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Systematic cyclicality of systemic bubbles: Evidence from the U.S. commercial banking system

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ABSTRACT

This paper investigates the extent of vulnerability in the U.S. commercial banking system through a pro-cyclical interaction between the market-wide risk perception and system-wide asset management behavior. Based on a Markov regime-switching model, the proposed diagnostic framework clearly illustrates its ability to provide an early warning signal of the build-up and unwinding of fragility in the financial system and the real economy for a counter-cyclical structure of regulatory policy. Empirical results demonstrate an asset pricing implication, as the proposed systemic bubble index is a significant factor that affects the investment opportunity set of stock investors for financial firms but not for non-financial firms.

1. Introduction

Since the onset of the 2007–2009 global financial crisis, the extant literature has stressed the importance of accurate and timely information on systemic risk for effective financial regulation and macro-prudential monetary policy. At the center of this challenge is the critical task of identifying the real-time dynamics of risk propagation in the financial system as a whole – one that addresses unobservable systemic implications prevailing in the financial system by considering its interaction with the business cycle. Accordingly, it is of paramount importance to develop a novel framework for quantifying the risk of an aggregate disruption in the financial system along with adverse feedback effects to the real economy in a timely manner.

To formulate macro-prudential capital standards in the post-crisis era, the Basel Committee on Banking Supervision (BCBS) has proposed a *counter-cyclical* structure of regulatory policy as a countermeasure for the existing *pro-cyclical* policy of forcing banks to restrict their lending during downturns. It follows that such a capital-charge cyclicality in the banking system indeed amplifies business cycle fluctuations, and the recurring pro-cyclicality exacerbates a financial crisis; see Adrian and Brunnermeier (2011), Shin (2010), Brunnermeier et al. (2009) and others. The objective of the counter-cyclical

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regulation is to avoid such an amplification mechanism and mitigate pro-cyclicality by encouraging banks to build up capital buffers during periods of excess credit growth, as the realization of systemic risk tends to appear with a noticeable lag in the accumulation of system-wide bubble. The pro-cyclicality is closely related to the myopic *de facto* risk measurement in the banking sector, which mainly relies on contemporaneous signal from the market or backward-looking information such as past profit flows, sales growth, and credit scores. As such, measurable risk tends to be underestimated when the bubble is being built-up, and overestimated when the problem is realized. It is evident that adding a financial burden on already distressed institutions will accelerate such a self-reinforcing propagation effect through the *leverage cycle* in the transmission of negative shocks to the real economy; see Geanakoplos (2010) for details.

In this regard, a perceptive measure of systemic vulnerability is indispensable for detecting *early-warning signals* towards the counter-cyclical regulatory approaches in a proactive manner. It is not surprising that financial market data has been widely employed as a forward-looking indicator of systemic fragility because of its high-frequency availability and reliability with rapid response to innovations.[1] However, it is worth noting some concerns regarding careless (and possibly reckless) credence in market-based information as a basis for measuring systemic risk, which is conceptually different from systematic (or market) risk. Whereas systematic risk refers to the undiversifiable risk intrinsic to the entire financial market, systemic risk is recognized as a different source of fundamental risk that lies dormant beneath the intertwined financial networks. As pointed out by Benoit et al. (2013), however, both systemic and systematic risks may be empirically and almost perfectly correlated if the systemic risk measurement is solely grounded by the financial market data.[2] Another potential pitfall of market-based systemic indicators, usually captured by the dynamics of asset price volatilities, lies in the *volatility paradox*, i.e., the build-up of systemic risk is cultivated in low volatility environments.[3] This paradox certainly triggers the pro-cyclicality between the financial market and the system from levering up on risky securities along with the resulting leverage cycle. Consequently, the signals from the market-based indicators, as an exclusive and exogenous measure of systemic risk, must be pro-cyclical and inevitably contain false-alarm prone noises orthogonal to the development of systemic bubble.[4] Thus, a blind dependence on market-based risk measures can be misleading towards overreaction to or understatement of the negative shock, indicating that policy makers need to be cautious before taking macro-prudential policy actions. Likewise, a naive counter-cyclical monetary policy based solely on market data can also be myopic and lead to a sub-optimal regulation, causing a substantial abuse of social welfare and capital.

Other than market-based measures, however, only a few authors have devised systemic risk measures with the consideration of distinctive (but potentially lagging) systemic indicators. For instance, Giesecke and Kim (2011) developed dynamic systemic risk measures based on a system-wide default prediction by using historical default data (with several market variables as covariates), and Shin (2010) proposed non-core liabilities tax as a macro-prudential regulation from the balance sheet information. Shin (2013) supported this argument by comparing three types of early warning indicators of financial instability – those based on financial market prices, those based on normalized measures of total credit and those based on liabilities of financial intermediaries. Gray and Jobs (2010) proposed a systemic risk measure based on the Merton's structural model which can be naturally interpreted as market volatility adjusted pseudo-leverage.

Our analysis mainly focuses on commercial banks because of their central role as a transmission channel in the amplification of the business cycle through pro-cyclical interaction between the financial system and the real economy. Massive securitization of loans and securities of bank's balance sheet has led to *market pro-cyclicality* in the way of connecting commercial banks' balance sheets and asset prices in the market. The core of the market pro-cyclicality problem is associated with the interaction between the mark-to-market asset valuation and the active asset management in the banking system, along with the propagation and amplification channels of market-wide shocks throughout the entire financial system.[5] As Adrian and Shin (2010) put it differently, the degree of bank's risk-taking through the *balance-sheet* channel is closely related to the liquidity fluctuations owing to unpredictable common asset-price shocks through the *market* channel. That is, the system-wide balance sheet management in response to the aggregate asset price trend generates a positive or negative feedback loop, followed by a chain of spillover effects, which is crucial in gauging systemic risk (see Tasca and Battison, 2012), and the market pro-cyclicality certainly generates a systemic bubble regarding the financial instability. Although we can view the system-wide balance sheet in terms of both liabilities and assets, we mainly focus on the asset side in that the dynamics of systemic liquidity depends more upon assets (e.g., bank credit, interbank loans, and cash assets) than liabilities (e.g., deposits, borrowings, and

[1] For example, the CoVaR measure introduced by Adrian and Brunnermeier (2011) and marginal expected shortfall (and systemic expected shortfall, which is its extended version) suggested by Acharya et al. (2010) make use of equity market data. Other examples include the (risk-neutral) probability of default, proposed by Huang et al. (2012), based on the market credit default swap data, and the CATFIN measure of Allen et al. (2012) to gauge the aggregate level of risk taking in the financial sector using a cross-sectional analysis of equity returns of financial firms.

[2] For instance, Fig. 4 in Benoit et al. (2013) illustrates the strong relationship between an equity-based systemic indicator (marginal expected shortfall, MES) and the corresponding beta specific to financial institutions, implying the homogeneous quality of information between two risk measures.

[3] Brunnermeier and Sannikov (2012) explain this phenomenon as endogenous risk (i.e., risk self-generated within the system) by studying the full equilibrium dynamics of an economy with financial frictions. Brunnermeier and Oehmke (2013) assert that this volatility paradox is associated with excessive leverage and maturity mismatch in the banking system.

[4] In this context, Borio (2010) argues for the paradox of financial instability in which "*asset prices are unusually strong, leverage measured at market prices artificially low, and risk premia and volatilities low precisely when risk is highest.*"

[5] Brunnermeier and Sannikov (2012) pointed it out as "*financial frictions lead to the amplification of shocks, directly through leverage and indirectly through prices.*"