Effect of banking and macroeconomic variables on systemic risk: An application of ΔCoVaR for an emerging economy

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ABSTRACT

This article examines systemic risk in the Brazilian banking sector, paying specific attention to the role of accounting and macroeconomic variables in shaping systemic risk. Based on data for the period from 2011 to 2015, we perform an analysis in two steps. In the first step, we measure the systemic risk in Brazil based on ΔCoVaR framework. In the second step, we present empirical evidence from a panel data analysis regarding the determinants (banking and macroeconomic variables) of the systemic risk. The findings denote that the systemic risk measured using the ΔCoVaR methodology is consistent with the main events contained in the Financial Stability Reports issued by the Central Bank of Brazil. Furthermore, the empirical evidence highlights the importance of bank liquidity, profitability, leverage, and interest rate in determining systemic risk. One implication of this analysis is that prudential regulation policy must be coordinated with monetary policy in order to mitigate the systemic risk.

1. Introduction

Since the creation of the Basel Committee, there has emerged a number of initiatives to regulate financial institutions in many countries, but it was only after the subprime crisis (2007–2009) that the focus of regulation changed from individual institutions to the financial system as a whole. This change in the focus was due to the widespread contagion of risk among various institutions, which virtually paralyzed financial sector activity in the United States where the crisis began and which soon spread to the countries of Europe and the rest of the world. The crisis made it clear that the regulatory measures hitherto adopted were not able to prevent a collapse of the financial system, precisely because of its microprudential characteristic, whose concern was to individually safeguard each financial institution from the risks to which it would be exposed (Berner, Goodhart, & Kashyap, 2011; Blanchard, Dell’Ariccia, & Mauro, 2010; Hanson, Kashyap, & Stein, 2011).

The new debate that emerged began to consider the adoption of macroprudential regulation measures, with the objective of reducing and monitoring the systemic risk (Davis & Karim, 2009; and Bisias, Flood, Lo, & Valavanis, 2012). The definition of systemic risk is not simple due to divergences in the choice of what represents a system and in determining the factors that lead to this risk. Some scholars consider as a system only the set of institutions that make up the financial system (e.g. Adrian and Brunnermeier, 2016; Borri, Caccavaio, di Giorgio, & Sorrentino, 2014), while others understand that the concept of a system must encompass all sectors of the economy (e.g., Bernal, Gnabo, & Guilmin, 2014; Drakos & Kouretas, 2015). Furthermore, regarding the factors that cause systemic risk, there is divergence in the literature whether they are endogenous (Kindleberger & Aliber, 2005) or exogenous (Diamond & Rajan, 2001; and Allen & Wood, 2006) to the financial system of each country.
In order to adopt regulatory measures and to evaluate their performance, the systemic risk diagnosis must be correct. In this context, the measurement of systemic risk is fundamental for the regulatory authorities monitoring and interfering in the financial system with the objective of ensuring its stability. Among the measures for systemic risk, ΔCoVaR is worth highlighting because it allows the quantification of systemic risk as the impact of a financial institution, market or system on the value-at-risk (VaR) of other financial institutions, markets or systems. In addition, the data required for its computation are public and the methodology is relatively simple.

Adrian and Brunnermeier (2016) proposed ΔCoVaR as a measure of systemic risk, defined as the change in the value-at-risk of the financial system conditional on the fact that an institution is being under distress relative to its median state. Although the ΔCoVaR has been used in several studies for the measurement of systemic risk (Adams, Füss, & Gropp, 2013; Bernal et al., 2014; Borri et al., 2014; Drakos & Kouriitas, 2015; Gauthier, Lehar, & Souissi, 2010), there is a scarcity in the literature of its application to the case of emerging economies. In particular, the lack of information regarding the financial market in emerging economies is one of the main obstacles to the use of ΔCoVaR. In order to obtain a measure of the systemic risk for the Brazilian economy through the application of ΔCoVaR, this study, as in Bernal et al. (2014), makes use of the observation of situations in which the financial system is in times of distress. In addition, in order to evaluate the systemic risk measure through ΔCoVaR, we make an analysis of its performance confronting the facts presented in the financial stability reports of the Central Bank of Brazil (period from January 2011 to December 2015). The findings indicate that the systemic risk measured by ΔCoVaR is able to comprehend the main movements that marked the Brazilian financial system.

In addition to the above-mentioned analysis, we investigate the main causes of imbalances in the Brazilian financial system. Under this perspective, we present empirical evidence of how macroeconomic factors and the behavior of the financial institutions affect the financial system. In order to verify the influence of macroeconomic factors (exchange rate, interest rate, and output growth) and banking characteristics (liquidity, deposits, return on assets, and leverage) on the systemic risk, we perform a panel data analysis based on a sample of 18 banks for the period from 2011 to 2015 (quarterly frequency). The results obtained in this study allow the regulatory authority to institute measures directed at each identified risk factor and indicate the need for coordination between monetary policy and prudential regulation policy. Furthermore, monitoring financial institutions through accounting records enables the regulator to identify changes in the impact on the systemic risk and to develop specific measures for institutions that present problems.

The remainder of this study is organized as follows: Section 2 is a brief review of the literature regarding macroprudential regulation and the use ΔCoVaR in the estimation of systemic risk. Section 3 presents the measurement of systemic risk for the Brazilian economy based on ΔCoVaR methodology. Section 4 provides empirical evidence, through an econometric analysis, of the determinants of systemic risk. Section 5 concludes the paper.

2. Review of the literature

This study relates to several others in the literature on macroprudential regulation and especially on the use of ΔCoVaR in the estimation of systemic risk. In order to make a presentation of the main aspects related to the subject in the literature, this section presents two parts. The first approach studies regarding the influence of the financial system on the rest of the economy as well as the determining factors of the systemic risk. In general, regarding the measurement of systemic risk, there are three main characteristics. Part of the literature emphasizes models that use stock returns to measure systemic risk. Furthermore, there is the view that prudential regulation must be proportional to the contribution of each financial institution to the systemic risk. Finally, there is also recognition of the importance of conducting studies that provide elements for the implementation of regulatory policies. The second part presents how the literature uses ΔCoVaR to measure systemic risk in different countries and to estimate the contribution of different financial sectors (insurance, banks, and other financial services) to the systemic risk.

2.1. Macroprudential regulation

Since the outbreak of the subprime crisis, a vast literature has emerged to assess the role of the financial system in the economic stability. In particular, the correct identification of the determinants of systemic risk allows the regulatory authority to adopt appropriate measures to ensure the stability of the financial system. Davis and Karim (2009) argue that financial crises are not random events and they present several phases. According to these authors, the need to monitor financial markets and to recognize financial instability has led many central banks to adopt macroprudential supervision.

In order to observe how the regulator of the financial system should operate to avoid the onset of another crisis as observed in 2007–2009, Berner et al. (2011) analyze whether stabilization of the banking system would be enough to stabilize the entire financial system. The aforementioned authors analyze the impact of emergency sales of assets (fire sales) through a dynamic general stochastic equilibrium (DSGE) model with the incorporation of credit risk and the possibility of default of agents. Their findings indicate that capital and liquidity requirements, even when combined, are not enough to prevent emergency sales of assets.

Arnold, Borio, Ellis, and Moshirian (2012) also analyzes the association of systemic risk with nonbank financial institutions, the adequacy of capital requirements, and the procyclicality of the financial system. The authors acknowledge that macroeconomic stability depends on the identification of risk in the financial system and the factors that determine it. According to this view, models for measuring systemic risk through the behavior of stock returns of financial institutions listed on the stock market, which work well for the United States, may require changes to be used in other markets.

The systemic importance of an institution is a result of its size and its interconnections in national and international financial
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