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The Phillips Curve and the Italian Lira, 1861-1998

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Abstract

We examine Italian inflation rates and the Phillips curve with a very long-run perspective, one that covers the entire existence of the Italian lira from political unification (1861) to the entry of Italy in the European Monetary Union (end of 1998). We first study the volatility, persistence and stationarity of the Italian inflation rate over the long run and across various exchange-rate regimes that have shaped Italian monetary history. Next, we estimate alternative Phillips equations and investigate the extent to which nonlinearities, asymmetries and structural changes characterize the inflation-output trade-off in the long run. We capture the effects of structural changes and asymmetries on the estimated parameters of the inflation-output trade-off relying partly on sub-sample estimates and partly on time-varying parameters estimated with the Kalman filter. Finally, we investigate causal relationships between inflation rates and output and extend the analysis to include the US and the UK for comparison purposes. The inference is that Italy has experienced an inflation-output trade-off only during times of low inflation and stable aggregate supply.

JEL Codes: E31, E32, E5, N10.

Keywords: inflation, Phillips curve, Italian lira.

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1. Introduction

After dominating the policy agenda across the 1970s and the 1980s, two decades of apparent price stability have confined the dynamics of inflationary processes to the outer limits of the macroeconomic debate. This is unsatisfactory for various reasons. First, many aspects of past inflationary processes are still unsettled, as is the issue of whether the optimal level of the inflation rate, whether zero or low. Second, inflation is not dead, as its current rise in the US, UK and the euro area suggests. Third, past spells of low inflation could guide us to interpret the current state of affairs and to identify those forces that transform low rates of inflation into higher rates. This paper intends to stimulate the debate on these issues by investigating the evolving nature of the trade-off between inflation and output.

We examine Italian inflation rates and the Phillips curve with a very long-run perspective, one that covers the entire existence of the Italian lira from political unification (1861) to the entry of Italy in the European Monetary Union (end of 1998). Italy, as a case study, has two attractive features. The first is that this country has experienced higher average and more volatile inflation rates than most industrialized countries and across a variety of monetary regimes. The second is that Italy differs from anglo-saxon market structures and institutions, whereas the bulk of the literature on the Phillips curve has concentrated mainly on those countries. The long historical reach of our study appears to be particularly suitable to draw inferences among heterogeneous countries.

Methodologically, this study first examines the volatility, persistence and stationarity of the Italian inflation rate over the long run and across various exchange-rate regimes that have shaped Italian monetary history (Fratianni and Spinelli, 2001a). Next, we estimate alternative Phillips equations and investigate the extent to which nonlinearities, asymmetries and structural changes characterize the inflation-output trade-off in the long run. We capture the effects of structural changes and asymmetries on the estimated parameters of the inflation-output trade-off relying partly on sub-sample estimates and partly on time-varying parameters estimated with the Kalman filter. Finally, we investigate causal relationships between inflation rates and output and extend the analysis to include the US and the UK for comparison purposes.

The main results are as follows. The level, volatility and persistence of inflation display significant fluctuations over the entire sample. Fixed exchange rate regimes, and especially the gold standard, are associated with lower inflation rates than more flexible forms of exchange rates. Bretton Woods stands out as the only major non-war inflationary period. Inflation persistence is higher under flexible exchange rates, especially after Bretton Woods. Non-stationarity of inflation appears to be a feature of flexible exchange rates.

As to the inflation-output trade-off, *inter alia* we provide estimates of a consensus model that blends the original expectation-augmented Phillips curve with the most recent stylizations on persistence and price/wage rigidity (Woodford, 2003). Over the whole sample, we detect a negative relationship between inflation and output, suggesting dominance of supply-side shocks and inflation expectations. Yet, when we account for the large effects of the two world wars and post-Bretton Woods inflation, the Phillips curve exhibits the textbook positive feedback from cyclical conditions to inflation. The inference is that Italy has experienced an inflation-output trade-off only during times of low inflation and stable aggregate supply.

2. A brief sketch of prices and inflation from the *Monetary History*

As a starting point, we find it useful to summarize the salient points of the behaviour of the price level and its rate of change during the entire history of the *lira*, from political unification in 1861 to Italy's entry into the European Monetary Union (EMU) in 1998 (Fratianni and Spinelli 2001a). We measure the price level by the logarithm of the annual price deflator of national income; see Figure 1.[1] Prices are relatively stable from

[1] Obvious data limitations impair the study of the purchasing power of the Italian lira in the long run. However, several measures of the price level across the long time span considered in this paper have recently emerged. For instance, Spinelli and Trecroci (2008) examine time series of the implicit price deflator of national income, cost of living and wholesale prices. In this paper we pick up the former, but experiments with the other indices show that most of our findings are qualitatively unaffected by the choice we make. The sample period used is 1868-1998, except in the case of the UK, where the sample starts in 1872. The pre-1950 GDP, population and price data were obtained from Flora (1983, 1987) and Mitchell (1992, 1993), whilst data on exchange rates, fiscal variables and the money supply are compiled by Fratianni and Spinelli (2001a) using a variety of historical sources. The data for the post-1950 period was checked for consistency using standard sources (IFS, OECD).

1861 to the start of World War I, that is during the period characterized by the international gold standard. Upward movements in the price level occur, not surprisingly, during the two world wars and in the modern period following World War II. The years from 1927 to 1933 are instead a period of deflation.

Figure 2 displays the inflation rate computed as the first difference of the logarithm of the price deflator. It confirms visually the mean-stationary of the inflation rate during the international gold standard, the sharp accelerations imparted by the two wars, the deflation of the inter-war years, the rising inflation of the 1970s, its decline in the 1980s in sympathy with what was happening in other industrial countries, and the significant disinflation of the late 1990s. On average, Italian inflation has exceeded by five percentage points the inflation rate of the rest of the world, defined as the inflation rate of the significant reference country.[2] This Italian inflation excess was contained within one percentage point during the gold standard but rose to eight percentage points in the 1970s. If we exclude the war periods, the drivers of the Italian inflation rate were fiscal and monetary impulses affecting aggregate demand against a relatively stable aggregate output supply. Overall, the fiscal impulse was dominant in the sense that it determined the course of monetary policy (Fratianni and Spinelli 2001b).

Inflation, once started, tends to persist. This is due in part by the dynamics of inflation expectations and in part by the overhang of monetary base that declines slowly after the monetary shock ends. Differences in the strength of inflation expectations, driven by credible monetary policy actions, explain differences in inflation persistence. For example, monetary tightening in 1926 and 1947 was well publicized and widely believed to be permanent by the public; inflation came down quickly. On the other hand, repeated monetary tightening in the 1960s, 1970s, and 1980s were perceived to be temporary or easily reversible; inflation stuck on the high side.

Over the 138-year span of history, Italy has lived through several monetary regimes: it has swung from the gold standard to inconvertible fiat money; alternated periods of fixed exchange rates with periods of flexible rates; and experimented alternatively with interest rate, total domestic credit, monetary base, and inflation rate

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[2] Reference country is either France up to World War I, the United Kingdom in the inter-war period, and the United States after World War II.

targeting. The fixed exchange rate regime was often adopted to signal the country's determination to a course of deflation or disinflation, but just as often created unsustainable conflicts with other goals of economic policy and, hence, was not a credible pre-commitment device for deflation or disinflation. It is worth pointing out that the successful disinflation of the nineties, which made it possible for Italy to join EMU, instead, was the result of a tough-minded inflation rate targeting and was accompanied by stable output growth.

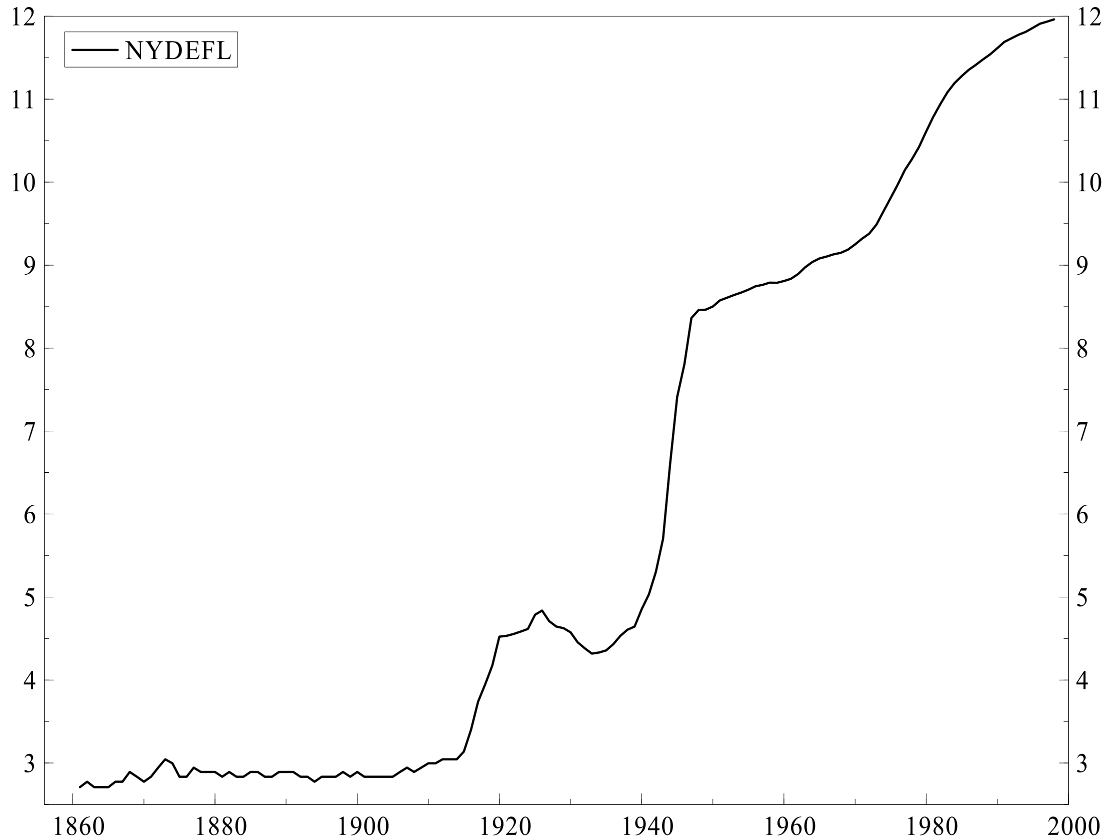


Figure 1, Italy, 1861-1998: implicit price deflator of the national income, natural log of index.

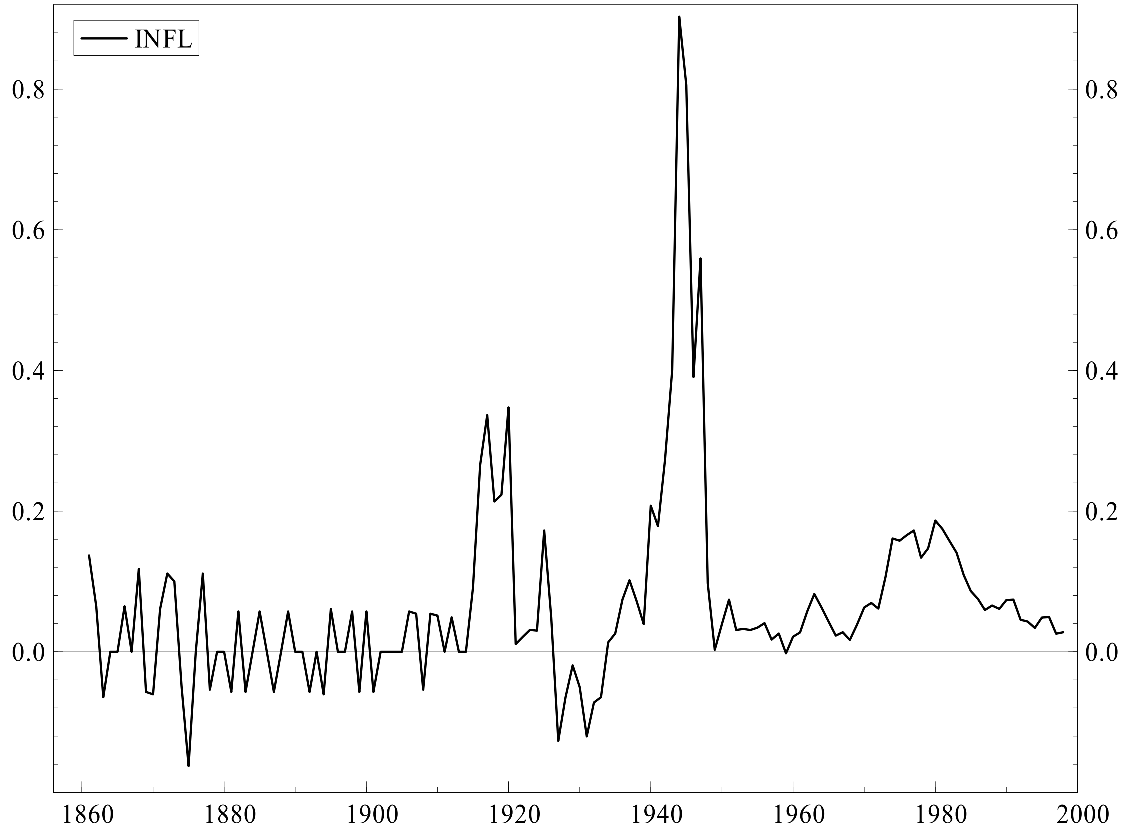


Figure 2, Italy, 1861-1998: implicit price deflator of the national income, change in the natural log of index.

3. Statistical analysis of the Italian inflation process

In order to capture the evolution of the statistical properties of the Italian inflationary processes, we will focus on both the whole span 1861-1998 and some sub samples defined by the different monetary and exchange-rate regimes Italy adopted over the long period under observation. In particular, we will consider the following partition, put forward, *inter alia*, by Fratianni and Spinelli (2001a):

1) 1861-1913: dominance of the gold standard and fixed exchange rates;
2) 1914-1949: world wars and interwar years, mainly with flexible exchange rates;
2.1) 1920-1936: interwar years, with spells of both fixed and flexible rates;
3) 1950-1973: Bretton Woods system, hence fixed exchange rates;
4) 1974-1998: fixed but adjustable peg.

Table 1 displays average inflation rates (m), their standard deviations (s) and variation coefficients ($cv = s / m$) for the whole sample and the five sub periods.

SAMPLE	e_1=1375.2**; e_2=261.79**		
	m	s	***cv***
1861-1998	6.805	13.934	2.048
1861-1913	0.647	5.801	8.966
1914-1949	15.049	23.252	1.545
1920-1936	1.508	10.976	7.279
1950-1973	4.269	2.423	0.568
1974-1998	9.902	5.334	0.539

Table 1, Italy. Implicit price deflator of the national income, change in the natural log of index. Average (m), standard deviation (s), coefficient of variation (*cv*), normality test, 1861-1998. '**' indicates rejection of the null with a 99% confidence interval.

Barring WWII, the period with the highest average inflation was the post-Bretton Woods era of fixed but adjustable peg, while the periods of gold standard and Bretton Woods fixed rates were the ones with the lowest inflation. Inflation volatility, as measured by the its standard deviation, was highest in the 1914-1949 sub sample, but adjusting this measure for its mean reveals greater variability during the classical gold standard and lower variability in the last half-century of the sample. Overall, inflation on average seems lower with fixed exchange rates and higher under flexible exchange rates. Amongst the two experiences with fixed exchange rates, the Bretton Woods years had a much higher inflation, although less volatile, than during the gold standard. In any case, we detect ample time-variation in the mean and standard deviation; this recommends examining inflation's stationarity properties.

Table 1 also contains the results of Jarque and Bera (1987) (e_1) and Doornik and Hansen (1994) (e_2) tests for normality. Essentially, these tests evaluate whether asymmetry and kurtosis of the series correspond to those of a normal distribution[3]. Table 1 shows results for the whole sample: there is clear evidence against the null of normality. To evaluate persistence, we compute the autocorrelation function (ACF) up to the 10th lag. Figure 3 plots the function computed over the whole sample. The first lags have large coefficients, while negative values are reached only after 8-9 lags; we conclude that Italian inflation was highly persistent. Figure 4 displays the correlogram for the four main sub periods[4], and confirms that persistence was higher with flexible exchange rates and reached a maximum after the demise of the Bretton Woods system.

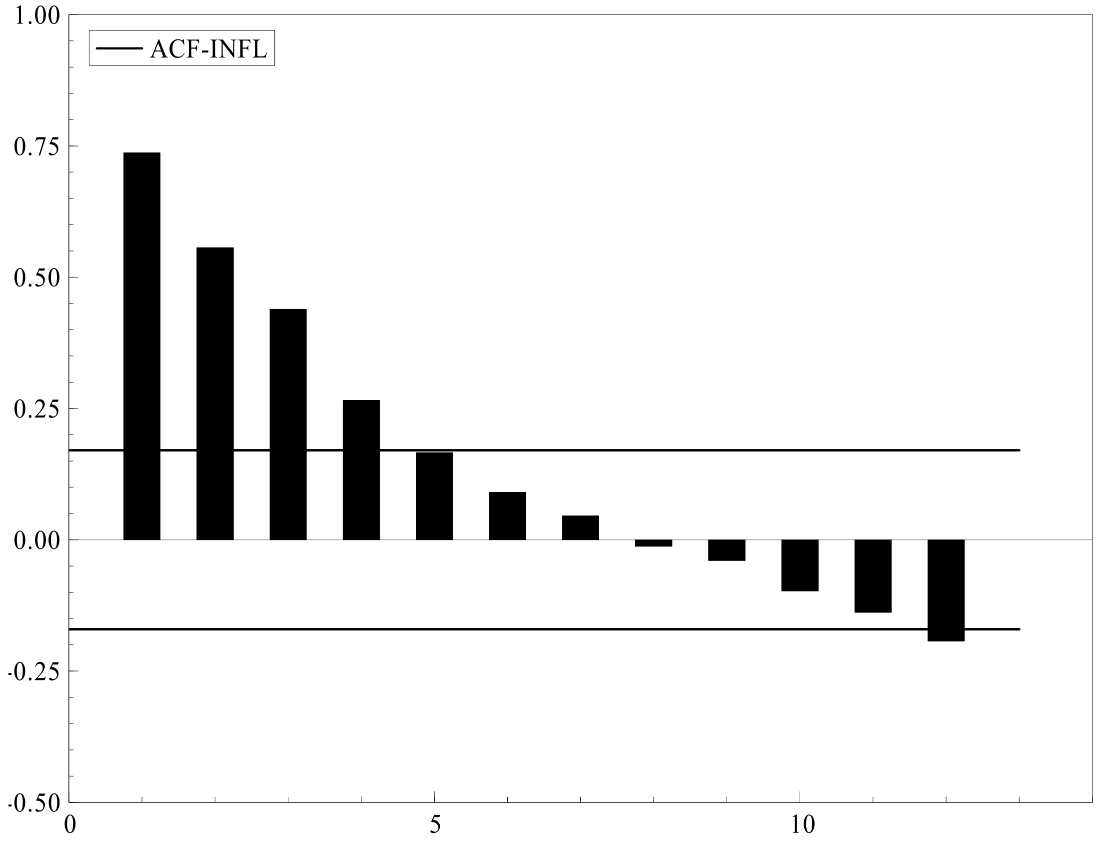


Figure 3, Italy, 1861-1998. Implicit price deflator of the national income, change in the natural log of index. Autocorrelation function; horizontal lines represent ± 2 standard deviations from estimated autocorrelations, assuming the population value is zero.

[3] We remind that Jarque and Bera's test has low power in small samples. Doornik and Hansen's test adjusts for this bias.

[4] Given the limited number of its observations, we do not include results for the 1920-1936 sub sample.

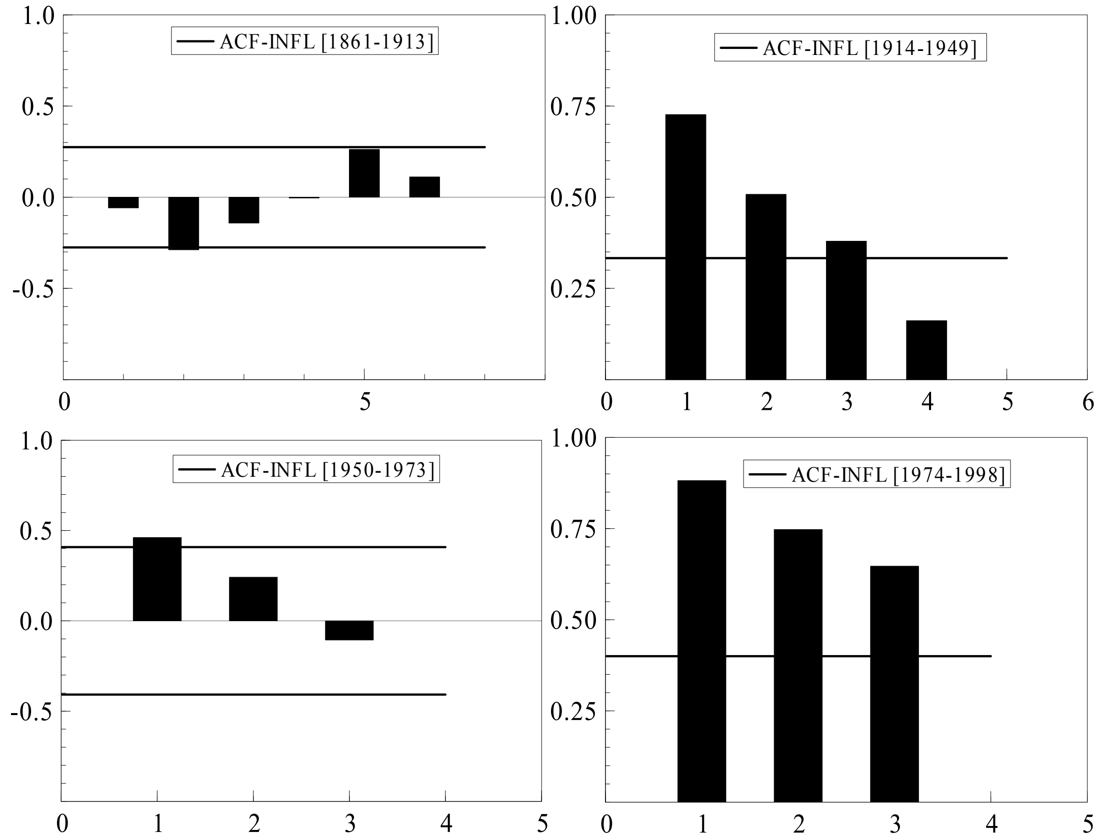


Figure 4, Italy, various sub samples. Implicit price deflator of the national income, change in the natural log of index. Autocorrelation functions; horizontal lines represent ± 2 standard deviations from estimated autocorrelations, assuming the population value is zero.

Finally, we investigate the stationarity of the inflation process. To this end, we employ the Augmented Dickey-Fuller (ADF) test, which we remind is implicit in the evaluation of the t-statistic t 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 τ 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.

Table 2 presents results for the whole sample and the four main sub periods. We included *t-values* for the β coefficient for both the model with a constant and that with constant and trend, each estimated with $n = 3$ [5].

INFL	Constant				Constant and trend			
SAMPLE	**i=0**	**i=1**	**i=2**	**i=3**	**i=0**	**i=1**	**i=2**	**i=3**
1861-1998	-4.535**	-4.095**	-3.732**	-4.114**	-4.656**	-4.219**	-3.853*	-4.285**
1861-1913	-7.364**	-6.683**	-6.497**	-5.662**	-7.315**	-6.671**	-6.512**	-5.729**
1914-1949	-2.264	-2.211	-2.082	-2.673	-2.209	-2.171	-2.058	-2.684
1950-1973	-2.004	-1.571	-1.406	-1.154	-2.292	-1.823	-1.807	-1.548
1974-1998	-0.4841	-0.9693	-0.6881	-1.207	-3.719*	-3.690*	-3.374	-3.582

Table 2, Italy, various sub samples. Implicit price deflator of the national income, change in the natural log of index. Augmented Dickey-Fuller test Augmented Dickey-Fuller. '**' indicates rejection of the null with a 99% confidence interval.

The results of the ADF test can be summarized as follows:

a) Over the whole sample, inflation appears to be a stationary process: the null of a unit root can be rejected in both models with a 1% significance level.
b) The same as a) applies to the gold standard.
c) On the contrary, the period 1914-1949 is unambiguously characterized by non-stationarity.
d) For the Bretton Woods years and afterwards, overall results support non-stationarity.

These findings suggest that fixed exchange rates tend to be associated with stationary inflation, whilst flexible rates are best characterized by non-stationary inflation. However, the nature and frequency of the structural changes cannot be determined through unit root tests. Moreover, the ADF test has low power in small samples and with variables containing MA components (see Maddala and Kim, 1998). This would suggest focusing on structural breaks rather than on the unit root properties of the series. We believe it even more appropriate to study the structural changes of the inflationary process jointly with output dynamics, within the context of the Phillips curve.

4. Italian inflation and output in the long run

In the light of the above results, it appears crucial to distinguish the temporary

[5] 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 those of MacKinnon (1991). A statistic significant at the 5% is identified by *, at the 1% by **.

components of the inflation process from its long-term, more permanent component. Various methods are obviously available. It is common to extract trend inflation through the application of Hodrick-Prescott (HP), linear or band-pass filters. Alternatively, results from market surveys or measures extracted from inflation swaps or bond-based break-even inflation rates are available, but only for relatively short and recent samples of data. In this paper, we employ the *Structural Time Series* (STS) approach proposed by Harvey (1989) to generate a series for trend inflation. The procedure amounts to decomposing the original series into trend, recursive stochastic cycles, and irregular components that vary over time[6]. 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. Other procedures, like using alternative filtering methods or polynomial trends, did not yield significantly better fit for our model.

Figure 5 plots the estimated Kalman-filter-based trend along with that of a trend computed using the more conventional Hodrick-Prescott filter. We will use them in turn in our subsequent estimates.

[6] For more details, see Hamilton (1994) and Canova (2007).

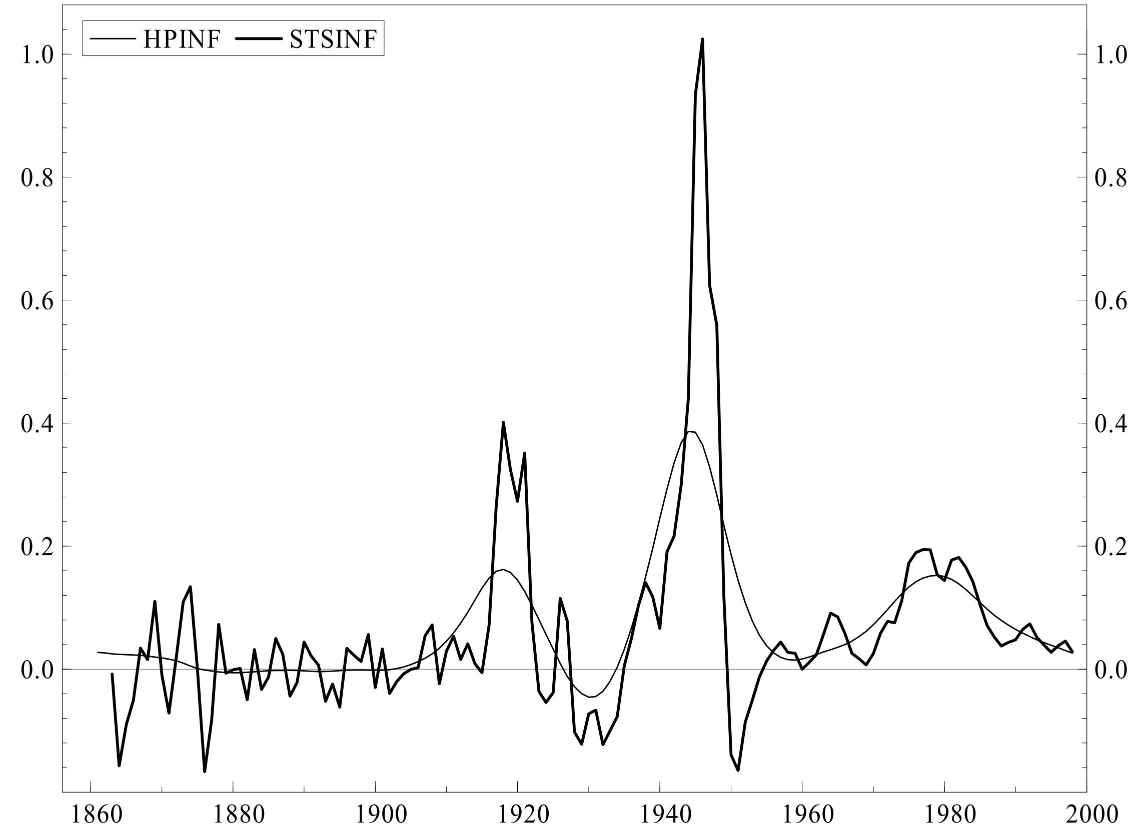


Figure 5, Italy, 1861-1998. Hodrick-Prescott (HPINF) and Kalman-filter based (STSINF) measures of trend inflation.

Figure 6 plots actual inflation and both the HP and STS measures of expected inflation over the most recent part of the sample, 1949-98. The third notable inflation process in the sample appears to originate already in the early 1960s, peak in 1980-82, and get back to moderate levels only at the end of the sample.

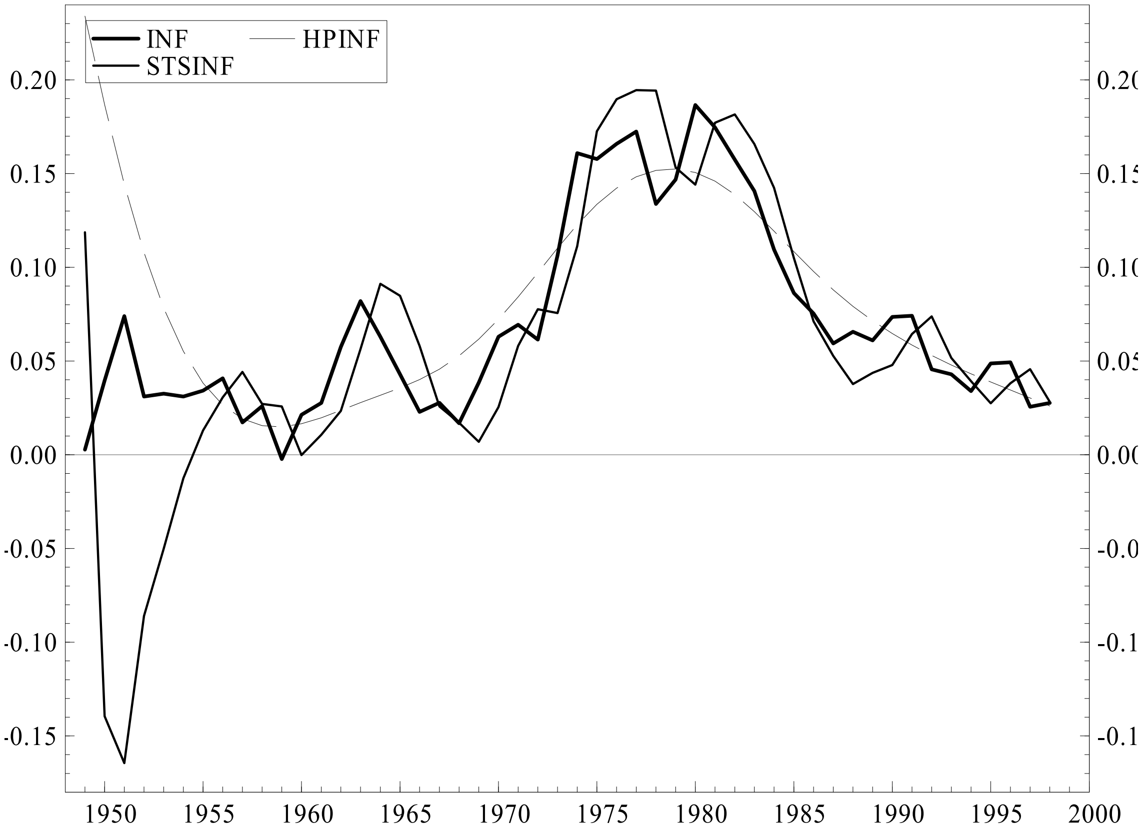


Figure 6, Italy, 1949-1998. Inflation (INF), Hodrick-Prescott (HPINF) and Kalman-filter based (STSINF) measures of trend inflation.

In order to reach some conclusion as to the cyclical and structural determinants of the inflationary process, we now examine the long-term behaviour of output and inflation jointly. Our reference point is a consensus model of inflation and output that blends the original expectation-augmented Phillips curve (Phelps, 1967; Friedman, 1968) with the most recent stylizations on persistence and price/wage rigidity (Woodford, 2003). In detail, a reduced-form representation of the relationship between inflation and output could be:

$$\pi_t = \gamma\left(y_t - y_t^*\right) + E_{t-1}\pi_t \tag{1}$$

where $y_t - y_t^*$ denotes the output gap, that is, the difference between the current level of output and its NAIRU or natural level, and $E_{t-1}\pi_t$ the expected inflation rate, conditional on last period's information. The dependence of current inflation on last period's expectations comes from the application of rational expectations to a structural model with partial price rigidities. This implies that

(i) unexpected changes in aggregate demand affect both inflation and output;

(ii) the stickier the prices, the lower γ, which represents Phillips curve's slope.

The literature often discusses the following equation:

$$\pi_t = \gamma\left(y_t - y_t^*\right) + \beta E_t \pi_{t+1} \qquad (2)$$

This differs from (1), as it links shifts of the curve to changes in conditional (i.e., current) expectations of future inflation. Theoretically, the difference is noticeable; much less so in practical terms, as expected inflation is serially correlated. For this reason, our estimates are based on the following encompassing model (see Woodford, 2003):

$$\pi_t = \beta E_t \pi_{t+1} + \omega \pi_{t-1} + \gamma\left(y_t - y_t^*\right) + \varepsilon_t, \qquad (3)$$

To measure the output gap, we employ again the STS approach. We fit a univariate model for real GDP, and extract time-varying measures of potential output that for each observation rely only on information available up to the point of estimation. As a robustness check, we also tried with a measure of output gap provided by the OECD, and with HP- and band-pass filters, but we found very little differences in the resulting estimates of the Phillips curve.

As a preliminary check, Figure 7 shows a scatter plot for inflation and our two measures of the output gap over the whole sample, along with a regression line. In contrast with the conventional Phillips-type relationship, a negative link between inflation and deviations of output from potential emerges. This apparently puzzling finding is based on a very long sample and comprises three important inflationary episodes with many potential structural breaks; it is then appropriate for our estimation to be performed over shorter sub samples as well.

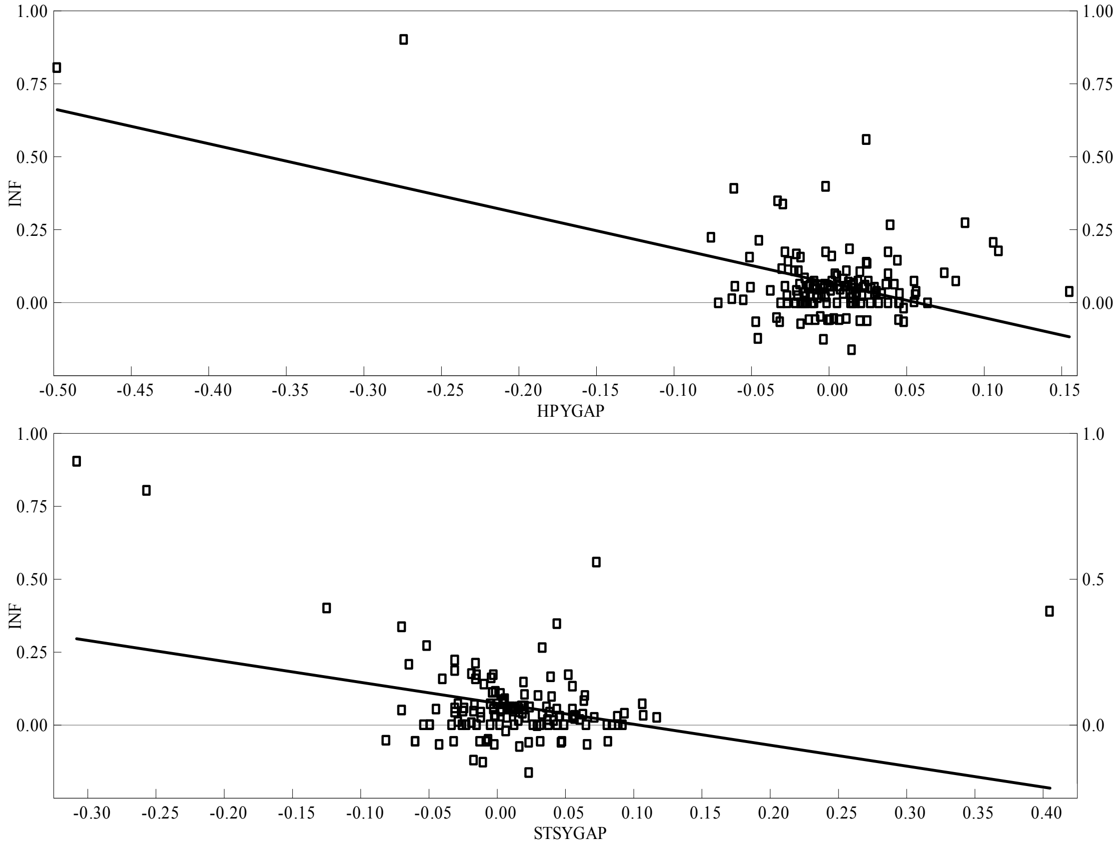


Figure 7, Italy, 1861-1998. Inflation (INF), Hodrick-Prescott (HPYGAP) and Kalman-filter based (STSYGAP) measures of the output gap.

First, we estimated equation (3) using OLS over the sample 1861-1998 and removing the observations around the two world wars (1916-1920 and 1940-1947). The estimates we obtained, based on both the HP and STS definitions of output gap, are as follows (t-values in parentheses):

$$\underset{}{\pi_t} = \underset{(6.13)}{0.541\, E_t\pi_{t+1}} + \underset{(3.17)}{0.268\,\pi_{t-1}} - \underset{(-1.67)}{0.255\,\left(y_t - y_t^*\right)^{HP}} + \hat{\varepsilon}_t$$

$$\pi_t = \underset{(5.98)}{0.509\, E_t\pi_{t+1}} + \underset{(3.24)}{0.275\,\pi_{t-1}} - \underset{(-0.8)}{0.092\,\left(y_t - y_t^*\right)^{STS}} + \hat{\varepsilon}_t$$

Overall, output gap turns out to have almost no influence on inflation dynamics:

using the HP-based definition, the output gap becomes significant – although again with a negative sign- at a 90% confidence interval. On the contrary, forward-looking inflation expectations and lagged inflation are significant, and remain so even when we re-estimate over variously defined sub samples. As a preliminary interpretation of these findings, we stress that recurrent periods of wide output and inflation shocks dominate the data, and this likely drives the results we obtain. Figure 13 shows scatter plots over the estimation sample after purging the observations for the years 1973-1984, the largest non-war inflationary (and stag-flationary) process. Indeed, a positive output-inflation relationship emerges, albeit a weak one, thus confirming that only when large real or monetary shocks are removed from the sample the output-inflation trade-off has the conventional positive sign.

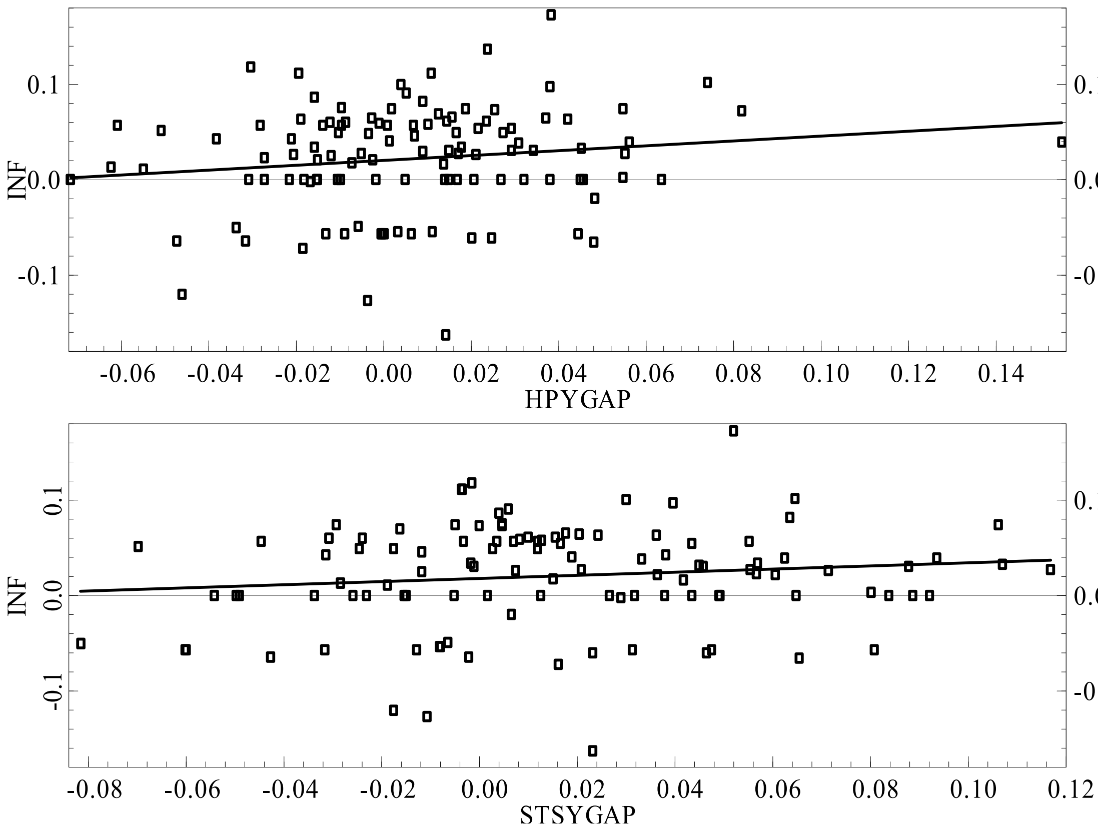


Figure 8, Italy, 1861-1915, 1921-1939, 1948-1972, 1985-1998. Inflation (INF), Hodrick-Prescott (HPYGAP) and Kalman-filter based (STSYGAP) measures of the output gap.

These findings are also in line with results from stability analysis on estimated Phillips curves, which provide evidence of breaks in their key coefficients (Bai and

Perron, 2003). Such changes could be tentatively attributed to shifts in the actual conduct of monetary policies, in the collective attitude towards the costs of inflation, or more generally in the monetary regime (see Cecchetti et al., 2007; Kim and Nelson, 2006). We believe that our findings for Italy and the evidence concerning other economies motivate the use of a full-fledged TVP approach. This will enable the identification of the conditional inflation-output trade-off in the long run, and help in identifying the causal links between observed institutional or behavioural changes and the structural shifts in the curve's coefficients.

We therefore computed additional estimates that explicitly allow for time variation in the parameters of the Phillips curve. We employed a time-varying-parameter (TVP) approach to estimate our models. In practice, we allowed the Phillips curve's coefficients to vary over time. What we obtained were estimates of the state vector for each observation in our sample. These estimates can then describe the evolution of the Phillips curve's coefficients over time.

Let us represent the model in a general state-space form (see Harvey, 1989; Kim and Nelson, 1999):

$$\begin{aligned} \mathrm{p}_t &= c_t + x_t' b_t + e_t \\ b_{t+1} &= d + T' b_t + z_{t+1} \end{aligned} \tag{4}$$

where

$$e_t \approx N(0, \mathrm{s}^2),\ z_t \approx N(0, Q),\ b_0 \approx N(a_0, \Sigma_0)$$

with x_t containing the explanatory variables.

The first equation in (4) is the measurement or observation equation. It is the classical linear regression model except that we allow the parameter vector b_t (representing the state variables) to change stochastically according to the transition described in the second equation in (4)[7]. Summing up, this time-varying formulation involves forecasting the optimal state vector in each period, based on information

[7] We follow the prior distribution proposed by Doan et al. (1984), which assume that changes in the endogenous variable modelled are so difficult to forecast that in the AR(1) process of the unobserved state vector the coefficient on 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. Measurement errors and the disturbances to transition equations are assumed to be serially and mutually independent.

available up to the previous period[8]. 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 structural parameters. This allows us to capture major shifts, which are extremely likely in the long historical span of our dataset.

Figure 9 plots the times series of the estimated coefficient g_t in equation (3), that is, the sensitivity of current inflation to changes in the output gap[9]. We computed the displayed estimates by using a HP-based measure of inflation expectations and trying with both STS and HP definitions of the output gap.

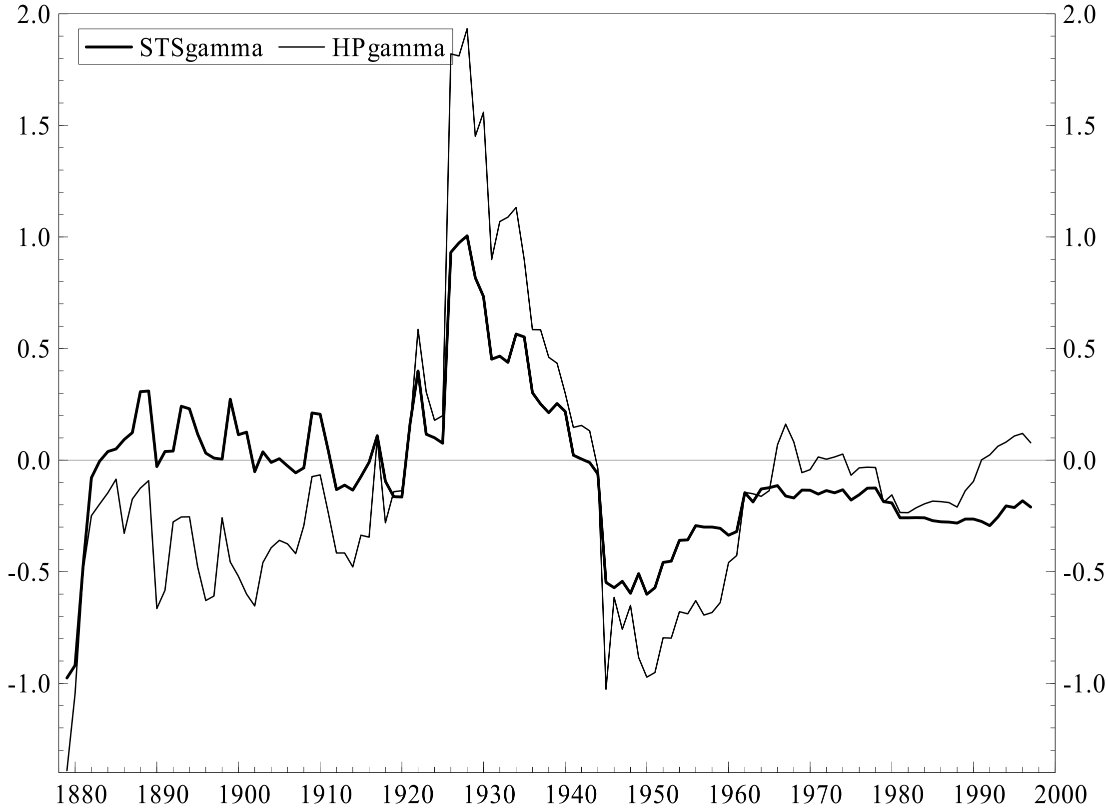


Figure 9, Italy, 1861-1998. Phillips curve, output gap TVP coefficients obtained using Hodrick-Prescott and STS-based measures of the output gap.

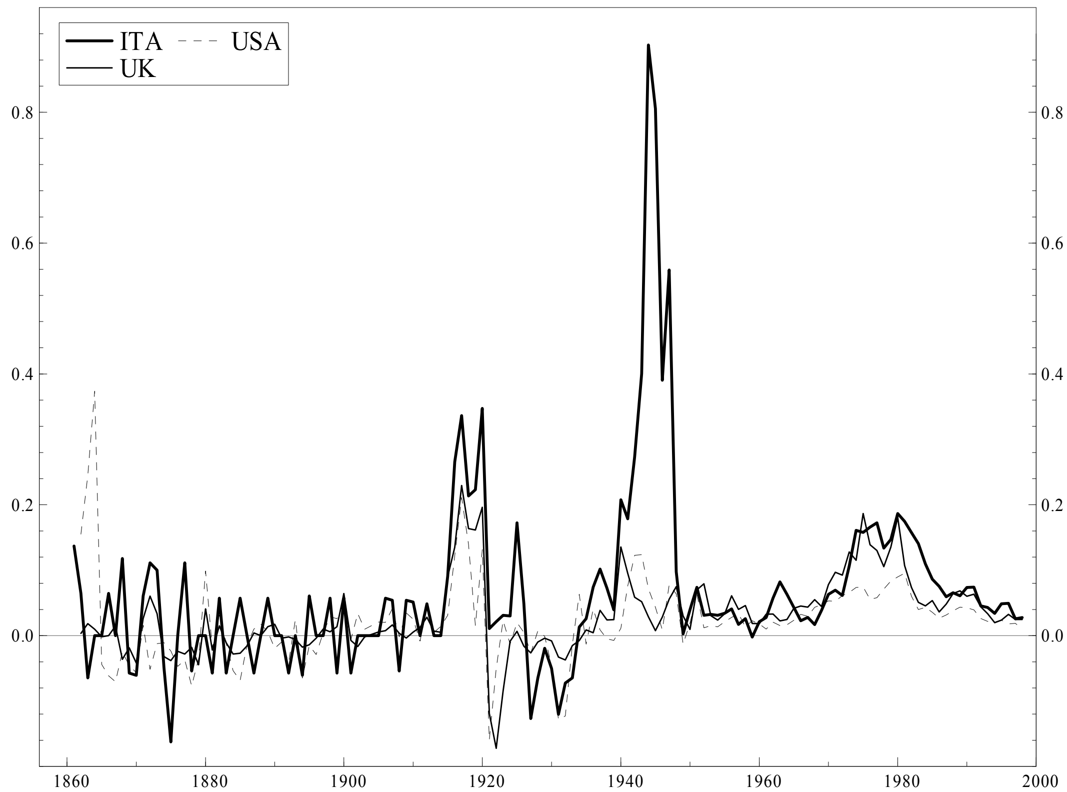
The graph substantially confirms the dynamics of the link between inflation and

[8] Under the normality and independence assumptions about the disturbances, the computation of the state vector is obtained via application of the Kalman filter.
[9] For brevity we do not show here the full results of our TVP estimation, which are available from the authors upon request.

output. In particular, the value of the estimated coefficient drops when inflation shows up during episodes of higher macroeconomic variability and, regardless of the measure of output gap we employ in the Phillips curve, it turns negative starting around WWII. The estimates confirm that during those instances, the traditional Phillips curve in Italy simply breaks down, or assumes a "perverse" slope.

5. Comparing Italy with the USA and UK

It is now even more compelling to compare our findings for Italy with what one can obtain on similar data and sample spans for other countries using the same methodology. Therefore, we extended the analysis to the USA and UK. Figure 10 groups the annual inflation rates (all based on the price deflator of national income) for the three countries. Italian inflation easily emerges as having the highest mean and volatility; sub sample analysis (not shown here for simplicity) also shows that this holds for all sub periods bar one[10].



[10] Another interesting finding is that Italian and UK inflation rates have similar persistence levels, both far higher than for the US.

Figure 10, USA, UK and Italy, 1861-1998. Inflation rates.

Turning to a comparison of the inflation-output relationships across the three countries, Table 3 contains the results for the standard New Keynesian Phillips Curve specification estimated (via OLS) both for the whole sample and for the sub samples of gold standard, the two world wars, and the post-1946 period[11].

NKPC: USA			
Sample	$E_t\pi_{t+1}$	π_{t-1}	$(y_t - y_t^*)$
1861-1998	1.031 (7.16)	0.167 (2.07)	0.069 (1.08)
1861-1913	1.274 (4.52)	-0.042 (-0.28)	-0.215 (-1.48)
1914-1949	1.285 (3.83)	0.000 (0.00)	0.218 (1.94)
1950-1998	0.707 (6.02)	0.302 (2.67)	0.127 (2.16)
NKPC: UK			
Sample	$E_t\pi_{t+1}$	π_{t-1}	$(y_t - y_t^*)$
1861-1998	0.639 (7.04)	0.397 (5.83)	0.356 (4.62)
1861-1913	0.331 (1.76)	0.158 (1.15)	0.185 (1.87)
1914-1949	0.763 (2.93)	0.390 (3.03)	0.463 (2.79)
1950-1998	0.649 (4.90)	0.369 (2.98)	0.179 (1.36)
NKPC: Italy			
Sample	$E_t\pi_{t+1}$	π_{t-1}	$(y_t - y_t^*)$
1861-1998	0.981 (11.00)	0.079 (1.09)	-0.881 (-7.55)
1861-1913	0.574 (1.88)	-0.057 (-0.41)	-0.383 (-1.26)
1914-1949	1.031	0.049	-0.969

[11] For these estimates we measured the output gap using a HP-based series for potential output. Results do not qualitatively differ with the STS approach.

	(6.07)	(0.36)	(-4.48)
1950-1998	0.369	0.630	0.023
	(3.63)	(6.33)	(0.178)

Table 3. USA, UK and Italy, various samples. New Keynesian Phillips Curve, coefficient estimates and t-values.

The main results are as follows:

1. Using the full sample, only for the UK the output coefficient appears significant and positive; Italy confirms a negative sign.
2. As to sub samples, output is positively related to inflation in the US in 1914-1949 and 1950-1998 and in the UK in all subperiods until WWII.
3. Inflation expectations are always fundamental determinants of actual inflation rates.
4. The gold standard stands out as the sub period with the most ambiguous results.

Finally, to get a sense of the cross-country evolution of the inflation-output relationship, we also estimated TVP models for UK and the US. Figure 11 plots the output gap coefficients computed using the TVP methodology we outlined above. The dominant feature is that UK and Italy have witnessed similar falls in the size of the output gap coefficient after WWII, although in the UK the long-run relationship seems to have held up. In the US, the sensitivity of inflation to output developments is both more sizeable and stable, with no fundamental breaks even during the 1970s' stagflation. These findings broadly confirm in a cross-country dimension that the standard trade-off between inflation and output growth emerges only during periods of low inflation and limited macroeconomic volatility.

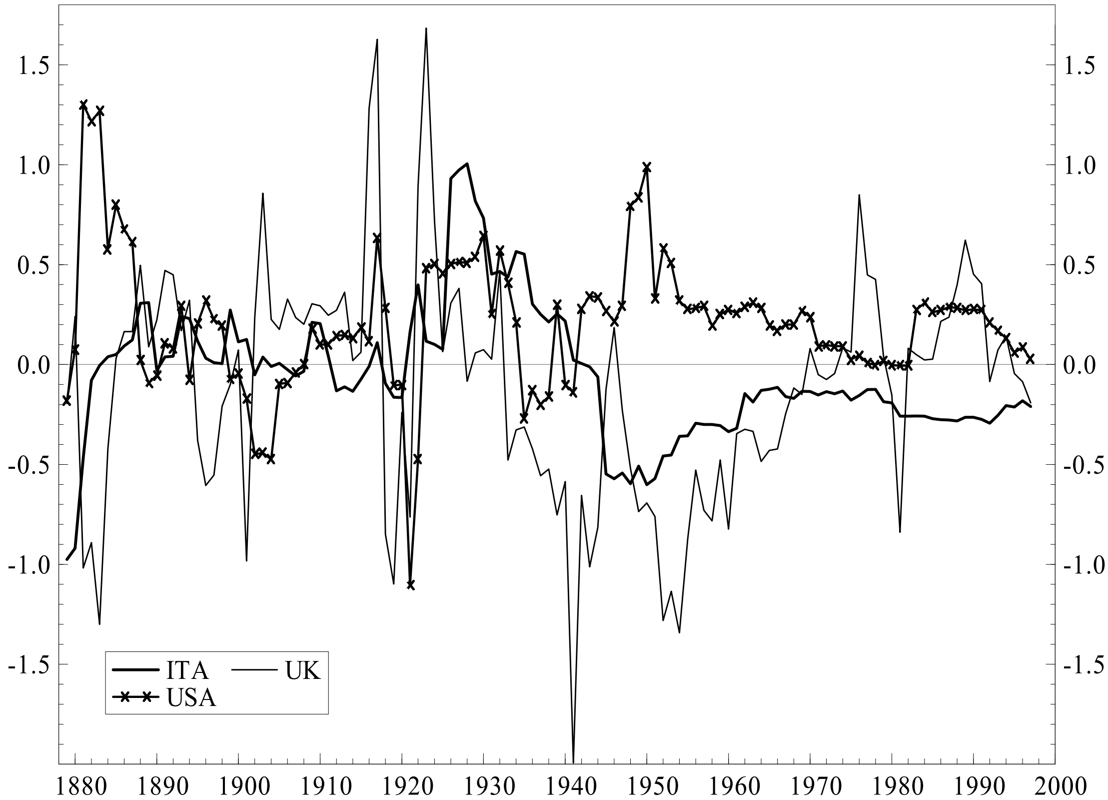


Figure 11, USA, UK and Italy, 1861-1998. Phillips curve, output gap TVP coefficients obtained using STS-based measures of the output gap.

5. Concluding remarks

Going back to Figure 10, one could easily conclude that Italy did win her long-standing fight against inflation, albeit only at the end of the twentieth century. Which factors did produce an inflation course and an output-inflation trade-off so stubbornly different from those of other countries? The key findings of our study confirm that the standard trade-off between inflation and output growth breaks down during periods of high inflation and marked macroeconomic volatility. Also, they seem to corroborate some of the results and claims contained in a famous 1973 article by Lucas: "*In a stable price country like the United States, then, policies which increase nominal income tend to have a large initial effect on real output, together with a small, positive initial effect on the rate of inflation. Thus, the apparent short-term trade-off is favorable, as long as it remains unused. In contrast, in a volatile price country like Argentina, nominal income changes are associated with equal, contemporaneous price movements with no discernible effect on real output. These results are, of* *course, inconsistent with the existence of even moderately stable Phillips curves. On the other hand, they follow directly from the view that inflation stimulates real output if, and only if, it succeeds in "fooling" suppliers of labor and goods into thinking relative prices are moving in their favour*." (Lucas, 1973, pp. 332-333).

These comments are suggestive of one causal relationship between inflation and the level of economic activity, but fall short of providing a structured answer as to the main drivers of the inflation bias that Italy suffered from throughout history. Our evidence is consistent with the received wisdom that Italy has reined in inflation thanks largely to global disinflation pressures and a central bank that became independent in the 1990s. It is therefore apparent that the peculiar nature of the output-inflation trade-off in Italy is the consequence of the inability of the Italian economy to withstand adverse supply-side shocks and the poor quality of its monetary policy. The investigation on which of these factors had the upper hand in the 138-year long history of the Italian lira and Phillips curve, is left to further ongoing research.

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