Structural and Transitory Determinants of Labour Mobility: "Holt's Conjecture" and Italian Experience

1. Introduction*

Labour mobility, especially in recent years, has attracted the attention of trade union and industrial relations experts, sociologists and students of politics. This growing literature has, unfortunately, not been matched to date by an equal interest on the part of economists. Indeed, the only theoretical model of the labour market to be founded on the turnover rate is that of Holt. He assumes that the two main components of turnover — the flows of hirings and separations (layoffs and quits) — are random variables which remain essentially constant as aggregate demand varies. However, this assumption, which we shall call "Holt's conjecture" (and which R. Hall and others have gone so far as to call "Holt's law"), cannot be justified either on theoretical grounds or on the basis of our empirical tests.

The central conclusion of our study is that the flows of both hirings and separations are considerably affected by both cyclical (or transitory) determinants connected with the demand for labour, and by structural determinants connected with the proportion of employment accounted for by marginal workers with a lower degree of

* The equations proposed in this article are part of the Banca d'Italia's econometric model, M2 BI. The authors wish to thank the participants in a seminar held in the Banca d'Italia's Research Department, during which a preliminary draft was discussed. Our special thanks go to P. Maggi for his constant and invaluable help in the collection of data and econometric estimation, to F. Carmignani of the CESPE for helpful discussions regarding the criteria adopted in the preparation of statistics and their reliability, to E. Pinelli of the Ministry of Labour for his cooperation during the collection and analysis of the data used for the empirical test, and to D. Siniscalco for a number of useful discussions of the subject. The authors remain, of course, responsible for the views expressed and any remaining errors.

job stability. In the case of Italy, furthermore, the turnover rate has been quite considerably affected since the "hot autumn" of 1969 by the greater strife in industrial relations (the so-called Workers' Statute) and, in particular, by the trade unions' "freezing of layoffs" and firms' "freezing of hirings", as well as by the fall in quits in the face of rising unemployment. Both these determinants of a socio-political nature have had a stronger effect since the oil crisis of end-1973 and the growth in expectations of greater unemployment associated with the embargo of the oil-producing countries. In addition, our theoretical model is capable of generating, together with the market and socio-political determinants described above, an inversion of the Phillips curve (with clockwise loops rather than the traditional anticlockwise ones) when demand for labour is particularly high. As will be shown, this can be the result of an increase in the flow of quits which is not offset by a reduction in the flow of layoffs and an increase in that of hirings.

"Holt's conjecture" and the implications of its theoretical construction for the labour market and the Phillips curve are examined in the next section. In Section 3 we describe our basic model and its implications for the structural and transitory determinants of labour mobility. In Section 4 we set out the results of the empirical test made with reference to the flows of hirings and separations in Italy. We then discuss the implications of the model and present our conclusions.

2. "Holt's Conjecture" and the Implications of its Construction

Let P_s be the probability that a single unemployed worker finds one vacancy in a unit of time and P_h the probability that the ensuing job interview ends with acceptance on both sides. The probability that an unemployed worker will find work, P_u, can therefore be expressed as the product $P_h P_s$, multiplied by the number of vacancies, VP_hP_s. The probability of a hiring in the unit of time chosen, P_u, can, in turn, be expressed as the reciprocal of the average time it takes an unemployed worker to find a job, $1/T_u$. Thus, if in equilibrium the average search time is two days, the probability that the worker will find employment is, on average, equal to one half per day. Analogously, the probability that a firm will fill a vacancy

in a unit of time, P_v, can be expressed as the sum of the product P_hP_s for all unemployed workers, $UP_hP_s=1/T_v$. It follows, as Holt also suggests,[1] that with random sampling of the available job offers, P_u and P_v can be considered as proportional to the number of unemployed workers and that of vacancies respectively,

$$[1a] \qquad P_u = \frac{VP_h}{T_s} = \frac{1}{T_u}$$

$$[1b] \qquad P_v = \frac{UP_h}{T_s} = \frac{1}{T_v}$$

where T_u and T_v, which are respectively the average duration of unemployment and the average time taken to fill a vacancy, can be expressed as the reciprocals of P_u and P_v, and $T_s=1/P_s$ is analogous to T_u and T_v and represents the average time taken to search for a single vacancy.

Multiplying the probability of a hiring in a unit of time, P_u, by the total number of unemployed, U, (or P_v by V), one obtains the flow of hirings, F (identically equal to the flow of vacancies filled) in the unit of time,[2]

$$[2] \qquad F = \frac{U}{T_u} = \frac{V}{T_v} = \frac{UVP_h}{T_s}$$

The flow of hirings can, therefore, be expressed as the ratio of a "stock" (the number of unemployed workers or the number of vacancies) to a "time" (the average duration of unemployment or the average time to fill a vacancy).

In conditions of stochastic equilibrium, F can be considered as approximately constant and interpreted as:

---

[1] C.C. Holt, "Job Search, Phillips Wage Relation, and Union Influence: Theory and Evidence", and also C.C. Holt, "How Can the Phillips Curve be Moved to Reduce both Inflation and Unemployment?" both in E.S. Phelps (ed.), *Microeconomic Foundations of Employment and Inflation Theory*, Norton, 1970. See also C.C. Holt, "Improving the Labor Market Trade off between Inflation and Unemployment", in *Papers and Proceedings of the American Economic Association*, May 1969.

[2] It is interesting to note that a relation not very different from Holt's [2] had already been perceived by Lipsey — see R.G. Lipsey, "The Relation between Unemployment and Wage Rates", in *Economica*, February 1960, p. 15 note (1) — and taken up again by B. Corry and D. Laidler, "The Phillips Relation: a Theoretical Explanation", in *Economica*, May 1967, p. 195.

i) the flow of vacancies filled, which by definition is equal to the flow of hirings;

ii) the flow of new vacancies;

iii) the flow of separations (layoffs and quits). In conditions of stochastic equilibrium, the flow of separations can be considered as approximately constant, in view of the negative correlation between layoffs and quits as demand changes. In fact, at lower levels of demand a larger number of layoffs tends to be matched by a smaller number of quits (and viceversa at higher levels of demand). When the unemployment rate oscillates stochastically about a given value, the flow of separations must tend to equal that of hirings (vacancies filled). Otherwise, the stochastic equilibrium value of the unemployment rate originally assumed would change. It also follows that the flow of new vacancies must tend to equal these magnitudes. The conditions of stochastic equilibrium therefore ensure the equality of the turnover rates i), ii) and iii).

Dividing both the members of [2] by the total labour force, LF (taken here as an exogenous variable of the model) one obtains:

$$[2a] \qquad T_u = \frac{u}{f}$$

$$[3a] \qquad T_v = \frac{v}{f}$$

where u and v indicate respectively the rate of unemployment, U/LF, and the vacancy rate, V/LF, and where $f = F/LF$ is the turnover rate.

From what has been said, it follows that F in Holt's model can only be considered constant if its components in [2] are constant or vary so that they offset each other. In conditions of stochastic equilibrium, it can be assumed that T_s and P_h are given parameters. T_s can be interpreted as a technical constant determined by the information conditions in the economy. P_h, on the other hand, tends to increase on the labour demand side at higher levels of productive activity but, under the same circumstances, to decrease on the supply side, and viceversa. These conditions suggest that P_s is relatively stable, in the absence of unsystematic oscillations. Finally, it seems reasonable, for the reasons set out under point iii), that, with F given and with P_h and T_s also given (in the sense indicated above), the product UV should show relatively small cyclical oscillations and, therefore, that U and V should move in opposite directions as demand varies.

The central postulate of Holt's analysis is that the rate of change of the money wage a worker in search of employment desires, $\dot{w}^d$, can be expressed as a decreasing function of the time spent in search of a job, T_u. This search time, T_u, in turn, is proportional to the unemployment rate, u, with f given:

$$[4] \qquad \dot{w}^d = s(u; f)$$

The unemployment rate can, in turn, be expressed in terms of V using the flow relation [2]:

$$[5] \qquad u/f = \frac{T_s}{P_h V} = \frac{1}{kv}$$

with $k = (P_h/T_s)LF$.

In order to close the model, one can take the identities,

$$U = LF - E$$

$$V = J - E$$

where E and J are respectively total employment and the total supply of jobs. Dividing both relations by the total labour force, one obtains

$$u = 1 - e$$

$$v = j - e$$

with $e = E/LF$ and $j = J/LF$. Subtracting the second relation from the first, one obtains:

$$[6] \qquad v = u + j - 1$$

The relations [4], [5] and [6] form a system of three equations in the three unknowns $\dot{w}^d$, u and v, which, given f and k, can be solved for any given value of j. This is the ratio of the total supply of jobs (the sum of the jobs already filled and vacancies) to the total labour force, and is the parameter of the demand for labour whose value at any moment determines the "stochastic" equilibrium solution of the system.

In Figure 1, equation [6] is shown for two different values of j, with $j_2 > j_1$. Given the inverse relationship between u and v, [5], (represented by the downward sloping curve), the intersection of [6] and [5] determines the equilibrium values of v and u. Finally, the

latter variable determines the corresponding value of $\dot{w}^d$ in [4], in the lower section of the figure.

The uniqueness of the solution and the characteristics of the model depend crucially on the assumption that f can be considered constant in conditions of stochastic equilibrium — an assumption which, rather than "Holt's law",[3] we would be prepared to call "Holt's conjecture". For the reasons just mentioned, the assumption appears fairly reasonable as long as j fluctuates within limits close to its stochastic equilibrium value. But, as we shall try to show in the next section, there is no reason for considering f to be constant *a priori* in disequilibrium conditions. On the contrary, there is reason to believe that it is not constant but tends to vary systematically as the conditions of the labour market change. A number of implications of this confutation of "Holt's conjecture" will be discussed in Section 4.

3. Structural and Transitory Determinants of Labour Mobility

As we have pointed out, the assumption of a constant turnover rate (and, therefore, of constant flows of hirings, separations and new vacancies) limits Holt's model to conditions of stochastic equilibrium and contrasts with the derivation of a Phillips curve in disequilibrium conditions. There are at least three reasons for expecting the flow of hirings not to be constant but, on the contrary, an increasing function of both the level and the rate of change of the demand for labour, j:

i) in the first place, as can be seen from [2], when there is an increase in the demand for labour, the increase in V will tend to occur "before" there is any decrease in U. Their *ex post* product may prove to be relatively stable for statistics regarding sufficiently long periods; but statistics collected at the aggregate level (even on a quarterly basis) may still understate the variability of this aggregate[4] within the period;

[3] See R.E. Hall, "The Process of Inflation in the Labor Market", in *Brookings Papers on Economic Activity*, no. 2, 1974, pp. 355-6.

[4] For a discussion of the *ex ante* and *ex post* variability of the product uv, see J. C.R. Dow and L.A. Dicks-Mireaux, "The Excess Demand for Labor: A Study of Conditions in Great Britain, 1946-1956", in *Oxford Economic Papers*, February 1958. Phelps has estimated a relation between u and v which suggests pro-cyclical variations in their product; see E.S. Phelps, "Money Wage Dynamics and Labor Market Equilibrium", in *Microeconomic Foundations...*, *op. cit.* More recently, a relation analogous to that estimated by Phelps has been found for England by J.I. Foster, "The Relationship between Unemployment and Vacancies in Great Britain (1958-72): Some Further Evidence", in D. Laidler and D.L. Purdy (eds.), *Inflation and Labor Markets*, Manchester University Press, 1974.

ii) furthermore, in conditions of involuntary unemployment, given the minimum acceptance wage rate, an increase in the rate offered by firms will have the effect of increasing the probability that the finding of a vacancy will lead to acceptance on both sides. The flow of hirings will be correspondingly high. This suggests that, as a first approximation, P_h in [2] should be rewritten as an increasing function of the difference between the rate of change of the average money wages paid to workers and offered to applicants, and the rate of change of the average wage demanded, $\dot{w}^d$. In conditions of disequilibrium, the demanded wage can diverge from the offered wage,

$$[10] \qquad P_h = \pi(\dot{w}^o - \dot{w}^d),\ \pi' > o$$

where $\dot{w}^d$ can now be thought of as the average of the frequency function of the money wages demanded by workers in search of employment. In particular, at the beginning of a sharp and unexpected increase in demand, $\dot{w}^o$ will tend to increase since the number of vacancies, V, increases for any given number of unemployed workers, U. The rate of change of wages, $\dot{w}^d$, will only increase, instead, because the number of unemployed workers and the average duration of unemployment tend to fall in subsequent periods. This effect is reinforced by the greater uncertainty of the labour market for the single worker compared with firms, which, from time to time, decide and, therefore, know what their employment policy is. The single worker is ready to mistake a higher offered wage for a better employment opportunity than those considered on average to be available in the labour market.[5] The probability, $P_s = 1/T_s$, of finding a single vacancy can, on the other hand, be considered constant as a first approximation (though it is conceivable that it also tends to increase as demand increases, since a higher v/u ratio would suggest less *interference* between one unemployed worker and another in their search for a job).

[5] As an illustration, this implies that *ex ante* $\dot{w}^o$ can be empirically considered as approximating actual $\dot{w}^o$ and *ex ante* $\dot{w}^d$ with a distributed lag of the values recorded in earlier periods (in conditions of over employment, these relations may be inverted, cf. Section 5).

The above are short-term (i.e. transitory) effects in the sense that they depend on the *variations* in the demand for labour, i.e. $\dot{j}$. These variations, in turn, are reflected in short-term variations of the opposite sign in the unemployment rate. But:

iii) there is a more fundamental reason of a structural nature for expecting higher flows of both hirings and separations, not only when there is an increase in the demand for labour, $\dot{j}$, but also when there is a higher level of demand, j, and, therefore, also in the long-term. In particular, at the same time as demand expands, increasingly marginal labour, which, as is well known, is characterized by higher turnover rates,[6] is taken into production. The higher turnover of these marginal workers is due both to the fact that they are the last to be hired during an expansionary phase and the first to be laid off in a recession, and to their greater propensity to quit. This higher quit rate of marginal workers is due to their inferior career prospects and to the fact that their seniority privileges are usually equally limited. Furthermore, it is much more difficult for trade unions to defend workers in these more marginal jobs when they are laid off. It is to be expected, therefore, that the average turnover flow will have a cyclical pattern as a result of the cyclical variations in the proportion of less stable marginal workers in employment. The possibility that the flow of hirings, F, varies as a direct function of the level of labour demand (in the long term) and of changes in labour demand (in the short term), as the above considerations would suggest, has been recognized from time to time by Holt himself.[7] Nevertheless, he has never gone on to draw the theoretical conclusions, despite the existence of earlier studies along these lines[8] and the possibility of testing the empirical validity of his "conjecture" regarding the fundamental constancy of the turnover rate.

Finally, beyond a certain rate of expansion of the demand for labour, the increase in the flow of quits may not be offset by the fall

[6] See R.E. HALL, "Why Is the Unemployment Rate so High at Full Employment", in *Brookings Papers on Economic Activity*, no. 3, 1970.

[7] See his "The Unemployment-Inflation Dilemma: A Manpower Solution", mimeo, Institute of Urban Studies, Washington, 1973. See also M.S. COHEN and R.M. SOLOW, "The Behaviour of Help-Wanted Advertising", in *Review of Economics and Statistics*, February 1967.

[8] See, in particular, S. BEHMAN, "Labor Mobility, Increasing Labor Demand, and Money Wage-Rate Increases in Manufacturing", in *The Review of Economic Studies*, October 1964.

in layoffs (the flow of which can, of course, never be negative), so that there is an increase in the flow of separations. We shall return to this point in Section 5.

The points raised above suggest that a distinction should be made between the flow of hirings, f_h, and the flow of separations, f_s. In particular, in conditions of disequilibrium, the flow of hirings as a percentage of the labour force, f_h, will, in view of what we have said, be an increasing function of the Keynesian parameter of the demand for labour, j,[9] of its rate of change, $\dot{j}$, and of P_h, which, in turn, depends on $\dot{w}^d$ and $\dot{w}^o$,

$$[11] \qquad f_h = C(j, \dot{j}, \dot{w}^d, \dot{w}^o)\ Cj > o,\ C\dot{j} > o,\ C\dot{w}^d < o,\ C\dot{w}^o > o$$

where Cj represents the long-term change in f_h as a result of a change in the level of j and the consequent structural change in the composition of the labour force discussed above under point iii). In addition, $C\dot{j}$ represents the short-term change in f_h as a result of the disequilibrium changes described above under points i) and ii). Finally, the other two derivatives give the sign of the changes in f_h accompanying the changes in P_h and, therefore, in the arguments of [10].

For every given *level* of j and, therefore, when the market has reached an equilibrium rate of unemployment ($\dot{u} = \dot{j} = o$), f_h in the above expression can be interpreted indifferently, not only as the flow of hirings, but also as the flow of separations, f_s, or of new vacancies, f_v (expressed as a percentage of the labour force, along the lines of Holt's model). But, notwithstanding this coincidence for every given level of j, these parameters are now an increasing function of the level of j (Cj>o in [11] and of its short-term

[9] A more general formulation of the model should also take account of variations in the available labour force. In general, the increase in the labour force in expansionary conditions makes the hypothesis of point i) above regarding an increase in the flow of hirings valid *a fortiori*, in that U declines correspondingly less in [2]. It should be noted, furthermore, that the introduction of a function regarding the labour force would also make the long-term effect of point iii) valid *a fortiori*, as a result of the entry into production of increasingly marginal labour caused by the higher level of j. In order to reduce the formalization of the model to its essential features, we have preferred to omit these complications. It would, however, be possibile to take them into account by making LF endogenous along the lines of the now traditional equation of Tella (see A. TELLA, "The Relationship of Labor to Employment", in *Industrial and Labor Relations Review*, April 1964), and the subsequent literature.

variations ($\dot{Cj} > o$). Furthermore, in conditions of disequilibrium, ($\dot{j} \neq o$), the flow of new vacancies and of layoffs and quits not only may now diverge between themselves, but also be substantially different from the flow of hirings (vacancies filled), as may the total flow of separations.

For example, in an expansionary phase, ($\dot{j} > o$), a bigger flow of hirings may be accompanied by a smaller flow of separations, as a result of a smaller flow of layoffs which is not offset by an increase in quits (and, analogously, for $\dot{j} < o$). This, in turn, suggests that the sign of the change in the flow of separations corresponding to a change in the total supply of jobs, $\dot{j}$, cannot be determined *a priori* (unlike the sign of the flow of hirings), since the two components of the flow of separations (the flows of layoffs and quits) respond to changes in j with changes of opposite sign. We shall return to this point later.

In particular, defining $\dot{V} \equiv V - V_{-1}$, $\dot{U} \equiv U - U_{-1}$, and calling the level of the flow of new vacancies and that of separations (layoffs and quits) in the same unit of time respectively F_v and F_s, we can write:

$$F_s - F_h = \dot{U} = -\dot{E};\ F_v - F_h = \dot{V}$$

for a constant labour force, where F_h denotes the flow of hirings. Dividing both members by the total labour force, LF, we have:

[12] $$f_s - f_h = \dot{u} = -i$$

[13] $$f_v - f_h = \dot{v}$$

where $i = \dfrac{\dot{E}}{LF}$

It should be noted that, in the conditions of non-Walrasian equilibrium discussed above,

$$F_h - F_s \cong F_h - F_v \cong o$$

implies the previously mentioned equality of flows of Holt's model:

$$F_h \cong F_s \cong F_v$$

The total flow of separations can, in turn, be expressed as:

[12'] $$F_h + \dot{U} = F_s = F_s^* + \hat{F}_s = EP_e^* + E\hat{P}_e = E(P_e^* + \hat{P}_e)$$

where F_s^*, $\hat{F}_s$, P_e^* and $\hat{P}_e$ indicate respectively the flow of quits, the flow of layoffs, the probability of a quit and the probability of a layoff in the unit of time chosen, and $(P_e^* + \hat{P}_e)$ is the corresponding probability of a separation. Dividing both members of [12'] by the total labour force, we obtain:

[14] $$f_h + \dot{u} = (1 - u)\ (P_e^* + \hat{P}_e)$$

the *unemployment constraint* of the model. This constraint makes it possible, for given values of the other variables, to determine P_e^* or $\hat{P}_e$. In particular, the latter can be expressed, as a first approximation, as an increasing function of the vacancy rate, v,

[15] $$P_e^* = f(v);\ f_v > o$$ [10]

4. The Empirical Test

For a first empirical test of our hypothesis, we have used data regarding Italy. The figures for the flows of hirings and separations prepared by the Ministry of Labour refer to workers in manufacturing industry effectively employed in the factories surveyed. Firms with less than 12 employees are excluded and this makes the empirical test of our hypothesis more difficult, since it is likely that turnover is highest precisely in these smaller units, as they have a larger proportion of unstable marginal worker. It follows that the turnover

[10] Starting from the view that the flow of quits is mainly an expression of the conditions of labour supply, S. Behman ("Labor Mobility...", *op. cit.*, p. 25) attempted to establish a causal link going from the flow of quits to that of changes in nominal wages. However, the measure required for a test of this kind is a "potential" flow of quits rather than the effective flow (in conditions of involuntary unemployment). Firms can estimate the average number of quits there will be in the absence of an adequate increase in wages and will tend to avoid the related costs by adjusting their wage rates. For these reasons, the actual flows of quits are not likely to be very sensitive to changes in the demand for labour, except in cases of over-employment (in [15], on the contrary, we are interested in the actual and not a potential P_e^*).

(hirings, separations) of the available sample underestimates the variance of the universe.

Our empirical test covers the period from 1965-IV to 1974-II. The estimations do not go beyond 1974 because data were not available for subsequent years at the time our econometric estimates were made. Some checks made by Fabrizio Carmignani of the CESPE (the Centro Studi di Politica Economica of the Italian Communist Party) suggest, moreover, that the figures for the flow of hirings are overestimated by about three percentage points in both the third and the fourth quarters of 1973. The data for 1971 and 1972 also seem to contain some inaccuracies, though much less marked. However, rather than wait for a longer and more accurate series to be made available, we decided to publish the results up to 1974 and to update them when this became possible.

Another difficulty is that the period considered, from 1965-IV to 1974-II,[11] saw a profound change in the climate of industrial relations in Italy. As Figure 1 shows, both the flows of separations (gross of changes in the labour force) and that of hirings fell sharply after the second quarter of 1969, as a result both of the weaker demand for labour, in accordance with what was suggested in the previous section, and of the greater strife which accompanied the wage negotiations of the "hot autumn" of 1969 and the subsequent introduction of the Workers' Statute, which made it more difficult for firms to lay off workers legally. The fall became even sharper after the end of 1973 because of fears of a further worldwide reduction in aggregate demand and employment as a result of the oil embargo. This caused the trade unions and workers to "serry their ranks" against layoffs and reduced the flow of quits. In addition, there was the passing of the law regarding individual labour disputes in August 1973. Under this law, disputes concerning employee workers in both the public and the private sectors were entrusted to (often politically motivated) lower court magistrates (who came to be known as *pretori d'assalto*) rather than to the higher courts. This resulted in cases being decided within two months instead of several

[11] 1965-IV was chosen as the starting date because it was when the Ministry of Labour extended and made changes in the sample of firms it surveyed. The number of hirings and separations were corrected by eliminating transfers between different factories of the same company so as to make turnover rates correspond as faithfully as possible to the cyclical situation considered (cf. C. Dell'Aringa, "La mobilità del lavoro nell'industria", in *Vita e Pensiero*, 1974).

years and thus discouraged firms from laying off workers. As Figure 1 shows, however, firms responded to this fall in separations by considerably cutting back their hirings, the flow of which fell on an annual basis from 32 per cent of the labour force employed in manufacturing industry in 1969 to less than 25 per cent in 1974.

The third factor which makes it difficult to carry out an empirical test of equation [11] in the previous section is that we have no measure of the total supply of jobs (j, the sum of the number of employed workers and that of vacancies), since job vacancy statistics are not available in Italy. For this reason, in the specification of the equation of the flow of separations [12']

$$[12''] \qquad F_s = E(P_e^* + \hat{P}_e) = E\,P_e$$

we have approximated the probability of a separation, P_e, by taking as a measure of the level of the demand for labour the ratio of unemployed workers to employed workers in manufacturing industry, or:

$$[16] \qquad \frac{F_s}{E} = P_e = \alpha + \beta\,\frac{U}{E} + \gamma\left(\frac{\dot{U}}{E}\right);\ \alpha > 0,\ \beta < 0,\ \gamma \gtrless 0$$

where the expected signs reflect the hypotheses discussed in the previous section. Not having statistics referring exclusively to unemployed blue-collar workers in manufacturing industry (to which, instead, both the flows and the number of employed workers used as the denominator of f_h and f_s refer), we have taken a measure of the total number of unemployed blue and white-collar workers. The latter, as is well known, represented a fairly small and constant proportion of total Italian manufacturing employment over the period in question.

Expressing the total flow of separations as a ratio of the total number of employed workers, it follows that:

$$[17] \qquad f_s = \frac{F_s}{E} = \alpha + \beta\,\frac{U}{E} + \gamma\left(\frac{\dot{U}}{E}\right).$$

The flow of hirings has been approximated analogously, to give the reduced form:

$$[18] \qquad f_h = \frac{F_h}{E} = \hat{\alpha} + \hat{\beta}\,\frac{U}{E} + \hat{\gamma}\left(\frac{\dot{U}}{E}\right).$$

With $\hat{\beta}<0$ and where $\hat{\gamma}<0$ also reflects the effect, $\dot{C}_w^o > \dot{C}_w^d$, in expansionary conditions, along the lines discussed in [11].

Relation [12], $f_s - f_h = \left(\frac{\dot{U}}{E}\right) = \dot{u}$ (dividing both members of the equation by the total number of employed workers rather than by the total labour force) is true, however, only if a constant labour force is assumed. Since it is well known that there were, instead, changes in the Italian labour force during the estimation period, the use of [12] requires that f_s should be gross of the changes in the labour force in manufacturing industry,

$$\frac{\Delta FL}{E}.$$

In other words,

[19] $$f_s^* - f_h = \dot{u}$$

where $f_s^* = f_s + \frac{\Delta FL}{E}$.

Subtracting the members of [18] from those of [17] gross of ΔFL, [19] implies:

[20] $$\alpha = \hat{\alpha} \qquad \beta = \hat{\beta} \qquad (\gamma - \hat{\gamma}) = 1$$

As we emphasized in the previous section, the sign of the effect of changes in the demand for labour — measured in our equation by the variable $\left(\frac{\dot{U}}{E}\right)$ — on the flow of separation, γ is uncertain *a priori* because the changes in the two components of this flow (layoffs and quits) are of the opposite sign. This uncertainty is further complicated in our specification by the fact that the flow of separations is considered gross of the changes in the industrial labour force, which should, in turn, be negatively correlated with $\left(\frac{\dot{U}}{E}\right)$.

In order to take account of the fall in the flow of separations and of the consequent fall in that of hirings, partly attributable to the previously mentioned "exogenous" events (the Workers' Statute, the law regarding individual labour disputes and the oil

embargo), the econometric estimation of the model includes two dummy variables, each of which is introduced in the period in which the corresponding events occurred: the first, d*, in the period from 1970-I (as a result of the climate accompanying the introduction of the Workers' Statute) to 1973-III; the second, d**, in the period from 1973-IV (which saw both the new law concerning the *pretori d'assalto* and the oil crisis) to the end of the period considered, 1974-II. It should be remembered that the inaccuracies in the statistics for the third and fourth quarters of 1973, to which attention was drawn above, imply an underestimation of the coefficients of both dummy variables, which, in turn, "purifies" the estimated coefficients of the other two independent variables.

The empirical test of the model is shown in the following table. In accordance with what we said above in connexion with the dummy variables, the estimation was divided into three periods. The first was unaffected by the "exogenous" events which were subsequently to reduce turnover and goes from 1965-IV to 1969-IV. The second, from 1970-I to 1973-III, includes the dummy variable, d*, which represents the introduction of the Workers' Statute and the strife which was present in the aftermath of the 1969 "hot autumn". Finally, the dummy variable, d**, is added in the third period, from 1973-IV to 1974-II, to take account of the other two determinants.

As can be seen, despite the approximations made necessary by the lack of certain data and inaccuracies in the measurement of others, the results shown in Table 1 are in line with the *a priori* expectations of our model. In particular, in all three periods the coefficients of the variables are of the sign and order of magnitude expected on the basis of [20].

In addition, the significance of the coefficient of the ratio of unemployed to employed workers, U/E, (which measures the structural dependence of both turnover flows on the level of the demand for labour) is extremely high in all the equations. The coefficient of the change in the ratio of unemployed to employed workers, $\dot{U}/E$, (which measures the cyclical or transitory effect of changes in the demand for labour) is also significant for the flow of hirings in all three periods (with Student's t rising from a minimum of 2 in the first period to more than 2.5 for the equation covering the whole period of estimation). In accordance with the *a priori* expectations of our model, the coefficient of this variable in the flow of separations equation is less significant. As we have argued, this coefficient is a

TABLE 1

ESTIMATES OF THE RATES OF TURNOVER IN MANUFACTURING INDUSTRY

Equation	Dependent variable	Constant	U/E	$(\dot{U/E})$	d^*	d^{**}	R^2	SE	DW
				Period: from 1965 - IV to 1969 IV					
(1)	f_h	9.14 (.26)	−.231 (.03)	−.49 (.24)			.84	.04	.75
(2)	f_s^x	9.13 (.27)	−.225 (.03)	+.39 (.25)			.84	.04	.90
				Period: from 1965 - IV to 1973 III					
(3)	f_h	9.20 (.34)	−.239 (.03)	−.537 (.27)	−1.51 (.20)		.75	.05	.80
(4)	f_s^*	9.17 (.29)	−.224 (.03)	+.571 (.23)	−1.52 (.17)		.75	.05	1.21
				Period: from 1965 - IV to 1974 II					
(5)	f_h	9.11 (.38)	−.238 (.04)	−.762 (.29)	−1.43 (.22)	−2.59 (.33)	.75	.06	.94
(6)	f_s^*	9.10 (.31)	−.223 (.03)	+.413 (.23)	−1.47 (.18)	−3.14 (.27)	.82	.05	1.43

Sources of data: Ministry of Labour and ISTAT.
f_h = flow of hirings in manufacturing industry.
f_s^* = flow of separations in manufacturing industry, gross of changes in the labour force.
U/E the number of employed workers in industry dividend by the number of employed workers (source: Ministry of Labour).
$(\dot{U/E})$ = rate of change in U/E
d^* = dummy variable (from 1970-I to 1973-III).
d^{**} = dummy variable (from 1973-IV to 1974-II).
R^2 = correlation coefficient (corrected for degrees of freedom).
SE = standard error of the regression as a percentage of the dependent variable.
DW = Durbin-Watson statistic.
COST = costante della regressione.
The value given in brackets below the coefficients are their standard errors.

measure of γ in [16], and the sign of this parameter is uncertain *a priori,* partly because the flow of separations is gross of changes in the labour force. In fact, since these changes are negatively correlated with the rate of change in the ratio of unemployed to employed workers, they reduce the significance of the coefficient in question, the sign of which is positive in all the equations. This, in turn, means that a cyclical reduction in the demand for labour tends to reduce the flow of quits less than it increases the flow of layoffs. Even though this sign is uncertain *a priori*, the positive value

obtained should cause no surprise, given the well-known limited propensity to quit in a labour market such as Italy's, characterized by a high level of structural unemployment. The standard error of the regressions — of the order of magnitude of 5 per cent — is also satisfactory. The Durbin-Watson statistic, on the other hand, still shows some positive auto-correlation among the residuals, even in the "complete" equation of the flow of hirings for the whole period (equation 5, Table 1).

Another characteristic of the above estimates is that, whereas they are in line with the conditions of the first two inequalities of [20], they diverge somewhat from the third $(\gamma - \hat{\gamma}) = 1$. This is presumably due to the fact that while the flows of hirings and separations (Ministry of Labour) are calculated as a ratio of average employment *during* the quarters considered, those regarding the unemployed not only include, as already mentioned, the (small) share of white-collar workers in manufacturing industry but also refer to the *end* of each quarter. For this reason, and in an attempt to reduce the auto-correlation among the residuals still present in equation 5 of Table 1, an "imputed" ratio of unemployed workers to employed workers was calculated from the difference $(f_s^* - f_h)$, as implied by [19]. The results obtained are shown in Table 2.

One interesting feature of these estimates (in which the set of constraints implied by [20] is, of course, respected) is the significance of the coefficient of the changes in the ratio of unemployed to employed workers $\dot{U/E}$. This coefficient is even more significant than the estimates shown in Table 1, especially in equation 5 regarding the flow of hirings. There is also a reduction in the positive auto-correlation of the residuals compared with equation 5 in Table 1. As in that case, the values regarding the dummy variables are highly significant and indicate a sharper "exogenous" reduction in both turnover flows from 1973-IV onwards. As was also to be expected, the coefficient of the changes in the ratio of unemployed to employed workers, which is uncertain *a priori* in our model, is not significant, especially in the complete equation, [6], of Table 2.

It should be noted that these estimates confirm the results obtained by Tarantelli in earlier tests made with reference to American industry.[12] Both these estimates and those discussed in this article

[12] We give below the equations for the flows of hirings and separations estimated by Tarantelli (*Studi di Economia del Lavoro,* Milan, 1974) for the period

TABLE 2

ESTIMATES OF THE RATES OF TURNOVER IN MANUFACTURING INDUSTRY

Equation	Dependent variable	Constant	U/E	$(U/\hat{E})$	d^*	d^{**}	R^2	SE	DW
			Period: from 1965-IV to 1969-IV						
(1)	f_h	9.13 (.26)	−.228 (.03)	−.518 (.25)			.85	.05	.80
(2)	f_s^*	9.13 (.26)	−.228 (.03)	+.482 (.25)			.85	.05	.80
			Period: from 1965-IV to 1973-III						
(3)	f_h	9.12 (.30)	−.230 (.03)	−.646 (.18)	−1.46 (.17)		.81	.05	1.06
(4)	f_s^*	9.13 (.30)	−.230 (.03)	+.354 (.18)	−1.46 (.17)		.81	.05	1.06
			Period: from 1965-IV to 1974-II						
(5)	f_h	9.04 (.32)	−.227 (.03)	−.821 (.18)	−1.40 (.18)	−3.03 (.29)	.82	.05	1.32
(6)	f_s^*	9.04 (.32)	−.227 (.03)	+.179 (.18)	−1.40 (.18)	−3.03 (.29)	.81	.05	1.32

Sources of data: Ministry of Labour and ISTAT.

(U/E) = "imputed" ratio of unemployed workers to employed workers in industry.

$(U/\hat{E})$ = rate of change of the "imputed" unemployment ratio. (For the other symbols, see the legend of Table 1).

reinforce our original hypothesis concerning the incorrectness of "Holt's conjecture". In fact, contrary to the implications of "Holt's conjecture", our estimates reveal that the two main components of turnover depend considerably — and not only transitorally but also,

---

1955-71 on the basis of quarterly data regarding American manufacturing industry (Sources: U.S. Department of Labor, *Employment and Earning Statistics* and *Economic Report of the President*):

$$f_h = \underset{(.43)}{4.1} - \underset{(.32)}{.52}\,\frac{u}{u_{-1}} + \underset{(0.36)}{\frac{.12}{u^2}}$$

$$D.W. = 2.03 \qquad R^2 = .62 \qquad S.E. = .06$$

and, analogously,

$$f_s = \underset{(.76)}{3.} - \underset{(.059)}{.21}\,u + \underset{(.32)}{.4}\,u/u_{-1} + \underset{(.19)}{.45}\,f_{s-1}$$

$$D.W. = 1.57 \qquad R^2 = .75 \qquad S.E. = .04$$

where u is the unemployment rate of the U.S. manufacturing sector.

and above all, structurally — on the level of and the cyclical changes in, the demand for labour, as well as on determinants of a socio-political nature, which are particularly important in Italy's case.

5. Some Implications and Conclusions

In Section 3 we said that, beyond a certain level of demand, the increase in the flow of quits might not be offset by the fall in that of layoffs, which in any case cannot be less than zero. This implies that, when demand for labour is at a high level, there may be a larger increase in the flow of separations than in that of hirings and, therefore, a rise in the rate of increase in wages *and* in the unemployment rate. Before concluding, therefore, it seems desirable that we should take a closer look at these implications of the theoretical considerations underlying our model and of the empirical tests described above.

The condition for a rising Phillips curve can easily be derived from our model. If the flow of hirings (equal, in equilibrium, to the flow of separations) is expressed as an increasing function of the vacancy rate, the relation between u and v can be rewritten as:

$$[2'] \qquad f_h = \Psi(v) = k\,u\,v$$

where $k=(P_h\,P_s)\,LF$. The condition for this "Beveridge curve" to be rising rather than falling is that the relation between u and v in the figure below should change sign. This implies the existence of a level of v, v^*, in the relation between u and v at the point where the inversion takes place.

Differentiating totally [2'], we obtain:

$$kvdu - kudv = \dot{\Psi}\,dv.$$

From which, at the minimum,

$$\frac{du}{dv} = \frac{\dot{\Psi} - ku}{kv} = \frac{v\dot{\Psi} - kuv}{kv^2} = 0,$$

(and, in addition, $\frac{d^2u}{dv} > 0$) which, in view of [2'] implies:

$$v\dot{\Psi} = \Psi.$$

It follows that from the first order condition for a minimum we obtain, for $v=v^*$ in Figure 2,

$$[2''] \qquad \frac{v\dot{\psi}}{\psi} = \eta_{f,v} = 1$$

where $\eta_{f,v}$ is the elasticity of f_h with regard to changes in v.

The significance of the aforementioned condition is that at the point where u is a minimum, corresponding to v^*, any change in v is entirely reflected in a change of the same sign in $f_h=uvk$.

Taking the logarithm of f_h and differentiating totally,

$$[2'''] \qquad \text{dlog}f_h = \text{dlog}u + \text{dlog}v + \text{dlog}k.$$

We thus find (assuming, for the sake of simplicity, that k is constant) that when u *increases* with increases in v (i.e. an inversion of the "Beveridge curve") and f_h, dlogu>o and, therefore, $(\text{dlog}f_h - \text{dlog}v) > o$, so that $\left(\frac{\text{dlog}f_h}{\text{dlog}v} = \eta f_{h,v}\right) > 1$, to the right of v^* in Figure 2. Analogously, to the left of v^*, we expect that $o < \frac{\text{dlog}f_h}{\text{dlog}v} < 1$. The elasticity, $\eta f_{h,v}$ is, of course, zero in the particular case postulated by Holt, in which f is constant.

Finally, it should be noted that, since $k=P_hP_s$ LF varies as described above, in conditions of disequilibrium, the more P_h increases with P_s and with LF both constant, the more the inversion of the Beveridge curve will tend to be "held up" and completely neutralized in the limiting case of a new job being accepted *before* the previous job is left, (so that v, k and f increase with the same value of u).

The possibility of an increase in the flow of quits which is not offset by a decrease in the flow of layoffs (which, in any case, cannot be negative) and an increase in that of hirings (since P_h cannot rise above a certain maximum value and, therefore, T_u fall below a certain minimum, positive value, $T\breve{u}>o$), implies an increase in the unemployment rate in [14]. This can be interpreted in terms of an inversion of the labour supply curve in the $\dot{w}$, u plane. It should be noted that, in the vicinity of the inversion, f_h increases with u since P_u cannot exceed the maximum level $P\breve{u}$ (corresponding to the minimum value of T_u, $T\breve{u}$). It follows that the disequilibrium relation between $\dot{w}$ and u can lie in the

neighbourhood of the rising section of S in Figure 3.[13] In the figure u^* ($f_h/P\breve{u}$) is the "minimum" value of u, in correspondence with which the inversion in the relation occurs — the loop of the Phillips curve, originally discussed by Lipsey, becomes clockwise instead of anticlockwise.

The dotted curve, S', represents a possible (econometric) interpolation of the "Phillips curve", estimated for a period in which both the traditional section and the section which is "perverse" are large. It is worth noting that this produces a distorted estimate of the slope of the curve, which, in general, will be all the more inclined compared with the real curve the greater the number of periods in which the economy — or (more realistically) some sectors — shifted along the rising section of the curve.

To conclude, the empirical test of the hypothesis put forward in this article suggests that the components of turnover (the flows of hirings and separations) depend crucially — and not only transitorally but also, and above all, structurally — on the level of, and the changes in, the demand for labour. The empirical test also highlights the importance of other, socio-political, determinants. These have been especially important in the case of Italy (and presumably, of France and the United Kingdom) in view of the strife which has been a feature of industrial relations since the end of the 1960s.

As Figure 1 shows, the flows of hirings and separations on an annual basis fell from values of around 32 per cent of the total number of workers employed in manufacturing industry just before the 1969 "hot autumn" to a level about ten percentage points lower (i.e. by more than 25 per cent) at the end of the period considered. The corresponding values derived from *provisional* statistics for 1975 and 1976 show a further sharp fall in turnover to 10-12 per cent, as can be seen from the table at the bottom of the page.[14]

---

[13] For a theoretical framework which is different, but nonetheless consistent with the approach adopted here, see B. CORRY and D. LAIDLER: "The Phillips Relation: ...", *op. cit.*, p. 195 note 1, and the comment by J. VANDERKAMP (together with the authors' reply) in the same review.

[14] The figures refer to manufacturing industry. It should be noted that the flows of separations are given here net of the changes in the labour force in manufacturing industry. The figures in brackets are derived from the corrections made by F. Carmignani of the CESPE in the recent study mentioned in the text. Unfortunately, the "corrections" for the early 1970s are not available, though they

Our estimates give the order of magnitude of the relative importance of the "market" and "exogenous" socio-political factors which have given rise to the changes in turnover rates in Italy. The orders of magnitude for the period from 1973-IV to 1974-II are, of course, to be treated with considerable caution in view of the shortness of the period. On the other hand, the further falls in the values of the components of turnover in 1975 and 1976 suggest that the order of magnitude of the dummy variable is underestimated as a result of the lack of complete data for 1975-76 (and, on the basis of what we know, also for the last two years).

We must also point out that, although our dummy variables do not explicitly describe the mechanism whereby the changes in the turnover flows are dependent on the previously mentioned socio-political determinants, the link clearly goes from the "freezing of layoffs" (and, in part, from thé fall in quits), imposed by the trade unions since the early 1970s in an attempt to protect employed workers, to the "freezing of hirings" decided by firms as a "vendetta" of the market. This would suggest that the two dummy variables used in our model in connexion with the flow of hirings should be replaced by a lagged variable connected with the flow of separations (which would continue to depend on the two dummies). We plan to incorporate this and other possible improvements in the theoretical reference model and the empirical test in a subsequent paper and to disaggregate the empirical tests of the flows of layoffs and quits by productive sector, size of firm and type of work.[15]

Cambridge, Mass. F. MODIGLIANI - E. TARANTELLI

should be much smaller. The starred values are estimates, since the official ones are not yet available.

[15] Preliminary estimates show, as was to be expected, that the flows of layoffs and quits depend respectively positively and negatively (with a very high level of significance) on the "structural" ratio of unemployed workers to employed workers.

		f_h	f_s			f_h	f_s
1973	I	6.80 (5.9)	5.18	1975	I	2.15	2.88
	II	5.81 (5.5)	6.50 (5.1)		II	2.44	2.89
	III	9.00 (6.2)	5.61 (4.8)		III	3.12	3.48
	IV	7.90 (4.8)	6.70 (5.7)		IV	2.16	3.34
1974	I	4.64	3.78	1976	I	2.90	2.80*
	II	4.76	4.04		II	3.81	3.20*
	III	4.57	4.24		III	4.15	3.69
	IV	2.70	4.10		IV	2.99	3.82