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Forward-looking monetary policy and anticipated shocks to inflation

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ABSTRACT

This paper extends a standard New Keynesian model to describe the effects of anticipated shocks to inflation and forward-looking monetary policy. Using the data generated from this modified model suggests that overlooking these two factors in the standard Cholesky structural vector autoregressive identification scheme will generate a price puzzle. Furthermore, this paper demonstrates that failing to account for these two factors may result in significant estimates of two other explanations of the price puzzle—the cost channel of transmission of monetary policy and indeterminacy due to violation of the Taylor principle—even though neither features in the data generating process.

1. Introduction

Concern with a positive response of prices to a contractionary monetary shock can be traced several decades back. Widely cited in the empirical literature on this subject is the 1970s comment of Congressman Wright Pitman that fighting inflation with higher interest rates was akin to "throwing gasoline on fire." His simile appeared to be highly counterintuitive, as the standard models predicted that an increase in interest rates would reduce aggregate demand and hence the price level. Academic interest in the effect of shocks to the interest rate on the price level became prominent starting with the seminal paper by Sims (1992). In a comment on that work, Eichenbaum (1992) termed a positive response of prices to a contractionary monetary policy shock the 'price puzzle', a phenomenon that has been widely studied in the literature since.

The price puzzle is typically addressed in two ways: Finding empirical model specifications that resolve it and imply that the puzzle does not exist, or finding theoretical modeling mechanisms that provide substantiation for the puzzle. On the former front, much of the literature has evolved from Sims' (1992) pioneering work, which found that introducing an index of commodity prices into the empirical system helped reduce the extent of the price puzzle, leading him to the conjecture that central banks may use 'information variables' that indicate the advent of inflation and allow them to react preemptively. He then suggested that failure to include these variables into an empirical system results in a misspecified model; correcting this misspecification would then remove the price puzzle.

On the second front, several theoretical mechanisms have been studied that give rise to the price puzzle. Ravenna and Walsh (2006), among others, investigate the role of the cost channel of transmission of monetary policy, whereby interest

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rates enter a representative firm's marginal cost function and therefore become a part of the forcing process for inflationary dynamics. In this setup, a contractionary monetary policy shock raises interest rates and hence the firm's marginal cost. In the short term, this increase in cost translates into an increase in price inflation, which later declines due to the decrease in aggregate demand that results from higher interest rates. Hence models that incorporate the cost channel may be able to explain the price puzzle.[1] Importantly, however, as Section 4 documents, there is a considerable disagreement in the literature over whether a model featuring an empirically plausible extent of the cost channel could give rise to the price puzzle.

Introducing indeterminacy into the model economy by means of violating the Taylor principle is another way of generating the price puzzle. Castelnuovo and Surico (2010) examine the structural vector autoregressive (SVAR) models of the price puzzle price at different time periods and show that, in the quarterly data, the price puzzle existed in the 1966–1979 sample but was absent in the 1979–2002 sample. Samples that span these two time periods are likely to produce some behavior consistent with the price puzzle. The authors explain the discrepancy in the results from these two subsamples by the difference in the conduct of monetary policy: Insufficiently tight monetary policy may result in indeterminacy, which, as they demonstrate with simulated data, produces impulse responses consistent with the price puzzle.[2] Auray and Feve (2008) show that the price puzzle can arise due to indeterminacy in a model without sticky prices where the conduct of monetary policy is given by a money supply rule.

The present paper contributes to this strand of the literature by considering a data generating process (DGP) that provides a unified explanation for several previously documented phenomena. This DGP has the following properties: (a) It generates a 'price puzzle' in a simple SVAR framework, even though it is not a feature of the theoretical DGP; (b) this process features a forward-looking monetary policy rules and anticipated shocks to inflation thus placing the Sims' (1992) hypothesis into the dynamic stochastic general equilibrium (DSGE) context; (c) it shows that under some conditions where the 'price puzzle' appears in the SVAR framework, the estimates of the monetary policy-maker's aggressiveness towards inflation will be much lower than in the true DGP, potentially leading to indeterminacy; and (d) it demonstrates that even though the DGP does not feature the cost channel of transmission of monetary policy, positive estimates of its extent can be obtained in a model that ignores the forward-looking aspect of monetary policy and anticipated shocks to inflation.

More specifically, this paper relies on two modeling mechanisms whose role has not been formally studied in the DSGE explanations of the price puzzle. First, it assumes that the cost-push shock can be split into two components: anticipated and unanticipated. Wohltmann and Winkler (2009a,b) study the impact of anticipated cost-push shocks on the conduct of optimal monetary policy and show that, in a model with sufficiently sticky prices, they generate larger social welfare losses than unanticipated shocks of the same size. More broadly, the idea that an exogenous shock may have anticipated and unanticipated components derives from the large recent literature on the so-called technological news shocks.[3]

The second modeling device investigated in this paper comes from the literature on the inflation-forecast-based monetary policy rules. Levine et al. (2007) propose a class of inflation-forecast-based rules with desirable stabilizing properties and call them the Calvo-type interest rate rules. They also show that these rules have superior stabilizing properties over earlier forecast-based rules, where the central bank responds to expected inflation at a given forecast horizon.[4] Gabriel et al. (2009) demonstrate that such a rule describes the behavior of the US Federal Reserve quite well.

The rest of the paper is organized as follows. Section 2 makes two amendments to the standard New Keynsian model used as the workhorse for the analysis of monetary policy conduct. First, the standard Taylor rule is replaced with its forward-looking version that nests the former as a special case. The second modification allows a fraction of inflationary shocks to be anticipated. Section 3 uses the data generated by the modified model to estimate the standard SVAR model of a measure of real activity, inflation, and interest rate using the Cholesky identification scheme. The price puzzle emerges when the central bank is sufficiently forward-looking and a large fraction of cost-push shocks can be anticipated, a result that echoes the Sims (1992) conjecture. Section 4 uses the same simulated data to estimate the standard model that assumes no forward-looking behavior on the part of the central bank and that none of the cost-push shocks are anticipated; however, it does allow for the cost channel to be present. The results suggest that as the degree of forward-looking behavior and the share of anticipated inflationary shocks increase in the true data generating process, so will the estimates of the extent of the cost channel of transmission of monetary policy; furthermore, the Taylor principle may be violated. Finally, Section 5 concludes.

2. A model of the data generating process

Harking back to the conjecture of Sims (1992), this section develops a data generating process in the context of a standard dynamic stochastic general equilibrium (DSGE) model featuring an exogenously evolving process that carries information

[1] In a related paper, Berkelmans (2008) develops a model with imperfect information that generates the price puzzle because the agents cannot immediately distinguish between supply and monetary shocks.

[2] Tightness of monetary policy is measured in the spirit of Clarida et al. (1999): To produce determinacy in the New Keynesian model, the coefficient on expected future inflation should be greater than 1 in the interest rate rule. Clarida et al. (1999) also show that the this coefficient was less than 1 in the pre-1980 subsample, which is consistent with the results of Castelnuovo and Surico (2010).

[3] See Beaudry and Portier (2006), Jaimovich and Rebelo (2006), Francis et al. (2007), and Barksy and Sims (2009) for a discussion of alternative approaches to model and identify technological news shocks in the data. Fujiwara et al. (2008) and Schmitt-Grohe and Uribe (2008) provide empirical estimates of the importance of technological news shocks in a New Keynesian model and of several anticipated shocks in a real business cycle model, respectively.

[4] See Clarida et al. (2000) for empirical estimates of the standard inflation forecast-based rules. Batini et al. (2006) provide a comprehensive overview of indeterminacy arising in this class of rules and for ways of dealing with it.