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Short-term wholesale funding and systemic risk: A global CoVaR approach

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ABSTRACT

We use the CoVaR approach to identify the main factors behind systemic risk in a set of large international banks. We find that short-term wholesale funding is a key determinant in triggering systemic risk episodes. In contrast, we find weaker evidence that either size or leverage contributes to systemic risk within the class of large international banks. We also show that asymmetries based on the sign of bank returns play an important role in capturing the sensitivity of system-wide risk to individual bank returns. Since short-term wholesale funding emerges as the most relevant systemic factor, our results support the Basel Committee's proposal to introduce a net stable funding ratio, penalizing excessive exposure to liquidity risk.

1. Introduction

The fact that financial markets move more closely together during times of crisis is well documented. Conditional correlations between assets are much higher when market returns are low in periods of financial stress (see King and Wadhwani, 1990; Ang et al., 2006). Co-movements typically arise from common exposures to shocks, but also from the propagation of distress associated with a decline in the market value of assets held by individual institutions, a phenomenon we dub 'balance sheet contraction' and which is of particular concern in the financial industry. The recent crisis has shown how the failure of large individual credit institutions can have dramatic effects on the overall financial system and, eventually, spread to the real economy. As a result, international financial policy institutions are currently designing a new regulatory framework for the so-called systemically important financial institutions (SIFIs) in order to ensure global financial stability and prevent, or at least mitigate, future episodes of systemic contagion.[1]

In this paper, we analyze the main determinants of systemic contagion from an individual institution to the international financial system, i.e., the empirical drivers of tail-risk interdependence. We examine a sample of large international banks that are the target of current regulatory efforts and that would likely be considered too-big-to-fail by central banks. These banks are characterized by their large capitalization, global activity, cross-border exposures and/or representative size in the local industry. Using data spanning 2001–2009, we explicitly measure the contribution of the balance sheet contraction of these institutions to international financial distress. As regulators seek for meaningful measures of interconnectedness (Walter, 2011), this paper contributes to the current debate on prudential regulatory requirements.

Our study builds on the novel procedure put forward by Adrian and Brunnermeier (2011), the so-called CoVaR methodology, and generalizes it in several ways in order to deal with the characteristics of a sample of 54 international banks and to address the asymmetric patterns that may underlie tail dependence. The main empirical findings of our analysis can be summarized as follows:

First, we find that short-term wholesale funding is the most reliable balance sheet determinant of a bank's contribution to global systemic risk. Financial institutions use short-term wholesale funding to supplement retail deposits and expand their balance sheets. These funds are typically raised on a short-term rollover basis with instruments such as large-denomination certificates of deposit, brokered deposits, central bank funds, commercial paper and repurchase agreements. Whereas it is agreed that wholesale funding provides certain managerial advantages (see Huang and Ratnovski (2011) for a discussion), the effects on systemic risk of an overreliance on these liabilities were under-recognized prior to the recent financial crisis. Banks with excessive short-term funding ratios are typically more interconnected to other banks, exposed to

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[1] A rapidly growing literature discusses how contagion can occur through spikes in counterparty risk within a network of credit-interdependent institutions or through fire sales of securities (Adrian and Shin, 2010; IMF, 2010). Section 2 in this paper offers a survey of the literature in this field.

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a high degree of maturity mismatch, and more vulnerable to market conditions and liquidity risk. These features can critically increase the vulnerability not only of interbank markets and money market mutual funds, which act as wholesale providers of liquidity, but eventually of the whole financial system.

According to our analysis, an increase of one percentage point in short-term wholesale funding leads to an increase in the contribution to systemic risk of 16 basis points for quarterly asset returns at the 1-quarter horizon and 43 basis points at the 1-year horizon. These results support current regulatory initiatives aimed at increasing bank liquidity buffers to lessen asset-liability maturity mismatches as a mechanism to mitigate individual liquidity risk, such as the liquidity coverage ratio recently laid out by the Basel Committee on Banking Supervision under the new Basel III regulatory framework.[2] This paper shows that these initiatives may also help to reduce the likelihood of systemic contagion. In contrast to the role played by short-term wholesale funding, we find weaker evidence that either size or leverage is helpful in predicting future systemic risk within our set of large international banks. Consequently, the empirical analysis in this paper provides clear evidence of the major role played by short-term wholesale funding in the spreading of systemic risk in global markets.

Second, our analysis reveals a strong degree of asymmetric response that has not been discussed in the existing literature on systemic risk. We examine the asymmetric sensitivity of the system to an individual bank based on the sign of bank returns. A distressed systemic institution is likely to have greater spillover effects on the rest of the financial system when its balance sheet is contracting, and therefore an empirical analysis of tail risk-dependence within a financial system should distinguish between episodes of expanding and contracting balance sheets. Our results show that individual balance sheet contraction produces a significant negative spillover on the Value-at-Risk (VaR) threshold of the global index. Whereas the sensitivity of left tail global returns to a shock in an institution's market valued asset returns is on average about 0.3, the elasticity conditional on an institution having a shrinking balance sheet is more than two times larger. Therefore, controlling for balance sheet contraction is crucial in order to rank financial institutions by their contribution to systemic risk.

Third, we find evidence that the banks that received prompt recapitalization in Q4 2008 were able to improve their relative position during the crisis period. In contrast, the banks that were rescued by public authorities later in Q4 2009 became relatively more systemic during the crisis period. In other words, the ripple effects from their individual distress were more widespread throughout the financial system. This conclusion is based on the results showing that the credit crisis added 0.1 percentage points to the co-movement between individual and global asset returns, while recapitalization during the crisis period dampened co-movement by 0.14 percentage points. Consequently, the timing of recapitalization is also important for systemic risk.

Finally, our paper highlights the relevance of crisis episodes in measuring systemic risk and of the response policy actions. Our results show that the marginal contribution of an individual bank's financial distress to the 1% quantile of the system returns increases from 1 percent in an average quarter between 2001 and 2009 to 1.4 percent in a quarter characterized by money market turbulence at the height of the global financial crisis during Q3 2007–Q1 2009.

The remainder of the paper is organized as follows. Section 2 surveys the most representative literature on systemic risk, highlighting the differential features of the CoVaR approach. Section 3 discusses the data employed in the two stages of our analysis. Section 4 lays out our CoVaR estimation framework and shows the estimates of individual contributions to systemic risk. Section 5 analyzes the determinants of systemic risk and reports the results of several robustness checks. Finally, Section 6 summarizes our main findings and concludes with policy recommendations.

2. Related literature and choice of methodology

Our study builds on the CoVaR methodology proposed by Adrian and Brunnermeier (2011), which allows us to generate time-varying estimates of the systemic risk contribution for each bank in our sample. This methodology has been applied in a number of recent studies (e.g., Van Oordt and Zhou, 2010; Roengiptya and Rungcharoenkitkul, 2011). Our study provides two main contributions with respect to these studies. First, we focus on an international sample of large banks. These banks are particularly important from a regulatory perspective. Second, we extend the basic CoVaR methodology to account for a number of econometric issues related to asymmetric responses, recapitalization effects and structural changes that originated during the global financial crisis.

There exists a growing literature that has suggested several alternative approaches to address the existence of systemic interrelations using different procedures and variables. Lehar (2005) characterizes the conditional correlations between banks and asset portfolios using default probabilities of financial institutions as a measure of systemic risk. Goodhart and Segoviano (2009) construct a banking stability index to estimate interbank dependence for tail events using credit default swap data. Huang et al. (2009) propose a measure of systemic risk based on the price of insuring a pool of banks against financial distress based on ex ante measures of default probabilities of individual banks and forecasts of asset return correlations. More recently, Acharya et al. (2010) define the systemic expected shortfall as the propensity of a financial institution to be undercapitalized when the system as a whole is undercapitalized. This is a measure of the *exposure* of banks to systemic tail events, which nevertheless can easily be reverted to capture risk contribution (see Section 5 for more details). Brownlees and Engle (2011) construct short- and long-run MES forecasts and propose the SRISK index, which captures the expected capital shortage of a firm given its degree of leverage and Marginal Expected Shortfall (MES). Alternatively, De Nicolo and Lucchetta (2010) use a dynamic factor to model quarterly time series of macroeconomic indicators of financial and real activity and obtain forecasts of systemic real risk and systemic financial risk. Gray and Jobst (2010) examine contagion across markets and institutions using extreme value theory, while Kritzman et al. (2010) introduce the so-called absorption ratio measure to assess systemic risk using a principal components approach; see also Billio et al. (2010) for a related analysis.

As an alternative to systemic risk measures based on the marginal risk contributions of individual institutions, network analysis is concerned with the joint distribution of losses of all market participants. Cont et al. (2009) and Martínez-Jaramillo et al. (2010) have analyzed the Brazilian and Mexican interbank markets, respectively, using this approach. Cao (2010) shows how to use Shapley values to decompose the system-wide risk among the individual institutions in a CoVaR setting (see also Tarashev et al., 2009). A very comprehensive survey of the main systemic risk measures and analytical frameworks developed over the past several years is contained in Bisias et al. (2012). All of these procedures have both methodological advantages and shortcomings relative to other methods, so there is no such a thing as an optimal procedure in the literature with which to measure systemic risk.

The particular choice of the CoVaR methodology as a tool to characterize systemic risk in this paper is largely motivated by three

[2] This ratio will require banks to maintain sufficient liquid assets to contain a 100% run-off of unsecured wholesale funding provided by financial institutions during a 30-day stress scenario, which contrasts with the 5–10% run-off assumed for retail deposits during a significant liquidity stress episode.