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Assessing the fit of small open economy DSGEs

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ABSTRACT

We describe a simple extension of the Monacelli (2005) small open economy model that incorporates a non-tradable good, habit persistence and price indexation. The empirical fit of eight different specifications of this model is then tested in a Bayesian framework using data for three small open economies; Australia, Canada, and New Zealand. The results show that the model with a non-tradable good fits the data better than the one-good model across all specifications considered. In contrast to Rabanal and Rubio-Ramarez (2005), we find that adding price indexation to either the one- or two-good model deteriorates overall empirical fit.

1. Introduction

Much recent work in macroeconomics has been on the development of dynamic stochastic general equilibrium (DSGE) models for the analysis of monetary policy. Indeed, there is mounting evidence that these models are capable of matching business cycle dynamics as well as purely statistical models, such as VARs Smets and Smets (2004). Accordingly, central banks have begun to move towards models with strong microeconomic foundations, away from the older-generation models developed in the 1990s.[1] Central bank modellers are thus being confronted with a variety of questions relating to the design of DSGE models, such as how to model the real exchange rate and whether or not to include habit formation and price indexation.

This paper takes a step back from the more complicated DSGEs currently being developed by academics and central banks, and aims to find some normative results regarding the empirical fit of small open economy DSGEs. Specifically, we aim to assess whether adding a non-tradable good, habit formation, and price indexation to a small open economy DSGE improves its overall empirical fit.

Differences between the behavior of tradable and non-tradable prices have been shown to be important in determining real exchange rate dynamics (De Gregorio et al., 1994; Engel, 1999; Burnstein et al., 2005). There is also empirical evidence suggesting that modelling tradable and non-tradable prices separately can improve the forecasting performance of the Phillips curve (Matheson, 2006). Hence, the non-tradable sector is a key feature of some recent open economy DSGEs, such as those of Laxton and Pesenti (2003) and Devereux et al. (2006).

Habit formation and price indexation have also been found to be important in fitting DSGEs (Smets and Smets, 2004; Christiano et al., 2005), and these mechanisms have become standard features of the models being developed by many central banks (see, for example, Murchison and Rennison (2006)).

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[1] For example, the Bank of Canada has developed a new DSGE model to replace its old Quarterly Projection Model (QPM) Murchison and Rennison (2006). DSGEs are also currently being developed at the central banks of Chile, New Zealand, Norway and Sweden, to name a few.

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Since Gali and Gertler (1999) developed their popular New Keynesian DSGE for the analysis of monetary policy in a closed economy, the model has been extended to the small open economy by Gali and Monacelli (2005), and augmented further by allowing for deviations from the law of one price by Monacelli (2005). Acknowledging the importance of the non-tradable sector, Santacreu (2005) extended the Gali and Monacelli (2005) by adding a non-tradable good (as well as habit persistence and price indexation). Likewise, the Monacelli (2005) model has been augmented with habit persistence and price indexation by Justiniano and Preston (forthcoming) and Liu (2006). But the question remains: Which of these additional features are key to improving the overall empirical fit of the canonical small open economy DSGE?[2]

We outline a general model that allows for deviations from the law of one price, habit persistence, price indexation and a non-tradable good. This general model nests a variety of different specifications of the small open economy DSGE, such as Monacelli's one-good model and versions of the one- and two-good model that exclude habit persistence and/or price indexation. Altogether, we have eight different specifications of the model. The empirical fit of the model is then tested in a Bayesian framework using data for three inflation targeting small open economies; Australia, Canada, and New Zealand.[3]

The results show that the two-good model fits the data better than the one-good model across all specifications considered. In contrast to the Rabanal and Rubio-Ramarez (2005) results for the closed economy, we also find that the addition of price indexation to either the one- or two-good model deteriorates overall empirical fit. Indeed, our results suggest that, if one were to augment the one- or two-good model with endogenous persistence mechanisms, better fit can be achieved by using habit formation rather than price indexation.

The paper proceeds as follows. We first outline the general model specification in Section 2. Next, we discuss the Bayesian estimation methodology and the data. The results of the model comparison are discussed in Section 6, and we conclude in Section 7.

2. The general model

This section sketches out our general model specification. For a more detailed description of the tradable side of the model, the reader is referred to Gali and Monacelli (2005) and Monacelli (2005). More details on the inclusion of the non-tradable sector, habit formation, and price indexation can be found in Santacreu (2005).

2.1. Consumers

There is a representative household which maximizes the intertemporal utility function:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{\widetilde{C}_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\psi}}{1+\psi} \right), \tag{1}$$

subject to an intertemporal budget constraint. σ is the inverse of the intertemporal substitution of consumption, ψ is the inverse labour elasticity, and N_t is total labour effort. In equation (1):

$$\widetilde{C}_t = C_t - hC_{t-1}, \tag{2}$$

where h is the parameter of habit persistence, C_t is a consumption index consisting of differentiated goods. Labour is supplied to both traded and non-traded sector in the following way:

$$N_t = N_{H,t} + N_{N,t}, \tag{3}$$

where the subscript H refers to 'home-produced' tradables, and the subscript N refers to the non-tradable sector. Labour is completely mobile across sectors, which implies that wages in the traded and non-traded sectors are identical.

In aggregate, assuming complete asset markets, the household's budget constraint is

$$P_t C_t + E_t(F_{t+1} D_{t+1}) \leqslant D_t + W_t N_t + \Pi_t, \tag{4}$$

where P_t is the price index, E_t is the expectations operator, D_{t+1} is the nominal payoff in period $t+1$ of the portfolio held at the end of period t, F_{t+1} is the stochastic discount factor, W_t is the nominal wage, and Π_t is the profit of firms re-distributed to households.

The consumption bundle, C_t is a constant elasticity of substitution (CES) index composed of both tradable, $C_{T,t}$ and non-tradable goods, $C_{N,t}$:

$$C_t = \left((1-\lambda)^{1/v} C_{T,t}^{\frac{v-1}{v}} + \lambda^{1/v} C_{N,t}^{\frac{v-1}{v}} \right)^{\frac{v}{v-1}}, \tag{5}$$

where λ is the share of non-tradable goods in the economy and v is the intratemporal elasticity of substitution between tradable and non-tradable goods at Home ($v > 0$).

[2] The fit of the closed economy New Keynesian DSGE with price (and wage) indexation was tested in a Bayesian framework by Rabanal and Rubio-Ramarez (2005). However, to date, the fit of its open economy counterpart has not been fully assessed.

[3] These three economies were chosen because they have long histories as inflation targeters relative to most other small open economies.