AN ECONOMETRIC MODEL OF THE GREEK ECONOMY WITH SPECIAL REFERENCE TO THE MONETARY SECTOR *

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I. INTRODUCTION

The purpose of this paper is to study the workings of the Greek economy, especially its monetary system, to discover quantitative information about monetary and general economic policy, to find what links exist between the real sector and the financial sector, to check the forecasting performance of the model within the sample period and finally to use the model for short run planning by making simulation projections for the period 1980 - 1984.

After estimating the main economic relationships of the real sector, of prices, of the external sector as well as of the government and of the financial sector, we chose the most appropriate specification of each behavioural equation according to certain criteria, such as α-priori information from economic theory about the sign and the magnitude of the coefficients of the explanatory variables, the t-values of the estimated coefficients, the squared coefficient of multiple correlation (R^2), the Durbin - Watson (D - W) statistic and the pattern of the residuals over the estimation period, in order to build an econometric model of the Greek economy using annual data at constant 1970 prices for the period 1958 - 1974.

The model consists of 34 structural equations and 17 identities. Out of the 34 structural equations, 8 are equations of the real sector, 2 equations of prices, 3

* The model discussed in this paper is a modified version of an econometric model presented in a Ph. D. thesis in the University of Kent at Canterbury (1980). I owe my thanks to R.J.D. Hill for the valuable suggestions on the content of this paper. Thanks are due to Professor George D. Demopoulos for his useful suggestions .

equations of the government sector, 4 equations of the external sector and 17 equations of the monetary sector.

The way in which financial variables affect real economic activity is through investment expenditure. Another link is through the real weighted average interest rate on credits and through prices which are directly related to the money supply. The link of the fiscal with the monetary sector is through the government budget balance identity and the public entities deposits equation which are related to tax revenue.

As far as the level of disaggregation is concerned, the model seems to satisfy more the purpose of providing the working of the monetary system, because of the relatively high degree of disaggregation of the monetary sector. However, it also emphasizes through the various links between the real and the monetary sector the impact of financial variables on the real sector.

As far as the estimation technique is concerned the principal components two stage least squares (2SLS) method using principal components of all the predetermined variables is used. (See Klock and Mennes (I960)).

The model presented below is strictly a Keynesian demand determined model designed to reflect the behaviour of the economy in the short run, especially the impact of alternative monetary and fiscal policies. It takes the capital stock and the labour force as given. Wages do not appear in the model, because appropriate employment data is not available. This also explains why production function and demand for labour equations do not appear in the model. It seems plausible, however, that in the short run the demand approach to aggregate economic forecasting is applicable especially in situations like those where labour has not been a constraint in the expansion of economic activity[1].

Special emphasis is given on making the model dynamic by including lagged dependent variables.

As we said before, the system of equations develops from the necessity of explaining the movements of private consumption expenditure, private investment, private deposits, credits, prices etc. Explanation of the movements of consumer expenditure brings into the picture income variables, and these in turn produce price variables,

(1) However, the demand determined models encounter difficulties in explainingin a satisfactory way the Greek economy of the seventies and there is evidence that supply constraints have to be taken into consideration.

which in turn are dependent on the money supply. Explanation of the movements of private fixed investment also brings into the picture credit variables as well as private deposit variables which in turn are dependent on income and on interest rates which play an important role in the demand equations for financial assets.

The model also provides specification of three sectors which at least seems necessary for any financial model ; a government sector, a commercial banking sector and a special credit institution sector. There are some inter - sectoral dependence represented by a set of identities. In fact it provides a balance sheet for commercial banks, and a government budget identity to express the condition that government expenditure must be financed by either taxation or a budget deficit.

The model is also characterized by heavy emphasis on the role of the instruments of economic policy, particularly the instruments of monetary policy. Monetary policy transmits its effects by changes in interest rates. In Greece the maximum interest rates on bank deposits, advances, treasury bills and the rediscount interest rate are set by the authorities. In addition to the above mentioned orthodox instruments of the monetary policy the model makes use of other alternative measures like the reserve - ratio, accounting for direct control, the compulsory sales of treasury bills to commercial banks and the direct Central Bank advances. The model also investigates the effects of the government expenditure and of the tax rates which are considered as instruments of the fiscal policy. Variables are expressed in millions of drachmae unless otherwise specified. Interest rates are expressed in percentages and they are mean period data. (See definition of variables).

II. THE THEORETICAL FRAMEWORK

Here the theoretical underpinnings of the individual equations and other structural considerations are discussed. It will be seen that the partial adjustment model assuming either a flow or a stock adjustment process, modified at times by short-term constraint variables is used providing the theoretical basis for most behavioural relationships in the model. (See DE. Leeuw (1965), Goldfeld (1966)).

Private consumption expenditure based on a flow adjustment model, depends on personal disposable income and on lagged consumption, the latter reflecting the consumers' inertia due to past habits, customs, standards etc.

The shortage of satisfactory data in the fields of employment, wages and incomes generally necessitates a somewhat unorthodox treatment of this sector. Indeed

the agricultural income equation transforms the output in agriculture into an income variable. Agricultural income also responds to changes of prices. Wage income is related to GNP and to prices.

The investment equations are based on a variation of the stock adjustment model. Investment expenditure depends among other things on other financial variables like credit availability and interest rate. We use a real weighted average interest rate on credits supplied in the manufacturing as a proxy for the cost of capital. The justification is that if producers do not suffer from money illusion in planning expenditures, then there would be an immediate rationalization for the use of real rather than nominal interest rates. (See G. Fisher and D. Sheppard in Johnson and Nobay (1972), p. 194).

Inventory investment is considered in a naive form to be a function of the National Income and of an interest rate variable.

Price equations are based on a modified approach of the quantity theory, containing also arguments of the mark - up approach such as an import price index reflecting factors outside the country, the rate of indirect taxation and a proxy variable for the pressure of demand. (See Avrimides (1972), Ball (1973), Tsoris (1976)).

Tax receipts depend upon both tax rates and the tax base. An endogenous determination of real revenue is carried out at a highly aggregated level derived from linearization of an identity. Although the direct and indirect tax function are not sophisticated the results are nevertheless useful valid for small changes in the variables involved. (See Pavlopoulos (1966), Avrimides (1972), Katos (1978)).

The majority of subsidies goes to agricultural and export sector implies that subsidies are considered as a function of the agricultural income and of the prices. (See Tsoris (1976)).

In relation to the external sector traditional economic theory suggests that income effects should be significant variables in explaining demand for imports. The lagged foreign exchange reserves at Central Bank is also important explanatory variable reflecting the conditions in tde balance of payment.

Explanatory variables often selected in the long term capital inflow and outflow functions are an activity variable like the level of GNP or Profit Income. The profit — capital ratio variable has been also considered as an index of the average rate of return of capital. (See Adelman and Chenery (1966), Ball (1973)).

The modified stock adjustment theory of portofolio behaviour is used as the

basis for most of the behavioural equations of the financial sector. In the financial markets for bank deposits, banks accept any volume of deposits at the going interest rates which are determined by monetary authorities. The financial assets are assumed as demand determined. The model also assumes that the authorities meet the total demand for currency.

The distinction between sight, savings and time and restricted deposits in the model was necessary because we minimize the error of aggregation resulting from the estimation of an aggregate function, we can use different explanatory variables and we remove the restriction that an explanatory variable have the same coefficient for each asset.

The estimated equations for the financial assets are of the same basic form. The flow of the assets depends on various interest rates, some measure of income, on the lagged dependent variable and on prices on the grounds that the more prices are increasing the less attractive are the asset.

Treasury bills have been sold to the commercial banks on a compulsory basis ; in particularly the commercial banks were obliged to invest in treasury bills a given percentage of their demand and saving deposits. However, the commercial banks kept excess reserves of treasury bills and the variables that explain the behaviour of these are the own interest rate and a substitute one to represent the alternative way to invest the excess reserves. Furthermore commercial banks have been allowed to invest part of their legal reserves requirements in tresury bills. (See Kasmas (1971), Halikias (1978)). Commercial banks' excess reserves bear an opportunity cost which is represented by the yield of the best alternative which seems to be treasury bills. The lag stoock variable, a constraint variable like the total deposists with commercial banks and the bank borrowing variable which represent the reserve position of the banks are the most common variables explaining the behaviour of excess reserves.

In the model by commercial bank borrowing we mean rediscount funds and loans from Bank of Greece the financing of particular sectors of the economy. Banks are likely to compare the rediscount rate with the rate on savings deposits in deciding the extent to which they will rely on the Bank of Greece for funds. Moreover an increase in the flow of total deposits with commercial banks is expected to reduce borrowing because the rediscounting became void.

Our specification of the credit functions assumes that during the period in consideration excess demand existed in most of the categories of credits provided. This mean that the banks have not met the total demand for credit. Actually during

the period in consideration the ceilings imposed by the monetary authorities on the majority of the credits justify the assumption that there was an unsatisfied demand, while the introduction of treasury bills absorbed some of the funds which commercial banks traditionally used to dispose of short term credit. (See Halikias (1978)).

The flow of supply of bank credit is taken to depend on the interest rate on such loans, on the reserve position of the banks, on the total deposits with the banks, on the policy instrument of the monetary authorities and the holding of treasury bills. Finally we note that considerable differences between the long term and short term credit have been founded in respect to the policy adopted by the monetary authorities.

Total public entities deposits include part of Government borrowing as well as money savings of general government and depends on government revenue. Two types of deposits related to each other are examined. (See Kasmas (1971), Avrimides (1972)).

III. EVALUATION OF THE REDUCED FORM AND SOME POLICY IMPICATIONS

So far we have specified, measured and evaluated all individual structural equations. (See the structural model). We can now proceed to examine the overall effect of each exogenous variable on every endogenous one. The reduced form shows explicitly the alternative policy variables that can be used to affect an endogenous variable.

Table I represents a submatrix of the impact multipliers containing only the policy variables. We shall not explain the mechanism through which the interactions take place but only the final results that a change in each of the policy variables have.

From the examination of the impact multipliers we observe that a stringent monetary policy will be associated with one, or a combination of the following : an increase in r^A, r_{slg}. d' r_{tr}. b' (r_{red} - r_{sav}(i), r_M, RR_{66}, Tb^{RR} and a decrease in rsav· d' rt. d $r_{p\cdot s}$. d (rimp — r_{sav}. d) and Cr^{BG}.

We also observe that interest rates are quite powerful measures for the monetary authorities and that a change in the stucture of the above variables can affect significantly GNP.

TABLE 1

A sub-matrix of impact multipliers

2SLS reduced-form coefficients of the structural model

	c_{g+ig}	c^{ind}	c^{dir}	r_{π}	$r_{cap.s}$	$r_{cap.d}$	$r_{t.d}$	$r_{p.s.d}$	$r_{tr.b}$	$(r_{rod} - r_{cap.d})$	r_{π}	RR_{OS}	$Tb^{(2)}$	$r_{imp} - r_{cap.d}$	$cr^{(3)}$
1. Cp	0.67	-122157	-77254	-189	-47	60	10	14	-80	-48	-609	-1136	-495	29	0.136
2. Y_d	0.73	-80653	-31037	-206	-50	66	11	15	-88	-52	-665	-1241	-518	32	0.14
3. I_p^l	0.05	-10221	-2151	-296	-4	5	0.8	1	-7	-4	-51	-95	-40	2	0.01
4. I_p^{ie}	0.17	-30012	-6145	-48	-16	55	7.7	3.5	-62	-33	-146	-840	-363	13	0.03
5. I_p^b	0.52	-89265	-19738	-145	-65	28	8	10	-62	-37	-1008	-872	-364	23	0.104
6. I_p^R	0.047	-5478	-1003	-13	-14	26	10	21	-83	-53	-17	-1210	-493	40	0.21
7. $\dot{P}_{GNP}$	0.00003	0.93	-1.13	0	-0.06	-0.03	0	0	0	0	0.03	-0.05	-0.02	0	0.000006
8. Imp	0.45	-48201	-19597	-128	-31	41	7	9	-54	-32	-412	-768	-321	20	0.09
9. Cur	0.221	-40113	-8945	-62	-460	20	3	5	-26	-16	-200	-373	-156	10	0.04
10. GNE	2.099	-221596	-90097	-589	-142	128	32	43	-251	-148	-1895	-3539	-1477	92	0.424
11. Y	1.96	-356278	-75004	-551	-137	174	30	40	-235	-139	-1777	-3315	-1385	86	0.397
12. P	1.21	-270916	-42809	-341	-63	121	19	25	-145	-86	-1100	-2051	-857	53	0.24
13. Y_{pd}	1.72	-312334	-197030	-483	-120	152	26	35	-206	-122	-1558	-2906	-1214	75	0.35
14. t_d^s	0.37	92060	107460	-105	-26	33	6	8	-45	-27	-339	-632	-264	16	0.076
15. M	0.24	-44763	-9483	-69	-462	-252	4	5	-29	-18	-223	-416	-174	11	0.05
16. D^{cb}	0.25	-52221	-9755	-72	-18	919	409	5	-31	-18	-231	-431	-180	11	0.05
17. $D_p^{r.l}$	0.087	-12887	-3679	-25	-6	40	1	95	-10	-6	-79	-148	-62	4	0.017
18. Cr^T	0.20	-30162	-5780	-56	-11	497	52	105	-410	-260	992	-5937	-2419	103	1.04
19. Cr_t^{cb}	0.106	-16162	216	-30	-5	414	50	2	-399	-253	780	-5077	-2359	104	0.02

The effect of a unit change in r_M on GNP is about 0.8% of the mean value of GNP ; similarly the effect of a unit change in r^A on GNP is about. 0.25% of the mean value of GNP.

Examination of the impact multipliers of the monetary policy instruments reveal that they are in accord with a priori expectations as to the sign and produce quite significant effects on both financial and non - financial variables. With respect to financial variables it was found that the effect fell more heavily on private deposits and commercial bank loans while with respect to nonfinancial variables the effect fell more heavily on private investment expenditure rather than to consumption expenditure. The results seem to suggest that monetary policy is capable of playing an important role in affecting the level of economic activity.

As far as the fiscal policy variables are concerned we observe that these also affect directly and significantly the level of economic activity and are quite appropriate policy variables. Actually in the year when a change of one unit in government expenditure variable takes place the result is an increase in private consumption expenditure by 0.67, in total private investment by 0.8 which leads finally to an increase in GNP by 2.09. An increase in the rates of indirect and direct taxation by 0.01, on the other hand, reduces the GNP by 2215 (1 % of the mean value of GNP) and 900 (0.4% of the mean value of GNP) million drachmas respectively.

IV. EVALUATION OF THE FORECASTING PERFORMANCE OF THE MODEL

The right specification of an econometric model is judged by its forecasting ability to perform well «within» the sample period.

However, it is not a simple matter to decide whether a whole system is satisfactory or to detect which part of it is inadequate. The tendency therefore has been to examine sequentially various pieces of evidence and from these to make a judgement as to the over - all capacity of the model to perform satisfactory.

We have derived predictions based on the reduced form which takes into consideration all the actual exogenous variables and produces the estimated endogenous ones. We distinguish two categories of simulation predictions. One step simulation (OSS) where the model is solved, each period using actual values for the lagged endogenous variables and dynamic simulation (DS) where solution values are used for the lagged endogenous variables. If our simulated values differ very much from

the actual ones then we incorporate this error in our subsequent calculations. Thus dynamic simulation displays the model's inherent dynamic characteristic and offers a test of the model's stability. From the examination of the dynamic solution and of the true path for each endogenous variable it is possible to draw conclusions about the unsatisfactory parts of the model's specification. (See Sowey (1973), Desai (1976)).

We derived «within period» forecast values of the endogenous variables for the last nine periods of the sample by applying OSS and DS. We compare the actual observations with the predicted ones and the results from the two methods with the results derived from a naive model (TT). The naive model was estimated from the period 1958 - 1974 and the resulting time trend variables were substituted for each of the 51 endogenous variables. Table 2 contains the statistics that will be used as the general criteria to check the forecasting performance of the model. They correspond to the model prediction by using OSS, DS and TT.

The first criterion employed is the mean absolute percentage error (MAPE). The second criterion is Theil's original version of the inequality coefficient (U) and for models which predict changes the choice of data is automatic. (See Stekler (1968). When models predict the levels of economic variables, however, we obtain the predicted change data by considering successive differences of the predicted levels. The values that the inequality ceoefficient assume lie between 0 and .The smaller the value of U the better is the forecasting performance of the model. If U = 0 we say that with our model we attain perfect forecasts. If U = 1 the model forecasts are no better than a «naive» zero -change prediction while if U>1 the predictive power of the model is worse than the zero - change prediction.

Looking at the figures for the (MAPE) we observe that OSS produced better forecasts for 44 out of 51 variables compared with the forecasts derived by the TT model, while DS produced a better forecast for 40 out of 51 variables compared with the TT model. The above results reveal that both techniques produced better forecasts in the most of the key variables and that OSS produced better forecasts compared with the DS ones. The TT model has been found to produce better forecasts compared with the forecasts derived by OSS and DS for the variables : excess reserves of commercial banks, working capital credit to industry, trade credits credits by special credit institutions and foreign exchange of commercial banks.

Looking at the figures for the U we observe that whilst for some variables like agricultural income, inventory investment, foreign and domestic borrowing of the state and foreign exchange of commercial banks the inequality coefficient is above unity, the overall performance of the model seems satisfactory since 47, of

TABLE 2

Simulation solution of the model within the sample period (MAPE)—Mean absolute percentage error. U–Theil's inequality coefficient.

	(MAPE)			U			(MAPE)			U	
	TT	OSS	BS	OSS	BS		TT	OSS	BS	OSS	BS
Cp	2.67	0.75	0.97	0.22	0.24	SD^{cb}	134	73.7	93.4	0.86	0.94
Y_A	7.25	4.15	4.34	1.26	1.27	Cr_{bd}^{cb}	57.4	41.8	43.7	0.57	0.57
Y_w	3.8	2.2	2.71	0.57	0.63	Cr_{wc}^{cb}	30	32.3	32.2	0.28	0.28
I_p^A	10.5	9.74	10.1	0.91	0.92	Cr_{tr}^{cb}	29.6	32.1	32.6	0.33	0.34
I_p^H	12.5	7.51	8.47	0.85	0.91	Cr_{lt}^{cb}	32.9	23.8	25.8	0.25	0.26
I_p^D	17.7	12.4	13.6	0.87	0.86	Cr^{sci}	2887	3638	3084	0.42	0.40
I_p^R	8.94	9.16	8.63	0.81	0.78	TPED	107.5	78.5	86.9	0.32	0.32
H	380	351	328	1.05	1.03	D_{PE}^{16ll}	465	415	468	0.36	0.38
P_{GNP}	123	48.3	50.5	0.76	0.73	GNP	3.9	1.99	2.22	0.65	0.63
P_{cp}	333	136	127	0.60	0.61	FDS'	21.7	6.7	6.94	1.39	1.33
T_{dir}	3.42	2.15	2.6	0.45	0.47	GDP	4.6	2.39	2.83	0.72	0.71
T_{ind}	4.04	1.52	1.53	0.43	0.41	Y	4.5	2.49	3.0	0.77	0.75
S	34.2	19.5	23.6	0.69	0.75	P	10.8	4.07	4.67	0.90	0.91
Imp	8.5	4.1	4.04	0.67	0.66	Y_{pd}	4.28	2.36	2.74	0.73	0.72
Exp	13.3	7.8	7.82	0.70	0.70	T^{st}	2.56	1.35	1.38	0.64	0.64
CI	22.3	16.3	16.3	0.78	0.77	R^M	101	73.5	83.8	0.47	0.52
CO	29	14.4	15.4	0.99	0.99	M	60.6	51.9	52.8	0.32	0.34
Cur	188	154	147	0.49	0.52	$TSSD^{cb}$	50.6	48.2	54.4	0.27	0.29
$SigD_T^{cb}$	125	124	123	0.46	0.45	D^{co}	44	41.2	45.7	0.25	0.27
SD_p^{cb}	40.1	38.1	45.2	0.23	0.27	D_p^{sci}	38.9	34.2	44.5	0.22	0.30
TRD_p^{cb}	41.6	34	35.3	0.24	0.25	FR^{cb}	133	227	241	1.15	1.18
$PosSD_p^{nci}$	46	39	49.7	0.25	0.35	$r_k(R)$	80.7	38	45.8	0.78	0.77
SD_p^{sci}	20.4	11	15.7	0.11	0.15	Cr^T	18.9	19.7	18.4	0.36	0.34
$VisD_p^{nci}$	432	137	146	0.35	0.39	Cr_p^M	17.8	15.6	14.7	0.16	0.26
SD^{cb}	48	15.6	15.6	0.19	0.19	Cr_T^{cb}	20.6	14.8	15.8	0.16	0.16
$\mathcal{E}^{cb}$	168	158	161	0.62	0.64						

the most important variables, out of 51 ones, for both OSS and DS, produced better forecasts compared with the forecasts derived by the zero - change prediction model.

The satisfactory predictive performance of the model within the sample period is a promising factor for its usage for future simulation projection.

V. SIMULATION - PROJECTIONS FOR THE PERIOD 1980-1984

The model has been used to make «genuine» forecasts, for future periods using forecasts of future values of exogenous variables as inputs, created from a «naive» model. The naive model was estimated from the period 1958 - 1974 and the resulting time trend variables were substituted for each of the 48 exogenous variables. However, we must note that forecast errors arise in this case not only from the errors in the model but also from the errors in the predictions of exogenous variables.

Since from the policy point of view it is useful to know the values of some key economic magnitudes in the next four or five years we have simulated the economy from 1980 - 1984. Given that the values of the exogenous variables will come out true the simulation results revealed that during the period 1980 - 1984 the total GNP will increase at an average rate of about 3.8% per annum, real private consumption by 3.5%, real fixed private investment by 4.5% and the volume of imports by 4.5% per annum. The rate of inflation is expected to be around 18.5% per year, for the next five years. (See Table 3).

VI. SOME LIMITATIONS

There seem to be two main limitations in this model ; some important sectors are missing or incomplete and some variables are poorly defined. The missing sector is the employment sector and the incomplete sectors are the agricultural and the government sector.

The poorly defined variables in the model are some components of bank credits. Many of the equations are at an early stage of development and much more detailed work must be be carried out.

Improvements should include more satisfactory specifications of the equations -

TABLE 3

Simulation — Projection 1980 – 1984

		1980	1981	1982	1983	1984
1.	C_p	318952	330391	341838	353277	364715
2.	Y_w	161491	168135	174703	181427	188072
3.	I_p^A	7192	7480	7768	8055	8343
4.	I_p^N	23066	24261	25455	26649	27842
5.	I_p^D	41818	43998	46179	48358	50538
6.	I_p^R	24274	25269	26264	27259	28253
7.	P_{GNP}	18.01	18.94	19.86	20.79	21.71
8.	I_{Ep}	106747	111578	116412	121243	126075
9.	Cur	12739	13419	14098	14777	15456
10.	GNP	501437	521143	540858	560564	580270
11.	Y	412571	428819	445074	461321	477568
12.	P	182846	190606	198370	206129	213889
13.	Y_{pd}	397645	412999	428373	443727	459081
14.	T_d^c	85405	88923	92429	95947	99464
15.	M	17397	18273	19181	20087	20993
16.	D^{cb}	27371	28837	30304	31770	33235
17.	D_p^{sol}	8582	9019	9458	9895	10333
18.	Cr^T	42107	44154	46200	48247	50293
19.	Cr_T^{cb}	17581	18453	19283	20134	20985

particularly in respect to lag distributions - the incorporation of new data in many areas (i. e. wages, employment), the inclusions of additional equations with further disagregation of some of them specially consumption and tax equations, the adoption of more consistent estimation techniques, further examination of deflation procedures and closer study of the linkages between various sectors of the model. Some reversable causation may also be present, especially between investment expenditure and credits on the one hand and treasury bills and excess revenues on the other.

The links between the monetary and real sector undoubtedly warrant further study. On the face of it, monetary variables play significant roles in determining a range of expenditures. Interest rates through their impact on the financial aggregates also indirectly influence spending decisions. The role of interest rates in determining asset-holder's behaviour is distinguished.

Finally we must note that the model in spite of all imperfections and limitations is hoped to be a useful tool for the forecasters and policy makers and may serve as a building block for future econometric studies.

DEFINITION OF VARIABLES

ENDOGENOUS VARIABLES

1. C_p Private consumption expenditure at constant 1970 prices.

2. Y_A Agricultural income deflated by the implicit price index of National income (i.e. P_y).

3. Y_w Wage and salaries income deflated by P_Y.

4. I^A_p Private investment in agriculture at constant 1970 prices.

5. $I^M p$ Private investment in manufacturing and mining at constant 1970 prices.

6. Ip Private investment in dwelling at constant 1970 prices.

7. I^{R}_{p} Private investment in the rest of the economy at constant 1970 prices.

8. H Inventory investment at constant 1970 prices.

9. PGNP Percentage rate of growth of the implicit Gross National Product price index (i.e. P_{GNP}).

10. P_{Cp} Percentage rate of growth of the implicit private consumption expenditure price index.

11. T_{dir} Total direct taxes on income deflated by the implicit price index of total government expenditure (i.e. P_{Cg+Ig}).

12. T_{ind} Total indirect taxes deflated by P_{cg+Ig}.

13. S Sudsides deflated by $P_{C}g+i_{K}$.

14. Imp Imports of goods and services deflated by the import price index.

15. Exp Exports of goods and services deflated by tue export price index.

16. CI Long term capital inflow deflated by P_{GNP}.

17. CO Long term capi;al outflow deflated by P_{GNP}.

18. Cur Flow of currency circulation deflated by the implicit price index of Gross Domestic Product (i.e. P_{GNP}).

19. Sig D^{ch}_{T} Flow of total sight deposits with commercial banks deflated by P_{GDP}.

20. SDp^{cb} Flow of private savings deposits with commercial banks deflated by P_{GDP}.

21. $TRDp^{b}$ Flow of private time and restricted deposits with commercial banks deflated by P_{GDP}.

22. $PosSD_p^{cl}$ Flow of private postal savings deposits deflated by P_{GDP}.

23. SD_p^{sci} Flow of savings deposits with special credit institutions deflated by P_{GDP}.

24. TRD_p^{sci} Flow of time and restricted deposits with special credit institutions deflated by $P_{GI)P}$.

25. Tb^{cb} Flow of treasury bills of commercial banks deflated by $\mathbf{P_{GDP}}$

26. R_E^{cb} Flow of excess reserves of commercial banks deflated by PGDP-

27. BB^{cb} Flow of borrowing of commercial banks from Bank of Greece deflated by P_{GDP}.

28. Cr^{cb}_{bd} Flow of supply of bills discounted credit to industry by commercial banks deflated by the implicit price index of private investment in manufacturing.

29. Cr^{cb}_{wc} Flow of supply of working capiral credit to industry by commercial banks deflated by the implicit price index of private investment in manufacturing.

30. Cr_{tr}^{cb} Flow of supply of credit to trade by commercial banks deflated by P_{Gnp}.

31. Cr_{it}^{cb} Flow of supply of long term credit to industry plus the credit to handicraft by commercial banks deflated by the implicit price index of private investment in manufacturing.

32. Cr^{sci} Flow of supply of credit by scecial credit insticutions deflated by P_{GDP}.

33. TRED Flow of total public entities deposits deflated by P_{GDP}.

34. D_{PE}^{1611} Flow of public entities deposits according to law 1611/1950 deflated by P_{GDP}.

Other endogenous variables determined from identities

35. GNP Gross National Product at constant 1970 prices.

36. FDB^{S} Foreign and Domestic Borrowing of the State deflated by P_{GDP}.

37. GDP Gross Domestic Product at constant 1970 prices.

38. Y National income at constant 1970 prices.

39. P Profits estimated as residual at constant 1970 prices.

40. Y_{pd} Personal disposable income deflated by P_{Y}.

41. T^{st} Direct State taxes plus indirect State taxes deflated by P

42. R" Flow of unborrowed reserves of commercial banks deflated by $P_{G1)P}$.

43. M — Flow of money supply deflated by P_{GDP}.

44. $TSSD^{ch}$ — Flow of sight and savings deposits with commercial banks deflated by P_{GDP}.

45. D^{cb} — Flow of sight and savings and time and restricted deposits with commercial banks deflated by P_{GDP}.

46. Dp^{sci} — Flow of postal savings and savings and time and restricted deposits with special credit institutions deflated by P_{GDP}.

47. FR^{cb} — Change in foreign exchange of commercial banks deflated by PGDP.

48. $r_M(R)$ — Real weighted average interest rate on credits to manufacturing sector.

49. Cr^T — Flow of total credit of the economy teflated by P_{GDP}.

50. Cr_p — Flow of rtotal private credit to manufacturing sector deflated by the implicit price index of private investment in manufacturing.

51. $Cr_T{}^{cb}$ — Flow of total credit supplied by commercial banks deflated by P_{GDP}.

EXOGENOUS VARIABLES

Policy instruments

1. (Cg+Ig) — Goverment consumption plus government investment at constant 1970 prices.

2.	T^{ind}	Ratio of total indirect taxes to private consumption.
3.	T^{dir}	Ratio of total direct taxes on income to National Income.
4.	r^{A}	Interest rate on credits to farmers.
5.	r_{sigd}	Interest rate on sight deposits.
6.	$r_{sav.d}$	Interest rate on savings deposits.
7.	r_{td}	Interest rate on time deposits.
8.	$r_{p.s.d.}$	Interest rate on postal savings deposits.
9.	$r_{tr.b}$	Interest rate on treasury bills.
10.	$(^{r}red—^{r}sav.d)$	Bank of Greece rediscount interest rate minus interest rate on savings deposits.
11.	r_M	Weighted average interest rate on credits to bills discount working capital, handicraft and long term credit.
12.	RR_{66}	Ratio of obligatory deposits of commercial banks with the Bank of Greece to bills discounted credit plus working capital credit plus trade credit supplied by commercial banks for the years (1966-1974).
13.	Tb^{RR}	Ratio of obligatory treasury bills held by commercial banks to total sight and savings deposits wich commercial banks.
14.	$(r_{imp}—r_{sav\ p})$	Interest rate on credits to trade supplied by commercial banks minus interest rate on savings deposits.

15. Cr^{BG} Flow of supply of credit of Bank of Greece and of Government deflated by P_{GDP};

Other exogenous variables

16. Y^{A} Output in agriculture at constant 1970 prices.

17. $Cr^{H}p$ Flow of private credit to housing deflated by the implicit price ndex of private investment in dwellings.

18. Y^{R} Output in the rest of the economy at 1970 prices.

19. (GNP— GNP) Deviation from trend of the GNP (t =1 at 1958).

20· Pimp Percentage rate of growth of import price index.

21. t Time trend (t =1 at 1958)

22. (P /K) Index of the average rate of return on capital (i.e. Profits / Total Capital Stock).

23. $RR^{c1)}$ Flow of obligatory deposits of Commercial Banks with the Bank of Greece deflated by P_{GDP}.

24. NIR Net income from the rest of the world at constant 1970 prices.

25. $TRED_{-t}$ Identical to (33) but lagged one period.

26. OTH Other transfers to households deflated by P_{Y}.

27. D Depreciation at constant 1970 prices.

28. T_R^{oth} Other taxes estimated as residual.

29. $SigD_R$ Flow of sight deposits with special credit institutions and Bank of Greece estimated as residual.

30. SDp_E^{cb}, Flow of public entities savings deposits with the commercial banks deflated by P_{GDP}.

31. OA^{cb} Other account of commercial banks (include securities etc.) estimated as residual.

32. M_{-1} Identical to (43) but lagged one period.

33. Cr_R Flow of credit supplied mainly by special credit institutions and Bank of Greece to manufacturing sector estimated as residual.

34. $(OR—OE)_R$ Other revenue of the government (mainly revenue from government entreprenuership) minus other expenditure of the government deflated by P_{GDP}.

35. Cr_K^b Flow of credit supplied by commercial banks to other sectors (mainly to tourism) estimated as residual.

36. C_{p-1} Private consumption expenditure lagged one period at constant 1970 prices.

37. K^A_{-1} Capital stock in agriculture sector lagged one period at constant 1970 prices.

38. K^M_{-1} Capital stock in manufacturing and mining sector lagged one period at constant 1970 prices.

39. K^D_{-1} Capital stock in dwellings sector lagged one period at constant 1970 prices.

40. K^{R}_{-1} Capital stock in the rest of the economy lagged one period at constant 1970 prices.

41. R^{cb*}_{E-1} Stock of excess reserves of commercial banks one period deflated by P_{GDP}.

42. Cur^{*}_{-1} Stock of currency circulation lagged one period deflated by P_{GDP}

43. FR_{-1} Foreign exchange reserves lagged one period deflated by PGDP.

44. TRD^{cb}_{p-1} Identical to (21) but lagged one period.

45. SD^{cb}_{p-1} Identical to (20) but lagged one period.

46. $PosSDp^{sci}_{p-1}$ Identical to (22) but lagged one period.

47. SD^{sci}_{p-1} Identical to (23) **but** lagged one period.

48. TRD^{sci}_{p-1} Identical to (24) but lagged one Period.

THE STRUCTURAL MODEL

Estimates of structural Equations—2SLS results[2]

CONSUMPTION—INCOME-INVESTMENT—PRICES

1. $C_p = 2740 + 0.3911\ Y_{pd} + 0.5495\ C_{p-1}$ $R^2 = 0.9968$ D—W = 2.7
   (3.74) (4.12)

(2) t = values in parenthesis

2. Y_A =—1012 +0.9936 Y^A +441 P_{GNP} R^2 =0.9542 D—W =2.47
(10.3) (3.85)

3. Y_w =—9394 +0.351 GNP—284 P_{Cp} R^2 =0.9959 D—W=1.84
(47.6) (3.25)

4. I^Ap =2038 +0.0287 GDP—0.057 K^A_{-1}—280r^A R^2 =0.861 D—W=1.80
(1.50) (1.05) (2.93)

5. Ip^M =—4431+0.0799 GDP—0.076 K^M_{-1}+0.115 Crp^M—86r_M (R)
(3.06) (0.76) (0.48) (0.89)

R^2 =0.9774 D - W =1.17

6. $1p^D$=15880+0.286 **GDP—**0.3078 K^D_{-1} +2.155 **Cr^H_p—**522 r_M (R)
(6.61) (6.45) (5.19) (3.87)

R^2 =0.9802 D—W=1.86

7 I^R_p =-7453+0.4369 Y^R-0.1752 K^R_{-1} +0.202 Cr^T— 212 r_M(R)
(5.04) (3.39) (1.41) (1.75)

R^2 =0.9664 D—W=1.9

8. H =—1062 +0.0388 Y—395 r_M (R) R^2 =0.6426 D - W =2.30
(1.99) (1-75)

9. P_{GNP} =0.565 +0.8301 P_{Cp} +0.00012 M +0.0000036 (GNP—GNP)
(12.1) (0.80) (0.23)

R2 =0.9632 D - W =3.35

10. P_{Cp} =—1.69 +0.512 P_{Imd} +YO T^{iud} +0.00037 $M_{\_t}$
(4.60) (0.21) (1.08)

R^2 =0.9105 D— W=2.31

GOVERNMENT SECTOR

11. $T_{dil.} = -16254 + 0.1233\ Y + 131885\ T^{dir}$ $R^2 = 0.9976$ D—W = 2.23
(4.31) (6.13)

12. $T_{in„} = -31252 + 0.1963\ C_p + 159983\ T^{ind}$ R2 = 0.9931 D-W = 1.64
(41.42) (9.67)

13. $S = -4496 + 0.1639\ Y_A + 111\ P_{Cp}$ R2 = 0.8802 D—W = 1
(4.68) (2.33)

EXTERNAL SECTOR

14. $Imp = -19130 + 0.2175\ GNP + 0.7754\ FR_{\_t}$ R2 = 0.9872 D—W = 2.19
(20.05) (4.70)

15. Exp = —17004 + 3821 t (Cochram—Orcutt method)
(5.68) R2 = 0.6979 D—W = 1.61

16. Cl = —39969 + 0.0675 GNP + 196150 (P/K) R2 = 9189 D—W = 1.99
(9.31) (2.34)

17. CO = —1405 + 0.0296 P $R^2 = 0.8763$ D—W = 1.91
(10.31)

MONETARY SECTOR

18. $Cur = -5018 + 0.1126\ Y - 0.45226\ Cur^*_{-1} - 445\ r_{Sig.d}$
(2.60) (1.82) (0.58)'

R2 = 0.6238 D—W = 1.42

19. $SigD^{cb}_{T} = l_0 + 0.0131Y - 274r_{sav}$, $R^2 = 0.4847$ D-W = 1 90
(3.61) (1.43)

20. $SD^{cb}_{p} = -14301 + 0.0852\ Y - 0.2959\ SD^{cb}_{p-1} + 1170\ r_{sav.d} - 429P_{r}$
(4.90) (1.19) (2·12) (3·26) CP

$R^2 = 0.8211$ D—W=1.90

21. $TRD^{cb}_{p} = -6321 + 0.0318\ Y + 0.0678\ TRD^{cb}_{p-1} + 405\ r_{t} - I59\ P$
(3-46) (0.25) (1.48) (2.45)

$R^2 = 0.8041$ D—W=1.72

22. $PosSD^{sci}_{p} = -2914 + 0.0939\ Y_{w} - 0.8179\ PosSD^{sci}_{p-1}, + 93\ r\ \_152P$
(5.42) (2.75) (0.48) (3.36)

23. $SD^{sci}_{p} = —867 + 0.0048\ Y — 0.5129\ SD^{sci}_{p-1} + 76\ r$
(4-16) (1.31) (3.35)

$R^2 = 0.8887$ D—W = 2.0

24. $TRD^{sci}_{p} = -241 + 0.0046\ Y + 0.473\ TRD^{sci}_{p-1} - 44r_{sav} - 43P_{GDP}$
(2.23) (1.59) (0.52) (2.24)

$R^2 = 0.6999$ D—W = 2.21

25. $Tb^{cb} = 1280 + 11471\ Tb^{RR} + 0.5194\ RR^{cb} + 2115\ r_{t}, -1680r$
(3·75) (2.11) (3.63) $(2.95)^{M}$

$R^2 = 0.8547$ D—W = 2.52

26. $R^{cb}_{E} = 2072 + 0.3054\ RR^{cb} + 0.065\ D^{cb} + 0.496\ FR^{cb} - 1\ 382\ R^{cb}_{E-1}$ 273 r
(2.34) (2.65) (2.06) (8 48)

—273 r_{trb}—0.166 BB^{cb}
(2.18) (0.97) R^2 =0.9439 D—W =1.78

27. BB^{cb} =360+0.3707 D_{PE}^{1611}+0.2562 $Cr^{cb}{}_T$—0.2571 D^{cb}— 158(r_{red}—$r_{sav;d}$
(2.24) (3.15) (5.06) (1.15)

R^2 =0.7106 D—W=2.38

28. $Cr^{cb}{}_{bd}$ =-715 +0.242 BB^{ch} +0.0497 D^{cb} +96 r_M— 513 RR_{56}
(1.19) (1.74) (0.58) (0.49)

R2 =0.3243 D—W=1.80

. . .

29. $Cr^{cb}{}_{wc}$ =-2053 +0.1385 $TRD^{cb}{}_p$ +0.3642 $TSSD^{cb}$ +0.4468 BB^{cb} +244r_M
(0.35) (1.47) (0.94) (0.82)

-2926 RR_{66}—0.17786 Tb^{ch} R^2 =0.7732 D—W =2.34
(1.47) (0.59)

30. $Cr^{cb}{}_{tr}$ =—167 +0.0729 D^{cb} +0.2774 BB^{cb}—398 RR_{66} +130(r_{imp}—$r_{sav\,d}$)
(2.55) (1.48) (0.39) (0.76)

R2 =0.49773 D—W =1.95

31. $C^{cb}{}_{rlt}$=—9+0.1426 D^{cb}+33r_M(R)—0.126 R^u R2 =0.8734 D—W1.95
(7.77) (1.69) (2.54) ;

32. Cr^{scl} =—2130 +1.086 $D^{sci}{}_p$ +297 r_M R2 =0.5051 D—W =2.45
(3.69) (0.52)

33. TPED=—1164+0.0811 T^{st} +0.2168 $TPED_{\_t}$ R^2 =0.6242 D—W =1.97
(2.63) (0.84)

34. D_{PE}^{1611} =--217 +0.7498 TPED R2 =0.7982 D—W =2.61
(7.70)

35. $GNP = C_p + I^A_p + I^M_p + I^D_p + I^R_p + H \quad (C_g + I_g) + Exp - Imp + NIR$

36. $FDB^S = (C_g + I_g) T^{st} - (OR - OE)_R$

37. $GDP = Y + D - NIR$

38. $Y = GNP - D - T_{ind} + S$

39. $\rho_{=Y-} Y_{A-} Y_W$

40. $Y_{pd\ pd} = Y - T_{dir\ dlr} + OTH$

41. $T^{st} = T_{dir} + T_{ind} - T^{oth}$

42. $R^u = RR^{cb} + R|^b - BB^{cb}$

43. $M = Cur + Sig\ D_T^{cb} + SigDR$

44. $TSSD^{cb} = SD\hat{}^b + SigD!i,^b + SD^{\circ b}_{PE}$

45. $D^{cb} = TSSD^{cb} + TRD^{cb}_p$

46. $D_p^{ci} = SD_p^{ci} + TRD_p^{ci} + PosSD_p^{ci}$

47. $FR^{cb} = D^{cb} + BB^{cb} - RR^{cb} - R_E^{cb} - Cr_T^{cb} + OA^{ob}$

48. $r^M(R) = r_M - P_{GNP}$

49. $Cr^{T} = Cr_{T}^{cb} + Cr^{BG} + Cr^{sci}$

50. $Cr^{M}{}_{p} = Cr^{cb}{}_{bd} + Cr^{cb}{}_{wc} + Cr^{cb}{}_{lt} + Cr^{M}{}_{R}$

51. $Cr^{cb}{}_{T} = Crr^{cb}{}_{bd} + Cr^{cb}{}_{wc} + Crr^{eb}{}_{tr} + Crr^{cb}{}_{lt} + Crr^{cb}{}_{R}$

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