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Real business cycles, sticky wages or sticky prices? The impact of technology shocks on US manufacturing

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Abstract

In this paper, we examine empirically the predictions of a range of theoretical models which give a prominent role to technology shocks in explaining business cycles. To this end, we estimate (4-digit SIC) industry-level VAR models for US manufacturing using real output, the real wage and utilization corrected measures of technology and labor input. Our results support both sticky-wage DGE and RBC models over sticky-price DGE models. Moreover, they cast some doubt on the importance of technology shocks as propulsive mechanism for business cycles at the industry level.

JEL classification: E32; O47

Keywords: Real business cycles; Sticky-price DGE models; Technology shocks; Total factor productivity

1. Introduction

The purpose of this paper is to examine empirically the predictions of a range of theoretical models, which give a prominent role to technology shocks in explaining business cycles. The theoretical representations include RBC-type (see, e.g. Kydland and Prescott, 1982; Long and Plosser, 1983; King and Plosser, 1984) and New Keynesian DGE-type models which allow for wage and price rigidity (see, e.g. Goodfriend and King, 1997; Rotemberg and Woodford, 1997; Galí, 1999). Notable empirical contributions which examine the impact of technology shocks include Galí (1999),

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Basu et al. (1998) and Shea (1998).[1] This paper makes a contribution to the empirical literature on business cycles by estimating (4-digit SIC) industry level VAR models using real output, the real wage and utilization corrected measures of technology and labor input.

Our main findings are the following. First, in contrast to Galí (1999) and Basu et al. (1998) whose results support the sticky-price DGE model, we find that our results are much more supportive of RBC-type models, or DGE models with sticky wages. Second our utilization and effort adjustments actually strengthen the empirical support for the RBC and sticky-wage models, despite the fact that the utilization-adjusted TFP innovations are markedly less procyclical. Third, there are markedly distinct responses to technology shocks in different manufacturing sectors.

The rest of the paper is structured as follows. To help identify the expected impact of technology shocks predicted by alternative theories, Section 2 describes a stylized general equilibrium model with varying degrees of wage and price stickiness. Section 3 discusses the factor-utilization adjustments made to our TFP and labor input series. Section 4 outlines our econometric method and presents our VAR results. Finally, Section 5 concludes.

2. A stylized model of technology shocks

2.1. Flexible prices

We begin by setting out a standard Sidrauski–Brock money in the utility function model.[2] Aggregate output in the economy is given by a constant-return Cobb–Douglas production function in capital and labor inputs:

$$Y_t = A\exp(z_t)K_{t-1}^{\alpha}L_t^{1-\alpha}, \quad z_t = \rho z_{t-1} + \varepsilon_t, \ 0 < \rho < 1, \tag{1}$$

where A is total factor productivity and z_t is a stochastic shock to TFP, which is assumed to follow an AR(1) process.[3] The representative agent maximizes the present

[1] Shea's approach is not strictly comparable to ours since his empirical analysis is not aimed at the debate between different business cycle theories. However, the positive response of factor inputs to technology shocks is supportive of RBC-type models.

[2] These models have been extensively analyzed in the macroeconomics literature (see inter alia King et al., 1988; Campbell, 1994; Uhlig, 1995; Walsh, 1998). They provide a useful way of nesting the consumption-smoothing effects of pure RBC theories within a monetary DGE model. For an early attempt to incorporate a monetary sector into RBC models, see King and Plosser (1984).

[3] Note that here we interpret the variables K and L broadly, as being measures of effective capital and labor input, respectively. This is since our empirical work takes seriously the notion that the Solow residual is not an accurate measure of technology due to fluctuations in unobservable labor and capital utilization. For convenience, we do not explicitly model the intensive margins along which labor and capital are varied in the theory. Not doing so could have non-trivial quantitative implications for the theoretical responses of the total effective labor input to a technology shock. However, we believe that the qualitative implications would be relatively robust.