A NOTE ON INFLATION PERSISTENCE

Steinar Holden
John C. Driscoll

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ABSTRACT

      Macroeconomists have for some time been aware that the New Keynesian Phillips curve, though highly popular in the literature, cannot explain the persistence observed in actual inflation. We argue that two of the more prominent alternative formulations, the Fuhrer and Moore (1995) relative contracting model and the Blanchard and Katz (1999) reservation wage conjecture, are highly problematic. Fuhrer and Moore (1995)'s formulation generates inflation persistence, but this is a consequence of their assuming that workers care about the past real wages of other workers. Making the more reasonable assumption that workers care about the current real wages of other workers, one obtains the standard formulation with no inflation persistence. The Blanchard and Katz conjecture turns out to imply that inflation depends negatively on itself lagged, i.e. the opposite of the empirical regularity.

Steinar Holden
Department of Economics
University of Oslo
Box 1095 Blindern, 0317 Oslo, Norway
steinar.holden@econ.uio.no
http://folk.uio.no/~sholden/

John C. Driscoll
Brown University
Department of Economics
Box B
Providence, RI 02912
and NBER
John_Driscoll@brown.edu
http://econ.pstc.brown.edu/~jd

The short run relationship between inflation and unemployment, which has been highly controversial for decades, is now even more puzzling. Much of the literature has converged on one particular specification, the "New Keynesian Phillips curve", based on John Taylor (1980) and Guillermo Calvo (1983). Indeed, Bennett McCallum (1997) has called it the "the closest thing there is to a standard formulation". Richard Clairda, Jordi Gali and Mark Gertler (1999) have used a version of it as the basis for deriving some general principles about monetary policy. However, as has been recently pointed out by N. Gregory Mankiw (2001): "Although the new Keynesian Phillips curves has many virtues, it also has one striking vice: It is completely at odd with the facts." Larry Ball (1994) gave an early indication of this, by showing that this model predicts that an anticipated disinflation is expansionary, which seemed inconsistent with the experiences of many countries in the 1980s and 90s. More forcefully, Jeff Fuhrer and George Moore (1995) showed that the model predicts stickiness in prices, but not in inflation, and thus is unable to explain the inertia of actual inflation.

The empirical failure of the standard formulation of the short-run aggregate supply curve has led to a number of new models that do exhibit persistence in inflation. One formulation, by Fuhrer and Moore (1995) (which they refer to as the relative contracting model) has been widely used in the literature and in popular graduate text books (e.g. Carl Walsh (1998), pp. 224-225, 460-467, 472-474, and David Romer (2001) pp. 295-296). Another suggestion, by Olivier Blanchard and Larry Katz (1999), is that inflation persistence may be explained by taking into account the dependence of workers' reservation wages on past wages. A third route, adopted by John Roberts (1998) and Ball

(2000), is to apply different varieties of near-rational expectation formation, essentially a form of adaptive expectations, to staggered wage-setting models.

In this note we argue that the proposals by Fuhrer and Moore (1995) and Blanchard and Katz (1999) are highly problematic. As a justification for their new model, Fuhrer and Moore argue that agents care about relative real wages, and not about nominal wages. We show that this motivation is misleading. Fuhrer and Moore's model is based on agents caring about the real wages that other workers obtained in the past. If Fuhrer and Moore's model were modified so that workers cared about the contemporaneous real wages of other workers, which is arguably the more reasonable assumption, then the model coincides with the standard formulation of Taylor (1980), and there is no inflation persistence.[1]

Blanchard and Katz do not formally model their point, but refer among other things to that fact that unemployment benefits institutionally depend on previous wages, suggesting that reservation wages will move with lagged wages. They conclude (page 73) "that taking into account the dependence of the reservation wage on past wages holds a key to understanding the dependence of inflation on itself lagged." We propose two alternative representations of their idea, and show that in contrast to the presumption by Blanchard and Katz (1999), this idea implies that inflation depends negatively on itself lagged.

The Fuhrer and Moore model

Consider the two-period framework used by Taylor (1980) and Fuhrer and Moore (1995). Wages are set in contracts lasting for two periods. Contracts are staggered, so that half of the contracts are set in each period. Let x_t denote the log of the contract wage set in period t. Prices are a constant unit markup over wages so that the log of the price index in period t, p_t, is the average of the contract wages negotiated in period t and period t-1.

$$(1) \qquad p_t = \tfrac{1}{2} \, (x_t + x_{t-1}).$$

Taylor (1980) assumed that contract wages are set as a average of the lagged and the expected future wage contracts, adjusted for excess demand y_t.

$$(2) \qquad x_t = \tfrac{1}{2} \, (x_{t-1} + E_t x_{t+1}) + k y_t \qquad\qquad\qquad k > 0.$$

(2) can be rearranged to

$$(3) \qquad \Delta x_t = E_t \Delta x_{t+1} + 2 k y_t,$$

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[1] This paper is not the first to question the microfoundations of Fuhrer and Moore (1995); c.f. Roberts (1998) and Taylor (1999). However, their arguments are different from ours. Roberts' criticism is that the model implies agents "are concerned about having a large change in their nominal wage relative to inflation when employment is high. Hence, the Fuhrer and Moore model "slips a derivative" relative to the conventional microeconomics". Taylor argues that the wage should be related to the price level over the full contract period, a point already acknowledged by Fuhrer and Moore in their appendix B.

where $\Delta x_t \equiv x_t - x_{t-1}$. First difference (1) to obtain the rate of inflation as:

$$(4) \qquad \pi_t \equiv \Delta p_t = \frac{1}{2}\left(\Delta x_t + \Delta x_{t-1}\right).$$

Substituting out for (3) and (3) lagged in (4), we obtain

$$(5) \qquad \pi_t = E_t\pi_{t+1} + k(y_t + y_{t-1})$$

Thus, as emphasized by Fuhrer and Moore (1995), in the Taylor model any persistence in π_t must derive from persistence in y_t. In contrast, Fuhrer and Moore propose a new contracting equation, where agents care about relative real wages:

$$(6) \qquad x_t - p_t = \tfrac{1}{2}\left(x_{t-1} - p_{t-1} + E_t(x_{t+1} - p_{t+1})\right) + ky_t.$$

Substituting the definition of x_t in equation (6) into the price index equation (1), yields

$$(7) \qquad \pi_t = \tfrac{1}{2}\left(\pi_{t-1} + E_t\pi_{t+1}\right) + (k/2)\left(y_t + y_{t-1}\right).$$

Thus, there is persistence in inflation, as lagged inflation enters with a positive coefficient.

To justify their model, Fuhrer and Moore (page 131) argue: "In the relative wage specification, however, agents compare the real value of their wage contracts with the real value of wage contracts previously negotiated and still in effect, and with contracts expected to be negotiated over the duration of the contract period .." However, this justification is misleading. Presumably, the most natural interpretation of "the real value

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of wage contracts previously negotiated that are still in effect" is $x_{t-1} - p_t$, i.e. the nominal wages set in the previous period evaluated at current prices. In contrast, according to (6), agents care about $x_{t-1} - p_{t-1}$, that is, the real wages that the other group of workers had in the previous period.[2]

Much more importantly, however, the assumption implicit in (6) is difficult to defend theoretically. It is not difficult to explain why agents may compare their own real wage with the real wage that other groups obtain at the same time, and many other studies make this assumption (eg V. Bhaskar, 1990). However, it is harder to understand why workers should compare their own real wage with the real wage other groups had last period.

To explore the consequences of the more reasonable assumption, that workers care about the real wage other groups obtain at the same time, we substitute $x_{t-1} - p_t$ for $x_{t-1} - p_{t-1}$ in (6). Furthermore, we also make the theoretically preferable assumption that the real wage to be determined is the expected real wage over the contract period, and not the real wage in the first period of the contract period (as also argued by Fuhrer and Moore, 1995, in their appendix B). Thus, we substitute $x_t - \frac{1}{2}(p_t + E_t p_{t+1})$ for $x_t - p_t$ on the RHS of (6)[3], to obtain

(8) $x_t - \frac{1}{2}(p_t + E_t p_{t+1}) = \frac{1}{2}(x_{t-1} - p_t + E_t(x_{t+1} - p_{t+1})) + k y_t.$

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[2] Later in the paper, Fuhrer and Moore note (p. 141) that defining preferences over $x_{t-1} - p_{t-1}$ is "a convenient simplification".
[3] Retaining $x_t - p_t$ would not change the conclusion qualitatively.

However, it is immediate that (8) can be simplified to (2), that is, the standard framework of Taylor (1980). Thus, the crucial feature of the model of Fuhrer and Moore is not that agents care about relative real wages; indeed, the standard formulation of Taylor is consistent with that. The crucial feature of the model of Fuhrer and Moore is that agents are assumed to care about the real wages that other groups had in the previous period, which is an assumption that is harder to justify.

Effect of past wages

From Fuhrer and Moore's formulation one might also expect inflation persistence to be generated if workers cared about their own past wages; this is the conjecture of Blanchard and Katz (1999). One can think of various ways in which past wages may affect the wage setting. Blanchard and Katz refer to the fact that unemployment benefits depend on past wages. In a bargaining setting, the outcome might then depend on past wages, through the effect of the unemployment benefits, as well as on the expected real wages of other workers. Observe however that benefits are linked to past nominal wages, while the real value depends on current prices. Thus, workers who negotiate in period t had their past wages negotiated in period t-2, implying that real benefits depend on $x_{t-2} - p_t$. Extending the Taylor formulation to include this aspect suggests the following formulation (where $0 < \gamma < 1$):

$$(9) \qquad x_t - \frac{1}{2}(p_t + E_t p_{t+1}) = \gamma(x_{t-2} - p_t) + \frac{1-\gamma}{2}(x_{t-1} - p_t + E_t[x_{t+1} - p_{t+1}]) + k y_t.$$

Substituting (1) in (9) and rearranging yield

$$(10) \quad \frac{2+\gamma}{4}\Delta x_t = -\gamma\Delta x_{t-1} + \frac{2-\gamma}{4}E_t\Delta x_{t+1} + ky_t.$$

Using the definition of π_t from (4) in (10), we obtain

$$(11) \quad \Delta x_t = -\gamma\Delta x_{t-1} + \frac{2-\gamma}{2}E_t\pi_{t+1} + y_t.$$

Using (4) and (11), we obtain

$$(12) \quad \pi_t = -\gamma\pi_{t-1} + \frac{2-\gamma}{4}\left(E_t\pi_{t+1} + E_{t-1}\pi_t\right) + \frac{k}{2}\left(y_t + y_{t-1}\right).$$

Thus, the direct effect of lagged inflation is negative, the opposite of the inflation persistence evident in data.[4] As in the Taylor model, any persistence must derive from persistence in y_t. The intuition for the negative effect of lagged inflation is that high inflation in period t-1 reduces the real value of the workers' benefits', and thus weakens workers' bargaining position. This dampens wage growth in period t, and consequently lowers period t inflation.

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[4] The negative direct effect of lagged inflation is the result of the negative effect of lagged wage growth, as is evident from a comparison of (10) with the corresponding Taylor equation (3).

Past wages may also affect wage setting if workers' aspirations in job search and wage bargaining are shaped by their previous earnings, as also suggested by Blanchard and Katz (1999). One justification for this, proposed by Tore Ellingsen and Steinar Holden (1998), is that past expectations may affect wage setting via workers' choice of durable consumption goods. To see whether this idea may explain inflation persistence, consider a formulation where the wage outcome depends on the real wages that the workers had in the previous period, $x_{t-2} - p_{t-1}$, as well as on the expected wages of other workers:

$$(13) \quad x_t - \frac{1}{2}(p_t + E_t p_{t+1}) = \gamma(x_{t-2} - p_{t-1}) + \frac{1-\gamma}{2}(x_{t-1} - p_t + E_t[x_{t+1} - p_{t+1}]) + ky_t$$

Substituting (1) in (13) and rearranging yield

$$(14) \quad \frac{2-\gamma}{4}\Delta x_t = -\frac{\gamma}{2}\Delta x_{t-1} + \frac{2-\gamma}{4}E_t \Delta x_{t+1} + ky_t .$$

Using (4), (14) can be further rearranged to

$$(15) \quad \Delta x_t = -\frac{\gamma}{2-\gamma}\Delta x_{t-1} + E_t \pi_{t+1} + \frac{2k}{2-\gamma}y_t .$$

Using (4) and (15), we obtain

$$(16) \quad \pi_t = -\frac{\gamma}{2-\gamma}\pi_{t-1} + \frac{1}{2}\left(E_t\pi_{t+1} + E_{t-1}\pi_t\right) + \frac{k}{2-\gamma}\left(y_t + y_{t-1}\right).$$

Again, we find negative direct effect of lagged inflation, the opposite of the inflation

persistence evident in the data.

Conclusions

Macroeconomists are faced with a puzzle: the standard theoretical formulation of the

short run aggregate supply curve seems to be an empirical failure. The standard

formulation exhibits stickiness in prices but not in inflation, in contrast with the

persistence in actual inflation. A number of alternative formulations have been proposed.

We argue that two of the more prominent ones, the Fuhrer and Moore (1995) relative

contracting model and the Blanchard and Katz (1999) reservation wage conjecture, are

highly problematic. Fuhrer and Moore (1995)'s formulation generates inflation

persistence, but this is a consequence of their assuming that workers care about the past

real wages of other workers. Once one replaces their formulation with the more

reasonable assumption that workers care about the current real wages of other workers,

the resulting formulation immediately reduces to the standard formulation with no

inflation persistence. To explore the Blanchard and Katz conjecture, we specify two

formulations where workers' reservation wages depend on their own past wages (either

because unemployment insurance is related to own past wages or because the past real

wage has a more direct effect). We find that inflation depends negatively on itself lagged,

ie the opposite of the empirical regularity.

This leaves open the question of how to generate inflation persistence in

contracting models. Recently, several different alternative types of explanations have

been proposed. Roberts (1998) and Ball (2000) have suggested models that relax the assumption that expectations are rational. Estaban Jadresic (2000) proposes a staggered price-setting model with a flexible distribution of price durations. Mankiw and Ricardo Reis (2001) argue that information about macroeconomic conditions diffuses slowly through the economy. In a companion paper (John Driscoll and Holden, 2001), we show that inflation persistence may be caused by coordination problems associated with workers being concerned about fair treatment, in the sense that they care disproportionately more about being paid less than other workers than they do about being paid more.

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