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**Comment** Hao Zhou

There are two approaches to understanding the issue of systemic risk and macroprudential regulation—one is empirical macroeconomics based, and the other is financial market based. These two approaches have different methodologies, emphases, and purposes. De Nicolò and Lucchetta's chapter belongs to the macro-centric approach. It helps us to better understand the fundamental linkage between the real economy and the financial sector, especially in the long run. However, unlike a financial-centric approach, the chapter is silent on the interaction among large banks, the nonlinear feedback effect, and the identification of individual institutions that are systemically important.

**Two Approaches to Systemic Risk**

There is a long tradition in the empirical macroeconomics literature (see, e.g., Bernanke, Gertler, and Gilchrist 1998) that introduces the financial sector as a market imperfection into a real business cycle framework. Such an add-on approach typically labels the financial sector as an accelerator, multiplier, or amplifier, in that shocks into the economy come from the real side and are magnified by the financial sector. The recent financial crisis and deep recession have also prompted more research along this direction.<sup>1</sup>

This chapter follows De Nicolò and Kwast (2002) in defining systemic risk as the risk that either a real or a financial shock will trigger a significant decline in real activity. The systemic financial risk is measured as the value at risk (VaR) for the market-adjusted return of a large portfolio of financial firms at the 5 percent level, and the systemic real risk is measured by the similar GDP 5 percentile. The empirical implementation builds on the dynamic factor model of Stock and Watson (2005) with quarterly data. For estimating systemic risks, GDP and financial VaRs are estimated via quantile regressions, and can be explicitly related to the conditional VaR (CoVaR) framework advocated by Adrian and Brunnermeier (2009). Empirical estimation consists of two steps: first, a standard dynamic factor approach is adopted to estimate the VaR parameters and to filter out the latent factors; then, the standard quantile regression is applied to the GDP and financial and impulse-response or stress testing is conducted.

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1. One example is the Federal Reserve and JMCB (*Journal of Money, Credit, and Banking*) Conference on Financial Market and Monetary Policy held in June 2009, which emphasizes the linkage between financial market and macroeconomy and the implications for monetary policy.

An alternative approach is to focus on the microeconomic structure of the financial industry, while treating macroeconomy only as a background. The CoVaR measure (Adrian and Brunnermeier 2009) looks at the VaR of one portfolio conditional on the VaR of another portfolio, which focuses on the spillover effect from one bank's failure to the safety of another bank or the whole banking system. The "Shapley Value" decomposition approach (Tarashev, Borio, and Tsatsaronis 2009) constructed in the game theory used by Tarashev, Borio, and Tsatsaronis (2009) allocates the systemic risk to individual banks by defining the contribution of each bank as a weighted average of its add-on effect to each subsystem of that bank. Huang, Zhou, and Zhu (2010) consider bank's systemic importance as its marginal contribution to a hypothetical insurance premium of distress loss that a banking system may suffer. Such an intuitive method has advantages of being both subadditive, as opposed to the CoVaR measure, and simple to implement, as opposed to the Shapley value approach.

### **Advantages and Disadvantages**

For the impulse-response analysis in empirical macroeconomics, typically the shocks to factors are extracted through orthogonalization but without meaningful economic interpretations. This chapter uses economic theory implied sign restrictions to help identify whether the real or financial shocks are coming from supply side or demand side. A large class of general equilibrium monetary macroeconomic models can identify aggregate demand shock if both GDP and inflation responses are positive and identify aggregate supply shock if GDP response is positive, while inflation response is negative (Canova and De Nicolò, 2002). On the other hand, partial equilibrium banking models (see, e.g., Boyd, De Nicolò, and Loukoianova 2009) can identify credit demand shock from positive responses in both bank credit growth and lending rate change and identify credit supply shock from positive response of bank credit growth and negative response of lending rate change.

Such an identification scheme for shocks to the system generates meaningful empirical findings about systemic risk and stress testing. For example, a common misunderstanding of the 2007 to 2009 economic crisis is that it was caused by the credit crunch and de-leveraging, rather than the sharp declines in real activity since December 2007. With a rigorous identification scheme, this chapter finds that in the long run it is (always) the real shocks in final demand that ultimately determine the investment fluctuations, in association with the indirect credit demand channel. And bank credit growth slowdowns are primarily the results of the declines in aggregate real demand, not the other way around. It is the most important finding in the chapter, which also has implications for the financial-centric approach in systemic risk. For a

financial crisis to have enduring effect on the business cycle, the crisis must be originated from the real economy.

What is missing in such a macro-centric approach for systemic risk monitoring? One obvious problem is that by treating all the financial firms in one sector, the approach overlooks the interaction among large institutions, which is a main cause for this and previous financial crises. Also, by adopting the empirical macroeconomic VaR, the chapter cannot address the nonlinear feedback effect that is instrumental in spreading fear during the recent financial turmoil. Last, but not least, the macro-centric method cannot identify individual institutions that are deemed too-big-to-fail or systemically important.

### **Alternative Financial-Centric Approach**

An alternative approach to systemic risk is a micro-based financial-centric one, with attention to individual firms' asset correlations, leverage ratios, and liability sizes (Huang, Zhou, and Zhu 2009). Such a systemic risk indicator, a hypothetical insurance premium against catastrophic losses in a banking system, is constructed from real-time financial market data using the portfolio credit risk technique. The two key default risk factors, the probability of default (PD) of individual banks and the asset return correlations among banks, are estimated from credit default swap (CDS) spreads and equity price comovements, respectively. Together with the banks' liability sizes, these inputs effectively capture the three main ingredients missed by the macro-centric approach—interconnectedness, leverage, and too-big-to-fail—for large complex financial institutions.

For the purpose of macroprudential regulation, it is important not only to monitor the level of systemic risk, but also to understand the sources of risks in a financial system. One perspective is to decompose the credit risk of the portfolio into the risk contributions associated with individual sub-portfolios (either a bank or a group of banks). As demonstrated by Huang, Zhou, and Zhu (2010), the total risk can be usefully decomposed into a sum of marginal risk contributions. Each marginal risk contribution is the conditional expected loss from that subportfolio or a bank, conditional on a large loss for the full portfolio. It is important that the marginal contribution of each subgroup or bank adds up to the aggregate systemic risk. This additivity property is desirable from an operational perspective, because it allows the macroprudential regulation to be implemented at individual bank level.

Huang, Zhou, and Zhu (2010, figure 3) shows that such a systemic risk indicator for twenty-two Asia-Pacific banks was very low at the beginning of the global crisis. The indicator then moved up significantly, reaching the first peak when Bear Stearns was acquired by JP Morgan on March 16, 2008. Things changed dramatically in September 2008 with the failure of Lehman

Brothers. The distress insurance premium hiked up and hovered in the range of 150 and 200 basis points (or 50 to 70 billion USD). The situation did not improve until late March 2009. Since the G20 Summit in early April 2009, the distress insurance premium has come down quickly and returned to pre-Lehman levels in May 2009.

Huang, Zhou, and Zhu (2010, figure 8) further divide banks into six groups: Australian banks, Hong Kong banks, Indian banks, Korean banks, Singapore banks, and banks from Indonesia, Malaysia, and Thailand. In relative terms, the marginal contribution of each group of banks was quite stable before mid-2008. Australian banks were obviously the most important ones and contributed the most to the systemic vulnerability. However, since September 2008, the relative contribution of Australian banks decreased substantially, whereas banks from Hong Kong and Singapore became more important from a systemic perspective.

### Summary

To conclude, the macro-centric approach to financial systemic risk, as in De Nicolò and Lucchetta's chapter, among others, can help us better understand why the business cycle is ultimately driven by the shocks from the real side of the economy, especially in the long run. However, such an approach lacks attention to details—asset correlation, leverage ratio, and too-big-to-fail—for identifying individual institutions that are systemically important. A micro-centric approach, as in Huang, Zhou, and Zhu (2009, 2010), among others, captures these missing ingredients critical in systemic risk regulation and is potentially more operational in practice than a macro-centric approach.

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