

Has the Inflation Process Changed? A Comment *

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Introduction

The paper by Cecchetti and Debelle (CD, henceforth) makes an interesting contribution to the growing literature on inflation dynamics. The first part of the paper is largely descriptive, and complements other recent attempts to identify the presence of significant changes over time in the time series properties of inflation measures. CD's analysis makes use of aggregate and sector-level CPI inflation data for a number of OECD countries. They conclude that the presence of a change in the mean of inflation, observable for most countries and CPI components, is the dominant feature of the data. Once that change in mean is accounted for, the degree of inflation persistence is relatively small, and does not display a significant decline over time in most cases. Furthermore, and with few exceptions, neither observed changes in the mean or in the persistence measures can be mapped clearly to the changes in monetary policy regime that have taken place during the period considered for many of the countries in their sample. The previous statistical results compiled by CD are a valuable addition to the current stock of evidence on the properties of inflation. Most significantly, some of CD's findings question both the results and conclusions drawn by other authors.

In the second part, CD try to go beyond a simple statistical characterization, aiming instead at providing an assessment of existing structural price-setting models in light of the evidence of a cross-sectional connection (or lack thereof) between CD's inflation persistence measures and the indicators of price rigidities developed by several authors in the context of the ECB's Inflation Persistence Network. CD show that no significant relationship between those measures can be detected. Independently of the previous evidence, the finding of relatively low inflation persistence leads CD to conclude that the early criticisms of optimizing forward-looking price setting models that were grounded on the apparent inconsistency of the latter with the presence of high inflation persistence may be misplaced.

My discussion below focuses on what I view as an important caveat in CD's interpretation of the sort of reduced-form evidence found in the present paper, a caveat that is also found in some of the related literature.

Inflation Persistence and Optimizing Price-Setting Models

Underlying much of CD's analysis and its motivation is the notion--stressed by authors like Fuhrer and Moore (1995)--that the evidence pointing to high inflation persistence is inconsistent with the optimizing price setting models that have been widely adopted in the recent monetary business cycle literature. Those models, CD claim, generate high persistence in the price level (which would be increasing in the degree of stickiness), but not in its first difference (i.e., in the rate of inflation). The evidence of very low persistence uncovered by CD (when proper treatment of shifts in means is made) is thus presented as reconciling (at least partly) the univariate evidence on inflation persistence with the abovementioned structural models. But to what extent do optimizing, forward looking models necessarily imply low inflation persistence? Next, I show by means of three simple examples that the connection between price stickiness and persistence is not an obvious one.

Example #1: Inflation Persistence with an Exogenous Output Gap

Consider an economy for which inflation dynamics are described by the difference equation

$$\pi_t = \beta E_t \{ \pi_{t+1} \} + \kappa_\theta x_t$$

where x_t is the output gap, β is the discount factor, and κ_θ is a coefficient inversely related to the degree of price stickiness (see, e.g., Galí and Gertler (1998) for a derivation). The previous inflation equation, based on a price setting model originally due to Calvo

(1983) and usually referred to as New Keynesian Phillips curve (NKPC), is a key building block of the workhorse framework used for monetary policy analysis. It implies that inflation is a purely forward-looking variable, in the sense that past inflation does not play an independent role in determining current inflation. Instead the latter depends exclusively on current and expected future values for the output gap. Suppose next that the output gap follows an exogenous AR(1) process

$$x_t = \rho_x x_{t-1} + u_t$$

where $\rho_x \in [0,1)$ and u_t is white noise. In that case it is easy to show that inflation will also follow an AR(1) process of the form

$$\pi_t = \rho_x \pi_{t-1} + \frac{\kappa_\theta}{1 - \beta \rho_x} u_t$$

In other words, inflation will inherit the persistence of the output gap. An increase in the degree of price stickiness would reduce κ_θ and, as a result, would lower the variance of inflation. But it would not have any effect on its persistence. Hence, on the basis of the previous analysis, there is no reason to expect any connection (across countries or sectors) between measures of inflation persistence, on the one hand, and indicators of the degree of price stickiness on the other. Furthermore, the eventual finding of high inflation persistence cannot be interpreted as evidence of any “structural” dependence of current inflation on past inflation: as illustrated in the above example, that dependence may be non existent, without that implying any constraints on the persistence of inflation itself.

Of course, the assumption of an exogenous output gap is clearly unrealistic, so perhaps one may suspect that any eventual influence of price stickiness on inflation might work through its effect on the output gap. Evaluating the previous hypothesis requires laying down a full-fledged model, so the answer is likely to depend on some details of the model. The following example, based on a standard model from the literature, illustrates how the persistence of inflation is not necessarily related to the degree of price stickiness, even when we endogenize the output gap.

Example #2: Inflation Persistence under a Simple Taylor Rule

Suppose that, in addition to the NKPC introduced above, the economy's equilibrium is described by a new IS-type equation

$$x_t = E_t \{x_{t+1}\} - \frac{1}{\sigma} (r_t - E_t \{\pi_{t+1}\} - r_t^*)$$

together with a simple Taylor rule determining the short term nominal rate r_t

$$r_t = \phi_\pi \pi_t$$

where $\phi_\pi > 1$ (a sufficient condition for a determinate equilibrium), and an exogenous process for the natural real rate r_t^* (which by definition must be independent of both the degree of price stickiness and the monetary policy rule):

$$r_t^* = \rho_r r_t^* + v_t$$

The solution to the model above yields the following reduced form process for inflation:

$$\pi_t = \rho_r \pi_{t-1} + \psi v_t$$

where ψ can be shown to be a decreasing function of the degree of price stickiness (in addition to showing a negative relation with the inflation coefficient ϕ_π in the Taylor rule). But, most importantly for our purposes, the persistence of inflation is independent of the degree of price stickiness and the strength of the central bank's response to inflation. Instead, inflation inherits the persistence of the natural real rate (given by ρ_r), which is by definition independent of the degree of price stickiness or the monetary regime.

Example #3: Inflation Persistence with a Hybrid NKPC

Finally, let me consider an economy in which a fraction of price setters follow a simple backward-looking rule-of-thumb that makes their newly set prices depend partly on lagged inflation, whereas the rest of firms behave in an optimizing forward-looking way as in the

basic Calvo model. In that case, and as shown in Galí and Gertler (1998) the dynamics of inflation are given by the hybrid NKPC

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E_t \{\pi_{t+1}\} + \lambda x_t$$

where γ_b and γ_f are, respectively, increasing and decreasing in the fraction of backward looking firms and with the output gap following the same exogenous AR(1) process considered in our first example. The reduced form process for inflation is given by

$$\pi_t = \delta_1 \pi_{t-1} + \frac{\lambda}{\delta_2 \gamma_f} \frac{1}{1 - \rho_x \delta_2^{-1}} x_t$$

where $\delta_1 \equiv \frac{1 - \sqrt{1 - 4\gamma_b \gamma_f}}{2\gamma_f}$. In contrast with the previous examples, the persistence of

inflation in this case does depend on characteristics of the economy other than the persistence of the output gap itself. In particular, it can be shown (after some tedious algebra) that δ_1 is increasing in the fraction of backward-looking firms (as one would anticipate), but decreasing in the degree of price stickiness (somewhat less intuitive result). Hence, in the context of the hybrid NKPC model proposed above, low levels of inflation persistence (as detected in the CD paper) will emerge in economies with (i) a small fraction of backward-looking firms, and (ii) high degrees of price stickiness, a configuration consistent with the structural estimates in Galí and Gertler (1998), among others. Nevertheless, and as illustrated by examples #1 and #2 above, that property is far from being robust to the specification of the environment. Further work is clearly needed in order to understand better the connection between inflation persistence, price stickiness and other features of the price setting process before we can jump to any hard conclusions in the light of reduced form evidence like the one presented by CD in their paper.

Inflation Persistence and Measurement Error

Let me conclude my discussion of the CD paper with a brief comment on an aspect of their evidence that could easily be missed by the casual reader. CD carry out their empirical analysis

using CPI data for 17 countries. With the exception of Australia and New Zealand for which quarterly data are used, the frequency of the time series analyzed is *monthly*, corresponding to month-to-month changes in the (log) CPI. That choice, which contrasts with the more common use of quarterly inflation data in the related literature, is potentially problematic. The reason is simple and well-known to anyone who has ever plotted a month-to-month inflation series (CD refrain from doing so): that series is extremely volatile, possibly because of measurement error or temporary factors unrelated to underlying inflation trends. The excess noise associated with those series may account for much of the low persistence uncovered in the data, relative to other studies. A formal analysis of the implications for the estimates of inflation persistence of the data frequency chosen lies beyond the scope of the present paper, but should certainly be kept in mind, especially when attempting comparisons across studies.

References

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