Journal of International Money and Finance 58 (2015) 191–223

Contents lists available at ScienceDirect

Journal of International Money and Finance

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

Tail risk and systemic risk of US and Eurozone financial institutions in the wake of the global financial crisis

Stefan Straetmans [a,*], Sajid M. Chaudhry [b]

[a] School of Business and Economics, Maastricht University, The Netherlands
[b] Birmingham Business School, University of Birmingham, UK

ARTICLE INFO

Article history:
Available online 21 August 2015

JEL Classification:
G21
G28
G29
G12
C49

Keywords:
Banking
Systemic risk
Asymptotic dependence
Multivariate extreme value theory

ABSTRACT

We evaluate multiple market-based measures for US and eurozone individual bank tail risk and bank systemic risk. We apply statistical extreme value analysis to the tails of bank equity capital losses to estimate the likelihood of individual institutions' financial distress as well as individual banks' exposure to each other ("spillover risk") and to global shocks ("extreme" systematic risk). The estimation procedure presupposes that bank equity returns are "heavy tailed" and "tail dependent" as identifying assumption. Using both US and eurozone banks allows one to make a cross-Atlantic comparison of tail risks and systemic stability. We also assess to what extent magnitudes of tail risk and systemic risk have been altered by the global financial crisis. The results suggest that both tail risk and systemic risk in the US are higher than in the eurozone regardless of the considered sample period.

1. Introduction

The banking and economic crisis that emerged in 2007 has reminded everybody that financial stability should not be taken for granted. The negative impact on the real economy has been smoothened, though, by the sustained efforts of central banks and national governments to stabilize the financial

* Corresponding author. Tel.: +31 433883679.
E-mail address: s.straetmans@maastrichtuniversity.nl (S. Straetmans).

http://dx.doi.org/10.1016/j.jimonfin.2015.07.003
0261-5606/

system. Thus, financial and systemic stability have regained central bankers' and supervisory authorities' attention as one of their top priorities.

This paper compares US and eurozone financial stability both from an individual bank risk as well as a systemic risk perspective. The cross-Atlantic perspective makes sense because banking consolidation and financial deregulation seem to have been stronger in the US than in the eurozone during the last 10 to 15 years (Group10, 2001). On the one hand, the removal of US regulatory barriers to universal and cross-state banking has led to the emergence of large and complex banking organizations (LCBOs) that have not only become "too big to fail" but also "too complex to fail". In contrast, the European banking market is still more fragmented despite the introduction of the single currency. Eurozone retail banking is generally less integrated than wholesale banking and banks' capital market-related activities. This relatively lower degree of European banking market integration may be due to cross-country legal and tax barriers, differing national supervisory rules, cultural differences or geographic distance (Berger et al., 2003; Heuchemer et al., 2009).

The difficulty to observe supposed triggers of systemic instability like e.g. the degree of interbank interconnectedness, the location of banks within the interbank "network" or the correlations constitutes a serious complication. Therefore, a majority of the empirical banking stability literature has proposed more indirect "market-based" micro-level indicators of systemic risk. Probably the oldest strand of literature on bank equity "spillovers" applies event study methodology to measure the impacts of specific bank distress or bank failures on other banks' stock prices (Slovin et al., 1999; Wall and Peterson, 1990). Other authors applied various regression approaches to link abnormal bank stock returns to asset-side risks, including those related to aggregate shocks (Kho et al., 2000; Smirlock and Kaufold, 1987). Gropp et al. (2009) use an ordered logit specification to identify spillovers between banks based on the changes in their distances-to-default. More recent micro-level measures of systemic risk include e.g. CoVaR (Adrian and Brunnermeier, 2014), Marginal Expected Shortfall (Acharya et al., 2010; Brownlees and Engle, 2015) or corisk (Chan-Lau, 2009).[1]

Whereas the literature described above mainly focused on identifying contagion-type bank equity spillovers, others argued that systemic instability may be due to aggregate shocks. Using historical data on banking panics and business cycle proxies going back to the 19th Century, Gorton (1988) shows that business cycles have often been leading indicators of bank panics. Hellwig (1994) suggests that the fact that deposit contracts are noncontingent on the state of the macro economy may also partly explain their vulnerability toward aggregate shocks. Allen et al. (2012) construct a tail measure of aggregate systemic risk (called CATFIN) using the cross-sectional distribution of financial institutions' equity returns. This index also acts as an early warning indicator toward future real economic activity.

We apply statistical extreme value theory (EVT) toward identifying systemic risk.[2] In line with the existing empirical systemic risk literature reviewed above, we distinguish between "co-crash" indicators between bank equity returns (to identify "spillover" or "contagion" risk) from crash probabilities of bank stock returns conditional on aggregate shocks (to identify "extreme" systematic risk or "tail-β").[3] The proposed risk indicators are also market-based because they make use of banks' equity returns.[4] Market-based approaches presuppose that bank stocks are efficiently priced and thus reflect all

[1] Alternative approaches to systemic risk modeling have been developed that do not depend on market-based information. Deposit withdrawals or survival times of healthy banks during banking crises have been studied (Calomiris and Mason, 1997, 2000). A more recent literature tries to relate bank contagion risk to central bank data on interbank exposures (Degryse and Nguyen, 2007; Mistrulli, 2005; Upper and Worms, 2004; van Lelyveld and Liedorp, 2006). Purely theoretical models of bank contagion have been proposed (Allen and Gale, 2000; Freixas et al., 2000). Bisias et al. (2012) provide a comprehensive survey of 21 systemic risk indicators that have been proposed through time.

[2] Other applications of multivariate EVT toward assessing asset market linkages during stress periods include, for example, Straetmans (2000), Longin and Solnik (2001) and Poon et al. (2004) for stock markets; Hartmann et al. (2003a, 2003b) for currency linkages; Hartmann et al. (2004) for stock-bond linkages; and Hartmann et al. (2006) for banking system stability.

[3] The terms bank "spillovers" or bank "contagion" will be used interchangeably throughout the paper.

[4] In terms of definition, the Marginal Expected Shortfall (MES) and the Conditional Value-at-Risk (CoVaR) come close to our indicators as they are also probabilistic-based. In contrast to previous approaches toward modeling market linkages and spillovers that were often correlation-based, both MES, CoVaR and our indicators allow for non-linear dependence in the data.