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Journal of Economic Dynamics & Control 31 (2007) 906–937

JOURNAL OF  
Economic  
Dynamics  
& Control

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# Does inflation increase after a monetary policy tightening? Answers based on an estimated DSGE model<sup>☆</sup>

Pau Rabanal<sup>\*,1</sup>

*Research Department, La Caixa*

Received 3 February 2004; accepted 23 January 2006

Available online 4 August 2006

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## Abstract

This paper estimates the importance of the cost channel of monetary policy in a New Keynesian model of the business cycle. A model with nominal and real rigidities is extended by assuming that a fraction of firms need to borrow money to pay their wage bill. Hence, a monetary policy tightening increases effective unit labor costs of production, and might imply an increase in inflation. The paper examines the conditions under which the model can generate a positive response of inflation to a monetary contraction, and estimates the model's parameters using Bayesian methods. The paper shows that the estimated demand-side effects of monetary policy dominate the estimated supply side effect, even if restrictions are imposed that make occurrence of a positive inflation response to a monetary contraction more likely.  
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*JEL classification:* C11; C15; E31; E32

*Keywords:* Price puzzle; New keynesian models; Bayesian methods; United states

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<sup>☆</sup>This paper was written while the author was an economist at the International Monetary Fund and previously circulated as IMF Working Paper 03/149, under the title "The Cost Channel of Monetary Policy: Further Evidence for the United States and the Euro Area." The views expressed in this paper are those of the author only and should not be attributed to the International Monetary Fund, its Executive Board, or its management, or to "La Caixa" (Caixa d'Estalvis i Pensions de Barcelona).

\*Tel.: +34 934 046888; fax: +34 934 046892.

E-mail address: [prabanal@lacaixa.es](mailto:prabanal@lacaixa.es).

<sup>1</sup>Current address: Avinguda Diagonal 621–629, Torre 1, Planta 6, 08029 Barcelona, Spain.

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doi:10.1016/j.jedc.2006.01.008

## 1. Introduction

What is the effect of monetary policy on prices? The conventional view suggests that monetary policy tightenings are associated with declines in output and inflation. However, the results coming from using vector autoregressive (VAR) models are far from conclusive: one of the most controversial findings in the empirical literature on monetary policy shocks is the so-called ‘price puzzle,’ whereby a tightening of monetary policy is associated with an increase, rather than a decrease, of the price level. Two main explanations have been offered for this phenomenon: one implies that the unexpected part of monetary policy shocks is not well measured, while the other suggests that there are ‘cost channel’ effects of monetary policy.

The first explanation suggests that VAR models cannot properly measure the forward-looking component of monetary policy, and hence, do not properly measure monetary policy shocks. Suppose that the central bank expects higher inflation in the future, due to productivity shocks, oil price shocks, exchange rate developments, and the like. When the central bank increases interest rates, those shocks may have already been built into the economy, so a simultaneous increase in interest rates and prices is observed. Therefore, the price puzzle arises due to a misidentification of the unexpected component of monetary policy shocks. Sims (1992) suggested that once commodity prices are included in a VAR model, the price puzzle disappears. His explanation was that the information set available to policy makers may include variables useful in forecasting inflation that the econometrician has not considered. A more recent paper by Romer and Romer (2004) constructs series of monetary policy shocks after controlling for the endogenous response of the Federal Reserve to its own forecasts of output growth, inflation and unemployment. Among other results, they find that the price puzzle becomes irrelevant.

The second explanation suggests that there is no methodological problem with a price puzzle type of behavior. On the contrary, it is indeed the cost channel of monetary policy that causes prices (or inflation) and nominal interest rates to move in the same direction after a monetary policy shock. When the central bank increases interest rates, some production (financing) costs increase, which will tend to cause an increase in the inflation rate. This ‘supply side’ effect of monetary policy may coexist with and, in fact, dominate the traditional ‘demand-side’ effect. Barth and Ramey (2001) reach this conclusion using industry level and aggregate data for the United States, and show that their finding is robust even when commodity prices are introduced in their VAR. More recent work by Christiano et al. (2005) reaches the same conclusion, using aggregate data.

This paper attempts to disentangle these two conflicting explanations by estimating a dynamic stochastic general equilibrium (DSGE) model using a Bayesian approach. The use of DSGE models based on staggered price and wage setting (i.e. New Keynesian models) has become increasingly popular for the analysis of monetary policy, due to their analytical tractability. However, in the baseline model, there is no room for a cost channel of monetary policy: increases in interest rates

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