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What (really) accounts for the fall in hours after a technology shock? ☆

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ABSTRACT

The paper asks how state of the art DSGE models that account for the conditional response of hours following a positive neutral technology shock compare in a marginal likelihood race. To that end we construct and estimate several competing small-scale DSGE models that extend the standard real business cycle model. In particular, we identify from the literature six different hypotheses that generate the empirically observed decline in hours worked after a positive technology shock. These models alternatively exhibit (i) sticky prices; (ii) firm entry and exit with time to build; (iii) habit in consumption and costly adjustment of investment; (iv) persistence in the permanent technology shocks; (v) labor market friction with procyclical hiring costs; and (vi) Leontief production function with labor-saving technology shocks. In terms of model posterior probabilities, impulse responses, and autocorrelations, the model favored is the one that exhibits habit formation in consumption and investment adjustment costs. A robustness test shows that the sticky price model becomes as competitive as the habit formation and costly adjustment of investment model when sticky wages are included.

1. Introduction

As initially proposed by Galí (1999), the empirical evidence suggests that a positive technology shock leads to a decline in labor inputs. In addition, Francis and Ramey (2005), Liu and Phaneuf (2007), Whelan (2009), and Wang and Wen (2011) find that this result is robust to different specifications of the structural vector autoregression (SVAR) model and the measure of productivity used.[1] On the other hand, the standard real business cycle model fails to account for this empirical regularity. This paper uses a full information method and quarterly U.S. data to estimate small-scale structural general equilibrium models exhibiting alternative theoretical specifications that could drive hours to drop following a technology shock. Our main focus is the identification of the theoretical assumption that is mostly accepted by the data using formal tests. A survey of the recent literature reveals the existence of six competing hypotheses which generate a decline in hours after a positive neutral technology shock: (i) sticky prices (à la Galí, 1999); (ii) firm entry and exit with time to build (à la Wang and Wen,

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[1] Whether hours rise or fall following a positive technology shock depends on whether hours enter the SVAR in log-levels or log-differences. However, Fernald (2007) shows that if one allows for plausible trend breaks in labor productivity, then hours worked fall on impact of a positive technology shock, regardless of whether hours are measured in differences or in levels.

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2011); (iii) habit in consumption and costly adjustment of investment (à la Francis and Ramey, 2005); (iv) persistence in the permanent technology shocks (à la Lindé, 2009); (v) labor market friction with procyclical hiring costs (à la Mandelman and Zanetti, 2010); and (vi) Leontief production function with labor-saving technology shocks (à la Francis and Ramey, 2005). To our knowledge, this is the first paper that uses a full information approach to identify the assumptions that are most likely responsible for generating the decline of hours worked following a positive technology shock.

Our main result is that—in terms of model posterior probabilities, impulse responses, and autocorrelations—introducing habit formation in consumption and investment adjustment costs in a small-scale dynamic and stochastic general equilibrium (DSGE) model significantly improves the model fit; at the same time the model can accurately account for the negative short-term correlation between output and labor conditional to a technology shock. Large values of the posterior odds ratio provide unambiguous evidence in favor of the model with habit in consumption and costly adjustment of investment as specified by Francis and Ramey (2005). Then comes the sticky price hypothesis as the second best alternative, followed by the introduction of labor frictions. The version of the model embedding persistent technology shocks and alternatively the Leontief production function specification is ranked fourth and fifth, respectively. Finally, the model encompassing entry-exit firms with time-to-build hypotheses is not supported by the data even when compared with the plain vanilla structure of the RBC model. This leads us to conclude that the observed decline in hours following a positive technology shock is most likely yielded by the combination of habit in consumption and costly adjustment of investment, which markedly dominates the other alternative assumptions. This result is robust to extending the different models with additional features such as nominal wage rigidity; however, it becomes less obvious to statistically discriminate between the sticky price and the habit formation models.

The rest of the paper is organized as follows. Section 2 revisits the stylized facts related to the response of endogenous variables to technology shocks, then describes the benchmark model. Section 3 describes the different versions of the model with particular attention paid to a limited information identification scheme. Section 4 sets out the Bayesian Maximum likelihood estimation and examines the ability of the models to capture the main characteristics of the actual data. Section 5 checks the robustness of our results with respect to the initial reference model. Section 6 concludes the paper.

2. Stylized facts and the RBC model

2.1. Stylized facts

For the sake of identifying technology shocks we adopt the commonly used long-run identification as applied by Galí (1999), Christiano et al. (2004), and various others. According to Blanchard and Quah (1989), the additional restrictions needed to identify the structural shocks come from the long-run influence of the shocks of the model on the variables of the

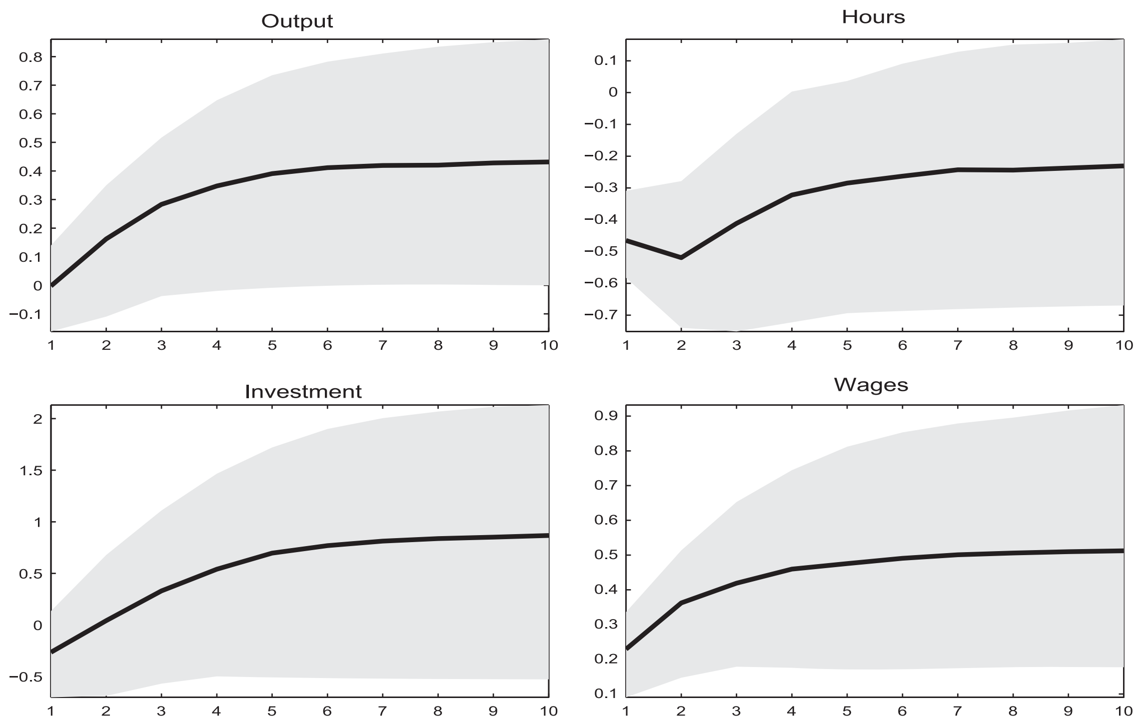

Fig. 1. SVAR IRFs following a technology shock.