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Comment Mathias Drehmann

In response to the global financial crisis, many policymakers have called for supplementing microprudential regulation focusing on institution-specific

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risks with a macroprudential approach, taking account of system-wide interactions and externalities (e.g., G20 2009; FSF 2009). Broadly speaking, the macroprudential approach can be separated along two dimensions (see BIS 2009). First, there is a time dimension related to the procyclical nature of the financial system. Second, there is the cross-sectional dimension, as the failure of one institution may have severe ramifications for other participants in the system. Recent reforms by the Basel Committee (2010, 2011) address both dimensions by proposing countercyclical capital buffers and surcharges for globally systemically important banks. Yet many questions remain open.

The chapter by Acharya, Pedersen, Philippon and Richardson (henceforth APPR) provides a valuable contribution in this area, as it discusses several methods to determine potential regulatory surcharges to force banks to internalize the externalities of financial crises: regulatory stress tests, statistical-based measures of capital losses, pricing of contingent capital insurance, and market-based prices of insuring this risk. I will abstain from discussing each method separately.[1] Instead, I want to highlight that the authors take one particular perspective on what constitutes systemic risk and the systemic importance of individual banks. And as I will show, different perspectives can lead to materially different conclusions.

The Nature of Systemic Risk

The chapter begins by defining "that systemic risk emerges when the aggregate capitalization of the financial sector is low." Also, that the breakdown of intermediation in such a situation would lead to severe consequences to the real economy. While there is no universally agreed-upon definition of systemic risk, this definition shares important elements with most other definitions (Borio and Drehmann 2009). First, it focuses on the financial system as a whole, as opposed to individual institutions. Second, it does not consider the financial system in isolation, but thinks about welfare in terms of the real economy.

Ideally, systemic risk measurement would not only assess the aggregate capitalization of the financial sector, but it would also capture other important facets of systemic risk such as liquidity. In addition, the measurement approach would be broad enough to take into account other determinants such as substitutability or complexity, which have been identified to influence the systemic importance of banks (BCBS 2011). Operationally, though, such a broad scope is impossible to implement, unless simple indicators are used. However, an indicator approach clearly has its own drawbacks. The

1. Given current technologies it is highly unlikely that stress tests can be effectively used as a tool to measure a bank's systemic importance ahead of crisis (see Borio, Drehmann, and Tsatsaronis 2011).

focus on capital is therefore a useful first step, which I will also adopt for the remainder of my discussion.

Different Perspectives on Measuring the Systemic Importance of Banks

At the heart of the chapter is the idea that the regulatory system has to be changed to set incentives for financial firms to limit their contributions to systemic risk, or alternatively, to reduce their systemic importance. I fully support this, and the question—which is also the main question of the chapter—is how. But before engaging in this discussion, let me distinguish what I mean by systemic risk and systemic importance. Within the context of APPR, I would prefer to define the expected system-wide capital shortfall (conditional on crises) as a measure of system-wide risk, and each bank's expected capital shortfall (conditional on crises) as a bank-specific measure of systemic importance. This would also underline a nice feature of their approach, as their framework of the sum of bank-specific measures of systemic importance adds up to the level of overall system-wide risk.

APPR suggest a range of methods to calibrate capital surcharges. Nonetheless, the authors take one specific perspective of what constitutes systemic importance. Other perspectives are possible. For example, the Basel Committee (2011) associates a banks' systemic importance by its impact on the rest of the system, should it default. This system-wide "LGD" is then proxied by indicators. CoVar, as suggested by Adrian and Brunnermeier (2009), is another alternative.

As APPR, Drehmann and Tarashev (2011a) (henceforth DT 2011a) measure a bank's systemic importance as its share in the overall level of system-wide risk. They differ from APPR along two dimensions.

First, DT (2011a) measure system-wide risk differently. Drehmann and Tarashev (2011a) adopt the perspective of a macroprudential regulator, which measures system-wide risk by the expected credit losses that the banking system as a whole may impose on nonbanks in systemic events. These events, in turn, are characterized by aggregate losses exceeding a critical level; that is, financial crises in the language of APPR.

Second and more important, DT (2011a) explore two approaches, which decompose the same quantum of system-wide risk, but allocate it differently across individual institutions. This is illustrated in figures 5C.1 and 5C.2, taken from Drehmann and Tarashev (2011b).

The first approach is equivalent to the perspective taken by APPR, which starts by focusing on systemic events or, in the language of APPR, financial crises (shaded area in the left-hand panel of figure 5C.1). It then measures the systemic importance of a bank, say bank *i*, as the expected losses incurred by its nonbank creditors in these events. This approach equates systemic importance with the expected participation of individual banks in systemic events. Thus, DT (2011a) label it the participation approach

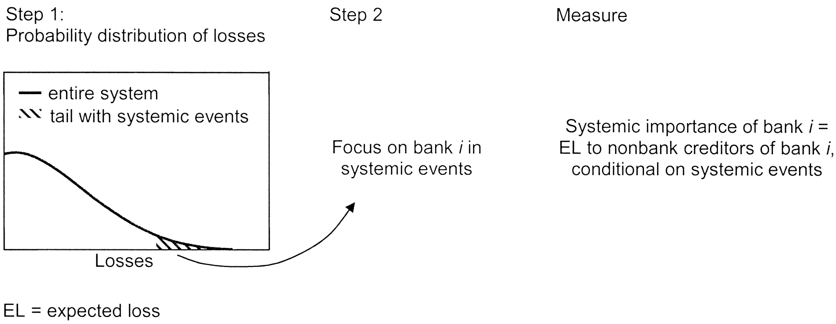

Fig. 5C.1 Participation approach (PA)

(PA). Economically, PA equals the actuarially fair premium that the bank would have to pay to a provider of insurance against losses it may incur in a systemic event.

Importantly, a bank's participation in systemic events is conceptually different from its contribution to system-wide risk. Consider, for example, a bank that is small in the sense that it can impose only small losses on its nonbank creditors. As this bank can participate little in systemic events, PA assigns only limited systemic importance to it. The same bank, however, might be highly interconnected in the interbank market and contribute materially to system-wide risk by transmitting distress from one bank to another. As PA is not designed to capture such transmission mechanisms, DT (2011a) propose an alternative: the contribution approach (CA). The

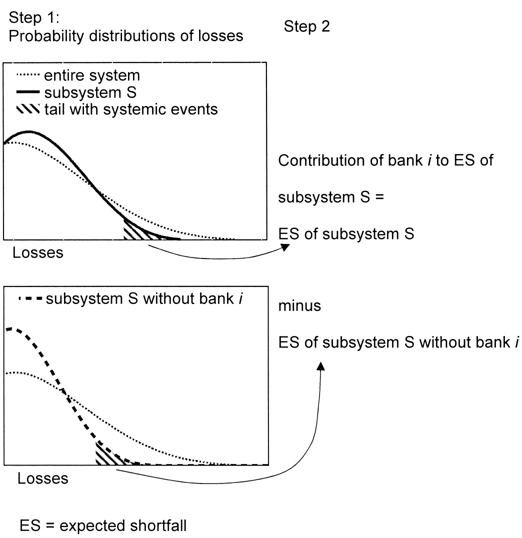

Fig. 5C.2 Contribution approach (CA)

CA accounts explicitly for the fact that a bank contributes to systemic risk through its exposure to exogenous shocks, by propagating shocks through the system, and by being itself vulnerable to propagated shocks.

Contribution approach is rooted in a methodology first proposed by Shapley (1953) for the allocation across individual players of the value created in a cooperative game. As a measure for systemic importance it was first suggested by Tarashev, Borio, and Tsatsaronis (2010) and extended by DT (2011a) to allow for interbank markets.[2] Details are discussed in these papers but the intuition behind this methodology is quite simple. One could use the level of risk an individual bank generates in isolation as a measure of systemic importance. But such an approach would miss the contribution of each bank to the risk of others. Similarly, it is not enough to consider only the marginal-risk contribution of a single bank, calculated as the difference between the system-wide risk with and without the bank. The reason is that this calculation ignores the complexity of bilateral relationships, which is especially pronounced when interbank exposures can propagate shocks within the system through a potentially long chain of market participants. The Shapley methodology accounts fully for such interactions by ascribing to individual institutions a weighted average of the marginal contributions each makes to the risk in each possible subsystem. The derivation of such a marginal contribution for a given subsystem *S* is illustrated in figure 5C.2.

Analyzing a system of twenty large globally active banks, DT (2011a) show that the participation and contribution approach can disagree substantially about the systemic importance of a particular bank. This can affect not only the level but also the rank-ordering of the systemic importance of banks in a system.

The differences between PA and CA can be most easily explained with a stylized system of five banks, shown in figure 5C.3. Four banks are typical in that they borrow to and lend from nonbanks. DT (2011a) label them periphery banks (PB) as they only engage in one-sided interbank transaction: two of these banks are interbank lenders and the other two are interbank borrowers. The fifth bank is a central counterparty, which only intermediates between these four banks and does not engage with nonbank customers. The balance sheets and the measures of systemic importance under PA and CA are shown in table 5C.1.[3]

Intuitively, the central counterparty should be systemically important as contagion can only spread via this bank. However, the perspective taken by

2. The contribution approach in a setting with interbank markets has also been studied by Gauthier, Lehar, and Souissi (2010) and Liu and Staum (2010).

3. The technical derivation of the measures is discussed in detail by DT (2011a). It is based on a simulation procedure that starts by drawing a set of correlated exogenous shocks, which determines which banks experience fundamental defaults. If there is a fundamental default, the ensuing contagion defaults are derived via the "clearing algorithm" of Eisenberg and Noe (2001). To construct a probability distribution of these losses, one million sets of exogenous shocks are drawn.

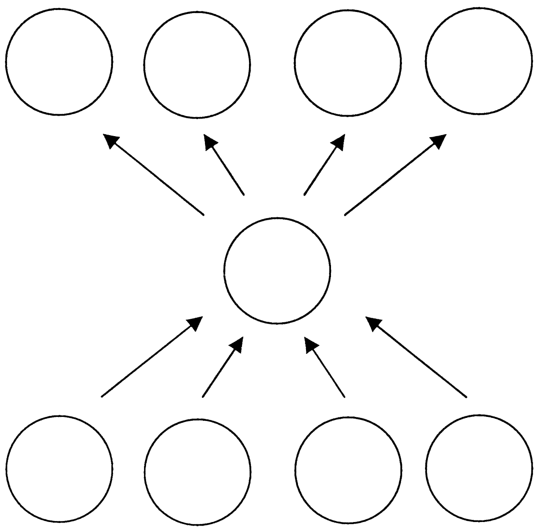

Fig. 5C.3 The hypothetical interbank system

APPR—the participation approach PA—assigns it *zero* systemic importance (last column of table 5C.1). The reason for this is twofold. First, the central counterparty does not lend to nonbanks, therefore it can only default because of counterparty credit risk in the interbank market. Second, since it does not borrow from nonbanks, the expected loss of nonbank creditors conditional on a crisis is zero. Thus, by design it can *never participate* in systemic events. That said, this bank creates indirect links between lending and borrowing periphery banks, thereby *contributing* to system-wide risk, which the contribution approach CA captures correctly.

The difference in the measured systemic importance of the peripheral interbank lenders and borrowers (last two rows in table 5C.1) between the two approaches also reflects fundamental factors. To understand why, consider an interbank transaction without a central counterparty, which the interbank lender funds by nonbank deposits and the interbank borrower uses to buy assets. Assume also that this interbank link leads to contagion from the borrower to the lender in some systemic events. Thus, the link raises the expected participation of the lending bank in systemic events but leaves the participation of the borrowing bank unchanged. And since participation in systemic events is all that matters to PA, this approach attributes the entire risk associated with this interbank link to the interbank lender. By contrast, a key property of the Shapley value is that risk is split equally between the two counterparties. In this way, CA captures the idea that an interconnected bank can contribute to system-wide risk through two channels: by directly imposing losses on its own nonbank creditors, and by indirectly imposing losses on the nonbank creditors of banks from which it has borrowed.

Table 5C.1 Differences in measure of systemic importance

	Balance sheets[a]				Measures of systemic importance[b]	
	EQ	NBL	IBL	IBA	**CA**	**PA**
Central counterparty	3	0	32	32	**0.22**	**0**
PB lender	5	87	0	8	**0.58**	**0.70**
PB borrower	5	87	8	0	**0.58**	**0.52**

[a]PB: periphery bank; EQ: equity; NBL: nonbank liabilities (= size); IBL: interbank liabilities; IBA: interbank assets. There are two PB lenders and two PB borrowers in the system. To satisfy the balance sheet identity, we assume that the central counterparty invests three units in a risk-free asset.

[b]All values are in percent. The PA and CA values are expressed per unit of system size. All other values pertain to a bank in the particular group. The f.PD and c.PD are fundamental and contagion PDs, respectively. For further details see Drehmann and Tarashev (2011a).

Since PA and CA are valid alternative measures of systemic importance but provide materially different results, it is essential that users have a clear understanding of which measure is designed to address which question. If the goal is to design a scheme for insuring against losses in systemic events, then the participation approach provides the natural measure. And this is what APPR propose to do, most clearly with their third and fourth measure. Yet, the authors argue repeatedly that "the idea of systemic risk surcharges is that they provide incentives for the financial firm to limit its *contributions* to systemic risk" (my emphasis). If this is the case, however, the contribution approach should be used.

Measuring Systemic Risk with Market Prices

With the exception of stress tests, the authors rely on markets either directly, to price systemic risk, or indirectly, as market data are used to derive the measures. For listed banks, data availability is therefore not an issue. Computationally, the calculations are also relatively straightforward. Together, this makes the implementation very simple.[4] Yet, it puts the onus on markets to price systemic risk correctly.

It is more than doubtful that markets can be effective in pricing systemic risk because of what we call the "paradox of financial instability" (Borio and Drehmann 2009): the system looks strongest precisely when it is most vulnerable. Credit growth and asset prices are unusually strong, leverage mea-

4. The approach by Tarashev, Borio, and Tsatsaronis (2010) or DT (2011a) is computationally more cumbersome as it involves the derivation of expected shortfall of all 2^N subgroups in a system of N banks.

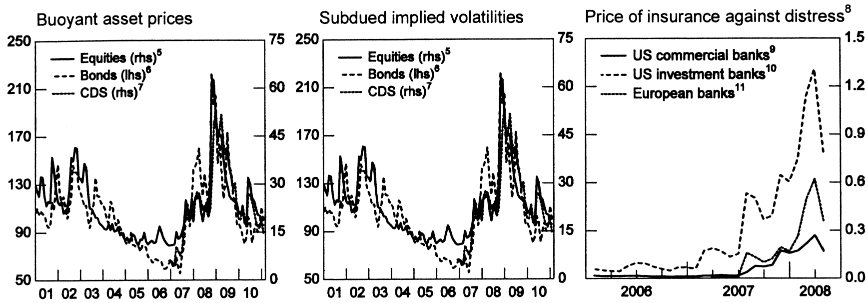

Fig. 5C.4 Footprints of the paradox of financial instability, the US example

Source: Drehmann, Borio, and Tsatsaronis (2011).

Notes:

[1]End 2001 = 100.

[2]S&P 500.

[3]S&P Case Shiller index, twenty cities.

[4]Five-year on-the-run CDX.NA.HY 100 spread, in basis points.

[5]VIX index (implied volatility on S&P 500).

[6]MOVE index (implied volatility on treasury options).

[7]Implied volatility on the five-year-on-the-run CDX.NA.HY 100 spread.

[8]In percent, based on CDS spreads. Risk neutral expectation of credit losses that equal or exceed 15 percent of the corresponding segments' combined liabilities in 2006 (per unit of exposure to these liabilities); risk neutral expectations comprise expectations of actual losses and attitudes toward risk. Taken from Tarashev and Zhu (2008).

[9]Ten banks headquartered in the United States.

[10]Eight banks headquartered in the United States.

[11]Sixteen universal banks headquartered in Europe.

sured at market prices is artificially low, profits and asset quality are especially healthy, and risk premia and volatilities are unusually low precisely when risk is highest. What looks like low risk is, in fact, a sign of aggressive risk taking. Figure 5C.4 illustrates this point based on the behavior of market prices during the run-up to the crisis in the United States (left-hand and center panels). This perverse behavior infects more formal measures of systemic risks that use market prices, including correlations. This is also the case for implied price of insurance against systemic event (right-hand side panel), which is a measure of system-wide risk very much along the lines of APPR (see Tarashev and Zhu 2008). Clearly, these measures were unusually subdued ahead of the crisis and showed signs of trouble only once overt financial market stress emerged in mid-2007.

The authors are aware of this problem. Their measures, for example, decline in the run-up to the crisis (e.g., table 5.3 in APPR). They argue that more sophisticated methods using long-run volatilities can partly address this issue. Given the behavior of credit default swap (CDS) spreads (left-hand panel, figure 5C.4), which should focus on downside risks in the future, I am skeptical that this will truly help.

Nonetheless, there is value in these measures as they seem to be successful in identifying systemically important firms, as judged, for example, by out-of-sample tests for the recent crisis. This is clearly useful information for policymakers and practitioners. Given the state of the literature, more generally, it seems most prudent anyhow to analyze a diverse range of tools to measure systemic risk and systemic importance such as simulation models, network approaches, general equilibrium models, simple indicators, and the like.[5] The method proposed in this chapter could be one of these tools and the conference as a whole could be a good starting point to explore potential avenues.

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5. Besides the chapters in this conference volume, Borio and Drehmann (2009) provide a recent survey about different approaches to measure financial instability.

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