Journal of Economic Dynamics & Control 36 (2012) 47–62

Contents lists available at SciVerse ScienceDirect

Journal of Economic Dynamics & Control

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

# Endogenous business cycle propagation and the persistence problem: The role of labor-market frictions

Steve Ambler, Alain Guay, Louis Phaneuf *

*Département des sciences économiques and CIRPÉE, Université du Québec à Montréal, CP 8888, Succ. Centre-ville, Montréal QC Canada H3C 3P8*

ARTICLE INFO

*Article history:*
Received 6 September 2010
Received in revised form
23 June 2011
Accepted 14 July 2011
Available online 24 August 2011

*JEL classification:*
E32
E62

*Keywords:*
Business cycle propagation
Persistence problem
Sticky wages
Costly labor adjustment

ABSTRACT

Contrasting sharply with a recent trend in DSGE modeling, we propose a business cycle model where frictions and shocks are chosen with parsimony. The model emphasizes a few labor-market frictions and shocks to monetary policy and technology. The model, estimated from U.S. quarterly postwar data, accounts well for important differences in the serial correlation of the growth rates of aggregate quantities, the size of aggregate fluctuations and key comovements, including the correlation between hours and labor productivity. Despite its simplicity, the model offers an answer to the persistence problem (Chari et al., 2000) that does not rely on multiple frictions and adjustment lags or *ad hoc* backward-looking components. We conclude modern DSGE models need not embed large batteries of frictions and shocks to account for the salient features of postwar business cycles.



## 1. Introduction

A recent trend in dynamic stochastic general equilibrium (DSGE) modeling has seen frictions and shocks proliferate to improve the fit of macro models.[1] This modeling strategy has been prone to criticism. Among the new frictions, some like the rule-of-thumb behavior of price-setters and the backward indexing of wages and prices lack a convincing microfoundation (Woodford, 2007; Cogley and Sbordone, 2008), whereas of the many shocks now driving these models, some are dubiously structural and do not have a clear economic interpretation (Chari et al., 2009).[2] But do DSGE models really need to rely on heavy batteries of frictions and shocks to account for the salient features of the postwar U.S. business cycle? The answer we provide in this paper is no.

Our approach differs sharply from the recent trend. We show that a parsimonious DSGE model featuring just a few labor market frictions goes a long way matching several stylized facts that have characterized the postwar U.S. business cycle. While doing so, our model also offers a solution to the so-called *output persistence problem* unveiled by Chari et al. (2000) (CKM).

* Corresponding author.
*E-mail addresses:* steve.ambler@gmail.com (S. Ambler), guay.alain@uqam.ca (A. Guay), phaneuf.louis@uqam.ca (L. Phaneuf).

[1] A notable example of a DSGE model with numerous frictions is Christiano et al. (2005) where aggregate fluctuations are driven by a shock to monetary policy. Smets and Wouters (2007) and Justiniano and Primiceri (2008) use more or less the same set of frictions, but include many types of shocks, Justiniano and Primiceri emphasizing the conditional volatility of shocks.

[2] In some DSGE models, adjustment lags in the response of macroeconomic variables to a monetary policy shock are added to frictions to match the short-run restrictions used in structural vector autoregressions (SVAR) to identify a monetary policy shock (see Rotemberg and Woodford, 1997; Christiano et al., 2005; Boivin and Giannoni, 2006; Altig et al., 2011). When tested, however, these restrictions turn out to be invalid (Normandin and Phaneuf, 2004).

0165-1889/$ - see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.jedc.2011.07.003

Several DSGE models developed in reaction to CKM's findings have produced more persistent, but monotonically declining responses of output following a monetary policy shock (see Section 5.3). In contrast, our framework delivers persistent *and* hump-shaped responses of aggregate quantities to a monetary policy shock. Our model's responses are consistent with evidence both from the empirical literature on monetary policy (see among others Galí, 1992; Bernanke and Mihov, 1998; Christiano et al., 1999, 2005; Normandin and Phaneuf, 2004; Romer and Romer, 2004) and from structural vector autoregressions in Cogley and Nason (1995) and Galí (1999) about the effects of nontechnology shocks on output. Furthermore, in contrast to the handful of models which have produced hump-shaped responses of output to a policy shock (e.g., Walsh, 2005; Christiano et al., 2005; Smets and Wouters, 2007), our model is able to do so with a small number of frictions and without the use of *ad hoc* backward-looking elements. Our findings are thus fully consistent with the optimizing behavior of households and firms.

Relative to a perfectly competitive real business cycle (RBC) model, the only frictions used in our framework are a cash-credit structure to motivate money, Calvo-style staggered nominal wage contracts and labor adjustment costs.[3] The flexible price assumption is motivated by recent U.S. micro level evidence by Bils and Klenow (2004), who show that for several categories of consumer goods and services, prices adjust much more frequently than most observers previously thought, with a mean of 3.3 months and a median waiting time between price adjustments of 4.3 months. The sticky-wage assumption follows from micro level evidence pointing to substantial rigidity in U.S. nominal wages. Using data from the Survey of Income and Program Participation (SIPP), Barattieri et al. (2010) show that, once corrected for measurement error, nominal wages are very slow to adjust, with adjustment probabilities of 18% per quarter or lower. They also find that the hazard function for wage changes has a clear peak at 12 months, consistent with the general impression that wages and salaries are reviewed annually. Therefore, according to micro data on wages and prices, wage stickiness is substantially more pervasive than price stickiness. The second type of friction embedded in our model is costly labor adjustment and is supported by plant-level evidence in Cooper and Willis (2004, 2009), among others.[4]

While these structural ingredients are not new, the evidence they help produce is. Indeed, we show that once combined into a single DSGE framework, these frictions deliver a surprisingly high number of findings consistent with the salient features of the postwar business cycle. We estimate our model with U.S. postwar quarterly data using the generalized method of moments (GMM) with overidentifying restrictions. Given our emphasis on labor market frictions, we require in the estimation of the model that it matches a set of moments composed of the following labor-market related observations (see section 4.3, Table 2), among others:

- The short-run autocorrelations of differenced hours worked have been significantly higher than the autocorrelations of the growth rates of aggregate quantities. Specifically, while the first and second-order autocorrelations of differenced hours are 0.58 and 0.36, they are 0.38 and 0.29 for output growth, followed by 0.31 and 0.27 for investment growth, and by 0.23 and 0.19 for consumption growth. Beyond the second order, the autocorrelations decay rapidly.
- The autocorrelations of nominal wage inflation have been high and positive at short and medium horizons.
- Wage inflation has been somewhat less volatile than output growth with a ratio of 0.83.
- The volatility of first differenced hours has been slightly smaller than the volatility of output growth with a ratio of 0.92.
- Differenced hours have comoved positively with output growth.
- The correlation between differenced hours and differenced labor productivity has been weakly negative.

The first observation points to significant differences in the postwar dynamics of employment, output, investment and consumption growth. It will guide our assessment of the realism and strength of internal propagation induced by our frictions. Kydland and Prescott (1982) and King et al. (1988a) have shown that the standard neoclassical growth model can easily match the autocorrelations of most aggregate quantities when these variables are detrended with the Hodrick–Prescott filter and technology shocks are generated through an AR(1) process. But in the event that the level of technology is non-stationary, the standard RBC model dramatically fails to account for the positive short-run serial correlation in real GDP growth, investment growth and hours growth, with the autocorrelations of differenced investment and differenced hours predicted by the standard RBC model being negative (King et al., 1988b, Table 1). Focusing on the short-run autocorrelations of output growth and an important trend-reverting component in real GDP in response to a nontechnology shock, Cogley and Nason (1995) show that a wide range of RBC models fail to account for output dynamics. This leads them to the conclusion that RBC models embody weak endogenous propagation mechanisms.

A notable exception is a paper by Wen (1998), who looks at the dynamics of output, consumption, investment and employment using the empirical procedure proposed by Watson (1993). Wen argues that a RBC model augmented to include habit formation on leisure choice and an employment externality accounts well for the dynamics of aggregate

[3] The labor adjustment costs we have in mind include those for advertising a job, screening, testing, and training new workers when the workforce expands, and the costs of legal requirements and regulations when the workforce shrinks. Varying labor input may also be costly because of changes in the input mix or because a restructuring of the workforce may be called upon within working plants, giving rise to planning and organizational costs. Also, along an increase in employment, firms may have to buy new equipment, giving rise to costs of getting access to financial capital.

[4] The aggregate consequences of costly labor adjustment have been analyzed by Sargent (1979), Kydland and Prescott (1991), Mendoza (1991), Fairise and Langot (1994), Cogley and Nason (1995) and Janko (2008), among others.