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Systemic risk measurement: Multivariate GARCH estimation of CoVaR ☆

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ABSTRACT

We modify Adrian and Brunnermeier's (2011) CoVaR, the VaR of the financial system conditional on an institution being in financial distress. We change the definition of financial distress from an institution being exactly at its VaR to being at most at its VaR. This change allows us to consider more severe distress events, to backtest CoVaR, and to improve its consistency (monotonicity) with respect to the dependence parameter. We define the systemic risk contribution of an institution as the change from its CoVaR in its benchmark state (defined as a one-standard deviation event) to its CoVaR under financial distress. We estimate the systemic risk contributions of four financial industry groups consisting of a large number of institutions for the sample period June 2000 to February 2008 and the 12 months prior to the beginning of the crisis. We also investigate the link between institutions' contributions to systemic risk and their characteristics.

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1. Introduction

The recent financial crisis has alerted the public to the fragility of the financial system and systemic risk. Value-at-Risk (VaR), arguably the most widely-used risk measure by financial institutions, has been criticized by many as incapable of capturing the systemic nature of risk since its focus is on an institution in isolation. VaR has been used by regulators as an instrument to determine capital levels that need to be set aside by financial institutions against market risks. However, since VaR considers only the risk that an institution faces when considered in isolation, it is not possible to gauge the risk facing the financial system from an institution's VaR. As a result, recently, there has been considerable interest in alternative risk measures which do not suffer from VaR's shortcoming, namely, its inability to account for the possibly systemic nature of an institution's risk and financial distress.

One of these recent studies is Adrian and Brunnermeier (2011) (referred to as AB henceforth) who introduce a new risk measure: Conditional Value-at-Risk (CoVaR). They define $CoVaR^{i|j}$ as the VaR of institution i conditional on institution j being in financial distress, which they define as institution j being at its VaR. By conditioning on another institution's financial distress, they aim to go beyond idiosyncratic risk and to capture possible risk spillovers among financial institutions.

While the $CoVaR^{i|j}$ measure can be computed for any two financial institutions i and j, AB consider the specific case where i is the financial system. In this case CoVaR becomes the VaR of the financial system conditional on institution j being in financial distress, and hence can be used to determine a financial institution's contribution to systemic risk. While it may not be easy to find consensus on the exact definition of systemic risk, the following quote from the Federal Reserve Governor Daniel Tarullo's July 2009 testimony before the Senate Banking, Housing, and Urban Affairs Committee is one definition that many can probably agree on, and also one that CoVaR seems to capture[1]

> *"Financial institutions are systemically important if the failure of the firm to meet its obligations to creditors and customers would have significant adverse consequences for the financial system and the broader economy."*

Among other recent studies that propose measures to quantify systemic risk are Billio et al. (2012), Zhou (2010), Huang et al. (2009), Segoviano and Goodhart (2009), Acharya et al. (2010),

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[1] http://www.federalreserve.gov/newsevents/testimony/tarullo20090723a.htm.

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