Introducing financial frictions and unemployment into a small open economy model

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ABSTRACT

Which are the main frictions and the driving forces of business cycle dynamics in an open economy? To answer this question we extend the standard new Keynesian model in three dimensions: we incorporate financing frictions for capital, employment frictions for labor and extend the model into a small open economy setting. We estimate the model on Swedish data. Our main results are that (i) a financial shock is pivotal for explaining fluctuations in investment and GDP. (ii) The marginal efficiency of investment shock has negligible importance. (iii) The labor supply shock is unimportant in explaining GDP and no high frequency wage markup shock is needed.

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1. Introduction

The recent financial crisis has made it clear that business cycle modeling no longer can abstract from financial factors – they appear, both *prima facie* and using more advanced methods, to be the main source and/or propagation mechanism of this downturn. The crisis has also led to a shift in the type of questions that are being asked in macroeconomics, and to be able to answer these questions requires an increased emphasis on financial aspects. It is also becoming increasingly clear that the standard business cycle approach of modeling labor markets without explicit unemployment has its limitations. Aside from the obvious drawback of not having implications for unemployment, the standard approach also relies on wage markup shocks to explain a large fraction of the variation in main macro variables such as GDP and inflation. It also tends to induce too little persistence in hours worked as these are modeled as costless to adjust. We resolve all these limitations by integrating recent progress in labor market modeling into a comprehensive monetary business cycle model. The paper is furthermore motivated by some questions that most existing business cycle models are mute on, but that we would like to answer: How important are financial and labor market frictions for the business cycle dynamics of a small open economy? In particular, what are the quantitative effects of financial shocks on investment and output? How is unemployment affected by a sudden and temporary decrease in export demand or an increase in corporate interest rate

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spreads? Taking into account financial market data, is investment primarily driven by shocks to investment demand or investment supply? Finally, is the cost of increasing employment related to the tightness of the labor market in the way implied by search-matching models of the labor market? In order to address these questions we extend what is becoming the standard empirical new Keynesian model, see e.g. Christiano et al. (2005, henceforth CEE), in three dimensions and estimate it on Swedish data.

First, we incorporate financial frictions in the accumulation and management of capital similar to Bernanke et al. (1999, henceforth BGG) and Christiano et al. (2003, 2008). The financial frictions that we introduce reflect that borrowers and lenders are different agents, and that they have different information. Thus we introduce 'entrepreneurs'. These agents own and manage the capital stock, financed both by internal and borrowed funds. Only the entrepreneurs costlessly observe their own idiosyncratic productivity. The presence of asymmetric information in financing the capital stock leads to a role for the balance sheets of entrepreneurs.

The debt contracts extended by banks to entrepreneurs are financed by issuing liabilities to households. In addition to their accumulated savings, households can also borrow foreign funds to deposit into banks. In the model the interest rate that households receive is nominally non-state-contingent. These nominal contracts give rise to wealth effects of unexpected changes in the price level of the sort emphasized by Fisher (1933). For example, when a shock occurs, which drives the price level down, households receive a wealth transfer. This transfer is taken from entrepreneurs whose net worth thereby is reduced. With the tightening of their balance sheets, the ability of entrepreneurs to invest is reduced, and this generates an economic slowdown. A similar mechanism is set in motion whenever the price of capital changes as this affects the asset side of entrepreneurs' balance sheets.

Second, we include the labor market search and matching framework of Mortensen and Pissarides (1994) and, more recently, Hall (2005a–c) and Shimer (2005,b). We integrate the framework into our environment – which includes physical capital and monetary factors – following the version of Gertler and Trigari (2009, henceforth GT) and Gertler et al. (2008, henceforth GST) implemented in Christiano et al. (2007, henceforth CIMR). A key feature of this model is that there are wage-setting frictions, but they do not have a direct impact on ongoing worker employer relations as long as these are mutually beneficial. However, wage-setting frictions have an impact on the effort of an employer in recruiting new employees. Accordingly, the setup is not vulnerable to the Barro (1977) critique that wages cannot be allocational in ongoing employer–employee relationships (see Hall, 2005c).

There are three main differences between the our labor market modeling and GST. We motivate our choices regarding these three differences in Section 4. GST assume wage-setting frictions of the Calvo type, while we instead work with Taylor-type frictions. GST shut down the intensive margin of labor supply in their empirical specification, while we allow for variation in this margin. An important step forward is that we allow for endogenous separation of employees from their jobs. Endogenous separations have been modeled earlier, e.g. by den Haan et al. (2000), but not in a comprehensive monetary DSGE model.

In the standard new Keynesian model, the homogeneous labor services are supplied to the competitive labor market by labor contractors who combine the labor services of households who monopolistically supply specialized labor services (see Erceg et al., 2000, henceforth EHL). Our labor market model dispenses with the specialized labor services abstraction and the accompanying monopoly power, which commonly is modeled as time-varying ('wage markup' shocks). The reason for this modeling choice is that we do not think this type of union monopoly power, nor its high frequency time-variation, accurately describes the labor market. Labor services are instead supplied to the homogeneous labor market by 'employment agencies' – a modeling construct best viewed as a goods producing firm's human resource division. Each employment agency retains a large number of workers. At the beginning of the period a fraction of workers are randomly selected to separate from the agency and go into unemployment. Also, a number of new workers arrive from unemployment in proportion to the number of vacancies posted by the agency in the previous period. After separation and new arrivals occur, the nominal wage rate is set. Then idiosyncratic shocks to workers' productivities are realized and endogenous separation decisions are made.

The nominal wage paid to an individual worker is determined by Nash bargaining, which occurs once every N periods. Each employment agency is permanently allocated to one of N different cohorts. Cohorts are differentiated according to the period in which they renegotiate their wage. Since there is an equal number of agencies in each cohort, $1/N$ of the agencies bargain in each period. The intensity of labor effort is determined efficiently by equating the worker's marginal cost to the agency's marginal benefit. The efficient provision of labor on the intensive margin implies an important difference to EHL where instead a direct link between the sticky wage and hours worked is assumed.

Third, we extend the model into a small open economy setting by incorporating the small open economy structure of Adolfson et al. (2005, 2007, 2008) (henceforth ALLV). We model the foreign economy as a vector autoregression (VAR) in foreign inflation, interest rate, output and two world-wide unit-root technology shocks, neutral and investment-specific. As ALLV we allow for both an exogenous shock and an endogenous risk-adjustment term that induce deviations from uncovered interest parity (UIP), but our motivation is different, and we therefore choose a different form of endogenous risk-adjustment. The international interaction consists of trade of goods as well as in riskless bonds. The three final goods – consumption, investment and exports – are produced by combining the domestic homogenous good with specific imported inputs for each type of final good. We allow for Calvo price rigidity both of imports and exports and in that way allow for limited pass-through. Finally, it is worth noting that bank lending, and in particular monitoring of defaulting entrepreneurs, is a purely domestic activity.

We estimate the full model using Bayesian techniques on Swedish data 1995q1–2010q3, i.e. including the recent financial crisis. In our estimation we select our model priors endogenously, using a strategy similar to the one suggested by Del Negro and Schorfheide (2008). The estimation allows us to give quantitative answers to the questions posed above.