"PRICE CHANGES AND THE RATE OF CHANGE OF MONEY WAGE RATES IN GREECE, 1954-1978: A TEST OF THE EXPECTATION HYPOTHESIS"

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ABSTRACT

This study, in spite of the various disadvantages, seeks to establish the arguments which determine the money wage-rate and price equations during the period 1954-1978 through a variety of statistical methods. Also, this paper tests various expectation hypotheses included in the basic money wage-rate equation. One conclusion is the rejection of the stringent version of the expectation hypothesis that in the long run the price expectations should be fully anticipated in actual wage changes and mutually the acceptance of the looser version of the neoclassical hypothesis. Another conclusion, is that the Phillips-Lipsey hypothesis is applicable to the Greek data, and on the other hand, that the pricing system adopted by the Greek enterprises takes place according to the mark-up over prime (main) costs principle.

I. Introduction

The objective of this paper is to shed light on the Greek money wage and price determination process in non-agricultural industries (manufacturing and services industries) using annual observations over the sample period 1954-1978. Recent literature has been rich in empirical work directed at improving and replicating the original Phillips curve relationship.[1]

Phillips in his pioneering article advanced the money-wage/unemployment trade-off for the United Kingdom. In particular, he proposed that there is a statistically

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* The author is indebted to S. Hannah, Lecturer in the Dept. of Economics, for his helpful suggestions and encouragement.

1. Phillips, A.W., "The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-1957", Economica, 1958, pp. 283-99.

significant relationship between the level and the rate of change of unemployment (U and $\mathring{U}$) and the rate of change of money wage rates (dw/dt) in the United Kingdom and also that this relationship has been stable since 1862, although subsequent work has shown that other variables are also important in determining wage inflation. Lipsey[2], has reconsidered the original Phillips' hypothesis by introducing changes in the cost of living as an additional explanatory variable and supported, in contrast to Phillips, that there is no additional role for changes in unemployment to play ($\mathring{U}$).

Dicks-Mireaux and Dow[3], Hines[4] and others supported also that the rate of change of the price level (cost of living) affects significantly the rate of change of money wage rates and that the rate of change of the percentage of the labour force unionised may affect the rate of change of money wage rates. Moreover, other authors, i.e. Kaldor, Perry, Bhatia, Ekstein-Wilson, and Phelps argued that the profit hypothesis, reflecting product market conditions is superior to an explanation using unemployment (U) and its change ($\mathring{U}$)[5], while Routh and Knowles-Winsten[6] cast doubt on the general validity of the Phillips hypothesis arguing whether the findings of Phillips had any implication for public policy.

One theory which recently has been receiving considerable attention is the so-called "expectation hypothesis" which, in constrast to the "bargaining mechanism approach", suggests that the money wage equations depend on expectations of the future rate of change of prices (inflation expectations) and/or the level of money wage rates that is expected to rule, as well as the unemployment rate.[7]

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2. Lipsey, R.G., "The relation between Unemployment and the rate of change of money wage rates in the United Kingdom, 1862-1957: A further analysis", Economica, 1960, pp. 1-31.

3. Dicks-Mireaux, L.A. and J.C. Dow, "The Determinants of Wage Inflation in the United Kingdom, 1946-1956", Journal of the Royal Statistical Society, series A (General), part 2, 1959.

4. Hines, A.G., "Trade Unions and Wage Inflation in the United Kingdom, 1893-1961", Review of Economic Studies, 1964, pp. 221-252.

5. Kaldor, N., "Economic Growth and the Problem of Inflation" Economica, 1959, pp. 287-291. Perry, G.L., "The Determinants of wage changes and Inflation-Unemployment trade-off in the United States", Review of Economic Studies, 1964, pp. 287-308. Bhatia, R.J., "Profits and the rate of Change in Money Earnings in the United States, 1935-1959", Economica, 1962, pp. 255-262.
Ekstein, O. and T.A. Wilson, "The determination of money wages in American Industry", Quarterly Journal of Economics, 1962, pp. 379-414.
Phelps, E.S., "Money-Wage Dynamics and Labour-Market Equilibrium", Journal of Political Economy, 1968, pp. 678-711.

6. Routh, G., "The Relation between Unemployment and the rate of Change of money wage rates: A Comment", Economica, 1959, pp. 299-315.
Knowles, K.G.J.C. and C.B. Winsten, "Can the Level of Unemployment Explain Changes in Wages?", Bulletin of the Oxford University Institute of Statistics, 1959.

7. Friedman, M., "The role of monetary policy", American Economic Review, 1968. Phelps, E.S., "Phillips Curves, Expectations of Inflation and Optimal Unemployment over time", Economica, 1967, pp. 254-281.
Lucas, R.E. Jr., and L.A. Rapping, "Price Expectations and the Phillips Curve", American Economic Review, 1969, pp. 342-350.

Before proceeding to the specification of money wage rate and price change equations, we test whether expectations of wage or price changes are significant in explaining the behaviour of actual wage changes in the Greek economy using the OLS method.

II. The Expectations Hypothesis

In this section I introduce expectations into the basic money wage equation. In its simplest form, the expectation hypothesis for wage specification is written as:[8]

$$\mathring{w}_t = a_0 + a_1/UR_t + a_2\, \mathring{p}^*_t \tag{1}$$

where $\mathring{w}_t$ = average percentage change in the money wage rate in period t, UR_t = average rate of unemployment in period t, and $\mathring{p}^*_t$ = average expectations of the future rate of inflation during period t.

The above equation emphasises non-competitive aspects of wage determination as well as competitive conditions of wage determination. According to Friedman and Phelps the labour market behaves as if it were perfectly competitive and also that the workers are not blinded by money illusion during their negotiations with the employers. As a consequence, in the long run, the coefficient for $\mathring{p}^*_t$ will be equal to unity which means the absence, in the long-run, of a money-wage/unemployment trade-off (The Phillips curve will be vertical) or equivalently the apearance of a wage/price spiral[9], while in the opposite case (non-competitive labour market) the coefficient for $\mathring{p}^*_t$ takes values between zero and unity. However, in contrast to the above authors, other economists found that the coefficient of $\mathring{p}^*_t$ was significantly less than unity which is evidence for the absence of a wage/price spiral.[10]

However, equation (1) is non-operational due to the absence of direct observations of price expectations ($\mathring{p}^*_t$ is an unobservable variable). Therefore, it is necessary to substitute $\mathring{p}^*_t$ for observable variables or to make assumptions about how expectations are formed (both workers and employers make the same expectations). The present study considers the following hypotheses:

$$\mathring{p}^*_t = \mathring{p}_t \tag{2}$$

8. Friedman, M., Op. cit.

9. Friedman, M., Op. cit.
Also: Champernowne, D.G., Comment on Dicks-Mireaux and Dow, Op. cit.

10. Turnovsky, S.J. and M.L. Wachter, "A Test of the "Expectations Hypothesis" using directly observed wage and price expectations", Review of Economics and Statistics, 1972, pp. 47-54.
Cowling, K. and D. Metcalf, "An Analysis of the Determinants of Wage Inflation in Agriculture", Manchester School, 1965, pp. 179-204.

which means that inflation expectations equal the actual (current) rate of price changes ($\mathring{p}_t$) (i.e. static expectations). Taking into account the above assumption, equation (1) is written as:

$$\mathring{w}_t = a_0 + a_1/UR_t + a_2\,\mathring{p}_t \qquad (3)$$

In the above equation (3), the average percentage change in the nominal wage rate in non-agricultural industries is determined by the conditions in the labour market ($1/UR_t$), and by the changes in the cost of living index (p). The influences which exert the changes in the consumer price index ($\mathring{p}$) on wages has been referred to as cost-push inflation.[11] On a prior ground, the correlation between $\mathring{w}$ and $\mathring{p}$ is positive ($a_2 > 0$), since the trade unions power positively is associated with the changes in the cost of living index – the existence of unions reinforce the importance of the price variable.

Other alternative assumptions about how expectations are formed which I tried to test in my experiments are: the Cagan's adaptive expectation hypothesis:[12]

$$\mathring{p}^*_t - \mathring{p}^*_{t-1} = \beta(\mathring{p}_t - \mathring{p}^*_{t-1}) \qquad 0<\beta\leqslant 1 \qquad (4)$$

or

$$\mathring{p}^*_t = \mathring{p}^*_{t-1} + \beta(\mathring{p}_t - \mathring{p}^*_{t-1}) \qquad (5)$$

where β is the adaptive expectations coefficient showing the proportion of the error ($\mathring{p}_t - \mathring{p}^*_{t-1}$) by which expectations are revised, the hypothesis according to which expectations are formed extrapolatively:

$$\mathring{p}^*_t - \mathring{p}_t = \gamma(\mathring{p}_t - \mathring{p}_{t-1}) \qquad (6)$$

or

$$\mathring{p}^*_t = \mathring{p}_t + \gamma(\mathring{p}_t - \mathring{p}_{t-1}) \qquad (7)$$

and finally the assumption that expectations are formed as a general distributed lag of previous price changes:

$$\mathring{p}^*_t = (1-\lambda) \sum_{i=0}^{n} \lambda^i\,\mathring{p}_{t-i} \qquad (8)$$

where n is the length of the lag, and λ is the adaptive expectations parameter ($(1-\lambda)\Sigma_{\lambda}^{i} = 1$, since λ^i is a geometric progression which sums to $1/(1-\lambda)$). If we put $(1-\lambda)\lambda^i = \vartheta_i$, so that $(1-\lambda)\,\Sigma\lambda^i = \Sigma\vartheta_i = 1$, equation (8) becomes:

11. Spitaller, E., "Prices and Unemployment in Selected Industrial Countries", International Monetary Fund, No. 3, November 1971, p. 533.

12. Cagan, P., "The Monetary Dynamics of Hyperinflation", Ch. 2 in Friedman, M. (ed), Studies in the Quantity Theory of Money, Chicago: Chicago University Press, 1956.

$$\dot{p}^*_t = \sum_{i=0}^{n} \vartheta_i \, \dot{p}_{t-i} \quad (9)$$

The assumptions about the ϑ_i expressed by equation: $(1-\lambda)\lambda^i = \vartheta_i$ were first proposed by Koyck and so this is known as a Koyck or geometric (or first-order) distributed lag.[13]

Substituting equations (5), (7) and (9) in equation (1), I obtain the following money wage equations (10), (11) and (12) respectively.

$$\dot{w}_t = a_0 + a_1/UR_t - a_1(1-\beta)/UR_{t-1} + a_2\beta\,\dot{p}_t\,(1-\beta)\,\dot{w}_{t-1} \quad (10)$$

$$\dot{w}_t = a_0 + a_1/UR_t + a_2\,\dot{p}_t + a_2\gamma\,(\dot{p}_t - \dot{p}_{t-1}) \quad (11)$$

$$\dot{w}_t = a_0 + a_1/UR_t + a_2 \sum_{i=0}^{n} \vartheta_i \, \dot{p}_{t-i} \quad (12)$$

In the above equations, as it is seen, I do not introduce other explanatory variables (i.e. profits variable), since in my opinion profits do not play any role in the formation of expectations, although recently it was suggested by Gordon and Hynes[14] that profits can be an important explanatory variable in the expectation theory of money wage determination. The method which I applied in order to estimate the above equations (10), (11) and (12), as stated in Section I, is the OLS method, over the sample period 1954-1978 using annual observations. The data used for the estimation of these equations is the money wage rate per man-hour in manufacturing and services industries (W/LAB), where W = Total wages and salaries at current prices in non-agricultural industries, and LAB = Employment in non-agricultural sector × Hours per week × 0.048 = Total man-hours (in million hours) in non-agricultural sector. As unemployment rate (UR) I used the general level of unemployment and not the unemployment rate in the non-agricultural sector, following Dicks-Mireaux and Dow[15] who suggested that "local" unemployment is not as relevant in the wage adjustment process as is the general level of unemployment. Finally, as price level data, I used the consumer price index (CPI).

Although autoregressive schemes like equations (11) and (12) seem crude, since according to these equations workers are interested in past inflation rates only and

13. Koyck, L.M., "Distrributed Lags and Investment Analysis", Amsterdam: North-Holl and Publishing Co., 1954.
See also: Jorgenson, D.W., "Rational Distributed Lag Functions", pp. 135-49. Econometrica, 1966 and Solow, R.M., "On a Family of Lag Distributions", Econometrica, 1960, pp. 399-406.

14. Gordon, D.F. and A. Hynes, "On the Theory of Price Dynamics" in Microeconomic Foundations of Employment and Inflation Theory, E.S. Phelps (ed.), New York: W.W. Norton Co. Inc., 1970.

15. Dicks-Mireaux, L.A. and J.C. Dow, Op. cit.

not those in the future[16], a preferred approach would be to test the expectation hypothesis using direct price expectations data[17], but this is not possible because of insufficient data for the Greek economy.

III. The Results

As regards equation 1 of Table 1, it is seen that all the explanatory variables of the wage adjustment process, except the unemployment rate variable (UR), are statistically significant at the 5% probability level and the coefficients have the a priori expected signs.

R^2 is high indicating that the involved explanatory variables in the curvilinear "Phillips curve" –equation 1– (Table 1) satisfactorily explain actual money wage changes, while the DW statistic shows that there is no serious autocorrelation of the disturbance terms. I tried to re-estimate the static expectation form without taking into account the constant term, but the results found were inferior comparatively with those of equation 1 (Table 1).

TABLE 1

Wage Equations: Indirect Expectations Data
Estimated by the OLS method

1. Static Expectation

$$\dot{w}_t = \underset{[2.10895]}{0.04438360} + \underset{[1.23836]}{0.1470016} / UR_t + \underset{[2.31930]}{0.5199544}\, \dot{p}_t + \underset{[5.06176]}{0.1191041}\, DUM^{*} \qquad \underset{0.7122}{\bar{R}^2} \quad \underset{2.0209}{DW}$$

2. Adaptive Expectation Hypothesis

$$\dot{w}_t\ \underset{[0.30434]}{0.01014429} - \underset{[0.29916]}{0.07796738} / UR_t + \underset{[1.40787]}{0.4929573} / UR_{t-1} + \underset{[0.06989]}{0.02486011}\, \dot{p}_t\ +$$

$$+ \underset{[0.88214]}{0.1898985}\, \dot{w}_{t-1} \qquad \underset{0.4799}{\bar{R}^2} \quad \underset{1.9383}{DW}$$

2΄

$$\dot{w}_t = -\underset{[0.21952]}{0.05604999} / UR_t + \underset{[1.47875]}{0.5112370} / UR_{t-1} - \underset{[0.09168]}{0.02844846}\, \dot{p}_t + \underset{[0.99639]}{0.2072724}\, \dot{w}_{t-1}$$

$$\underset{0.4791}{\bar{R}^2} \quad \underset{1.9315}{DW}$$

16. See: Turnovsky, S.J., "Empirical Evidence on the Formation of Price Expectations", Journal of the American Statistical Association, Vol. 65, 1970, pp. 1441-1454.

17. Carlson, J.A. and M.J. Parkin, "Inflation Expectations", Economica, 1975, pp. 123-138.

3. Geometric Distributed Lag

$$\dot{w}_t = \underset{[1.36913]}{0.03964899} + \underset{[0.66248]}{0.1118155}\ /UR_t + \underset{[0.43703]}{0.1310553}\ \dot{p}_t + \underset{[2.41377]}{0.5885146}\ \dot{p}_{t-1} + \underset{[0.25014]}{0.0590298}\ \dot{p}_{t-2}$$

$$+ \underset{[1.40127]}{0.3297293}\ \dot{p}_{t-3} \qquad \underset{0.5972}{\bar{R}^2} \qquad \underset{1.6731}{DW}$$

3΄

$$\dot{w}_t = \underset{[2.81275]}{0.2974245}\ /UR_t - \underset{[0.14603]}{0.04177513}\ \dot{p}_t + \underset{[2.28344]}{0.5854917}\ \dot{p}_{t-1} + \underset{[0.28621]}{0.07203424}\ \dot{p}_{t-2} +$$

$$+ \underset{[1.17918]}{0.2895320}\ \dot{p}_{t-3} \qquad \underset{0.5746}{\bar{R}^2} \qquad \underset{1.4488}{DW}$$

4. Extrapolative Expectation Hypothesis

$$\dot{w}_t = \underset{[1.47573]}{0.04161075} + \underset{[1.11861]}{0.1760778}\ /UR_t + \underset{[2.45448]}{0.7971436}\ \dot{p}_t - \underset{[2.71334]}{0.6339839}\ (\dot{p}_t - \dot{p}_{t-1})$$

$$\underset{0.5278}{\bar{R}^2} \qquad \underset{1.6138}{DW}$$

4΄

$$\dot{w}_t = \underset{[3.67088]}{0.3621153}\ /UR_t + \underset{[1.99267]}{0.6396778}\ \dot{p}_t - \underset{[2.69428]}{0.6573129}\ (\dot{p}_t - \dot{p}_{t-1}) \qquad \underset{0.5091}{\bar{R}^2} \qquad \underset{1.3672}{DW}$$

(The numbers in brackets show the t-ratios; $\bar{R}^2$ is the coefficient of determination corrected for degrees of freedom, and DW is the Durbin-Watson statistic; all percentage changes are at annual rates).

*DUM_t = Dummy variable, which takes the values 1 for theyears 1956, 1967, 1975 and 1977 due to political instability in Greece, and 0 for all other years.

The results obtained for equation 1 (Table 1) imply that the static expectation hypothesis is valid for the Greek labour market; in negotiations with the entrepreneurs over actual wage contracts, the worker's inflation expectations are approximated by the current rate of inflation.

The most striking feature of the results of the remaining equations in Table 1, with the possible exception of the extrapolative equation 4΄, is the lack of success shown by these autoregressive models in explaining expectations, probably due to their omission of the effect of foreign rates of inflation on the formation of expectations of domestic rates of inflation. In particular, in equations 2/2΄, 3/3΄ almost all the coefficients of the involved explanatory variables are either statistically insignificant or their corresponding signs are not consistent with the a priori expected ones, which means that the estimated autoregressive expectations (adaptive expectation hypothesis and distributed lag model) generates no long-run trade-off (vertical long-run Phillips curve) in contrast to the neoclassical –monetary– version of the theory[18].

With respect to equations 4 and 4΄ (Table 1) (Hicks' extrapolative hypothesis) it is seen that these are more promising than those which are formulated according to adaptive expectations and weighted expectations hypotheses in terms of t-ratios. Moreover, comparing equations 4 and 4΄, it is seen that the results of equation 4΄ are beeter on grounds of statistical criteria (t-ratios), although the absence of the constant term in equation 4΄ reduces the goodness of fit in this equation. In equation 4΄, all the involved explanatory variables are statistically significant (the estimates of their corresponding coefficients are significantly different from zero at 5% probability level), and also their signs are the expected ones. From the results of equation 4΄ it is found that $\gamma<0$, which means that workers expect past trends to reverse themselves, in which case their expectations are said to be regressive. However, even though the explanatory variables in extrapolative equation 4΄ enter so significantly, the fact that they are below unity, lead us to reject the stringent version of the hypothesis for the Greek economy, namely, that the coefficient of the expectation variable should be unity or in other words to reject the view of monetarists (neoclassical view) that in the long run the price expectations should be fully reflected in current (actual) wage changes. Furthermore, the results of equation 4΄ (and generally the results of the standard expectations hypotheses as a whole) do not provide an adequate test of the extrapolative hypothesis. First, it is seen in Table 1, that the error terms in equation 4΄ are seriously autocorrelated which is attributed either to mis-specification at this equation or to misbehaviour of the error terms and as a consequence, the application of ordinary least squares (OLS) will give biased and unbiased but inefficient estimates in the first and second case respectively.[19]

Secondly, simultaneous equations bias may cause the coefficients and t-statistic of the estimated autoregressive models in Table 1 to be biased. However, subsequent developments in the theory of formulating and estimating different expectations models (i.e. Almon lags, and ARIMA (auto-regressive integrated moving average) models) have removed many methodological problems which have appeared in estimating inflationary expectations. Particularly, the ARIMA model provides a general framework for the most efficient forecast of inflation, when no information other than past inflation is considered.[20]

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18. Friedman, M., Op. cit. Phelps, E.S., Op. cit.

19. Johnston, J., "Econometric Methods", McGraw-Hill Co., 1972.
Also: Griliches, Z., "Distributed Lags: A Survey", Econometrica, 1967, pp. 16-49.

20. Feige, E.L. and D.K. Pearce, "Economically Rational Expectations: Are Innovations in the Rate of Inflation Independent of Innovations in Measures of Monetary and Fiscal Policy?", Journal of Political Economy, 1976, pp. 499-522.

For more details about the ARIMA models see: Nerlove, M., «The Dynamics of supply: Estimation of farmere response to price» Baltimore: John Hopkins, 1958, and Pindyck, R.S., and D. L. Rubinfeld, «Econometric models and Economic Forecasts» New York Mc Graw Hill Co., 1976 pp. 452-476.

The main conclusion which is established from the above discussion is that, for the period 1954-1978, there is a significant extrapolative price expectations effect on wage inflation in Greece. In addition, the coefficients of the price variable were consistently above 0.50 so that, even allowing for estimation bias, the difference was no too large to support the looser version of the neoclassical natural rate hypothesis. In addition, except the extrapolative expectation hypothesis, the static expectation hypothesis (inflation expectations equal the actual rate of inflation) also works well over the sample period 1954-1978 in the Greek economy.

IV. Specification of the Wage and Price Changes Equations

In the present section of this study I will attempt to determine the rate of change of money wage rates (average hourly rates over a year) in the non-agricultural sector and the rate of change of consumer prices during the period 1954-1978 using annual observations. Particularly, as concern the specification of money wage changes I will test whether the Phillips-Lipsey hypothesis is valid for the Greek economy.

A. Specificiation of the Wage Equation

Following the classical formulation of the Phillips curve, it is common to estimate the wage equation in terms of percentage changes in wages. The model in quastion is implicit in Phillips' work amended by Lipsey. The Phillips-Lipsey hypothesis suggests that the rate of change of money wages is a function of the level of excess demand (supply) in the labour market. The model which is derived from the demand-supply relation, as it is said above, is implicit, which means that the variables which are entered in this relation are implicitly taken account of in a dynamic wage adjustment process which is of the form:

$$\frac{dw}{dt} = m \left[\left(\frac{L^S - L^D}{L^S} \right) / Z \right] + \frac{dp}{dt} \quad (13)$$

where dw/dt = the rate of change of the non-agricultural wage rate, L^S = supply of labour, L^D = demand of labour[21], Z = set of relevant exogenous variables and dp/dt = is the current rate of change of consumer price index. The above realistic, disequilibrium model which allows for the existence of a disparity between demand and supply (dynamic wage adjustment process or reaction function) is written in terms of percentage rate of changes of non-agricultural money wage rates as below:

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21. We do not intend to estimate in this paper demand and supply functions for non-agricultural labour. For statistical estimates of labour supply functions for the Greek labour market see: Paleologos, J.M., "An Aggregate Macro-economic Growth Model for the Greek Economy: 1954-1978", thesis submitted for the degree of M.A. (Econ.) in Keele University.

$$\frac{d(w/p)}{dt} \cdot \frac{p}{W} = \left[p \cdot \frac{dw}{dt} - \frac{dp}{dt} W \right] \cdot \frac{p}{W} \cdot \frac{1}{p^2}$$
$$= \frac{dw}{dt} \cdot \frac{1}{W} - \frac{dp}{dt} \cdot \frac{1}{P} \tag{14}$$

However, this percentage rate of change of money wage rate depends on the excess supply (demand) in the non-agricultural labour market; $(L^S - L^D)$. Hence, it is:

$$\frac{dw}{dt} \cdot \frac{1}{W} - \frac{dp}{dt} \cdot \frac{1}{P} = m \left[\frac{L^S - L^D}{L^S} \right]$$

or

$$\frac{dw}{dt} \cdot \frac{1}{W} = m \left[\frac{L^S - L^D}{L^S} \right] + \frac{dp}{dt} \cdot \frac{1}{P} \tag{15}$$

which means that the percentage rate of change of non-agricultural money wage rates depends on the percentage of excess supply in the labour market (disequilibrium between supply and demand in the labour market) and in addition on the percentage rate of change of consumer price index (Phillips-Lipsey hypothesis).

In my experiments, as an indicator of the excess supply (demand) in the labour market I will use the unemployment rate, although the unemployment rate variable (UR) may not be a suitable indicator for the disequilibrium between supply and demand (excess demand or supply)[22]. I will cosnider in this study, the unemployment rate variable as the only indicator of the "pressure of demand for labour", due to the absence of other more preferable indicators for the excess supply (demand) (i.e. unfilled vacancies) in the Greek economy. As it is stated previously, as the unemployment rate variable (Unemployed/Economically active population), I will use the general level of unemployment rate and not the local unemployment following the suggestion of Dicks-Mireaux and Dow.[23]

The main reasoning behind the wage equation is that of the law of supply and demand, stating that money wage rates increase when is small and decrease when excess demand is small. Thus, the correlation which I expect to find in my experiments between percentage rate of change of non-agricultural money wage rates and the unemployment rate variable will be negative. Moreover, although Phillips, in his original work[24], suggests a curvilinear relation between the rate of change of money wage rates and the unemployment rate, I will adopt, in my experiments, a linear form between these variables, following Lipsey's proposition[25], since the introduction of non-linearity would disturb the simultaneous approach which I will apply later in the pre-

22. Dow, J.C.R. and L.A. Dicks-Mireaux, "Excess Demand for Labour", Oxford Economic Papers, Vol. 10, 1958.

23. Dicks-Mireaux, L.A. and J.C. Dow., Op. cit.

24. Phillips, A.W., Op. cit.

25. Lipsey, R.G., Op. cit.

sent study. Furthermore, by introducing the unemployment rate variable I explain the effect of the existence of union power in the bargaining process.

As regards the set of relevant exogenous variables (Z), this affects the rate of change of the non-agricultural wage rate independently of the unemployment rate variable in order to avoid multicollinearity phenomena among explanatory variables. The possible arguments which, from other similar works, suggested for the variable Z may be: The level of profits in the non-agricultural secor (π), its rate of change ($\mathring{\pi}$), the rate of change of per capita personal disposable income ($\mathring{y}$), and the rate of change of the level of unemployment rate ($U\mathring{R}$). Also, a dummy variable (DUM) is introduced in my experiments of the wage equations, which takes the values 1 for the years 1956, 1967, 1975 and 1977 and zero elsewhere in order to catch up the enormous peaks due to political instability in these years which disturbed the bargaining process (the Government has actively intervened in the wage bargaining process).

As regards the price level variable (cost of living index) it is seen in equation (15) that the Phillips-Lipsey hypothesis has allowed for the possible influence of conditions in the product market on wages by introducing the percentage rate of changes of cost of living index, the influence of which, as I said before, it is known as a cost-push inflation. Actual bargaining over wage rates takes place in terms of money wages, and we assume that neither workers nor entrepreneurs suffer from money illusion.

I introduce profit variable in the non-agricultural sector, since workers claims will be partly explained by the Union's evaluation of the employer's ability to grant wage increases[26].

Finally, I introduce the percentage rate of change in the unemployment rate ($U\mathring{R}$), since this variable constitutes one of the more predictable arguments of the rate of change of money wages. In other words, changes in the unemployment rate serve as a handy index of future labour market conditions[27]. Thus, the wage-rate relationship to be estimated is of the form:

$$\mathring{w}^*_t = f\{UR_t,\ U\mathring{R}^*_t,\ \pi_t,\ \mathring{\pi}^*_t,\ \mathring{p}^*_t,\ DUM,\ U_t\} \qquad (16)$$

where $\mathring{w}^*$ ($= 1/w \cdot dw/dt$), $U\mathring{R}^*_t$, $\mathring{\pi}^*_t$, $\mathring{p}^*_t$ are the percentage rate of changes of non-agricultural money wae rate, of unemployment rate, of profits in non-agricultural sector, and of cost of living index respectively at time t, while U_t is the disturbance term which is assumed to subject to first and second order autocorrelation schemes; that is

26. Ekstein, O. and T.A. Wilson, Op. cit.
Kaldor, N., Op. cit.
Perry, G.L., Op. cit.

27. Bowen, W.G. and R.A. Berry, "Unemployment Conditions and Movements of the Money Wage Level", Review of Economics and Statistics, 1963, p. 167.

$$U_t = \rho_1 U_{t-1} + \varepsilon_t \text{ and } U_t = \rho_2 U_{t-2} + \varepsilon_t'$$

where $-1 < \rho_1 < 1$ and $-1 < \rho_2 < 1$ are the autocorrelation coefficients, and ε_t and ε_t' are the "white noise" residuals, i.e. subject to usual stochastic assumptions.

B. Specification of the Price Equation

The previously described wage equation is intended to show jointly the behaviour of workers and entrepreneurs in bargaining over wages. Now I am considering an e-quation which is intended to reveal the behaviour of the entrepreneurs with respect to the determination of prices over costs. The price variable that I am using in this study measures final market prices of consumer goods (durable and non-durable goods) as the central price variable.

There are two basic models for explaining determinants of price changes, i.e. the model which uses marginal productivity equations transformed into equations of labour's share under the restriction that the production function is of the Cobb-Douglas type[28], and the models based on the cost-mark-up principle. In the U.K. and Dutch models, price mark-up equations have been used, while U.S. and Canadian models use equations for labour's share.

The rate of change in the price level is determined by the following factors:

1. Changes in wage rates

The simple rationalisation for the inclusion of these cost variables is the assumption that prices are marked up over prime costs (full cost pricing). This cost-mark up principle has been used by Klein et. al. in the U.K. model.[29]

2. Change in imports price level

In an open economy, as the Greek economy is, this variable plays an important role. Imports price increases influence the final product price increases. This type of exogenous cost inflation, is also the main cost for the firms in Greece, in addition to the labour cost variable (money wage variable).

3. Changes in productivity

Except the above mentioned main cost variables which play an important role in the determination of the rate of change in the price level, the mark-up relation would

28. Klein, L.R. and A.S. Goldberger, "An Econometric Model of the United States, 1929-1952", Amsterdam: North-Holland Publishing Co., 1955.

29. Klein, L.R., et. al., "An Econometric Model of the United Kingdom", Oxford, Blackwell, 1961.

vary also with the level of productivity. Consider the case in which the product market is in equilibrium. Then the excess demand would be zero in each period over time. So, the relationship between price change and the excess demand would imply that price increase is zero ($p_t = p_{t-1}$.........) over time. Economic theory suggests, however, that in long-run, the time path of prices would be determined by the time path of the marginal productivity of labour (q = labour productivity index in non-agricultural industries: gross domestic product in the non-agricultural sector/labour demand in man-hours in the non-agricultural sector). The expected coefficient of a productivity variable is negative, since increasing productivity enables entrepreneurs to reduce prices and hold levels of profits[30].

So, the form of the mark-up equation to be estimated is:

$$\mathring{p}^*_t = f\{\mathring{w}^*_t, \mathring{m}^*_t, \mathring{q}^*_t, u_t\} \tag{17}$$

where $\mathring{m}^*_t$ represents the percentage change in the import price index, $\mathring{q}^*_t$ is the percentage change in the labour productivity index in manufacturing and services industries (non-agricultural sector) and u_t is the disturbance term which also is assumed to be liable to first and second order autocorrelation schemes, as the disturbance term U_t in the money wage-rate equation.

V. Estimation of the Wage and Price Changes Equations

The statistical results of the estimated wage and price equations, which have been presented in the previous section, are given in Tables 2 and 3 respectively, while all the supplementary statistical tests relevant to these tables are shown in Table 4. The methods which I used in estimating these equations are (i) the ordinary least squares method (OLS), (ii) the autoregressive least squares method (ALS), (iii) the two-stages least squares method (2SLS) and (iv) the autoregressive two stages least-squares method (A2SLS). I used exactly the same computer package (GIVE) that Professor D. Hendry (London School of Economics) created and used in his demand model for the U.K. economy[31].

With respect to the estimated wage-rate equations, I observe, in Table 4, that the imposed autoregressive restrictions on the disturbance terms are valid at 5%, in terms of the $x^2(i)$ test, and that the disturbance terms are not subject to serious autocorrelation (first and second order autocorrelation schemes) in terms of the $x^2(1)$ test. Also, the F(j,1) test, in the same table, reveals that the additional explanatory variables in the wage equations are statistically insignificant. So, the rejection of the equations estimated by the ALS method and the acceptance of those estimated by the OLS method is obvious. The accepted wage-rate equations are written below.

30. Klein, L.R. and J.R. Ball, "Some Econometrics of the Determination of Absolute Prices and Wages", Economic Journal, 1959, pp. 465-482.

31. Hendry, D.F., "Stochastic specification in an aggregate demand model of the United Kingdom", Econometrica, 1974, pp. 559-578.

$$\mathring{w}^*_t = 0.10891 - 0.00659\ UR_t + 0.57047\ \mathring{p}^*_t + 0.12132\ DUM1 \quad (18)$$
$$[2.84147] \quad [1.69105] \quad [2.94700] \quad [5.11951]$$

$$R^2 = 0.75984,\ DW = 2.19960,\ r_{\mathring{w}^*_t UR_t \cdot \mathring{p}^*_t DUM1} = -0.27790,$$

$$r_{\mathring{w}^*_t \mathring{p}^*_t \cdot UR_t DUM1} = 0.56008, \quad r_{\mathring{w}^*_t DUM1 \cdot \mathring{p}^*_t UR_t} = 0.76140$$

$$\mathring{w}^*_t = 0.15395 - 0.01089\ UR_t + 0.48784\ \mathring{p}^*_t \quad (19)$$
$$[2.78314] \quad [1.41733] \quad [1.70212]$$

$$R^2 = 0.44833,\ DW = 1.68653,\ r_{\mathring{w}^*_t UR_t \cdot \mathring{p}^*_t} = 0.30922,$$

$$r_{\mathring{w}^*_t \mathring{p}^*_t \cdot UR_t} = 0.36374$$

$$\mathring{w}^*_t = 0.22410 - 0.01557\ UR_t - 0.48435\ \mathring{\pi}^*_t + 0.10531\ DUM1 \quad (20)$$
$$[7.83805] \quad [3.61722] \quad [1.91687] \quad [3.89499]$$

$$R^2 = 0.70677,\ DW = 1.80804,\ r_{\mathring{w}^*_t UR_t \cdot \mathring{\pi}^*_t DUM1} = 0.63860,$$

$$r_{\mathring{w}^*_t \mathring{\pi}^*_t \cdot UR_t DUM1} = 0.40255,\ r_{\mathring{w}^*_t DUM1 \cdot \mathring{\pi}^*_t UR_t} = 0.66631$$

$$\mathring{w}^*_t = 0.26441 - 0.01698\ UR_t - 0.79277\ \mathring{\pi}^*_t \quad (21)$$
$$[8.10948] \quad [3.22823] \quad [2.63189]$$

$$R^2 = 0.53407,\ DW = 1.75619,\ r_{\mathring{w}^*_t UR_t \cdot \mathring{\pi}^*_t} = 0.59515,$$

$$r_{\mathring{w}^*_t \mathring{\pi}^*_t \cdot UR_t} = 0.51688$$

$$\mathring{w}^*_t = 0.21403 - 0.01201\ UR_t + 0.29243\ \mathring{p}^*_t - 0.68341\ \mathring{\pi}^*_t \quad (22)$$
$$[3.69759] \quad [1.70147] \quad [1.05213] \quad [2.15015]$$

$$R^2 = 0.75984,\ DW = 2.19960,\ r_{\mathring{w}^*_t UR_t \cdot \mathring{p}^*_t \mathring{\pi}^*_t} = -0.37222,$$

$$r_{\mathring{w}^*_t \mathring{p}^*_t \cdot UR_t \mathring{\pi}^*_t} = 0.24070,$$

$$r_{\mathring{w}^*_t \mathring{\pi}^*_t \cdot UR_t \mathring{p}^*_t} = 0.45205$$

$$\mathring{w}^*_t = 0.27493 - 0.02719\ UR_t + 0.16228\ UR^*_t \quad (23)$$
$$[8.49020] \quad [4.82425] \quad [3.10240]$$

$$R^2 = 0.55037,\ DW = 1.63154,\ r_{\mathring{w}^*_t UR_t \cdot UR^*_t} = -0.73336,$$

$$r_{\mathring{w}^*_t UR^*_t \cdot UR_t} = 0.56999$$

TABLE 2

Wage-rate equations estimated by the OLS/ALS method

Method	Equation	Constant	UR_t	$\dot{p}^*_t$	$\dot{\pi}^*_t$	UR^*_t	DUM1	R^2	S^2	DW	F	RSS
OLS	1	0.10891 [2.84147]	−0.00659 [1.69105]	0.57047 [2.94700]			0.12132 [5.11951]	0.75984	0.00182203	2.19960	20.03826	0.03461861
ALS	1'	0.10382 [2.99211]	−0.00637 [1.36384]	0.59690 [3.29574]			0.13701 [5.30055]		0.00186433			0.03355796
OLS	2	0.15395 [2.78314]	−0.01089 [1.41733]	0.48784 [1.70212]				0.44833	0.00395586	1.68653	7.72045	0.07516138
ALS	2'	0.15961 [2.81378]	−0.01149 [1.41672]	0.44304 [1.55752]					0.0040474			0.077334538
OLS	3	0.22410 [7.83805]	−0.01557 [3.61722]		−0.48435 [1.91687]		0.10531 [3.89499]	0.70677	0.0022465	1.80804	15.26551	0.04226836
ALS	3'	0.22132 [6.81538]	−0.01536 [3.02118]		−0.43598 [1.65199]		0.09429 [2.99787]		0.00230579			0.04150420
OLS	4	0.26441 [8.10948]	−0.01698 [3.22823]		−0.79277 [2.63189]			0.53407	0.00334103	1.75619	10.88944	0.06347955
ALS	4'	0.26092 [7.24170]	−0.01683 [2.79944]		−0.75914 [2.44117]				0.00346910			0.06244380
OLS	5	0.21403 [3.69759]	−0.01201 [1.70147]	0.2943 [1.05213]	−0.68341 [2.15015]			0.56107	0.00332232	1.94175	7.66949	0.05980183
ALS	5'	0.21301 [3.66155]	−0.01213 [1.63404]	0.28577 [1.03388]	−0.65988 [2.04462]				0.00345401			0.05871824
OLS	6	0.27493 [8.48020]	−0.02719 [4.824251]			0.16228 [3.10240]		0.55037	0.003240	1.63154	12.24072	0.06481340
ALS	6'	0.27121 [6.92262]	−0.02670 [3.89830]			0.13560 [2.38568]			0.00333896			0.06344028

TABLE 3

Price level equations estimated by the OLS/ALS method

Method	Equation	Constant	$\dot{w}^*_t$	$\dot{m}^*_t$	$\dot{q}^*_t$	log (q_t / q_{t-1})	log (w_t / w_{t-1})	R^2	S^2	DW	F	RSS
OLS	1	0.01542 [1.12200]	0.16430 [1.55026]	0.42274 [5.51368]				0.75511	0.00111239	2.44722	30.83544	0.02224781
ALS	1'	0.01154 [0.99880]	0.19299 [2.03743]	0.42187 [6.03620]					0.0010846			0.02060881
OLS	2	0.02366 [1.75423]	0.35595 [2.57592]	0.29687 [3.10587]	−0.47912 [1.98679]			0.79724	0.0009695	2.61312	24.90213	0.01842082
ALS	2'	0.02275 [1.93423]	0.34220 [3.16617]	0.32195 [4.14547]	−0.45681 [2.13531]				0.0009095			0.01637229
OLS	3	0.02468 [1.52976]	0.68325 [6.38713]		−0.97552 [4.51372]			0.69430	0.0013886	1.75983	22.71136	0.02777320
ALS	3'	0.02521 [1.47999]	0.67771 [5.49525]		−0.97129 [4.03404]				0.0014523			0.02759454
OLS	4	0.02001 [1.35465]				−0.93136 [4.62289]	0.71519 [6.54823]	0.70425	0.0011038	1.84068	23.81238	0.02207629
ALS	4'	0.02019 [1.31202]				−0.92726 [4.06704]	0.71202 [5.84601]		0.0011601			0.02204265

TABLE 4

Supplementary statistical tests relevent to Tables 2 and 3

Equation		$\hat{\rho}$	$t(\hat{\rho})$	$X^2(1)$	$X^2(i)$	(i)	F(j, 1)	(j, 1)
1/1'	(Table 1)	−0.22782	0.95731	0.7150	5.38682	3	1.13946	4,15
2/2'	»	0.16875	0.66108	0.53808	5.73383	2	1.75935	3,16
3/3'	»	0.17881	0.70108	0.41961	5.94836	3	1.19526	4,15
4/4'	»	0.12966	0.53290	0.36192	6.13719	2	1.83297	3,16
5/5'	»	0.13782	0.54189	0.40229	4.89119	3	0.95210	4,14
6/6'	»	0.19317	0.74658	0.49251	2.57876	2	0.80954	3,17
1/1'	(Table 2)	−0.28746	1.23860	1.76008	2.40727	2	1.12563	3,17
2/2'	»	−0.34087	1.41648	2.71150	6.88134	3	1.94071	4,15
3/3'	»	0.08047	0.32114	0.14843	5.99669	2	1.73555	3,17
4/4'	»	0.03937	0.15509	0.03508	4.88009	2	1.35011	3,17

It should be noted at this point that equations in Table 2 were selected from experiments which tested different time-lags and different combinations of independent variables and other types of specification of the profit explanatory variable (i.e. the ratio of profit to capital stock in non-agricultural industries = rate of return on capital).

Among the above equations, (18) and (19) satisfy our expectations on grounds of theoretical criteria, because the statistical findings of the remaining equations are not consistent with a priori theory which suggests the following hypotheses about signs of the coefficients of the explanatory variables.

(1) $\vartheta \dot{w}^* / \vartheta UR_t < 0$, i.e., an increasing percentage rate of change of unemployment weakens the bargaining power of the workers and vice versa, and (2) $\vartheta \dot{w}^* / \vartheta \dot{\pi}^* > 0$, i.e., an increasing rate of change of profits makes employers more willing to grant, and workers will be more successful in obtaining wage increases.

Moreover, by comparison of equations (18) and (19), it is seen that the results of (18) are, statistically, more satisfactory. In fact, the introduction of the dummy policy variable (DUM1) increased the goodness of fit of equation (18) and also increased the importance of the explanatory variables UR_t and $\dot{p}^*_t$ in terms of the t-ratios.

The main conclusions which are established from the results of equation (18) are:

(i) The applicability of the Phillips-Lipsey hypothesis to Greek data is satisfactory, although the unemployment rate variable is just significant.

(ii) The contribution of the price variable to percentage rate of change of wage rate is high. Particularly, the effect of 10% increase of consumer prices is associated with 5.7% increase in the annual $\dot{w}$. In other words, the cost of living plays an active role in wage adjustment mechanism.

(iii) The above (ii) conclusion reveals some union power, during the period considered in this paper, if we take into consideration that the claims of the trade unions are based on the change of prices. Then, although the majority of the trade unions in Greece are not well organised, their activities exert some influence on wage changes.

(iv) Taking into account that price changes are also an indicator of product market conditions, then the association between wage and price changes in consistent with the demand-pull theory of inflation. A rise in demand for goods implies a rise in price according to micro-economic theory, which in turn leads to an increased demand for labour and other production factors and pull-up wage rates. Also, the influence of the percentage rate of change of p on wages gives some support to the cost-push inflation.[32]

(v) The Phillips-Lipsey hypothesis in Greece reveals that the level of unemployment which stabilizes the rate of change of money wage rates and the index of consumer prices ($Dw = \Delta p = 0$), where the symbol Δ denotes difference, is about 13 per cent which is close to that level found by Germidis and Negreponti-Delivanis[33] using the method of Taylor.[34]

(vi) Although I assumed that both the workers and the entrepreneurs do not suffer from "money illusion", my result provides evidence that "money illusion" is not entirely absent during the bargaining process between workers and employers. This evidence is based on the value of the elasticity of $\mathring{w}^*$ with respect to $\mathring{p}^*$ at the point of the sample means, applying the formula suggested by Klein and Goldberger,[35] ≈ 0.2642 (OLS) which differs significantly from unity.

(vii) As concerns the unemployment-rate variable (demand-pull variable), it is seen that there exists the a priori expected negative relationship between the $\mathring{w}^*$ and this variable, or in other words the percentage rate of change of wage rate ($\mathring{w}^*$) is a decreasing linear function of the unemployment-rate, and that its elasticity at the point of the sample means (≈ -0.27096 OLS) is slightly higher, in absolute terms, than that of the price variable (cost-push variable). This elasticity gives support to the fact that the behaviour of the employers in bargaining over wages is not affected seriously by the level of unemployment in the labour market[36]. Moreover, the restrictive importance of the unemployment-rate variable is revealed also from the values of

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32. Klein, L.R. and J.R. Ball, Op. cit.

33. Germidis and Negreponti-Delivanis found that the general unemployment rate in Greece is about 11%. See: Germidis, D.A. and M. Negreponti-Delivanis, "Industrialisation, employment and income distribution in Greece: A Case Study", Paris: OECD, 1975.

34. Taylor, J., "The behaviour of unemployed and unfilled vacancies: Great Britain, 1958-1971. An alternative view", Economic Journal, 1972, pp. 1352-1364.

35. Klein, L.R. and A.S. Goldberger, "An Econometric Model of the United States, 1929-1952", Amsterdam: North-Holland Publishing Co., 1969.

36. Vanderkamp, J., "Wage and Price Level Determination: An Empirical Model for Canada", Economica, 1966, pp. 194-218.

the partial correlation coefficient (i.e. approximately 27% of the variance in $\dot{w}^*$ not already "explained" by $\dot{p}^*$ and DUM1, can be attributed to UR).

(viii) The importance of the constant term reveals that, apart from movements in the explanatory variables, there is, annually, a time trend of some 0.10 per cent, which could be explained by "environmental" factors or by the history of this specific variable.

(ix) Finally, the importance of the dummy policy variable (DUM1) implies that the Greek Government has actively intervened in the wage bargaining process by means of its incomes policy.

With respect to the estimated price level equations (Table 3), I select equations 2, 3 and 4 since the results of these equations are more satisfactory comparatively with the results of equation 1. The selected price level equations, as also the wage-rate ones, have been estimated by the OLS method, since it is seen in Table 4, that the disturbance terms are not subject to serial correlation ($X^2(1)$ test) and also the F(i,1) test reveals that the additional lagged explanatory variables are statistically insignificant which means that equations 2, 3 and 4 are correctly specified. These equations are written below as:

$$\dot{p}^*_t = \underset{[1.75423]}{0.02366} + \underset{[2.57592]}{0.35595}\ \dot{w}^*_t + \underset{[3.10587]}{0.29687}\ \dot{m}^*_t - \underset{[1.98679]}{0.47912}\ \dot{q}^*_t \qquad (24)$$

$$R^2 = 0.79724,\ DW = 2.61312,\ r_{\dot{p}^*_t\dot{m}^*_t \cdot \dot{w}^*_t\dot{q}^*_t} = 0.58029,$$

$$r_{\dot{p}^*_t\dot{w}^*_t \cdot \dot{m}^*_t\dot{q}^*_t} = 0.50876$$

$$r_{\dot{p}^*_t\dot{q}^*_t \cdot \dot{m}^*_t\dot{w}^*_t} = -0.37334$$

$$\dot{p}^*_t = 0.02468 + 0.68325\ \dot{w}^*_t - 0.97552\ \dot{q}^*_t \qquad (25)$$

$$R^2 = 0.69430,\ DW = 1.75983,\ r_{\dot{p}^*_t\dot{q}^*_t \cdot \dot{w}^*_t} = -0.71037,$$

$$r_{\dot{p}^*_t\dot{w}^*_t \cdot \dot{q}^*_t} = 0.81916$$

$$\log\left(\frac{p_t}{p_{t-1}}\right) = 0.02001 - 0.93136 \log\left(\frac{q_t}{q_{t-1}}\right) + 0.71519 \log\left(\frac{w_t}{w_{t-1}}\right) \qquad (26)$$

$$R^2 = 0.70425,\ DW = 1.84068,\ r_{\log\left(\frac{p_t}{p_{t-1}}\right) \log\left(\frac{q_t}{q_{t-1}}\right) \cdot \log\left(\frac{w_t}{w_{t-1}}\right)} = -0.71872$$

$$r_{\log\left(\frac{p_t}{p_{t-1}}\right) \log\left(\frac{w_t}{w_{t-1}}\right) \cdot \log\left(\frac{q_t}{q_{t-1}}\right)} = 0.82579$$

It is seen in the above equations that all the corresponding explanatory variables are statistically significant at the 5% probability level and that the estimated coefficients have the a priori expected signs. Moreover, the explanatory power of these equations is relatively high.

From the statistical results of these equations we draw the following tentative conclusions:

1. The money wage rate, import price index and the productivity variables determine the level of prices in the Greek economy.

2. The average elasticity of the price variable with respect to the money wage rate variable is 0.768447, which means that a change of 10% in money wage rate in non-agricultural industries leads to a positive change of about 7.6% in consumer prices. The significance of money wage rate variable (labour cost variable) gives support to the assumption, made previously, that many enterprises in the Greek economy set their prices according to a "full cost pricing" or "mark-up" over main costs principle, which, as it was said, has been used in models of the U.K. and the Dutch economies.

3. The other prime cost which affects the price variable is the import price index. A 1% change in import prices appears to lead to a positive change of about 0.30% in consumer prices, which is smaller than that of the money wage rate. Thus, for the open Greek economy the import price variable plays an important role as another main cost variable. This fact supports the commonly held view in Greece, that the movement of the price level in the Greek economy is sensitive to import prices, a fact that always should be kept in the mind of the various governing bodies before they employ any policy. As Klein and Ball point out "the contribution of import prices to price fluctuations has been referred to as cost-push inflation (deflation) but not one that is attributable in any sense to trade union power"[37].

4. Furthermore, labour productivity is an important variable in the price equation. I used the productivity variable as a cyclical variable trying to indicate a "reduced need" (increased productivity) or an "increased need" (reduced productivity) to mark-up prices over costs. The importance of the included variables in the price equation also has been revealed from the values of the corresponding partial correlation coefficients. In particular, in equation (24), both money wage-rate and import price variables explain more than 50% of the variance in the percentage rate of change of the price variable.

5. Finally, there may be no significant differences between straight linear and log-linear specifications (equations 25, 26), despite the fact that the coefficient of determination in the latter case (eqaution 26) is slightly higher than in equation 25.

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37. Klein, L.R. and J.R. Ball, Op. cit., p. 471.

VI. The Simulataneous Relations between Wages and Prices

So far, the estimates of the coefficients and my discussion have been concerned with the single-stage least squares method (OLS), without taking into consideration the trade-off between price and wage variables. However, it is true that there exists no one-way causal relation between these variables. This phenomenon of feedback means that neither the wage rate equation nor the price equation may be properly estimated individually by the OLS/ALS method. In addition, the estimates that I found, using the OLS/ALS method, statistically, would tend to be biased (simultaneous equation bias) and inconsistent[38]. So, in order to avoid this risk I estimated the wage and price functions, using a more consistent statistical technique, i.e. the 2SLS/A2SLS method.

A formulation of the simultaneous feedback mechanism is expressed as the following simultaneous equation system:

$$\begin{aligned} \mathring{w}^*_t &= a_0 + a_1 UR_t + a_2 \mathring{p}^*_t + a_3 DUM1 \\ \mathring{p}^*_t &= a'_0 + a'_1 \mathring{w}^*_t + a'_2 \mathring{m}^*_t + a'_3 \mathring{q}^*_t \end{aligned} \qquad (27)$$

In the above system, only the wage and price variables are assumed to be determined endogenously, while all the other variables are dtermined exogenously. The results for this system, using the 2SLS/A2SLS method are presented in Table 5, while all the supplementary statistical tests relevant to Table 4 are presented in Table 6.

In Table 5, equation 1/1′ is the wage-rate equation, and equation 2/2′ represents the price level equation.

Particularly, with respect to the wage equation we can see that all the estimates of the coefficients of the variables, except that of the unemployment-rate variable, obtained by the 2SLS method, are significantly different from zero at 5% significance level as well as their signs are consistent with the a priori theory. Also, all the estimates of the coefficients of the included variables in the wage-rate equation obtained by the A2SLS method, except that of the UR_t variable, are significant at 5% significance level. However, from Table 6 results that the autoregressive restrictions imposed of the residuals are valid, whereas these residuals are free of serious autocorrelation on grounds of the $X^2(i)$ and $X^2(1)$ tests respectively. Therefore, the wage rate equation estimated by the 2SLS method (equation 1 in Table 5) is the finally accepted one and it is written as:

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38. See Johnston, J., "Econometric Methods", Second edition, McGraw-Hill Co, 1972. Koutsoyiannis, A., "Theory of Econometrics", Second edition, MacMillan: London, 1977.

TABLE 5

Wage and Price Equations Estimated by the 2SLS/A2SLS method

Method	Equation	Constant	UR_t	$\dot{p}_t^*$	$\dot{w}_t^*$	$\dot{m}_t^*$	$\dot{q}_t^*$	DUM1	R^2	S^2	DW	F	RSS
2SLS	1	0.10785 [3.33839]	−0.00627 [1.49806]	0.59725 [3.37129]	–	–	–	0.11190 [6.09672]	0.85267	0.00084502	2.02140	34.72487	0.01521027
A2SLS	1	0.10648 [3.02365]	−0.00612 [1.34220]	0.60772 [3.07174]	–	–	–	0.11208 [5.88259]	–	0.00089359	–	–	0.01518983
2SLS	2	0.02478 [5.64680]	–	–	0.29153 [5.25228]	0.33331 [9.97084]	−0.37114 [4.56076]	–	0.97912	0.00008001	1.65956	281.32449	0.00144013
A2SLS	2	0.03366 [3.91485]	–	–	0.17172 [2.99737]	0.35433 [11.96788]	−0.23904 [3.23230]	–		0.00007419	–	–	0.00126129

$$\mathring{w}^*_t = 0.10785 - 0.00627\ UR_t + 0.59725\ \mathring{p}^*_t + 0.11190\ DUM1 \qquad (28)$$
$$\quad |3.33839| \quad |1.49806| \quad |3.37129| \quad |6.09672|$$

$$R^2 = 0.85267,\ DW = 2.02140,\ r_{\mathring{w}^*_t UR_t \cdot \mathring{p}^*_t DUM1} = -0.33295,$$

$$r_{\mathring{w}^*_t \mathring{p}^*_t \cdot UR_t DUM1} = 0.62212$$

$$r_{\mathring{w}^*_t DUM1 \cdot UR_t \mathring{p}^*_t} = 0.820816$$

Similarly, it is seen in Table 5 that all the estimates of the coefficients of the explanatory variables of the price equation estimated by the 2SLS/A2SLS method are statistically significant at the 5% level. The tests of Table 6 lead us to reject the estimates obtained by the A2SLS (Autoregressive - two stages least squares) method.

TABLE 6

Supplementary statistical tests[39] relevant to Table 5

Equation	$\hat{\rho}$	$t(\hat{\rho})$	$X^2(1)$	$X^2(i)$	(i)	F(j, 1)	(j, 1)
1/1′	−0.04027	0.14710	0.02958	4.12399	3	0.72729	(4,14)
2/2′	0.67658	2.63108	2.91707	5.03295	3	1.52350	(4,14)

Then, the finally accepted price equation, in the present study, estimated by the 2SLS method is written as:

$$\mathring{p}^*_t = 0.02478 + 0.29153\ \mathring{w}^*_t + 0.33331\ \mathring{m}^*_t - 0.37414\ \mathring{q}^*_t \qquad (29)$$
$$\quad |5.64680| \quad |5.25228| \quad |9.97084| \quad |4.56076|$$

$$R^2 = 0.97912,\ DW = 1.65956,\ r_{\mathring{p}^*_t \mathring{w}^*_t \cdot \mathring{m}^*_t \mathring{q}^*_t} = 0.77791,$$

$$r_{\mathring{p}^*_t \mathring{m}^*_t \cdot \mathring{w}^*_t \mathring{q}^*_t} = 0.92016,$$

$$r_{\mathring{p}^*_t \mathring{q}^*_t \cdot \mathring{m}^*_t \mathring{w}^*_t} = -0.73218$$

Assuming that $\Delta p = \Delta w = \Delta m = 0$; equation (29) yields $\Delta q = 0.06623$ at the point of sample means. In other words, the labour productivity growth rate associated with unchanged prices (consumer price index and imports price index) and wage levels is

39. For more details about these tests see: Hendry, D.F., Op. cit.

6.623% annually. At the same time, assuming that the Government does not intervene in the money wage-rate adjustment mechanism, equation (28) yields UR = 17.200957. In other words, the level of unemployment which stabilizes the rate of change of money wage rate and of change of price level ($\Delta p = \Delta w = 0$) in the non-agricultural sector is about 14%, which is a little higher from the corresponding finding using the OLS/ALS method.

Alternatively, when the wage rate is allowed to go up at the same rate as the productivity of labour and also as the imports price index, i.e. $\Delta w = \Delta q = \Delta m$, and when the Government remains neutral to the wage negotiations, then equations (28) and (29) reduce to:

$$\dot{p}_t^* = 0.06480009 - 0.00221325 \ UR_t \tag{30}$$

Equation (30) shows the trade-off between inflation and unemployment rate from which the unemployment rate associated with price stability is computed as about 30%, a figure which is of course extremely far from the goal of full employment.

Since the average level of unemployment in the sample period (1954-1978) is 6.24% and the highest level is 10.924% (in 1957), it can be argued, using (30), that the level of inflation which is consistent with the average rate of unemployment for the period 1954-1978 and $\Delta w = \Delta q = \Delta m$ is equal to 6.466%.

VII. Conclusions

The findings derived in this study are summarised as follow:

1. The money wage rate and price level equations estimated by the OLS/ALS and 2SLS/A2SLS methods confirm the theoretical behaviour of the corresponding economic variables in the Greek economy.

2. The Phillips-Lipsey hypothesis is applicable to Greek data. In fact, the level of unemployment rate and the consumer price index affect the money wage rates, although my findings reveal that the relationship between money wage changes and unemployment rate is not high.

3. My results with respect to the price equation are compatible with the hypothesis that the pricing system by the Greek firms takes place according to the mark-up prime costs (full-cost pricing) principle.

4. The import prices affect the price level in Greece significantly, which is quite reasonable for an open, relatively small economy, such as the Greek economy is.

5. The main costs employed in the price equation are the labour cost and the import prices.

6. The simultaneous determination of prices and money wage-rates is perfectly applicable to Greek data; in other words, there is a strong feed-back effect from price changes to wage changes.

7. Although the present paper reveals that there is evidence supporting the cost-push hypothesis, it would be a mistake, according to Lipsey[40], to try to judge between cost-push and demand-pull hypotheses only.

8. Finally, the predictive power of the money wage rate and price level equations (estimated by the 2SLS/A2SLS method) is given in Figures 1 and 2 respectively, and as it is seen in these figures this is satisfactory within the sample period.

APPENDIX

Data

Year	Money Wages in non-agricultural sector (W)	Employment in non-agricultural sector (EM)	Hours per week HW)	Index of consumer prices (P) 1970:1.0000	Index of import prices (m) At constant 1970 prices
1954	16713.0	1412.447	44.0	0.6358	0.9734
5	19546.0	1446.095	44.0	0.6712	0.9831
6	23458.0	1427.154	44.0	0.7219	1.0313
7	24065.0	1375.140	44.0	0.7303	1.0506
8	25778.0	1460.514	44.0[41]	0.7667	0.9638
9	27582.0	1406.406	44.0	0.7524	0.9542
1960	30484.0	1472.397	44.2	0.7904	0.93949
1	33163.0	1578.925	44.7	0.7996	0.9156
2	36190.0	1581.571	44.1	0.8212	0.9060
3	39691.0	1626.618	43.8	0.8293	0.9060
4	45811.0	1652.142	43.9	0.8605	0.9330
5	52610.0	1687.409	43.8	0.9003	0.9513
6	60415.0	1712.958	43.3	0.9396	0.9600
7	67241.0	1648.758	43.6	0.9360	0.9500
8	75051.0	1630.062	43.7	0.9468	0.9600
9	84195.0	1678.731	43.8	0.9815	0.9600
1970	93913.0	1766.891	44.6	1.0000	1.0000
1	104392.0	1888.291	44.1	1.0300	1.0300
2	120549.0	1945.371	44.6	1.0730	1.1300
3	145548.0	2030.232	43.4	1.2755	1.3400
4	177373.0	2009.835	43.8	1.5940	1.9800
5	217793.0	1980.486	42.7	1.7236	2.3200
6	273887.0	2083.550	41.9	1.9587	2.6000
7	347418.0	2062.167	41.0	2.1885	2.7200
8	427300.0	2184.886	41.2	2.4566	3.0100

Sources: Ministry of Co-ordination's National Accounts of Greece: Nos. 22, 23, 24. Bulletin of labour Statistics. International Labour Office. Geneva.
Monthly Bulletin of Statistics, United Nations.
Statistical Yearbook of Greece, years 1952, 1962, 1972, 1973, 1977.

40. Lipsey, R.G., Op. cit., p. 31.

41. For the data before the year 1958, I used the value of year 1959, that is 44 hours per week, because it was impossible to obtain the actual figures.

Year	Unemployment rate (UR)%	Gross Domestic Product in non-agricultural sector (GDPNA)	Profits in non-agricultural Sector (π) (including depreciation)
1954	5.609	66944.0	38490.0
5	5.654	71455.0	40771.457
6	5.703	79426.0	44199.623
7	10.924	82120.0	46794.338
8	8.558	89068.0	51774.30
9	8.501	92361.0	53261.096
1960	7.423	99338.0	56947.876
1	5.913	105936.0	60602.968
2	5.910	111724.0	63701.232
3	5.653	119577.0	68259.086
4	5.399	131731.0	74283.828
5	5.503	143632.0	80148.099
6	5.697	153324.0	83828.868
7	7.533	161865.0	87214.679
8	6.913	177411.0	95684.60
9	6.512	195116.0	106735.80
1970	5.020	210942.0	117029.0
1	3.341	229889.0	127730.68
2	2.519	252430.0	138766.88
3	2.155	278065.0	158986.98
4	2.574	269635.0	150967.33
5	3.151	283100.0	153541.46
6	2.451	303778.0	159458.32
7	2.230	318483.0	161714.14
8	2.500	336750.0	164249.68

Sources: Ministry of Co-ordination: National Accounts of Greece: Nos. 22, 23, 24.

The money wage rates (w) used in the present study are expressed in manhours (LAB), that is: $w = W/LAB$, where as man-hours I used the time series which result from the formula: Number of Employment (EM) × (Weeks per year) × (Hours per week = HW). In my calculations, I have considered that a year consists of 48 working weeks. Man-hours are expressed in million hours.

The data relevant to Profits in Non-Agricultural Sector, resulted from the formula: Gross Profits in Non-Agricultural Sector (π) = GDPNA (at constant 1970 prices) − Total wages and salaries in Non-Agricultural Sector (at constant 1970 prices).

Finally, the time series of labour productivity in non-agricultural industries (q) are expressed in real and not nominal productivity, and result from the ratio: q=GDPNA (at constant 1970 prices)/Man-hours (LAB).

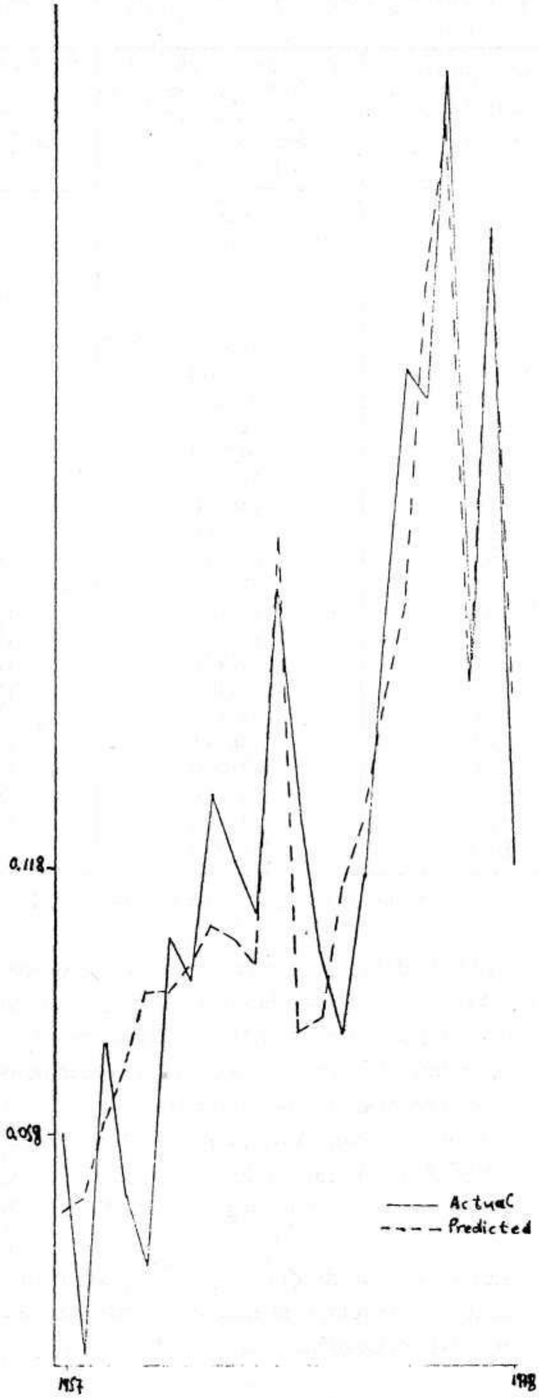

Figure 1
Money wage rate equation

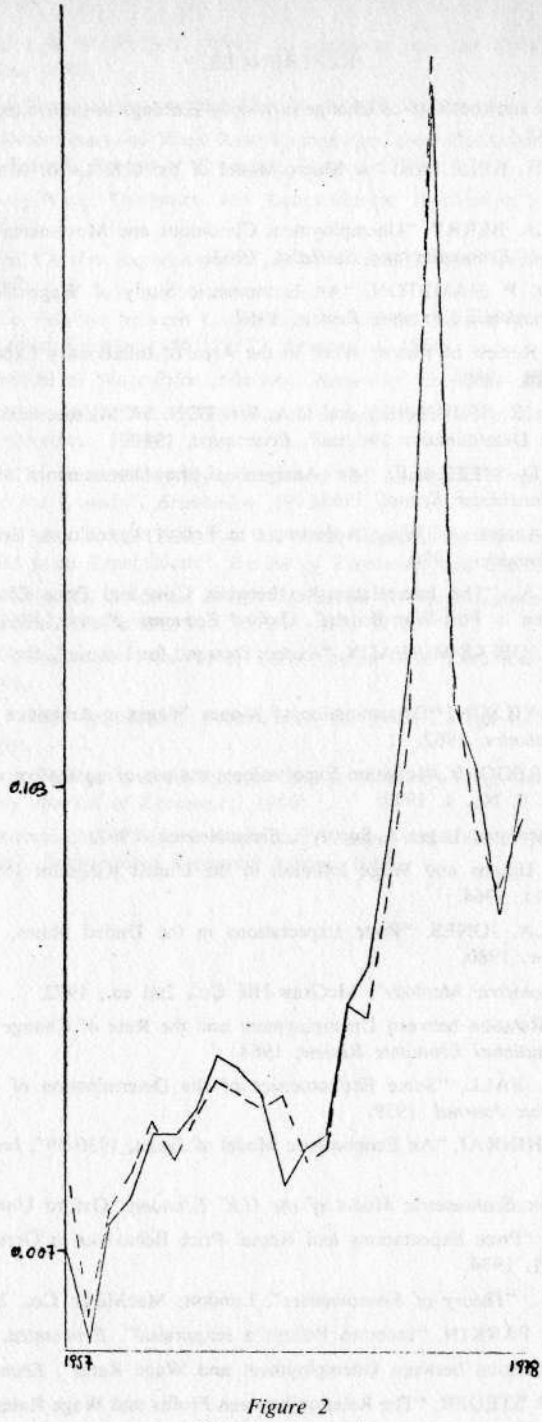

Figure 2
Price level equation

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