Economic Modelling 36 (2014) 517–537

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

The financial accelerator and the real economy: A small macroeconometric model for Norway with financial frictions☆,☆☆

Roger Hammersland [a,b,*,1], Cathrine Bolstad Træe [b]

[a] Statistics Norway, Norway
[b] Norges Bank, Norway

ARTICLE INFO

Article history:
Accepted 5 April 2013

JEL classification:
E1
E32
E44

Keywords:
The financial accelerator
Structural vector error correction modelling
Impulse response analysis
Forecasting

ABSTRACT

This paper studies the salient features of a core macro econometric model that allows for self-reinforcing co-movements between credit, asset prices and real economic activity. In contrast to the economic literature that cultivates highly stylized model representations aimed at illustrating the workings and the implications of such a feature, the model of this paper integrates two mutually reinforcing financial accelerator mechanisms within the framework of a fully-fledged core macroeconomic model. The impulse responses of such a model is in line with the ones typical of SVAR/DSGE models, though the amplitude of shocks is in most cases stronger than the ones pertaining to these kinds of models. This is due to the workings of the financial accelerators that contribute to magnify the effects of shocks to the economy. A forecast comparison undertaken between our model and an alternative macro econometric model without a financial block, suggests that financial feedback mechanisms may be forecast improving.

1. Introduction

Mainstream macro models have until recently been relatively silent about the dependencies that may exist between financial markets and the real side of the economy. The current financial crisis – which came as a surprise to a majority of academics and policymakers – has however brought these issues to the forefront of economic debate and many in the economics profession are today busy seeking to improve our understanding of these interactions.

That said, there have been efforts in the decades before the crisis to develop analytical tools in the form of macroeconometric models to uncover the links between the financial sector and the real economy. In the 1990s several central banks started to publish reports on financial stability and some central banks even adopted macroeconometric models to assist their analysis. The macroeconometric model of Norges Bank, RIMINI,[2] represented an early attempt in this respect. In 1995, a version of this model – furnished with inter alia endogenous house prices, household credit and wealth effects in consumption (See Eitrheim, 1993) – was used to analyse the development in some simple indicators of financial stability (see Eitrheim and Gulbrandsen, 2000). This revealed a potential for improving the analyses of financial stability, and at this point RIMINI was chosen for model based analyses in the financial stability reports.[3] In the years that followed, a continuum of different and increasingly more elaborate versions of the model served as an active tool in the analyses of the monetary policy wing as well as the financial stability wing of the central bank.

However, when RIMINI later was phased out in favour of a dynamic stochastic general equilibrium (DSGE) model,[4] an urgent need was felt

☆ We are indebted to many colleagues and seminar participants. In particular we would like to thank David F. Hendry, Myron Kwast and Steinar Holden for the valuable comments on former drafts of the paper. We would also like to thank the participants at Eurostat's 6th Colloquium on Modern tools for Business Cycle Analysis and participants at internal staff seminars at Statistics Norway and Norges Bank for many insightful comments and suggestions. Special thanks goes to Haakon Solheim and Eilev Jansen for commenting on and proofreading the draft versions of the paper, and to Farooq Akram for his comments and contribution to the forecast evaluation in Section 4. We would also like to address a word of thanks to the Institute for New Economic Thinking at the Oxford Martin School, University of Oxford, and an anonymous referee, the first for providing us with support for this research project and the second for valuable comments and suggestions that certainly has contributed to improve on this paper. The authors alone are responsible for the views expressed in the paper and for any errors that may remain.

☆☆ The analyses of this paper have been conducted by using PcGive 10.2 (Doornik and Hendry, 2001) and Eviews 7.2 (Lilien et al., 2013).

* Corresponding author.
E-mail addresses: rhs@ssb.no, roger.hammersland@norges-bank.no (R. Hammersland), Cathrine.Bolstad.Trae@dnb.no (C.B. Træe).

1 This paper was partly written when Roger Hammersland was a visiting scholar at the Institute for New Economic Thinking at the Oxford Martin School.

2 For a concise account of RIMINI see e.g. Chapter 1 in Bårdsen et al. (2005).

3 In addition to having been through an comprehensive internal evaluation procedure within the central bank, the first financial stability reports were all discussed in joint meetings with the Norwegian Financial Supervisory Authority and the Ministry of Finance. This illustrates the relatively high degree of attention given to these analyses by the Norwegian authorities.

4 A forerunner of today's Norwegian Economy Model (NEMO).

0264-9993/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.econmod.2013.04.051

for a new macroeconomic framework which focused on financial frictions and was tailored to the needs of the bank's financial stability wing. The first completed version of such a model saw the light of day in 2007 and was based on a core model of the Norwegian real economy which had been around for some time (See Bårdsen et al., 2003, 2005). This model was put to use as a stress testing device in the fall financial report of that year (Financial Stability 2/2007). Since then, increasingly sophisticated versions of this model have provided an important part of the stress test apparatus of the bank's financial stability wing. The model has also been frequently used to illustrate the relative importance of different transmission channels (See e.g. Andersen et al., 2008).[5] This demonstrates that there has been a persistent demand for these types of model based analyses from within as well as outside the bank.[6]

This paper gives a brief description and studies the salient features of the model version as of fall 2010. It captures, however, the essential of the sequence of model versions alluded to above, older as well as more recent ones. It is therefore legitimate to assume that the properties of the most recent generation of the model probably would not deviate too much from those we report in this paper. A common feature of all the versions is that the core macroeconometric model is designed to incorporate self-reinforcing mechanisms caused by financial frictions, often referred to as financial accelerators. However, in contrast to highly stylized model representations frequently used for illustrating the working of such a mechanism, the model adopted by the Norwegian central bank integrates such a feature in a fully-fledged macroeconomic structural model framework.

In the model we entertain in this paper,[7] the role of the financial block is primarily to take account of the co-movements and pro-cyclicality of credit, asset prices and real economic activity that typically characterize a financial accelerator. The model differs from optimizing representative agent models in several respects, the main reason for this being a less stringent theoretical framework, and the fact that data are given a more central role in the shaping of the long- and short-run structure of the model.[8] Notwithstanding this, the impulse response pattern overall of such a model turns out to be very much in line with the ones one would have expected using a SVAR/DSGE modelling framework, though the amplitude of shocks is in most cases stronger than the ones pertaining to these kinds of models. This is due to the working of the financial accelerators that contribute to magnify the effects of shocks to the economy. Furthermore, a forecast comparison undertaken between our model and an alternative macroeconometric model without a financial block, suggests that financial feedback mechanisms – in addition to enhancing the practical relevance of a model by incorporating a mechanism of high real-world authenticity – may improve the forecasting properties of theory informed macroeconometric models in general.

In the following, we start out with giving a brief explanation of the financial accelerator hypothesis in Section 2, referring in this context to an example of particular relevance for the successful outcome of an empirical modelling exercise based on Norwegian data. In Section 3 we present the full core macroeconometric model and its methodological foundation. That is, Section 3.1 starts out with a brief account of the principles behind the construction of our data-based model while a more extended account of the methodology used in design and estimation is relegated to Section 3.2. In the latter case particular emphasis is laid on a discussion of a pragmatic and non-dogmatic approach to model design. In Section 3.3 we then give a more comprehensive account of the model's main features, including in this a full account of all the model's behavioural equations. Finally, Section 3.4 summarizes Section 3 by spelling out the model's entire transmission mechanism to a monetary policy shock, where we focus on the role of the financial accelerators. In Section 4, we proceed to a description of the model's long- and short-run responses to a wide range of different "structural" shocks.[9] In this section, particular importance has been attached to describing the dynamic transmission mechanism of shocks. Section 5 addresses the model's forecast properties, comparing the model's forecasts to forecasts of simple autoregressive and vector autoregressive models and an alternative econometric model designed and estimated on Norwegian data. Finally, Section 6 offers some concluding remarks.

2. The financial accelerator

There is much to indicate that financial frictions could have an important bearing on the transmission mechanism of shocks to the economy. As a case in point, the drop in activity that is assumed to follow as a consequence of a positive shock to the rule governing the policy rate could be reinforced through several channels in the presence of frictions. Such a contingency might be illustrated by spelling out the transmission mechanism of a monetary policy shock in the presence of self-reinforcing feedback loops between credit, asset prices and real economic activity.

First, given that a positive shock to the policy rule will lead to a jump in money market interest rates (long- and short-term), bank lending rates will to a varying degree follow suit. Through affecting the propensity to save on the part of households, lowering real investments and reducing net trade – last as a consequence of an appreciating real exchange rate – such an interest rate hike would lead to a drop in activity that could potentially be reinforced by a procyclical correction to asset prices. Such a kind of a self-reinforcing feedback mechanism is given support by standard theory. For instance in the case of Tobin's Q (Tobin, 1969) such a contingency is spelled out through lower asset prices leading to a drop in the ratio of the market value of capital to its replacement cost and thus reduced investment. The permanent income hypothesis (Friedman, 1957) can likewise be used to argue for a similar mechanism based on a negative wealth effect in consumption.

However, in the presence of financial frictions this is only part of the story. Lower asset prices, that affect net worth of firms and household wealth, would also have a negative effect on the value of collateral. In the presence of asymmetric information that raises the cost of external finance relative to the cost of internal finance, this would affect the borrowing capacity of wealth constrained entrepreneurs and households and thus reduce investments. Through the working of a credit-asset price spiral where lower asset prices spur lower credit and lower credit in turn leads to a reduction in investment – and thus further reductions in asset prices due to their procyclicality – this amounts to a mechanism that in the end will lead to a self-reinforced procyclical drop in domestic absorption and output, asset prices and credit. Such a mechanism is often referred to as a financial accelerator in the literature (See e.g. Bernanke et al., 1999; Kiyotaki and Moore, 1997). Fig. 1 presents a

[5] A recent use is the stress test in Financial Stability 2/2012.

[6] This is reflected also by the fact that the analyses have all been – and until quite recently were – presented for the bank's Executive Board, but also by the relative attention given to these analyses by the Norwegian media.

[7] The model is based on an augmented and revised version of the model documented in Bårdsen et al. (2005) and Bårdsen and Nymoen (2009a).

[8] See Section 3.2 and the discussion therein for a more precise account of such an approach.

[9] A structural shock is often taken to mean a shock with a clear structural interpretation, in the sense of referring to shocks to structural model representations derived from an explicit utility maximizing rational representative agent (RA) framework. However, in this case, a structural shock is given a far wider interpretation, and refers to shocks to theory-driven structural representations in general, be that structures based on more old fashioned type of macro informed models – so-called emergent models – or micro based macro models, including in this structural representations based on an explicit representative agent utility maximizing framework. A consequence of this is that the concept of "a structural shock" loses its un-ambiguity as several types of shocks can rightly be claimed to have a structural interpretation, though the way they are defined or interpreted as structural will differ across models. In spite of this, Section 4 reveals a great degree of conformity between our impulse responses and those following from a typical SVAR or DSGE framework.