Inflationary Expectations and the Demand for Money: The Greek Experience

A Comment and Some Different Results

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In a recent article in this Journal *Brissimis* and *Leventakis* (1981) – from now on B-L – examine whether the interest rate or inflationary expectations are more important in the Greek demand-for-money function. Their results indicate "that the market for $M1$ is segmented from the markets for either financial or real assets" (p. 568) while for $M2$ "substitution was evidenced between savings and time deposits and between saving deposits and real assets, the elasticity of substitution being higher in the former case" (p. 511).

The purpose of this comment ist twofold: First, to reveal a serious theoretical error that B-L have committed regarding the implementation of the "rational expectations approach", and second to show that a careful specification of the demand-for-money function produces results for the narrow demand for money strikingly different than those obtained by B-L and mentioned above[1].

I.

According to B-L, "rational expectations are essentially the same as the predictions of the relevant economic theory . . . [and, therefore, one] . . . would assume that the actual rate of inflation is a valid approximation to the expected rate" (p. 563). B-L, however, fail to realize the statistical properties of such a specification, given the underlying theory. According to *Muth*'s theory, rational expectations are formed so that

$$\dot{P}_t^e \equiv E\,(\dot{P}_t/\Omega_t) \tag{1}$$

[1] This note is restricted to the results for $M1$ for which data are available to us. We were unable to obtain the savings deposits series for the whole period.

where E, the expected value operator, refers to the actual distribution of the random variable $\dot{P}_t$ given the available information set Ω_t. Put differently, the realized distribution is

$$(2) \qquad \dot{P}_t = E\,(\dot{P}_t/\Omega_t) + \varepsilon_t$$

and by the rationality assumption the error term should be white noise and uncorrelated with any of the variables appearing in the information set Ω_t. Equations (1) and (2) permit us to write

$$(3) \qquad \dot{P}^e_t = \dot{P} - \dot{\varepsilon}_t$$

Substituting (3) in B-L's equation (5), where an error term (η_t) has been added, we get

$$(4) \qquad M_t = a_0 + a_1 Y_t + a_2\,(\dot{P}_t - \varepsilon_t) + a_3 P_t + \eta_t$$

or

$$(5) \qquad M_t = a_0 + a_1 Y_t + a_2 \dot{P}_t + a_3 + \varepsilon_t$$

where

$$e_t \;= \eta_t - a_2 \varepsilon_t \,.$$

It is easily verified that the error term e_t is not independent of $\dot{P}_t$ and, accordingly, straightforward application of OLS yields estimates that are biased and inconsistent. It seems that B-L confuse rational expectations with perfect foresight. Under perfect foresight, the classical assumptions about the error term would be satisfied and estimators are BLUE. One can employ this assumption and, at least, maintain theoretical consistency. But if B-L want to maintain the assumption of rational expectations, their approach is seriously flawed. If only were the implementation of the concept of "rational expectations" so easy.

The treatment of expectations is a thorny and still very debatable problem. Whether expectations are "fully rational", "rational" or "weakly rational" is still a moot point. Despite the theoretical appeal of the rational expectations literature, "weakly rational" (extrapolative) expectation-patterns are still widely used given the, sometimes, insuperable problems encountered in trying to implement the full information concepts. A relatively easy way to construct a "rational" expectations variable (*McCallum*, 1976), in the absence of a fully specified macroeconomic model, yields results that critically depend on the instruments chosen. In this note we have made use of two proxies for the expected rate of inflation. The actual inflation rate (used under the assumption of static expectations, by setting $\mu = 1$ in B-L's equation [7]) and a "weakly rational" or purely extrapolative predictor $\dot{P}^*_t \equiv E(\dot{P}_t / \dot{P}_{t-1}, \dot{P}_{t-2}, \ldots)$. The results did not differ in any statistical sense and only those with the actual inflation rate are reported.

II.

To ensure comparability of B-L's results to ours we tried to replicate their equations (2) and (4) presented in their Table 1[2]. Our results, together with theirs, are shown below in Table I. The replication of equation (2) is quite successful; the very small difference may be due to the use of a different price index. The GNP deflator was unavailable to us and the GDP deflator was used in its place. The replication of equation (4), however, was almost impossible. As can be seen in Table I, our results differ from those obtained by B-L. Our interest, however, lies in the implications of equation (2), and, for that purpose, our results can be safely considered comparable.

The policy implications that one can draw from equation (2) are unconventional and, if valid, very significant. These results, for example, imply that the Greek banking system cannot attract or mobilize funds through interest rate variations. Further, the particular interest rate policy (administered or market determined interest rates) that the Bank of Greece should follow would seem to be immaterial under such circumstances. We find these implications rather unsettling on two counts. Theoretically, in a relatively monetized economy agents should be sensitive to the opportunity cost of money, however defined. Empirically, econometric and noneconometric evidence from the Greek economy indicates that money demand has responsed positively and significantly to changes in interest rates[3]. It is important, therefore, to establish whether B-L's results are due to some data peculiarities or they indeed represent the structure of the Greek money market. Two relevant checking diagnostics for identifying data problems are the plotting of the raw and transformed data and the examination of the regression residuals. Plotting the data reveals a positive

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[2] The definitions and source of the data are given in the Appendix. All data used, however, are available from the author on request.

[3] See, e.g. *Papadakis* (1979), *Himarios* (1982) and *Zolotas* (1965).

Table I

OLS Estimates of the Demand for $M1$ Function 1955 - 1978*

	Dependent Variable: ln $M1$								
	C	$\ln Y_t$	$\ln P_t$	$\ln RS_t$	$\ln (P_t/P_{t-1})$	$\ln M1_{t-1}$	$\bar{R}^2$	$D-h$	$\hat{\sigma}$
(B-L)	−1.32	0.41	0.39	−0.10		0.67	0.9986	0.20	
	(1.29)	(2.49)	(3.28)	(1.74)		(6.05)			
	−0.66	0.43	0.38	−0.10		0.67	0.9984	0.43	0.038
	(2.46)	(2.17)	(2.70)	(1.82)		(4.84)			
(B-L)	0.001	0.08	0.07		0.71	0.91	0.9989	0.05	
	(0.001)	(0.54)	(0.90)		(2.95)	(10.38)			
	−0.146	0.18	0.11		0.28	0.87	0.9985	0.20	0.041
	(0.61)	(0.98)	(1.23)		(1.06)	(7.95)			

* $D-h$ is the absolute value of *Durbin*'s h-statistic for the detection of autocorrelation in the presence of a lagged dependent variable. $\hat{\sigma}$ is the estimated standard error of the regression. The numbers in parentheses under the estimated coefficients are absolute values of t-statistics.

"blip" in the money supply ($M1$) for 1967. Examining the residuals of the OLS regression reveals the existence of a positive "outlier" (at least twice its standard error) for the same year. The source of such an "influential data point" can easily be traced to the coup-d'état that took place in early 1967. The uncertainty created by this event led to an increase in the narrowly defined demand for money. Correcting for such a temporary shift produces the following equation:

$$\text{(3)}\quad \ln \hat{M}1 = \underset{(3.220)}{-0.830} + \underset{(2.187)}{0.083}\, DUM + \underset{(2.850)}{0.536} \ln P_t - \underset{(3.461)}{0.464} \ln P_t - \underset{(2.325)}{0.126} \ln RS_t + \underset{(4.520)}{0.591} \ln M1_{t-1}$$

$$\bar{R}^2 = 0.9987 \qquad \hat{\sigma} = 0.035 \qquad D - h = 1.26$$

The interest rate is now significant at the 5 % confidence level and the speed of adjustment has increased to a more reasonable level. The robustness of the relationship between the interest rate and $M1$ can be further established by considering two alternative and theoretically preferable specifications of the money demand function. Given that the nominal demand for money was found to be homogeneous of degree one in prices one should proceed to estimate the money demand function in real terms (*Chow*, 1966). *Jacobs* (1974), however, has recently argued that there is no justification for estimating a money demand function either in nominal or real terms and that a real per capita formulation seems theoretically preferable. Table II below presents the results for both real and real per capita data. All three specifications give consistent results, with the interest rate becoming highly significant when the data are expressed in real or real per capita terms. Further, the speed of adjustment has increased, with approximately 45 percent of the disequilibrium removed within a year. This constitutes roughly a 30 percent increase as compared to that implied by equation (2) (Table 1) of B-L.

The results presented above allow us to overwhelmingly reject the null hypothesis of no relationship between the demand for money and the interest rate for the period under consideration. Greece, therefore, is not different from other economies for which "all studies of the demand function for narrow money ... find some role for at least one opportunity cost variable" (p. 568).

Having established that the return on financial assets (in the Greek case, mainly bank deposits) is an important explanatory variable of the demand for $M1$, the question remains whether real assets are directly substitutable

Table II

OLS Estimates for the Demand for *M1* Function 1955 - 1978

Dependent Variable	C	DUM*	$\ln(\mathrm{GNP}/P_t)$	$\ln(\mathrm{GNP}/NP)_t$	$\ln RS_t$	$\ln(M1/P)_{t-1}$	$\ln(M1/NP)_{t-1}$	$\bar{R}^2$	$\hat{\sigma}$	$D-h$
$\ln(M1/P)_t$	−0.662 (2.24)	0.091 (2.676)	0.575 (3.724)		−0.155 (4.242)	0.555 (5.152)		0.997	0.0322	0.07
$\ln(M1/NP)_t$	−0.346 (2.683)	0.086 (2.522)		0.559 (3.473)	−0.153 (4.219)		0.575 (5.275)	0.997	0.0322	0.00

* *DUM* is a dummy variable for the constant taking the value 1 for 1967 and 0 elsewhere.

with $M1$ as well. A priori, one could argue that in periods of low or moderate inflation transaction balances are not expected to be sensitive to the inflation rate[4]. In a consistently inflationary environment, however, coupled with interest rates that do not follow the market rate of return incentives are generated to economize on transaction balances. Until 1972 Greece had a low or at least moderate inflation rate. The year 1973 marked the beginning of a highly inflationary period which has persisted to date. B-L find no evidence that the inflation rate affected the demand for $M1$ either in the non-inflationary or the inflationary period (p. 566). We tried to address this problem by using the more appropriate form of the real per capita specification and by replacing the GPD deflator by the CPI. Whatever the theoretical reasons for deflating nominal variables by a broad index (GNP or GDP), when one comes to inflationary expectations the CPI seems to be the appropriate choice. This is particularly true for Greece where the CPI remains the most widely (if not the only) publicized and understood price index. Table III presents the results for the two periods 1955 - 1972 and 1955 - 1978[5].

In equation (1) we have followed B-L in treating the expected inflation rate as an alternative to the interest rate opportunity cost. The inflation rate is insignificant for this period although the autocorrelation present in the residuals introduced by the omission of the interest rate does not allow firm conclusions[6]. As a result of autocorrelation the adjustment speed is also very slow. The introduction of the interest rate in equation (2) removes the autocorrelation and it also doubles the speed of adjustment. The inflation rate is, however, insignificant. Equation (3) extends the sample to include the inflationary period 1973 - 1978. This equation is again plagued by autocorrelation, although less serious than that of equation (1), but the inflation rate has now become significant. The existence of autocorrelation again prevents us from deriving any firm conclusions about confidence intervals, but we have the first evidence indicating that the inflation rate is probably significant. When the interest rate is again introduced in equation (4), autocorrelation no longer exists but the inflation rate becomes insignificant. This is probably the result of the common trend in both the inflation rate and the interest rate. One way to attack this problem is to make the data

[4] For a more extensive discussion, see *Himarios* (1982).

[5] These equations were also run with the GDP and the real-terms specification. The main conclusions implied by the use of the CPI remain essentially valid.

[6] When the *Durbin-Watson* statistic implies the existence of autocorrelation, it is still appropriate to use it in models with lagged dependent variables. Its bias consists in not detecting autocorrelation when in fact it exists. Notice also the very low speed of adjustment which is the result of serial correlation, as *Griliches* (1967) has shown.

Table III
OLS Estimates for Demand for $M1$
(Real per capita variables)

Period 1955 - 1972	C	DUM	$\ln Y_t$	$\ln (P_t/P_{t-1})$	$\ln RS_t$	$\ln M1_{t-1}$	$\bar{R}^2$	D.W.	$\hat{\sigma}$
1	−0.166	0.062	0.248	−0.599		0.825	0.9935	1.4607	0.0472
	(0.864)	(1.227)	(1.085)	(0.571)		(5.871)			
2	−0.465	0.098	0.770	−0.469	−0.231	0.416	0.9966	0.14*	0.0354
	(2.712)	(2.480)	(3.261)	(0.595)	(3.212)	(2.521)			
Period 1955 - 1978									
3	−0.140	0.063	0.199	−0.482		0.850	0.9960	1.593	0.0395
	(0.978)	(1.485)	(1.363)	(2.409)		(8.954)			
4	−0.363	0.090	0.582	−0.088	−0.168	0.553	0.9974	0.20*	0.0330
	(2.568)	(2.464)	(3.269)	(0.345)	(2.958)	(4.329)			

* *Durbin*'s h-statistic (absolute values).

stationary by first-differencing them. Since equations (2) and (4) are free from autocorrelation, however, first differencing may introduce serial correlation. Table IV presents the results for the first differences in the logarithms of the variables. In equation (1) the significancy of the inflation rate has been raised to the point that one cannot ignore the variable, although the size of the coefficient is small. The next question is whether this inflation coefficient applies to the whole period or ideed it is only the inflationary period that matters. In equation (2) we have introduced an interactive dummy variable for 1973 - 1978. It is clear that the results derived in Table III are validated. Inflation did not affect the demand for $M1$ in the pre-1973 period but it did so for the post-1972 period. Equation (2) indicates that the interactive dummy variable introduces multicollinearity again and, indeed, when the interest rate is dropped in equation (3), the inflation rate coefficient for the 1973 - 78 period becomes highly significant. Unfortunately, the problem of multicollinearity is very hard to overcome given the data constraints. Although the coefficient for the inflation rate cannot be precisely estimated, it can, however, be concluded with a high degree of confidence that it does enter the demand for money function for the period 1973 - 1978.

III.

The following conclusions can thus be drawn when all the results presented are taken together.

1. The interest rate has been an important explanatory variable in the demand for $M1$ for the whole period under consideration, as one would theoretically predict.
2. The inflation rate is not significant in explaining the demand for $M1$ prior to 1973. The consistenty high inflationary pressures of the post-1972 period, however, have generated strong incentives to economize on transaction balances to the extent that inflation can safely be considered as an additional explanatory variable for the post-1972 period.
3. This same fact may help explain the reduction in the interest rate coefficient evident in the post-1972 period. The negative real interest rates may have reduced the attractiveness of bank deposits.

These conclusions are strikingly different from those derived by B-L concerning the demand for $M1$ and have different policy implications. A persistence in a policy of administered interest rates, for example, that are set below market rates could have severe consequences for a system that still relies

Table IV

Estimates for the Demand for $M1$[1]

(Real per capital log differenced variables)

Period 1956-1978	C	DUM[2]	$\ln(Y_t/Y_{t-1}$	$\ln(RS_t/RS_{t-1}$	$\ln(\dot{P}_t/\dot{P}_{t-1})$	$\ln(\dot{P}_t/\dot{P}_{t-1})xD$[3]	$\ln(M1/M1_{t-1})$	$\bar{R}^2$	$D-h$	$\hat{\sigma}$	$\hat{\varrho}$
1	0.018	−0.049	0.493	−0.090	−0.006		0.467	0.637	0.05	0.033	−0.406
	(1.221)	(2.209)	(2.067)	(1.975)	(1.722)		(3.541)				(2.038)
2	0.016	−0.061	0.436	−0.012	−0.003	−0.030	0.589	0.705	0.20	0.031	−0.375
	(1.152)	(2.765)	(1.926)	(0.207)	(0.883)	(1.802)	(4.108)				(1.856)
3	0.016	−0.062	0.437		−0.003	−0.032	0.601	0.704	0.21	0.030	−0.367
	(1.183)	(2.963)	(1.994)		(0.879)	(2.805)	(4.917)				(1.805)

[1] All equations have been corrected for autocorrelation using the *Hildreth-Lu* technique.

[2] *DUM* is a dummy variable for the constant for 1967 - 1968 and 1968 - 1969.

[3] D is an interactive dummy variable taking the value 0 for 1956 - 1972 and 1 for 1973 - 1978.

heavily on fund mobilization through the banking system in order to finance its investment spending.

Appendix

GNP = Gross National Product, IFS (International Financial Statistics, IMF) (line 99 a).

P = GDP deflator, IFS (line 99 b/line 99 b.p).

N = Population, IFS (line 99 z).

$M1$ = Narrow definition of money, IFS (line 32).

RS = Interest rate on savings deposits with banks (period weighted average) from *Monthly Statistical Bulletin,* Bank of Greece, (various issues). The end-of-period interest rate was also used but the results were identical.

$\dot{P}_t = \log (P_t / P_{t-1})$

References

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Zusammenfassung

Inflationäre Erwartungen und die Geldnachfrage: Die griechische Erfahrung – Ein Kommentar und einige abweichende Resultate

Dieses Papier befaßt sich mit zwei Aspekten des Beitrages von *Brissimis* und *Leventakis* (1981). Zum einen kritisieren wir, daß den Autoren ein schwerwiegender theoretischer Irrtum unterlaufen ist, indem sie unwissentlich rationale Erwartungen mit vollständiger Vorausschau gleichsetzen. Wir zeigen, daß unter ihren Annahmen die Resultate statistisch unzuverlässig und widerspruchsvoll sind. Zum anderen überprüfen wir aufs neue ihre Schlußfolgerung, daß „der Markt für die Geldmenge $M\,1$ sowohl von den Geld- als auch von den Sachvermögensmärkten segmentiert ist". Eine sorgfältige Überprüfung der Daten sowie eine richtig spezifizierte Gleichung der Geldnachfrage stützt die genau gegenteilige Hypothese mit einem hohen Wahrscheinlichkeitsgrad.

Summary

Inflationary Expectations and the Demand for Money: The Greek Experience A Comment and Some Different Results

This note addresses two points in the *Brissimies* and *Leventakis* (1981) paper. First, we argue that the authors have committed a serious theoretical error in, unknowingly, identifying rational expectations with perfect foresight. We show that, under their assumptions, their results are biased and inconsistent. Second, we reexamine their conclusion that "the market for $M1$ is segmented from the markets for either financial or real assets". A careful examination of the data and a correctly specified money demand equation support the exactly opposite hypothesis with a high degree of confidence.

Résumé

Anticipations inflationnistes et demande monétaire: L'expérience grecque – Un commentaire et quelques résultats différents

Ce papier s'intéresse à deux aspects de l'article de *Brissimis* et *Leventakis* (1981). Nous critiquons d'abord le fait que les auteurs ont commis une erreur théorique de dimension en assimilant par ignorance des anticipations rationelles à des prévisions complètes. Nous démontrons que dans leurs hypothèses, les résultats sont statistiquement incertains et contradictoires. Ensuite, nous réétudions leur conclusion prétendant que « le marché de la masse monétaire $M\,1$ est segmenté tant par les marchés des avoirs financiers que par ceux des patrimoines réels ». Un examen minutieux des données ainsi qu'une équation correctement spécifiée de la demande monétaire appuie l'hypothèse exactement inverse avec un très haut degré de probabilité.