Journal of Economic Dynamics & Control 40 (2014) 279–292

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

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

Consumer misperceptions, uncertain fundamentals, and the business cycle

Patrick Hürtgen

University of Bonn, Kaiserplatz 7-9, 53113 Bonn, Germany

ARTICLE INFO

Article history:
Received 27 July 2011
Received in revised form
12 May 2013
Accepted 8 January 2014
Available online 18 January 2014

JEL classification:
D83
E32

Keywords:
Imperfect information
Noise shocks
Aggregate fluctuations
Bayesian estimation
Bayesian model comparison

ABSTRACT

This paper estimates the importance of shocks to consumer misperceptions "noise shocks" for U.S. business cycle fluctuations. I embed imperfect information as in Lorenzoni (2009) into a Smets and Wouters (2007)-type DSGE model. Agents only observe aggregate productivity and a signal about the permanent component contaminated with noise. Based on this information agents form beliefs about the temporary and the permanent component of productivity. Shocks to the signal (noise shocks) trigger aggregate fluctuations unrelated to changes in productivity. Bayesian estimation shows that noise shocks explain up to 14 percent of output and up to 25 percent of consumption fluctuations. Nominal rigidities and the specification of the monetary policy rule are crucial for the importance of noise shocks. These features help to resolve conflicting results in the previous literature.

1. Introduction

The notion that consumer optimism or pessimism can cause business cycle fluctuations has a long tradition in economics. It dates back at least to Pigou (1927), who believed that "errors of undue optimism or undue pessimism in their business forecasts" caused industrial fluctuations, and Keynes (1936), who assigned a large role to "animal spirits" in explaining business cycle fluctuations. A number of studies revive the idea of expectation-driven cycles (see Beaudry and Portier, 2004, 2006; Eusepi and Preston, 2011; Angeletos and La′O, 2013). Among these, Lorenzoni (2009) presents a calibrated model where noise shocks or "animal spirit" shocks induce business cycle fluctuations.[1] Noise shocks induce fluctuations in consumers′ beliefs unrelated to fundamental changes, generating positive co-movement in consumption, output, employment and inflation.

This paper provides new empirical evidence on the importance of noise shocks as a driving force of the U.S. business cycle and compares the fit to the perfect information model. Imperfect information as in Lorenzoni (2009) is embedded in a New Keynesian model with price and wage rigidity, investment adjustment costs and variable capital utilization building on Smets and Wouters (2007) and Justiniano et al. (2010). Consumers are rational and *passively learn* about the fundamentals of the economy by observing noisy signals.[2] Specifically, agents learn about the temporary and the permanent component

E-mail address: huertgen@uni-bonn.de

[1] Lorenzoni (2009) calibrates the signal to generate as much noise-driven volatility as possible.

[2] A vast literature focuses on different variants of learning, among these rational inattention (e.g. Mackowiak and Wiederholt, 2009) and least-squares learning (e.g. Eusepi and Preston, 2011). In this paper learning means that rational agents form beliefs about unobserved state variables.

0165-1889/$ - see front matter
http://dx.doi.org/10.1016/j.jedc.2014.01.008

of productivity by only observing aggregate productivity and a signal about permanent productivity contaminated with noise. Shocks to the signal (noise shocks) affect consumers′ perception about unobserved productivity components triggering aggregate fluctuations. The main results are: Noise shocks account for 14 percent of output fluctuations and 25 percent of consumption fluctuations on impact. After 12 quarters, they still explain 10 percent of output and 12 percent of consumption fluctuations.[3]

Blanchard et al. (2013) show that the consumers′ signal extraction problem implies a non-fundamental vector autoregressive (VAR) representation rendering it impossible to identify noise shocks in a VAR. The filtering problem and the identification of noise shocks require the estimation of a structural model. Building on their contribution I employ Bayesian methods to estimate a medium-scale imperfect information New Keynesian model with several shocks using U.S. data. Based on these estimates it takes consumers about eight quarters to disentangle pure noise from fundamental shocks. Furthermore, smoothed estimates of the signal fit remarkably well to data from the Michigan Consumer Sentiment Survey.

Counterfactual experiments show that nominal rigidities and the specification of the Taylor rule crucially affect the importance of noise shocks—a finding that helps to reconcile conflicting results on the importance of noise shocks (as I discuss later). A positive noise shock triggers a perceived wealth effect as consumer mistake noise for an increase in permanent productivity. The higher is price stickiness, the stronger responds aggregate demand. Wage stickiness substantially increases consumption fluctuations even in the presence of moderate price stickiness: Sticky wages imply that firms rationally anticipate reduced fluctuations in their real marginal costs. Hence, inflation variability decreases as compared to the flexible wage case. Less variation in inflation reduces the responsiveness of the real interest rate through the Fisher equation and therefore reduces consumers′ willingness to postpone consumption to later periods. Thus, due to a weaker intertemporal substitution effect, households increase consumption more under sticky wages than under flexible wages. In addition, the less responsive the central bank sets interest rates to inflation and real activity, the stronger are the effects of noise shocks through less variation in the real interest rate.

This paper also compares the fit of the incomplete information model using marginal likelihoods with the model where consumers perfectly observe the state of the economy. The resulting Bayes factor is too small to sharply discriminate between both models. Second, this paper estimates the imperfect information model assuming identical autocorrelation parameters for the temporary and permanent productivity process an assumption maintained in previous literature such as in Blanchard et al. (2013). The Bayes factor provides strong evidence in favor of the model allowing for different autocorrelation parameters. It is noteworthy that the estimation of the restricted case yields a very high degree of nominal rigidity and surprisingly low Taylor rule coefficients. In line with the counterfactual analysis these estimates contribute to a much stronger effect of noise shocks on consumption and output.

Closely related empirical literature does not agree on the importance of noise shocks finding that these shocks explain between 0 and 75 percent of short-run fluctuations in consumption. The model framework in this paper nests the specifications in Blanchard et al. (2013) and Barsky and Sims (2012) allowing to identify the factors that drive the importance of noise shocks. Blanchard et al. (2013) employ a maximum likelihood estimation of a highly stylized New Keynesian model with noise shocks. They find that 75 percent of consumption fluctuations on impact and still more than 50 percent after four quarters are due to noise shocks, while technology shocks account for the remaining fraction. However, their estimation yields virtually fixed prices running counter to microeconomic evidence on price adjustments (Bils and Klenow, 2004) and macroeconomic evidence from estimated DSGE models (Smets and Wouters, 2007). In an extended New Keynesian model similar to the one employed in this paper (but with identical autocorrelation parameters for temporary and permanent productivity) they find that noise shocks explain more than 50 percent of consumption fluctuations on impact and about 25 percent after two years. Noise shocks account for a large fraction of cyclical fluctuations due to high degrees of nominal rigidity and a very low responsiveness to inflation and output of the interest rate rule.[4] By impulse response function matching Barsky and Sims (2012) estimate a DSGE model featuring price rigidity, habit formation, and capital adjustment costs and find that noise shocks explain virtually no aggregate fluctuations due to general equilibrium effects. Based on counterfactual analysis this paper confirms that for intermediate degrees of price rigidity and flexible wages noise shocks do not explain a large fraction of consumption volatility, but in combination with wage rigidity noise shocks do account for a sizable fraction of business cycle fluctuations.

Noise-driven business cycles as presented in this paper crucially differ from the literature on news-driven business cycle models (e.g. Jaimovich and Rebelo, 2009; Schmitt-Grohé and Uribe, 2012). In news-driven models agents have more information than in the imperfect information setup considered in this work as they perfectly observe current and future productivity (news) shocks.[5] In addition to the aforementioned studies this paper is also related to Milani (2007) and Eusepi and Preston (2011). These papers provide a learning mechanism where agents deviate from the rational expectations assumption in that agents learn about parameters of the model from historical data. The focus of this work is instead to analyze an incomplete information model which gives rise to a channel that leads agents to temporarily deviate from the complete information model equilibrium. Thus, within an imperfect information model, noise shocks generate business cycle fluctuations in a full rational expectations framework.

[3] The model features a variety of conventional supply, demand and markup shocks.

[4] Estimates for the average price and wage duration are close to two years and the Taylor rule coefficient on inflation is virtually one.

[5] In principle, information about future changes may be offset by a new observation in the next period, e.g. a positive news shock to be realized in three periods from today may be offset in period two. As news shocks are typically assumed to be i.i.d., systematic/correlated erroneous beliefs cannot arise.