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An alternative interpretation of the recent U.S. inflation performance

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Abstract

An approach to decomposing and interpreting the inflation process is proposed. It suggests that the low U.S. inflation rate in recent years reflects a structural development, but that the low levels of unemployment may be a mainly cyclical phenomenon.

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1. Introduction

The performance of the U.S. economy during the second half of the 1990s has been remarkable, with a combination of high growth, low inflation, and declining unemployment. It has also been a source of puzzlement. Popular attempts to explain the development roughly fall into two categories: (i) inflation has been held down temporarily by favourable shocks while the real side of the economy has been experiencing a more or less traditional cyclical upturn. Often, this view is combined with the perception of an asset-price bubble that is fuelled by, and is itself reinforcing, the high real economic activity; (ii) the development reflects the emergence of a new type of economy, characterised by intense competition and high productivity, in which inflation is persistently restrained. The low rate of unemployment is often regarded as a permanent phenomenon that is also attributed to this new type of economy. Neither view has yet gained general acceptance.

In an attempt to shed some further light on this issue, this paper proposes an alternative approach to decomposing and interpreting the inflation process, based on the so-called unobserved-components methodology. A key feature of this approach is that the NAIRU and the long-run component of inflation are modelled as unobservable variables with individual dynamics. Whereas modelling the NAIRU in this fashion is now common practice[1], a latent-variable approach has not yet, to our knowledge, been applied to the long-run component of inflation. A major reason for modelling long-run inflation endogenously in this way is that the development of long-run, or structural, inflation plays a crucial role in theories of the impact of the so-called New Economy. For some years, it has been claimed that the U.S. economy has entered a new era in which inflation is much less of a threat than in the past. Arguments

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[1] See, e.g., Gordon (1997) or Apel and Jansson (1999).

that have been emphasised are, e.g., pressures on firms from global competition, transformation of payments systems, and, not the least, investments in new technologies and the adoption of new business practices.[2] Since these factors are likely to be reflected in quite persistent trends rather than in temporary shocks, it seems appropriate to assume that they primarily have a bearing on inflation's long-run component. This should not be seen as questioning the fact that inflation ultimately is a monetary phenomenon and hence that a central bank can control it reasonably well in the long run. It does, however, reflect the view that factors which a central bank may have difficulty in both identifying and controlling may have an impact on inflation, even on a more persistent basis. Since these factors tend to be difficult to measure empirically, it seems reasonable to model long-run inflation as an unobserved variable.

Through the endogenous determination of both the NAIRU and long-run inflation, the approach makes it possible to distinguish between different types of changes in the more persistent part of inflation. Specifically, changes in inflation that are not captured by supply-shock proxies do not, as is often the case, automatically show up as changes in the NAIRU. Instead, it is up to data to choose whether, e.g., a fairly persistent decline in inflation is due to a fall in the unobservable NAIRU or to a decline in inflation's likewise unobservable long-run component.

2. The model

[2] See, e.g., Browne (1999). Marimon et al. (1997) emphasise the role of the transformation of payments systems and argue that the role of electronic money in curbing inflation probably has been undervalued.

The model consists of the following equations (here directly presented in their empirical format):

$$\pi_t - \pi_t^{LR} = \sum_{i=1}^{4} \rho_i (\pi_{t-i} - \pi_{t-i}^{LR}) + \eta_1 (u_{t-1} - u_{t-1}^N) + \sum_{j=0}^{3} \omega_j z_{t-j} + \varepsilon_t^{PC} , \quad (1)$$

$$u_t^N = u_{t-1}^N + \varepsilon_t^N , \quad (2)$$

$$\pi_t^{LR} = \pi_{t-1}^{LR} + \varepsilon_t^{LR} , \quad (3)$$

$$u_t - u_t^N = \sum_{k=1}^{2} \delta_k (u_{t-k} - u_{t-k}^N) + \varepsilon_t^C , \quad (4)$$

where π_t is actual inflation (as measured by the log difference of the CPI), π_t^{LR} long-run inflation, u_t the rate of unemployment, u_t^N the NAIRU, and z_t a vector of supply-shock proxies (normalised so that when supply shocks are absent, $z_t = 0$). In the specification used, the z_t vector includes changes in the relative prices of fuel and electricity, changes in labour productivity, and changes in the real effective exchange rate. The error terms ε_t^h, $h = PC, N, LR, C$, are assumed to be IID and mutually uncorrelated with constant variances (σ_h^2). The lag lengths are set on the basis of tests against serial correlation.

Under the restriction $\pi_t^{LR} = 0$, $\forall t$, Eq. (1) becomes a traditional so-called 'triangle' Phillips model (see, e.g., Gordon, 1997).[3] However, by formulating an explicit parametric process for the long-run rate of inflation, we are able to identify the dynamics associated with changes in inflation's long-run and cyclical components, respectively, while still consistently

[3] The label 'triangle' is intended to summarise the fact that in this model the actual rate of inflation depends on three basic determinants: inertia (lags of actual inflation), demand (the unemployment gap), and supply (the supply-shock proxies).

acknowledging the unobservability of the NAIRU. Hence, both the NAIRU and long-run inflation enter as explicitly identified (possibly time-varying) components that can be econometrically estimated along with the remaining parameters of the model. Note that at a neutral state of demand and in the absence of shocks ($u_t - u_t^N = z_t = \varepsilon_t^{PC} = 0,\ \forall t$), inflation will converge towards long-run inflation. This rather general approach to the inflation process is similar to the formulation in various textbooks (see, e.g., Burda and Wyplosz, 1997).

Eqs. (2) and (3) imply that both the NAIRU and long-run inflation are assumed to follow stochastic trends, more specifically random walks. The random-walk assumption appears to be a standard one in this type of framework, but it should be emphasised that the methodology as such does not restrict the processes for the NAIRU and long-run inflation to random walks. Other processes are also feasible within this framework, and one may also incorporate potential structural determinants of the NAIRU and long-run inflation. Eq. (4) specifies the assumed evolution of cyclical unemployment, in this case a purely autoregressive process.

For purposes of estimation, it is convenient to re-write the model (1)-(4) in state-space form. The Kalman filter and maximum likelihood can then be applied to obtain estimates of the unknown parameters and of the time series of the unobserved components, i.e. the NAIRU and long-run inflation. Briefly, the Kalman filter generates, for a given set of model parameters and starting values, a sequence of optimal conditional predictions of the observable variables. The prediction errors are then used in a maximum-likelihood routine to find the optimal set of parameters and the corresponding estimates of the unobserved components.[4]

3. Empirical results

[4] For full technical details, see, e.g., Hamilton (1994).

The model is estimated using quarterly U.S. data for the period 1970:1 to 1999:2, taken from *OECD Main Economic Indicators*. The key results are displayed in Table 1 and Fig. 1. The parameter estimates have the expected signs and are highly significant in most cases. The time series in Fig. 1 are based on the one-sided estimates of the unobserved components and the estimates have been annualised to better reflect the information typically considered by policy makers.

The Phillips-curve mechanism is illustrated by the negative relationship between cyclical unemployment and cyclical inflation. (Cyclical inflation is computed using the (annualised) one-sided estimate of $(1-\sum_{i=1}^{4}\rho_i L^i)^{-1}\eta_1(u_{t-1}-u_{t-1}^N)$.) The results indicate a substantial fall in long-run inflation in the last two decades. In recent years, long-run inflation has been close to, and even slightly below, zero.[5] The decline has been concentrated to two periods – the first half of the 1980s and the period from the beginning of the 1990s onwards. It is notable that whereas the first phase of decline in long-run inflation coincides with positive cyclical unemployment, the approach associates the second phase of decline mainly with negative cyclical unemployment. This suggests that whereas the first phase is likely to largely reflect the well-known fundamental reorientation of monetary policy, the second phase of decline probably has other explanations.

[Fig.1]

[Table 1]

In sum, the results suggest that the low and fairly stable actual rate of inflation during the second half of the 1990s is the combined result of a very low structural rate of inflation

counterbalanced by a fairly high cyclical inflation rate. This interpretation of the recent U.S. inflation performance is consistent with the New-Economy view in the sense that they indicate the presence of a structurally declining component of inflation, illustrated by the fact that the long-run component of inflation in recent years has fallen to 'all-time-low' levels. However, at the same time the results suggest that the strong unemployment performance is mainly the result of a cyclical upturn. Hence, the results also lend some support to the view that the performance of the U.S. economy largely reflects a cyclical phenomenon, with beneficial shocks holding inflation down. Unlike that view, however, the results imply that the downward pressure on inflation is of a relatively persistent nature rather than temporary.

It is notable that the results of the model appear to be compatible with certain recent empirical observations. For example, Gordon (1998) notes that whereas price inflation has remained subdued in recent years, wages have increased in line with historical patterns. This suggests that there may be restraining forces on product markets that do not apply to the same extent to labour markets. Fig. 1 illustrates that the model is compatible with such a development in that it suggests a positive cyclical unemployment rate in the late 1990s of about the same magnitude as the most recent upturn in the late 1980s.

Some New-Economy theories imply not only a decline in long-run inflation but also more radical changes in traditional relationships, or even their complete breakdown. In the model, possible candidates for such significant shifts are the parameters that reflect the dynamics of the business cycle or the inflationary effects of cyclical shocks. If such shifts have occurred, then our results may be interpreted as reflecting problems of mis-specification rather than a genuine economic course of events. To address this issue we have re-estimated Eqs. (1)–(4)

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[5] Even though the trends are clear, the exact point estimates should be interpreted somewhat carefully since latent-variable estimates of the kind we derive here may be surrounded by a rather sizeable amount of uncertainty (see, e.g., Staiger et al., 1997).

excluding the most recent downturn of unemployment; that is, based on data excluding the time period 1993:4-1999:2. The results for the key parameters are given in the second row of Table 1. As can be seen, the estimates display only very small changes (given a reasonable allowance of change with respect to distributional dispersion).

4. Concluding remarks

This paper proposes an alternative approach to decomposing and interpreting the inflation process. Although the empirical model is rather parsimonious and further research is necessary to qualify the empirical results, the tentative conclusions appear to be both interesting and reasonable. The results suggest that the low and fairly stable inflation rate in the U.S. during the second half of the 1990s is the combined result of very low structural inflation counterbalanced by fairly high cyclical inflation. Put differently, the results indicate that the recent low unemployment rate may be mainly cyclical, whereas the low rate of inflation primarily seems to reflect a structural and more persistent phenomenon. In this sense, the puzzle is perhaps not so much the favourable development of unemployment as the remarkably low rates of inflation.

The decomposition of the inflation process proposed in this paper raises some general questions regarding the conduct of monetary policy that so far have been little discussed. For example, to what extent should an inflation-targeting central bank counteract a downward trend in the long-run rate of inflation by stimulating demand? To some extent, of course, the favourable long-term inflation trend allows the central bank to pursue a more expansionary monetary policy than would otherwise be possible. However, if trend inflation is extremely low, monetary policy may, correspondingly, need to be very expansionary. To what extent,

then, is there a risk of reaching a point where cyclical economic activity becomes so high that problems emerge elsewhere in the economy, e.g. on asset markets, even though price inflation remains subdued? Furthermore, are the effects symmetric, so that there also may be risks involved in counteracting an unusually high long-term inflation rate with a very contractionary policy? This paper does not provide the answers, but we believe that the approach proposed here may be useful when thinking about these types of questions as well as about other aspects of the inflation process.

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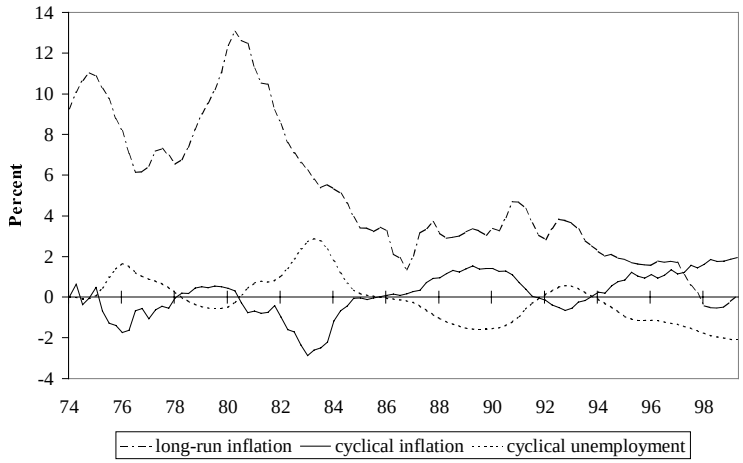

Fig. 1. Long-run inflation, cyclical inflation, and cyclical unemployment rate in the U.S.

Table 1
Estimation results for selected parameters: full sample and 1970:1-1993:3[a]

	η_1	δ_1	δ_2	σ_{LR}	σ_C	σ_N
Full sample	–0.807 (0.000)	1.632 (0.000)	–0.684 (0.000)	0.296 (0.000)	0.261 (0.000)	0.000 (0.998)
1970:1-1993:3	–0.800	1.626	–0.698	0.344	0.277	0.000

[a]Note: The full sample covers the time period 1970:1-1999:2. The numbers within parentheses are *p* values for testing the null hypothesis of restricting a particular parameter to zero.