Journal of Macroeconomics 46 (2015) 235–263

Contents lists available at ScienceDirect

Journal of Macroeconomics

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

Financial sector and output dynamics in the euro area: Non-linearities reconsidered

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ARTICLE INFO

Article history:
Received 7 January 2015
Accepted 14 September 2015
Available online 9 October 2015

JEL Classification:
E2
E44
G01

Keywords:
Vector STAR
Financial stress
Financial cycle
Real economy
Regime-switching
Euro area

ABSTRACT

We analyze the feedback mechanisms between economic downturns and financial stress for several euro area countries. Our study employs newly constructed financial condition indices that incorporate banking variables extensively. We apply a non-linear Logistic Vector Smooth Transition Autoregressive (LVSTAR) model for investigating instabilities in the link between the financial sector and economic activity. The LVSTAR model allows for non-linear dynamics and regime changes between low and high stress regimes. It can also replicate the regime-specific amplification effects shown by our theoretical model. The amplification effects, however, change over time. Specifically after the Lehman collapse, we observe the presence of strong non-linearities and amplification mechanisms for some euro area countries. Thus, these strong amplification effects appear to be related to rare but large events, and to a low-frequency financial cycle. Prior to the financial crisis outbreak we find corridor stability even if the financial sector shock takes place in a high stress regime. More important seems to be the shock propagation over time in the economy. Only with the occurrence of rare but large events we find strong endogenous feedback loops and a loss of stability as described by the high stress regime of our theoretical model. The economy leaves the corridor of stability and is prone to adverse feedback loops.

1. Introduction

The financial and economic crisis has drawn attention to the need for a better understanding of destabilizing effects that arise in the financial sector and spill over to the real economy. In turn, weakening economic conditions are likely to feed back to the financial sector, thus giving rise to an adverse feedback loop.

Recent studies incorporate financial market frictions into theoretical models and analyze the spillover mechanisms from the financial sector to the real economy. Non-standard amplification mechanisms such as the credit channel or financial stress to economic activity have recently started to become more important in theoretical modeling. Besides the financial accelerator mechanism of Bernanke et al. (1999), mostly applied to firms in the past, there is a more recent literature concentrating on the banking sector as a source for business cycle dynamics. Such theoretical studies have started with Stiglitz and Greenwald (2003) and continued with Adrian and Shin (2009), Geanakoplos and Farmer (2009), Adrian et al. (2010), Gorton (2010), Geanakoplos (2011), Mittnik and Semmler (2013), and Brunnermeier and Sannikov (2014). The latter studies examine the balance sheets of banks, showing that a downward spiral is triggered through overleveraging, financial interdependencies, and contagion effects.

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http://dx.doi.org/10.1016/j.jmacro.2015.09.002
0164-0704/

The new theoretical models are similar in that they highlight (i) the critical impact exerted by financial sector dynamics and (ii) amplification and destabilizing effects of the financial sector on economic activity.

Mittnik and Semmler (2013) as well as Brunnermeier and Sannikov (2014) emphasize that a theoretical analysis based on traditional log-linearization techniques is likely to be inadequate due to local instabilities and non-linear amplification mechanisms which do not arise near the steady state but can generate switches to different regimes. Their theoretical models and simulation results are in contrast to the DSGE model tradition where amplifying effects occur locally around a stable unique steady state. In our paper, a theoretical model that allows for regime-specific dynamics in low and high financial stress regimes is introduced which is solved by a recent numerical procedure called Nonlinear Model Predictive Control. In the low stress regime, the interest rate on borrowing is at a low level and remains constant. Here, the solution path of the debt to capital ratio converges to the steady state and the economy faces sustainable debt dynamics. In the high stress regime, however, the interest rate to be paid on debt is a non-linear function of the leverage ratio. We show that, if the leverage ratio moves beyond a certain threshold, debt becomes unsustainable. As a consequence, there is no convergence and a loss of stability. This will motivate our empirical work employing a regime-switching Logistic Vector Smooth Transition Autoregressive (LVSTAR) model.

As to empirical work, there is a growing number of econometric studies that also deal with the impact of financial conditions on economic activity. This recent research strand is based on multivariate, non-linear models since those are able to capture the kind of interdependent, regime-switching dynamics described by theoretical models (see for instance, Davig and Hakkio, 2010; Holló et al., 2012; Hubrich et al., 2013; Mittnik and Semmler, 2013; van Roye, 2013; Hubrich and Tetlow, 2013).

The results of these studies indicate that financial stress – which is a reflection of vulnerability of the financial sector – has a strong, but regime-specific impact on the real economy. In particular, all studies find extreme negative effects of an increase of financial stress on economic activity in a distressed period, whereas the effects in a low stress period are relatively small or even negligible. Besides the stronger effect, Hubrich and Tetlow (2013) point out that the negative impact on the economy is long-lasting in high stress periods. Additionally, the model outcomes of Mittnik and Semmler (2013) imply that the size and sign of shocks matter.

What has been lacking in the literature so far is work on non-linear linkages and asymmetric dynamics as they may unfold over time. For instance, effects of financial sector instability on economic activity may depend on the actual state of the financial sector. During some downswings this effect may be more severe than during others. These amplification effects to the real economy might not matter much for a considerable time period, but then a triggering event may generate a rare and adverse response such as the one experienced in the years 2008, 2009.

In our empirical work we analyze the feedback and amplification mechanisms between economic downturns and financial conditions in several euro area countries. Based on a new data set for extracting financial condition indices that extensively includes banking variables, we explore how the financial–real economy nexus behaves over time.

The hitherto theoretical and empirical findings suggest the need for an empirical approach that can accommodate varying dynamic patterns across alternative states of the economy. We propose a non-linear multivariate Logistic Vector STAR model framework, introduced by Teräsvirta and Yang (2004a, 2004b), which has not been used in this literature so far. In contrast to previous studies it is able to capture regime changes in a more flexible way.

Using a LVSTAR model, we confirm the relevance of non-linearities in the link between the financial sector and output. In most countries, a shock to the financial market leads to a long-lasting negative response in economic activity. A high financial stress regime amplifies negative effects on output. Thus, it is important to distinguish between periods of low and high financial stress when assessing the impacts of financial shocks on real economic activity, as the results of shocks are regime-dependent. Moreover, we show that the amplification effects change over time in the euro area countries. Negative output effects that we find in our study are not as pronounced as they are in some other studies. This holds true specifically for the time before the Lehman collapse. After the crash, however, we observe the presence of strong non-linearities and amplification mechanisms. This suggests that events leading to a major economic breakdown are rare but large events, and they are related to a low-frequency financial cycle.

Thus, our contribution is threefold: first, we use new financial condition indices which are comprehensive and put a stronger focus on the banking sector. Second, we apply a non-linear Vector STAR model which has not been used in this literature before. Third, we comprehensively investigate the (potentially changing) dynamics between the financial sector and the real economy over time for several euro area countries.

The remainder of the paper is organized as follows. Section 2 motivates our empirical analysis with a theoretical model which allows for regime-specific dynamics in a low and a high stress regime. Section 3 presents empirical results of the relation between the financial sector and the macroeconomy. Section 3.1 thereby describes the ZEW Financial Condition Indices. The non-linear Vector STAR model and its characteristics are presented in Section 3.2. Section 3.3 first compares results of linear and non-linear models. Then, it analyzes the financial market–output nexus over time. Finally, Section 4 concludes.

2. Theoretical model

In the following, we introduce a financial–real interaction model with an essential role of the financial sector which motivates our empirical work employing a regime-switching model.[1] The theoretical model introduced here resembles that of

[1] Semmler and Chen (2014) present a similar model.