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Testing the asymmetric effects of financial conditions in South Africa: A nonlinear vector autoregression approach

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ABSTRACT

The negative consequences of financial instability for the world economy during the recent financial crisis have highlighted the need for a better understanding of financial conditions. We use a financial conditions index (FCI) for South Africa previously constructed from 16 financial variables to test whether the South African economy responds in a nonlinear and asymmetric way to unexpected changes in financial conditions. To this end, we make use of a nonlinear logistic smooth transition vector autoregressive model (LSTVAR), which allows for a smooth evolution of the economy, governed by a chosen switching variable between periods of high and low financial volatility. We find that the South African economy responds nonlinearly to financial shocks, and that manufacturing output growth and Treasury Bill rates are more affected by financial shocks during upswings. Inflation responds significantly more to financial changes during recessions.

1. Introduction

The global financial crisis of 2007–08, and its severe impact on many of the world's economies, has demonstrated the necessity for a better understanding of financial conditions and their impact on the macroeconomy. Thompson et al. (2015a) construct a financial conditions index (FCI) for South Africa to capture in a single indicator the full spectrum of financial variables that affect the South African economy[4]; and they find using a forecast encompassing approach (Thompson et al., 2015b) that this FCI has good out-of-sample forecasting ability for the key macroeconomic variable of growth in manufacturing production. The aim of this paper is to investigate whether Thompson et al.'s (2015a) FCI has an asymmetric effect on

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[4] See Thompson et al. (2015a) for a full discussion of FCI's in practice, the literature pertaining thereto, as well as the econometric methodology used in estimating this FCI.

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output, interest rates and inflation, in other words to test whether there exists nonlinearity between South Africa's financial market conditions and its macroeconomy.

Hubrich et al. (2013:47) suggest that more pronounced impacts of financial sector shocks on the real macroeconomy should be expected during financial crises or periods of high financial stress. The rationale is that effects of the credit channel will come into force, and the resultant deterioration in consumer demand will lead to macroeconomic contraction. Hubrich et al. (2013) point out that financial stress "affects real-financial linkages because asymmetric information and uncertainty impede borrower–lender relationships and can induce credit rationing. This might imply asymmetric effects and transmission of financial shocks across regimes". They test this hypothesis for the euro area by incorporating a financial stress index into a Markov-switching Bayesian VAR, so as to investigate potential nonlinearities in the interaction between financial conditions and the macroeconomy. Two broad types of asymmetries are considered: (1) asymmetry between regimes (i.e. between different parts of the business cycle, generally between upswings and downswings); and (2) asymmetric responses to positive versus negative shocks.

Weise (1999) uses a nonlinear vector autoregression (VAR) approach to investigate whether monetary policy has asymmetric effects on output and prices. Similarly, we use the impulse response functions (IRFs) generated from a nonlinear VAR to investigate the two types of asymmetries mentioned above. Specifically, we analyse: (1) if the effects of a shock to financial conditions in South Africa are larger in downturns than in upturns (i.e. if the effects vary over the business cycle); (2) whether positive and negative financial conditions shocks have asymmetric effects; and (3) whether this asymmetry in (1) and (2) is affected by the size of the shock.

Weise's (1999) model uses real output growth as a switching variable. Instead of fixing the coefficients on all variables within the VAR (except for the monetary variable) in response to the switching variable, Weise (1999) sets up an aggregate demand–aggregate supply (AD–AS) model in structural form. All of the coefficients of the reduced form model vary in response to the switching variable. In choosing a threshold, we test the use of the FCI versus inflation, output growth or interest rates as individual switching variables, as well as allowing for each equation within the VAR to have an individual switching variable (i.e. four switches in total). As in Weise (1999) and Teräsvirta and Yang (2014), our model allows for smooth regime transitions (as opposed to discrete shifts), which is a more realistic representation of the macroeconomic variables over business cycle switches. This general way of modelling is a logistic smooth transition vector autoregression (LSTVAR) which is a multivariate extension of the logistic transition autoregression proposed by Teräsvirta and Anderson (1992).[5]

We assess the results of two LSTVAR models – one with inflation as a switching variable, and one with a different switching variable for each equation within the VAR. We find using both models that the South African economy is indeed asymmetric in its responses to financial shocks – manufacturing output growth is more affected by financial shocks during recessions, while inflation and interest rates respond more during upswings. The size of the financial shock, however, matters little for the response of the economy. To the best of our knowledge this is the only study in the literature analysing the asymmetric impact of financial shocks, through a financial conditions index, on the macroeconomy.

Other studies that also take the underlying state of the economy into account when analysing the impact of shocks on the real economy include Baumeister et al. (2008) and Caggiano et al. (2015a,b). Baumeister et al. (2008), using a time-varying VAR model show that the impact of the dynamic effects of excess liquidity shocks on economic activity, asset prices and inflation differ over time and depends on the source of increased liquidity and the underlying state of the economy (including asset price boom-bust, business cycle, monetary stance and others). Caggiano et al. (2015a) use nonlinear VAR models to obtain tax elasticities across recessions and expansions in an attempt to assess to what extent fiscal spending multipliers in the U.S. are countercyclical. Their results, based on generalised impulse responses, suggest that fiscal spending multipliers in recessions are greater than one, but not statistically larger than those in expansions. Caggiano et al. (2015b) employ a nonlinear VAR to document the asymmetric reaction of real economic activity to uncertainty shocks during expansions and recessions. Their results point to monetary policy ineffectiveness during the first months after the shock, especially in recessions, and to policy effectiveness in the medium-term, especially during expansions.

The remainder of this paper is organised as follows: Section 2 discusses the data used in the compilation of the FCI and in the nonlinear VARs; while Section 3 provides details on the econometric methodology used. Section 4 presents the empirical results, namely the linearity test results, the LSTVAR estimation results and the impulse response functions. Section 5 concludes the paper.

2. Data

The FCI estimated in Thompson et al. (2015a) is compiled using principal components analysis (PCA) applied to a set of sixteen monthly financial variables (see Table A1 in the Appendix) over the period 1966M02–2012M01. Thompson et al. (2015a) purge the FCI of any potential endogenous feedback effects, so as to ensure that it captures only information about pure financial shocks and not past economic activity, inflation or interest rate effects. They also address the issue of parameter non-constancy and structural breaks through the implementation of rolling-window estimation techniques, using windows

[5] For a discussion on the use of nonlinear forecasting models versus linear models, as well as of regime-switching models, see Camacho (2004).

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