Journal of Economic Dynamics & Control 36 (2012) 830–850

Contents lists available at SciVerse ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

How well does sticky information explain the dynamics of inflation, output, and real wages?

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ARTICLE INFO

Article history:
Received 18 March 2010
Received in revised form
7 June 2011
Accepted 30 December 2011
Available online 28 February 2012

JEL classification:
C13
E30
E52

Keywords:
Sticky-prices
Sticky-information
Inflation-indexation

ABSTRACT

This paper finds that a model with sticky information is less successful than a standard model featuring nominal rigidities, inflation indexation, and habits in generating the dynamics triggered by technology shocks, as estimated by a vector autoregression using U.S. macroeconomic data. The real wage responses after a permanent increase in productivity clearly favor the standard model. The sticky information model fails to replicate the observed inertial response in the real wage, whereas the standard model relies on inflation indexation in wage-setting to achieve a better fit. The two models are, however, statistically equivalent after a shock in monetary policy.

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1. Introduction

Inflation and output take time to adjust to different macroeconomic developments. Empirical evidence on monetary policy shocks, for instance, finds that output and inflation respond to a variation in the nominal interest rate in a sluggish manner, with peak responses occurring several quarters after the initial change in the monetary policy instrument; further, inflation responses lag behind those of output.[1] Fuhrer and Moore (1995), Chari et al. (2000), and Fuhrer (2006) have documented the inability of the standard sticky price model to replicate these patterns. Real rigidities, such as those that increase the degree of strategic complementarities among price-setters, are unable to reproduce the observed hump-shaped responses of inflation and output after a shock in monetary policy.[2]

Christiano et al. (2005), among many others, include indexation to past inflation in price-setting, habit formation in consumption, and adjustment costs in investment to generate hump-shaped responses in inflation and output. This approach, which we can call “backward-looking behavior”, has been successful in empirical work.[3] An alternative is to assume environments where information is incomplete, as do Sims (2003), Woodford (2003a), and Mankiw and Reis (2002, 2006).

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[1] See Christiano et al. (1999) for the U.S., Mojon and Peersman (2003) for Europe, and Wang and Wen (2007) for several OECD countries.

[2] Most real rigidities assumed in the literature diminish the contemporaneous response of prices to fluctuations in the marginal cost. In empirical work, these assumptions help to estimate a “plausible” degree of price stickiness in macro models, closing the gap between macro and micro evidence about the frequency of price changes (see, Eichenbaum and Fisher, 2007). Modeling devices include firm-specific labor and capital (Woodford, 2003b; Altig et al., 2011), a countercyclical markup (Kimball, 1995), raw material inputs (Rotemberg and Woodford, 1995), among others. These devices, however, cannot generate the hump-shaped response of inflation that has been documented after a shock in monetary policy.

[3] See Christiano et al. (2005) and Smets and Wouters (2007), among others.

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doi:10.1016/j.jedc.2011.12.007

The "sticky information" approach proposed by Mankiw and Reis (2006) assumes that information flows slowly throughout the population. In recent years, this approach has become one of the most studied incomplete information environments to generate hump-shaped inflation responses. Further, the sticky information hypothesis can be extended to consumers and workers to generate hump-shaped responses in output and nominal wage inflation as well.

Given the popularity of the backward-looking behavior approach and the sticky information approach, it is natural to ask which one better explains the sluggish macroeconomic dynamics that have repeatedly been characterized in the data. The strategy taken in this paper to answer this question is the following. A model containing real rigidities serves as a common structure to build two model variants: a *backward-looking behavior* variant and a *sticky information* variant. Household preferences and market structures are similar in the two variants, changing only the way in which nominal and information rigidities enter the models. In particular, the backward-looking behavior variant adds price and wage rigidities *à la* Calvo, habits in consumption, and inflation indexation in price- and wage-setting. The sticky information variant assumes a stochastic process of updating information that applies to consumers, firms, and workers. The two variants are then compared in terms of their predicted dynamics after a shock in monetary policy and a permanent increase in labor productivity.

Other studies tackle a similar question, reporting a wide array of both answers and methodologies. Andrés et al. (2005) and Trabandt (2007) find that a sticky information model performs as well as a sticky price model with lagged inflation indexation. Kiley (2007), Korenok and Swanson (2007), and Coibion (2010) find, in contrast, that the data seem to favor a New Keynesian Phillips curve (i.e., derived from sticky prices and added, sometimes, with indexation) over a sticky information Phillips curve. Coibion and Gorodnichenko (2011), Dupor et al. (2010), and Knotek (2010) argue that a model containing both sticky prices and sticky information, i.e., a "dual stickiness" model, better explains the dynamics of inflation. Remarkably, all of these papers consider only the case of information frictions in firms, assuming that workers and consumers have full information. Thus, the models are most often compared in terms of certain moments of inflation and, sometimes, output.

Mankiw and Reis (2006) argue, in contrast, that a *pervasive* slow diffusion of information (in other words, that all agents are subject to information frictions) is a necessary feature of the sticky information approach to fit different moments of the data.[4] To the best of my knowledge, only Mankiw and Reis (2006, 2007), Reis (2009), and Gomes (forthcoming) consider information frictions in firms, workers, and consumers all together. Nevertheless, these authors do not compare the performance of the pervasive sticky information model to that of the standard model with backward-looking behavior.

The contribution of this paper is threefold. First, it compares a full-fledged general equilibrium model with pervasive information frictions with a standard sticky price model with backward-looking behavior. Second, it extends the model comparison to more variables in addition to inflation and output, including the real wage, wage inflation, and the nominal interest rate. Third, the paper compares the models using the evidence from the type of structural vector autoregressions (SVARs) that motivated the departure from the pure sticky price model in the first place.

Using the minimum distance estimation proposed by Rotemberg and Woodford (1997), the parameters that generate persistence and hump-shaped responses in each of the model variants are estimated (such as the sticky price and sticky information probabilities, the degrees of inflation indexation, habits, and the monetary rule coefficients). The minimum-distance approach consists of choosing these parameters so that the distance between the model-based impulse responses and the SVAR responses is minimized given a certain weighting matrix. The empirical responses correspond to a shock in monetary policy and a permanent shock in labor productivity, as previously mentioned. The estimation procedure involves a bootstrapping method that helps to screen problems of parameter identification and computes the prediction accuracy of each model variant with respect to the empirical impulse responses of different variables.

The results are as follows. The two model variants are statistically equivalent after a shock in monetary policy. However, after a permanent shock in productivity, there is a clear and statistically significant difference favoring the backward-looking behavior model in terms of the responses of the real wage, the nominal wage, and output. Further, this result is confirmed in the course of different robustness exercises, where the backward-looking behavior variant is regularly better at predicting the responses either of the real wage or of wage inflation and inflation in general. The exercises include different identification strategies for the technology shock, sub-sample estimation, and model extensions, including a version with capital, and an alternative version of the sticky information model featuring "dual stickiness".

Inflation indexation in nominal wages is the crucial device that allows the backward-looking behavior variant to fit closely the SVAR's real wage responses to a permanent increase in productivity. Wage indexation can effectively explain why nominal wages have a positive or null effect at impact and afterwards decrease moderately in the periods that follow the technology shock. This behavior cannot be replicated by the sticky information model, which predicts an increase in nominal wages that lasts for several quarters and implies a quicker than observed rise in real wages.

The remainder of the paper is organized as follows. Section 2 presents the SVAR impulse responses that are used in the minimum-distance estimation. Section 3 describes the baseline model and presents the two variants. Section 4 details the

[4] For instance: (1) inflation tend to rise jointly with output during booms; (2) real wages are smoother than output; and (3) real variables respond gradually to macroeconomic shocks.

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