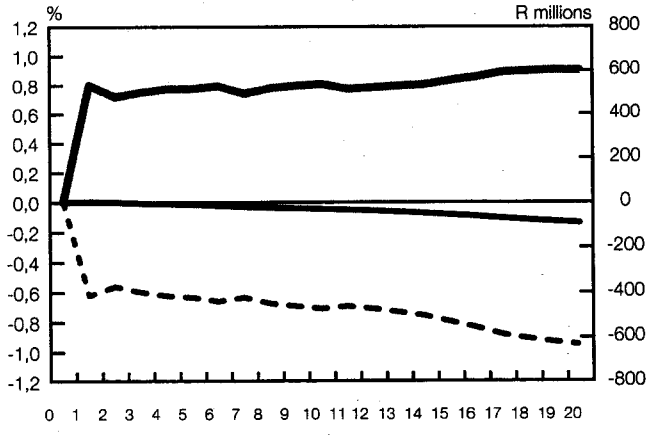
Owing to the respective weights of total government consumption expenditure, this hypothetical 10 per cent increase in nominal terms permeates through to the real economy by means of an average 3,9 per cent increase in the total real government consumption expenditure. Although the expected effect of this alternative policy scenario would be an expansion of domestic production, the simulated results indicate otherwise.

The initial increase in domestic demand results in a rise in the volume of imports of goods and non-factor services. The simulation results illustrate that as imports expand the trade account of the balance of payments begins to deteriorate. This has repercussions on the external value of the rand and the rand/dollar exchange rate depreciates. The depreciation in the rand leads to higher import costs, thus aggravating inflation. The simulation indicates that because of the depreciation of the rand inflation is anticipated to increase by an average 0,14 percentage points in the very first year.

The results of the simulation indicate further that five years after the initial policy shock the level of real gross domestic product is 0,1 per cent lower than the baseline scenario. This is primarily caused by the fact that the induced government consumption expenditure has been nullified by a decline in real private consumption and investment expenditures, due to increased interest rates (see Graph 13). In the process an average of 2 270 job opportunities per annum were lost in the non-agricultural sector.

The fact that the total remuneration of employees remains more or less constant implies that increased government revenue in the form of indirect and direct tax accumulations is virtually non-existent. Government expenditure, on the other hand, increases quite substantially in the alternative simulation. The net effect on the government fiscal accounts is an expansion of about R1,5 billion in the level of the government deficit before borrowing in the first year after the policy change to a level that is almost R3,8 billion higher than the actual level of the final year.

Graph 13: The effect of a 10 per cent increase in the nominal consumption expenditure by the general government, excluding remuneration of employees



6. Summary

Forecasts and the evaluation of alternative policy suggestions are of crucial importance in the formulation

of financial programmes of the government and in fiscal and monetary policy.

The emphasis in the sub-model for government finances incorporated in the main model of the South African Reserve Bank has been placed on explaining the endogenous government revenue variables by means of the product of tax rates and tax-base entities. Government expenditure is primarily treated as an exogenous policy instrument.

The model allows for interaction between the public sector and the aggregate expenditure components, allowing model-users to illustrate the secondary feedback effect of an alteration to the tax base via current income. In addition to this channel, the impacts of fiscal policy changes on other major economic entities incorporated in the model can be investigated.

The main advantage of this model lies not in its capacity to capture all the complexities of the South African tax structure, but rather in its ability to produce results within a consistent framework.

Previous Occasional Papers

Occasional Paper No **1**, December 1990; The optimal allocation of savings in the South African economy and the role of monetary policy *by* J.A. Lombard and J.P. van den Heever.

Occasional Paper No **2**, December 1990; Notes on oil, gold and inflation.

Occasional Paper No **3**, January 1991; South Africa's balance of payments: Sources, methods and reliability *by* E.J. van der Merwe and M.C. Bester.

Occasional Paper No **4**, July 1991; South Africa's public-sector accounts 1973 to 1990.

Geleentheidspublikasie no **5**, September 1991; Suid-Afrika se nasionale rekeninge, 1946 tot 1990.

Occasional Paper No **6**, May 1993; Is South Africa in a debt trap? *by* E.J. van der Merwe.