Discussion of

“Inflation Persistence"

Jeffrey C. Fuhrer

by Raf Wouters (NBB)

Key Developments in Monetary Economics,
ECB, 129-30 October 2009, Frankfurt

Main topics discussed in the paper

- introduction - motivation
- defining and measurement issues: reduced form persistence
- structural sources: NK-PC and DSGE model
- inference problems in small sample
- microeconomic evidence

Introduction - motivation

- Motivation for the issue of persistence:
  - inflation is highly correlated with its own lags.
  - once inflation deviates from its target value, it might be costly to bring it back to this target: the sacrifice ratio may be high if inflation is a persistent process.
- Important to understand the magnitude and the sources of inflation persistence:
  - is persistence an intrinsic or structural feature of the price setting process: has inflation a structural backward looking component ?
  - is inflation persistence mainly determined by the forward looking nature of the price setting problem ? Under rational expectations, inflation will inherit the persistence of its underlying determinants (marginal costs, markup and supply shocks), whose dynamics might depend on the broader economic features and the policy environment in particular.
  - if the forward looking nature of the price setting problem is important, inflation expectations might be an independent source of inflation persistence when price setters have imperfect, limited or sticky information about the structure or the state of the economy.

Defining and measuring reduced-form persistence

- evidence on reduced form persistence in US data yields complex results:
  - inflation displays high persistence over long samples;
  - unclear whether there is a **significant** reduction during the post-Volker period: the paper adds an additional argument against a decline in persistence based on core inflation data;
  - however the variance of the low frequency component of inflation has declined (but did not disappear which may explain the problem to detect a significant decline in persistence) (Stock Watson 2007);
  - the inflation gap, inflation correcting for the long trend, has a moderate persistence and this persistence has declined since 1980 (Cogley Primiceri Sargent 2007);

Defining and measuring reduced-form persistence

- international and historical evidence suggest a strong link between inflation persistence and the monetary policy regime (providing a clear nominal anchor) and/or the inflation level (Levin Piger 2003, Benati 2008);
- evidence from structural models also suggests that intrinsic inflation persistence is low after controlling for the inflation trends (Gali Gertler 1999, Coenen Wieland 2005, Cogley Sbordone 2006, Smets Wouters 2003-2007, Benati 2008);

=> Structural models should be sufficiently flexible to account for both the low and the medium/short frequency behaviour of the inflation process in order to estimate correctly the intrinsic inflation persistence.

Defining and measuring reduced-form persistence

- the empirical section would benefit from a discussion of
  - the statistical problems of measuring persistence (autocorrelation) and the potential bias of LS in small samples;
  - the power of the tests to identify significant breaks in persistence;
  - evidence on the spectral decomposition of the inflation process and the relative changes in the low and medium/short persistence in inflation;
  - provide evidence on the timing of changes in the persistence using time-varying VAR.

Structural sources of persistence

- This section analyses alternative sources of inflation persistence in the context of a structural model:
  - based on the New Keynesian Phillips Curve with an exogenous driver process, inflation persistence (measured by first order autocorrelation coefficient) is analytically related to the persistence of the underlying driving process, the slope of the PC, the relative volatility of the price markup shock versus the marginal cost or output-gap component;
  - based on a basic three equation DSGE model, the role of the monetary policy reaction coefficient to inflation and the degree of policy inertia is also considered.

- This analysis provides useful insights but:
  - would benefit from a systematic analysis of these mechanisms in a DSGE model;
  - illustrate the problem of accounting for long term inflation trends: by allowing for changes in the (actual or perceived) inflation objective and/or persistent markup shocks.

Structural sources of persistence

- the standard NK sticky price model cannot explain the high inflation persistence observed in long samples:

	AR(1)	sum coefficients
DATA: GDP deflator, 1966-2004	0,87	0,92
DSGE model: section 3.3		
long sample	0,66	0,32
small sample	0,65	0,30
DSGE SW-2007 - iid markups		
long sample	0,65	0,74
small sample	0,62	0,70
Alternative models to account for high persistence		
DSGE SW-2007 - arma markups		
long sample	0,84	0,86
small sample	0,81	0,82
DSGE SW-2007 - inflation ojb. Shocks (DEW 2009)		
long sample	0,98	0,99
small sample	0,79	0,86

Structural sources of persistence

- the standard NK-PC is a model for the inflation gap rather than for the inflation level (Cogley-Sbordone 2006);
- in most models, the long term inflation trend results from exogenous sources which is not convincing:
  - exceptions are the models that allow for learning either by the central banks or the private sector
- the remaining inflation gap is still persistent.

Structural sources of persistence

- relative contribution of various mechanisms behind inflation-gap persistence in a fully specified DSGE context:

	AR(1)	sum coefficients
DSGE SW-2007 - iid markups		
inflation	0.65	0.74
real marginal cost	0.86	0.85
lower MP reaction to inflation (1.25 instead of 2.0)		
inflation	0.81	0.86
real marginal cost	0.89	0.88
higher intrinsic persistence (indexation 0.75 instead of 0.23)		
inflation	0.76	0.73
real marginal cost	0.83	0.80
increased slope of the PC (0.10 instead of 0.02)		
inflation	0.73	0.72
real marginal cost	0.73	0.71

Structural sources of persistence

- the analysis of different determinants of inflation persistence in a DSGE context can provide different insights than the analysis of the PC with an exogenous driver:
  - the role of expectations, and therefore also the systematic monetary policy, tends to be more important;
  - the role of intrinsic inflation persistence and the slope of the PC are not dominating;
  - in the discussion of the PC slope, the role of real rigidities and strategic complementarity is crucial;
  - one important factor in the persistence of the driving process is the persistence in wage inflation;
  - a GE-context might help to identify the relative role of intrinsic persistence relative to the persistence in the exogenous markup/supply shocks;

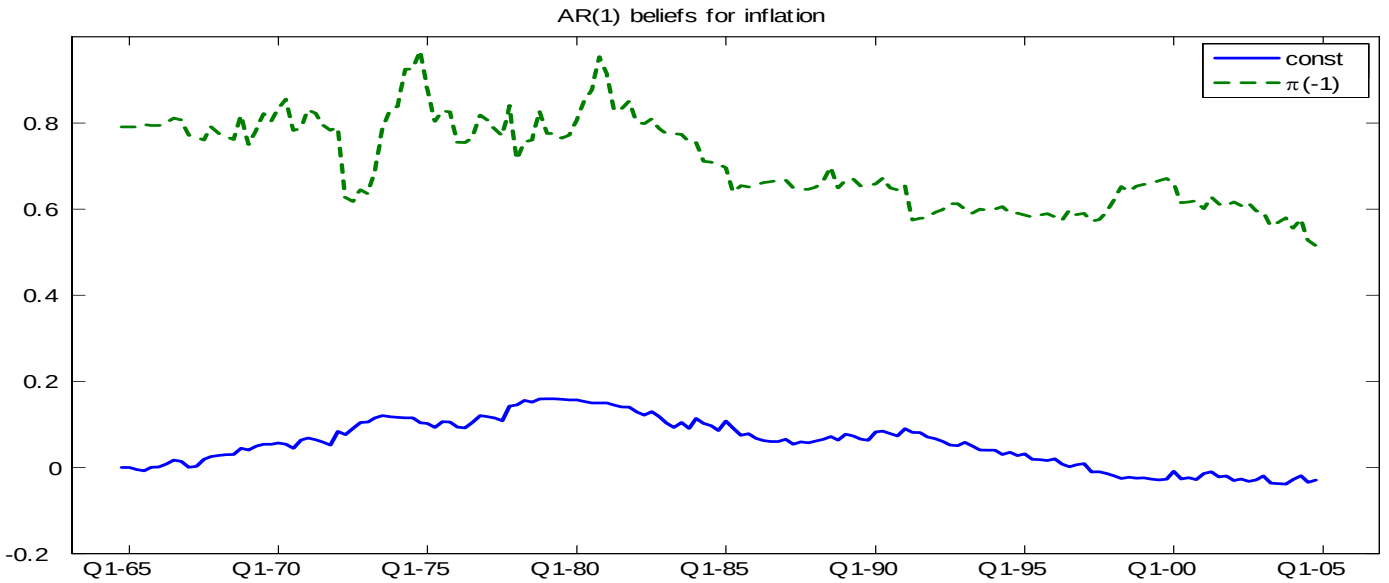
=> understanding the decline in inflation persistence is extremely complex.

Structural sources of persistence

- If forward looking aspects are important in price setting, there might be an important role for deviation from rational expectation due to imperfect, limited or sticky information.
- With imperfect information agents have to learn the structure and the state of the economy: with learning the perceived inflation target and perceived inflation persistence will adjust to recently realized shocks and trends, and this might become an additional source of inflation persistence (Orphanides and Williams 2005).
- Milani 2005, Lansing 2009, and Slobodyan Wouters 2008-2009 have shown that learning dynamics can successfully explain the observed inflation persistence without relying on intrinsic persistence or persistent markup shocks.

Structural sources of persistence

- In Slobodyan Wouters 2009, we re-estimate SW2007 under the assumptions that agents use and update small forecasting models to construct their expectations about future values. Beliefs about future inflation levels and inflation persistence turn out to be highly time-varying under kalman filter learning.



Structural sources of persistence

- The model with learning fits the data better than the RE model, and in particular the inflation data;
- The time-varying beliefs can explain the main trends in inflation during the great inflation/moderation as well as the flattening of the PC;
- The forecasts implied by the PLM are more in line with the survey forecast than the RE forecasts;
- Inflation dynamics are well explained without relying on intrinsic persistence, exogenous dynamics in the markup shocks, or changes in the policy rule.
- Persistence is not a structural feature of the price setting process, but remains a potential risk, that requires close monitoring by MP.

Inference problem in small sample

- In this section, it is argued that one should not draw strong conclusions about inflation persistence based on the small sample experience of stable, close to i.i.d., realisations of inflation over the last decade.
- Small sample estimates of the mean, the autocorrelation and the slope of a simple PC have large standard errors.
- This explains why it is difficult to come up with significant evidence about declining persistence or about the flattening of the PC over time.
- This large uncertainty, together with the asymmetric costs of over- versus under-predicting inflation persistence for monetary policy outcomes, can explain why prudent monetary policy makers are still concerned about persistence (Coenen 2003).

Micro evidence on persistence

- The paper explains in detail how aggregation can explain the coexistence of low persistence at the micro level and high persistence at the macro level;
- Absence of persistence in individual price changes, and lumpy price adjustment instead of continuous adjustments contradict with the idea of intrinsic persistence or sticky information models;
- The random nature of price adjustments, constant or decreasing hazard rates, and systematic differences in the frequency of price changes across sectors are consistent with a purely forward looking “Calvo-mixture” model (Angeloni et al 2006). This sector heterogeneity can also help to explain the persistence in the aggregate inflation rate (Carvalho 2006, Nakamura Steinsson 2008);
- STD models that are consistent with the observed frequency and distribution of micro price changes (DKW 2009, Costain Nakov 2008, Woodford 2008) can also explain persistent inflation responses to aggregate demand shocks.

Concluding

- The paper provides a very complete review of all the issues and evidence on inflation persistence;
- One can disagree with some of the interpretations and conclusions but, given the large uncertainty in the evidence, one can not expect differently.