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Systemic risk with endogenous loss given default

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ABSTRACT

When many financial institutions fail simultaneously, the remaining institutions in the system are unlikely to have sufficient liquidity to acquire all failed institutions. As a result, some assets will have to be liquidated and sold to outsiders at firesale prices, giving rise to a potentially high losses given default (LGDs) for creditors of failed institutions. This study analyzes the consequences of this firesale mechanism for systemic risk. Our findings suggest that systemic risk is likely to be heavily underestimated when the potential for firesales, and thereby the endogenous nature of LGDs, is not taken into account. The magnitude of the negative bias increases with asset return correlations, banks' return variability, the degree of asset specificity of bank loans and the degree of concentration in the banking sector. The analysis suggests that time-varying liquidity requirements are an effective way to reduce the potential for firesales and thereby lower systemic risk.

1. Introduction

Since the outbreak of the global financial crisis that started with the fall of Lehmann Brothers in September 2008, macroprudential regulation of the financial system has become a major concern to regulators and policymakers. The main objective of macroprudential regulation is to safeguard the stability of the financial system as a whole, in order to prevent the occurrence of a systemic crisis in which many financial institutions fail simultaneously. Such systemic crises tend to be costly because they are associated with high fiscal costs and lead to large output losses due to disruptions in lending to the real economy (Hoggarth et al., 2002; Allen and Carletti, 2013). Consequently, a growing body of economic research analyzes and measures systemic risk.

This study adds to the literature by analyzing how the potential for a firesale during times of distress in the financial system affects systemic risk through the effect of firesales on losses given default (LGDs).[1] Although there are a number of studies in the literature that show how firesales can result from the joint failure of multiple financial institutions (Shleifer and Vishny, 1992; Acharya and Yorulmazer, 2008), their consequences for systemic risk have not yet been analyzed. We analyze these consequences and quantify them using the widely used concept of Expected Shortfall (ES).[2] Our analysis thereby bridges a gap in the literature that exists between those studies dealing with firesales during periods of systemic distress and those that deal with the measurement of systemic risk.

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[1] A firesale occurs when during a bankruptcy, assets are sold at extremely discounted prices. This is especially likely to happen when the failing firm's sector is in distress (Shleifer and Vishny, 1992; Acharya and Yorulmazer, 2008; James and Kizilaslan, 2014).

[2] The α% Expected Shortfall is the *average* loss of the α% worst losses. As such, Expected Shortfall is a measure of tail risk.

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Following Acharya (2009), we define systemic risk as the risk that creditors of financial institutions incur large losses as a result of the joint failure of multiple institutions due to correlated returns on the asset side of their balance sheets.[3] While most studies take LGDs as exogenously given, we show that when there is a potential for firesales, LGDs become endogenous. Our study illustrates that LGDs depend, among other things, on the degree of return correlation across banks' loan portfolios as well as the aggregate liquidity in the financial system, the latter of which is endogenous in our model. Monte Carlo simulations indicate that systemic risk is underestimated when LGDs are assumed to be exogenous. Furthermore, the magnitude of the negative bias increases with an increase in banks' asset return variability, the return correlations of their loan portfolios, the asset-specificity of loans and the degree of concentration in the banking system.

Our findings emphasize the importance of appropriately modeling LGDs associated with joint defaults of multiple financial institutions. Furthermore, they show that liquidity plays an important role in this respect, and suggest that regulations regarding minimum liquidity ratios for systemically important financial institutions (SIFIs) are an effective way to reduce the potential for firesales and thereby lower systemic risk. More specifically, during 'normal times' SIFIs should be required to hold a certain proportion of their assets in the form of a liquidity buffer, which could be used to purchase the assets of failed institutions during times of systemic distress.

The outline of the remainder of this paper is as follows. Section 2 embeds our study in the existing literature. Firesales and LGDs are modeled in Section 3. The effects of firesales on systemic risk are then analyzed in Section 4. Finally, some concluding thoughts follow in Section 5.

2. Overview of the literature

This section summarizes the literature on systemic risk and elaborates on the literature dealing with firesales and LGDs. Finally, we position our study in these two strands of the literature.

2.1. Systemic risk

The literature on systemic risk can largely be categorized into two strands. The first strand mainly deals with the possibility of contagious defaults, which occur when the failure of an individual financial institutions spreads as a contagion through the financial system, causing other institutions to fail as well. These studies generally focus on direct interlinkages between financial institutions (i.e. interbank loans), using network models and simulations to assess the vulnerability of a particular system to contagious defaults. Some studies that use this approach are Furfine (2003), Upper and Worms (2004), Müller (2006), Hałaj and Kok (2013) and Peralta and Zareei (2016). For an overview of this strand of the literature, see Upper (2011). The second strand of the literature – to which the current study contributes in particular – analyzes how systemic risk arises as a result of correlations in institutions' asset portfolios.[4] The rationale for this approach is that simultaneous defaults might occur even in the absence of direct connections between financial institutions if their asset portfolios are very similar. When asset portfolios are similar, different institutions are likely to incur large losses at the same time. As a result, failures are likely to be correlated. Since bank-specific risk measures do not take such indirect linkages into account, a number of new measures related to systemic risk have been developed, which we discuss below.

Early contributions by Lehar (2005) and Kuritzkes et al. (2005) define systemic risk as the risk that a (hypothetical) deposit insurer, which has insured the liabilities of all financial institutions in the system, incurs significant losses. In this framework, the liability of the deposit insurer can be interpreted as a portfolio of short put options on correlated assets, so that the Merton (1974) model can be applied to obtain an estimate of systemic risk. Adrian and Brunnermeier (2016) propose a measure (called CoVaR) to capture the contribution of individual institutions to systemic risk. Their measure is calculated as the Value-at-Risk (VaR) of the financial system as a whole conditional on a particular financial institution being in distress. Acharya et al. (2017) introduce a measure that is conceptually quite similar to CoVaR. Their Systemic Expected Shortfall (SES) refers to the propensity of a financial institution to be undercapitalized when the system as a whole is undercapitalized. Again, by conditioning on a systemic event, SES measures the *contribution* of a particular bank to systemic risk rather than systemic risk itself. This also holds for the SRISK measure developed by Brownlees and Engle (2016). Huang et al. (2009, 2012) construct a so-called Risk Insurance Premium, which measures the insurance premium that protects against distressed losses of a hypothetical debt portfolio consisting of the total liabilities of all financial institutions in a system. They estimate this premium by combining information about CDS spreads of individual institutions and asset return correlations across banks. Jobst and Gray (2013) analyze systemic risk by looking at the multivariate distribution of losses associated with the default of different combinations of institutions in a financial system and subsequently derive the distribution of the aggregate loss.

[3] Note that *systemic* risk is a concept that is fundamentally different from *systematic* risk, which is the risk of a particular firm that can be explained by the risk of the market as a whole.

[4] We only summarize the most relevant studies below. For a complete overview of this strand of the literature, please refer to Bisias et al. (2012).