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**Persistent Disinflationary Effects on Unemployment
in a Small Open Economy: Italy 1979-1995**

by

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UNEMPLOYMENT IN A SMALL OPEN ECONOMY: ITALY 1979-1995

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Abstract. The aim of this paper is to investigate the effects on the rate of unemployment of the disinflationary policies and other aggregate demand shocks which affected the Italian economy during the period 1979-1995. To this end, a structural cointegrated VAR model is built and the structural disturbances are recovered by imposing a set of short-run, contemporary restrictions. The results show that both short-run and long-run movements in unemployment are influenced by disturbances to aggregate demand, as well as by supply shocks. This evidence seems to be at odds with the predictions of "natural-rate" theories.

JEL Classification: C32, E32;

Keywords: Structural Cointegrated VAR; Identification; Disinflation; Unemployment

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1. Introduction

This paper shows that disinflationary policies and other adverse shocks to aggregate demand caused a persistent increase in Italian unemployment in the 1980s and early 1990s. These results are at odds with the prediction of “natural rate” theories, according to tight monetary policies provoke only a rise in cyclical unemployment, since the long-run equilibrium unemployment is independent of monetary policy and aggregate demand. The picture which emerges from this paper is different: both short-run and long-run movements in unemployment are influenced by monetary policy and other shocks to aggregate demand, as well as by shocks on the supply side.

These results support hysteresis theories (cf. Blanchard and Summers, 1986). In fact, a central prediction of these models is that a disinflationary process causes a rise in cyclical unemployment and this provokes a rise in the long-run trend, the so-called non-accelerating inflation rate of unemployment (NAIRU).

It is important to point out that in 1979, the starting year of our investigation, the world economy was affected by three major events: (1) the Iranian revolution and the connected second oil shock which caused an increase both in unemployment and inflation in the industrialized countries; (2) Italy and some other European countries joined the fixed exchange rate mechanism of the European Monetary System (EMS); (3) The reaction of main central Banks to inflation consisted in a sharp increase of short-term interest rates. Hence, in 1979 we observe both a peak in inflation and the beginning of the disinflation era. In the early 1980s, as a consequence of disinflationary monetary policies, Italy and most OECD countries experienced recessions and the rate of unemployment rose to levels unknown since the Great Depression. Moreover, in Italy, as in other European countries, the increase in unemployment revealed itself strongly persistent. Furthermore, in the early 1990s, there was a new episode of tightening monetary conditions in Italy since exchange rate goals and anti-inflation policy induced another sharp increase in short-term interest rates. The recession of 1992-93 followed and in the period 1991-1995 the rate of unemployment rose three percentage points to twelve percent.

In two recent papers Ball (1997, 1999) criticizes the prevailing explanation of the rise in European unemployment in the eighties, founded on imperfections in the labour market. Such imperfections induced by a set of rules, regulations and labor market institutions, would make the labor market too inflexible. Ball argues that this “conventional wisdom” fails to consider the role of monetary policy and aggregate demand in the rise of long-run unemployment.

In this paper we try to address the questions raised by Ball and other authors

by investigating the interactions among inflation, unemployment and monetary policy that characterize the Italian economy. To this end, a simple structural cointegrated VAR model, with quarterly data spanning the period 1979-1995, is built. We recover the structural shocks by imposing a set of identifying restrictions which aim to capture some features of a small open economy like Italy. Moreover, we avoid neutrality restrictions capable of obscuring potential permanent effects on unemployment of aggregate demand shocks and monetary policy intervention.

A widely held view maintains that in the 1980s and early 1990s Germany, the country that was the anchor of the EMS, was the 'conductor of the European orchestra'¹, and hence, identifying the monetary policy rule for a small open economy like Italy necessarily requires the consideration of German variables. In line with the recent literature on monetary policy rules (e.g. Taylor,1999) it is assumed that the central bank uses a short-term interest rate as its instrument.

In a first stage we identify the long-run relationships which are suggested by cointegration analysis and theoretical reasonings. The first important conclusion is that the Italian economy is characterized by a long-run tradeoff between inflation and unemployment. In a second stage we investigate the dynamic effects at different horizons on inflation and unemployment of three different kinds of structural disturbances: monetary policy shocks, demand shocks and supply shocks. Since we want to detect the potential presence of long-run effects of monetary policy and other demand shocks on unemployment, we do not impose *a-priori* low frequency restrictions, and identification is achieved by imposing a set of contemporaneous, short-run restrictions on the cointegrated VAR. The second important conclusion we draw from impulse-response analysis, is that movements in the rate of unemployment, both at the business cycle frequencies and in the long run, are explained by all the three shocks.

The paper is organized as follows: Section 2 outlines the strategy followed in order to achieve the identification of the structural disturbances; section 3 proceeds to the estimation of the empirical model, selection of the cointegration rank and identification of the long-run relations; in section 4 we recover the structural parameters by imposing a set of contemporary restrictions on the estimated vector error-correction model and show the dynamic response of inflation and unemployment to structural disturbances; section 5 concludes.

¹ 'conductor of the international orchestra' is the famous expression that Keynes used in order to characterize the leading role of the UK during the classic gold standard and the asymmetrical working of this system.

1. The Approach of the Paper

Let us consider a vector X_t (5 x 1) of I(1) series including, respectively, three Italian variables, the rate of unemployment (U), the short-term interest rate (Int), the rate of inflation (Inf), and two German variables, the short-term interest rate (Intg), and the rate of inflation (Infg). Under the hypothesis of existence of long-run equilibrium relationships, i.e. cointegration, among the variables, the structural model has the following representation:

$$A\Gamma(L)\Delta X_t = A\mu - A\gamma^*\alpha'X_{t-1} + Ce_t \quad (1)$$

where Δ is the difference operator, L is the lag operator and μ is a constant vector. The rank, $r < n$, of the autoregressive total multipliers matrix $A(1) = \gamma\alpha'$, is given by the number of independent long-run relations. Moreover, γ is a (n x r) matrix of loadings and α is a (n x r) matrix of cointegrating vectors. It is well known that it is possible to offer a structural interpretation of these relations only by imposing some meaningful identifying restrictions. It is shown that exact identification of α^* is achieved by imposing r normalizations, one for each vector, and $r - 1$ restrictions for each row, i.e. a total of r^2 independent restrictions. A and C are matrices of full rank, e_t is the vector of structural disturbances with $E(e_t) = 0$ and contains orthonormal variables, i.e. $E(e_t e_t') = I$.

Contemporaneous effects of innovations on the observable variables included in the vector X_t are described by the matrix C , whereas instantaneous interactions among endogenous variables are captured by the matrix A .

The reduced form associated with the structural model (1), is given by:

$$\Gamma(L)\Delta X_t = \mu - \gamma\alpha'X_{t-1} + \epsilon_t \quad (2)$$

where ϵ_t is the (5 x 1) vector of disturbances such that $E(\epsilon_t) = 0$ and $E(\epsilon_t \epsilon_t') = \Omega$. Johansen (1991) has shown that the reduced-form Wold representation of (2) is given by:

$$\Delta X_t = \rho + B(L)\epsilon_t \quad (3)$$

where: (i) $\rho = B(1)\mu$ (ii) $B(1) = \alpha_{\perp} \Phi \gamma'_{\perp}$. γ_{\perp} e α_{\perp} are, respectively, the orthogonal complements to the matrix of error correction coefficients and the matrix of cointegration vectors, i.e. $\alpha' \alpha_{\perp} = 0$, $\gamma' \gamma_{\perp} = 0$; (iii) $\Phi = (\gamma'_{\perp} \Psi \alpha_{\perp})^{-1}$, where Ψ is the derivative of $\Psi(z)$, the characteristic polynomial of model (2), for $z = 1$.

The structural Vector Moving Average representation is:

$$\Delta X_t = \rho + H(L)e_t \quad (4)$$

where: $H(0) = A^{-1}C$, and $H(L) = B(L)A^{-1}C$.

Equations (1) and (2) imply the following set of linear relations linking ϵ_t , the vector of error terms, and e_t , the vector of structural innovations:

$$A\epsilon_t = Ce_t \quad (5)$$

From (5) we obtain:

$$A\epsilon_t\epsilon'_t A' = Ce_t e'_t C' \quad (6)$$

and, by taking expectations, we have:

$$A\Omega A' = CC' \quad (7)$$

this equation implies a set of $n(n+1)/2$ non-linear restrictions on the parameters of the A and C matrices. Since identification requires $n^2 + n^2$ restrictions, there are $2n^2 - n(n+1)/2$ free elements.

Notice that this kind of structural VAR allows the instantaneous interaction among the endogenous variables to be modelled and, at the same time, it makes it possible to model the impact effect of the orthonormal disturbances affecting the system. As stressed by Amisano and Giannini (1997) this represents the most general parameterisation since it is usual, in the structural VAR framework, to choose A to be the identity matrix or C to be a diagonal matrix.

Let us now summarize the method followed in this paper in order to identify the structural model. The first step of the approach consists in the estimation of reduced form (2). The second step, given a selected cointegration rank, attains the identification of the long-run relationships. The final step consists in the specification of a set of identifying restrictions on A and C, and in the characterization of the dynamic effects of structural shocks.

It is important to notice that, although we recover the structural disturbances affecting the economic system by considering cointegrating relationships, we do not impose *a-priori* long-run neutrality effects of some shocks. Instead, we impose a set of contemporaneous restrictions essentially based on the idea that, within the quarter, changes in the endogenous variables do not have effects on inflation and unemployment. As emphasized by Mankiw (2001) there is a wide agreement about the fact that demand shocks have a gradual and delayed effect on inflation. Moreover, it is well known that unemployment and labor market variables lag with respect to economic activity and, in general, show a slow reaction to a change in the economic conditions. As far as the monetary policy shock is concerned, we take into account that for a small open economy it is not possible to conduct a completely independent monetary policy. Hence, we assume that the central bank set the short-term interest rate after observing the current German short-term interest rate.

The approach based on contemporaneous restrictions in VAR models was pioneered by Bernanke (1986), Blanchard and Watson (1986) and Sims (1986). It represents an important point of departure with respect to the recursive scheme, based on Cholesky decomposition² as in Sims (1980). Another important application of this methodology has been proposed in Blanchard (1989). Blanchard and Quah (1989) proposed, instead, an alternative identification strategy. They assumed a difference-stationary process for real output and imposed restrictions at frequency zero advocating a class of economic models which suggest long-run neutrality. In particular, they assume that demand disturbances have only a transitory effect on the level of output³. Applications of this approach, in which variables are taken as I(1) but do not exhibit cointegration, are given in Las-

² The Cholesky decomposition is usual labelled as “atheoretical identification” whereas the approach based on contemporaneous restrictions is labelled as “structural VAR”. In our opinion, this distinction is misleading since both procedures enable the structural disturbances to be recovered by advocating some more or less plausible economic scheme, whether recursive or not.

³ A crucial assumption in structural VAR models is that no zero of the determinant of the moving average matrix polynomial is of modulus less than one. Lippi and Reichlin (1993) shows that non fundamental representations may quite naturally arise. Moreover, such nonstandard moving-average representations may be associated with interesting economic hypotheses. Nev-

trapes and Selgin (1995) and Bullard and Keating (1995), among others. King, Plosser, Stock and Watson (1991) extended the Blanchard-Quah model to the cointegration case⁴. A recent survey of methods that identify permanent and transitory shocks in cointegrated systems is provided by Levtchenkova, Pagan and Robertson (1998). Although the approach based on long-run restrictions has recently been criticized (e.g. Faust and Leeper, 1997), it is widely utilized in empirical macroeconomics⁵. This probably stems from the fact that alternative models make different predictions about the relative importance of demand and supply shocks in explaining fluctuations in economic activity at high and medium frequencies, whereas they generally predict that movements in economic activity at low frequencies are dominated by supply shocks.

Combinations of contemporaneous and long-run restrictions have been used by Gali (1992) and, more recently, by Fisher, Huh and Peters (2000). Some conditions under which a Sims causal ordering and a Blanchard-Quah type decomposition are equivalent in cointegrated systems, are given in Ribba (1997) and Fisher-Huh (1999). Given a bivariate cointegrated system, Ribba shows that if the $I(1)$ variable which is first in the causal ordering is not caused at frequency zero by the second variable, it follows that Sims (1980) orthogonalization is such that a shock to the variable ordered second has only a transitory effect on the level of the variable first. In Fisher and Hu (1999) it is shown that in the multivariate case, provided the number of weakly exogenous variables is equal to the number of common trends, King *et al.* (1991) orthogonalization with long-run restrictions and Sims orthogonalization, based on a recursive structure, are equivalent⁶.

ertheless, in this paper we maintain the usual assumption that the structural moving-average representation (4) is fundamental.

⁴ A systematic framework for analyzing the different types of models proposed in structural VAR literature is developed in Amisano and Giannini (1997).

⁵ Faust and Leeper argue that structural inference regarding impulse responses may be biased, since the long-run effects of shocks are imprecisely estimated in finite samples. Nevertheless, Levtchenkova *et al.* (1998) question the practical relevance of this point since it relies upon the more general problem pertaining to the selection of the order of the VAR.

⁶ These conditions may appear, at first glance, too restrictive to be satisfied and so they could sound like special cases. Yet, it is worth considering that the two most cited works in this area of research, namely the papers by Blanchard and Quah (1989) and King *et al.* (1991), estimate models satisfying the condition of equivalence. Ribba (1997) points out that the bivariate model estimated by Blanchard and Quah satisfies the following restriction: the rate of unemployment does not cause at frequency zero the GNP. As for the paper by King *et al.* we refer to the first model they discuss, including three $I(1)$ variables: real-per capita consumption, investment and private output. A cointegration rank of two is selected and consumption is not caused at frequency zero by investment and private output. It follows that a recursive structure with the consumption first is such that shocks to investment and output have only transitory

3. Estimation

The period of estimation, with quarterly data, is 1979:1-1995:4. We specify a five-dimensional VAR with $X_t = [U, Int, Inf, Intg, Inf g]$ where U, Int and Inf are, respectively, the Italian unemployment rate, the short-term interest rate and the annualized rate of inflation measured by the consumer price index. Intg and Inf g are, respectively, the German short-term interest rate and the annualized rate of inflation⁷.

The individual series included in X_t behave as if they were I(1) processes⁸. In particular, we interpret the potential presence of a unit root in the rate of unemployment as due to economic mechanisms underlying the dynamic process of unemployment which lead to highly persistent effects of demand and supply shocks.

Reimers (1993) suggests using, for cointegrated systems, the Hannan–Quinn criterion for the selection of lag length. Accordingly, a VAR model was specified with one lag. Moreover, on the basis of Johansen’s (1992) trace test, at the 2.5 percent level, a cointegration rank of two was selected. Hence, two independent long-run relations were identified. In a first stage we impose two restrictions on each cointegrating vector, i.e. we start with a just identified long-run structure. The matrix of cointegrating vectors, α'_0 , has the form:

$$\alpha'_0 = \begin{pmatrix} 1 & 0 & \alpha_{13} & \alpha_{14} & \alpha_{15} \\ 0 & 1 & \alpha_{23} & \alpha_{24} & \alpha_{25} \end{pmatrix}$$

As for the first cointegrating vector, since our aim is to investigate a possible long-run relationship between inflation and unemployment, we impose two additional restrictions: $\alpha_{14} = \alpha_{15} = 0$. If we test for such overidentifying restrictions, the hypothesis of a long-run Phillips tradeoff may not be rejected (see table 2).

As far as the second relation is concerned, economic theory suggests that, in the long run, discrepancies in national and foreign nominal interest rates should

effects on the level of the three variables. (see Fisher and Huh, 1999).

⁷ The data are from OECD, Main Economic Indicators. As for short-term interest rates, int is the three month interbank rate and intg is the three month Frankfurt Interbank Offered Rate. Inf g, the German annualized rate of inflation, is measured by the consumer price index and U is the standardized unemployment rate.

⁸ Of course, the usual battery of unit root tests was conducted and the results (not reported) show that all series can be represented as difference-stationary processes. Nevertheless, it is well known that any such test has arbitrarily low power as against a sufficiently close alternative.

reflect differentials in the respective rates of inflation. This conclusion is an implication of the relative Purchasing Power Parity (PPP) or, more precisely, it descends from the joint consideration of PPP and Uncovered Interest Parity (UIP). Hence, we also tested the following restrictions: $\alpha_{23} = \alpha_{24} = -1$; $\alpha_{25} = 1$. These restrictions are clearly rejected by data and the final long-run identified structure (see table 3) is expressed by the following matrix of cointegrating vectors:

$$\alpha'^* = \begin{pmatrix} 1 & 0 & \alpha_{13} & 0 & 0 \\ 0 & 1 & -1 & \alpha_{24} & \alpha_{25} \end{pmatrix}$$

It is important to notice that these results, as a whole, are consistent with the idea that nominal shocks have very persistent effects on real variables. This clearly shows up in the first long-run relationship which establishes a long-run tradeoff between inflation and unemployment. But, if monetary and other nominal shocks have long-lasting effects on the real side, then it follows that PPP (or UIP) does not hold.

Our findings are thus consistent with the existence of a non-vertical long-run Phillips curve. Weber (1994), building on a previous work by King and Watson (1992), estimates a bivariate VAR model including changes in inflation and unemployment and, after imposing a set of identifying restrictions, concludes that for six of the G7 economies the hypothesis of a vertical long-run Phillips curve cannot be rejected. The exception is represented by Italy where, in effect, this hypothesis is rejected. In his comment on Weber's paper, Canova (1994) points out that (i) in general, a bivariate framework raises questions since useful information is thrown away unless the underlying economic system is recursive and inflation and unemployment are in the upper part of the recursive system; (ii) once the variables are assumed to be $I(1)$, a natural way of investigating long-run relations is to test for cointegration. Moreover, Canova observes that the tests presented by Weber are inefficient in the presence of cointegration⁹.

⁹ Indeed, Canova also raises a deeper methodological question: the entire approach based on the assumption of unit roots and cointegration tends to shift the attention of the researcher from the issue of selecting sensible identifying restrictions in VAR modelling to the statistical investigation of time series properties. As a consequence, the results concerning the dynamic effects of shocks rely heavily upon these statistical choices. We would like to observe that these criticisms have quite naturally a bidirectional causality, in the sense that the reversal argument is equally legitimate: suppose we assume a trend-stationary process, whereas the 'true' process has a unit root; suppose we do not consider cointegration, whereas...etc.

It should be added that the bivariate approach, employed by Weber, fails to consider the nature of small open economy for countries like Italy.

The set of overidentifying restrictions imposed on the second cointegrating vector was clearly rejected (see table 2). Note that it is not possible to assess whether this rejection is due to failure of PPP or UIP (or both). A recent survey of the literature on testing PPP is offered in Rogoff (1996). According to the author, one possible explanation for the purchasing power parity puzzle rests on the persistence of monetary shocks on the real economy in the presence of sticky nominal wages and prices¹⁰. Giovannini (1995) has emphasized that during the period 1979-1992 PPP did not materialize in Europe since data show a clear trend in nominal exchange rates of France, Italy and Spain with respect to Germany despite the process of convergence of inflation differentials¹¹. Moreover, as the author stresses, Italy maintained restrictions on capital account transactions for the first part of the 1980s and these restrictions were gradually removed only starting from 1987. In particular, the liberalization of all major financial transactions was achieved in 1990. Of course, from the point of view of our investigation, this adds another possible reason for the failure of convergence of Italian and German interest rates we found in the data.

A different view is expressed in Sarno e Taylor (1998). The authors observe that a necessary condition for PPP to hold is that the real exchange rate be a stationary process. So they consider bilateral real dollar exchange rate series for the G5 countries during the post-Bretton Woods period and apply a multivariate test of nonstationarity. Their results support the stationarity for the real exchange rates examined. Notice, nevertheless that their investigation embraces a different period (1974-1997) and, more importantly, does not include Italy.

¹⁰ Rogoff draws attention to the fact that consensus estimates show a tendency to convergence toward PPP in the very long run. Hence, our rejection of this hypothesis could depend on the sample selected, which spans a period of about 20 years. It is no accident that the terms "persistent" and "permanent" are used interchangeably throughout this paper.

¹¹ Indeed, as regards the Italian inflation differential, it decreased from a peak of 16 percent reached in 1980 to virtually zero in 1983. Yet, convergence slowed at the end of 1980s when the inflation differential, relative to consumer price index, seemed to stabilize about 4 percent.

Cointegration Analysis and Long-Run Relations

Table 1
Johansen's Cointegration Rank Test (Trace test)

H ₀ : rank	Statistic	97,5% c.v.
r = 0	133.58	71.80
r ≤ 1	68.78	50.35
r ≤ 2	31.54	32.56
r ≤ 3	5.79	17.52
r ≤ 4	0.67	4.95

Table 2

H ₀ : The Cointegration space contains		significance level
Long-run Phillips tradeoff	$\chi^2_{(2)} = 4.68$	0.0962
Relative PPP-UIP	$\chi^2_{(3)} = 12.97$	0.0047
Long-run Phillips tradeoff and relative PPP-UIP	$\chi^2_{(5)} = 46.69$	00000

Table 3
Identified long-run relationships (std.errors in brackets)

$U_t = -0.304Inf_t$ <p>(0.0253)</p>
$Int_t = Inf_t + 7.56Intg_t - 10.23Infg_t$ <p>(0.99) (0.932)</p>
LR Test for over-identification :
$\chi^2_{(3)} = 5.222, \text{ significance level} = 0.1562$

4. Identification of Structural Disturbances and Simulation Analysis

This section is devoted to specifying the identifying restrictions which allow the structural disturbances to be recovered. After recovering these disturbances, we proceed with the simulation analysis and show the dynamic effects of the structural shocks on inflation and unemployment.

Recall that ϵ_t , the vector of error terms, and e_t , the vector of structural innovations, are related by: $A\epsilon_t = Ce_t$. We selected the following contemporaneous structure:

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & a_{23} & a_{24} & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & a_{45} \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \epsilon_u \\ \epsilon_{int} \\ \epsilon_{inf} \\ \epsilon_{intg} \\ \epsilon_{infg} \end{pmatrix} = \begin{pmatrix} c_{11} & c_{12} & 0 & 0 & 0 \\ 0 & c_{22} & 0 & 0 & 0 \\ c_{31} & 0 & c_{33} & 0 & 0 \\ 0 & 0 & 0 & c_{44} & 0 \\ 0 & 0 & 0 & 0 & c_{55} \end{pmatrix} \begin{pmatrix} e_s \\ e_{mp} \\ e_d \\ e_{mpg} \\ e_{dg} \end{pmatrix} \quad (8)$$

The supply shock is identified by assuming that unemployment is contemporaneously exogenous to other variables. Note that a direct effect of monetary policy shocks on unemployment is allowed for. Structural innovations in unemployment could reflect changes in productivity or changes in the labor force. It is worth pointing out that these short-run restrictions leave room for the possibility of long-run effects on unemployment of monetary policy and other demand shocks.

There has recently been a certain convergence among the researchers on the fact that the central bank pursues monetary policy by using as its instrument the short-term interest rate (e.g. Taylor, 1999). In accordance with this view, we assume that the short-term interest rate measures the stance of monetary policy. The reaction function of the Italian monetary authority is built on the assumption that the interest rate is set in relation to the current value of inflation and the German short-term interest rate. That is, the central bank of a small open economy like Italy, given the possibility of capital account transactions, cannot conduct an independent monetary policy. As far as the German short-term interest rate is concerned, we assume that it is set after observing the current value of domestic inflation. Moreover, we assume that Italian variables do not contemporaneously affect both the German variables.

Innovations in the rate of inflation are attributed to demand innovations. Nevertheless, we allow a direct effect on inflation of supply innovations. For, if this kind of disturbances reflects changes in productivity, then a positive supply

shock should induce an opposite reaction of inflation.

In table 4 estimates of the A and C parameters are reported together with the associated standard errors. All the estimated coefficients are significant at the conventional level, excepted c_{31} .

Table 4

Contemporaneous coefficients in the structural model

	a_{23}	a_{24}	a_{45}	c_{11}	c_{12}
Coeff.	-0.159	-0.474	-0.134	0.296	0.082
S.E.	0.049	0.152	0.047	0.026	0.037
	c_{22}	c_{31}	c_{33}	c_{44}	c_{55}
Coeff.	0.956	0.095	2.406	0.702	1.855
S.E.	0.083	0.307	0.209	0.061	0.161

LR test for 5 over-identifying restrictions:
 $\chi^2_{(5)} = 9.74974$, significance level = 0.08264

Figures 1-6 plot the impulse-response functions of inflation and unemployment to the supply, monetary policy and demand shocks with the 90 per cent confidence bounds¹². The dynamic effects of supply innovations show that unemployment increases in the current quarter and thereafter the size of this increase reduces. Such adverse effect of a positive supply shock turns out to be permanent, since unemployment does not return to its initial value. As emphasized by Blanchard (1989), some models predict that an increase in productivity might provoke an increase in unemployment in the short run, owing to shortage of ag-

¹² These asymptotic confidence bounds were obtained by following the analytical formulae developed in Amisano and Giannini (1997).

gregate demand in relation to the pace of technological change¹³. The long-run effects rest on the various channels studied by the literature on hysteresis and discussed at length in Blanchard and Katz (1997). A potentially interesting one is the following: if a productivity shock maintains unemployment high for many quarters this provokes an increase in the proportion of long-term unemployed who can lose skills. As a consequence, their effect on bargaining decreases and the unemployment rate does not show any tendency to converge to the previous level.

As expected, inflation moves in the opposite direction to supply shocks. Notice that, although the contemporaneous effect is insignificant it tends to increase over time and induces a permanent decrease in the rate of inflation.

A monetary policy shock, i.e. an unexpected movement in the short-term interest rate, provokes a movement of unemployment in the same direction and the effect of this adverse monetary shock, however small in amplitude, does not show any tendency to revert over time. As for inflation, recall that our identifying restrictions impose the absence of contemporaneous effects of monetary policy shocks. The impulse-response function shows that inflation reduces after a monetary tightening and, in our opinion, this is undoubtedly an important result. For, although largely expected on an *a-priori* ground, it gives additional plausibility to the identification scheme adopted in this paper. It is well known that a common finding of many VAR studies published in the late 1980s and early 1990s was the temporary increase of inflation in response to a monetary tightening. Of course, this puzzling result represented an unattractive feature of the VAR approach (see the discussion in Sims, 1992).

As far as demand shocks are concerned, we observe a reduction of unemployment, both in the short and long run. After 7-8 quarters the reduction in unemployment reaches a floor and thereafter persists over time. The demand shock has a permanent effect on the rate of inflation. An increase in the aggregate demand induces its major effect on inflation in the first year and thereafter the effect steadily decreases.

The picture shown by the impulse-response functions gives reasonable support to an interpretation of the evolution of the Italian economy in the period 1979-1995 as driven by a mixture of shocks, on the supply and demand side, which had permanent effects on the rate of unemployment. Our results allow a natural-rate model for Italian unemployment to be rejected. They also jeopardize

¹³ For the US economy in the period 1965-1986, Blanchard (1989) shows that unemployment is higher than normal for 6 quarters in response to a positive supply shock and returns slowly to its normal level.

Impulse-Response Functions

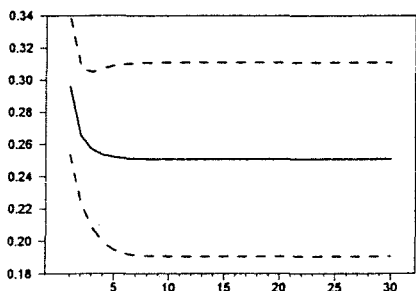


Figure 1. Response of U to a supply shock.

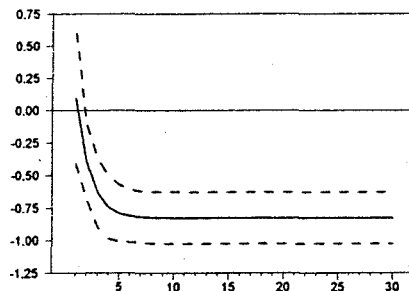


Figure 2. Response of Inf to a supply shock.

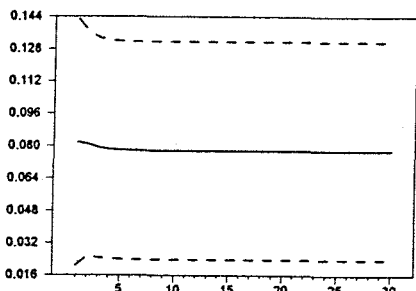


Figure 3. Response of U to a monetary policy shock.

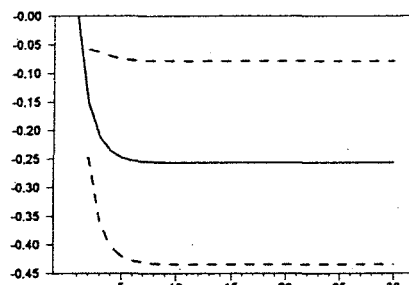


Figure 4. Response of Inf to a monetary policy shock.

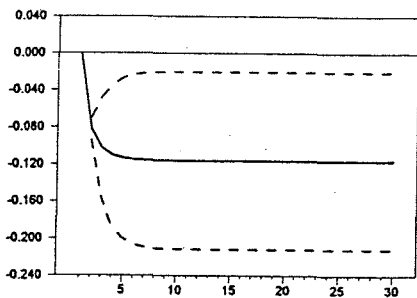


Figure 5. Response of U to a demand shock.

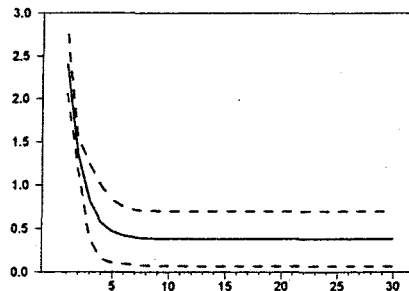


Figure 6. Response of Inf to a demand shock.

an interpretation skewed towards rigidity in the labour market since we find that monetary policy and other adverse shocks to aggregate demand contributed to the rise of the unemployment rate.

In the remainder of this section we briefly discuss the results obtained by some other studies which have investigated the fluctuations in the Italian rate of unemployment by using structural VARs. In a recent study Balmaseda, Dolado and Lopez-Salido (2000) estimate, for a sample of 16 OECD countries, a three variable system including output growth, real wage growth and the unemployment rate. They impose a set of long-run identifying restrictions stemming from an insider-outsider framework and recover three structural shocks hitting the labour market: productivity, labor supply and aggregate demand shocks. Their main findings are that demand shocks reveal persistent effects on unemployment in most countries and that an approach based on the partial hysteresis interpretation, i.e. unemployment taken as an $I(0)$ process, yields reasonable results. Moreover, they find that unemployment fluctuations are dominated by demand shocks at the business cycle frequencies whereas labour supply and productivity shocks dominate at lower frequencies. The authors observe that in some economies like Italy and Spain, which they label as “sclerotic economies”, demand shocks have long-run effects on unemployment. The methodology adopted by Balmaseda *et al.* does not contemplate the possibility of long-run equilibrium relationships among the variables.

The latter were considered in Giannini *et al.* (1995) who applied the traditional “Keynesian” setting (cf. Blanchard, 1989) to the Italian economy for the period 1970-1990. The authors impose a set of contemporaneous restrictions on a cointegrated VAR model and find that demand shocks dominate output fluctuations in the short run but lead only to temporary decrease in the unemployment rate. As for real supply shocks, they exhibit small effects on nominal variable fluctuations. In this sense, the structural shocks identified produce results that are consistent with a traditional Keynesian description of economic fluctuations. Consistently with this traditional description, the estimated impulse-response functions do not display permanent effects of aggregate demand shocks. Moreover, it is worth noticing that the analysis is conducted in a closed economy framework.

The methodology proposed in King *et al.* (1991) has been applied to the Italian economy by Onofri, Paruolo and Salituro (1994). The authors build a model for the Italian economy founded on a natural-rate hypothesis and impose a set of long-run restrictions based on neutrality effects for real and nominal demand shocks. The main conclusion they draw is that the permanent supply shock gives the dominant contribution in explaining both the short-run and long-

run movements in aggregate output.

We want to stress the main points of convergence as well as some important differences that characterize these researches on the Italian economy founded on structural VARs. The persistent effects of aggregate demand shocks on real variables and a dominant role which is attributed to supply shocks in explaining movements at low frequencies of real variables represent common conclusions of these investigations. Yet, the results presented in this paper show the presence of short-run and long-run effects of monetary policy shocks in explaining unemployment which are often neglected. Furthermore, these structural disturbances are identified by taking into account the dominant role played by the German central bank in driving the monetary policy in Europe in the 1980s and early 1990s. We have also found, by using cointegration techniques, a long-run tradeoff between inflation and unemployment which contradicts the “natural-rate” of unemployment hypothesis underlying many econometric investigations. Finally, the impulse-response functions have shown that the long-run relationships presents bidirectional causality, in the sense that both demand and supply shocks affect the two variables at low frequencies.

5. Conclusions

The rate of unemployment rose in most OECD countries in the 1980s. As stressed by Ball (1997), countries which experienced larger decrease in inflation and longer disinflationary periods had larger increases in unemployment. Ball argues that the central cause of this rise in unemployment was the tight monetary policy undertaken in most OECD countries in order to reduce inflation.

In this paper we have investigated the nexus between inflation and unemployment in the context of the Italian economy during the period 1979-1995, i.e. a period of prolonged disinflation. The task was accomplished by estimating a cointegrated VAR model on which a set of over-identifying contemporary restrictions was imposed. In particular, a monetary policy shock has been identified on the assumption that the central bank throughout this period was mainly concerned with control of the inflation rate and, more important, had to take into account the decisions of the German central bank regarding the short-term interest rate. In effect, we have tried to incorporate in the structural model the idea that for a small open economy it is not possible to conduct an independent monetary policy - at least, not completely independent. Our findings can be summarized as follows. It is not possible to reject the hypothesis of a long-run tradeoff between inflation and unemployment. Moreover, aggregate demand shocks and monetary

policy shocks exert effects on the rate of unemployment both in the short and the long run. As for supply shocks, such as change in productivity or in labor force, they also play an important role in explaining movements in unemployment and inflation at all frequencies. These results do not support ‘natural-rate’ based models for the Italian economy but seem consistent with a hysteretical interpretation of unemployment dynamics. The specific channels through which demand shocks have propagated very persistent effects on the real variables were not investigated in this paper and should be an objective for a future extension of this research.

Finally, it would be tempting to assert that expansionary aggregate demand policies could permanently reduce the rate of unemployment and indeed this is an implication of our results. Nevertheless, we believe that this conclusion is to be taken *cum grano salis*. For, there is at the moment no convincing proof that hysteresis also works in the opposite direction and it is our conviction that the results obtained with linear structural models need to be corroborated by further evidence. Furthermore, we emphasize that aggregate demand policies should not (and cannot) be undertaken at a single country level. On the other side, looking at the Euro area, we should pay closer attention to the experience of the US economy in the 1980s, when the strong recovery which followed the 1982 recession was magnified by loosening monetary policy and increasing public spending.

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