

economia

Alternative Estimations of the Wage and Price Equations in Italian Industry

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1. *Introduction*

The aim of jointly pursuing high employment and price stability was put into operation in Italy in the sixties and it revealed itself to be more arduous and urgent during the seventies and in the first half of the eighties when even stagnation periods were characterized by high inflation rates. In the second half to the eighties however inflation were substantially curbed while unemployment still scored highest among EC countries.

For these reasons it seems important to update the wage and price changes specification in the Italian industrial sector where the institutional context shows an inflationary process where conflictual and oligopolistic factors are complementary more than alternative in its specification.

In this framework alternative econometric estimations – ranging from OLS to simultaneous equations methods – are offered in this paper with the purpose of making a contribution in terms of hypothesis testing.

Price stability is here analysed starting from the mark-up theory of price determination. According to this theory entrepreneurs in the industrial sector react to production cost changes, when perfect competition does not hold, via price changes according to a relationship – which is stable on the average – between factor cost and direct cost of a production unit. Indeed

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if prices depend only on costs, the control of the latter – if there is no excess demand on the goods market – implies the control of the former.

The simplest mark-up theory, with reference to the industrial sector, assuming that if labour productivity does not change with output, marginal cost is constant with respect to changes of output – is expressed as follows:

$$p_i = V_i + qV_i \quad (1)$$

where p_i indicates the wholesale price index of industrial goods, V_i represents the unitary direct cost ($V_i = w_i/\pi_i + M_i/x_i$), w_i is the unitary wage in the industrial sector, π_i is the labour productivity, M_i indicates the cost of primary inputs, x_i is the total value added in the sector considered, and q is a gross proportional margin. Only cost changes which hold for all firms modify the general supply conditions, inducing price changes. According to Sylos Labini¹, the cost changes which alter market equilibrium, in the sense that they induce direct cost changes, are essentially two: labour productivity changes, however engendered, provided that they are general, and cost changes of the variable inputs. Consequently price changes can be specified as follows:

$$\dot{p}_i = (1 + q)\dot{V}_i \quad (2)$$

where dotted variables indicate their percentage rate of change.

Nonetheless it is not realistic to assume that demand changes in the goods market induce corresponding supply changes and no price changes, if competition is not perfect and factor prices are rigid downwards. In fact imperfect competition allows for price changes even outside the two cases envisaged by Sylos Labini. Even non generalized changes in the average total costs which should not alter market equilibrium, may give rise to price changes since the cost structure tends to vary among

¹ See P. Sylos Labini, *Prezzi, distribuzione e investimenti: un'interpretazione dello sviluppo post-bellico*, in G. Fuà (ed.), *Lo sviluppo economico in Italia*, vol. II, Milano, F. Angeli 1969, pp. 405-75.

industries and average costs tend to vary within them according to firm size.

The above considerations do not allow us to maintain Sylos Labini's hypothesis of constant marginal cost. Consequently the industrial price changes specification has to include a further determinant given by the changes in inventories. These are related to market demand for goods even though it may be economical to have production runs at constant rate of output. This 'production smoothing' hypothesis, which has found an empirical content in Italy², takes away some relevance of the inventory cycle on price changes. In fact, in this case, entrepreneurs tend to stabilize their production activity via an anticyclical inventories management. On the other hand it can be observed that buyers' resistance to price increases may decline in the phase of building up inventories. Finally the coefficient of the inventories changes is also downward biased because of the implicit positive effect on direct production costs due to possible economizing on scale when sales increase. Though this last effect may be compensated by the opposite influence due to the cyclical changes of the profit margins, which tend otherwise to remain constant in the long run. The specification of the industrial price index changes may then be expressed as follows:

$$\dot{p}_i = d + f\dot{w}_i - g\dot{\pi}_i + h\dot{p}_m + jB \quad f, g, h, j > 0 \quad (3)$$

where p_m indicates the price index of imported primary inputs, as a proxy for the unitary cost of primary inputs, B indicates change in inventories and d, f, g, h, j are parameters.

A further determinant of the industrial price index changes may be found in the expectations errors made by the entrepreneurs in the previous period. In this case unanticipated price changes would be absorbed in the following periods indepen-

² In the period 1962-74, when the relative price stability favoured correct demand expectations, Conti found evidence that Italian suppliers' expected demand for goods was more stable than the effective demand. See V. Conti, *Produzione e domanda in un modello di disequilibrio*, in Aa.Vv., *Contributi alla ricerca economica*, Banca d'Italia Roma, dic. 1975, pp. 89-138, in particular pp. 90-1 and 133-4.

dently of the process according to which price expectation are formed. The specification is then modified in the following way:

$$\dot{p}_i = d + f\dot{w}_i - g\dot{\pi}_i + h\dot{p}_m + jB + 1(\dot{p}_i - \dot{p}_i^e)_{t-1} \quad (4)$$

where $\dot{p}_i^e$ is the expected wholesale price index.

It may be observed that the analysis of price behaviour concerns either the price levels or their structure. This means that, in the context of inflation rates specification, besides the relevance of industrial price changes, also the rigidities and the disequilibria of the distributive and agricultural sectors should be considered. In fact the oligopolistic structure of the market and the wide differentiation in the protection of internally produced goods from international competition has allowed for price increases in the Italian services sector even when industrial goods prices were constant. This is due to a minor difficulty for the former in shifting their cost increases onto prices together with a minor incidence of their primary input cost increases. These considerations underline that the conflict over the distribution of pre-tax income does not only take place between wage and profit earners but also among the profit earners themselves.

In the present model anyway the specification of the expected inflation rates has only been focused on their relationship with the price changes of industrial goods:

$$\dot{p}_c^e = m + n\dot{p}_i \quad n > 0 \quad (5)$$

where $\dot{p}_c^e$ is an expected consumer price index, and m, n are parameters.

The previous analysis of industrial price changes highlights the opportunity of rejecting any monocausal theories of industrial price changes or of the inflationary process where, on the contrary, conflictual and oligopolistic motivations are complementary and not mutually exclusive in their explanations. Indeed this means that wages control is not sufficient for achieving prices control. Furthermore any derivation of trade-off curves between the dependent and each of the independent variables, or other variables related to them, is allowed for only on a *ceteris paribus* condition which is anyhow unrealistic and consequently useless for an analysis aiming to offer an operative contribution

to policy-makers on this issue. Nonetheless, given the widely acknowledged relevance of wage changes to cost and price changes, it is worthwhile to look again at the wage specification in the Italian industry³.

The most significant contribution to the explanation of monetary wage changes remains the Phillips curve as integrated by Lipsey, in spite of the significant changes which have taken place in the labour market during the seventies and the eighties – i.e. new forms of income support, balkanization of the labour markets, increased bargaining power of the unions, increased institutional protection of wages against inflation:

$$\dot{w}_i = o + sU_i^{-1} + t\dot{p}_c \quad s, t > 0 \quad (6)$$

where U_i is the percentage rate of industrial unemployment and p_c is the consumer price index; o, s, t , are parameters.

Many doubts have been cast by scholars on the theoretical and empirical relevance of labour productivity changes on monetary wage changes. Inasmuch as value added changes per worker indicate an increase in the entrepreneurs ability to pay, it can be expected that the unions' pressure for wage increases may be confronted with less resistance when the compensation for the wage increase has already been realized via labour productivity increase. This compensation may, on one hand, leave the profit margins unchanged and, on the other hand, assure an easier absorption of the industrial products in the market. Furthermore it can be suggested that the uncertain statistical results obtained for Italy about the significance of labour productivity in wage changes specifications are due to different impacts of labour productivity in connection with different magnitudes of unanticipated inflation. In other words the trade unions' bargaining power could possibly be focused more on the effort to regain unanticipated inflation of the previous years, if that is high, than on keeping up with productivity gains. These considerations lead to an integration of the wage changes determi-

³ See G.C. Romagnoli, *I presupposti teorici per una politica dei redditi in Italia*, in G.M. Rey (ed.), *Sistematica e tecniche della politica economica*, Milano, F. Angeli 1984, pp. 477-536.

nation in the Italian industry weighting labour productivity against the percentage rate of unanticipated inflation:

$$\dot{w}_i = o + sU^1 + t\dot{p}_c^e + z((1 - \frac{\dot{p}_c - \dot{p}_c^e}{\dot{p}_c^e})\dot{\pi}_{i,t})_{t-1} \quad (7)$$

where consumer prices have been substituted with their expectations.

2. Alternative estimations

The interdependent system of price and wage structural equations for the Italian industry is now confronted with annual data for the period 1970-1989. Alternative econometric estimations of equations (4), (5) and (7), ranging from OLS to 3SLS and FIML methods are compared.

On top of the asymptotically efficient and consistent simultaneous and system methods OLS have been considered because they are simple to compute, but also on the grounds that some small samples results lead us to use them.

OLS estimations

$$\begin{aligned} \dot{p}_{i,t} = & .00414 + .4774\dot{w}_{i,t} - .841 \dot{\pi}_{i,t} + .00313\dot{p}_{m,t} + \\ & (.184) \quad (2.91) \quad (-4.48) \quad (2.45) \\ & + .0000334B_t + .4748 (\dot{p}_{i,t-1} - \dot{p}_{i,t-1}^e) \\ & (3.155) \quad (3.043) \end{aligned} \quad (4)$$

$$\bar{R}^2 = .871; \text{SER} = .0209; \text{MV} = .12; \chi_A^2(1) = 3.18; \chi_D^2(1) = .812;$$

$$\begin{aligned} \dot{p}_c^e = & .007593 + .982 \dot{p}_{i,t} \\ & (.581) \quad (9.998) \end{aligned} \quad (5)$$

$$\bar{R}^2 = .846; \text{SER} = .024; \text{MV} = .153; \chi_A^2(1) = .216; \chi_D^2(1) = 2.621;$$

$$\dot{w}_{i,t} = .014 + .44226 U_{i,t}^{-1} + .6333 \dot{p}_{c,t}^e +$$

(7.55) (2.926) (7.534)

(7)

$$+ .266 \left(\left(1 - \frac{\dot{p}_{c,t} - \dot{p}_{c,t}^e}{\dot{p}_{c,t}^e} \right) \dot{\pi}_{i,t} \right)_{t-1}$$

(3.107)

$$\bar{R}_2 = .857; \text{SER} = .0205; \text{MV} = .153; \chi_A^2(1) = .017; \chi_D^2(1) = .083$$

3SLS estimations

$$\dot{p}_{i,t} = .0152 + .325 \dot{w}_{i,t} - .931 \dot{\pi}_{i,t} + .00352 \dot{p}_{m,t} +$$

(.561) (1.455) (-4.577) (3.546)

(4)

$$+ .0000441 B_t + .554 (\dot{p}_{i,t-1} - \dot{p}_{i,t-1}^e)$$

(3.624) (3.342)

$$\bar{R}^2 = .902; \text{SER} = .0182; \text{MV} = .12.$$

$$\dot{p}_{c,t}^e = .00571 + .998 \dot{p}_{i,t}$$

(.435) (9.983)

(5)

$$\bar{R}^2 = .862; \text{SER} = .023; \text{MV} = .153$$

$$\dot{w}_{i,t} = .0136 + .486 U^{-1} + .591 \dot{p}_{c,t}^e +$$

(.831) (3.57) (7.03)

(7)

$$+ .262 \left(\left(1 - \frac{\dot{p}_{c,t} - \dot{p}_{c,t}^e}{\dot{p}_{c,t}^e} \right) \dot{\pi}_{i,t} \right)_{t-1}$$

(3.466)

$$R^2 = .879; \text{SER} = .0183; \text{MV} = .153$$

FIML estimation

$$\dot{p}_{i,t} = .0208 + .278 \dot{w}_{i,t} - .964 \dot{\pi}_{i,t} + .00347 \dot{p}_{m,t} +$$

(.539) (1.232) (-2.855) (1.624)

(4)

$$+ .0000453 B_t + .6003 (\dot{p}_{i,t-1} - \dot{p}_{i,t-1}^e)$$

(5.376) (2.159)

$$\dot{p}_{c,t} = .00506 + 1.003 \dot{p}_{i,t} \quad (5)$$

(.136) (4.366)

$$\dot{w}_{i,t} = .0137 + .476 U_{i,t}^{-1} + .6003 \dot{p}_{c,t}^3 +$$

(.436) (1.915) (3.513)

$$+ .268 \left(\left(1 - \frac{\dot{p}_{c,t} - \dot{p}_{c,t}^e}{\dot{p}_{c,t}^e} \right) \dot{\pi}_{i,t} \right)_{t-1}$$

(.805)

(7)

All estimates were performed with TSP

Values in parentheses indicate 't' statistics;

R^2 is the coefficient of determination;

$\bar{R}^2$ is R^2 adjusted for the degrees of freedom;

SER is the standard error of the regression;

MV is the mean value of the dependent variable;

χ_A^2 is the Lagrange multiplier test of residual serial correlation;

χ_D^2 is a heteroskedasticity test based on the regression of squared residuals on squared fitted values.

OLS perform rather well in estimating the wage-price model.

The three equations compare well with those of the 3SLS. The results of the two estimation methods do not appear to be markedly different from each other. The actual estimations tend to group together and their difference is much less than their relative standard errors.

The same considerations do not hold for FIML estimators. The coefficient of wage changes in equation (4) loses most of its significance and this happens to an even greater extent for the coefficient of weighted labour productivity in equation (7). There is apparently an accumulation of systematic errors on this variable, possibly indicating a specification error. This confirms the particular sensitivity of the FIML estimation method to specification errors and underlines the tentative nature of the results of this paper.