

Chapter 4*

Measuring Systemic Risk

Overview

The most important lesson from the financial crisis of 2007-2009 has been that failures of some large financial institutions can impose costs on the entire system. We call these “systemically important” financial institutions. Their failures invariably put regulators in a compromised situation since, absent pre-arranged resolution plans, they are forced to rescue the failed institutions to preserve a functioning financial system. In the recent crisis, this has involved protecting, not just insured creditors, but sometimes uninsured creditors and even shareholders. The anticipation that these bailouts will occur compromises market discipline in good times, encouraging excessive leverage and risk-taking. This reinforces the systemic risk in the system. It is widely accepted that systemic risk needs to be contained by making it possible for these institutions to fail, thus restraining their incentives to take excessive risks in good times. First and foremost, however, regulators need to ascertain which institutions are, in fact, systemically important. Indeed, the systemic risk of an individual institution has not yet been measured or quantified by regulators in an organized manner, even though systemic risk has always been one of the justifications for our elaborate regulatory apparatus.

There are some institutions that follow highly cyclical activities and are thus heavily correlated with aggregate economic conditions. If these institutions are also highly levered, especially with short-term debt, then they face “runs” in the event of sufficiently adverse news about their condition. This makes them more prone to failure and liquidation. If their failure were unrelated to aggregate conditions, their liquidation would be straightforward, as there would be healthy players in the financial sector to acquire them or their assets. However, when institutions’ asset risk is correlated with that of the economy, they are likely to fail when the rest of the financial sector is under stress too, and their liquidation is difficult and potentially destabilizing for other players if fire-sale asset prices lead to externalities. In this case, systemic risk propagates through the effect of firm failures on asset prices. Many observers attribute the markdowns in prices of illiquid “toxic” assets during the crisis of 2007-2009 (at least partly) to several, highly levered financial firms having taken a one-way bet on the housing price in the economy – a bet that went bad and produced difficult funding conditions for much less levered financial institutions that were holding similar assets.

Interconnection among financial firms can also lead to systemic risk under crisis conditions. Financial institutions are interconnected in a variety of networks in bilateral and multilateral relations and contracts, as well as through markets. Under normal conditions, these interconnections are highly beneficial to the financial system and its constituents. For example, they can be used by financial institutions to diversify risk as well as to accumulate capital for specific functions. Under crisis conditions, this is not the case: First, these interconnections (including markets) may fail to function in their normal way, resulting in particular institutions’ facing excessive and unexpected risks. Second, many interconnections and commitments cannot be altered quickly and therefore, in a crisis, may transfer risk and losses across financial firms,

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resulting in cascading failures. Third, certain institutions are central to key financial networks, and their failure can result in widespread failures. These institutions may be "too large" (to fail) but may also be highly interconnected, although not particularly big.

The failures of Bear Stearns, Lehman Brothers and AIG all contributed to systemic risk in the form of uncertainty about which interconnections would transmit default risk. In the case of Bear Stearns, the risk was stemmed through government support. In the case of Lehman Brothers, the risk spread as losses on Lehman bonds caused the Reserve Primary Fund, a money market fund, to "break the buck," causing a run on it and several other money market funds. And in the case of AIG, its counterparty position was so large in terms of exposures of other potentially systemic institutions and municipalities, in the United States as well as in Europe, that it could not be allowed to fail.

Finally, while size by itself need not lead to systemic effects of failures, it may if large-scale liquidations are feared and lead to disruption of markets, interconnections, and the loss of intermediation functions that they might take months, or years, to rebuild. Cases in point are the Continental Illinois Bank's failure in 1984, the near collapse of Long-Term Capital Management in 1998, and that of Citigroup in the autumn of 2008. Of course, this brings with it the curse of "too-big-to-fail" expectations and the attendant moral hazard problems.

Current Proposals

The House Financial Services Committee in the United States has approved legislation that would establish tough new federal controls on "systemically important" financial firms. The House bill (H.R. 4173) considers a company as systemic if material financial distress at the company could pose a threat to financial stability or the economy; or the nature, scope, size, scale, concentration, and interconnectedness, or mix of the company's activities could pose a threat to financial stability or the economy. In particular, the bill recommends that the systemic risk regulators consider the following criteria: (1) the amount and nature of the company's financial assets; (2) the amount and nature of the company's liabilities, including the degree of reliance on short-term funding; (3) the extent of the company's leverage; (4) the extent and nature of the company's off-balance sheet exposures; (5) the extent and nature of the company's transactions and relationships with other financial companies; (6) the company's importance as a source of credit for households, businesses, and state and local governments and as a source of liquidity for the financial system; (7) the nature, scope and mix of the company's activities; and (8) the degree to which the company is already regulated by one or more federal financial regulatory agencies.

The Senate bill adds another criterion to the above list: (9) the operation of, or ownership interest in, any clearing, settlement or payment business of the company.

To the best of our knowledge, no specific list of systemic firms has yet been determined. We believe that based on the House and the Senate bills, even once a list is determined, it may not be disclosed publicly. Internationally, the Financial Stability Board, an international body of regulators and central bankers, based out of the Bank for International Settlements, has compiled a list of 30 global financial institutions; these firms are considered as "Systemic Risk

Institutions” for cross-border supervision exercises, such as drawing up living wills or recovery and resolution plans. This list includes six insurance companies and 24 banks from the United Kingdom, Continental Europe, North America, and Japan, even though the exact criteria employed have not been revealed.

Evaluation of Current Proposals

Our evaluation of these proposals is centered around four themes: individual criteria for determining systemic institutions versus employing market-based continuous measures of systemic risk; identification of those institutions that serve “public utility” functions inside a private enterprise; employing stress tests and aggregated risk exposure reports to measure interconnectedness and assess the risk of the system as a whole; and whether the list of systemic institutions should be made public.

- 1) While we do not disagree with the list of criteria suggested by the House bill, we do not recommend a pure reliance on classification based on rigid criteria. Suppose for example that banks are divided into systemic risk categories by size and suppose that resolution plans applied only to the top size category. Clearly, there would be tremendous advantage for banks that are near the lower threshold of the top size category to remain just below that size. Indeed, larger banks may simply break themselves up yet retain virtually identical models; the true systemic risk will not be reduced, even though it is now contained in many more, smaller institutions. The same regulatory arbitrage rule applies for coarse categorization based on leverage. A corollary of this argument is that a group of institutions that are individually small but collectively exposed to the same risk -- for example, money market funds -- could all experience runs when there is an aggregate crisis and high-quality issuers of commercial paper also get close to default. These should be considered as part of a potentially systemic risk pocket of the economy.

An alternative to coarse categorization of systemic risk is to employ market-based measures that are more continuously variable. In this case, we prefer using stock market data because it is least affected by bailout expectations. For instance, a simple measure called Marginal Expected Shortfall (MES) estimates, in a given past period (say one year), on the worst 5% days of the market or the financial sector index, the average stock return of a given financial firm. This average return is called its MES, and the more negative the MES, the more systemically risky is that financial firm. Academic research^{*} has shown that firms ranked by such a systemic risk measure, computed pre-crisis, were also ranked in terms of their realized losses during the crisis. It also shows that the MES of firms is also linked to their capitalization/leverage, but that certain types of institutions (securities dealers and brokers) appear inherently more systemically risky than others (depository institutions) each year. In principle, these measures can be estimated with greater sophistication that takes into account the pro-cyclicality of risk and the leverage of financial firms. Also, there are more sophisticated techniques available to measure the types of losses that might occur in rare events such as financial crises.

^{*} Acharya, Viral V, Lasse Pedersen, Thomas Philippon, and Matthew Richardson, 2009, “Measuring Systemic Risk,” Working Paper, New York University Stern School of Business.

Overall, we see the two approaches – relying on simple systemic risk criteria such as size, leverage and interconnectedness and relying on market-based estimates of systemic risk – as complementary. The first is more transparent and likely to flag obvious candidates; the second is a reality check based on market perceptions as to whether some candidates have been missed altogether under the obvious criteria or some obvious ones are less systemic than they seem at first blush. For instance, securities dealers and brokers show up as being most systemic in every single year since 1963, based on stock market data (MES), even though they have remained essentially unregulated. By contrast, AIG is a natural one-way insurance provider of large quantities that is not identified by stock market data as being significantly systemic until a year into the crisis. Also, while systemic risk categories can be “arbitraged” by market participants, market-based systemic risk measures are more difficult to evade when the firm’s true systemic risk has not diminished.

- 2) It is certainly useful to examine financial institutions that have a huge concentration in volume of one or more product areas. These firms are generally likely to be making markets in that product. Hence, we particularly endorse the Senate addition to the systemic risk criteria that firms operating or significantly owning public utility functions -- such as clearing (for instance, Bear Stearns for credit derivatives until its failure in March 2008 and JPMorgan Chase and Bank of New York for repurchase agreements) and payment and settlement (several large commercial banks that provide banking services to households and corporations) -- participate in the payments system and move reserves around in the economy. These entities are likely to be systemic in that their failures would impose significant counterparty risk and disruptions on other financial institutions. Hence, they should be deemed as systemic regardless of any other criteria. Indeed, our recommendation – discussed in Chapter 16 – is to move the public utility function out of private financial firms (for instance, as clearinghouses), to subject the public utility to sufficiently high capital standards, and thereby eliminate most of the systemic risk associated with performance of the function.
- 3) A key issue that arises in measuring systemic risk is that interconnections of financial institutions are somewhat opaque, and their precise nature may be entirely different in a stressed scenario than under normal conditions. For instance, counterparty exposures can reverse signs when conditions change. And deep out-of-the-money options, such as those sold by AIG to banks as synthetic insurance, can lead to defaults due to margin or collateral calls even before events being insured materialize. There is no simple answer to these questions, but two important steps can be taken:
 - a. First, in order to have any hope of assessing interconnectedness of a financial institution and its pivotal role in a network, detailed exposures to other institutions through derivative contracts and interbank liabilities is a must. This requires a legislation compelling reporting, such that all such connections are registered in a repository immediately after they are formed or when they are extinguished, along with information on the extent and form of collateralization and the risk of collateral calls when credit quality deteriorates. These reports could be aggregated by risk and maturity types to obtain an overall map of network connections.

Indeed, a key benefit of producing these risk reports and making them transparent is that they help address another risk *within* an institution – the so-called “operational risk” – which can also lead to systemic risk concerns if it brings down a sufficiently large and systemically important firm. Operational risk is typically attributed to deficiencies in corporate processes (a company's risk management systems), in its people (due to incompetence, fraud or unauthorized behavior), and in its technology (its information systems, quality of its data, its mathematical modeling, etc.). Risk management systems benefit considerably from information transparency (intra- as well as inter-company), while satisfying all corporate, regulatory and privacy constraints.

Within a company, there have to be rules for daily aggregation of positions that are reported to the higher levels in the company -- preferably in conjunction with matching aggregate information received from the more important counterparties in order to reduce probabilities of errors and fraud. At the corporate level, the net positions of the separate divisions of the company have to be compiled and analyzed (including dependencies and risk correlation analyses, etc.). It is thus beneficial if a top-down structure from risk reports required by the systemic risk regulator is in place, whereby minimum standards are imposed on individual firms to gather and aggregate such information on their own exposures. At regular time intervals, the aggregate information would be shared with the regulator and other counterparties.

- b. Second, in order to be able to project into infrequent future scenarios, such scenarios need to be modeled and considered in the first place. An attractive way of dealing with such projection is to conduct stress tests – along the lines of the Supervisory Capital Assessment Program (SCAP) exercise conducted by the Federal Reserve during February to May 2009. To report its objectives and findings, we quote from the report: ** “From the macroprudential perspective, the SCAP was a top-down analysis of the largest bank holding companies (BHCs), representing a majority of the U.S. banking system, with an explicit goal to facilitate aggregate lending. The SCAP applied a common, probabilistic scenario analysis for all participating BHCs and looked beyond the traditional accounting-based measures to determine the needed capital buffer. The macroprudential goal was to credibly reduce the probability of the tail outcome, but the analysis began at the microprudential level with detailed and idiosyncratic data on the risks and exposures of each participating BHC. This firm-specific, granular data allowed tailored analysis that led to differentiation and BHC-specific policy actions, e.g., a positive identified SCAP buffer for 10 BHCs and no need for a buffer for the remaining nine.”*

We recommend making such stress tests a regular part of the Federal Reserve toolkit to determine the risk of institutions in stressed systemic scenarios, as well as to assess the overall systemic risk of the financial sector in such scenarios. There has been valuable knowledge and experience developed in the exercise of SCAP 2009, and this

* See the Federal Reserve Bank of New York report on the SCAP exercise (Hirtle, Schuermann and Stiroh, 2009) at http://newyorkfed.org/research/staff_reports/sr409.html

could be built upon. The Federal Reserve should conduct stress tests at the request of the systemic regulator. Such assessments should be done more frequently in a crisis and may complement the firm's own test (as recommended by the Securities and Exchange Commission in SEC.1114.Stress Tests). Indeed, we find it comforting that the House bill calls for systemic institutions to be subject to quarterly or semi-annual stress tests.*

- 4) We recommend a fully transparent approach to systemic risk measurement and categorization. The primary objection to the public disclosure of systemically important institutions is that it implicitly confers too-big-to-fail or too-interconnected-to-fail guarantees on such institutions. The two issues must be separated. The problem of implicit guarantees is best resolved by the creation of a resolution authority and a process that limits the fallout from failure. The problem of transparency has to do with releasing valuable capitalization and counterparty exposure information that market participants can use to price more accurately risk in contracts with each other and to employ suitable risk controls. Indeed, all the evidence suggests that the information released by the SCAP exercise of 2009 on relative strengths and weaknesses of banks was perceived as welcome news in the marketplace. Furthermore, continuously varying market-based measures of systemic risk such as MES are easily computable by market participants, and they obviate for opacity.

* HR 4173. Sec. 1114