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IN ITALY: A CRITIQUE OF
MODIGLIANI AND TARANTELLI

by
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and
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The Wage Inflation - Unemployment Trade-off in Italy: 
A Critique of Modigliani and Tarantelli.*

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Introduction

Wage and price determination in Italy has been investigated by a number of researchers. Differences in their findings prevent the presentation of simple policy prescriptions as to the potentially most effective means of controlling inflation. For example, Ward and Zis (1974) concluded that trade union militancy, as proxied by strike activity, is both a statistically and economically significant determinant of wage inflation. Similarly, Laidler (1976) argued that "strike activity appears to have had a systematic influence on inflation for Italy" though the predictive ability of the fitted wage equation, testing the trade union militancy hypothesis, was not particularly impressive. These conclusions regarding the role of trade union militancy have been challenged by Spinelli (1976) who has shown that an excess demand-expectations model of wage and price determination, adapted for an open economy, can satisfactorily explain the course of inflation in Italy. Whatever may have been the role of trade union militancy in generating inflationary pressures, there is general agreement that excess demand is an important determinant of the rates of change of wages and prices. The apparent presence of various sources of inflationary pressures is best represented by the eclectic approach adopted by Labini (1972). Modigliani and Tarantelli (1973) focussed exclusively on the nature of the relationship between excess demand and wage inflation and concluded that, contrary to the implications of the natural rate hypothesis associated with Friedman (1968), "for a developing country, a permanent reduction of u below some initial natural rate (achieved after an even larger temporary drop) does not generate an increasingly rapid inflation but, on the contrary, is consistent with any stable value of \( \dot{p} \) and \( \dot{w} \), including \( \dot{p} = 0 \)." (1)
The objective of this paper is to critically appraise the empirical findings of Modigliani and Tarantelli and challenge their conclusion that there exists a long-run trade-off between wage inflation and unemployment in Italy. Of course this issue rests on the value of the coefficient on the expected rate of inflation. However, features present in particular wage equations can bias the value of this coefficient in either direction in relation to the critical value of unity implied by the natural rate hypothesis. Thus our investigation of the wage inflation-unemployment trade-off requires that the theoretical framework employed by Modigliani and Tarantelli be scrutinized.

In Section II we present the Modigliani-Tarantelli model and draw attention to its most important features. Section III presents statistical evidence relevant for an appraisal of the robustness of the Modigliani-Tarantelli conclusions. Our conclusions which are briefly stated in Section IV suggest that the proposition that there is a long-run trade-off between wage inflation and unemployment cannot be sustained.

Section II

Modigliani and Tarantelli rest their analysis of Italian wage inflation on the assertion that "the fundamental feature of the labour market in a developing country is the strong heterogeneity of the available labour force." They define a developing country as one "which starts out with a substantial volume of structural unemployment and gradually works it down in the development process." It is, then, argued that in such an economy the labour force can be split into two segments: the trained and the untrained workers. It follows, therefore, that the unemployed workers can be divided into two groups: those who possess some skill and those who have none. It is on this distinction,
based on the degree of skill possessed by the unemployed, that the fundamental hypothesis tested by Modigliani and Tarantelli rests. They hypothesize that any given level of unemployment will reflect a different level of excess demand depending on the ratio of the trained to untrained workers seeking employment, that is, "any given level of unemployment will tend to produce a smaller downward pressure on wages, the larger the portion of unemployment that is accounted for by the untrained unemployed." In other words, Modigliani and Tarantelli hypothesize that in a "developing country" the relationship between unemployment and excess demand will so change during the process of industrialization as to shift the Phillips curve towards the origin. Given that untrained workers receive some skill when employed in times of high excess demand, a family of Phillips curves can be drawn each associated with the minimum level of unemployment previously reached. This, then, implies that the relevant short-run Phillips curve is nearer to the origin, suggesting an improved trade-off relationship between unemployment and wage inflation, the lower the level of unemployment achieved in the past. This hypothesis in itself is perfectly consistent with the natural rate of unemployment hypothesis. All that it argues is that structural changes in the labour market will tend to reduce the natural rate of unemployment. Consequently, the Modigliani and Tarantelli analytical framework cannot be viewed as an alternative to that presented by Friedman in which the trade-off between unemployment and wage inflation is predicted to be only a short-run phenomenon. It, therefore, follows that the issue under contention is an empirical one and relates to the particular features of the chosen equation to be estimated.

Modigliani and Tarantelli in developing their analysis of the implications of the heterogeneity of the labour force in establishing the adequacy
of the level of unemployment to measure the true level of excess demand in the labour market derived the following equation

\[ \dot{w} = a + B \frac{1 - \beta (u_m - \gamma)}{u - \beta (u_m - \gamma)} + D \dot{p}_c \]  

(1)

where \( \dot{w} \) and \( \dot{p}_c \) are the rates of change of money wage rates and of the deflator for private domestic consumption respectively, \( u \) is the level of unemployment while \( u_m \) denotes the minimum level of unemployment previously reached. The parameter \( \beta \) indicates the weight to be attached to an untrained worker for the purposes of adjusting aggregate unemployment. Finally, \( \gamma \) is described, somewhat misleadingly, as the level of 'frictional' unemployment. In effect \( \gamma \) represents an irreducible level of unemployment which cannot be affected by real changes such as greater mobility or improved information in the labour market. In their empirical work Modigliani and Tarantelli utilized data for unemployment both for the whole economy and for the non-agricultural sector alone. Their findings were not affected by the inclusion/exclusion of the agricultural sector. Their annual data covered the years 1952-1968.

Modigliani and Tarantelli, however, did not estimate equation (1). They argued that equation (1) "has the property that for a developed country operating in the neighbourhood of full employment, so that \( u_m = \gamma \), it reduces
to the standard Phillips-Lipsey version. However, in our view, this version suffers from one shortcoming: it implies that $u$ has a lower bound of zero and, hence, could be smaller than minimum frictional unemployment, which is an obvious contradiction." Thus in order to eliminate this contradiction they proceeded to estimate the following equation:

$$
\dot{w} = a + B \frac{1 - \beta(u_m - \gamma)}{u - \gamma - \beta(u_m - \gamma)} + D \dot{\rho}_c
$$

We would argue that what Modigliani and Tarantelli identify as a "contradiction" is as relevant to their theoretical framework as to that associated with the studies by Phillips and Lipsey. Setting $u_m = \gamma$ implies that for a developed country the Phillips curve wage equation reduces to

$$
\dot{w} = a + B \frac{1}{u - \gamma} + D \dot{\rho}_c
$$

However, the Modigliani-Tarantelli argument is not free from an element of circular reasoning. They, first, choose a level of unemployment and postulate that this is the minimum that can be reached and, then, identify the existence of a logical contradiction in allowing a level of unemployment below that which is defined as the minimum attainable. Whatever the merits of this argument may be, we would contend, however, that consistency requires that equation (1) is compared with the conventional Phillips curve type of wage equation. Alternatively, if equation (2) is chosen, its performance must be contrasted not with the usual wage equation but with $u - \gamma$ being the measure of excess demand in the labour market. If the second alternative is chosen, then it follows that whatever differences may emerge will not simply be due to the adjustments to the proxy of excess demand required by the heterogeneity of the labour force in a developing economy.

In estimating equation (2) Modigliani and Tarantelli justify the inclusion of $\dot{\rho}$ as an independent variable in terms of the Italian "institutional and legal practice...to tie wages explicitly to prices through escalator clauses."
They describe the inclusion of $\hat{p}$ in wage equations as a "thorny issue" which, however, is not particularly crucial for their purposes as they are "concerned primarily with the short-run Phillips curve." These arguments are difficult to interpret. Indeed, the discussion by Modigliani and Tarantelli of the role of $\hat{p}$ in wage equations is difficult to reconcile with the presentation of their model as one that is based on the "new" microeconomics. Given that they accept that wages are competitively determined and the theoretical foundations of their model there can be no doubt that logical consistency necessitates the inclusion of the expected rate of inflation as an independent variable in the wage equation, however it may be proxied. Further, the analytical distinction that Modigliani and Tarantelli make between the short and the long-run carries no implication regarding the inclusion/exclusion of $\hat{p}$ in the wage equation. For purposes of estimation this distinction is of no relevance. If $\hat{p}$ is a determinant of wage inflation there is no sense in postulating that estimating a short-run Phillips curve implies its exclusion while the long-run Phillips curve requires its inclusion. The existence or otherwise of a long-run trade-off between wage inflation and unemployment can be deduced solely from the value of the coefficient on the expected rate of inflation which, in the case of Modigliani and Tarantelli, is in effect proxied by $\hat{p}_c$. It follows, therefore, that we do not regard their comments on the role of $\hat{p}$ as consistent with their framework and, by implication, view, as we shall argue below, certain of their conclusions to be of doubtful validity.

Modigliani and Tarantelli estimated equation (2) and contrasted its performance with that of the following:

$$\dot{w} = a + BU^{-1} + D\hat{p}_c$$  \hspace{1cm} (3)

They concluded that their equation performed better than equation (3). This conclusion rested on comparisons of $R^2$ and standard errors. Further,
they claimed that their equation is superior as it leads to more intuitively plausible values for the parameters a and D. The coefficient on \( p \) assumes a value of 0.80 when equation (2) is estimated in contrast to a value of 1.13 when equation (3) is estimated. The former value is described to be "in line...with a priori expectations." Similarly, the increase in the value of the constant from 1.07 to 3.4 when equation (2) is estimated, is interpreted as reflecting more accurately "the strong trade union power and the labour market segmentation that...characterizes the Italian economy." This leads them to conclude "that even in the early stages of development, the trade union awareness of the long-run rate of increase of productivity tends to set a lower limit to the rate of increase of wages" so that "even when unemployment is high, trade union power succeeds in forcing increases in wages commensurate to the productivity trend." This particular interpretation of the size of the constant is hardly justified. Modigliani and Tarantelli simply assert that the constant reflects the impact of trade union power on wage inflation. It is not clear, however, why the constant is not indicative of employers' attitudes and bargaining strength rather than trade union power. Finally, Modigliani and Tarantelli draw attention to the fact that equation (3) "substantially underestimates the unusually high rate of change of wages in 1963" while their equation does not suffer from such a weakness.

These empirical findings provide the basis for a number of conclusions, the most important of which is that there exists a long-run trade-off between wage inflation and unemployment in Italy. In the following section we shall assess the robustness of the Modigliani and Tarantelli empirical findings. This assessment, in turn, can permit an evaluation of the relevance of their theoretical framework and, therefore, lead to a judgement of the impact of the heterogeneity of the labour force on the general applicability of the excess demand-expectations model of wage determination.
Section III

We have argued that if it is indeed the case that measuring excess demand in the labour market by the level of unemployment involves a mis-specification, arising from a lack of recogntion that the minimum level of unemployment that can be attained is greater than zero, then, this is a proposition of general applicability and not a necessary feature of the Modigliani-Tarantelli framework only. We, therefore, begin by estimating equation (3) and then contrast it with the following equation

\[ \dot{w} = a + B \frac{1}{u-\gamma} + Dp \]

(4)

We estimated different versions of equation (4), in each of which we allowed \( \gamma \) to assume a different value. We have used the data employed by Modigliani and Tarantelli and our sample period, 1952-1968, coincides with theirs. We have confined ourselves to unemployment data that exclude the agriculture sector.\(^2\)

Comparing equations (3) and (4) suggests that the inclusion of \( \gamma \) will necessarily influence the values of \( a, B \) and \( D \) in specific directions. The inclusion of \( \gamma \) results in the vertical axis, measuring \( \dot{w} \), to shift to the right which, in turn, implies that the Phillips curve will pivot so that the constant term will rise. Further, this shift will bias the value of \( D \) in the downward direction since excess demand is now forced to account for some of the variance of \( \dot{w} \) that in equation (3) is explained by \( \dot{p} \). Finally, the impact of \( \gamma \) on \( B \) will be to reduce its value. Thus, we would expect the value of \( B \) to be smaller the greater \( \gamma \) is.\(^3\)

Similarly, the greater \( \gamma \) is the lower \( D \) would be and the larger the value that \( a \) would assume. These predictions regarding the impact of \( \gamma \) on the various estimated parameters are confirmed by the empirical results presented in Table 1.
<table>
<thead>
<tr>
<th>Equation</th>
<th>Constant</th>
<th>( \frac{1}{u} )</th>
<th>( \frac{1}{u-1.5} )</th>
<th>( \frac{1}{u-2.0} )</th>
<th>( \frac{1}{u-2.5} )</th>
<th>( \hat{p} )</th>
<th>( R^2 )</th>
<th>SEE</th>
<th>D.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>1.013 (0.699)</td>
<td>20.297 (2.568)</td>
<td></td>
<td></td>
<td></td>
<td>1.088 (3.216)</td>
<td>0.670</td>
<td>2.31</td>
<td>1.77</td>
</tr>
<tr>
<td>1.2</td>
<td>2.073 (1.820)</td>
<td></td>
<td>11.301 (2.708)</td>
<td></td>
<td></td>
<td>0.927 (2.708)</td>
<td>0.720</td>
<td>1.75</td>
<td>2.20</td>
</tr>
<tr>
<td>1.3</td>
<td>2.643 (2.584)</td>
<td></td>
<td></td>
<td>8.491 (2.366)</td>
<td></td>
<td>0.807 (2.366)</td>
<td>0.745</td>
<td>1.73</td>
<td>2.10</td>
</tr>
<tr>
<td>1.4</td>
<td>2.958 (3.040)</td>
<td></td>
<td></td>
<td></td>
<td>7.312 (2.179)</td>
<td>0.738 (2.179)</td>
<td>0.760</td>
<td>1.70</td>
<td>2.04</td>
</tr>
<tr>
<td>1.5</td>
<td>3.617 (4.018)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.322 (4.062)</td>
<td>0.605</td>
<td>1.68</td>
<td>1.90</td>
</tr>
</tbody>
</table>

* t-values in parentheses
Evidently, therefore, the reduction in the value of the coefficient on $p$ and the increase of the constant which Modigliani and Tarantelli identified when comparing their preferred equation [equation (2)] to the conventional Phillips curve equation [equation (3)] are not due to their theoretical innovations resting on the heterogeneity of the labour force but to the, somewhat arbitrary, inclusion of $\gamma$.

Assuming that the inclusion of $\gamma$ cannot be sustained, we are led to comparing equation (1) with equation 1.1. In estimating equation (1) we adopted for $\gamma$ the value chosen by Modigliani and Tarantelli as well as their estimate of $\beta$. Equation (1) estimated as follows

$$w = -0.542 + 19.832 \frac{u - 2.0}{1 - 0.50\left(\frac{m}{100}\right)} + \frac{1.137p}{u - 0.50(u - 2.0)} (4.100) c$$

(1)

$$R^2 = 0.760 \quad \text{SEE} = 2.00 \quad \text{D.W.} = 1.85$$

Equation (1) is hardly consistent with some of the conclusions reached by Modigliani and Tarantelli. The coefficient on $p$ is not significantly different from unity implying no long-run trade-off between unemployment and wage inflation. Secondly, in terms of their arguments, the low value of $\gamma$ would indicate that either trade unions were extraordinarily docile, or that employers were exceptionally intransigent, or a combination of the two during the period 1952-68. However, equation (1) does perform marginally better than 1.1 in terms of the standard error. It could, therefore, be argued that by allowing for the heterogeneity of the labour force, Modigliani and Tarantelli were able to present a framework potentially superior to that conventionally employed in studies of wage determination. However, before such an argument could be accepted it is necessary to establish that this apparent superiority
is solely due to the theoretical innovations of Modigliani and Tarantelli and not to some other feature of their empirical work. Thus we decided to ascertain the impact that the unemployment variable employed by Modigliani and Tarantelli may have had.

Diagram 1 presents the values of unemployment used in equations 1.1 and (1), as well as that implied by the estimation of equation (2). It is evident that, however it is measured, unemployment reached its lowest value in 1963 when wage inflation reached a peak. However, if we adopt the Modigliani and Tarantelli preferred equation, i.e. equation (2) the fall in unemployment in 1963 is much more dramatic than if we measured the unemployment variable either as implied by equation (1) or equation (3). Given that between 1962 and 1963 the level of unemployment was reduced from 3.68% to 3.03% it is hardly surprising that equation 1.1 will seriously underpredict 1963. On the other hand, equation (1), given the value that the unemployment variable assumes, can be expected to perform somewhat better than equation 1.1 with respect to 1963. However, this would imply that the difference between equations 1.1 and (1) is entirely due to their performance with respect to the observations generated by a single year.

Prompted by these observations we re-estimated equation 1.1 and included a dummy variable for 1963. We obtained the following:

\[ \hat{\omega} = 3.025 + 14.237 U^{-1} + 0.649 \dot{p} + 7.922 d_{1963} \]  
\[ (2.513) \quad (2.356) \quad (2.343) \quad (3.5955) \]  
\[ R^2 = 0.840 \quad \text{SEE} = 1.701 \quad \text{D.W.} = 2.044 \]
In comparing equations 1.1a and 1.1 we observe that the standard error is significantly reduced from 2.31 to 1.78 and the $R^2$ rises from 0.670 to 0.847. Furthermore, equation 1.1a performs, on these criteria, better than the Modigliani-Tarantelli equation (1). These findings are consistent with those of Vinci (1976) who argued that "the alleged superiority of the estimate associated to the generalized relationship is based upon the comparison with a standard Phillips curve without a dummy, but if a comparison is made between the generalized version and a traditional Phillips curve with a dummy as an extra variable the two estimates coincide to a great extent". It may be argued that the use of a dummy is, in some sense, a convenient technical means of "rescuing" the traditional Phillips curve. Our response to this would be that the use of the particular unemployment variable employed by Modigliani and Tarantelli, given the values it assumes in 1963, amounts, in effect, to including a dummy variable for that year.

In order to investigate further the impact of 1963 on the relative performance of equations (1) and (3) we re-estimated them without the 1963 observations. We obtained the following:

**TABLE 2**

\[
\hat{\omega} = 3.025 + 14.237 u^{-1} + 0.649 \hat{p}_i \\
(2.513) \quad (2.354) \quad (2.343)
\]

\[R^2 = 0.539 \quad \text{SEE} = 1.70 \quad \text{D.W.} = 1.800\]

\[
\hat{\omega} = 1.759 + 13.864 \frac{u - 0.50(u - 2.0)}{100} + 0.766 \hat{p}_i \\
(1.315) \quad (3.124) \quad (3.124)
\]

\[R^2 = 0.613 \quad \text{SEE} = 1.558 \quad \text{D.W.} = 1.877\]

It is evident that in terms of standard error and $R^2$ equation 2.2 performs better than 2.1, but only marginally. However, in terms of the Modigliani-Tarantelli
arguments, equation 2.2 performs worse given that the values of the constant and the coefficient on $\hat{p}_C$ are respectively lower and higher than those derived when estimating the traditional Phillips curve.

On the basis of our empirical findings so far, we can conclude that the theoretical framework of Modigliani and Tarantelli does not provide a basis for deriving a wage equation superior to that which ignores the heterogeneity of the labour force. We have seen that the inclusion of $\gamma$, Table 1, which is not a prediction of the Modigliani-Tarantelli analysis, introduces a downward bias in the coefficient on $\hat{p}_C$ and that the 1963 observations are all important in generating the statistical superiority of their predicted equation vis-à-vis the conventional Phillips curve wage equation.

It may be objected that our conclusion is of limited interest given that Modigliani and Tarantelli did not estimate equation (1) but equation (2). Our response to this objection would be that given the sensitivity of $D$ to the value attached to $\gamma$, a consistent comparison of equations (2) and (3) necessitates that $\gamma$ is freely estimated and not given some or other arbitrary value, as was done by Modigliani and Tarantelli, however intuitively plausible this may be. Thus we re-estimated equation (2). Our findings are presented in Table 3, equation 3.2, in which we, also, for comparison purposes, reproduce the estimates presented by Modigliani and Tarantelli, equation 3.1.

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>B</th>
<th>$\gamma$</th>
<th>$\beta$</th>
<th>D</th>
<th>$R^2$</th>
<th>SEE</th>
<th>D.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>3.4</td>
<td>2.38</td>
<td>[2.0]</td>
<td>[0.56]</td>
<td>0.80</td>
<td>0.89</td>
<td>1.39</td>
<td>1.86</td>
</tr>
<tr>
<td></td>
<td>(5.2)</td>
<td>(6.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>3.948</td>
<td>2.995</td>
<td>2.120</td>
<td>0.428</td>
<td>0.582</td>
<td>0.88</td>
<td>1.55</td>
<td>2.01</td>
</tr>
<tr>
<td></td>
<td>(3.925)</td>
<td>(1.941)</td>
<td>(5.354)</td>
<td>(2.800)</td>
<td>(2.000)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Estimating equation (2) freely the values for $\gamma$ and $\beta$ that minimize the standard error are not particularly different from those found in the Modigliani and
Tarantelli study. However, in line with the results presented in Table 1, the rise in the value of \( \gamma \) from 2.0 to 2.1 is sufficient to reduce the value of \( D \) from 0.80 to less than 0.60. But the most important effect of estimating freely equation (2) relates to the standard error on the coefficient on the excess demand variable. This increases dramatically with the result that the \( t \)-value collapses from 6.4 to less than 2.0. We would, therefore, argue that an equation that is as sensitive as equation (2) appears to be a marginal increase in the value of \( \gamma \), can hardly provide the basis for accepting the conclusions reached by Modigliani and Tarantelli.

The doubts stemming from equation 3.2 regarding the robustness of the Modigliani-Tarantelli empirical findings prompted us to fit equation (2) over the period 1952-1976, always employing their data and definitions. We obtained the following

<table>
<thead>
<tr>
<th>( a )</th>
<th>( B )</th>
<th>( \beta )</th>
<th>( \gamma )</th>
<th>( D )</th>
<th>( D^2 )</th>
<th>SEE</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>3.155</td>
<td>5.730</td>
<td>0.304</td>
<td>1.935</td>
<td>0.842</td>
<td>0.839</td>
<td>2.725</td>
</tr>
<tr>
<td>(1.933)</td>
<td>(1.222)</td>
<td>(1.067)</td>
<td>(1.907)</td>
<td>(6.656)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The addition of the years 1969-1976 results in the \( B \), \( \beta \) and \( \gamma \) coefficients being insignificant and equation 4 cannot be judged as impressive on any criterion. However, it could be said that the 1969 "hot autumn" did give rise to such observations for 1970 as to bias the performance of the equation. Thus we re-estimated equation (2) with a dummy for 1970. Our findings were:

<table>
<thead>
<tr>
<th>( a )</th>
<th>( B )</th>
<th>( \beta )</th>
<th>( \gamma )</th>
<th>( D )</th>
<th>( d ) 1970</th>
<th>( R^2 )</th>
<th>SEE</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.a</td>
<td>3.729</td>
<td>2.135</td>
<td>0.481</td>
<td>2.012</td>
<td>0.922</td>
<td>8.508</td>
<td>0.907</td>
<td>2.128</td>
</tr>
<tr>
<td>(3.814)</td>
<td>(1.174)</td>
<td>(2.588)</td>
<td>(3.648)</td>
<td>(9.482)</td>
<td>(3.787)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Including a dummy for 1970 affects the statistical significance of \( \beta \) and \( \gamma \) but not of the coefficient on excess demand. Furthermore, the coefficient on \( \hat{p}_c \), \( D \), is now not significantly different from unity, implying that there does not exist a long-run trade-off between wage inflation and unemployment. However, whether we take 4 or 4a we are inevitably led to the conclusion that the relationships predicted by the Modigliani-Tarantelli framework are hardly
stable. But there does still exist the question of whether their equation
performs better than the conventional wage equation associated with the
Phillips curve. Thus, we estimated equation (3) for the period 1952-1976
and obtained:

5. \[ \dot{w} = 1.614 + 21.370U^{-1} + 0.838\delta + 7.070d1970 \quad R^2 = 0.870 \quad SEE = 2.386 \quad DW = 2.192 \]
   (1.160) (2.954) (8.233) (2.840)

The main difference between 5 and 4a lies in that the coefficient on the excess
demand variable is significant and the constant insignificant when a conven-
tional Phillips curve is estimated. The conclusion that the Modigliani-
Tarantelli chosen equation does not perform better than the conventional wage
equation is not dependent on employing \( U \) rather than \( U - \gamma \) as the proxy variable
for excess demand. Equation 6 uses the latter measure and gives:

6. \[ \dot{w} = 3.232 + 6.265\frac{1}{U-2.0} + 0.820\delta \quad R^2 = 0.880 \quad SEE = 2.257 \quad DW = 2.270 \]
   (3.671) (3.385) (8.363) (2.998)

It is evident that 6 is just as superior to 4a as 5. We are, therefore, led
to conclude that when the sample period is extended to 1976 the Modigliani-
Tarantelli preferred equation performs unimpressively and, certainly, worse
than the conventional Phillips curve type of wage equation. This conclusion
in no way depends on utilizing a dummy for 1970. Without it the Modigliani-
Tarantelli equation performs, if anything, worse than with it. However, as
equation 7 indicates, even when we exclude the dummy for 1970 the conventional
wage equation still performs better than either 4 or 4a.

7. \[ \dot{w} = 1.201 + 25.590U^{-1} + 0.807\delta \quad R^2 = 0.821, \quad SEE = 2.743, \quad DW = 2.183 \]
   (0.756) (3.144) (6.935)

Given our arguments so far, a more complete evaluation of the Modigliani-
Tarantelli theses would suggest that equation 7 be compared with an estimate
of equation (1) for the whole period. It was not possible to estimate freely
equation (1). The standard errors were so large that no confident inferences
could be drawn. However, equation (2) when freely estimated, equations 4
and 4a, yielded a value of γ in the region of 2.0. Thus we utilized this
estimate and proceeded to fit equation (1). We obtained the following
results:

<table>
<thead>
<tr>
<th>a</th>
<th>B</th>
<th>β</th>
<th>γ</th>
<th>D</th>
<th>R²</th>
<th>SEE</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.302</td>
<td>24.344</td>
<td>0.357</td>
<td>[2.00]</td>
<td>0.841</td>
<td>0.828</td>
<td>2.748</td>
<td>2.174</td>
</tr>
<tr>
<td>(0.159)</td>
<td>(3.089)</td>
<td>(1.298)</td>
<td></td>
<td>(6.933)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In contrast to equations 4 and 4a the coefficient on the excess demand variable
is now significant but β is insignificant. It is, further, evident that the
Modigliani-Tarantelli preferred equation does not perform better than equation
8. Finally, when contrasting equations 7 and 8 hardly any difference can be
identified so that the Modigliani-Tarantelli conclusion regarding the inferi-
ority of the traditional Phillips curve type of wage equation cannot be sus-
tained. However, rejecting their analytical framework and empirical results
is not sufficient for establishing that equation (3) performs best. Thus,
as a final test we re-estimated equation (3) with the rate of change of un-
employment, \( \dot{u} \), as an additional variable. This modification, of course, brings
equation (3) more in line with the wage equation associated with the Phillips
and Lipsey studies. The equation was estimated with and without a dummy
variable for 1970 and our findings were as follows:

9. \[ \dot{w} = 1.370 + 19.986u^{-1} - 0.075\dot{u} + 0.896\dot{p}_c + 6.706d_{1970} \]
    \[ (1.081) \quad (3.024) \quad (2.333) \quad (9.356) \quad (2.958) \]
    \[ R^2 = 0.898 \quad \text{SEE} = 2.171 \quad \text{DW} = 2.393 \]

10. \[ \dot{w} = 0.960 + 23.873u^{-1} - 0.081\dot{u} + 0.871\dot{p}_c \]
    \[ (0.651) \quad (3.154) \quad (2.172) \quad (7.806) \]
    \[ R^2 = 0.854 \quad \text{SEE} = 2.537 \quad \text{DW} = 2.293 \]

The inclusion of \( \dot{u} \) improves somewhat the performance of equation (3). Con-
sequently, both equations 9 and 10 are superior to the Modigliani and Tarantelli
equation 8.
It is of interest to note that equations 8, 9 and 10 estimate a coefficient on $\dot{p}_c$ not significantly different from unity which implies that there is no long-run trade-off between wage inflation and unemployment. We re-estimated these equations constraining the coefficient D to unity. Our findings were:

8.a

\[
\begin{array}{cccccccc}
 & a & b & b & \gamma & D & R^2 & DW & SEE & F \\
 & 0.024 & 19.975 & 0.494 & (2.00) & (1.00) & 0.814 & 2.026 & 2.792 & 0.425 \\
 & (0.013) & (2.889) & (2.460) & & & & & & \\
\end{array}
\]

9.a

\[
\dot{w}-\dot{p} = 1.465 + 16.540U^{-1} - 0.084\dot{u} + 6.92 \text{d1970} \\
& (1.154) & (2.852) & (2.696) & (3.052) \\
\]

\[
R^2 = 0.586 \quad \text{SEE} = 2.177 \quad \text{DW} = 2.333 \quad F = 0.236
\]

10.a

\[
\dot{w}-\dot{p} = 1.062 + 19.707U^{-1} - 0.093\dot{u} \\
& (0.716) & (2.943) & (2.554) \\
\]

\[
R^2 = 0.402 \quad \text{SEE} = 2.556 \quad \text{DW} = 2.204 \quad F = 0.332
\]

The F-test indicated that for none of the three equations can the hypothesis that the coefficient on $\dot{p}_c$ equals to unity be rejected. Consequently, we can conclude that even on the basis of the Modigliana-Tarantelli equation the conclusion that there is a long-run trade-off between wage inflation and unemployment cannot be sustained.
Section IV

We have argued that the theoretical framework employed by Modigliani and Tarantelli involved no analytical innovation that could justify its treatment as an alternative to the natural rate hypothesis. We have drawn attention to an adjustment to the unemployment variable in their empirical work which does not logically follow from their analysis. We have contended that if this adjustment, namely the inclusion of $\gamma$, is accepted, then consistency requires that $u-\gamma$ be the relevant excess demand variable in the conventional Phillips curve. This was not, however, the basis of comparison that led Modigliani and Tarantelli to conclude in favour of their own equation. We have shown that all the parameters are particularly sensitive to the value assumed by $\gamma$. Our empirical findings show unequivocally that the larger $\gamma$ is the lower the coefficient on $\dot{p}$ will be, resulting, consequently, to misleading conclusions regarding the existence of a long-run trade-off between wage inflation and unemployment. We have criticized Modigliani and Tarantelli for not estimating freely their preferred equation and have shown that when this is done their conclusions are less than well founded. Abstracting from the impact of $\gamma$ it has been demonstrated that the relative inferiority of the traditional Phillips curve over the sample period 1952-1968 is entirely due to the 1963 observations and the values assumed by the unemployment variable for that year when the Modigliani-Tarantelli definition is adopted. However, over the longer period, 1952-76, the equations derived from their framework are less than impressive. This is especially the case with their preferred equation that includes $\gamma$. Further, when the sample period is extended to include the 1970s, the conventional Phillips curve, including $\dot{u}$ as an independent variable, performs best. Furthermore, our findings point to the conclusion that contrary
to what Modigliani and Tarantelli argued there does not exist a long-run trade-off between wage inflation and unemployment in Italy. Note that this conclusion is valid for both sample periods when equation (1), i.e., the equation that directly follows from their analytical framework, is estimated. Consequently, we are led to the conclusion that the Modigliani-Tarantelli framework does not provide a basis for the analysis of wage determination superior to that associated with the natural rate hypothesis.
I

FOOTNOTES

1. On the other hand, Cross and Laidler (1976), Spinelli (1976) and Valcamonici (1973) present empirical results contradicting this conclusion.

2. For sources and definitions of data see Modigliani and Tarantelli (1973).

3. However, the degree of bias introduced, for any given value of $\gamma$, depends on the average level of unemployment during the sample period. Thus, the bias will be quantitatively larger, the larger the number of years with high unemployment within the sample period.
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Cross, R. and D. Laidler (1976): 'Inflation, excess demand and expectations in fixed exchange rate open economies: some preliminary empirical results' in M. Parkin and G. Zis (eds), Inflation in the World Economy, M.U.P.


Spinelli, F. (1976): 'The determinants of price and wage inflation: the case of Italy', in M. Parkin and G. Zis (eds) Inflation in Open Economies, M.U.P.

