Bayesian estimation of an open economy DSGE model with incomplete pass-through

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Abstract

In this paper, we develop a dynamic stochastic general equilibrium (DSGE) model for an open economy, and estimate it on Euro area data using Bayesian estimation techniques. The model incorporates several open economy features, as well as a number of nominal and real frictions that have proven to be important for the empirical fit of closed economy models. The paper offers: i) a theoretical development of the standard DSGE model into an open economy setting, ii) Bayesian estimation of the model, including assessments of the relative importance of various shocks and frictions for explaining the dynamic development of an open economy, and iii) an evaluation of the model's empirical properties using standard validation methods.
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1. Introduction

In this paper, we develop a dynamic stochastic general equilibrium (DSGE) model for an open economy and estimate it on Euro area data. We extend the closed economy DSGE model of Christiano et al. (2005) by incorporating open economy aspects. Our model combines elements of

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their closed economy setting with some of the features and findings in the New Open Economy Macroeconomics literature.[1]

Following Christiano et al. (2005), a number of nominal and real frictions such as sticky prices, sticky wages, variable capital utilization, capital adjustment costs and habit persistence are included in the theoretical model. We also allow for incomplete exchange rate pass-through in both the import and export sectors by including nominal price rigidities (i.e., local currency price stickiness), following, for example, Smets and Wouters (2002). The relevance of these frictions will be empirically determined in the estimation procedure. Apart from introducing the exchange rate channel, we also include a working capital channel (i.e., firms borrow money from a financial intermediary to finance part of their wage bill). Examining the role of the working capital channel is of particular interest, since Christiano et al. (2005) obtain a low estimated degree of price stickiness when allowing for working capital in matching the impulse responses after a monetary policy shock. In contrast, Smets and Wouters (2003, 2005) obtain a much higher degree of estimated price stickiness in a model without the working capital channel.

As in Altig et al. (2003), we include a stochastic unit-root technology shock in the model which induces a common stochastic trend in aggregate quantities. This allows us to use data in the estimation that has not been pre-processed (e.g. detrended). Compared to Smets and Wouters (2003, 2005), we also allow for a larger set of structural shocks, mainly due to the open economy aspects of our model. We perform relative model comparisons using Bayesian posterior densities to assess the importance of the various frictions and shocks for explaining business cycle fluctuations in the open economy.

We estimate the open economy model on Euro area data using Bayesian estimation techniques.[2] Smets and Wouters (2003, 2005) have shown that large-scale closed economy DSGE models can be successfully estimated using Bayesian methods. To simplify the analysis, we adopt the assumption that foreign inflation, output and interest rate are exogenously given. There is, however, substantial evidence in favor of this assumption. First, by estimating a VAR model with ten Euro area variables (inflation, output, interest rate, exchange rate, exports, imports, real wage, consumption, investment and employment) and three foreign variables ("rest of the world" inflation, output and interest rate), we find that the Euro area variables only account for a small fraction of the variation in the foreign variables (around 10% (20%) at the one- (five-) year horizon).[3] These findings are also supported by de Walque et al. (2005) who find small spillover effects in a joint structural analysis of business cycles in the Euro area, the US and the rest of the world. Second, to check the sensitivity of

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[1] Important contributions to the theoretical literature on monetary policy in open economies are, among others, Corsetti and Pesenti (2001), Galí and Monacelli (2005) and Kollmann (2001). Earlier work on estimating more simple small open economy models includes Ambler et al. (2004), Justiniano and Preston (2004), and Lubik and Schorfheide (2005). de Walque et al. (2005) and Rabanal and Tuesta (2006) have recently estimated multi-country DSGE models.

[2] Lindé (2003) provides support for modelling the Euro area as an open economy by showing that "the rest of GDP" (i.e., output minus consumption and investment) moves significantly after a shock to monetary policy using a VAR on Euro area data. Since government expenditures are not cyclical, this suggests that fluctuations in net exports are important.

[3] The identifying assumption in the analysis is that Euro area shocks have no contemporaneous effects on the foreign variables.