Monetary Policy and Macroprudential Policy – Literature Review

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1. Monetary Policy

The monetary policy transmission mechanism represents all the channels through which the central bank, by using a variety of monetary policy instruments, influences the dynamics of the aggregate demand and prices from the economy. The basic objective of monetary policy is maintaining price stability. Stable prices are an indispensable element of constructing solid foundations for long term economic growth.

The most widely used econometric instrument, in the context of monetary policy transmission mechanism assessment, is the Vector Autoregression (VAR)model, which allows researchers to study the macroeconomic effects of an unexpected change in policy-controlled interest rates in the United States and in the euro area countries. Leeper, Sims and Zha (1998) and Christiano, Eichenbaum and Evans (2000) have reviewed what one has learned from this extensive literature regarding the monetary transmission mechanism for the US economy. Christiano et al. (1999) review theoretical VAR models employed in analyzing the US economy and Boivin et al. (2010) study the theoretical background and recent empirical results regarding changes that have appeared in the transmission mechanism. The authors present a Factor Augmented VAR (FAVAR) but also a DSGE (Dynamic Stochastic General Equilibrium) model, and reach the conclusion that monetary shocks had a relatively limited impact on aggregate demand and inflation, in recent decades compared to the results obtained using a longer data recorded before 1980. These changes are the combined result of both shifts in monetary policy dynamics and expectations, the role of private sector behavior playing a small part at best, in the present context. In Europe, the VAR methodology has been used frequently in order to analyse the differences at the level of euro area countries, with regard to the transmission mechanisms of monetary policy.

As an alternative to the recursive identification scheme imposed by Choleski identification, Bernanke (1986), Blanchard and Watson (1986) and Sims (1986) introduced non-recursive restrictions on the contemporaneous interactions among variables for identification, also known as Structural VAR. Furthermore, due to the fact that different identification problems were still present, such as: output, exchange rate or price puzzles, the search for additional identifying restrictions led to the introduction of sign restrictions in the VAR models.

The literature regarding the VAR models with sign restrictions on the impulse response functions developed much lately, applications of this method being found in all areas where the Structural VAR can be applied. The restrictions usually regard the signs of impulse responses of variables to an identified shock either immediately (Faust, 1998) or in a longer time horizon (Uhlig, 2005). Other literatures follow the approach of Canova and De Nicolo (2002). With regards to Bayesian inference in VAR models (BVAR), was introduced by Doan et al. (1984) and Litterman (1983, 1986). The considerable empirical literature on the use of

BVARs showed their ease of use and satisfactory forecasting performance. From an econometric perspective, Structural Vector Autoregressive (SVAR) models are advantageous tools in summarizing variables describing monetary policy and real economy dynamics, as well as the interactions established between them. However, static SVAR models can provide misspecifications and lead to false conclusions, when significant structural changes occur in the economy, which perfectly defines Romania's development in the last 15 years.

One of the solutions proposed in recent literature, in order to overcome the aforementioned issues, is to replace the basic constant parameter models with time-varying parameter specifications such as TVP-VAR (Time-Varying Parameter VAR) or MS-VAR (Markov Switching VAR). The main difference between the two classes resides in the fact that, while TVP-VAR models assume that the parameters display a smooth dynamic, the MS-VAR coefficients are defined as discrete and sudden shifts from one state to another. Although no consensus has been reached over the superior model specification, many authors prefer applying a TVP-VAR procedure, based on the fundamental argument that central banks try to smooth out (flatten) changes in interest rates, in response to shifts in real economy variables.

Primiceri (2005) introduces time-variation in the model parameters but also in the covariance matrix of the innovations, a crucial element in distinguishing changes that appear in the size of the exogenous shocks from monetary policy transmission mechanism shifts. Other notable work in the field of time-varying parameter models was brought by Canova (1993), Stock and Watson (1996) or Cogley and Sargent (2001), with flexible parameters and various extensions or alternative specifications. For example, Cogley and Sargent extend the baseline model by incorporating stochastic volatility, but maintain the simultaneous relationships between the constant parameters.

Later on, the TVP-VAR models were once again extended by combining time-variation analysis with factor augmented models (FAVAR). Baumeister et al. (2010) review the changes that appear in the monetary policy transmission mechanism of the US economy, using a TVP-FAVAR model, and come to the conclusion that time variability is a dominant characteristic of macroeconomic variables. Franta et al. (2011, 2012) investigate the transmission mechanism dynamics of the Czech economy, by applying a TVP-VAR model with stochastic volatility, estimated using Bayesian inference, and find that aggregate demand and prices have become much more responsive to monetary policy shocks, together with the expansion of the domestic financial sector and the increase in shock persistence on the interest rates.

In the field of VAR models that incorporate a Markov-Switching behavior, the work of Paolillo and Petragallo (2004), on the the area of asymmetries in the transmission mechanism of monetary policy, takes into account the dynamics in the case of being in different states of the economy. They studied the asymmetries in the business cycle transmission between US and Euro Area using the Markov Switching VAR methodology. The most important policy implication of this analysis is that the monetary policy instrument is more effective in the recession state than in the high growth one. The role of time changes and breaks in structural models has been also highlighted by Sims and Zha (2006). They have investigated regime switches in the U.S. monetary policy over the period 1959-2003. Their best model features only a switching in the residuals' variance while among the coefficient switching models the best fit is given by a four regimes Markov switching model.

Based on the estimation of a MS-VAR that allows regime shifts without the need of assumptions about the dates of the shifts and assuming a recursive structure of the system, Gaytan Gonzalez and Gonzalez Garcia (2006) compared the impulse response functions and variance decomposition corresponding to different regimes, this allowing them to characterize the structural changes that have occurred in the last years in Mexico.

Lastly, to overcome dimensionality issues, Bernanke and Boivin were the first to combine dynamic factor models (based on the work of Stock and Watson, 2000) with the standard VAR approach. Their Factor-Augmented VAR (FAVAR) results were not accompanied by a puzzles and the response of output was consistent with economic theory, while VAR model showed strong price puzzle. A number of contributors have employed FAVAR method to study the international transmission of monetary policy shocks in an open economy. For example Mumtaz and Surico (2007) identified structural shocks with both sign restrictions and recursive method for UK economy. They found that FAVAR method eliminates most of the open economy anomalies such as exchange rate and forward discount puzzle.

Lagana and Mountford (2005) found that a contractionary policy leads to a depreciation of UK pound to US dollar and a rise in housing prices and stock market prices. Shibamoto (2007) used a FAVAR model to analyze the monetary policy shocks on the macroeconomic time series in Japan and the main finding was that the monetary policy shock has strong impact on real variables as employment and housing starts than on industrial production. Soares (2011) measures the effects of monetary policy in the euro area using a FAVAR model. He found that a contractionary monetary policy leads to a hump shaped pattern of GDP and the information captured by factors decrease the prices puzzle.

2. Macroprudential Policy

The ESRB Regulation defines systemic risk as "a risk of disruption in the financial system with the potential to have serious negative consequences for the internal market and the real economy". All types of financial intermediaries, markets and infrastructure may be potentially systemically important to some degree. Similarly, Adrian and Brunnermeier (2009) propose a definition that takes into consideration systemic risk impact on financial intermediation i.e. "the risk that institutional distress spreads widely and distorts the supply of credit and capital to the real economy". From a policy perspective, a natural counterpart to macroeconomic risk monitoring is macroprudential regulation.

Borio (2010) defines a macroprudential framework as calibrating supervision from the top down, rather than building it up from supervision of individual institutions. This perspective can help resolve a fallacy of composition, if risk is endogenous to the system while nonetheless appearing exogenous to individual firms. It is helpful to think of both the evolution of risk in a time dimension (e.g., procyclicality) and the allocation of risk in a cross-sectional dimension (e.g., common exposures and interlinkages).

On the subject of interconectivity and shock transmission mechanisms, Constancio (2012) refers to contagion as "one of the mechanisms by which financial instability becomes so widespread that a crisis reaches systemic dimensions". Early warning systems or leading indicators are best for addressing the time dimension, while some robust measure of each institution's contribution to systemic risk is appropriate for the cross-sectional dimension. Currently, no single measure can do both simultaneously, and in fact, many extant measures can be misleading.

Three major challenges in measuring and analysis of systemic risk are identified. First challenge is identifying the systemic risk drivers. Acharya and Richardson (2009) lay the foundation of one approach of dealing with this issue, which is predicting how much banks stocks devalue during stressed market conditions. A second issue is how to measure more precisely each financial institution'sxontribution to the overall systemic risk. Literature researches various risk attribution rules: Shapley Value Tarashev et al. (2010), Marginal expected Shortfall, Systemic expected Shortfall Acharya et al. (2010) and Value-at-risk derived measures: Component VaR, incremental VaR and Conditional VaR.

Another perspective on macroprudential regulation, in terms of minimum capital requirements or solvency ratios is given by Cifuentes et al. (2005). The study takes the matter of macroprudential regulation and mark-to-market rules which can generate undesirable spillover effects. The authors argue that marking to market enhances transparency but it may introduce a potential channel of contagion and may become an important source of systemic risk.

Other notable studies in the field of systemic risk measurement include Brownlees and Engle (2010), who introduce the concept of *Mean Expected Shorfall* (MES), Acharya, Pedersen, Philippon, and Richardson (2010), who propose a *Systemic Expected Shortfall* (SES) indicator that measures the individual institution's contribution to overall systemic risk and Huang, Zhou, and Zhu (2009, 2010), who introduce a systemic risk indicator called the *Distress Insurance Premium* (DIP), as a theoretical insurance premium against systemic financial distress. Adrian and Brunnermeier (2009) formulate the *CoVaR* measure, i.e. the Value at Risk of the financial system conditional on an individual institution being under stress, and Brownlees and Engle (2011, 2015) introduces the *SRISK* index to measure the systemic risk contribution of a financial firm.

One of the seminal challenges in gauging systemic risk and its effects on the real economy is building a robust measure for systemic financial stress in macroeconomic models. An important contribution was brought by Hartmann et al. (2014) on the matter of incorporating systemic risk in empirical macroeconomic models by using an European dataset. The authors integrated the Composite Indicator of Systemic Stress (CISS), developed by Holló, Kremer and Lo Duca (2012) as a measure of systemic financial instability, in a Bayesian Markov-Switching Vector Autoregression (MS-BVAR) model. The authors conclude that the most significant regime changes have an inclination to overlap with the most severe financial turmoil episodes, implying the fact that the economy functions in a profoundly different way in times of systemic instability compared to tranquil periods.

This approach was followed by several authors and applied in the case of European economies, such as Austria (Glocker and Kaniovski, 2014), Portugal (Braga, Pereira and Reis, 2014), United Kingdom (Corbet and Twomey, 2014), Germany (Roye, 2012) and others. A significant part of the studies also introduce the stress indicator in a macroeconomic framework to estimate the effects of systemic stress on the real economy, similar to Holló, Kremer and Lo Duca (2012).