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An estimated New-Keynesian model with unemployment as excess supply of labor [☆]

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ABSTRACT

Wage stickiness is incorporated to a New-Keynesian model with variable capital to drive endogenous unemployment fluctuations defined as the log difference between aggregate labor supply and aggregate labor demand. We estimated such model using Bayesian econometric techniques and quarterly US data. The second-moment statistics of the unemployment rate in the model provide a reasonable fit to those observed in US data. Our results also show that mainly wage-push shocks together with demand shifts and monetary policy shocks are the major determinants of unemployment fluctuations. Compared to an estimated New-Keynesian model without unemployment (Smets and Wouters 2007): wage stickiness is higher, labor supply elasticity is lower, the slope of the New-Keynesian Phillips curve is flatter, and the importance of technology innovations on output variability increases.

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1. Introduction

The New-Keynesian macro model has been extended in recent years to incorporate the endogenous determination of unemployment fluctuations in the labor market.¹ Taking the search frictions approach, Walsh (2005) and Trigari (2009) introduced unemployment as the gap between job creation and destruction that results in a labor market with real rigidities à la Mortensen and Pissarides (1994). Alternatively, Casares (2007, 2010), Galí (2011), Casares et al., 2012, and Galí et al. (2012) assume nominal rigidities on wage setting to produce mismatches between labor supply and labor demand that deliver unemployment fluctuations. In another recent paper, Michailat (2012) explores the interactions between search frictions, job rationing and wage rigidity and finds asymmetric patterns in business cycle fluctuations of unemployment.

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¹ Referential New-Keynesian models without unemployment are Christiano et al. (2005), Smets and Wouters (2003, 2007) and all the model variants collected in Woodford (2003). They belong to the family of dynamic stochastic general equilibrium (DSGE) models.

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This paper presents novel theoretical and empirical contributions. On the theoretical side, our model simultaneously accommodates unemployment fluctuations due to sticky wages, with variable capital, that brings labor-capital reallocations at the firm level. In contrast to the vast majority of the related literature, our model generates unemployment fluctuations without resorting to search frictions in the labor market. Hence, the model combines most of the nominal and real rigidities of full-fledged New-Keynesian models – Calvo-type price stickiness, consumption habits, investment adjustment costs, variable capital utilization, etc. –, with a labor market which generalizes that of Casares (2010) to include natural-rate unemployment and a rental market for capital. In that regard, we replace the standard way of introducing wage rigidities on labor contracts set by households (which follows the seminal paper by Erceg et al. (2000)) for a labor market structure in which excess-labor-supply unemployment stems from sticky wages. As a result, wage dynamics depend inversely upon fluctuations of the rate of unemployment. We also discuss the implications on inflation dynamics: the New-Keynesian Phillips curve turns flatter because of the negative effect of relative prices over relative nominal wages at the firm level.

On the empirical front, this paper includes the observed rate of unemployment in the estimation and provides a comparison between our proposed model and the Smets and Wouters (2007) New-Keynesian model, which is a well-known reference model in the DSGE literature. We follow a Bayesian econometric strategy to estimate the models using US quarterly data during the Great Moderation period (1984:1–2007:4).² In the comparison across models, we find similar estimates of many structural model parameters, though three remarkable differences. First, wage stickiness is significantly higher in the model with unemployment while price stickiness is nearly the same across models. As a consequence, the introduction of unemployment as excess supply of labor raises the average length of labor contracts (3.23 quarters with unemployment and 2.13 quarters without unemployment). Second, the labor supply curve is significantly more inelastic in the model with unemployment. Finally, the elasticity of capital adjustment costs is lower in the model with unemployment.

Our estimated New-Keynesian model reproduces the US business cycle features at least as well as DSGE models without unemployment and, crucially, provides a good characterization of US unemployment volatility and persistence. Furthermore, the impulse-response functions provide reasonable reactions of unemployment to technology innovations, demand shocks, monetary shocks and cost-push shocks. In the variance-decomposition analysis, model results indicate that the driving forces of unemployment fluctuations are mainly wage inflation shocks together with risk premium (demand-side) shocks, and monetary shocks playing a secondary role. Importantly, the model provides a good matching of the lead-lag comovement between the unemployment rate and output growth.

This paper is related to Galí et al. (2012), though developed independently. There are five important differences across models. First, and most importantly, in Galí et al. (2012) –following Galí (2011)– unemployment is perfectly correlated with the average wage mark-up and therefore moves in tandem with workers' market power. In contrast to assuming market power of households, this paper includes an intertemporal equation to set wages that match labor supply and labor demand. In turn, unemployment is introduced at a decentralized level that interacts with the price setting behavior. Second, marginal costs are firm specific only in our model due to firm-specific nominal wage setting. Third, both models feature a similar number of shocks but Galí et al. (2012) resort to wage mark-up shocks, whereas we introduce push shocks on indexed wages. Fourth, our model provides a reasonable characterization of the business cycle during the Great Moderation without having to assume away short-run wealth effects on labor. Fifth, wage-push shocks are here less important in explaining fluctuations across all aggregate variables than the wage markup shocks in Galí et al. (2012).

There is also a straightforward comparison of this paper to Casares et al. (2012), which ignores endogenous capital accumulation and consumption habits, and uses linear detrending to obtain the observable series for estimation. In turn, nominal rigidities on both price and wage setting are estimated to be significantly lower here, reducing the role of demand-side shocks for both output and unemployment variability.

The remainder of the paper proceeds as follows. Section 2 describes the model with sticky wages, unemployment as excess supply of labor and variable capital. Section 3 introduces the estimation procedure and discusses the estimation results. Section 4 presents the empirical fit of the two models along three important dimensions (second-moment statistics, variance decomposition and impulse-response functions) and compares some of the model-implied dynamic cross-correlations with those in the data. This section also provides a robustness analysis along with two important dimensions. First, the sample period is extended to include the most recent recession. Second, the two models are estimated without any labor measure as observable variable. Finally, Section 5 concludes with a summary of the main results.

2. A New-Keynesian model with unemployment

This section introduces unemployment in a New-Keynesian model with sticky wages and endogenous capital accumulation. Thus, we borrow most of the elements of the New-Keynesian model described in Smets and Wouters (2007) except for the labor market and wage setting behavior. On that dimension, we extend Casares (2010) and Casares et al. (2012), with the addition of variable capital accumulation and consumption habits. In contrast to Smets and Wouters (2007), employment

² Following Galí et al. (2012), we focus our analysis on the Great Moderation period in order to avoid issues associated with parameter instability and potential parameter estimate distortion due to the presence of non-linearities showing up during the Great Recession induced by (i) the zero lower bound on the Fed funds rate, and (ii) the binding downward nominal wage rigidities discussed in Galí et al. (2012). Moreover, the focus on the Great Moderation will allow us to compare our estimation results with those reported in Galí et al. (2012). Below, in a robustness section, we will also estimate the two models extending the sample period including data from the most recent recession period.

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