Nominal Effects of Fiscal and Monetary Policies in Greece

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I. Introduction

This paper investigates the effects of fiscal and monetary policies on the price level and the exchange rate in Greece. Since 1975, when the drachma effectively entered the flexible exchange rate era, (i) inflation in Greece has been relatively high, and (ii) the Greek currency has almost continuously depreciated. The present study attempts to determine the extent to which these two phenomena are the result of monetary policies (changes in the supply of money) or fiscal policies (changes in the central geovernment's budget deficit).

The methodology used here follows the "atheoretical" approach proposed by *Sims* (1980). Thus, instead of advancing a structural model, we will investigate the qualitative characteristics of the data using the approach of innovation accounting.[1] This method is based on the estimation of a vector autoregression (VAR) reduced-form model and a set of identifying (ordering) restrictions used to derive the orthogonalized structural innovations and the variables' responses to them. Ordering restrictions have generally no explicit economic justification[2] and, therefore, this "atheoretical" approach may not afford structural inference. Its conclusions, however, are useful because in addition to summarizing the properties of the data, they also restrict the set of plausible structural models.

The main empirical findings for the 1975 - 1987 period are as follows: First, monetary innovations are shown to have a more pronounced effect on inflation and the exchange rate than fiscal innovations. This implies that

[1] See *Cooley* and *LeRoy* (1985) for a critical discussion.

[2] Recent research has shown how *Sims*' technique can be modified to take into account identifying restrictions that usually take the form of long-run relationships. Examples include *Shapiro* and *Watson* (1988), *Blanchard* and *Quah* (1989) and *Blanchard* (1989). Modifications such as these consist an improvement in that they replace the "causality orderings" with explicit and defensible restrictions from economic theory.

monetary, rather than fiscal, policies must bear most of the responsibility for the inflation and depreciation of the drachma during this period. On the other hand, however, there is evidence that deficits exert at least a short-run pressure on the money supply, which means that fiscal shocks are not innocuous. Finally, the price level and the exchange rate are found to be closely linked during this period.

II. Empirical Estimation

Four variables are employed in the analysis: the government budget deficit, d, the M1 money supply, m, the CPI price level, p, and the exchange rate, e, defined as the number of drachmas per U.S. dollar. The data consist of quarterly observations obtained from the I.M.F. International Financial Statistics. The period examined is 1975: 1 - 1987: 4, with data before 1975 used as initial conditions in the estimation. All variables are seasonally adjusted and logged.

Before setting up the vector autoregressions (VARs) some preliminary tests are needed to determine the correct number of differencing. Table 1 reports standard *Dickey-Fuller* tests for the first differences of the series. The null hypothesis here is that the first differences are non-stationary (i.e., that they contain a unit root). Both standard and augmented Dickey-Fuller statistics reject the null for d and m. However, for p and e the null is not rejected by the augmented versions of the tests which implies that the rates of inflation and depreciation may contain a unit root.[3] To resolve this conflict between the two types of the Dickey-Fuller statistics for p and e, a stationarity test proposed by *Phillips* and *Perron* (1988) was also implemented. Shown in the last column of Table 1, the Phillips-Perron statistics provide strong evidence that all four series are stationary when differenced once. Since the Phillips-Perron test is valid for a wider class of models, the rates of inflation and depreciation of the drachma were both modelled as stationary.

Next, the series were tested for possible cointegration relationships.[4] With one possible exception, the results reported in Table 2 cannot uncover any

[3] *Dickey-Fuller* tests are known to be sensitive to the choice of p, the number of lags in the estimated equation (*Schwert*, 1987). Another shortcoming of Dickey-Fuller tests is their low power. Stationarity tests were also performed on the log levels of the four series and generally, as one would expect, non-stationarity could not be rejected.

[4] The idea behind cointegration is simple: two or more non-stationary variables are cointegrated if they "move together", in the sense that there exists a linear combination of them which is stationary. More formally, the non-stationary variables $x_1, \ldots, x_N$ are said to be cointegrated if there exists a vector α such that $\alpha'(x_1 \ldots x_N)$ is sta-

such relationships. The only exception may be the money-deficit pair for which cointegration is a possibility. The evidence, however, is very weak (non-cointegration is rejected only at the 10 % significance level for both versions of the *Dickey-Fuller* test) which means that it is safer to specify the model in first differences.[5]

TABLE 1

Stationarity Tests

$$(1-L)^2 x_t = \alpha + \lambda(1-L)x_t + \sum_{i=1}^{p}(1-L)^2 x_{t-i} + u_t$$

x	p	|DF(T)|	DF(F)	p	|ADF(T)|	ADF(F)	PP(t)
d	0	5.03**	12.7**	4	3.32**	5.55*	7.29**
m	0	15.16**	114.9**	4	4.18**	8.76**	30.12**
p	0	8.92**	39.8**	4	1.83	1.69	6.98**
e	0	5.53**	15.27**	4	1.75	1.54	5.91**

TABLE 2

Co-Integration Tests

$$(1-L)\hat{u}_t = \phi\hat{u}_{t-1} + \sum_{i=1}^{p}(1-L)\hat{u}_{t-i} + e_t$$

Variables	|DF|	|ADF|	Variables	|DF|	|ADF|
m,d	3.37#	3.33#	e,m,d	1.67	2.08
p,m	5.07**	2.07	p,m,d	4.35*	3.33
p,d	2.51	2.80	e,m,p	2.40	2.28
e,m	2.02	2.34	e,d,p	1.10	2.21
e,d	1.53	2.08	e,p,m,d	2.69	2.02
e,p	1.00	2.89			

tionary. This linear combination can be interpreted as the long-run, or "equilibrium", error. The cointegrating vector α can be shown to be unique if $N = 2$ (*Granger*, 1986; *Engle* and *Granger*, 1987). Cointegration pre-testing is necessary in order to determine whether the VAR will be specified in levels (if cointegration relationships exist) or differences (if cointegration relationships are absent).

[5] The model was also estimated in levels but the results (not reported here) were clearly inferior to the first difference specification. All results are available upon request.

The results of the unit root and cointegration tests lead to the following specification for the VAR:

$$A(L)\,(1-L)z_t = u_t \qquad (1)$$

where $A(L)$ is a matrix of polynomials in the lag operator L, $z_t = (d_t, m_t, p_t, e_t)'$, and $u_t = (u_{dt}, u_{mt}, u_{pt}, u_{et})'$. To determine the lag length of the VAR two versions of system (1) were initially estimated: an eight-lag version (the unrestricted model) and a four-lag version (the restricted model). Then, a likelihood ratio test was used to test the null hypothesis that the two specifications are statistically equivalent. The ratio statistic which is asymptotically x^2 with 64 degrees of freedom, was equal to 62.83 and thus the null cannot be rejected (the significance level is .518). All the following results are based on the VAR with four lags.

Table 3 contains the decomposition of variance for the four series. The numbers reported indicate the percentage of the forecast error in each variable that can be attributed to (orthogonalized) innovations in the other variables. The ordering used for the *Choleski* factorization is: d, m, p, e. The same ordering was used for the impulse response functions reported later. Experimentation with the present data set showed both the variance decomposition and the impulse response functions to be quite robust to different orderings, or even different methods of factorization (including the method proposed by *Bernanke,* 1986). It might be worth mentioning that even the p, e, d, m ordering gave almost identical results.

The main results from the decompositions of variance can be summarized as follows: (i) all series have a high degree of "persistence", and p has the greatest: even after 5 years, 79 % of the variability of inflation is explained by its own innovations; (ii) money supply is responsible for inflation more than the deficit or the exchange rate at all horizons; (iii) the exchange rate is expecially sensitive to the price level; (iv) money is affected by the deficit and the exchange rate; and (v) neither the price level nor the exchange rate are strongly driven by the deficit at all horizons.

An alternative way to present the relationships implied by the estimated VAR is through the impulse response functions. These functions trace the responses of each of the four variables to orthogonal innovations in the other variables. The twenty-period impulse responses for inflation, the rate of depreciation of the drachma, and the rates of growth of the money supply and the budget deficit are given in Graphs 1 to 4, respectively. Note that these are the responses of the growth rates of the variables. To obtain the responses of the log levels one would have to think in terms of the cumulative responses.

TABLE 3

Decompositions of Variance

Fraction of Deficit explained by shock to				
Quarter	Deficit	Money	CPI	Exchange
1	100.0	.0	.0	.0
4	72.9	7.8	8.6	10.7
8	65.0	9.8	9.2	16.0
12	61.8	11.5	9.5	17.2
16	62.0	11.3	9.8	16.9
20	61.3	11.3	10.2	17.2

Fraction of Money explained by shock to				
Quarter	Deficit	Money	CPI	Exchange
1	3.5	96.5	.0	.0
4	14.9	70.1	1.2	13.1
8	16.9	62.3	3.5	17.2
12	17.6	58.5	5.3	18.6
16	18.0	57.7	5.2	19.1
20	18.2	57.4	5.3	19.0

Fraction of CPI explained by shock to				
Quarter	Deficit	Money	CPI	Exchange
1	.4	.7	98.8	.0
4	.6	3.4	95.8	.2
8	.4	14.5	82.7	2.4
12	.4	14.2	80.3	5.1
16	.5	14.0	80.0	5.5
20	.6	13.9	78.8	6.8

Fraction of Exchange explained by shock to				
Quarter	Deficit	Money	CPI	Exchange
1	.4	.4	8.5	90.7
4	2.9	.3	11.2	85.6
8	2.2	.3	19.4	78.1
12	1.7	1.4	35.6	61.3
16	1.6	4.7	42.7	50.9
20	1.6	5.9	43.7	48.8

The responses of p and e are shown in Graphs 1 and 2. A monetary innovation has a definite inflationary effect that peaks five quarters later and gradually declines thereafter. (Thinking in terms of the cumulative response, the log level of p will be increasing until it stabilizes at a higher level.) Fiscal innovations, although clearly exerting upward pressure on inflation have a much less pronounced effect. Finally, a positive shock to e (a depreciation) has inflationary effects that reach a maximum about two years after the innovation. All these results are qualitatively in agreement with economic theory.

The exchange rate response to a positive innovation in the deficit is also consistent with economic theory. As the standard *Mundell-Fleming* model predicts[6] in the short-run (about six quarters here) the exchange rate is lowered, which means that the drachma appreciates. After that, e is mildly pressured upward, a fact consistent with the development of unfavorable expectations. All this confirms the cycle of "exchange-rate crowding-out" and "expectational crowding-out" as described in the last OECD (1990) survey for Greece.[7] As expected, positive monetary innovations lead to a depreciation of the drachma (although it is puzzling that it takes almost a year for e to rise). Finally, positive price innovations are associated with substantial depreciation.

Graphs 3 and 4 show the responses of m and d. In the short-run (4 to 5 quarters) the rate of growth of money responds positively to a shock in the deficit. This finding means that, at least to some extent, the deficit is monetized. Once more, one has to agree with the OECD (1990) report that there is "evidence of a growing conflict between monetary and budgetary policies" and that "rising public sector borrowing requirements have rendered monetary management increasingly difficult".[8] Positive innovations in p and e are followed by a monetary contraction in the short-run, and the monetary response seems to be stronger when defending the drachma. Finally, no definite pattern emerges for the responses of d.

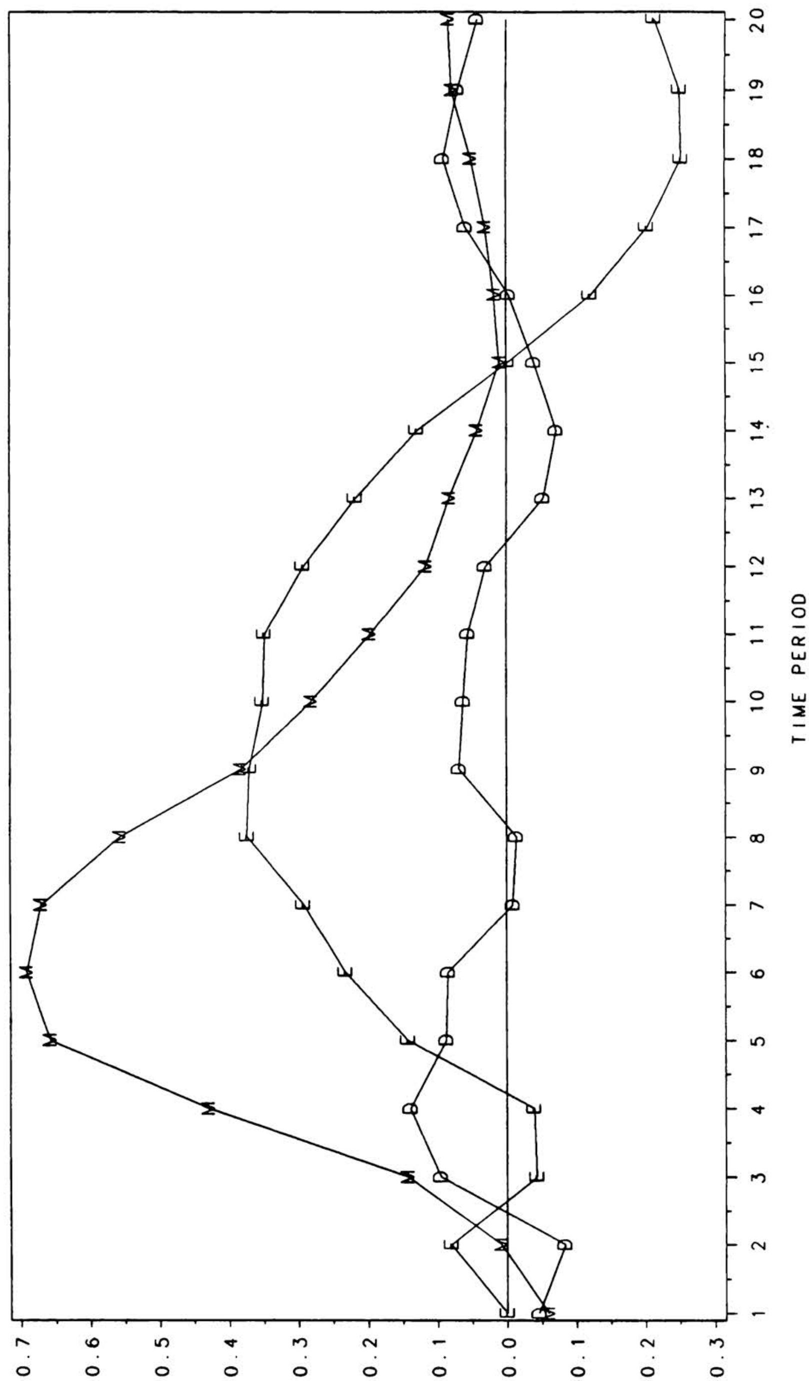
[6] See *Mundell* (1968), and for a more recent exposition *Frenkel* and *Razin* (1987).

[7] *OECD* (1990) pp. 39 - 40.

[8] *OECD* (1990) p. 83.

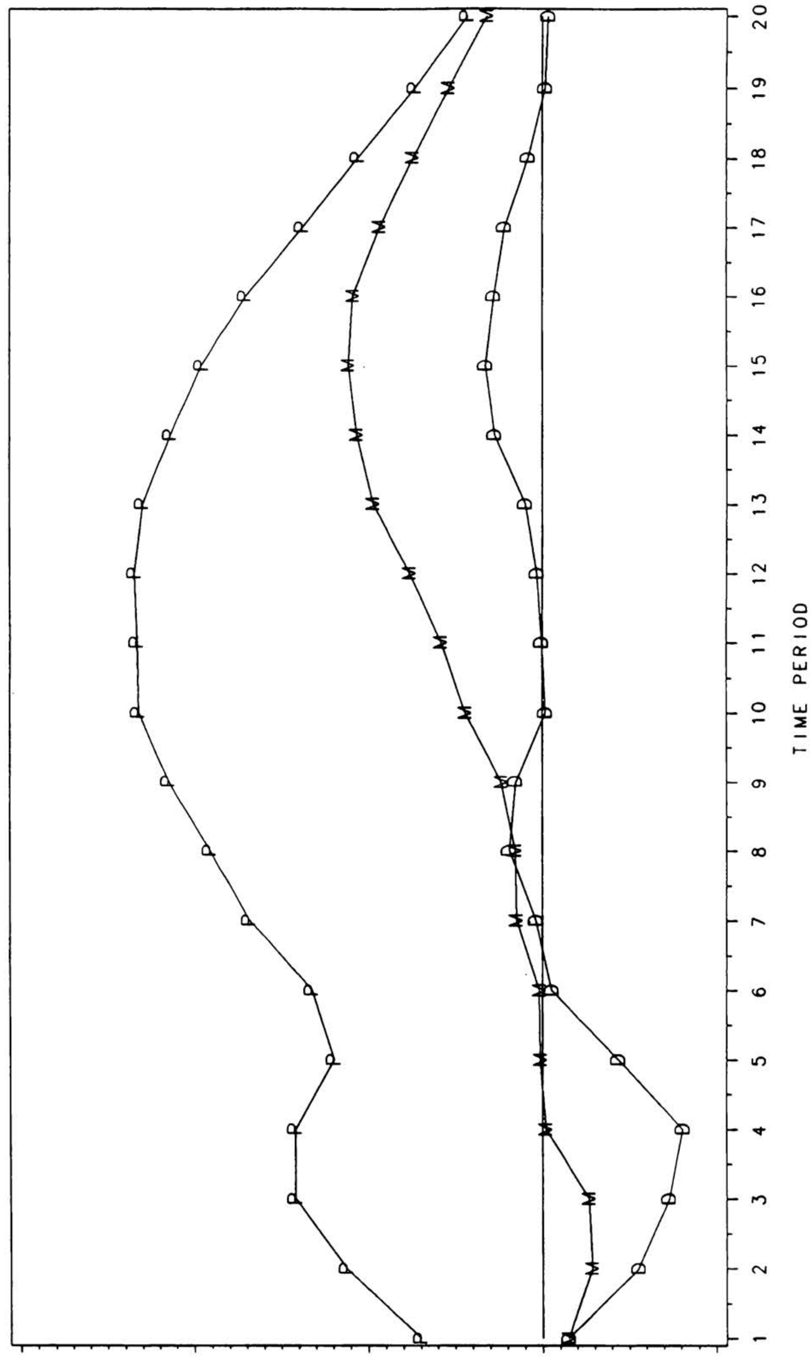
GRAPH 1

Responses of the CPI growth rate



GRAPH 2

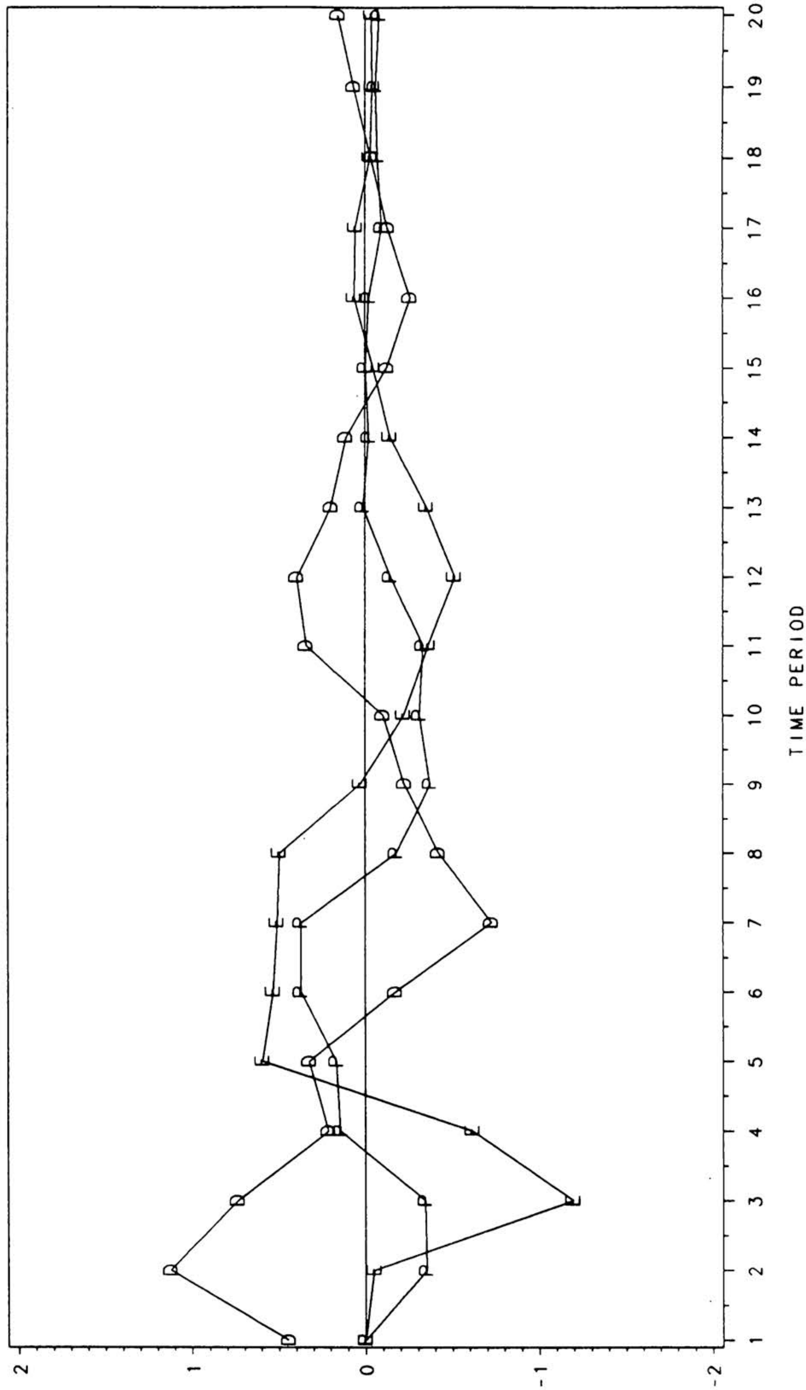
Responses of the Exchange growth rate



Responses to a shock in the growth rates of:
Money (M), Deficit (D), CPI (P)

GRAPH 3

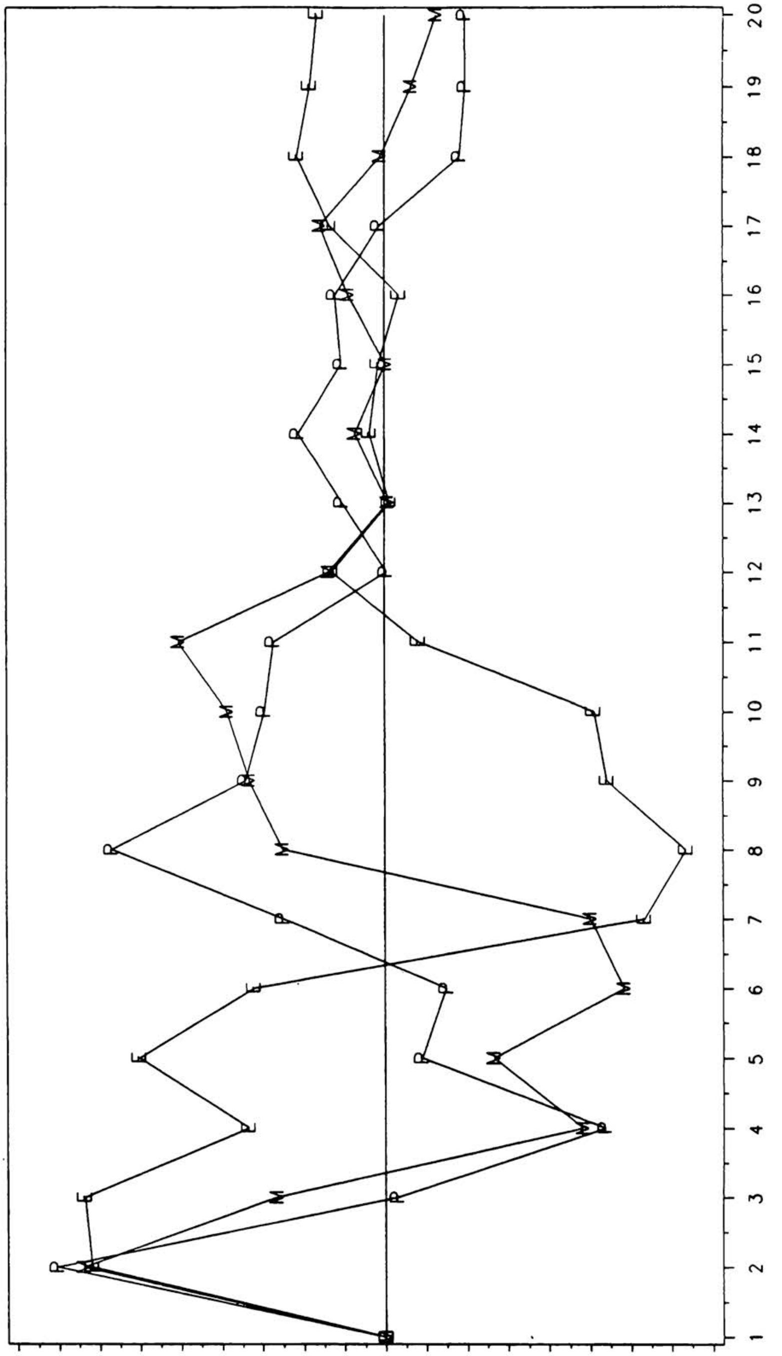
Responses of the Money growth rate



Responses to a shock in the growth rates of:
Deficit (D), CPI (P), Exchange (E)

GRAPH 4

Responses of the Deficit growth rate



Responses to a shock in the growth rates of:
Money (M), CPI (P), Exchange (E)

III. Conclusion

This paper investigated the effects of monetary and fiscal policies on the price level and the exchange rate in Greece during the 1975 - 1987 period. The main question of the study was: What have been the relative contributions of the budget deficit and the money supply to this period's high inflation and depreciation of the Greek currency? The answer can be put in a nutshell: monetary policies bear a greater responsibility than fiscal policies for both the inflation rate and the drachma depreciation during the 1975 - 1987 period.

Specifically, monetary expansions were shown to have a very pronounced effect on inflation and to lead to a depreciation of the drachma. Budget deficits have milder inflationary effects and were found to appreciate the currency but only in the short-run. Fiscal expansions also exert pressure on the money supply. All this would argue in favor of greater independence for the Bank of Greece, the Greek central bank. Finally, to the extent that it will impose a higher degree of monetary discipline, participation in the European Monetary System should be expected to have beneficial effects on inflation and the exchange rate.

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Summary

Nominal Effects of Fiscal and Monetary Policies in Greece

This paper investigates the effects of fiscal and monetary policies on the price level and the exchange rate in Greece. Expansionary monetary policies are found to be significantly responsible for inflation and the depreciation of the drachma. Budget deficits have milder inflationary effects and, in the short-run, appreciate the currency. Fiscal expansions are also followed by increases in the money growth, a finding that shows a conflict between monetary and fiscal policies and argues in favor of more independence for the central bank.

Zusammenfassung

Nominale Effekte der griechischen Fiskal- und Geldpolitik

In diesem Beitrag werden die Effekte der Fiskal- und Geldpolitik auf das Preisniveau und auf die Wechselkurse in Griechenland untersucht. Es erweist sich, daß eine expansive Geldpolitik in starkem Maße für die Inflation und Abwertung der Drachme verantwortlich ist. Die Auswirkungen von Haushaltsdefiziten sind weniger ausgeprägt und tendieren kurzfristig zu einer Aufwertung der Währung. Auf eine expansive Fiskalpolitik folgen auch Geldmengenzuwächse; diese Feststellung weist auf einen Konflikt zwischen Geld- und Fiskalpolitik hin und spricht für eine größere Unabhängigkeit der Zentralbank.

Résumé

Effets nominaux des politiques fiscale et monétaire en Grèce

Cet article examine les effets des politiques fiscale et monétaire sur le niveau des prix et sur les cours du change en Grèce. On a constaté que des politiques monétaires expansionistes sont responsables d'une manière significative de l'inflation et de la dépréciation de la drachme. Des déficits budgétaires ont des effets inflationnistes moindres et évaluent, à court terme, la monnaie. Des expansions fiscales entraînent également des augmentation de la croissance monétaire. Cette constatation traduit un conflit entre les politiques monétaire et fiscale et plaide en faveur d'une plus grande indépendance de la banque centrale.