International Review of Economics and Finance 40 (2015) 127–140

Contents lists available at ScienceDirect

International Review of Economics and Finance

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

Bank ownership, financial segments and the measurement of systemic risk: An application of CoVaR☆

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ARTICLE INFO

Available online 12 February 2015

JEL classification:
C21
C53
G20
G21
G28

Keywords:
Systemic risk
CoVaR
Quantile regressions
Risk management
Foreign banks

ABSTRACT

The recent financial crisis has shown that the regulatory framework that has been formulated and implemented over the last twenty years under the Basel I and II agreements has relied excessively on the monitoring of individual financial institutions. It failed to capture the contribution of systemic risk, which is considered to be the risk that is the outcome of collective behaviour of financial institutions that have significant effects on the real economy. This paper investigates whether the increased presence of foreign banks which are listed on a national stock market has contributed to the increase in the systemic risk, in particular, after the financial crisis of 2007–2009. We examine the extent to which the distress of foreign banks contributes to systemic risk for the US. In addition using relevant data for the UK we investigate the extent to which distress within different sub-segments of the financial system, namely, the banking, insurance and other financial services industries contribute to systemic risk. We conduct our analysis with the CoVaR measure of systemic risk recently developed by Adrian and Brunnermeier (2011) using daily data for the period 2 January 2000 to 31 December 2012. Furthermore, we complement our analysis with the application of two tests, the significance and dominance tests, to provide a formal comparison of the relative contribution of either the domestic or foreign banks and/or each individual financial sector. Our main results provide evidence that in the US, the non-US banks contribute to the systemic risk although most of the contribution comes from the US banks. In the case of the UK we show that the banking industry contributes relatively more to systemic risk in periods of distress than the insurance industry or the other financial services industry. Furthermore, when we examine the estimated $\Delta CoVaR$ measures, we observe that for all sectors the contribution to systemic risk has increased since 2008.

1. Introduction

The global financial crisis of 2007–2009 illustrated how distress can spread quickly through the financial system and threaten financial stability (Brunnermeier, 2009). Furthermore, Brunnermeier and Pedersen (2009) argue that the degree to which international

☆ An earlier version of the paper was presented at the 13th International Research Conference on Finance, Risk and Accounting Perspectives, Hughes Hall College, University of Cambridge, 18–20 November 2013 and we thank conference participants for valuable comments. This paper has also benefited from comments by seminar participants at the Athens University of Economics and Business, University of Birmingham and University of Crete. Kouretas acknowledges financial support from a Marie Curie Transfer of Knowledge Fellowship of the European Community's Sixth Framework Programme under contract number MTKD-CT-014288, as well as from the Research Committee of the University of Crete under research grant #2257. We would like to thank the Guest Editors, Shawkat Hammoudeh and Michael McAleer, the Editor, Hamid Beladi, and an anonymous referee for valuable comments and suggestions. We thank Manthos Delis, Qingwei Fan, Dimitris Georgoutsos, Gregory Guilmin, Jean-Yves Gnabo, Iftekhar Hasan, Liuling Liu, Chris Tsoumas, Maya Waisman, Qingwei Wang and Yun Zhu for many helpful comments and discussions. Theodoros Bratis and Evangelos Salachas provided superb research assistance. We also thank Marcus Brunnermeier and Gregory Guilmin for providing us with the STATA codes for estimating CoVaR. The usual caveat applies.

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http://dx.doi.org/10.1016/j.iref.2015.02.010
1059-0560/

financial institutions are linked depends on the level of market liquidity. Banks play a crucial role in the proper functioning of an economy because they provide the necessary liquidity to the markets and help to promote economic growth (Levine, 1997). Ill-functioning of the banking sector dramatically increases the costs in the real economy and historically has been a major source of financial crises, like the recent one, in both developed and emerging economies (Barth & Caprio, 2006; Demirguc-Kunt, Kane, & Laeven, 2009; Reinhart & Rogoff, 2009). Since October 1987, financial and banking regulation has focused on monitoring and regulating the banking industry.

The recent financial crisis has shifted the focus from the assessment of the risk management of individual financial institutions towards a more systematic or macro-prudential approach since it was made obvious that the micro-prudential regulatory framework is not sufficient to prevent world-wide contagion as a result of bank failures initially in the US and subsequently in Europe and elsewhere. The micro-prudential regulatory framework is based on the provisions of the Basle I and II agreements which imposed minimum capital requirements on the banks as a measure of prevention against unexpected losses (Pillar I). Within this framework the Basle II agreement led to the development of internal systems for measurement of market risk and such regulation looked at the soundness of individual financial institutions. However, such provisions based only on capital adequacy ignored factors such as size, degree of leverage, and interrelationships with the rest of the system. Stein (2010, p. 50) argued that "the overarching goal of financial reform must not be only to fortify a set of large institutions, but rather to reduce the fragility of our *entire system* of credit creation".

Instead, macro-prudential regulation implies that we observe the operation of the banking system as a whole (see Borio & Drehmann, 2009; Borio & Lowe, 2002; Gauthier, Lehar, & Souissi, 2012). Moreover, as was made evident from the recent financial crisis, an important element of systemic risk is the propagation of adverse shocks to a single institution through the rest of the system. The Basle III agreement which is still under formation is expected to address most of the issues related to systemic risk and develop the appropriate framework for regulation and supervision of the financial markets based on recent experience. Therefore, for Central Banks and financial regulators, it is of great value to be able to quantify the risks that can threaten the financial system, not only on the national level but also globally. Indeed, evaluating the risk stemming from important financial institutions which are labelled as "systemic" as well as the interrelationships within the financial system is of great importance for the regulators. Specifically, capital flows globally have increased substantially over the last decade leading to an increase in the degree of contagion, and the presence of foreign banks in mature and emerging economies has led to an increase in systemic risk. Therefore, as a result of the recent financial crisis and the role of the large financial institutions, governments and monetary authorities are in the process of developing a framework for the important domestic systemic financial institutions. To this end recently capital surcharges have been imposed on global systematically important banks.

Interdependence among financial institutions becomes particularly important during periods of distress, when losses tend to spread across institutions and the whole financial system becomes vulnerable. In this respect systemic risk is defined as multiple simultaneous defaults of large financial institutions. A systemic crisis that disrupts the stability of the financial system can have serious consequences and large costs for the whole economy and the society. During financial crises, episodes of contagion among financial institutions occur very often and therefore regulators need to take them into consideration when assessing the health of the financial system. Central banks are responsible for promoting financial stability in the domestic economy and hence a central component of the central banks' activities is to follow and analyse systemic risk. The financial crisis of 2007–2009 has put increased emphasis on analysing systemic risk and developing systemic risk indicators that can be used by central banks and others as a monitoring tool. In order to evaluate the stability of the banking system, a crucial element is the measurement of the systemic risk of a financial system. According to the Group of Ten (2001, p.126):

> "Systemic financial risk is the risk that an event will trigger a loss of economic value or confidence in, and attendant increases in uncertainly [sic] about, a substantial portion of the financial system that is serious enough to quite probably have significant adverse effects on the real economy. Systemic risk events can be sudden and unexpected, or the likelihood of their occurrence can build up through time in the absence of appropriate policy responses. The adverse real economic effects from systemic problems are generally seen as arising from disruptions to the payment system, to credit flows, and from the destruction of asset values."

Early works on this front by Lehar (2005), Goodhart, Sunirand, and Tsomocos (2005, 2006) and Goodhart (2006) proposed alternative measures of financial fragility which can be implemented at both the individual and the aggregate levels. Additionally, the Financial Sector Assessment Program (a joint IMF and World Bank initiative) was set up with the purpose of increasing the effectiveness of plans to promote the soundness of financial systems in their member countries.

Arnold, Borio, Ellis, and Moshirian (2012) also argue that key aspects of recent regulatory reforms which are under way through the Basle III agreement include measuring and regulating systemic risk and designing and implementing macro-prudential policies in an appropriate way. To this end the E.U. has established the European Systemic Risk Board and the US the Financial Stability Oversight Council in order to focus on the issue of systemic risk not only in those two regions but also at the global level. The collapse of numerous financial institutions over the last five years has imposed significant negative spillovers on governments and the economy as a whole. Therefore, in measuring systemic risk we need to consider the degree of risk of financial institutions and to allocate risks and costs across them so that we take into account the negative spillovers associated with financial instability. Although the issue of stability of the banking sector is very important, there are only a few studies that examine the impact of bank regulation and supervision on banking risk, some of which find that it has little effect on minimizing banking risk. Thus, Demirguc-Kunt and Detragiache (2011), using a sample of 3000 banks from 86 countries, reject the hypothesis that better regulation and supervision results in a sounder banking system. In contrast, Klomp and de Haan (2012) also examine the issue of the effectiveness of bank