AN ECONOMETRIC MODEL FOR FISCAL POLICY

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In this study an attempt is made to develop an econometric model for fiscal policy for Greece. The model explains all government revenues on a consolidated account within a macroeconomic framework. The main purpose is to measure the effects of government revenues and expenditures on the most important macroeconomic variables.

The estimation of such a model is believed to be of great importance for Greece. Firstly, in order to be able to choose the appropriate fiscal policy for correcting a probable disequilibrium in the economy it is necessary to know much about the main characteristics of the economic system as well as the basic effects of the alternative fiscal policies. However, only if accurate forecasts are available it is possible to adopt the appropriate corrective policies. Secondly, the relative importance of the government sector has increased in Greece. The provision of infrastructure and the increase in transfer payments that have been experienced in the last fifteen years, together with similar movements on the revenue side of the budget have considerably influenced the role that is assigned to the government nowadays. However, despite these changes we still do not have a precise idea of the main macroeconomic effects of these policies. Finally, we should take into consideration that the use of quantitative techniques in developing countries is still not very widespread. Thus, despite the various shortcomings of the present model there are still some benefits to be drawn. Macroeconomic models for the Greek economy were constructed in the early 1960's, though these were rather long-term planning models. The model proposed here is specified in such a way that it may be used for evaluating the impact of alternative fiscal policies. Since interest centres on ttors are unavoidable. Another reason for placing more emphasis on the government sector is that the statistical data are believed to be of a better quality than those of other sectors.

The construction of a sophisticated model requires a vast amount of information. However, in constructing a model for a developing country one faces the problems of availability and unreliability of the existing data. In many instances measurements for important variables do not exist while in some cases figures provided by the same body and referring to the same concept and year differ considerably from each other.

It has been argued [1] that macroeconomic models for developing countries should emphasize the supply side of the economy because changes in production are seriously constrained by the lack of such factors as skilled labour, financial resources, inadequate machinery and equipment and therefore low productivity. However, the unavailability of information for such important variables as capacity utilization, sectoral stocks of capital and changes in the quality of the labour sypply limit the specification of the present model to the demand side of the economy. But even then it was necessary at times to construct time series for the sample period from other information.

Another difficulty arose from the fact that in developing countries many unquantifiable socio-political, demographic and cultural forces are of great importance and affect in a very direct way the functioning of the economic system.

A question that also arises is to what extent models that have been successfully used in developed countries can describe, with some degree of accuracy, the functioning of the economic system of a developing country. Although one may argue that most of the problems in developing countries are the same in kind as those of the industrialized countries, they are certainly different in degree. This must be taken into account by the model builders in developing countries.

Due to the above reasons the formulation of econometric models in developing countries requires a more intense effort. Generally the model builder wants the model to conform as much as possible with reality and in doing so he must approach the problem by using alternative theories, emphasizing certain aspects and counting on the availability of statistical data[1]. Under our circumstances it was especially important to examine the results of many formulations and most of the equations were finally chosen from a number of alternative results. This was also done because there is little previous econometric work available for Greece so alternative relationships had to be tested.

In the estimation of the model we used annual observations for the period 1960-1973. Unfortunately data for the various macro-economic variables are not available on a quarterly basis. Moreover all equations were estimated by the method of ordinary least squares since in view of the problems outlined earlier, there seemed no merit in applying any more sophisticated procedure.

A more accurate and more useful model could be obtained by improving the present statistical foundations, revising and refining the empirical estimates and testing new theories and formulations.

Specification of the model

I. The Equations

1. $CD = 975.93 + 0.5374\ CD_{-1} + 0.0507\ (L/PC)_{-1}$
2. $CSD = -4377.12 + 0.1486\ TRPR/PC + 0.1455\ (DI - TRPR)/PC$

1. It should be noted that data derived from time series may indicate high correlations even though the relationships are of a non-causal nature.

3. $CND = 4744.84 + 0.0600\ DI/PC + 0.8561\ CND_{-1}$
4. $CS = 5140.02 + 0.5202\ TRPR/PC + 0.2168\ (DI\text{-}TRPR)/PC$
5. $IPE = 3066.18 + 0.8152\ IPE_{-1} + 0.8210\ [(PROF\text{-}TCOR)/PINV]_{-1}$
6. $IDW = -2240.94 + 0.0799\ DI/PINV + 0.2951\ CRDW/PINV$
7. $IMP = -9076.33 + 0.1335\ DI/P + 1.0075\ FER_{-1}$
8. $TINC = -1351.51 + 0.3637\ TI - 0.0486\ D1 - 0.0916\ D2 - 0.1463\ D3 - 0.1482\ D4$
9. $TCOR = 56.713 + 0.1274\ PROF_{-1} - 167.928\ D5$
10. $SSCON = -99.981 + 0.0143\ PI + 0.9427\ SSCON_{-1} - 113.120\ D6$
11. $TPROP = -567.76 + 0.0040\ SC$
12. $IMPD = -80.72 + 1.122\ (IMP.P)$
13. $TURIMP = -1613.97 + 19410.29\ t_{turimp} + 0.0524\ (IMP.P)$
14. $CLT = -67.22 + 8211.60\ t_{clt} + (IMP.P)$
15. $TUR = -1242.58 + 0.0177\ (TC.P) + 7241.50\ t_{tur}$
16. $TOB = -174.99 + 0.6401\ CTOB$
17. $STAMP = -1119.44 + 0.0125\ (GNP.P) + 0.7750\ STAMP_{-1}$
18. $TRCT = 24.114 + 1.1508\ TRCT_{-1}$
19. $NTR = -14.30 + 0.0188\ (GNP.P) + 6744.17\ D7$

II. Identities

20. $GNP = TC + IPE + IDW + GC + GI + X - IMP$
21. $PI = (GNP.P) - DEPR - TIND$
22. $DI = PI + TRPR - TINC - SSCON$
23. $TC = CD + CSD + CND + CS$
24. $TI = DECL - EXEM - DEDUC$
25. $TIND = TUR + TOB + TURIM + CLT + IMPD + TTRC + STAMP + OTHIND$
26. $TOTREV = TIND + TPROP + TCOR + TINC + SSCON + NTR + OTHDIR$

III. List of Variables

All monetary variables are in million drachmas and tax rates are in actual fractions. The endogenous variables are numbered and ordered so that their order of appearance in the list corresponds to the order of equations explaining these variables. Exogenous variables are ordered alphabetically.

a. Endogenous Variables

1. CD: Real personal consumption expenditures on durables.
2. CSD: Real personal consumption expenditures on semi-durables.
3. CND: Real personal consumption expenditures on non-durables.
4. CS: Real personal consumption expenditures on services.

5. IPE: Real private investment in plant and equipment.
6. IDW: Real private investment in residential construction.
7. IMP: Real imports.
8. TINC: Personal income tax.
9. TCOR: Corporate income tax.
10. SSCON: Social Security Contributions
11. TPROP: Property tax.
12. IMPD: Import duties.
13. TURIMP: Turnover tax on imports.
14. CLT: Consumption and luxury tax on imports.
15. TUR: Turnover tax.
16. TOB: Tobacco tax.
17. STAMP: Stamp duties.
18. TRCT: Transfer of capital tax.
19. NTR: Non-tax revenue.
20. GNP: Gross National Product (Real).
21. PI: Personal Income.
22. DI: Disposable Income.
23. TC: Total personal consumption (Real).
24. TI: Taxable income.
25. TIND: Indirect taxes.
26. TOTREV: Total revenue.

b. Exogenous variables

1. CRDW: Credit for housing to the private sector.
2. CTOB: Consumption of tobacco.
3. D1: Dummy variable: 1 for 1963 and 1964; 0 otherwise.
4. D2: Dummy variable: 1 from 1965 to 1967; 0 otherwise.
5. D3: Dummy variable: 1 from 1968 to 1971; 0 otherwise.
6. D4: Dummy variable: 1 for 1972 and 1973; 0 otherwise.
7. D5: Dummy variable: 1 from 1969 to 1973; 0 otherwise.
8. D6: Dummy variable: 1 from 1969 to 1973; 0 otherwise.
9. D7: Dummy variable: 1 in 1969 and 0 otherwise.
10. DECL: Declared income.
11. DEPR: Depreciation.
12. DEDUC: Deductions from the personal income tax.
13. GC: Real government consumption expenditures.
14. GI: Real government investment expenditures.
16. FER: Foreign exchange receipts.
17. L: Liquid assets.
18. P: Implicit GNP deflator (1970 = 100).
19. PC: Implicit deflator of private consumption expenditure (1970 = 100).

20. PINV: Implicit deflator of private investment expenditure (1970=100).
21. PROF: Corporate profits.
22. OTHDIR: Other direct taxes.
23. OTHIND: Other indirect taxes.
24. SC: Stock of capital.
25. TRPR: Transfer payments to the private sector.
26. t_{clt} : effective tax rate of luxury and consumption taxes.
27. t_{tur} : effective tax rate of turnover tax.
28. t_{tim} : effective tax rate of turnover tax on imports.
29. X: real exports.

Solution

To solve the model we used the Gauss-Seidel iterative procedure[2]. The procedure requires a set of initial conditions for the endogenous variables, the complete vector of estimated parameters, and a set of values for the exogenous variables. The iteration is terminated when the proportionate change in any variable between successive iterations is less than a prescribed tolerance. In other words for each period the iteration procedure stops when:

$$\frac{X_i^{(n+1)} - X_i^{(n)}}{X_i^{(n)}} < e$$

where $X_i^{(n)}$ is the value of the ith variable on iteration n. In the computer programme used to solve the model e was arbitrarily set equal to 0.0005.

Multiplier Analysis

A complete analysis of fiscal policy demands the computation of the multiplier effects of taxation, government expenditure programmes, and other policy measures applied in various combinations. This may help the policy maker to evaluate the efficacy of the various instruments in achieving certain objectives as well as to show the compatibility of the various objectives.

In any econometric model the future behaviour of the endogenous variables can be determined depending on the assumed behaviour of the exogenous variables. The latter variables can be conveniently classified into two categories: those that can be controlled by the policy maker and can therefore serve as policy instruments, and those that the policy maker cannot influence (or he can do so to a very limited extent). Thus, in discussions of economic policy it is the relationships between policy instruments and endogenous variables that matter, since they determine the policy

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2. The computer programme used was made by T. Harrison and P. Smith of the University of Southampton, and was kindly provided to the author by K. Tinsdale of the University of Manchester.

maker's ability to influence economic conditions. The usefulness of the model is that it provides the effect of alternative policy measures on the endogenous variables by making assumptions concerning the uncontrolled exogenous variables.

As was stated earlier the primary purpose of the present model is to investigate the implications of various stabilization policies. Although the model is too prelimina-

TABLE 1

Dynamic Multipliers on Gross National Product: Government expenditures variables, 1960-1973

Year	GC	GI	TRPR
1960	1.496	1.461	1.218
1961	1.599	1.569	1.392
1962	1.687	1.642	1.478
1963	1.795	1.765	1.688
1964	1.879	1.844	1.777
1965	1.944	1.902	1.824
1966	2.015	1.980	1.895
1967	2.107	2.061	2.000
1968	2.185	2.141	2.104
1969	2.253	2.211	2.169
1970	2.317	2.261	2.190
1971	2.388	2.311	2.154
1972	2.440	2.372	2.176
1973	2.498	2.419	2.075

TABLE 2

Dynamic Multipliers on Gross National Product: Tax Variables, 1960-1973

Year	Exem	t_{clt}	t_{tur}	t_{tim}
1960	0.145	−0.244	−0.027	−0.484
1961	0.172	−1.025	−1.210	−0.926
1962	0.278	−0.763	−0.815	−0.687
1963	0.326	−0.611	−0.544	−0.613
1964	0.328	−0.706	−0.655	−0.899
1965	0.295	−0.415	−0.438	−0.712
1966	0.370	−0.529	−0.542	−0.731
1967	0.350	−0.781	−1.074	−1.165
1968	0.449	−0.575	−0.842	−0.933
1969	0.538	−0.766	−0.936	−0.978
1970	0.404	−0.509	−0.508	−0.887
1971	0.373	−0.680	−0.729	−0.931
1972	0.398	−0.715	−0.769	−0.998
1973	0.333	−1.023	−1.241	−1.155

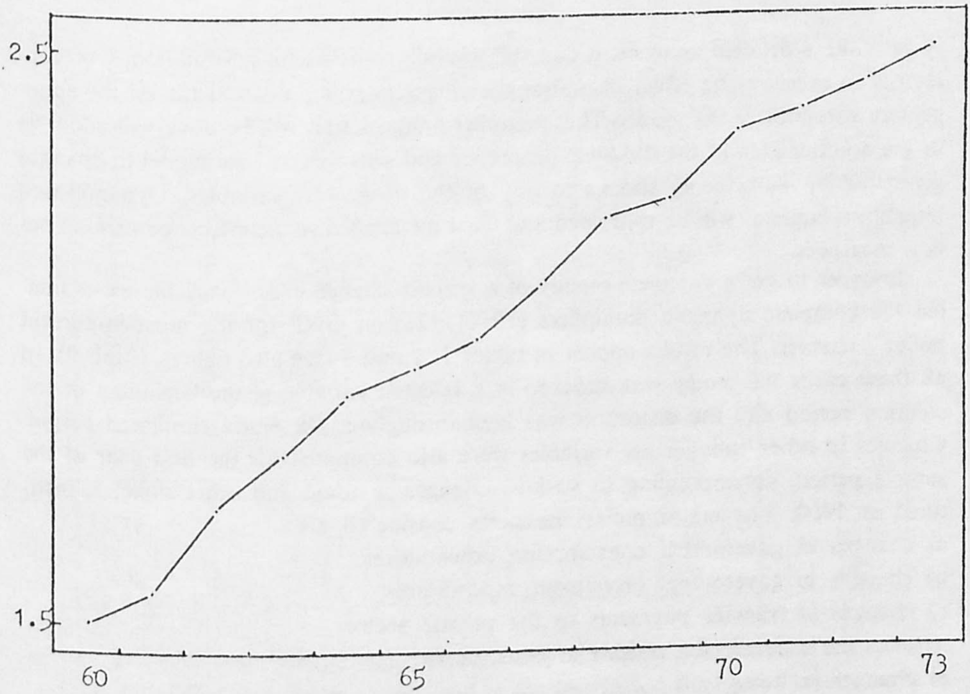

Figure 1 Exports dynamic multiplier on Gross National Product

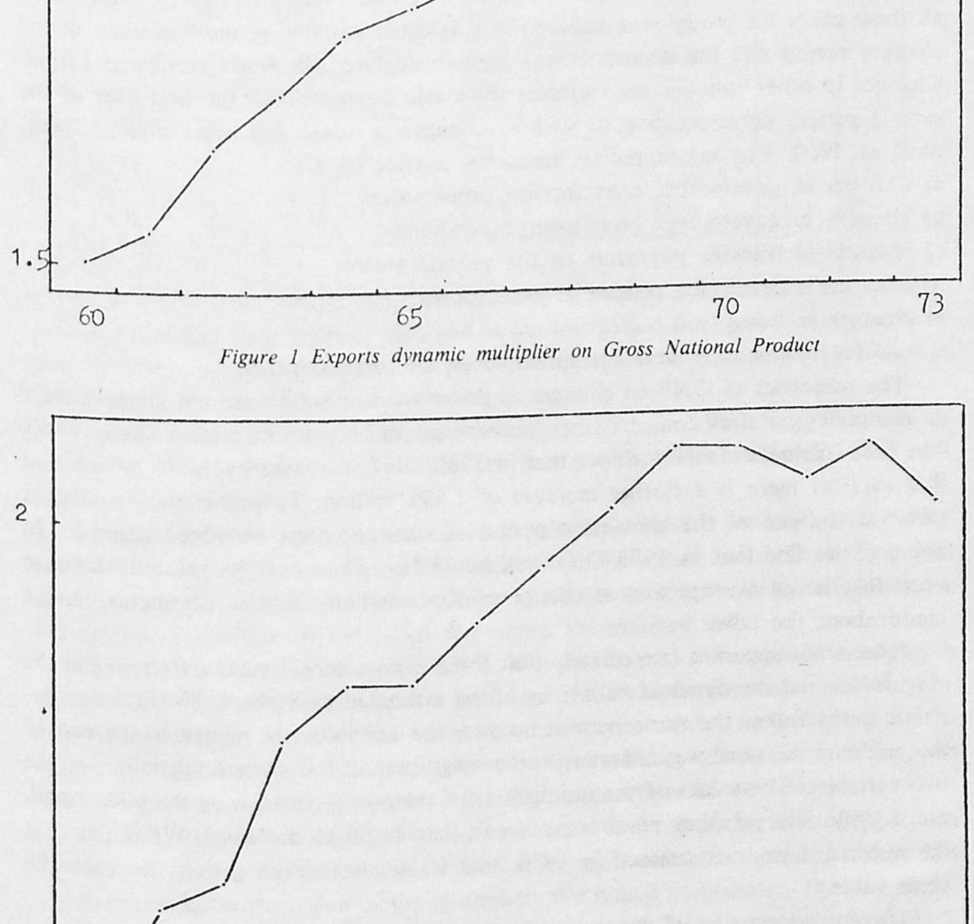

Figure 2 Transfer payments dynamic multiplier on Gross National Product

ry to make a detailed analysis, it can still provide some useful information. Our concern is to examine the effect of marginal changes in policy instruments on the endogenous variables of the model. The multiplier analysis that will be done will allow us to get a better idea of the dynamic properties and sensitivity of the model to changes generated by introducing shocks to any of the exogenous variables. Dynamic and impact multipliers[3] will be estimated and used for analyzing the effects of various policy measures.

In order to get a complete picture of a specific change in any variable we estimated the complete dynamic multipliers (1960-1973) on GNP for the most important policy variables. The results appear in tables 1, 2 and 3 (see also figures 1 and 2). In all these cases the model was shocked in a selected variable at the beginning of the solution period and the distortion was kept throughout the entire simulated period. Changes in other endogenous variables were also computed for the first year of the sample period, corresponding to various changes in fiscal and other policies, instituted in 1960. The major policy measures considered are:

a) changes in government consumption expenditures
b) changes in government investment expenditures
c) changes in transfer payments to the private sector
d) changes in credit for residential construction
e) changes in liquidity
f) changes in tax rates and exemption levels of selected taxes.

The responses of GNP to changes in government expenditures are given in table 1. The policy we shall consider is an increase say in GC, of one million Drs in 1960. The first column in table 1 shows that in 1960 GNP increases by 1.496 million and that in 1961 there is a further increase of 1.599 million. To obtain the increase in GNP at the end of the simulation period all changes must be added together. In doing so we find that in 1973 GNP will be 28.60 million over its value in the base year, that is, an average annual change of 2.043 million. Similar comments can be made about the other variables.

It becomes apparent immediately that there are no considerable differences in the magnitudes and the dynamic behaviour of the estimated multipliers. The first two dynamic paths follow the same pattern because the variables are related to the rest of the model in the same way. Moreover, the magnitude of this pattern is similar for the two variables. The values of the multipliers for transfer payments, on the other hand, are slightly different (they reach a peak and then begin to decrease). We notice that the maximum value is attained in 1970, that is, it takes eleven periods to reach the peak value.

The dynamic paths of the tax multipliers (table 2) on GNP are also similar to each other. We observe that the impact multipliers are relatively small; they increase

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3. These multipliers are called impact multipliers because they express the effect on the endogenous variable that occurs in the first year as a result of a change in the exogenous variable.

TABLE 3

Dynamic Multipliers on Gross National Product:
Selected variables, 1960-1973

Year	CRDW	L	FER	X
1960	0.368	–	–	1.512
1961	0.453	0.092	–2.093	1.579
1962	0.310	0.133	–2.181	1.684
1963	0.539	0.191	–2.253	1.785
1964	0.579	0.211	–2.307	1.870
1965	0.544	0.217	–2.337	1.938
1966	0.597	0.230	–2.326	1.992
1967	0.533	0.240	–2.418	2.072
1968	0.641	0.261	–2.450	2.156
1969	0.713	0.261	–2.456	2.204
1970	0.528	0.226	–2.492	2.296
1971	0.509	0.246	–2.525	2.350
1972	0.520	0.205	–2.463	2.422
1973	0.399	0.237	–2.308	2.449

slowly in the second period, then fall until they get again a high value in the eighth period. After that they begin to fall, and in the last period they get a value that is higher than one. It must be noted that all coefficients have a negative sign which is in accordance with the theory of tax multipliers.

We also estimated the GNP dynamic multiplier path for four non-government variables. As table 3 shows the values and the time pattern of the multipliers differ considerably among them.

Consider first the multiplier for credit to the private sector for residential construction. The value of the multiplier is considerably lower than unity. In the first year its value is 0.368 and gets its peak value in the tenth period. From there it begins to decrease until the last period when it reaches the value 0.399.

The multipliers for liquid assets behave in a similar way. The impact multiplier is zero because this variable acts with a time lag. The multipliers increase until the ninth period when they reach a peak value and then begin to fall. The multipliers for foreign exchange receipts have a negative value because they affect positively imports which in turn constitute a leakage from the secular flow of income.

The last complete multiplier that was estimated is for exports. It is often argued that exports play a key role in the stimulation of economic growth and therefore it is important to know the value of the multiplier. We notice immediately that the multipliers of an increase in exports are much larger than the others appearing in table 3. The export multipliers are also greater than the tax-change multipliers and this is logical because the whole initial increase in exports represents additional aggregate demand, not just the part that is consumed. We would expect the export multipliers to be much larger than the government expenditure multipliers because an increase in exports, being part of total private output affects investment directly, while an increase in government expenditure stimulates investment only after private spending has been increased. However, in an economy that is characterized by a low degree of self-sufficiency, the import leakage is relatively large and this affects the value of the multipliers. Moreover, the main component of the variable FER is exports. However, this variable affects negatively all the endogenous variables of the model except on imports. Thus, in the light of the model, one should not expect export multipliers higher than those obtained.

In order to get a more complete picture of the impact in selected variables of the model of marginal changes in the variables previously considered, we estimated impact multipliers whose values are shown in table 4.

The table reveals that an increase of GC by one million increases IDW by 0.121 million; imports by 0.193 million; consumption of nondurables by 0.080 million; consumption of services by 0.292 million; and consumption of semi-durables by 0.196 million. Adding up we get 1.496 millions which is the increase of GNP generated by an one million increase in GC[4].

As was expected, increases in tax rates affect negatively all endogenous variables except on total revenues, while increases in the levels of exemptions and deductions from the personal income tax have exactly the opposite effect.

Built -in stability of the system

Built in stability is usually defined as the stabilizing effectiveness of built-in-flexibility, that is, the fraction of the change in agrregate output that is prevented due to the operation of built-in-flexibility. Thus, in measuring the stabilizing effectiveness of flexibility one has to estimate what the level of national income would be with a given budget flexibility as compared to the level in its absence.

Musgrave and Miller [2] were the first to formulate a measure of built-in stability. The government expenditure multiplier they derived was:

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - c\,(1 - Er)} \tag{1}$$

where E stands for the income elasticity of tax yield and r represents the average rate of tax. The index of built in stability that was suggested was as follows:

$$\alpha = 1 - \frac{\dfrac{1}{1 - c\,(1 - t)}}{\dfrac{1}{1 - c}} = \frac{ct}{1 - c + ct} \tag{2}$$

4. CD and IPE are not affected because of the nature of the equations used, and X and GI are exogenous. Thus we have:

$$\Delta GNP = \Delta GC + \Delta CND + \Delta CSD + \Delta CS + \Delta IDW - \Delta IMP$$

TABLE 4

Impact Multipliers on Selected Variables

Policy variables	GNP	PI	DI	IDW	IMP	TOTREV	CND	CS	CSD
GC	1.496	1.079	1.077	0.121	0.193	0.057	0.080	0.292	0.196
GI	1.461	1.089	1.088	0.118	0.188	0.055	0.079	0.285	0.191
TRPR	1.218	0.897	1.897	0.209	0.334	0.071	0.140	0.888	0.343
CRDW	0.368	0.624	0.623	0.449	0.048	–	0.200	0.072	0.485
EXEM	0.145	0.366	0.729	0.053	0.085	−0.348	0.036	0.129	0.086
DEDUC	0.230	0.179	0.542	0.060	0.096	−0.347	0.040	0.145	0.097
t_{tur}	−0.027	−0.997	−0.995	−0.113	−0.180	1.015	−0.075	−0.273	−0.183
t_{clt}	−0.244	−1.172	−1.171	−0.133	−0.212	0.987	−0.089	−0.321	−0.215
t_{tim}	−0.484	−1.357	−1.355	−0.154	−0.246	0.992	−0.103	−0.372	−0.249
X	1.512	1.078	1.076	0.122	0.195	0.057	0.082	0.295	0.198

$$\text{or } a = 1 - \frac{\Delta Y}{\Delta Ya} \tag{3}$$

where ΔY is the change in income in a system with stabilizers, and ΔYa is the change in income in a system without stabilizers. In other words, ΔY is the multiplier of the system where taxation is treated as endogenous, and ΔYa is the multiplier of the system where taxation is treated as exogenous. Thus, *a* is the part of potential income change that does not materilise due to the operation of stabilizers.

The values that *a* can take range between one and zero. If *a* equals one all the increase in income is absorbed by taxation. If, on the other hand, *a* equals zero, the marginal tax yield is zero and there is no absorption of the increase in income. Obviously, in practice *a* has a value that is neither zero nor one but stands somewhere between so that $0 < \Delta Y < \Delta Ya$

Table 5 shows the multiplier of government expenditure on investment various taxes as exogenous. More specifically the alternative assumptions we make are the following:

a) Indirect taxes are exogenous
b) Taxes and duties on imports are exogenous
c) Direct taxes are exogenous

By making comparisons with the multipliers of table 1, we observe that the multipliers of government expenditure on investment are larger when alternative tax variables are assumed to be exogenous. This implies that the endogenization of the variables in question introduces an element of stabilization in the system.

Next, using the values from the tables 1 and 5 and referring to the year 1960, we find:

Indirect taxes
egogenous

$$\alpha = 1 - \frac{1.461}{1.502} = 0.027$$

Taxes on imports

egogenous

$$\alpha = 1 - \frac{1.461}{1.507} = 0.030$$

Direct taxes
exogenous

$$\alpha = 1 - \frac{1.461}{1.493} = 0.021$$

TABLE 5
Dynamic Multipliers on Gross National Product
(Selected Taxes Exogenous)

Year	Indirect Taxes Exogenous	Taxes on Imports Exogenous	Direct Taxes Exogenous
1960	1.502	1.507	1.493
1961	1.634	1.621	1.595
1962	1.761	1.714	1.697
1963	1.852	1.786	1.775
1964	1.949	1.883	1.804
1965	2.037	1.930	1.910
1966	2.112	2.019	1.972
1967	2.241	2.105	2.085
1968	2.330	2.164	2.136
1969	2.404	2.221	2.201
1970	2.461	2.279	2.283
1971	2.560	2.351	2.332
1972	2.615	2.445	2.386
1973	2.663	2.471	2.496

To find the amount of income that did not materialise because of the built-in flexibility, for any other year, we can simply insert the values of the relevant multipliers in the formula.

It was mentioned above that *a* is expected to lie between one and zero ($0< \alpha < 1$). How near to either extreme values *a* will actually lie depends on the conditions prevailing within the economy in question. For a developing country one would expect, on a priori grounds, *a* to lie very close to 0 and therefore our results are not surprising.

Looking at the above estimated coefficients we can see the implications for stabilization policy of the association of Greece with the EEC, when all taxes on imports will be abolished and therefore their stabilizing effectiveness will be lost.

Implications for Budgetary policy

The present model was built with the aim of giving more insight into budgetary policy for economic stabilization and growth in Greece, and it will be, therefore, interesting to see what conclusions can be drawn in this respect.

In the preceding sections we examined the effect of a marginal change in an exogenous variable on some selected endogenous variables. By using these estimates we can now examine another interesting point associated with fiscal policy, that is, the effect of a policy that keeps the government budget balanced. We can find for instance that the GNP that results from an increase of 1 million Drachmas each of government expenditure on investment and government revenue from consumption and luxury taxes is 1.217 million. More specifically we combine the effect of an increase in GI in 1960 with the effect of an increase in the rate that is necessary to make up the deficit from the increase of 1 million in GI.

Table 6 shows the impact multipliers of balance budget increases. As can be seen, the values vary depending on whether the expenditure increases are in GC, GI or TRPR, and on the type of tax employed.

TABLE 6

Balanced budget multipliers

	GC	GI	TRPR
t_{clt}	1.252	1.217	0.974
t_{tur}	1.469	1.434	1.191
t_{tim}	1.012	0.977	0.734

It is a fact that developing countries in particular, have experienced an increasing share of government expenditure in GNP. It is worth investigating, in the light of the model, the extent to which government expenditure programmes can be self-financed in Greece, through the higher tax receipts that follow expansions in economic activity generated by increases in public spending.

We saw in table 4 that an increase of 1 million in government consumption expenditure in 1960 increases total revenue by 0.057 million in that year. This is followed by an additional increase of 0.073 million in 1961, and in 1973 the government collects 2.100 million more than it was collecting before the increase in public expenditure. For the period as a whole the government collects on the average for each year, 0.150 million more than it did before the increase. We reach similar results when looking at other government expenditures or when we consider revenues in a disaggregated sense. Thus, we may conclude that all government revenues rise as the result of higher levels of the various components of GNP. We shall see now what the results will be on the balance of the government budget.

Let BB denote the budget balance. The change in surplus (+) or deficit (–) in the budget balance may be defined as the difference between total revenues and total public expenditures:

$$\Delta BB = \Delta TOTREV - \Delta TOTEXP$$

Assuming that all other exogenous variables remain unchanged, we have:

$$dBB = \frac{\partial TOTREV}{\partial GC} dGC - dGC \qquad (4)$$

or replacing the symbols with their numerical values:

$$dBB = 0.057\ dGC - dGC = -0.943\ dGC \tag{5}$$

Thus, depending on whether the initial condition is one of a surplus, balanced, or deficit budget, an increase in government consumption expenditure by 1 million will result to a decrease in the budget surplus, a deficit or an increase of the deficit by 0.943 million.

If the policy maker wishes to cover the deficit he can, in the light of the previous discussion, decide upon which taxes rates to raise and by how much.

Implications for growth

The great importance of fiscal policy in most developing countries arises from the fact that the government is required to play an active and important role in promoting economic growth. For instance, the system can be an effective instrument in encouraging private investment by tax incentives and subsidies and in financing those types of public investment that provide external economies in production. There is general agreement among economists in this respect.

It will be interesting to examine the power of the policy maker in promoting economic growth in Greece. The present model can be so utilized as to show the growth of GNP that is attributed to the rate of growth of the various policy instruments. However, in what follows we shall only consider the case of promoting economic growth through changes in government investment expenditure.

Assuming all other exogenous variables to remain unchanged, except on GI we have:

$$d\,GNP = \frac{\partial GNP}{\partial GI}\ dGI \tag{6}$$

where $\partial GNP / \partial GI$ is the multiplier of government expenditure on investment with respect to GNP.

Dividing formula (6) by GNP_{-1}, multiplying the right hand side by GI_{-1} / GI_{-1}, and rearranging terms we get:

$$\frac{dGNP}{GNP_{-1}} = \frac{\partial GNP}{\partial GI} \cdot \frac{dGI}{GI_{-1}} \cdot \frac{GI_{-1}}{GNP_{-1}} \tag{7}$$

or

$$R_{GNP} = R_{GI} \cdot \frac{\partial GNP}{\partial GI} \cdot \frac{GI_{-1}}{GNP_{-1}} \tag{8}$$

Formula (8) shows that the rate of growth of GNP is proportional to the rate of growth of GI. Using the estimated value of $\partial GNP / \partial GI$ that corresponds to 1960 (provided in table 1), and replacing GI_{-1}/GNP_{-1} by the values of the corresponding variables we get:

$$R_{GNP} = (1.461) \cdot (0.0689)\, R_{GI} = 0.1006\, R_{GI}$$

Assuming now various alternative rates of growth for GI we can find the corresponding rates of growth for GNP[5].

It must be noted that the estimates so derived give only the partial rate of growth of GNP. Thus, to get a more realistic estimate of the rate of growth of GNP one has to incorporate the influence of all other factors. The problem that the policy maker most often faces is how to achieve a warranted rate of growth of GNP given the initial conditions, the rates of growth of the uncontrolled variables, and his ability to manipulate the policy instruments. In such a case the following formula is more appropriate to him

$$R_{GNP} = \sum_j \left[\frac{\partial GNP}{\partial Zj} \cdot \frac{dZ_j}{Z_{j\text{-}1}} \cdot \frac{Z_{j\text{-}1}}{GNP_{\text{-}1}} \right]$$

$$\text{or} \qquad R_{GNP} = \sum_j m_j R_j \left(\frac{Z_{j\text{-}1}}{GNP_{\text{-}1}} \right) \qquad (9)$$

where m_j is the multiplier of the jth exogenius variable with respect to GNP and R_j is the rate of growth of that variable.

Conclusions

The main purpose of the present model was to measure the effects of government policy instruments on the most important macroeconomic variables. The estimation of such a model is believed to be of great importance for Greece, since it helps the policy maker to choose the appropriate policy for correcting a probable disequilibrium in the economy. Moreover, as in all developing countries, the relative importance of the government sector has increased in Greece, and the construction of the model is believed to give a precise idea of the main macroeconomic effects of the change in the role that is assigned to the government.

Despite the tremendous deficiencies in the available statistical data the results show that econometric techniques can be very useful for studying the main structural features of developing countries. The discussion also indicates that simulations can be very useful in designing appropriate and efficient policies.

An econometric model can help the policy maker in assessing the probable course of the economy and in the preparation of policy measures. By making certain

5. For instance assuming $R_{GI} = 0.01$ and $R_{GI} = 0.15$ we find $R_{GNP} = 0.001$ and $R_{GNP} = 0.015$ respectively.

assumptions, the policy maker can predict what the situation will be in the future. Moreover, the model will help him to choose the appropriate type and the extent of instruments that are required to achieve his targets.

However, econometric models for developing countries are bound to have a number of defects that must be remedied before they can be used as reliable instruments for economic policy. In order to improve and extend the model in the future we must have better and more accurate statistical data. When more and better information is available and incorporated into the model the estimates obtained will be closer to reality. From this point of view the benefit for building an econometric model for fiscal policy in Greece is its potential for improvement.

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