INTERNATIONAL MONETARY FUND
BANK FOR INTERNATIONAL SETTLEMENTS
FINANCIAL STABILITY BOARD

Report to G20 Finance Ministers and Governors

Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations

The attached report and background paper respond to a request made by the G20 Leaders in April 2009 to develop guidance for national authorities to assess the systemic importance of financial institutions, markets and instruments. The report outlines conceptual and analytical approaches to the assessment of systemic importance and discusses a possible form for general guidelines.

The report recognizes that current knowledge and concerns about moral hazard limit the extent to which very precise guidance can be developed. Assessments of systemic importance will necessarily involve a high degree of judgment, they will likely be time-varying and state-dependent, and they will reflect the purpose of the assessment. The report does not pre-judge the policy actions to which such assessments could be an input.

The report suggests that the guidelines could take the form of high level principles that would be sufficiently flexible to apply to a broad range of countries and circumstances, and it outlines the possible coverage of such guidelines. A set of such high level principles appropriate for a variety of policy uses could be developed, further, by the IMF, BIS and FSB, taking account of experience with the application of the conceptual and analytical approaches described here.

There are a number of policy issues where an assessment of systemic importance would be useful. One critical issue is the ongoing work to reduce the moral hazard posed by systemically important institutions. The FSB and the international standard setters are developing measures that can be taken to reduce the systemic risks these institutions pose, and the attached papers will provide a useful conceptual and analytical framework to inform policy discussions. A second area is the work to address information gaps that were exposed by the recent crisis (the subject of a separate report to the G20 from IMF staff and the FSB Secretariat), where assessments of systemic importance can help to inform data collection needs. A third area is in helping to identify sources of financial sector risk that could have serious macroeconomic consequences. We will keep you informed on our respective future policy work in these important areas.

Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations

Report to the G-20 Finance Ministers and Central Bank Governors

Prepared by:
Staff of the International Monetary Fund and the Bank for International Settlements, and the Secretariat of the Financial Stability Board
October 2009

Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations

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October 28, 2009

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EXECUTIVE SUMMARY

This paper responds to the request of the G-20 leaders for guidelines on how national authorities can assess the systemic importance of financial institutions, markets, or instruments. Reflecting the current state of analysis and country practices, the paper outlines conceptual and analytical approaches to the assessment of systemic importance and discusses a possible form for general guidelines. The assessments would involve a high degree of judgment, and the guidelines should be sufficiently flexible to apply to a broad range of countries and circumstances. More detailed guidelines could be developed as the state of knowledge in this field evolves and deepens.

The paper defines systemic risk as a risk of disruption to financial services that is (i) caused by an impairment of all or parts of the financial system and (ii) has the potential to have serious negative consequences for the real economy. Fundamental to the definition is the notion of negative externalities from a disruption or failure in a financial institution, market or instrument. All types of financial intermediaries, markets and infrastructure can potentially be systemically important to some degree.

The assessment of systemic importance will be conditioned by a number of considerations. The assessment is likely to be time-varying depending on the economic environment. It will also be conditioned by the financial infrastructure and crisis management arrangements, and their capacity to deal with failures when they occur. Institutions may be systemically important for local, national or international financial systems and economies.

The nature of the assessment will also be conditioned by its purpose—whether it will be used for example, to define the regulatory perimeter, for calibrating prudential tools including the intensity of oversight, or to guide decisions in a crisis. The paper is written primarily from the perspective of assessing systemic importance in normal times for the purpose of mitigating the exposure of the system to the risk of failure of systemic components and enhancing the financial system's resilience to shocks. The paper does not pre-judge the nature of the policy actions that could follow from the assessments.

Three key criteria that are helpful in identifying the systemic importance of markets and institutions are: *size* (the volume of financial services provided by the individual component of the financial system), ***substitutability*** (the extent to which other components of the system can provide the same services in the event of a failure) and ***interconnectedness*** (linkages with other components of the system).

- **For institutions**, the size of exposures, volumes of transactions or assets managed are indicative of the extent to which clients and counterparties could be disrupted. Clusters of institutions can be individually small but collectively significant because they fall into distress at the same time. Some institutions, for example those providing key services such as clearing and settlement, lack immediate substitutes for this role. Interconnectedness captures situations when distress in one institution raises the likelihood of distress in others.

- **For markets,** assessing systemic importance presents more conceptual challenges. The systemic importance of a market derives to an extent from that of the institutions that participate in it. However, the size of a market is a determinant of potential economic costs in case of malfunction. If the function of a stressed market cannot be replicated by other mechanisms, the economic impact can be significant. Interconnectedness refers to markets' interdependence on each other as well as on institutions.

An assessment based on these three criteria should be complemented with reference to financial vulnerabilities and the capacity of the institutional framework to deal with financial failures. Indicators of financial vulnerabilities include**:** leverage, liquidity risks, maturity mismatches, and complexity, including the group structures and business models of large institutions. Key elements of the institutional framework include clearing and settlement systems, and the arrangements for handling institutional and market failures should they occur.

Assessments will require a detailed knowledge of the functioning of the financial system and will be graduated involving a high degree of judgment. While some components of the financial system may consistently be assessed as highly systemic, the significance of others may fluctuate over time. The framework cannot be seen as a precise quantitative instrument, and assessments of systemic importance are likely to be judgment-based and not binary in nature.

A range of quantitative tools can be used as inputs to the assessments. Indicator based approaches are relatively simple and often effective in assessing systemic relevance. A number of more sophisticated methodologies (for example, network analysis, portfolio models of risk based on market data, stress testing and scenario analysis) can also be useful tools. Implementation of quantitative methodologies is limited in some cases by availability of data. In addition, assessments conducted in normal times using market data may have limited usefulness in crisis times because of shifts in market sentiment.

Enhancements in data availability will likely need to accompany the increased attention to identifying systemically important entities. The areas for attention include information on bilateral cross-border exposures among financial institutions, and flow of funds data that would include entities that are outside the regulatory perimeter.

Guidelines could codify the fundamental tenets pertaining to the assessment of systemic importance and promote consistent implementation across countries. These could take the form of high-level principles consistent with the general approach, and could cover issues such as national frameworks for assessing systemic risk, frequency of assessment, use of information and the methodologies outlined in this paper, communication of results and cross-border cooperation. The G20 request did not specify the form of the guidelines or how enforceable they though they should be. If the guidelines were to be applied in a formal manner, once experience is gained, consideration could be given to eventually integrating them into existing sectoral standards or developing a new international standard and related assessment methodology.

I. INTRODUCTION

1. **This paper responds to a call by the G-20 "on the IMF and the FSB to produce guidelines for national authorities to assess whether a financial institution, a market, or an instrument is systemically important."**[1] The G-20 Working Group 1 similarly asked "the IMF, in consultation with the BIS, FSB and other bodies, to jointly develop a common international framework and guidelines" in this area. This request was in response to the unprecedented reach of the financial crisis that began in August 2007 and the growing awareness that the macroprudential orientation of financial stability policy would need to be strengthened. The guidelines are to be prepared by the next meeting of Finance Ministers and Central Bank Governors, scheduled for November 7–8, 2009.

2. **In issuing this call, the G-20 emphasized several points.** First, the objective of the guidelines would be to help mitigate systemic risk by ensuring that all systemically important institutions, markets and instruments are subject to an appropriate degree of oversight and regulation. Second, guidelines were to prevent regulatory arbitrage, and should therefore focus on what institutions do rather than their legal form. These guidelines can potentially be relevant for (i) defining the perimeter for regulation; (ii) defining the scope and intensity of regulation and supervision applied to different institutions and markets; and (iii) the design and operation of policy responses in the event of a financial crisis. Detailed discussion of these potential uses is, however, beyond the scope of the present paper.

3. **The current state of analysis limits the extent to which very precise guidance can be developed.** The paper therefore outlines conceptual and analytical approaches to the assessment of systemic importance, and discusses a possible form for general guidelines. The latter would be structured as high level principles rather than detailed quantitative guidelines. There are several reasons for this:

- Responses to a survey of FSB members undertaken in April–July 2009 indicate that approaches vary quite widely. Moreover, the application of specific methodologies is constrained by data availability and has not advanced to a stage that could lead to a set of best practice quantitative methodologies.[2]

- Assessment of systemic importance involves a major element of state dependency and time-variability. A high degree of judgment and flexibility to reflect national and conjunctural circumstances will inevitably be involved in the assessments. While

[1] See the "Declaration on Strengthening the Financial System," *Global plan for recovery and reform: the Communiqué from the London Summit*, April 2, 2009 (http://www.londonsummit.gov.uk/en/summit-aims/summit-communique/).

[2] This survey was sent to central banks of FSB members and a few other countries, and was also sent to the Basel Committee, IAIS, and IOSCO for distribution to their members. See the Background Paper, Chapter 1 for a summary of responses.

quantitative approaches can provide useful inputs to the assessment, they cannot substitute for qualitative analysis.

- Developing (and communicating) assessment criteria that are too specific may raise moral hazard by creating incentives for firms to game the system, and weaken its usefulness in mitigating systemic risk.

- The choice of assessment methodologies is not independent of their possible policy uses (as outlined in paragraph 2). The paper is written primarily from the perspective of assessing systemic importance in normal times for the purpose of calibrating instruments that would mitigate systemic risk and enhance the financial system's resilience to shocks. The paper does not prejudge the nature of the policy actions which could vary by the type of institutions and form of the systemic risks. The techniques may be different when the assessments are conducted in crisis times.

4. **The paper is outlined as follows.** Section II discusses the definition of systemic importance. Section III examines the approaches to identifying whether institutions, markets or instruments are systemically important; and Section IV discusses the nature of possible guidance, its coverage and possible uses. [3]

II. DEFINITION

5. **Establishing what constitutes systemic importance has proved difficult, and most G - 20 members do not have a formal definition.** Nonetheless, in practice G-20 members consider an institution, market or instrument as systemic if its failure or malfunction causes widespread distress, either as a direct impact or as a trigger for broader contagion. The interpretation, however, is nuanced in that some authorities focus on the impact on the *financial system*, while others consider the ultimate impact on the *real economy* as key.

6. **The survey illustrated that country authorities recognize the state dependence of systemic importance.** In particular, while some entities may be of high systemic importance at all times, during periods of extreme turbulence the systemic importance of a larger set of entities is likely to increase , often because their problems may lead to widespread re-assessment of the robustness of other entities. As a result, drawing bright lines between systemic and non-systemic components runs the risk of overlooking sources of systemic threats.

7. **Against this background, this paper defines systemic event broadly.** In particular, it is the disruption to the flow of financial services that is (i) caused by an impairment of all or parts

[3] The main contributors to this paper are Li Lian Ong, Liliana Schumacher, Amitabh Arora, Marco Espinosa, Brenda Gonzalez-Hermosillo, Mangal Goswami, Erlend Nier, Andre Santos, Ian Tower, Nai Seng Wong, and Karim Youssef under the direction of R. Barry Johnston (all IMF/MCM); Kostas Tsatsaronis and Nikola Tarashev (BIS) and Marina Moretti (FSB).

of the financial system; and (ii) has the potential to have serious negative consequences for the real economy.

- Fundamental to the definition is the notion that systemic events are associated with ***negative externalities*** Every financial institution's incentive is to manage its own risk/return trade-off but not necessarily the implications of its risk taking for the operation of the financial system as a whole. While this behavior is common to all financial institutions, some have specific features that imply that failure would cause a significant disruption to the rest of the financial system and to the real economy. These features determine the systemic importance of individual institutions.

- ***An impairment or disruption to the flow of financial services*** would include situations where certain financial services are temporarily unavailable, as well as situations where the cost of obtaining the financial services is sharply increased. It would include disruptions due to shocks originating outside the financial system that impact on it, as well as shocks originating from within the financial system. A systemic event should be contrasted with more general wealth effects that may have severe macroeconomic consequences but are not associated with the impairment of the financial system.[4]

- The definition requires ***significant spillovers to the real economy,*** without which an impairment of financial services would not be considered systemic. The real economy impact could be either through an effect on supply or through an effect on demand for other goods and services, and could materialize over an extended period of time.

8. **The definition stresses the critical importance of the continued provision of financial services by the financial system, which includes**:

- ***Financial institutions,*** which perform critical functions in financial markets, including credit intermediation, maturity transformation, the provision of savings vehicles, risk management and payments services, and the support of primary and secondary funding market functioning.

- ***Financial markets and instruments,*** which represent another key channel of funding from savers to investors, a source of liquidity, and support the management and pricing of risk. These services are underpinned by financial infrastructure in the form of the clearing and settlement of financial transactions, as well as the trading, pricing and liquidity of financial instruments.

[4] For example, a collapse in an asset price can affect net worth, expenditure and the real economy but would not constitute a systemic event by this definition unless it disrupted the provision of some financial service. If a fall in asset prices weakens the balance sheets of financial institutions, which might in turn reduce the amount of credit provided to the real economy, this would be an important systemic event.

This implies that, in principle, all types of financial intermediaries or markets can potentially be systemically important. Moreover, it suggests that the degree of their importance can depend on the economic and financial environment and be time-varying (see next section).

III. Assessing the Systemic Importance of Institutions, Markets and Instruments

A. Assessment Issues

9. **The assessment of systemic importance will be conditioned by a number of considerations:**

- ***Assessing the systemic importance of an institution, a market or an instrument does not lend itself to binary outcomes.*** While some components of the financial system may rank consistently be assessed as highly systemic, the significance of others may differ depending on a number of factors including the state of the overall economy (see below). An assessment will therefore need to be graduated and take into account their potential systemic impact. This is likely to involve scoring along a range of potential outcomes. Drawing any sharp distinction between systemic and non-systemic components will require the exercise of considerable judgment on where to draw the line.

- ***The characterization of systemic importance is partly "endogenous" as it will depend on the structure of the financial system and the rules of the game.*** The systemic impact of a malfunction of one component may depend critically on the functioning of other elements, such as the robustness of markets and market infrastructure, and the institutional framework for crisis management and handling of failures when they occur. For example, robust crisis resolution frameworks and clearing and settlement systems can mitigate the potential externalities on the rest of the financial system due to failures in institutions and markets. The presence (absence) of such elements may act as potential mitigants (amplifiers) of the systemic importance of institutions, markets or instruments in the financial system.

- ***The assessment is likely to be time-varying depending on the economic environment.*** Systemic importance will depend significantly on the specifics of the economic environment at the time of assessment. Structural trends and the cyclical factors will influence the outcome of the assessment. For instance, under weak economic conditions there is a higher probability that losses will be correlated and failures in even relatively unimportant elements of the financial sector could become triggers for more general losses of confidence. A loss of confidence is often associated with uncertainty of asset values, and can manifest in a contagious "run" on short-run liabilities of financial institutions, or more generally, in a loss of funding for key components of the system. The dependence of the assessment on the specific economic and financial environment has implications about the frequency with which such assessments should take place, with the need for more frequent assessments to take account of new information when

financial systems are under stress or where material changes in the environment or the business and risk profile of the individual component have taken place.

- ***The nature of the assessment may be conditioned by its purpose.*** The assessment methodology and criteria may differ depending on whether the outcome would be used primarily for the purpose of defining the regulatory perimeter, of calibrating the intensity of oversight or of guiding decisions during a crisis. Assessments intended to define the regulatory perimeter will cover entities that may not normally report information, and thus may require innovative approaches to data collection. Further, if the purpose of the assessment is linked to stricter regulations, firms may structure and manage themselves in ways to avoid the criteria; if linked to support operations firms may try to meet the criteria, aggravating moral hazard. Assessments of systemic importance using real-time market information could be of high value for decisions on interventions to prevent systemic failures during crisis times. However, such analysis may yield little information on potential inter-dependencies in normal times.

- ***The nature of the assessment may be conditioned by its geographical context.*** Institutions may be systemically important for the local, national or international financial systems and economies or just for one of them. While the principles adopted in this paper can be applied to all levels, the actual implementation will vary. For institutions that are systemically important at an international level, the assessment may require coordination mechanisms among domestic authorities and a role for international bodies. Arrangements for international cooperation are discussed in Section IV.

10. **A high degree of judgment founded in a detailed knowledge of the functioning of the financial system will thus be required in any assessment**. Authorities will need to draw on an intimate knowledge of their financial system as part of the assessment, and judgment of systemic importance cannot be based simply on quantitative indicators/methods. Qualitative analysis will require a system-wide approach, similar to that used in the preparation of financial stability analysis as part of national financial stability reports or FSAP assessments.

B. Assessment Criteria

11. **The main criteria for assessing systemic importance relates to their potential to have a large negative impact on the financial system and the real economy.** The criteria should take into account both direct and indirect channels.

12. **Typically, the magnitude of the direct impact relates to size and the degree of substitutability, while the magnitude of the indirect impact depends on the strength of interconnectedness.** The criteria apply to both markets and institutions. Size and

interconnectedness are the most frequently cited criteria in the responses to the survey, and the importance of these criteria is also illustrated by the experiences with the recent financial crisis.[5]

- ***Size:*** The importance of a single component for the working of the financial system generally increases with the amount of financial services that the component provides.

- ***Lack of substitutability:*** The systemic importance of a single component increases in cases where it is difficult for other components of the system to provide the same or similar services in the event of a failure.

- ***Interconnectedness:*** Systemic risk can arise through direct and indirect interlinkages between the components of the financial system so that individual failure or malfunction has repercussions around the financial system, leading to a reduction in the aggregate amount of services.

The three criteria provide a useful analytical device to structure the assessment of systemic importance, but their relevance is often greatest when they are combined in different ways.

Institutions

13. **The link between the size of an institution and the systemic impact that its distress or failure will bring about is generally accepted as a key factor in the assessment of its systemic importance**. The size of the balance sheet and off-balance sheet exposures of the institution, the volume of transactions it engages in and processes, the volume of assets it warehouses or manages are all indicative of the extent to which its clients will be starved of funds, its business with other institutions will be disrupted and the magnitude of losses its counterparties may face. While size can be important in itself, it is much more significant when there are connections to other institutions. The relevance of size will also depend on the particular business model and group structure, and size may be of greater systemic concern when institutions are complex (see below).[6] A more subtle aspect of size has to do with clusters of institutions that can be individually small but collectively significant because they tend to fall into distress at the same point in time or have similar behavioral responses to a given shock. This can happen if the institutions are exposed to common risk factors (for instance through similar business models or exposure to correlated assets or liabilities). Hence, strong commonality can, in some cases, have a similar effect to large size from a systemic point of view.

14. **Some institutions lack immediate substitutes for the key role they play in the economy.** They are systemically important not so much because other institutions are financially exposed to them but because other financial market participants rely on them for the continued

[5] See Background Paper, Chapters 1 and 2.

[6] It has been noted, for example, that well capitalized large institutions with simpler business models and exposures can be a source of stability in times of stress.

provision of key specialized services. This would describe, for instance, institutions charged with providing systemically important infrastructure services, such as clearing, payment and settlement of trades, or custodial services. Limited substitutability is likely to be much more of a concern when the services provided are large in volume, or where they provide a key link in connections among financial institutions. The criterion can also apply to groups of institutions that perform a specialized function.

15. **Interconnectedness captures situations when financial distress in one institution materially raises the likelihood of financial distress in other institutions because of the network of contractual relations in which the institution operates**. This chain effect operates on both sides of the balance sheet, i.e., there are inter-connections on the funding side as well as on the provision of funds. The larger the number of links (the larger the number of creditors and clients), the higher potential to cause spillovers onto either clients and/or creditors. In addition, the larger the size of the individual exposures (the "thickness" of the links), the greater the potential that these effects will be magnified. Moreover, the complexity of the connections within a network, as well as confidence factors when a core element of the system comes under stress, can add to the uncertainty of participants in situations of stress, further increasing the risk that distress may take systemic proportions.

Markets and Instruments

16. **The assessment of systemic importance of markets presents more conceptual challenges than for institutions**. The reason being that the market is a more abstract notion that lacks precise delineation. A market is the combination of traded instruments, transacting counterparties (market participants) and the trading infrastructure that includes rules, conventions, settlement processes and information. By consequence, the systemic importance of a market derives to a certain extent from the systemic importance of the institutions that participate and use this market.

17. **The link between size and systemic importance in the case of markets is analogous to that in the case for institutions**. The size of activity in a market, measured either by the volume of transactions or by the number of participants, is a key determinant of the potential economic costs in the case of malfunction. The transactions volume metric is a proxy of aggregate (gross) exposures of participants in this market while the number of participants points to the number of institutions that will be affected.

18. **If the economic function of a stressed market cannot be easily replicated by other means the effect on the economy at large can be very significant independently of the size of the market**. Network effects and economies of scale may concentrate trading of a specific security in a particular market, which when disrupted becomes the source of systemic distress. The existence of substitutes can be examined with respect to the different functions that markets perform: provide a platform for raising funds by private and public sector borrowers, provide facilities for trading securities and for taking positions or hedging, and enhance the liquidity of portfolios. Typically the lack of alternative channels for trading a particular type of security or

risk will exacerbate the problem caused by disruptions in a large market. In other words, lack of substitutes or alternatives enhances the importance of size.

19. **Interconnectedness in the context of markets and instruments refers to the degree of interdependence that they have with each other and institutions**. For instance, derivatives markets depend on the smooth functioning of the corresponding markets in cash instruments. Institutions depend on markets for funding, for trading securities in adjusting their portfolios, for risk management and hedging, as well as for accessing liquidity. Conversely, markets depend on institutions' capital base for the underwriting of new securities and the provision of market-making services (liquidity). Interconnectedness increases when markets effectively lengthen the intermediation chain and when they channel risk on systemically important institutions. Another manifestation of interconnection is from the key role that money, government bond and, in some cases, foreign exchange markets play in the operation and transmission of monetary policy.

Contributing Factors

20. **An assessment based on the above main criteria can be supported by a number of other contributing factors.** Given the generality of the criteria and the dependence of their assessment on the economic environment a number of contributing factors can provide input to the evaluation of systemic importance. These often relate to financial vulnerabilities at the level of the specific institution or across institutions at a given juncture. The argument for considering such vulnerability measures as contributing factors is to help ensure that components of the system that pose a greater risk (i.e., those that are not only important but they are also more vulnerable) would be subject to appropriate oversight. The complementary indicators mentioned most often in the survey responses are leverage, liquidity and maturity mismatches, and complexity. These are discussed in some detail in Box 1.

21. **In addition, the assessment should be complemented with a review of the robustness of the existing institutional framework to deal with system-wide risk.** As regards markets, key structural characteristics such as the nature of involved exposures, the settlement and clearing arrangements and the overall technical infrastructure supporting the transactions would be a consideration. The potential systemic impact from failure is reduced the more robust these arrangements and the more successful they are in reducing bilateral risk. As regards institutions, the effectiveness of the crisis management framework in resolving failing institutions and transferring their activities quickly to other entities would be an important consideration in assessing the potential systemic impact of a failure.

A Possible Practical Qualitative Framework

22. **From an operational point of view a qualitative framework could be used to integrate the different components of the assessment and help arrive at judgments of systemic importance.** The discussion above presents three possible assessment criteria that can be used to structure the analysis. An ordinal scoring could be used to rank how an institution or market compares with others along each of these three dimensions while maintaining the

qualitative nature of the overall exercise. The ordinal scores could be complemented with an analysis of the contributing risk and institutional factors. An example of a possible such framework is discussed in Box 2.

23. **The framework can provide guidance but it is not a precise quantitative instrument and final decisions on systemic importance are likely to be based on judgment.** The framework may not factor in all sources of state dependency. Also, excessive reliance on quantitative techniques may lead to a false sense of precision given the early stage in the development of the relevant techniques and the limited availability of data inputs. As a result, the presumption of an overly rigorous publicized methodology could risk moral hazard from the part of private sector firms and create false confidence on the part of the prudential authorities. In addition, distinguishing between systemic and non systemic entities would involve additional and highly judgmental analysis.

Box 1. Contributing Factors to Assessment of Systemic Importance

This box discusses some of the specific or economy-wide factors that can affect the assessment of systemic importance in addition to the three main criteria. These factors are: leverage, large maturity mismatches and holdings of illiquid assets; and complexity. Some of these factors can be interpreted as indicators of vulnerability that can be useful to identify high-risk institutions, especially among those in the middle range of systemic importance when the general economic context may have the greatest bearing on assessing systemic importance. It could be argued that the use of vulnerabilities for identifying systemic importance could lead to moral hazard, since this will signal that these institutions would be bailed out if they ran into difficulties. The argument for using vulnerabilities for the assessment of systemic importance is that given the likelihood that official support may be used in the event of a crisis involving the specific components, there should be sufficient prudential oversight and regulation ex ante to minimize moral hazard. Moreover, an assessment of the vulnerability of the *system* to systemic risk from any of its components should take into account the robustness or vulnerability of other components and their capacity to withstand shocks emanating from that component.

Leverage is a measure of vulnerability (a proxy for default risk). It is also a proxy for an institution's ability to propagate distress in the system and it could therefore be used as a proxy for connectedness. This is so because in response to an adverse price movement, a leveraged position will be closed faster by an investor (with a similar risk tolerance) than if it were not leveraged–due to the impact of higher margin requirements. The larger the leverage, the smaller is the price change needed to trigger an unwinding of positions. An adequate measure of leverage should include both on- and off-balance sheet positions. A gross measure of leverage (adding the Absolute amount of short and long asset equivalent derivatives positions) would be more representative of the institution's capacity to magnify the initial shock and cause turbulence in asset markets.

Liquidity risks and large mismatches. Holdings of illiquid assets expose an institution to liquidity and market risks. This could potentially trigger systemic risk if the institution faces difficulties to roll over its funding and needs to liquidate large amount of assets to which other institutions also have exposure. The extent to which mismatches are a systemic threat will depend on a case-by-case analysis based on the size of the mismatches with respect to the size of asset markets and the existence of similar or correlated positions in other institutions. In this regard, country authorities may include institutions with this type of vulnerability within the set of systemically important institutions, in particular if these mismatches are part of the institution's regular business model. The institution's degree of concentration in one particular type of asset would also advise in favor of considering the institution as systemically important.

Complexity. A complex institution is an institution or financial group that (a) operates diverse types of activities through numerous legal entities (e.g., simultaneously operating banking, insurance and securities subsidiaries); (b) operates across borders with centrally managed capital and liquidity (as opposed to simpler networks of national subsidiaries); and/or (c) has exposures to new and complex products and markets that have not been sufficiently tested. It might be difficult to derive quantitative measures of complexity and the qualification of an institution or group as complex would most likely be a judgmental statement. In any case, it is difficult to think of complexity as a stand alone criterion for systemic importance unless this also applies to a large or highly connected institution. Complexity per se would not be enough to guarantee a large systemic impact. However, countries may see complexity as a source of vulnerability—in particular if complexity is also associated with lack of transparency, difficulties in understanding the exposures taken by the institution, and the potential magnification of information asymmetries in the case of a systemic event. In this regard, complexity could be included among the factors that increase vulnerability.

Box 2. A Possible Practical Assessment Framework

This box presents a scorecard that can potentially be used in assessing the overall systemic importance of individual components of the financial system. Components are assessed along the three dimensions (criteria) explained in the text and also in a number of sub-categories of each criterion as is deemed appropriate.

Scoring: The framework would assign a set of scores to qualitative criteria or quantitative indicators for each of the key functional characteristics of size, limited substitutability, and interconnectedness. The score would be assigned to each indicator using a letter grade scale that provides a coarse ordinal ranking of importance. For instance, a scale from A to E can be used to classify a component as highly significant ("A") or of negligible systemic importance ("E"). Each dimension can also be analyzed along more refined sub-dimensions if these are deemed to provide a better insight into the overall assessment of the specific component. Given the degree of judgment involved in this ordinal scoring, specific comments could provide the necessary nuance or convey the degree of uncertainty entailed in assessing each criterion.

	Score	Comments
1. Size		
1.1 Specific aspect		
1.2 Specific aspect		
…		
2. Limited substitutability		
2.1 Specific aspect		
…		
3. Interconnectedness		
3.1 Specific aspect		
…		

Benchmarking: The choice of the threshold for identifying systemic importance could be based on qualitative judgment or entail a more systematic approach, such as using a clustering methodology.

Institutional factors could be introduced into the benchmarking, especially those related to the capacity of the financial system to handle failures, should they occur. These can, if necessary, be explained in the comments column.

C. Quantitative Assessments

24. **Quantitative assessments can be used as input to qualitative judgment of the criteria.** The framework discussed in the previous section provides a general structure for the assessment of systemic significance of financial institutions and markets. This qualitative analysis can be strengthened in many cases by reference to various quantitative tools that can provide essential and objective input to the process. Quantitative tools can be either indicators or derived from more sophisticated models. The ideal model-derived measure of systemic impact would be built on the basis of a macroeconomic model that includes a developed financial sector to capture the macro-financial linkages, but also a description of the network of links between financial institutions and markets. Even countries that are advanced in their analytical approaches are still far from having such tools. This section lists a number of indicators and simpler models that have been developed and used by policy-makers as well as actual practices as they emerged from the responses to the survey.

Use of Indicators

25. **Indicator-based approaches are a starting point for analysis as they are relatively simple and often effective in assessing systemic importance.** The indicator approach has the advantage that it can draw on readily available data, such as balance sheet and supervisory data. Indicators derived from such data can be effective in making assessments where the systemic importance of institutions and markets tends to be relatively stable over time, but may be less suitable to identifying emerging trends. Indicators may also vary in their ability to capture specific criteria. For example, while it is feasible to derive indicators of size relatively straightforwardly, indicators that capture the degree of substitutability of services are harder to derive. Indicators are arguably also less capable of capturing the strength of interdependencies among institutions. In this regard, gaps in information, such as on derivative and counterparty exposures, may limit their current usefulness. Finally, indicator approaches typically do not cover entities that fall outside the regulatory perimeter.

26. **A list of possible indicators covering the criteria outlined above, focusing on the functions performed by financial institutions, markets and instruments, is provided in Table 1.** The choice of data for use in the calculations should reflect the relevant market context. For example, the choice between using consolidated or stand alone data might depend on whether the assessment is from a home or host country perspective.

27. **Indicators of size**. Different proxies for the volume of services provided by an institution or a market can be used as indicators of how this component compares to the size criterion. The primary areas are as follows. Some of these measures may also be relevant proxies of limited substitutability and of interconnectedness.

- ***Clearing and settlements:*** The volume of financial services provided through clearing, payments, and settlements are an indicator of systemic importance because of their central role in the functioning of financial systems.

- ***Financial intermediation:*** Institutions considered of systemic importance would have a large market share in contractual liabilities (retail deposits, etc) and claims (lending, securities holdings, etc.) The ratio of the institutions assets to GDP would also be significant.[7] A systemically important institution could also be an important player and market maker in the core money and financial markets (e.g., interbank, foreign exchange, government debt, equity, derivatives) or has a significant market share in loan syndications and capital market activity. A systemically important market could be identified by various indicators of the size of its capitalization and turnover.

- ***Risk control and management:*** The systemic importance of an institution or market can also be characterized by its central role in risk management and mitigation, since a failure could have a significant knock on effect in disrupting financial services. Notable areas where indicators could focus are institutions' contingent claims and exposures to OTC derivatives.

28. **Indicators of limited substitutability.** It is difficult to capture the degree of uniqueness in the contribution of an individual institution or of a specific market in the provision of a financial service. Simple indicators of concentration, borrowed from the industrial organization literature, can help gauge the degree of substitutability in specific market segments**.** One such indicator is the Hirschman-Herfindahl Index which is based on the distribution of market shares across all market participants/suppliers of a service. However, the use of such a simple proxy may not capture well the key dimensions of lack of substitutability. Instead, the assessment needs to take a more qualitative approach, identifying whether or not competing providers are readily available and identifying the strength of technological, regulatory and informational constraints that may impede a potential provider from taking up the slack in short notice. An example noted previously is institutions that provide systemically important infrastructure services, such as clearing, payment and settlement of trades, or custodial services, and may be captured by the size indicators noted above.

29. **Indicators of interconnectedness.** Such indicators require information on institution-specific exposures and cross ownership/cross-institution linkages**.** These would include inter-linkages between financial institutions (banks and non-banks), between markets, as well as between institutions and markets, including linkages across national and jurisdictional borders.[8] Information to assess such interconnectedness remains a key challenge as comprehensive information on individual financial institution's bilateral exposures is limited in many cases. The degree of interconnectedness can also be identified by extracting information from market

[7] As an alternative indicator, total assets as a percentage of government revenues or debt could be used to quantify the amount of contingent liabilities that a given institution may generate in sovereign balance sheets.

[8] In addition, inter-linkages between financial institutions and government balance sheets might arise as a consequence of public sector interventions to safeguard the financial system.

indicators such as CDS spreads and equity prices on correlation in exposures. However, the latter analysis may provide limited information on interconnections in normal times, and correlations are known to change between normal and crisis times.

More Sophisticated Measures

30. **A number of more sophisticated methodologies to assess potentially systemic institutions have been advanced** (see Table 2).[9]

- ***Network analysis:*** This suite of methods and related measures can be used to describe the degree of interconnectedness within financial systems and hence to assess the systemic importance of individual components. The basis for network analysis is the construction of a matrix of gross institutional exposures (domestic and cross-country). The characteristics of the network structure (the distribution of nodes, the intensity and complexity of the connections between nodes and so on) can be summarized by well established metrics described in the literature. Furthermore, the analyst can simulate spillovers resulting from hypothetical credit events to specific institutions. Most of the applied network literature has focused on the interbank credit markets because of the availability of data that lend themselves to this type of analysis and the importance of the exposures in banks' balance sheets. One of the main difficulties in implementing network analysis in a broader context is the availability of data on cross-institutional exposures. Moreover, the fact that actual exposures may change rapidly implies that the results of the analysis may have a limited validity.

- ***Portfolio models of risk based on market data:*** Methodologies developed for the measurement of risk in portfolios of securities have been adapted to the measurement of systemic risk for a "portfolio" of institutions. In this context, the methodologies have been enhanced to identify common risk factors, to track how distress in one institution may affect others, and to measure the contributions of individual institutions to system-wide risk. An important appeal of these types of methodologies is that they can be implemented using publicly available data—often market prices of securities and derivatives that are sensitive to the risk of individual institutions and observed at a high frequency. Several methodologies have been proposed.[10] These measures can be derived from a univariate perspective (one institution at the time), or in multivariate fashion (the impact of one institution on others in the financial system). They can be evaluated from a "bottom-up" approach (such that the overall fragility of the financial system reflects the summation of the individual fragilities of financial institutions), or based on a reduced-

[9] See Chapters 3 and 4 of the background paper for a more detailed discussion on some analytical techniques and for references.

[10] Some of these methodologies are presented in the Spring IMF Global Financial Stability Report (2009), Chapters 2 and 3, recent BIS Annual Reports (2008, 2009). A list of references is provided in the Background Paper, Chapter 4.

form "top-down" approach (by examining the fragility of the overall financial system). The latter approach is better capable of dealing with the assessment of (often complex) interactions between components but it also requires a methodology for allocating the overall assessment of risk to individual components. It should be noted that generally, methodologies relying on market data suffer from the limitation that market perceptions can vary greatly between normal and crisis times.

- ***Stress testing and scenario analysis****:* One way to address the potential state-contingent nature of systemic importance is through stress tests and scenario analysis, where the effects from hypothetical market shocks can be assessed. While market conditions can affect financial institutions, the latter can also in turn affect the former. Stress tests typically capture the first loop only.

31. **In practice, countries use a range of techniques to identify systemically important institutions, markets, and instruments** (See Box 3). The approaches cover the entire spectrum—from simple quantitative and qualitative indicators and assessments of market developments to more sophisticated techniques. Most countries rely on more than one methodology to assess systemic linkages but differ on the degree to which they integrate them. Some countries take a multi-dimensional approach: by scoring individual dimensions and then aggregating across dimensions to see if the entity is systemically important because of one single dimension or across different dimensions. Assessment of each dimension take into account qualitative and quantitative information. Ultimately, the choice of the appropriate methodology depends largely on the characteristics of each country's financial system and the availability of data. Countries have generally set the threshold for identifying systemic importance based on qualitative judgments.[11]

Data Enhancements

32. **Effective implementation of the above quantitative indicators and methodologies will likely require enhanced data collection**. In particular, survey responses noted that the lack of data on inter-institution exposures is an impediment to the application of methodologies that seek to assess interconnectedness. While supervisory returns can help fill the data gaps in a national context, significant data gaps exist on bilateral cross-border exposures and on exposures of locally operating branches that are supervised abroad.[12] An additional data challenge is

[11] For example, the original methodology used by Bank of England as one guide to help the analysis of financial stability risks, defined a group of LCFIs as those institutions belonging to or displaying at least two of the six key criteria: (i) Ten largest equity book runners worldwide; (ii) Ten largest bond book runners worldwide; (iii) Ten largest syndicated loans book runners worldwide; (iv) Ten largest interest rate derivatives outstanding worldwide; (v) Ten highest FX revenues; (vi) Ten largest holders of custody assets worldwide.

[12] See, for example, the key points made by the Users Conference on the Financial Crisis and Information Gaps hosted by the IMF and FSB in Washington DC July 7-8, 2009, at http://www.imf.org/external/np/seminars/eng/2009/usersconf/summary.htm, and also http://www.imf.org/external/pubs/cat/longres.cfm?sk=22824.0

presented by entities that fall outside the regulatory perimeter, and that may not disclose information on their exposures and operations in a sufficiently granular manner to allow assessments of their systemic relevance. Several survey respondents called for an expansion and refinement in flow of funds data to cover financial entities that fall outside the regulatory perimeter as this could help track the relevance of such entities in the overall flows of funds in the economy, and hence to alert authorities to situations where more intensive monitoring may be required. [13]

[13] An IMF-FSB report providing recommendations to address information gaps, including information on large interconnected financial institutions, will be presented to the G20 Finance Ministers and Central Bank Governors meeting in November 2009.

Box 3. Approaches Used in Practice

Countries use a variety of techniques to integrate different dimensions/criteria of systemic importance. Survey results indicate that they range from basic "traditional" techniques for identifying risks in the banking system, to sophisticated quantitative models, to qualitative criteria that include "market intelligence." In several instances, the analysis done in deciding whether to provide lender of last resort support—applying the guiding principle of whether failure could damage the stability of the financial system—is used as a technique to define systemic importance. Among some European countries, the ECB's Systemic Impact Assessment Handbook is used as a guide for determining the issues to be assessed. The assessment frameworks have generally been developed as part of national early warning systems.

Many countries rely on more than one methodology to assess systemic linkages and differ on the degree to which they integrate them with other approaches. Ultimately, the choice of the appropriate methodologies depends largely on the characteristics of each country's financial system and the availability of data.

- *A number of central banks conduct network analysis on a regular basis with a view to identifying institutions whose failure could have systemic implications.* They include the Oesterreichische Nationalbank (OeNB), National Bank of Belgium, Deutsche Bundesbank, Banco de México, De Nederlandsche Bank (DNB), Monetary Authority of Singapore, Swiss National Bank and Bank of England (BoE). The starting point of these analyses is banks' large exposures and interbank credit activities. Interpolation techniques are applied to construct domestic—and in some instances also cross-county—exposures matrices that are then used to analyze a series of hypothetical market and credit stress events.
- *Some countries also combine detailed network analyses with an assessment of the risk implications of banks' common exposures to different factors.* The Bundesbank, Banco de México and MAS use their analyses of banks' common exposures to conduct regular stress tests of their banking systems.
- *In some cases, countries' assessments of systemic importance explicitly incorporate both quantitative and qualitative criteria.* For instance, MAS uses an impact and risk model, which incorporates both quantitative and qualitative criteria, to assess the relative systemic importance of an institution within its sector of the financial services industry. In the UK the Bank of England and the FSA use a multi-dimensional approach to inform in-crisis judgments of systemic importance: this involves scoring individual dimensions using qualitative and quantitative information and looking across dimensions to assess systemic importance of an entity. .
- *Models to capture cross-sector or cross-border contagion have been developed by some central banks.* The DNB models cross-sector correlations between the banking and insurance sectors. Separately, the OeNB has developed the Systemic Risk Monitor model, which combines individual and systemic aspects of banks' risks by integrating the calculated impact of market and credit risk for individual banks with the risk of interbank contagion within the Austrian banking system and with their subsidiaries in Central and Eastern Europe, derived though the network model.

Countries are increasingly focusing on macro-financial linkages in their analysis of systemic relevance, although work in this area remains in its early stages. One leading example is the BoE's Risk Assessment Model for Systemic Institutions (RAMSI), which is being developed to inform its assessment of institution-specific and system-wide vulnerabilities. The analytical foundations of RAMSI draw from the stress testing and the network literature. It takes into account interbank linkages and macro-banking linkages by analyzing three areas of interconnectedness: funding feedbacks, asset fire sales, and a real sector-financial sector feedback loop.

IV. Options for the Guidelines

33. **The development of guidelines would support national authorities in their assessments of systemic importance and promote consistent implementation across countries.** The discussion has noted the difficulties with developing specific quantitative methodologies and the need to use these as input to structured qualitative analysis and the exercise of judgment and flexibility in conducting the assessments. This section outlines a possible form that guidelines could take, focusing on higher-level and organizational principles that are consistent with this general approach.

A. Content of the Guidelines

34. **The guidelines would codify the fundamental tenets pertaining to assessing systemic importance, and would be flexible enough to apply to a broad range of countries and circumstances.** They could be structured as short statements of high-level principles. In due course, these principles could be supported by more specific good practice guidance, spelling out the practical application of the principles. The G-20 request did not specify the form that the guidelines should take or how enforceable they thought they should be. If the guidelines were to be applied in a formal manner, once experience is gained, consideration could be given to eventually integrating the guidelines into existing sectoral standards (including, for example, the Basel Committee's Core Principles for Effective Banking Supervision), or developing a new international standard (and related assessment methodology).[14] Possible elements of the high-level principles are described below.

Establishment of a Framework

35. **The guidelines could establish the expectation that national authorities set up and operate frameworks for assessing the systemic importance of financial institutions, markets, and instruments on an ongoing basis.** Elements that the guidelines could elaborate on when establishing such a framework include:

- ***The definition of systemic importance,*** encompassing common elements, such as those set out in Section II and the survey responses.

- ***Roles and responsibilities*** of the agencies involved in the assessments, with appropriate arrangements for information sharing and confidentiality.

- ***The independence, accountability, resources and powers*** of the agencies responsible for assessing systemic importance.

[14] For the existing set of standards and codes, see: www.imf.org/external/np/exr/facts/sc.htm and www.financialstabilityboard.org/cos/key_standards.htm.

- ***The frequency of the assessments***, which should be high enough to keep pace with structural changes in the financial system and financial innovation.[15]

- ***Periodic review of the assessment framework*** to keep it up to date.

System-Wide Assessment

36. **The guidelines could emphasize that assessments of systemic importance need to cover the entire financial system—**both regulated and unregulated institutions, markets, and instruments. Guidance might deal with the following:

- ***Coverage*** of both regulated and unregulated institutions, markets, and instruments, including the need for the relevant authorities to have means to obtain and analyze information on unregulated entities and make use of available information, including regulatory reporting and supervisory insights.

- ***Consultation processes*** with the relevant domestic agencies as well as foreign counterparts to capture cross-border issues (see also below).

Information and Methodologies

37. **The guidelines could broadly outline the types of methodologies and data needed, while recognizing that the approaches will evolve and be adjusted in light of developments and specific country circumstances.** Some issues on which guidance might be helpful include:

- ***Qualitative analysis***, emphasizing the importance of authorities "knowing their financial system" and the use of judgment to reflect national circumstances.

- ***Information requirements*** as a basis to compile basic indicators and where appropriate conduct network analysis.

- ***Methodologies***, including an inventory of suggested indicators and methodologies drawing on those described in Section III.

- ***Framework for integration***, to ensure that the various dimensions of systemic importance are taken into account and brought together to arrive at an overall assessment of systemic importance.

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[15] Many countries responded that annual assessments could be appropriate, but with flexibility. More frequent assessments may be necessary during periods of financial turbulence. Conversely, assessments could be less frequent where financial sector growth and innovation are slow. Some countries are of the view that there should be on going monitoring and updating in addition to formal assessments, while others are concerned about the resource costs of frequent assessments.

- ***Benchmarks***, including how to take account of institutional and economic circumstances when distinguishing between systemic and less systemic entities.

Communication/Transparency

38. **The guidelines could suggest a framework for communication, recognizing that this would also depend on the purpose of the assessments.**

- ***Domestic agencies*** to which the assessment results should be conveyed, such as the relevant domestic regulatory agencies, central bank, ministry of finance, and deposit insurance and investment/insurance protection agencies, to allow these agencies to factor the assessments into their operations consistent with their responsibilities.

- ***Overseas agencies*** in respect of cross-border institutions, markets, and instruments, insofar as such information may be relevant for the authorities to exercise effective oversight of the entity for which they are responsible.

- ***Publication*** could be recommended of the assessment methodologies and frameworks applied. Caution would be needed in publishing the names of specific institutions, markets, and instruments to avoid moral hazard.[16]

Cross-Border Cooperation

39. **In view of the cross-border interconnectedness of key financial institutions and markets, international cooperation would be an essential element of assessments of systemic importance.** Such cooperation could include:

- ***Information sharing arrangements*** to enable agencies in other jurisdictions to prepare their own assessments. The specific information that might prove useful could include: domestic indicators or analysis of the role of foreign entities in local markets and networks, and information on the cross-border exposures of financial groups. The domestic agencies participating in the information sharing arrangements will need to be extended to include central banks and possibly fiscal agencies where the assessments would be used for decisions on crisis management.

- ***Joint assessments*** of systemic importance, which might be needed to capture cases where an institution/market may not be identified as systemically important at an individual country level but could be so regionally or globally.

- ***Global/regional assessments*** of systemic importance carried out at the global or regional level by international or regional bodies, as a complement to those performed by national

[16] Survey respondents broadly supported this view.

authorities, to help identify institutions/markets that may have fallen through national filters as well as gaps in cooperation and collaboration.

B. Possible Uses of the Guidelines

40. **National authorities could use the guidelines to adjust the scope and intensity of financial regulation and supervision.** Specifically, the guidelines could be used in the following ways:

- to update legal, regulatory and supervisory frameworks so as to bring systemically important financial institutions, markets and instruments within the scope of regulation, and to improve the resilience of the financial system;

- to calibrate prudential tools, including the intensity of regulation of systemically important financial institutions, markets and instruments;

- to inform initiatives to improve the safety and soundness or efficient functioning of markets. For example, the output of an assessment may highlight the need for strengthening clearing and settlement arrangements in markets where existing arrangements had previously been thought adequate;

- to prepare crisis intervention policies and strategies, recognizing that the decisions would be determined by the circumstances at the time.

Table 1. Basic Indicators of Systemic Importance and Associated Risks

Financial institutions		Financial markets and Instruments	Financial infrastructure
Primary Indicators	Secondary Indicators		
Size		Size	Size
Financial intermediation		Financial intermediation, risk management and control	Clearing and settlement systems
· Total assets and liabilities (and by components) as a percentage of GDP	· Sectoral and geographic composition of loans, deposits, and other contractual obligations and claims as a percentage of GDP	· Market's share in total funding to households, corporates (financial and non-financial), and governments	· Total value and number of cleared and settled transactions, on average and on peak days, as a percentage of GDP
· Market share in branch network and sector employment	· Foreign-currency denominated assets (including the exposures to unhedged borrowers) and liabilities as a percentage of GDP	· Market capitalization, gross market value, and open interest of securities (financial intermediation) and derivatives (risk control and management) as a percentage of GDP	· Market capitalization of clearing houses as a percentage of GDP
· Market share in contractual liabilities and claims	· Deposits and short-term liabilities as a percentage of total liabilities	· Number of securities (financial intermediation) and derivatives (risk control and management), trading days, and volume traded as a percentage of GDP	· Average payment value and number of payments processed through the system, on average and peak days
· Market share as market maker in the debt, equity, and foreign exchange, commodities and derivatives markets	· Total assets (including net exposures to off-balance sheet items) as a percentage of total equity (leverage ratio)	· Average daily turnover, average transaction value, and average number of trades (by instrument type) of securities (financial intermediation) and derivatives (risk control and management)	· Share of large-value payments and block orders processed
· Market share in interbanking activities, custodial and trust management	· VaR (or economic capital) as a percentage of total equity (risk-based leverage ratio) and capital adequacy ratio	· Number and value of newly listed (issuance) and privately placed securities (by type) and issuers (by sector) as a percentage of GDP	· Share of the own and third-party transactions cleared and settled
· Degree of concentration in different markets —such as the Herfindahl-Hirschman Index (HHI)	· HHI concentration measures for different business lines by revenues, assets, and net income (loan, trading, principal investment, and commission and fees)	· Composition and diversity of investor base (financial corporates, institutional, etc.)	Risk control and management
· Market share in consumer, mortgage, and corporate lending		· Volatility of margin call amounts and composition of collateral posted	· Available lines of credit and value of collateral pool as a percentage of maximum settlement obligations in the settlement arrangements
· Market share in loan syndication, origination, servicing, and securitization		· Complexity and standardization of securities (financial intermediation) and derivatives (risk control and management) instruments (expert judgment)	· Type and level of required collateral (as percentage of total transactions) used in the settlement system
· Market share in domestic and cross-border equity, bond underwriting and mergers and acquisitions		· Time between initiating and executing a transaction	· Credit transfers as a percentage of total payments through the system
· Market share in the dealer and brokerage services, including to hedge funds and institutional investors		· HHI measures related to the degree of institutional concentration in markets for funding and risk management	· Unexecuted confirmation backlogs
			· Share of transactions (by types) executed via the system
			· Time between initiating and executing a transaction
			· Share of transactions settled for other payment systems

Table 1. Basic Indicators of Systemic Importance and Associated Risks (continued)

Financial institutions		Financial markets and instruments	Financial infrastructure
Core Indicators	Secondary Indicators		
Size		Interconnectedness	Interconnectedness
Risk control and management		· Breakdown by turnover and outstanding positions of main market participants	· Number and type of links with other systems
· Market share of outstanding contingent assets and liabilities (futures, derivatives, guarantees, credit lines, etc)	· Gross value of derivatives (both asset and liability) as a percentage of total assets	· Notional value of derivatives markets as a percentage of underlying cash markets	· Size and nature of institutions and markets supported by the system (including the possibility of switching to another operator).
· Market share in credit enhancements (bond insurance and monolines)	· Netted position as a protection seller by type of instrument as a percentage of regulatory capital	· Price and spread correlations between different markets	· Type of transactions (foreign exchange, money or capital market, related to monetary policy operations)
· Market share in funding (interbank, repos, securities, and public resources) markets	· Maturity mismatch to regulatory (and other measures of) capital, and liquid assets as a percentage of short term liabilities		· Type of institutions and markets supported by the infrastructure system (percentage of operational revenue)
· Available for sale and trading book assets to total assets	· Unrealized profit or loss to tier 1 capital		
	· Unexecuted confirmation backlogs		
Interconnectedness			
· Share of domestic and foreign subsidiaries' assets to total assets (by domicile)	· Offshore and foreign subsidiaries' share of total revenue		
· Share of intra-group exposure (including derivatives) as a percentage of both assets and liabilities	· Credit enhancement and protection sold to intra-group entitities		
· Cross ownership, exposure and custody of own and other financial institutions' assets or liabilities	· Foreign subsidiaries as a percentage of host country financial sector		
· Consolidated international claims	· Credit spreads, bond spreads and price to book value (level and correlation)		
· Cross border derivatives exposures (notional) including offshore centers as a percentage of foreign assets	· Netted cross border derivative exposure (by type) to regulatory capital		
· Exposures to countries under stress	· Net exposure to countries under distress as a percentage of total equity		
· CDS and stock correlation of LCFIs			
· Share of outstanding balances at central banks, clearing, and settlement systems	· Type of collateral used to mitigate risk as a percentage of total assets		
· Market share in payment transactions - Share of the own and third party transactions (for both custodial and non-custodial institutions)			

Table 2. Risk Measures and Systemic Risk

Risk Measures aned Systemic Risk			
	Network	Market-based	
		Univariate	Multivariate
Definition	A model of linkages among financial institutions	Methodology based on extracting (reverse-engineering) default probabilities used by market participants when pricing financial instruments	
Calibrated using	Accounting and marked to market data	Market prices: stock (CCA and Moody's KMV), CDS premia, bond prices, equity options	Equity options, CDS premia, stock prices
Outputs	Nodes with high systemic impact	Individual institutions' default probabilities	Joint default probabilities; Defaults triggered by one default; Conditional default probabilities.
Useful to assess systemic risks?	yes	no	yes
Advantages	Provides detailed information on the nature of systemic dependences (e.g. types and size of exposures) Useful to inform adoption of prudential measures	Forward-looking High frequency Inmediately available Measure of market sentiment	Forward-looking High frequency Inmediately available Measure of market sentiment Useful to inform crisis management decisions Captures linear and non linear dependence
Shotcomings	Data intensive and most of them not collected regularly at present. In practice, just exposure data collected by clearing operations or central banks	Only available where liquid markets exist. Good if market assessment is good. Subject to market volatility. Typically, they measure risk-neutral default probabilities Difficult to separate default risk from market conditions (e.g. liquidity) Potentially affected by government capital injection or dilution. Do not provide underlying reasons for market assessment. In this regard, not very useful to inform prudential measures	