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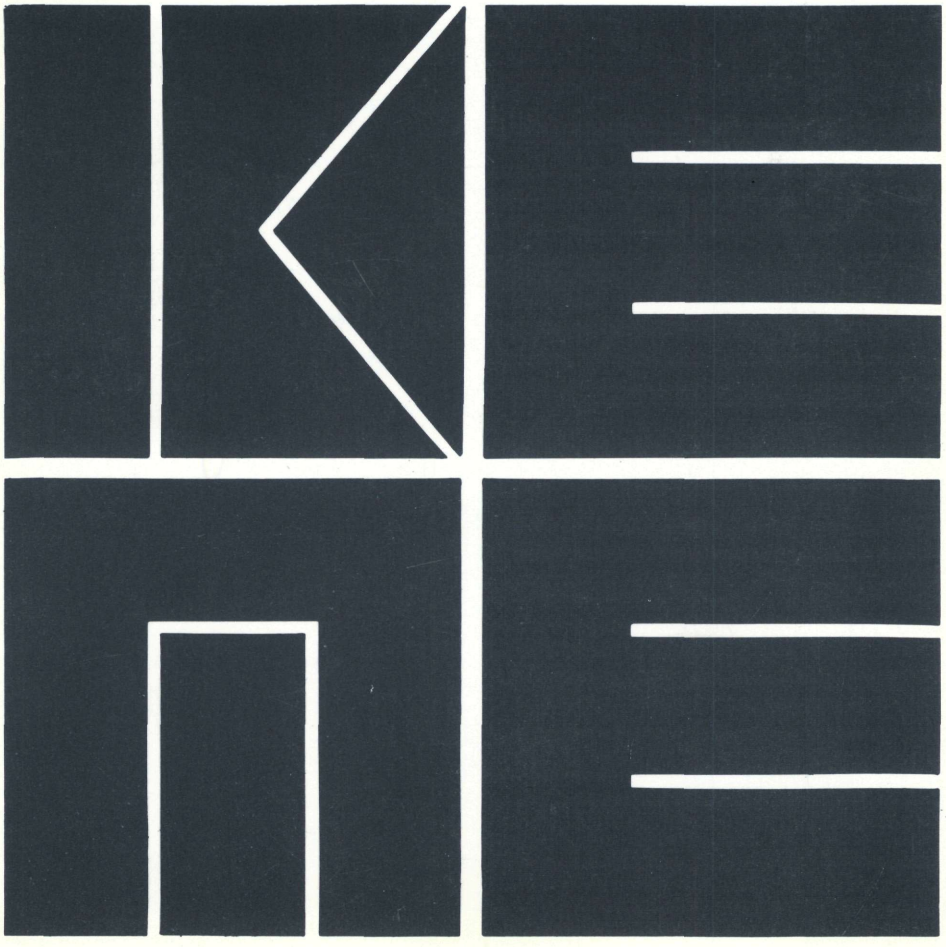
Th. Gamaletsos

Habit Formation and Inflation in Demand Analysis: A System Wide Approach



Athens 1984

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Habit Formation and Inflation in Demand Analysis: A System Wide Approach

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Athens, December 1984

Opinions or value judgements expressed in this book are those of the author and do not necessarily represent those of the Centre of Planning and Economic Research.

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A draft of this copy was referred to the «Studies Committee» of KEPE and three external referees; the text was revised by the author according to their comments and recommendations.

This study provides estimates for private consumption in the Greek economy, using econometric techniques based on the theory of «complete systems» of consumer demand.

The main contribution of this study lies in the dynamization of static linear demand systems such as the LES and GLES. This is done using a habit formation hypothesis, that is appropriately adjusted for the rate of inflation. By comparing two different dynamic forms of the GLES model, the author is able to test his hypothesis that inflation does affect consumer habits.

In this way, Professor Gamaletsos makes an original contribution to the literature, which has at the same time interesting policy implication.

Prof. Louka Katseli
Scientific Director, KEPE

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THEODORE GAMALETSOS

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1. Introduction

In an allocation of sectoral final demand we compared the merits of the Generalized Linear Expenditure System (GLES) and the Dynamic Generalized Linear Expenditure System (DGLES) developed by Gamaletsos[1]. The results of that comparison stated that the estimation of the D-GLES model gives an indication that empirical demand models, based on the classical consumer demand theory, could be used to allocate and forecast sectoral final demand. Furthermore the Dynamic GLES model, while not without its share of weaknesses, seems to be more attractive than the GLES and any other static expenditure system.

The purpose of this work is to see how inflation affects habits in demand analysis following the system wide approach. For that reason we use two different dynamic forms of the GLES model to analyze sectoral private consumer expenditures. The data base consisted of annual time series 1958-1977, for Greece. These data were taken from estimated input-output tables[2].

2. The Structure of the Models

The Dynamic Generalized Linear Expenditure Model or GAMA model, which permits marginal budget shares to depend on prices and minim-

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1. Th. Gamaletsos. *Forecasting Sectoral Final Demand by a Dynamic Expenditure System.* Center of Planning and Economic Research, Athens, 1980.

2. For details see Th. Skountzos and G. Mattheos. Input-Output Tables of the Greek Economy 1958-1975. (in Greek). Center of Planning and Economic Research, Athens, 1978.

um required expenditures to be functions of last period expenditures, has been presented in another work[3]. However we very briefly present this model here.

The GAMA model which is of the form

$$(1) \qquad e_{it} = p_{it}\gamma_i^* + \beta_{it}\,(y_t - \Sigma_{j=1}^n p_{jt}\gamma_j^*) + \alpha_i e_{it-1} - \beta_{it}\Sigma_{j=1}^n \alpha_j e_{jt-1}$$

$$(i = 1, \ldots, n \;;\; t = 1, \ldots, T)$$

is derived from the GLES model, which is

$$(2) \qquad e_{it} = p_i\gamma_i + \beta_{it}\,(y_t - \Sigma_{j=1}^n p_{jt}\gamma_j)$$

$$(i = 1, \ldots, n \;;\; t = 1, \ldots, T)$$

assuming that

$$(3) \qquad \tilde{e}_{it} = p_{it}\gamma_i = p_{it}\gamma_i^* + \alpha_i e_{it-1}$$

$$(i = 1, \ldots, n \;;\; t = 1, \ldots, T),$$

where e_{it} is the expenditure on commodity i at time t, p_{it} is the price of commodity i at time t, $y_t = \Sigma_{i=1}^n e_{it}$ is the «income» (total consumer expenditures in current prices at time t) and $\beta_{it} = \delta_{it}p_{it}^{\tau}\,(\Sigma_{j=1}^n \delta_j p_{it}^{\tau})^{-1}$ is the marginal budget share of commodity i at time t, and $\tau = \rho\,/\,(\rho - 1)$, δ_i's, α_i':σ, γ_i^*'s are parameters with $0 < \delta_i < 1$, $\Sigma_{i=1}^n \delta_i = 1$, $-\infty < \tau < +\infty$ and $\tilde{e}_{it}$ is the «mi-

3. Th. Gamaletsos. *«A Dynamic Generalized Linear Expenditure System of the Demand for Consumer Goods in Greece»,* in *Proceedings of the Econometric Society European Meeting 1979,* Chapter 17, North-Holland, 1981.

nimum required expenditure» for commodity i at time t, e_{it-1} is the last period expenditure for commodity i.

Equation (3) introduces a habit formation hypothesis adjusted for the rate of inflation. We see this more clearly if we devide (3) by p_{it}, which becomes

$$(4) \qquad \gamma_i = \gamma^*_i + \alpha_i q_{it-1} \left(\frac{p_{it-1}}{p_{it}} \right)$$

$$(i = 1, \ldots, n \ ; \ t = 1, \ldots, T)$$

or

$$(5) \qquad \gamma_i = \gamma^*_i + \alpha_i q_{it-1} \frac{1}{r_{it}}$$

where r_{it} is the rate of inflation of commodity i at time t.

According to this hypothesis the more the rate of inflation of a commodity is the less becomes the habit effect for that commodity. In this case the consumer adjusts inversely his habits according to the increase of inflation. If $r_{it} = 1$, or if $p_{it} = p_{it-1}$, that is if we have no inflation at all then habits effect fully the behavior of the consumer. This dynamic specification assumes that the consumer adjusts his preferences according to the increase of inflation. His preferences are not static anymore but they change intertemporally according to changes in the relative prices.

For reasons of comparison or to test this hypothesis with the usual habit formation hypothesis, we give another dynamic form of the GLES model. Instead of equation (4) or (5) we assume that

$$(6) \qquad \gamma_i = \gamma^*_i + \alpha_i q_{it-1} \qquad (i = 1, \ldots, n)$$

In this case if we use (6) in (2) we obtain the dynamic version of the GLES model

$$(7) \qquad e_{it} = p_{it}\gamma^*_i + \beta_{it}\,(y_t - \Sigma^n_{j=1} p_{jt}\gamma^*_j) + \alpha_i p_{it} q_{it-1} - \beta_{it}\Sigma^n_{j=1}\alpha_j p_{jt} q_{jt-1}\ ^4$$

$$(i = 1, \ldots, n\ ;\ t = 1, \ldots T).$$

This is the POL model. According to professor Pollak[5] the γ^*_i can be interpreted as a «physiologically necessary» component of γ_i and $\alpha_i q_{it-1}$ (the habit effect) as the «psychologically necessary» component. Pollak introduces habit effects into the complete demand systems in the usual way. He does not take into account how the rate of inflation reduces the habit effect. According to his hypothesis, the consumer will allocate his expenditures keeping the same habits overtime. Which of the two hypotheses is more appropriate to dynamize the GLES model is a matter of comparison between the GAMA and the POL model.

3. Estimation

The stochastic specification of the GAMA and POL models is the same with that used in my work[6], that is we interpret each of the expenditure equation as the conditional expectation of an e_{it} given y_t, p_{it}, ..., p_{nt} and e_{it-1}, ..., e_{nt-1} for $t = 1, \ldots, T$.

In this stochastic framework the GAMA and POL models become respectively

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4. The derivation of this model follows the same way with that of the GAMA model, which is explained in T. Gamaletsos, *Forecasting Sectoral Final Demand by a Dynamic Expenditure System.* op. cit.

5. R.A. Pollak. «Habit Formation and Dynamic Functions». *Journal of Political Economy*, Vol. Θ8, No. 4, August 1970, pp. 745-763.

6. Th. Gamaletsos. *Forecasting Sectoral Final Demand by a Dynamic Expenditure System.* op. cit.

(8) $$e_{it} = p_{it}\gamma_i^* + \beta_{it}\,(y_t - \Sigma_{j=1}^{n} p_{jt}\gamma_j^*) + \alpha_i e_{it-1} - \beta_{it}\Sigma_{j=1}^{n}\,\alpha_j\, e_{jt-1} + u_{it}$$

$$(i = 1, \ldots, n \;;\; t = 1, \ldots T),$$

and

(9) $$e_{it} = p_{it}\gamma_i^* + \beta_{it}\,(y_t - \Sigma_{j=1}^{n} p_{jt}\gamma_j^*) + \alpha_i p_{it} q_{it-1} - \beta_{it}\Sigma_{j=1}^{n}\alpha_{jt} p_{jt} q_{jt-1} + u_{it}$$

$$(i = 1, \ldots, n \;;\; t = 1, \ldots, T).$$

The criterion to fit these systems, each of n equations, is to choose estimates for our parameters to minimize the sum of squares of the residuals over all commodities and years: $\Sigma_{i=1}^{n}\,\Sigma_{t=1}^{T}\,\hat{u}_{it}^2$. This criterion is proposed by Stone[7,8] and was also used by Stone et. al.[9] by Goldberger and Gamaletsos[10] and by Gamaletsos[11,12,13,14]. More appropriate fitting criteria have been

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7. R. Stone. «Linear expenditure system and demand analysis: an application to the pattern of British demand». *Economic Journal, Vol.* 64, September 1954, pp. 511-527.

8. R. Stone. «Models for demand projections». pp. 271-290, in C.R. Rao (ed.) *Essays on Econometrics and Planning*. Oxford: Pergamon, 1965.

9. R. Stone, A. Brown and D.A. Row. «Demand analysis and projections for Britain, 1900-1970: a study in method». pp. 200-255 in J. Sandee (ed.), *Europe's Future Consumption*. Amsterdam: North-Holland, 1964.

10. A.S. Goldberger and Th. Gamaletsos. «A cross-country comparison of consumer expenditure patterns». *European Economic Review,* Spring 1970, pp. 357-400.

11. Th. Gamaletsos. *International Comparison of Consumer Expenditure Patterns: An Econometric Analysis*. Doctoral Dissertation, University of Wisconsin, 1970.

12. Th. Gamaletsos. «Further analysis of cross-country comparison of consumer expenditure patterns». *European Economic Review,* April 1973, pp. 1-20.

13. Th. Gamaletsos. «A Generalized Linear Expenditure System». *Applied Economics,* Vol. 6, 1974, pp. 59-71.

14. Th. Gamaletsos. *Interindustry Analysis of Private Consumption of the Greek Economy*. Center of Planning and Economic Research, Athens, 1975.

used by Barten[15] Pollak and Wales[16], Parks[17,18], Solari[19] and Phlips[20]. In this paper our purpose is to test which of the two dynamic specifications of the GLES model is the appropriate one and not to test which fitting criterion is the best. By comparing the GAMA and POL models we indirectly compare the classical (static) habit formation hypothesis with my (dynamic) hypothesis of habit formation adjusted for the rate of inflation. For fitting the GAMA and POL models we use the Gauss-Newton[21] computer program, a straightforward non-linear one. This computer program is a single-equation one. For this reason we write out each of these systems as one equation by making use of «constructed» variables. These constructed variables are given in my work[22].

In terms of the constructed variables the GAMA system (8) is expressed as

$$(10) \quad e_k = \left[\Sigma_{j=1}^{n-1} \delta_j p_{jk}^{\tau} + (1-\Sigma_{j=1}^{n-1} \delta_j) p_{nk}^{\tau} \right]^{-1} (w_{nk} + \Sigma_{j=1}^{n-1} z_{jk}\delta_j)$$

$$(\Sigma_{j=1}^{n} w_{kj} p_{jk}^{\tau}) (y_k - \Sigma_{j=1}^{n} p_{jk} \gamma_j^* - \Sigma_{j=1}^{n} e_{-jk} \alpha_j) +$$

$$\Sigma_{j=1}^{n} w_{jk} p_{jk} \gamma_j^* + \Sigma_{j=1}^{n} w_{jk} e_{-jk} \alpha_j + u_k$$

$$(k = 1, \ldots, n\ (t-1)),$$

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15. A.P. Barten. «Maximum likelihood estimation of a complete system of demand functions». *European Economic Review*, Fall 1969, pp. 7-73.

16. R.A. Pollak and T.V. Wales. «Estimation of the linear expenditure system». *Econometrica*, Vol. 37, October 1969, pp. 611-628.

17. R.W. Parks. «Systems of demand equations: an empirical comparison of alternative functional forms». *Econometrica*, Vol. 37, October 1969, pp. 629-650.

18. R.W. Parks. «Maximum likelihood estimation of linear expenditure system». *Journal of American Statistical Association*, Vol. 66, December 1971, pp. 900-903.

19. L. Solari. Théorie des Choix et fonctions de consommation semiagregées, modèles statistiques. Geneve: Drez, 1951.

20. L. Phlips. «The Demand for Leisure and Money». *Econometrica*, Vol. 46, No 5, September 1978, pp. 1025-1045.

21. Gauss-Newton. «Non Linear Least-squares Program BMD x 85», Social Science Data and Program Library Service, University of Wisconsin, 1967.

22. Th. Gamaletsos. *Forecasting Sectoral Final Demand by a Dynamic Expenditure System*. op. cit.

while the POL system (9) is given by

$$(11)\quad e_k = \left[\Sigma_{j=1}^{n-1} \delta_j \, p_{jk}^{\tau} + (1-\Sigma_{j=1}^{n-1} \delta_j \, p_{nk}^{\tau} \right]^{-1} (w_{nk} + \Sigma_{j=1}^{n-1} z_{jk} \, \delta_j)$$
$$(\Sigma_{j=1}^{n} w_{kj} \, p_{jk}^{\tau}) (y_k - \Sigma_{j=1}^{n} p_{jk} \, \gamma_j^* - \Sigma_{j=1}^{n} e_{-jk}^* \, \alpha_j) +$$
$$\Sigma_{j=1}^{n} w_{jk} \, p_{jk} \, \gamma_j^* + \Sigma_{j=1}^{n} w_{jk} \, e_{-jk}^* \, \alpha_j + u_k$$
$$(k = 1, \ldots, n\,(t-1)).$$

As we see the difference between these two models is on the specification of the lagged variables e_{-jk} and e_{-jk}^*. These variables are specified as follows:

$$e_{-1} = \begin{bmatrix} p_{11}q_{11} \\ \vdots \\ p_{1\,(T-1)}q_{1\,(T-1)} \\ p_{11}q_{11} \\ \vdots \\ P_{1\,(T-1)}q_{1\,(T-1)} \\ \vdots \\ p_{11}q_{11} \\ \vdots \\ p_{1\,(T-1)}q_{1\,(T-1)} \end{bmatrix}, \quad e_{-2} = \begin{bmatrix} p_{21}q_{21} \\ \vdots \\ p_{2\,(T-1)}q_{2\,(T-1)} \\ p_{21}q_{21} \\ \vdots \\ P_{2\,(T-1)}q_{2\,(T-1)} \\ \vdots \\ p_{21}q_{21} \\ \vdots \\ p_{2\,(T-1)}q_{2\,(T-1)} \end{bmatrix} \ldots \quad e_{-n} = \begin{bmatrix} p_{n1}q_{n1} \\ \vdots \\ p_{n\,(T-1)}q_{n\,(T-1)} \\ p_{n1}q_{n1} \\ \vdots \\ P_{n\,(T-1)}q_{n\,(T-1)} \\ \vdots \\ p_{n1}q_{n1} \\ \vdots \\ p_{n\,(T-1)}q_{n\,(T-1)} \end{bmatrix}$$

and

$$\underline{e}^*_1 = \begin{bmatrix} p_{12}q_{11} \\ \cdot \\ \cdot \\ \cdot \\ p_{1T}q_{1\,(T-1)} \\ p_{12}q_{11} \\ \cdot \\ \cdot \\ \cdot \\ p_{1T}q_{1\,(T-1)} \\ \cdot \\ \cdot \\ \cdot \\ p_{12}q_{11} \\ \cdot \\ \cdot \\ \cdot \\ p_{1T}q_{1\,(T-1)} \end{bmatrix}, \quad \underline{e}^*_2 = \begin{bmatrix} p_{22}q_{21} \\ \cdot \\ \cdot \\ \cdot \\ p_{2T}q_{2\,(T-1)} \\ p_{22}q_{21} \\ \cdot \\ \cdot \\ \cdot \\ p_{2T}q_{2\,(T-1)} \\ \cdot \\ \cdot \\ \cdot \\ p_{22}q_{21} \\ \cdot \\ \cdot \\ \cdot \\ p_{2T}q_{2\,(T-1)} \end{bmatrix}, \quad \ldots \; \underline{e}^*_n = \begin{bmatrix} p_{n2}q_{n1} \\ \cdot \\ \cdot \\ \cdot \\ p_{nT}q_{n\,(T-1)} \\ p_{22}q_{21} \\ \cdot \\ \cdot \\ \cdot \\ p_{nT}q_{n\,(T-1)} \\ \cdot \\ \cdot \\ \cdot \\ p_{n2}q_{n1} \\ \cdot \\ \cdot \\ \cdot \\ p_{nT}q_{n\,(T-1)} \end{bmatrix}$$

4. Estimates

The GAMA and POL models were fitted to Greek data for the years 1958-1977 on seven categories of secteral private consumption. These seven sectors are agriculture, manufacturing, construction, electricity, transportation and communication, housing and services. Estimates of the parameters of the GAMA and POL models for private consumption are reported in Tables 1 and 2 respectively. As we can see (Table 1) all δi's for the GAMA model are between 0 and 1, according to the theoretical model and only one of them is not significantly different from zero. However, for the POL model (Table 2) there is one δ_i which is negative and there are four of them which are not significantly different from zero. This is an indication that the structure of the GAMA model is better than that of the POL model. All minimum required quantities γ^*_i are negative and two of them are not significantly different from zero in the GAMA model, while in the POL model two of these γ^*_i coefficients are positive and five of them

are not different from zero. Finally comparing the estimates of the α_i coefficients reported on Tables 1 and 2 we observe that the GAMA model gives better estimates than that of the POL model.

Another criterion to compare these two models is the overall sum of squares of residuals across commodities and years; as we see this is 3.101 for POL model, while for GAMA model is only 0.6370. This is another indication that GAMA model fits better to the data used than the POL model.

In Tables 3-9 we report the actual and predicted values of sectoral private consumption together with their residuals for the GAMA and POL models. As we can see from the percentages of the residuals the GAMA model predicts (within the sample) better than the POL, especially for the last five years of the sample period. This forecast error in most cases (with the exception of construction and electricity) is less than 5%. The better fitting of the GAMA model compared to the POL model especially after 1973 justifies my hypothesis that habit formation is adjusted for the rate of inflation.

5. Conclusions

This work underlines the need of searching for new dynamic expenditure systems, which will be more satisfactory from theoretical and empirical point of view. The estimation of the GAMA and POL models gives an indication that dynamic (complete) demand systems could be used to allocate and forecast sectoral private consumption. Furthermore the GAMA model seems to be more attractive than the POL model. This means that my (dynamic) hypothesis of habit formation adjusted for the rate of inflation explains better consumer behavior than the (static) hypothesis of habit formation.

TABLES

TABLE 1

Parameter Estimates: GAMA Model
Private Consumption

Sectors	δ_i	γ^*_i	α_i	τ
Agriculture	0.087	−6.866	1.253	
	(0.008)	(1.488)	(0.042)	
Manufacturing	0.254	−27.320	1.375	
	(0.012)	(4.583)	(0.037)	
Construction	0.251	−0.399	2.443	
	(0.010)	(0.475)	(1.748)	
Electricity	0.011	−1.630	1.749	
	(0.014)	(1.301)	(0.531)	
Transportation—	0.045	−4.208	1.249	
Communication	(0.005)	(1.037)	(0.020)	
Housing	0.092	−6.014	1.206	
	(0.014)	(2.087)	(0.054)	
Services	0.260	−27.280	1.533	
		(3.019)	(0.013)	1.716
				(0.049)

$\Sigma_i \Sigma_t \hat{u}_i^{\,2}(t) = 0.6370$

The numbers in parentheses are asymptolic standard deviations of the coefficients.

TABLE 2

Parameter Estimates: POL model
Private Consumption

Sectors	δ_i	γ^*_i	α_i	τ
Agriculture	0.025	2.929	0.852	
	(0.021)	(2.143)	(0.075)	
Manufacturing	0.225	−17.860	1.197	
	(0.038)	(6.305)	(0.062)	
Construction	0.329	−0.377	2.581	
	(0.042)	(0.680)	(2.890)	
Electricity	0.029	−3.701	2.678	
	(0.026)	(2.796)	(1.229)	
Transportation–	−0.019	3.466	0.951	
Communication	(0.020)	(1.931)	(0.053)	
Housing	0.089	−5.683	1.180	
	(0.048)	(5.188)	(1.733)	
Services	0.322	−26.650	1.417	
		(5.945)	(0.047)	
				1.978
				(0.124)

$\Sigma_i \Sigma_t \hat{u}_i^{\,2}(t) = 3.101$

The numbers in parentheses are asymptolic standard deviations of the coefficients.

TABLE 3

Agriculture
Private Consumption

Years	Actual	Predicted		Residuals			
		GAMA	POL	GAMA	%	POL	%
1959	9.861	10.205	10.296	–0.344	–3.49	–0.435	–4.41
60	10.297	10.647	12.738	–0.350	–3.40	–2.441	–23.71
1	11.155	11.312	11.657	–0.157	–1.41	–0.502	–4.50
2	11.351	11.594	13.779	–0.243	–2.14	–2.428	–21.39
3	12.527	12.555	12.637	–0.028	–0.22	–0.110	–0.88
4	13.726	13.245	15.094	0.481	3.50	–1.368	–9.97
5	16.016	15.430	16.250	0.586	3.66	–0.234	–1.46
6	18.074	17.276	18.423	0.798	4.42	–0.349	–1.93
7	19.907	18.467	18.979	1.440	7.23	0.928	4.66
8	22.551	21.080	21.027	1.471	6.52	1.524	6.76
9	25.449	24.029	23.532	1.420	5.58	1.917	7.53
70	28.007	26.834	24.998	1.173	4.19	3.009	10.74
1	31.301	30.086	29.575	1.215	3.88	1.726	5.51
2	35.188	33.918	33.690	1.270	3.61	1.498	4.26
3	43.389	43.108	48.827	0.281	0.65	–5.438	–12.53
4	52.507	52.902	46.508	–0.395	–0.75	5.999	11.43
5	59.054	60.114	54.044	–1.060	–1.79	5.010	8.48
76	61.367	62.099	65.683	–0.732	–1.19	–4.316	–7.03
77	62.898	64.544	65.289	–1.646	–2.62	–2.391	–3.80

TABLE 4

Manufacturing
Private Consumption

Years	Actual	Predicted		Residuals			
		GAMA	POL	GAMA	%	POL	%
1959	33.192	33.149	34.496	0.043	0.13	−1.304	−3.93
60	34.943	34.893	34.671	0.050	0.14	0.272	0.78
1	38.230	37.893	38.854	0.337	0.88	−0.624	−1.63
2	39.348	39.381	38.794	−0.033	−0.08	0.554	1.41
3	43.993	43.381	44.107	0.612	1.39	−0.114	−0.26
4	47.319	46.916	46.157	0.403	0.85	1.162	2.46
5	54.268	53.300	53.208	0.968	1.78	1.060	1.95
6	60.277	59.518	59.041	0.759	1.26	1.236	2.05
7	62.052	64.025	61.444	−1.973	−3.18	0.608	0.98
8	66.014	67.417	65.442	−1.403	−2.13	0.571	0.86
9	70.322	71.642	70.631	−1.320	−1.88	−0.309	−0.44
70	73.494	74.697	74.575	−1.203	−1.64	−1.081	−1.47
1	78.535	79.552	78.511	−1.017	−1.29	0.024	0.03
2	85.103	85.915	85.668	−0.812	−0.95	−0.565	−0.66
3	102.138	101.387	103.381	0.751	0.74	−1.243	−1.22
4	121.747	122.102	127.685	−0.355	−0.29	−5.938	−4.88
5	136.878	137.805	138.088	−0.927	−0.68	−1.210	−0.88
6	144.794	144.034	142.272	0.760	0.52	2.522	1.74
7	154.475	152.348	150.818	2.127	1.38	3.657	2.37

TABLE 5

Construction
Private Consumption

Years	Actual	Predicted		Residuals			
		GAMA	POL	GAMA	%	POL	%
1959	0.089	–0.047	–0.023	0.136	152.81	0.112	125.84
60	0.118	–0.000	0.029	0.118	100.00	0.089	75.42
1	0.164	0.062	0.101	0.102	62.20	0.063	38.41
2	0.213	0.159	0.223	0.054	25.35	–0.010	–4.69
3	0.300	0.271	0.330	0.029	9.67	–0.030	–10.00
4	0.313	0.473	0.563	–0.160	–51.12	–0.250	–79.87
5	0.349	0.483	0.610	–0.134	–38.40	–0.261	–74.79
6	0.375	0.534	0.722	–0.159	–42.40	–0.347	–92.53
7	0.345	0.589	0.685	–0.244	–70.72	–0.340	–98.55
8	0.326	0.502	0.605	–0.176	–53.99	–0.279	–85.58
9	0.308	0.436	0.550	–0.128	–41.56	–0.242	–78.57
70	0.283	0.353	0.503	–0.070	–24.73	–0.220	–77.74
1	0.264	0.292	0.353	–0.028	–10.61	–0.089	–33.71
2	0.248	0.220	0.324	0.028	11.29	–0.076	–30.65
3	0.256	0.074	0.299	0.182	71.09	–0.043	–16.80
4	0.259	–0.058	0.204	0.317	122.39	0.055	21.24
5	0.243	–0.104	0.023	0.347	142.80	0.220	90.53
6	0.211	–0.227	–0.075	0.438	207.58	0.286	135.55
7	0.181	–0.470	–0.274	0.651	359.67	0.455	251.38

TABLE 6

Electricity
Private Consumption

Years	Actual	Predicted		Residuals			
		GAMA	POL	GAMA	%	POL	%
1959	0.739	0.267	0.055	0.472	63.87	0.684	92.56
60	0.827	0.399	0.077	0.428	51.75	0.750	90.69
1	0.961	0.597	0.549	0.364	37.88	0.412	42.87
2	1.049	0.639	0.420	0.410	39.08	0.629	59.96
3	1.242	0.950	1.081	0.292	23.51	0.161	12.96
4	1.402	1.133	1.044	0.269	19.19	0.358	25.54
5	1.685	1.510	1.765	0.175	10.39	−0.080	−4.75
6	1.958	1.878	1.886	0.080	4.09	0.072	3.68
7	1.914	2.213	2.573	−0.299	−15.62	−0.659	−34.43
8	1.925	2.081	3.109	−0.156	−8.10	−1.184	−61.51
9	1.928	2.077	2.254	−0.149	−7.73	−0.326	−16.91
70	1.883	1.980	2.196	−0.098	−5.20	−0.313	−16.62
1	1.868	1.987	2.104	−0.119	−6.37	−0.236	−12.63
2	1.864	2.091	1.902	−0.227	−12.18	−0.038	−2.04
3	2.040	2.272	2.211	−0.232	−11.37	−0.171	−8.38
4	2.191	2.390	2.509	−0.199	−9.08	−0.318	−14.51
5	2.187	2.408	2.397	−0.221	−10.11	−0.210	−9.60
6	2.017	2.038	2.018	−0.021	−1.04	−0.001	−0.05
7	1.835	1.685	0.932	0.150	8.17	0.903	49.21

TABLE 7

Transportation and Communication
Private consumption

Years	Actual	Predicted		Residuals			
		GAMA	POL	GAMA	%	POL	%
1959	4.411	4.479	5.294	−0.068	−1.54	−0.883	−19.88
60	4.973	5.140	6.078	−0.166	−3.34	−1.105	−22.22
1	5.817	6.060	6.364	−0.243	−4.18	−0.547	−9.40
2	6.392	6.477	7.506	−0.085	−1.33	−1.114	−17.43
3	7.616	7.902	7.701	−0.286	−3.76	−0.085	−1.12
4	8.144	8.765	9.390	−0.621	−7.63	−1.246	−15.30
5	9.273	10.131	9.622	−0.858	−9.25	−0.349	−3.76
6	10.212	10.938	11.297	−0.726	−7.11	−1.085	−10.62
7	11.677	10.939	11.979	0.738	6.32	−0.302	−2.59
8	13.788	13.212	12.679	0.576	4.18	1.109	8.04
9	16.300	15.579	16.346	0.721	4.42	−0.046	−0.28
70	18.904	18.019	18.293	0.885	4.68	0.611	3.23
1	22.424	21.528	20.564	0.897	4.00	1.860	8.29
2	26.980	25.997	24.293	0.983	3.64	2.687	9.96
3	35.953	35.309	30.890	0.644	1.79	5.063	14.08
4	47.540	47.558	46.781	−0.018	−0.04	0.759	1.60
5	59.143	58.967	60.792	0.176	0.30	−1.649	−2.79
6	68.885	68.969	69.416	−0.084	−0.12	−0.531	−0.77
7	80.253	81.550	81.092	−1.297	−1.62	−0.839	−1.05

TABLE 8

Housing
Private Consumption

Years	Actual	Predicted		Residuals			
		GAMA	POL	GAMA	%	POL	%
1959	8.635	8.878	8.867	−0.243	−2.81	−0.232	−2.69
60	9.306	9.679	9.579	−0.373	−4.01	−0.273	−2.93
1	10.404	10.748	10.860	−0.344	−3.31	−0.456	−4.38
2	10.926	11.081	10.819	−0.155	−1.42	0.107	0.98
3	12.443	12.595	12.682	−0.152	−1.22	−0.239	−1.92
4	13.250	13.507	13.209	−0.257	−1.94	0.041	0.31
5	15.022	15.251	15.377	−0.229	−1.52	−0.355	−2.36
6	16.474	16.337	15.915	0.137	0.83	0.559	3.39
7	17.441	16.718	17.319	0.723	4.15	0.122	0.70
8	18.992	18.192	19.402	0.800	4.21	−0.410	−2.16
9	20.602	19.717	20.145	0.885	4.30	0.457	10.35
70	21.794	20.760	20.820	1.034	4.74	0.974	4.47
1	23.413	22.463	23.076	0.950	4.06	0.337	1.44
2	25.301	24.417	24.624	0.884	3.49	0.677	2.68
3	29.988	29.285	27.084	0.703	2.34	2.904	9.68
4	34.883	34.621	32.276	0.262	0.75	2.607	7.47
5	37.713	38.325	38.947	−0.612	−1.62	−1.235	−3.27
6	37.670	38.981	38.529	−1.311	−3.48	−0.859	−2.28
7	37.115	38.587	40.376	−1.472	−3.97	−3.261	−8.79

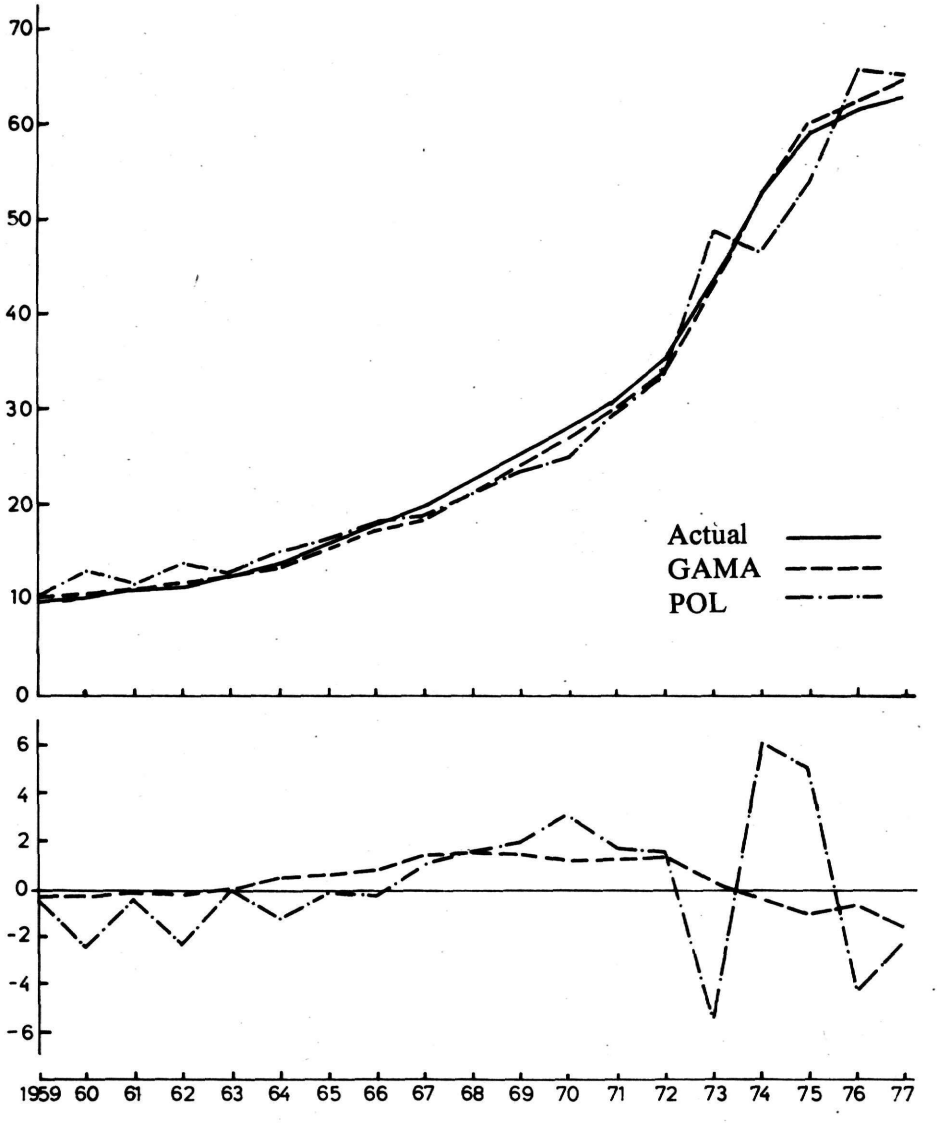
TABLE 9

Services
Private Consumption

Years	Actual	Predicted		Residuals			
		GAMA	POL	GAMA	%	POL	%
1959	19.331	17.913	18.085	1.418	7.34	1.246	6.45
60	20.773	19.518	19.324	1.255	6.04	1.449	6.98
1	23.209	22.177	22.840	1.032	4.45	0.369	1.59
2	24.409	23.356	22.672	1.052	4.31	1.737	7.12
3	27.882	27.201	28.220	0.681	2.44	–0.338	–1.21
4	30.330	29.929	29.900	0.401	1.32	0.430	1.42
5	35.133	35.209	35.863	–0.076	–0.22	–0.730	–2.08
6	39.372	39.471	39.124	–0.099	–0.25	0.248	0.63
7	42.346	42.146	42.152	0.200	0.47	0.194	0.46
8	47.072	47.406	47.451	–0.334	–0.71	–0.379	–0.81
9	52.531	53.294	53.056	–0.763	–1.45	–0.525	–1.00
70	57.809	58.672	58.806	–0.863	–1.49	–0.997	–1.72
1	65.686	66.990	67.774	–1.304	–1.99	–2.088	–3.18
2	76.843	78.346	79.201	–1.503	–1.96	–2.358	–3.07
3	101.759	102.590	101.306	–0.831	–0.82	0.453	0.45
4	137.635	138.345	141.237	–0.710	–0.52	–3.602	–2.62
5	181.274	181.371	181.082	–0.097	–0.05	0.192	0.11
6	231.870	231.790	228.437	0.080	0.03	3.433	1.48
7	307.011	305.761	306.215	1.250	0.41	0.796	0.26

DIAGRAMS

AGRICULTURE
PRIVATE CONSUMPTION



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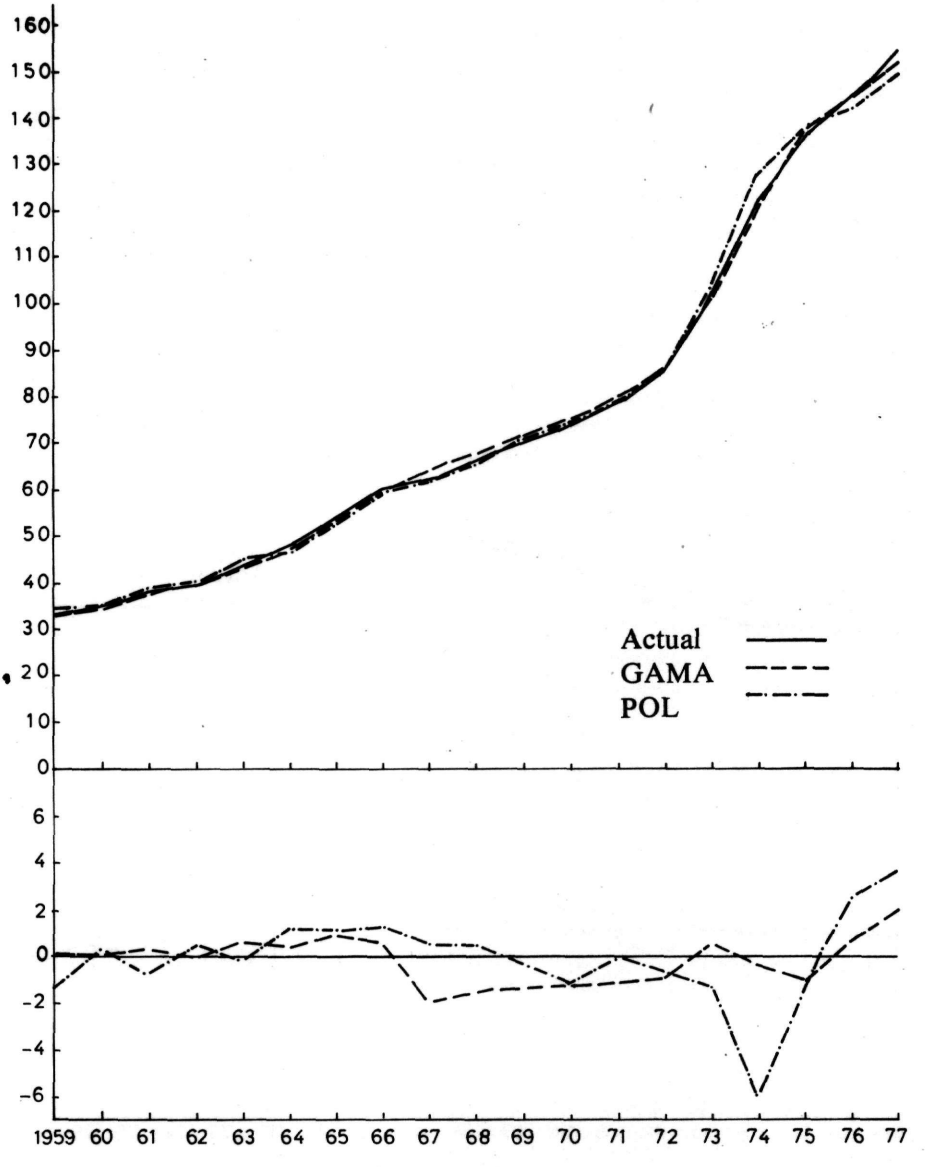
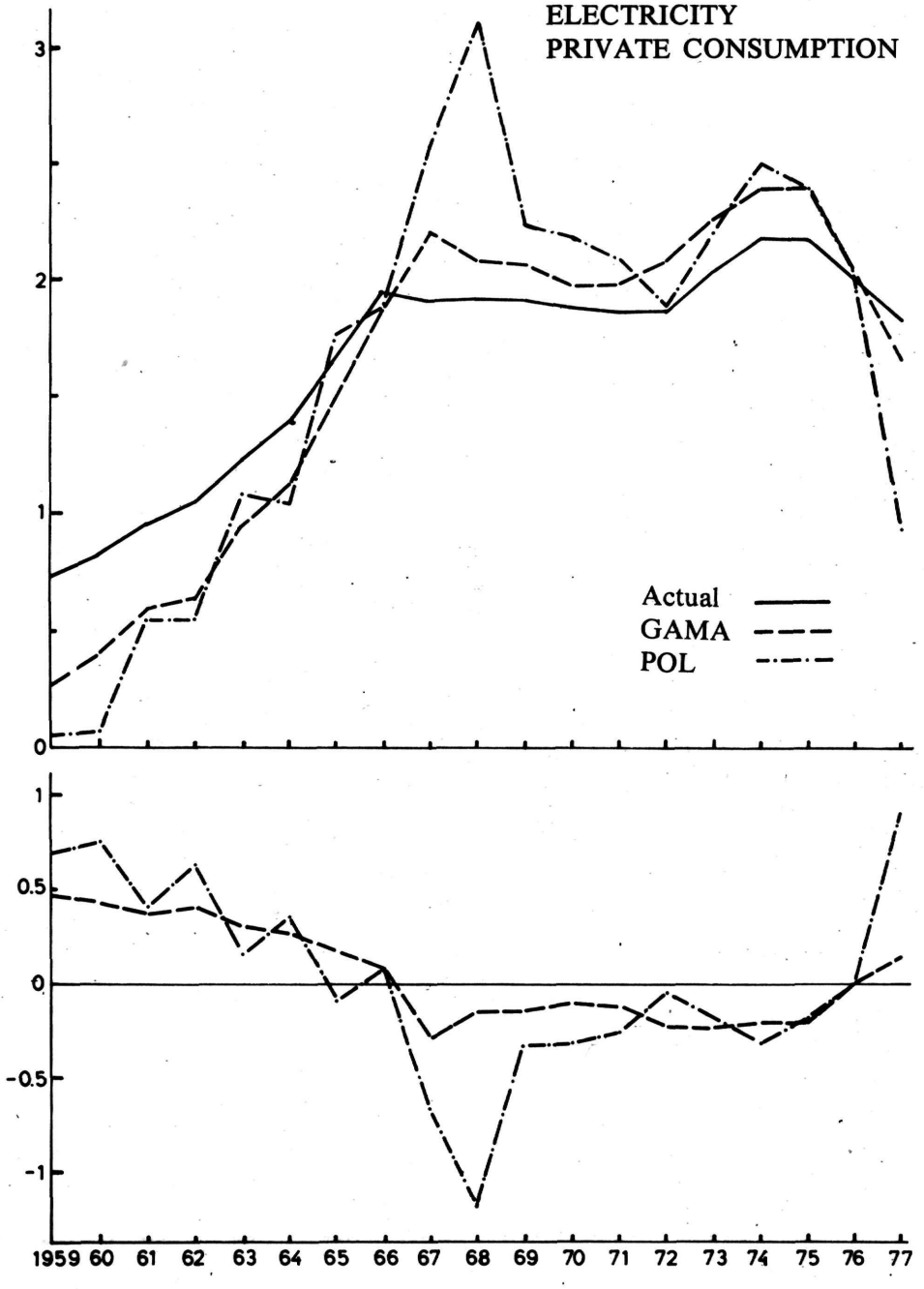
MANUFACTURING
PRIVATE CONSUMPTION




ELECTRICITY
PRIVATE CONSUMPTION
Actual
GAMA
POL
3
2
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1
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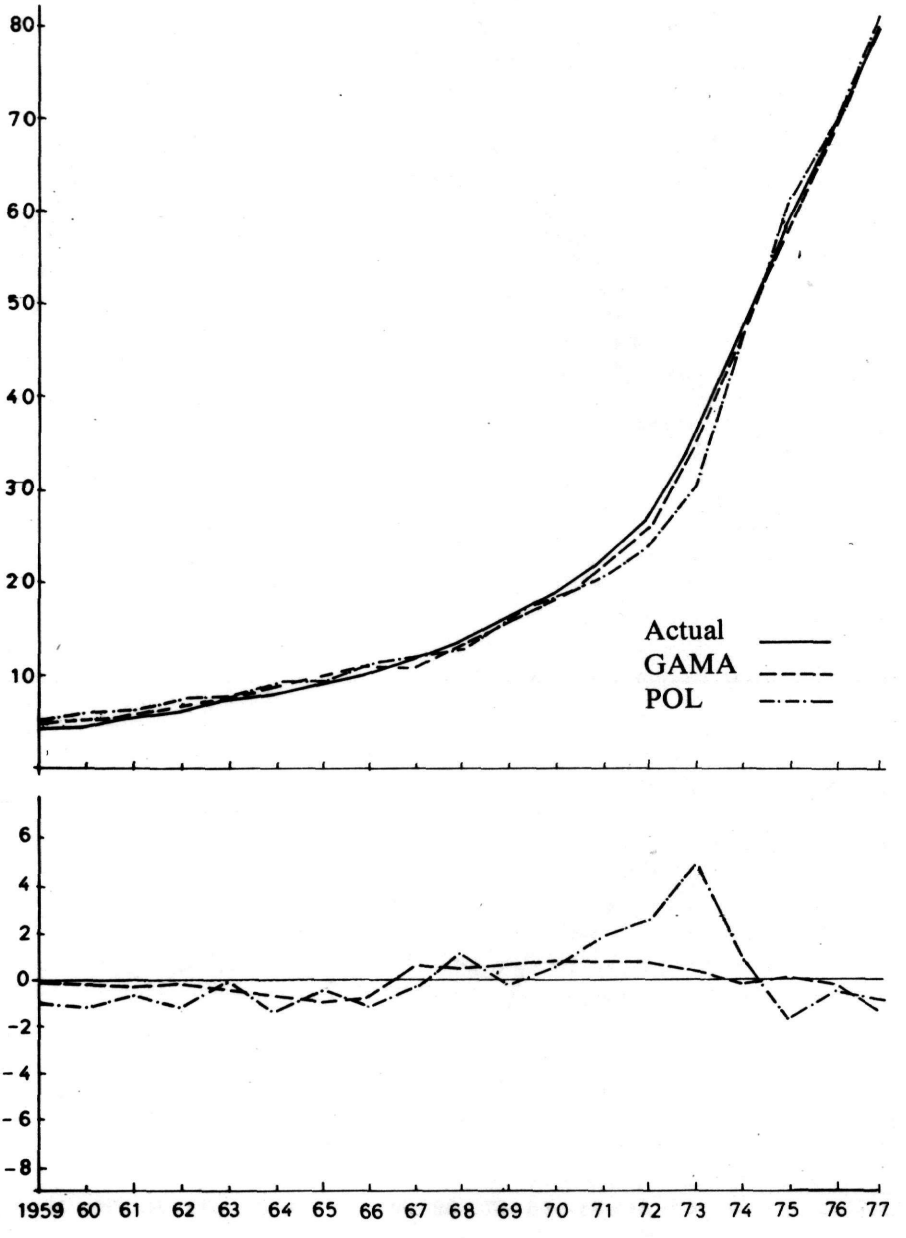
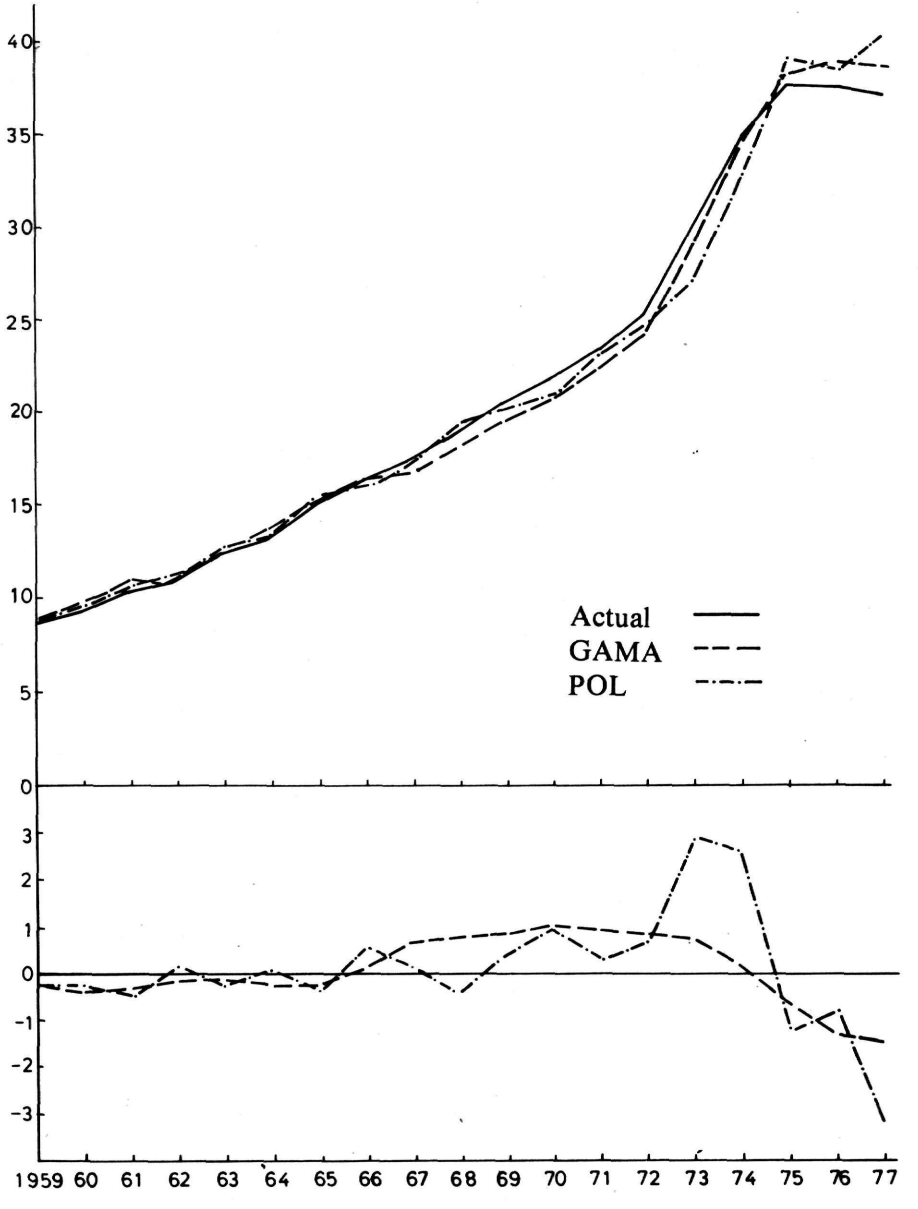
1959 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77

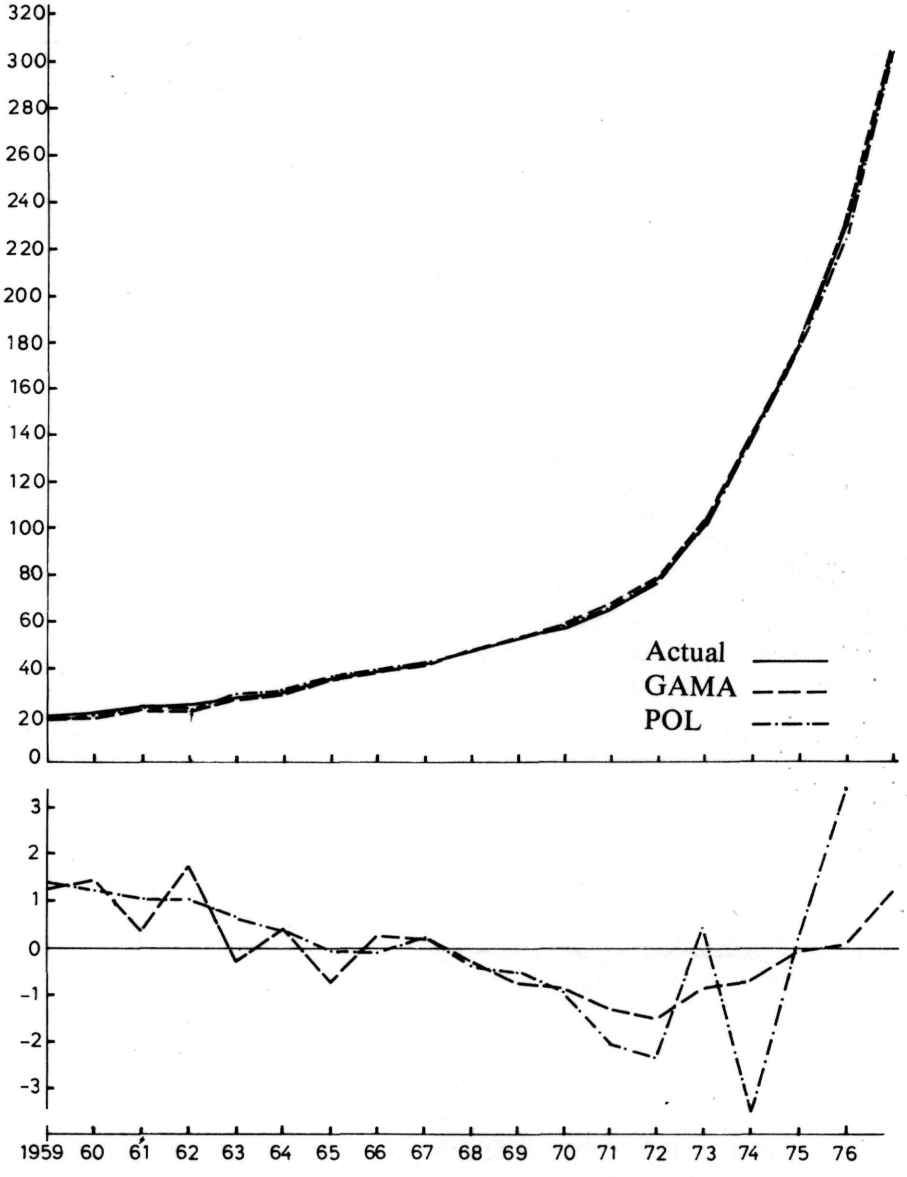
TRANSPORTATION AND COMMUNICATION
PRIVATE CONSUMPTION



HOUSING
PRIVATE CONSUMPTION



SERVICES
PRIVATE CONSUMPTION



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GRAPHIC ARTS
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