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AND
THE PHILLIPS CURVE IN ITALY

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Macroeconomic Instability and the Phillips Curve in Italy

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Abstract
The theme of this paper is whether there was a textbook-like Phillips curve in post-WWII Italy. We estimate a standard model of the relationship between inflation and the level of real economic activity over the 1949 to 1998 period and find no evidence of a significant and positive feedback from output to prices. We also estimate similar models for the UK and the US and compare them with the Italian experience. Italy stands out as “distinctive” with respect to the two Anglo-Saxon economies. We attribute this difference primarily to a fiscally dominated monetary policy and a rigid indexation mechanism aimed at protecting wages from inflation. These two institutions contributed to a persistent inflation bias and macroeconomic instability that lasted almost up until the entry of the country in the European Monetary Union.


Keywords: fiscal dominance, inflation, macroeconomic stability, wage indexation, Phillips curve.

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1. Introduction

Inflation dominated the policy agenda for much of the 1970s and the 1980s. Over the next two decades, greater macroeconomic stability (the “Great Moderation”) has confined the issue to the outer limits of the macroeconomic debate. In the light of recent developments, this was shortsighted. Between 2005 and the current downturn (2008-2009), inflation rates and expectations rose across most advanced economies, suggesting that inflation is not dead and continues to be worth studying it, mainly for its policy relevance and its impact on long-term macroeconomic performance. Shedding some light on unsettled aspects of past inflationary processes could also guide us in interpreting the current state of affairs and in identifying forces that trigger major inflation shocks. This paper contributes to the debate by investigating the trade-off between inflation and output in Italy and its evolving nature, with a particular focus on the post-WWII years.

There are at least three motivations for the choice of Italy as a case study. The first is that this country has experienced higher than average and more volatile inflation rates than most other industrialized countries across a variety of monetary regimes. The second is that Italy differs markedly from Anglo-Saxon market structures and institutions, on which the bulk of the Phillips curve literature has focused. Among the differences, rigidities in the labor market stand out. At the end of the 1960s, in step with the widespread union unrest in industrialized countries, Italian unions managed to impose a unique two-tier bargaining system -at the national and firm levels- keyed on an indexation mechanism called the Scala Mobile (SM). SM, inspired by a strong egalitarian motivation, held at centre stage until the early 1990s and exacerbated the inflationary process. Symmetrically, subsequent changes in the wage bargaining structure and in the indexation mechanism contributed, in addition to a tighter monetary policy, to the decline of inflation in the remainder of the 1990s and eased Italian membership in the European Monetary Union (EMU). Finally, the course of post-war Italian monetary policy was critically influenced by government financing requirements, a specific application of fiscal dominance (Fratianne and Spinelli, 2001b).

This paper asks whether the combination of a rigid wage indexation mechanism and a regime of fiscal dominance was responsible for Italian inflation to be significantly distinct from that in other advanced countries. We evaluate this distinctiveness using the
key metric of the inflation-output trade-off. Methodologically, we first examine the
volatility, persistence and stationarity properties of the Italian inflation rate across
various exchange-rate regimes that have characterized post-WWII Italian monetary
history (Fratianni and Spinelli 2001a). Next, we estimate alternative Phillips equations,
and study the effects of structural changes and asymmetries on the estimated parameters
of the inflation-output trade-off. For that, we rely partly on sub-sample estimates and
partly on time-varying parameter models estimated with a Kalman filter algorithm.
Finally, we contrast the Italian evidence with evidence from the US and the UK,
obtained by employing a similar approach.

Our key results are as follows. The statistical properties of inflation display
significant fluctuations over the post-WWII sample. Periods of fixed exchange rates and
looser wage bargaining mechanisms, often accompanied by less accommodative
monetary policies, experienced lower and more stable inflation rates than periods
characterized by more rigid labor market regulation and flexible exchange rates. A
fitting example is the 1972-84 period, which stands out as the only non-war episode of
high inflation. After the demise of the Bretton Woods agreement, strict wage indexation
made Italian wages sensitive to prices of imported goods, in fact contributing to
importing foreign inflation. Furthermore, the high rate of government budget deficit
monetization produced expansionary monetary policies and recurrent exchange-rate
crises, while inflation shocks and uncertainty hit hardest groups whose incomes were
less sheltered by indexation. These effects lasted in Italy much longer than in
comparable economies, at least until 1985. In that year, Italy starts a slow adjustment
process aimed at participating first in the Single European Market and later in the EMU.

Evidence on the inflation-output trade-off comes from a standard model that
blends the original expectation-augmented Phillips curve with more recent
specifications based on persistence and price-wage rigidity. Our main finding is that
there is no significant feedback from cyclical economic conditions on to inflation; that
is, we cannot detect a statistically significant Phillips curve. Moreover, we find some
evidence that the growth in the Treasury component (linked to government borrowing
requirements) of the monetary base is correlated with inflation. This result is consistent
with the hypothesis that both labor market rigidities and a fiscally dominated monetary
policy are the main drivers of Italian inflation.
The paper is organized as follows. In Section 2, we present the stylized facts on Italian inflation, on the link between monetary aggregates and budget deficits, and on the indexation mechanism. In Section 3, we analyze the statistical properties of the inflation rate. In Section 4, we present various estimates of the inflation-output equations, using conventional and time-varying methods. In Section 5, we compare the Italian estimates with those from the US and the UK. Section 6 discusses the main findings of our work and draws some conclusions.

2. Inflation in Italy, 1949-1998

2.1 Stylized facts

There are several ways to measure the Italian price level over the long run. Spinelli and Trecroci (2008) focus on the implicit price deflator of national income, cost of living and wholesale prices, dating back to 1861, the year of political unification in Italy. Here, we select the annual implicit price deflator, but our findings do not change significantly with alternative measures of the price level.

To put the analysis into historical perspective, we plot in Figure 1 the price level from 1861 to 2008. The plot shows that, for a long 50-year spell, approximately identified by the international gold standard, the Italian price level was relatively stable and had limited variability. The price level soared during WWI to level off only in the mid-20s, when Italy plunged into the only deflationary episode of its history.

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1 All pre-1950 GDP, industrial production, population and price data come from Flora (1983, 1987) and Mitchell (1992, 1993), whilst data on exchange rates, fiscal variables and the money stock are from Fratianni and Spinelli (2001a). We checked for consistency of the post-1950 data using standard sources, such as the IMF and OECD.
That episode ended with a second and more acute inflation outburst, first during WWII and then in the post-war years, but especially in the Seventies and part of the Eighties, the third major Italian inflation phase. It is in this period that the indexation mechanism was put in place.

Figure 2 below plots the log differences of the price level, for the years 1949 to 2008. Three developments stand out:

- Inflation was highly volatile in the 1950s and 1960s, when labor unions transitioned from post-war strength to significant weakening later in the fifties. Employment growth of the sixties raised union membership, also among unskilled workers. The weight of the latter, by the end of the sixties, grew relative to that of skilled workers, the traditional base of unions’ power.

- The first oil shock of 1973-4 triggered a sharp acceleration of the price level. That episode was followed by a surge in unions’ strength, massive strikes and an egalitarian money wage union policy. In 1975, monetary policy was tightened in response to rising wage pressures and a deteriorating external imbalance. Wage moderation, however, lasted only a couple of years, which explains an increase in inflation persistence.
A gradual return to lower rates of inflation started in the early eighties, following disinflationary policies enacted in the United States and the United Kingdom. Italian disinflation coincided with a decline in the unions’ power on wage bargaining, a loosening of the SM indexation mechanism, and the establishment of an income policy that can be interpreted as a *de facto* cooperative model among employers, unions and government. Tighter monetary policy, mostly the result of the Bank of Italy becoming increasingly independent from government, was ultimately responsible for Italy’s admission into EMU.

![Figure 2 - Italy, annual inflation rate, 1949-2008.](image)

Figure 2 - Italy, annual inflation rate, 1949-2008. Inflation is defined as the change in the natural log of the implicit price deflator of national income.

In what follows, we first provide an account of wage bargaining conditions in post-war Italy and a sketch of the fiscal dominance hypothesis, then present the statistical properties of the inflation rate, and finally examine the econometrics of the Italian Phillips curve for the period 1949 to 1998, the year before Italy joins EMU.

### 2.2 Wage indexation in post-war Italy

SM was first established in the province of Milan in 1944; it then spread quickly
to the rest of the country. The objective of indexation was to protect wages’ purchasing power from inflation erosion. Employers accepted it to avert social conflict. The SM indexation system had no exact counterpart in other industrialized countries and reflected the relative strength of Italian workers and left-wing parties. Employment growth in the sixties expanded union membership, proportionally more among unskilled than skilled workers (Cella and Treu, 1982). “Working-class power” peaked in the early seventies, when blue-collar workers accounted for 84% of manufacturing employees, leading to an explosion of labor strikes and an egalitarian wage policy.

SM worked by assigning a fixed lira sum to each percentage point increase in the price level index. This meant that lower money wages were more sensitive to price-level changes than higher money wages, a feature designed to achieve wage compression and larger income equality (Manacorda, 2004). Initially, wage indexation was less than complete. In 1975, at the peak of union power, the value of the fixed point was made uniform across workers and ‘hardened’ to compensate for price-level effects generated by the first oil crisis; in essence, it indexed money wages to imported inflation. Imported inflation was mostly the result of recurrent exchange-rate devaluations of the lira that took place soon after the demise of the Bretton Woods system. The extent of wage indexation to price-level changes expanded rapidly to reach full indexation and more. Modigliani and Padoa Schioppa (1978), fittingly, title their essay on Italian economic policy at the end of the seventies: “The Management of an Open Economy with ‘100% Plus’ Wage Indexation.”

The distortive effects of SM on work incentives contributed to a shift in favor of self-employment in the top end of the productivity distribution (Pellizzari, 2009). Frustration against the equalizing effects of SM erupted among white-collar workers. The pendulum then began swinging against SM. A first loosening of the SM impact on

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2 In 1946, the indexation mechanism was extended to Northern Italy, and soon after to the whole country, following a national agreement signed by the unions and Confindustria, the Italian Employers Association. Initially calculated at a provincial level, SM became uniform across all sectors, with differences based on age and sex.

3 Using Manacorda’s data, the ratio of the top-decile to the bottom-decile money wage was 2.40 in December 1977. From January to April 1978, with an increase of 5 points in the SM index, the ratio fell by 3% to a level of 2.32.

4 The 1975 Lama-Agnelli accord (after Luciano Lama, representing the three main Italian labor unions, and Gianni Agnelli, the head of Confindustria) reset the index at the new base of 100.

5 A key date is 1980, when an estimated 40,000 white-collar workers operated a strike at the FIAT headquarters in Turin.
money wages occurred in 1983. In April 1984, the government passed a law loosening the SM indexation adjustments. In response, the Italian Communist Party and the communist-backed union CGIL sponsored in 1985 a public referendum to restore full coverage under SM. The referendum was defeated. For the remainder of the 1980s, a much weaker form of SM continued to operate. Confindustria, the Italian Employers Association, repealed SM in 1991. In 1993, the government, the unions and Confindustria agreed to replace SM with an income policy, the essence of which was to link money wages to forward-looking expected inflation rates. The policy became effective the following year. In the meantime, the Bank of Italy, under Governor Antonio Fazio, engineered a strong disinflationary policy that was the main driver of Italy’s qualification for EMU (Fratianni and Spinelli, 2001a, ch. 12).

2.3 Fiscal dominance
The necessary conditions of fiscal dominance require that the government, in addition to controlling fiscal policy variables, has direct access to central bank financing so as to monetize a portion or the totality of its budget deficit. Under these circumstances, the government can raise the permanent level of expenditures without at the same time raising tax rates and, thus, influence current and future flows of the monetary base and the inflation rate. Fiscal dominance implies an intertemporal positive correlation between government budget deficits and money growth (Sargent and Wallace, 1981). Fiscal dominance also implies that the central bank can keep nominal interest rates “low” in relation to levels that are consistent with price-level stability. The low interest rate policy is aimed at reducing the cost to Treasury of financing budget deficits.

Fratianni and Spinelli (2001a and 2001b) provide a detailed account and econometric evidence that fiscal dominance characterized much of Italian monetary history from political unification to the creation of EMU. The height of fiscal dominance was reached during the sixties, the seventies and part of the eighties (Fratianni and Spinelli 2001a, chs. 4 and 10). In addition to monetizing a large share of budget deficits, the Bank of Italy put in place a complex web of controls and regulations to redirect national saving from the private sector to government. Interest rates were

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6 Such were the effects of the so-called “Accordo Scotti” among employers, unions and government.
kept low relative to inflation rates. Banks were subject to ceilings on bank loans and to minimum levels of purchases of government securities. An intricate web of regulations prevented people from diversifying assets across currencies. Controls on exchange rates and capital movements were increasingly tightened. The broad justification for these actions was that they were necessary to maintain interest rates below the level prevailing abroad and to allow the government to finance public debt at "reasonable" costs.

The low borrowing costs made it easy for political authorities to postpone needed adjustment. Budget deficits rose both in absolute value and in relation to GDP. Fiscal dominance left a legacy of fiscal profligacy and low credibility of the Bank of Italy. In 1981, Treasury agreed on what is popularly known as a "divorce" agreement, whereby the Bank of Italy was released from the obligation to buy unsold government securities at Treasury’s auctions (Fratianni and Spinelli 2001a, pp. 497-501). The agreement re-established some of the credibility the Bank had lost during the troubled seventies. Central bank credibility was again lost in September 1992, when Italy left the European Monetary System following a severe currency crisis. The Maastricht Treaty of the same year and the conditions to qualify for the final stage of EMU imposed tight constraints on Italian policy makers. In the years immediately preceding the launch of EMU the Bank of Italy was made completely independent of the executive. Fiscal dominance petered out because the Treasury had no longer access to central bank financing.

3. Statistical analysis of Italian post-war inflation

Having described the evolution of wage bargaining and indexation institutions and the dominance of fiscal policy over monetary policy for much of the 1949-1998 period, we now focus on the inflation data. To gain some insight into the evolution of inflation’s statistical properties, we split the sample in 1973 and study the resulting two sub-samples. The reason for the split is that in the first sub-sample (1949-1973), exchange rates were fixed within the Bretton Woods system, whereas in the second sub-sample (1974-1998) the Italian lira followed for the most part a “fixed but adjustable” peg within the European Monetary System.
Table 1 displays average inflation rates ($\mu$), their standard deviations ($\sigma$) and variation coefficients ($cv = \sigma / \mu$) for the whole sample and the two sub periods.

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>$e_1$=7.13*; $e_2$=22.6**</th>
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<tbody>
<tr>
<td>$\mu$</td>
<td>$\sigma$</td>
</tr>
<tr>
<td>1949-1998</td>
<td>7.00</td>
</tr>
<tr>
<td>1949-1973</td>
<td>4.269</td>
</tr>
<tr>
<td>1974-1998</td>
<td>9.902</td>
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</tbody>
</table>

**Table 1 - Italy. Summary statistics on annual inflation rates.** Inflation is defined as the change in the natural log of the implicit price deflator of national income. Mean ($\mu$), standard deviation ($\sigma$), coefficient of variation ($cv$), normality tests ($e_1$ and $e_2$). ‘*’ and ‘**’ indicate rejection of the null at the 5% and 1% significance level, respectively.

The inflation rate was much higher and volatile in the 1974-1998 sub-sample than in the earlier one, an outcome that is consistent with the intensity of fiscal dominance, social conflict, union bargaining power and exchange-rate turbulence in that period. Table 1 shows the results of the Jarque and Bera (1987) ($e_1$) and Doornik and Hansen (1994) ($e_2$) normality tests that evaluate whether asymmetry and kurtosis of the series correspond to those of a normal distribution.7 There is clear evidence against the null of normality for the entire sample.

Next we consider the stationarity properties of the inflation rate. For that, we employ the conventional Augmented Dickey-Fuller (ADF) test, which we remind is implicit in the evaluation of the $t$ statistic of the $\hat{\beta}$ coefficient in:

$$\Delta \pi_t = \alpha + \mu \tau + \beta \pi_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta \pi_{t-i} + u_t,$$

where $\tau$ is a deterministic trend. A significant statistic would imply rejection of the null hypothesis of unit root ($H_0 : \beta = 0$) and therefore stationarity of the inflation rate. Results are presented in Table 2, where we include $t$-values for the $\beta$ coefficient for both the model with only a constant and with a constant and a trend, each estimated

7 The Jarque and Bera test has low power in small samples; the Doornik and Hansen test corrects for this bias.
with \( n = 3 \). \(^8\)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>INFL</strong></td>
<td>Constant</td>
<td>Constant and trend</td>
<td></td>
</tr>
<tr>
<td>i=0</td>
<td>-1.731</td>
<td>-1.757</td>
<td>-0.4841</td>
</tr>
<tr>
<td>i=1</td>
<td>-2.100</td>
<td>-1.839</td>
<td>-0.9693</td>
</tr>
<tr>
<td>i=2</td>
<td>-1.421</td>
<td>-1.276</td>
<td>-0.6881</td>
</tr>
<tr>
<td>i=3</td>
<td>-1.389</td>
<td>-1.259</td>
<td>-1.207</td>
</tr>
<tr>
<td>i=0</td>
<td>-2.004</td>
<td>-2.292</td>
<td>-3.719*</td>
</tr>
<tr>
<td>i=1</td>
<td>-1.571</td>
<td>-1.823</td>
<td>-3.690*</td>
</tr>
<tr>
<td>i=2</td>
<td>-1.406</td>
<td>-1.807</td>
<td>-3.374</td>
</tr>
<tr>
<td>i=3</td>
<td>-1.154</td>
<td>-1.548</td>
<td>-3.582</td>
</tr>
<tr>
<td>i=0</td>
<td>-0.4841</td>
<td>-3.719*</td>
<td>-3.690*</td>
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<td>i=1</td>
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<td>i=3</td>
<td>-1.207</td>
<td>-3.582</td>
<td>-3.582</td>
</tr>
</tbody>
</table>

Table 2 - Italy, Augmented Dickey-Fuller test on inflation rates, various sub-samples. Inflation is defined as the change in the natural log of the implicit price deflator of national income. ‘*’ and ‘**’ indicate rejection of the null with a 95% and 99% confidence interval, respectively.

Overall, we cannot reject the null of a unit root in both models: the inflation rate appears to be a non-stationary process. This result emphasizes the persistence of Italian inflation and points to the persistence of Italian macroeconomic volatility as the likely underlying reason. It also supports the notion that the statistical properties of inflation changed over time. However, based on simple unit root tests we cannot determine the nature and frequency of the structural changes that are responsible for non-stationarity. Moreover, the ADF tests have low power in small samples, and with variables containing moving-average components (Maddala and Kim, 1998). This suggests that it is better to focus on the possible presence of structural breaks than on the unit-root properties of the series. We will examine possible structural changes of the inflation process below, jointly with output dynamics and in the context of a Phillips-curve relationship.

4. A Phillips curve for Italy?

It is important to disentangle the short-run variation of inflation from its long-term trend. Various methods are available, such as the Hodrick-Prescott (HP), linear or band-pass filters. Unfortunately, the results from market surveys or measures extracted from inflation swaps or bond-based break-even inflation rates are available only for relatively short and recent samples of data. We therefore base our inferences on two

\(^8\) The critical values for this procedure depend on the inclusion of the constant or of the constant and a trend term. The critical values we employ are from MacKinnon (1991). A statistic significant at the 5% is marked by *, at the 1% by **.
filtered measures. The first uses the *Structural Time Series* (STS) approach proposed by Harvey (1989); for more details, see Hamilton (1994). STS involves decomposing the original series into trend, recursive stochastic cycles, and irregular components that vary over time, using the Kalman filter.\(^9\) This generates a time-varying trend based on low-frequency autoregressive and cyclical components of inflation’s DGP. The second is the more conventional HP filter.\(^10\) Figure 3 plots actual inflation along with trend inflation estimated either using the Kalman filter (STSINF) or HP (HPINF). It is easy to spot the sizeable rise in the inflation rate in the late 1960s, peaking between 1980 and 1983, and finally declining towards the end of our sample.

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\(^9\) This way, we extract time-varying measures of expected inflation that for each observation rely only on information available up to the point of estimation. This modelling approach applies a Kalman-filter estimation procedure, in line with a plausible learning process for both the central bank and private agents.

\(^10\) These are not “ideal” measures of expected inflation. The two-sided nature of the HP filter, for instance, makes the inflation trend dependent on a perfect-foresight hypothesis. More generally, agents’ expectations of inflation will be the combination of some trend measure and a random component, which, according to rational expectations, should be unpredictable. Both the HP filter and the Kalman-filter-based trends, as well as almost all other alternative methodologies, violate this orthogonality condition, which on the other hand appears to clash with the empirical evidence in favor of adaptive inflation expectations (Fuhrer and Moore, 1995; Cogley and Sbordone, 2007).
Next, we begin our econometric analysis with a discussion of some hybrid inflation-output trade-off hypotheses. The first blends the classical expectation-augmented Phillips curve hypothesis (Phelps, 1967; Friedman, 1968) with more recent proposals featuring persistence and price-wage rigidity (Woodford, 2003). A reduced-form equation of the trade-off between inflation and output is given by (1):

\[ \pi_t = \gamma(y_t - y_t^*) + E_{t-1}\pi_t, \]  \hspace{1cm} (1)

where \( y_t - y_t^* \) denotes the output gap, that is, the difference between the current level of output and its NAIRU or equilibrium level, and \( E_{t-1}\pi_t \) the expected inflation rate, conditional on last period’s information. The \( E_{t-1}\pi_t \) term embeds a rational expectations hypothesis.

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11 What follows is not meant to be a complete discussion of the various Phillips hypotheses, but only a short reference to the main empirical features relevant to our empirical investigation.
hypothesis in a structural model of price rigidity. Equation (1) implies that: unexpected changes in aggregate demand affect both inflation and output; parameter $\gamma$, defining the slope of the curve, declines as prices become stickier; and the SM mechanism also reduces $\gamma$, making it zero (a perfectly horizontal curve) when indexation is complete.

The literature has often discussed a forward-looking specification of eq. (1):

$$\pi_t = \gamma(y_t - y_t^*) + \beta E_t \pi_{t+1}.$$  

Unlike (1), (2) makes the curve shift in response to revisions of current expectations of future inflation. However, from an observational point of view, the difference between (1) and (2) is not so significant given that expected inflation rates display a high degree of serial correlation. Recently, some consensus has emerged on a trade-off specification that accounts for inertia and nominal rigidities. In the framework commonly defined as the New Keynesian Phillips curve (NKPC), current inflation reacts to expected future inflation and current real economic activity, proxied by real marginal costs and empirically measured by income’s labor share. The result is a model where inflation is purely forward-looking. However, robust empirical evidence, both at the micro and macro level, confirms that inflation has a significant degree of inertia (Fuhrer and Moore, 1995; Woodford, 2003; Cogley and Sbordone, 2008). Building on these findings, most models add lagged inflation on top of forward-looking terms.12 Finally, given the small and open nature of the Italian economy, it is appropriate to add the rate of change of import prices ($\pi_t^*$) so as to account for the impact of foreign inflation on the domestic price level, impact that in Italy was exacerbated by the SM mechanism. Based on these considerations, we arrive at our preferred reduced-form equation:

$$\pi_t = \beta E_t \pi_{t+1} + \omega \pi_{t-1} + \gamma(y_t - y_t^*) + \delta \pi_{t-1}^* + \epsilon_t.$$  

The estimates that follow are based on (3). The output gap is measured with the

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12 Price indexation, rule-of-thumb behavior, non-linearities in price-setting mechanisms and time-varying trend inflation are amongst the theoretical explanations of inflation persistence.
STS approach. The time-varying potential output is computed by fitting a univariate model on real GDP. Each observation of the estimated potential output relies only on information available up to the point of estimation. As a robustness check, we also tried alternative measures of the output gap—one provided by the OECD, another estimated with the HP filter and a third estimated with band-pass filters—but found very little qualitative differences in the resulting estimates of the Phillips curve.

Equation (3) was first estimated with standard OLS over the sample 1949-1998. These estimates, based respectively on the HP and STS measures of the output gap, are presented below (t-values, shown in parentheses, are computed using heteroskedasticity and serial correlation consistent [HAC] standard errors):

$$\pi_t = 0.092 E_t \pi_{t+1} + 0.611 \pi_{t-1} - 0.151 \left( y_t - y_t^* \right)^{STS} + 0.145 \pi_t^* + \hat{e}_t$$  
(0.37)  (5.00)  (-1.33)  (2.90)  
$$R^2 = 0.85$$

$$\pi_t = 0.042 E_t \pi_{t+1} + 0.683 \pi_{t-1} - 0.014 \left( y_t - y_t^* \right)^{HP} + 0.154 \pi_t^* + \hat{e}_t$$  
(0.162)  (4.95)  (-0.09)  (2.81)  
$$R^2 = 0.84$$

Lagged inflation and import prices are the main drivers of actual inflation. Our estimates therefore confirm that, over the sample considered, domestic inflation was highly persistent and dependent on imported inflation, the latter reflecting recurrent exchange-rate devaluations of the lira. The output-gap coefficient is never statistically significant, regardless of the filtering methodology employed.

Overall, this evidence is inconsistent with the implications of a Phillips-type trade-off between inflation and output. This suggests that estimation should take into account the likely occurrence of shifts in the relationship between inflation and real economic activity. By allowing for time variation in the inflation-output trade-off,

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13 The use of alternative methods, like IV or GMM, suffers from well-known drawbacks pertaining to lack of robustness (Muscatelli et al., 2002), and in the case of our long historical sample, is anyway beyond consideration due to data limitation.

14 Although we cannot rule the impact of imported inflation due to changes in relative prices, changes in the nominal exchange rate are presumed to have exerted the dominant impulse.

15 We also tried a specification in which the change in industrial production replaced the output gap as a measure of economic activity. Results did not differ qualitatively from those reported.
estimates could shed more information on the links between observed institutional changes, such as the SM mechanism, and the structural shifts in the coefficients of the Phillips curve.

An additional consideration that might have affected the covariance between output and inflation shocks is the particular role played by monetary policy. Fratianni and Spinelli (2001b) report several episodes in which growth in the Italian monetary base was tied to changes in the Treasury’s borrowing requirements. In a famous paper, Lucas (1980) estimated a Phillips-type relationship with money in place of output on US data, since filtered data showed that inflation moves roughly one-for-one with money growth. This implies that inflation could react to changes in the monetary base, regardless of developments in the level of real activity. We re-estimated, therefore, our baseline inflation model by replacing the output gap and imported inflation with the growth in the Treasury component of the money base (MBTES). Below, we report our estimates:

\[
\pi_t = 0.088 \pi_{t+1} + 0.72 \pi_{t-1} + 0.103 \Delta MBTES + \hat{\epsilon}_t
\]

\[
(0.437) \quad (5.68) \quad (2.03)
\]

\[R^2 = 0.80\]

The positive and statistically significant coefficient of the change in MBTES is consistent with the fiscal dominance view, namely that changes in the monetary base, driven to accommodate the funding needs of fiscal authorities, exerted a positive impact on actual inflation.

This evidence, together with the time-series properties of inflation, supports the conjecture that over our sample period the covariance between inflation and real economic activity experienced significant shifts. An alternative method to treat this problem and yet obtain more transparent inference than with standard unit-root tests is to use comprehensive time-varying parameter (TVP) approach; see Granger and Jeon (2008).16 TVPs could help identify the conditional inflation-output trade-off and the causal links between observed institutional or behavioral changes and structural shifts in

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16 See also Kim and Nelson (2006) and Cecchetti et al. (2007). Alternatively, one could insert variously defined time trends in the model. The TVP approach yields much richer evidence about time variation, especially about aggregate demand and inflation expectations.
the parameters. To this end, we represent the model in a general state-space form (Harvey, 1989; Kim and Nelson, 1999):

\[ \pi_t = c_t + x_t b_t + e_t \]
\[ b_{t+1} = d + T b_t + z_{t+1} \]

where \( e_t \approx N(0, \sigma^2) \), \( z_t \approx N(0, Q) \), \( b_0 \approx N(a_0, \Sigma_0) \), and \( x_t \) defines a vector of the model’s explanatory variables. The first equation in (4) is the measurement or observation equation. It is the classical linear regression model except that the parameter vector \( b_t \) (representing the state variables) is posited to change stochastically according to the transition described in the second equation in (4). Summing up, this time-varying formulation involves forecasting the optimal state vector in each period, conditional on information available up to the previous period. This way we compute filtered estimates of the parameters and the residuals for each observation in the sample, thus accounting for the potential variation over time of the underlying parameters.

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17 We follow the prior distribution proposed by Doan et al. (1984), which assumes that changes in the endogenous variable are so difficult to forecast that in the AR(1) process of the unobserved state vector the coefficient of its lagged value is likely to be near unity, while all other coefficients are assumed to be near zero. The prior distribution is independent across coefficients, so that the MSE of the state vector is a diagonal matrix. We assume that measurement errors and the disturbances to transition equations are serially and mutually independent.

18 Under the normality and independence assumptions about the disturbances, the computation of the state vector is obtained with the Kalman filter.
Figure 4 - Italy, Estimates of $\gamma$ of eq. (3), 1949-1998. TVP coefficients obtained using HP (HPgamma) and STS-based (STgamma) measures of the output gap.

Figure 4 plots the times series of the estimated slope coefficient $\gamma$ in equation (3). The estimates were carried out using a HP-based measure of inflation expectations and two definitions of, alternatively, STS and HP definitions of the output gap. The dynamics of estimated $\gamma$ corroborates that the inflation rate and the output gap were negatively associated over most of the 1949-1998 sample. In contrast, were we to measure the inflation impact of output changes with standard constant-coefficient techniques, we would simply detect an insignificant response, as the result of a significant and negative feedback in the early part of the sample and a muted correlation in the latter part. The vigorous output dynamics of the 1950s and early 1960s was largely non-inflationary, as rapid productivity gains pushed the Italian economy’s production frontier, while Bretton Woods’ fixed exchange rates shielded the economy.

For brevity, we do not show here the full results of our TVP estimation; results are available from the authors upon request.
from monetary and other nominal shocks. This effect faded out over time. Stronger labor unions, compliant governments, and distorted monetary policy, as we have discussed above, imposed severe constraints on firms. This assessment is consistent with the central message of Modigliani and Tarantelli (1976), who showed that starting with 1968 deteriorating industrial relations were responsible for an upward shifting and an ever steeper Phillips curve (defined in terms of inflation and unemployment).²⁰

5. A comparison with the US and the UK

We now compare our Italian findings with those of the US and the UK. We employ similar methods over the same sample periods. Table 3 reports simple means and standard deviation of inflation rates over the two halves of our sample. Figure 5 plots the annual inflation rates (all based on the price deflator of national income) of the three countries. Italian inflation has the highest mean and volatility. UK and Italian inflation rates were substantially higher and showed a higher degree of persistence than US inflation rate, especially in the 1970s and the 1980s. However, after 1979 the UK and Italian experiences diverge, with the UK able to mop up inflation much faster than Italy.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Italy</th>
<th>USA</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>μ</td>
<td>σ</td>
<td>μ</td>
</tr>
</tbody>
</table>

Table 3 - US, UK and Italian annual inflation rates, 1949-1998. Means and standard deviations.

²⁰ It should be noted that in a later article Tarantelli (1978) argued that stagflation did not necessarily hamper the theoretical validity of a textbook-like Phillips curve, especially if the reaction of monetary policy to the resulting cost-push inflation was deflation. However, such reaction does not seem to have materialized up until the end of our sample.
Figure 5 - US, UK and Italian inflation rates, 1949-1998.

Turning to a comparison of the inflation-output relationships across the three countries, Table 3 contains the estimates for the baseline Phillips-type specification\(^{21}\).

\[
E_{t} \pi_{t+1} | \pi_{t-1} | (y_{t} - y_{t}^{*})
\]

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>UK</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>(E_{t} \pi_{t+1})</td>
<td>0.707</td>
<td>0.649</td>
<td>0.092</td>
</tr>
<tr>
<td>t-values</td>
<td>(6.02)</td>
<td>(4.90)</td>
<td>(0.37)</td>
</tr>
<tr>
<td>(\pi_{t-1})</td>
<td>0.302</td>
<td>0.369</td>
<td>0.611</td>
</tr>
<tr>
<td>t-values</td>
<td>(2.67)</td>
<td>(2.98)</td>
<td>(5.00)</td>
</tr>
<tr>
<td>((y_{t} - y_{t}^{*}))</td>
<td>0.127</td>
<td>0.179</td>
<td>-0.151</td>
</tr>
<tr>
<td>t-values</td>
<td>(2.16)</td>
<td>(1.36)</td>
<td>(-1.33)</td>
</tr>
</tbody>
</table>

Table 4 - US, UK and Italian Phillips curves, 1949-1998. Coefficient estimates and t-values.

The US are the only country with a textbook or New-Keynesian estimates, statistically significant, of an inflation-output trade-off. In the UK, the output elasticity, though positive, is statistically insignificant, whereas both expected and lagged inflation

\(^{21}\) For these estimates, we measured the output gap by generating a HP-based series for potential output. Results do not qualitatively differ with the STS approach. Models for the UK and Italy also contain import prices as a regressor.
have large and highly significant coefficients. In contrast, the coefficient on lagged inflation is highest in Italy, which also stands out as the country where output and inflation move in opposite directions during major shocks and where current inflation appears to be insensitive to expected inflation.

Finally, we examine the temporal evolution of the inflation-output relationship by estimating TVP models for the UK and the US as well. Figure 6 shows the dynamics of the output gap coefficient $\gamma_t$. The UK and Italy has a negative $\gamma$ up until the early 1970s, but the Italian $\gamma$ stays negative until the end of the sample. In the US, the estimated $\gamma$ mirrors the textbook case of being positive and relatively stable, with only one major breakdown during the stagflation of the seventies. These findings broadly confirm that the standard trade-off between inflation and output growth emerges only during periods of (and for those countries characterized by) low inflation and limited macroeconomic volatility.

The economic significance of these results may be better understood if they are

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure6.png}
\caption{US, UK and Italian estimates of $\gamma_t$ of eq. (3), 1949-1998. TVP coefficients obtained using STS-based (STGammagamma) measures of the output gap.}
\end{figure}

22 All remaining coefficients were assumed to be time-varying. Their estimates are available from the authors.
placed within the institutional context of the three countries. Italian and UK industrial relations were strikingly similar up until Mrs. Thatcher came to power in 1979: her government set monetary stability and low inflation as a priority. Legislation produced by Thatcher’s government gradually reduced the national role of unions and collective bargaining (Visser and Ruysseveldt, 1996). Union representation and strike frequency declined sharply to well below the European average. On the other hand, UK monetary authorities experimented with several institutional arrangements aimed at reigning in inflation, such as monetary targeting and a period of “shadowing the deutschmark”.

The US have had a structure of trade unionism similar to the UK’s, with a single major national center of member unions. Only few unions were outside the umbrella of the AFL-CIO or the TUC. In Italy, in contrast, significant union power was lodged outside the major labor confederations, which are divided along political, organizational, and religious lines. In the US and the UK, despite declining membership, unions were able to raise members’ wages substantially above non-union wages. In Italy, in contrast, wage settlements spilled over onto the non-unionized sector with the consequence that there was no significant union wage differential.23 National labor agreements had the force of law. Unions were strong and closely tied to political parties; their members were relatively homogeneous. In contrast, the employers’ association Confindustria was not rooted in a “dense” institutional framework and had a membership with relatively heterogeneous objectives. The latter differed along several dimensions, such as size of the firms, industrial sectors, and regions where the firms were located.

Italy did not go through radical policy changes similar to those experienced in the UK. A system of centralized wage bargaining remained at the core of Italian industrial relations, an equilibrium outcome stemming from the interplay of strong political parties, weak governments (Visser, 1998) and a fiscally dominated monetary policy. Macroeconomic instability manifested itself with a high and volatile inflation, accompanied by exchange rate devaluations and currency crises. It is no surprise that under such circumstances the identification of a stable trade-off between output and inflation is a challenging task if not outright impossible.

23 Time-series evidence for the 1970s and 1980s from both the US and the UK suggests that the union differential in the US is 18 per cent, higher on average than the 10 per cent found in the UK. (Blanchflower, Bryson and Forth, 2007).
6. Discussion of findings and concluding remarks

The estimated response of Italian inflation to output gap reveals the existence of a negative link between inflation and real economic activity. When we measure the inflation impact of output changes via the standard constant-coefficient technique, the outcome is a statistically insignificant response, reflecting a statistically significant but negative feedback in the early part of the sample and a muted correlation in the latter part. Only for the US, constant-coefficient estimates yield an inflation-output trade-off that is in line with the textbook or New Keynesian Phillips curve hypothesis. As to the UK, while the output elasticity is positive but statistically insignificant, expected inflation exerts a sizeable and statistically significant impact on current inflation. The Italian distinctiveness has its likely roots in output and inflation moving in opposite directions during major shocks and in inflation expectations being insignificant in driving current inflation. The exception to this pattern occurs in the period between the 1950s and the early 1960s, when output dynamics were largely non-inflationary (because pushed by rapid productivity gains) and the economy was shielded by nominal shocks through the operation of the Bretton Woods system of fixed exchange rates.

The UK as well experienced a negative relationship between inflation and real economic activity but only up until the 1970s; after that, the traditional relationship held up. In the US, the sensitivity of inflation to output was more robust and stable, with the major breakdown during the stagflation of the seventies. These findings broadly confirm that the standard trade-off between inflation and output growth emerge only during periods of low inflation and relative macroeconomic stability.

The comparison of Italy with the US and the UK sheds light on the institutional roots of inflation. Where market discipline and central bank independence are dominant arrangements, like in the US, we find a textbook-like Phillips curve. In contrast, where institutions are weak and fractious, like in Italy, no clear and consistent policy rule emerges. The UK experience is somewhat in the middle between the US and Italy, with the Thatcher regime representing the critical structural shift: in the new regime strong institutions supported and cooperated with a government credibly committed to fight inflation because it was not burdened by any persistent spending bias. We have argued that the Italian “distinctiveness” rests on two institutional mechanisms: a rigid wage
bargaining and indexation arrangements aimed at protecting real wages and a fiscally dominated monetary policy driven by profligate governments. These two forces were the engine of a persistent macroeconomic instability.

References
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