INTERNATIONAL MONETARY FUND

MANDATORY FINANCIAL STABILITY ASSESSMENTS UNDER THE FINANCIAL SECTOR ASSESSMENT PROGRAM: UPDATE

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EXECUTIVE SUMMARY

- In September 2010, the Executive Board made stability assessments under the Financial Sector Assessment program (FSAP) a regular and mandatory part of bilateral surveillance under Article IV for 25 jurisdictions with systemically important financial sectors. This landmark decision resulted in a more risk-based approach to financial sector surveillance and better integration of FSAPs into Article IV consultations in these jurisdictions.
- This decision was embraced by the membership and its implementation was successful. Just three years later, 24 out of the 25 jurisdictions have already undergone—or are planned to undergo shortly—mandatory financial stability assessments under the FSAP.
- The experience of the first cycle of mandatory assessments and the lessons learned from the financial crisis warrant re-visiting the original approach for determining jurisdictions with systemically important financial sectors. Moreover, following the adoption of the Integrated Surveillance Decision, the legal framework governing these mandatory assessments needs to be updated.
- Reflecting the lessons learned from the crisis, a new methodology for determining jurisdictions with systemically important financial sectors is proposed. The new methodology places greater emphasis on interconnectedness; expands the range of covered exposures; brings into consideration the potential for price contagion across financial sectors; and uses the most recent available data. Recent advances in modeling interconnectedness have made it possible to adopt a formula that captures these factors, while adhering to the principles of relevance, transparency, and even-handedness established by the 2010 Executive Board decision.
- On the basis of this new methodology, 29 jurisdictions are deemed to have systemically important financial sectors: Australia, Austria, Belgium, Brazil, Canada, China, Denmark, Finland, France, Germany, Hong Kong SAR, India, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, Norway, Poland, Russia, Singapore, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. It is thus proposed that financial stability assessments under the FSAP be a mandatory part of Article IV surveillance in these jurisdictions every five years.

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INTRODUCTION

1. **A landmark decision**. In September 2010, the Executive Board made financial stability assessments under the Financial Sector Assessment program (FSAP) a regular and mandatory part of bilateral surveillance under Article IV for jurisdictions with systemically important financial sectors.[1] This decision recognized that although financial sector issues were at the core of the Fund's surveillance mandate, the FSAP as designed in the late 1990s had severe limitations as a tool. Voluntary participation, the low frequency of assessments, and their very broad coverage (particularly in emerging market and developing countries, where assessments are typically conducted jointly with the World Bank) limited the usefulness of the FSAP for surveillance. Building on the revamp of the FSAP during the 2009 program review that delineated the institutional responsibilities of the Fund and the World Bank and defined the content of the stability assessment under the FSAP, the Executive Board took the next step in 2010 to make these stability assessments mandatory every five years for members with systemically important financial sectors.

2. **A more risk-based approach to financial sector surveillance**. Given the importance of the financial sector for Fund surveillance, it is appropriate for the Fund to scrutinize more closely the policies of those members whose financial sectors are systemically important. Universal voluntary participation in FSAPs made this difficult: it constrained the scope for prioritization; hampered the allocation of scarce FSAP resources where they may be most needed; and risked creating "selection bias" among the countries volunteering for assessments. Making stability assessments a mandatory part of Article IV surveillance for members with systemically important financial sectors was meant to address these shortcomings. Operationally, it allowed the Fund to allocate FSAP resources and expertise more effectively, thus strengthening the integration of FSAPs and Article IV consultations at least in these countries.

3. **Criteria for determining jurisdictions with systemically important financial sectors**. To require a specific group of members to engage in financial stability assessments under the FSAP on a mandatory basis while respecting the principle of uniformity of treatment, the Fund established a set of relevant and transparent criteria with which such members would be chosen. These criteria were based on two key features of a country's financial sector: *size* and *interconnectedness* with financial sectors in other countries. For the same reason, the methodology was explicitly designed to eschew as much as possible a priori judgments about the size and composition of the list (the number of jurisdictions was not predetermined, and it was not possible to "cherry-pick" individual jurisdictions), and to allow the data to determine its final composition. On this basis, 25 jurisdictions were determined to have systemically important financial sectors (Table 1). The precise methodology is explained in the 2010 staff paper and accompanying background paper.

[1] Decision No. 14736-(10/92), adopted September 21, 2010 (the "2010 Decision").

4. The case for an update. Since systemic importance is a dynamic concept and analytical tools evolve, it was understood that the list of jurisdictions, as well as the underlying methodology, would be periodically revisited. In particular, the staff paper envisaged that the methodology would be revisited in light of experience after the first round of mandatory assessments was completed, and the Decision would be reviewed no later than five years after its adoption. The case for updating the framework of the decision today rests on three arguments:

- *The first round of mandatory assessments is almost completed*. With the FSAPs in Canada, Switzerland, and Hong Kong SAR underway or planned in the coming months, 24 of the original 25 jurisdictions will have been assessed by the end of this fiscal year. The next section reviews the implementation of the 2010 Decision in the first round of assessments.

- *The legal framework for surveillance has evolved with the 2012 Integrated Surveillance Decision (ISD)*. The ISD established a framework for analyzing the impact of spillovers from members' domestic policies on the international monetary system, and made Article IV consultations a vehicle for both bilateral and multilateral surveillance. Given the potentially significant impact of spillovers from financial policies of members with systemically important financial sectors on other members, there is a need to bring the 2010 decision in line with the ISD. The section on the Legal Framework provides the details, and a Proposed Decision is attached.

- *The methodology for determining systemic importance should be improved to incorporate the lessons from the crisis*. The original methodology was heavily skewed toward size as the main determinant of systemic importance, and limited the measurement of interconnectedness to bilateral interbank exposures, mainly reflecting data and modeling constraints. But the experience of the global financial crisis, the sovereign debt crisis in Europe, and the most recent turbulence affecting some emerging market countries has shown that even events in relatively small countries that are highly interconnected can have a systemic impact. It also underscored the importance of nonbank

Table 1. Jurisdictions with Systemically Important Financial Sectors, 2010

Jurisdiction	Overall rank[1]
United Kingdom	1
Germany	2
United States	3
France	4
Japan	5
Italy	6
Netherlands	7
Spain	8
Canada	9
Switzerland	10
China	11
Belgium	12
Australia	13
India	14
Ireland	15
Hong Kong SAR	16
Brazil	17
Russian Federation	18
Korea	19
Austria	20
Luxembourg	21
Sweden	22
Singapore	23
Turkey	24
Mexico	25

Source: Staff estimates.

[1] Weighted average of size and interconnectedness rankings, see 2010 staff paper for details.

linkages—notably sovereign debt holdings—and of contagion through market sentiment. Recent advances in modeling interconnectedness have made it possible to adopt a methodology that captures some of these factors. The last section of the paper presents the new methodology and the updated list of jurisdictions with systemically important financial sectors.

IMPLEMENTATION OF THE 2010 DECISION: THE FIRST ROUND OF MANDATORY ASSESSMENTS

5. **The 2010 Decision was embraced by the membership and its implementation was successful**. Most jurisdictions requested assessments fairly close to the five-year mark since their last FSAP, consistent with the spirit of the decision. As a result, by November 2013, 24 out of the 25 jurisdictions have requested—and most have already undergone—mandatory financial stability assessments under the FSAP. The remaining jurisdiction, Ireland, currently a UFR case, is considering an assessment in late 2014 or early 2015. In all these cases, cooperation with the authorities was excellent, and there was close and effective integration with the Article IV mission. This highlights the buy-in and support by the membership for this important decision.

6. **This also avoided an excessive bunching of these mandatory assessments**. The time profile of these assessments is relatively spread out, with a peak in one year (Table 2). This facilitates the workflow of future assessments, which from now on will have to take place approximately every five years since the last FSAP, as long as the jurisdiction's financial sector continues to be deemed systemic.

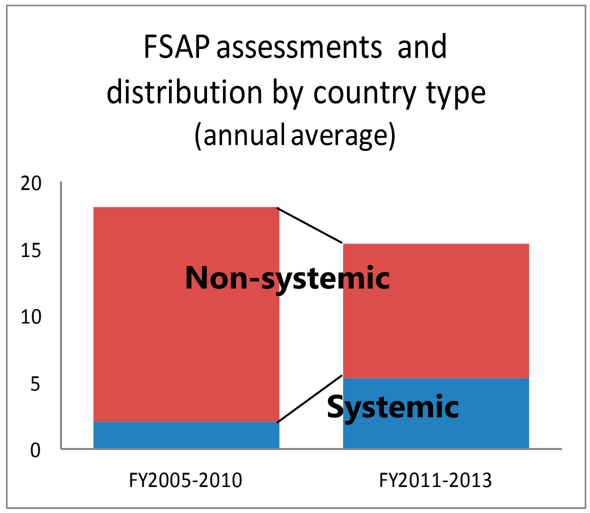
Table 2. Distribution of Mandatory FSAP Stability Assessments, 2010–14

2010	2011	2012	2013	2014
United States	China	Australia	Austria	Canada
	Germany	Brazil	Belgium	Hong Kong SAR
	Luxembourg	France	Italy	Switzerland
	Mexico	India	Korea	
	Netherlands	Japan	Singapore	
	Russian Federation	Spain		
	Sweden			
	Turkey			
	United Kingdom			

Notes: Based on the (actual or projected) date of the Board meeting at which the Article IV consultation, including the mandatory FSAP stability assessment, was concluded.

7. **Coordination with the World Bank, where relevant, went smoothly**. In six emerging market countries among the 25, FSAP missions are in principle conducted jointly with the World Bank (Brazil, China, India, Mexico, Russia, and Turkey). In these cases, undertaking the developmental assessment—the main responsibility of the Bank—is voluntary for the country, while the stability assessment is a mandatory part of Fund surveillance. Indeed in five out of these six countries, the mandatory financial stability assessments since 2010 took place in the context of joint Fund-Bank FSAP missions (in Russia, the mandatory assessment was a stand-alone FSAP stability module). The experience was satisfactory, with both the country authorities and the staff of the two institutions handling the difference in the legal basis for the assessments without a problem.

8. **The resource implications for assessments in countries with non-systemic financial sectors were significant**. As the 2010 staff paper had anticipated, conducting the mandatory financial stability assessments every five years while maintaining the same level of delivery of voluntary FSAPs in jurisdictions without systemically important financial sectors would be possible only with an increase in overall FSAP resources. In the event, the total number of FSAPs per year was progressively reduced from an annual average of 17–20 prior to 2010 to 14 in the current fiscal year. This reflected continuing resource constraints, as well as the increased cost per FSAP of assessing the revised, more complex financial sector standards and extending the coverage to areas highlighted by the global financial crisis (e.g., macroprudential policy frameworks). Combined with the increase in mandatory financial stability assessments, this had a noticeable impact on FSAP delivery to the rest of the membership.



THE LEGAL FRAMEWORK

9. **The legal framework governing mandatory financial stability assessments is firmly grounded in the Fund's Articles and, in particular, Article IV**. Article IV, Section 1 of the Fund's Articles requires members "to collaborate with the Fund and other members to assure orderly exchange arrangements and to promote a stable system of exchange rates" ("systemic stability"). Through its bilateral surveillance, the Fund assesses members' compliance with their obligations under Article IV, Section 1, including obligations governing the conduct of their domestic financial policies.[2] The mandatory financial stability assessment was designed to facilitate the Fund's assessment of such policies for the purposes of bilateral surveillance. While it would have been open

[2] Article IV, Sections 1(i) and (ii) provide that each member shall (i) "endeavor to direct its economic and financial policies toward the objective of fostering orderly economic growth with reasonable price stability, with due regard to its circumstances;" and (ii) "seek to promote stability by fostering orderly underlying economic and financial conditions and a monetary system that does not tend to product erratic disruptions".

to the Fund, in adopting the 2010 Decision, to require all of its members to undergo financial stability assessments as part of bilateral surveillance, the Fund chose to limit such assessments to members with systemically important financial sectors, given their importance for systemic stability.

10. The current paper proposes two key revisions to the 2010 Decision. The first would modify the methodology used by the Fund to identify members with systemically important financial sectors (discussed in greater detail below). The proposed revisions would replace the methodology currently set out in the Decision with the new methodology described in the following section. On the basis of this new methodology, the Managing Director would, in consultation with the Executive Board, update the list of countries subject to mandatory financial stability assessments.[3]

11. The second set of revisions would enable mandatory financial stability assessments to cover more comprehensively spillovers arising from a member's domestic financial sector policies. In this respect, the proposed decision would reflect changes made to the legal framework for surveillance through the adoption of the ISD. Article IV, Section 3(a) requires the Fund, in its multilateral surveillance, to oversee the international monetary system to ensure its effective operation. For this purpose, the ISD called on the Fund to focus on "spillovers arising from policies of individual members that may significantly influence the effective operation of the international monetary system, for example by undermining global economic and financial stability." [4] The ISD also made an Article IV consultation a vehicle for both bilateral and multilateral surveillance, enabling the Fund, in an Article IV consultation, to examine spillovers arising from a member's domestic policies not only where such policies undermine the member's own domestic or BOP stability but also where they may significantly affect the effective operation of the international monetary system, in particular, by undermining global economic and financial stability. Moreover, the ISD clarified that outward spillovers should be discussed irrespective of the channels through which they transmit (balance of payments or non-balance of payments, e.g., contagion, market pricing).

12. Consistent with this approach, the proposed revision to the 2010 Decision would make mandatory financial stability assessments a vehicle for both bilateral and multilateral surveillance. In this manner, the revised decision would allow for the coverage of spillovers in two separate contexts.

[3] Following the approach taken with the establishment of the framework for mandatory financial stability assessments in 2010, the Executive Board would, in the summing up of the Board discussion, take note of the Managing Director's determination of the list of jurisdictions with systemically important financial sectors.

[4] At present, coverage of spillovers arising from a member's domestic economic and financial policies in a mandatory financial stability assessment is limited. More specifically, as an instrument of bilateral surveillance, a mandatory financial stability assessment may only examine the spillover effects from such policies where they undermine the member's own domestic or balance of payments stability. To the extent that such policies are considered to be promoting the member's own domestic and balance of payments stability, the Fund currently cannot in a mandatory financial stability assessment examine the spillover effects of such policies even where they are undermining global economic and financial stability.

- In the context of bilateral surveillance, mandatory financial stability assessments would continue to cover spillovers arising from a member's domestic financial policies when those policies undermine the member's own domestic or balance of payments stability.

- In the context of multilateral surveillance, mandatory financial stability assessments would now cover spillovers arising from a member's domestic financial policies whenever they may significantly influence the effective operation of the international monetary system and, in particular, when they may undermine global economic and financial stability.

13. It is legally possible to make a mandatory stability assessment an instrument for multilateral surveillance and to cover spillovers that are relevant for multilateral surveillance. This does not imply any modification of members' obligations under the Fund's Articles.[5] Under Article IV, Section 3 (a), members are obligated to consult with the Fund on any issue that is relevant for the Fund's multilateral surveillance and its mandate to oversee the international monetary system to ensure its effective operation. As provided in the ISD itself, this obligation to consult covers spillovers arising from a member's domestic financial policies that may undermine global economic and financial stability.

14. The expanded coverage of spillovers in mandatory financial stability assessments would also facilitate the coverage of spillovers in Article IV consultations. In considering whether spillovers from financial sector policies should be discussed in the context of mandatory financial stability assessments, staff will be guided by the ISD and the Guidance Note on Article IV consultations. In particular, as explained in the Guidance Note, outward spillovers are deemed significant if, by themselves, or in combination with spillovers from other members' policies, or through their regional impact, they would enter the macrofinancial policy considerations of members representing a significant portion of the global economy. In instances where such actual or potential spillovers meet this threshold—which in practice is expected to be the case for a relatively small number of countries—they would have to be discussed and analyzed as part of the mandatory financial stability assessment. The relevant analysis would be included in the resulting Financial System Stability Assessment report, and could also be reflected in the main Article IV consultation report.

[5] Any such modification could only be effected through an amendment of the Fund's Articles. However, the ISD already includes provisions that require the Fund in its multilateral surveillance to focus on spillovers from members' financial policies that may significantly influence the effective operation of the international monetary system. Moreover, the ISD provides sufficient flexibility to accommodate the analysis of those spillovers in the Financial System Stability Assessment reports, Article IV consultation reports, or both.

UPDATED LIST OF JURISDICTIONS WITH SYSTEMICALLY IMPORTANT FINANCIAL SECTORS

A. The General Framework

15. As noted above, there is no universally accepted definition of "systemic importance." Systemic importance is not a binary concept but can be measured along a continuum, using different criteria. Systemic importance is also contingent on the state of global markets, thus reflecting to some extent the subjective views of market participants. Distinguishing between different countries on the basis of whether or not their financial sectors are "systemically important" is thus fraught with difficulty.

16. Mindful of this caveat, the 2010 paper laid out a conceptual foundation for systemic importance (size and interconnectedness) and three principles to which any methodology for determining jurisdictions with systemically important financial sectors must adhere.

- The criteria for differentiating between members must be transparent and relevant to the provisions in the Articles being implemented—in this case, Article IV.
- These criteria must have general applicability, i.e., be based on data and methodologies that are available for and applicable to all, or at least the majority of members, and that are applied uniformly.
- The determination of the list of jurisdictions with systemic importance must be objective and data-driven, eschewing as much as possible a priori judgments about the size and membership of the list.

17. Adhering to these principles imposes severe restrictions but is a key safeguard for the uniform treatment of members. The need for the criteria for determining systemic importance to be applicable as broadly as possible limits the dimensions of systemic importance that may be captured. Moreover, in any model-based, data-driven methodology, the determination of a systemic core depends on precisely how "systemic importance" is defined and measured, and the results may not always be consistent with established priors about the importance of individual countries (reflecting, for example, regional influence or membership in groups such as the G-20). Nevertheless, as the 2010 paper emphasized, adhering to these principles—notably a rules-based approach that limits the room for discretion—and, at the same time, being transparent about the models and data used, helps ensure the uniform and even-handed treatment of members in selecting those for which financial stability assessments under the FSAP would be made mandatory.

18. Focusing specifically on the financial sector also has implications for the concept of systemic importance underpinning this paper.

- **It is not a proxy for a jurisdiction's systemic importance writ large**. The concept of systemic importance used in this paper applies to the financial sector. It does not capture other aspects of a country's relative weight in the world economy, such as the size of the domestic market, trade linkages, or broader economic and political influence.

- **The extent of vulnerabilities is not a factor**. By defining a list of jurisdictions with systemically important financial sectors, this exercise is intended to maximize the benefits of regular financial stability assessments for surveillance, both for these jurisdictions individually and for the global financial system. It is not intended to identify the most vulnerable jurisdictions. To be sure, members that may be facing macrofinancial vulnerabilities, regardless of their size and interconnections, would also benefit from an in-depth look at their financial systems and may need additional Fund support. But there are other instruments, including Article IV surveillance, voluntary FSAPs, and technical assistance, which would continue to provide this type of analysis.

- **Like all quantitative analyses, it is limited by the quality of data**. In particular, it may not reflect accurately the importance of all nonbank and/or unregulated segments of the financial sector, nor can it fully take into account the differences in the quality of data collection and reporting across countries, as well as gaps in country coverage.

B. The 2010 Methodology Revisited

19. The original 2010 methodology identified 25 jurisdictions using a composite index of measures of size and interconnectedness of their financial sectors based on 2008 data. The size and interconnectedness measures, in turn, were themselves composite indices, calculated using different measures of financial activity and network centrality, respectively. The aggregate ranking of jurisdictions was obtained as a weighted average of the size and interconnectedness indices, with weights of 0.7 for size and 0.3 for interconnectedness. In the final stage, cluster analysis was used to identify groups of jurisdictions with financial sectors that have comparable degrees of systemic importance across a range of different weight combinations for size and interconnectedness around the central values of 0.7/0.3. The top two clusters, together accounting for 89 percent of the global financial system, were deemed to be the jurisdictions with systemically important financial sectors. For ease of reference, the 2010 methodology is summarized in Box 1, while the details are presented in the background paper accompanying the 2010 staff paper.

20. Applying the same methodology to the latest available (2012) data yields very similar results (Table 3). There are several changes in the aggregate ranking of jurisdictions relative to the 2010 exercise, but almost all are marginal (shifts by two to three places up or down), except for Ireland that shifts from fifteenth to the twenty-fourth position. The cluster analysis now indicates 24 jurisdictions with systemically important financial sectors: the original 25 minus Mexico.[6] These jurisdictions cover 88 percent of the global financial system.

[6] These 24 jurisdictions are consistently ranked at the top in virtually all permutations over a range of weight combinations. In addition, there are six jurisdictions (Mexico, Denmark, Malaysia, Saudi Arabia, South Africa, Indonesia, and Poland) that consistently appear in about half of all possible permutations.

Box 1. Summary of the 2010 Methodology for Determining Jurisdictions with Systemically Important Financial Sectors

The 2010 methodology was based on a three-stage process.

- In the first stage, separate ordinal rankings for all jurisdictions were developed for size and interconnectedness, as defined below.
- In the second stage, these rankings were combined into a composite index of systemic importance with weights of 0.7 for size and 0.3 for interconnectedness.
- In the final stage, cluster analysis was used to identify groups of jurisdictions with financial sectors that have comparable degrees of systemic importance. The underlying idea was to "let the data speak" in identifying financial sectors that are not only closely ranked but whose rankings are relatively stable across different weight combinations. To capture this idea, the standard deviation of ordinal rankings across different weight combinations was calculated, and then clusters were identified by iteratively minimizing the within-cluster sum of squared standard deviations from cluster means over a large number of possible clusters.

Four indicators of financial activity were used to capture size: currency and deposits in U.S. dollar terms, as a proxy of a jurisdiction's banking sector balance sheet size; the volume of non-banking activity in U.S. dollar terms; the international investment position (IIP) in U.S. dollar terms, which measures the gross external position of each jurisdiction; and the financial depth of the domestic economy, measured as a share of currency and deposits to the jurisdiction's GDP. The four indicators were scaled by the share of the jurisdiction's PPP GDP to world GDP. Finally, these indicators were combined into a single ranking for size by taking the median of the four.

Interconnectedness was defined as "network centrality" based on network models and using bilateral interbank exposure data from the BIS locational banking statistics. Four indicators of "network centrality" were considered: "in-degree," which measures the number of financial links of each jurisdiction; "closeness," which relates to the average of the shortest distance from one jurisdiction to all others; "betweenness," which focuses on the jurisdictions through which the shortest path goes through; and "prestige" (or "eigenvector centrality"), which takes into account the importance of the counterparties to which each jurisdiction is linked.

21. **The 2010 methodology was based on solid conceptual foundations, simple, and transparent**. The focus on size and interconnectedness as the chief ingredients of systemic importance reflected the conceptual framework originally developed by the IMF, BIS, and FSB for evaluating the systemic importance of financial institutions and markets,[7] suitably adapted to apply

[7] IMF/BIS/FSB (2009), *Guidelines to Assess the Systemic Importance of Financial Institutions, Markets, and Instruments: Initial Considerations*, Report to the G-20 Finance Ministers and Governors, October 2009.

to financial sectors as a whole. And the specific methodology employed to operationalize it was straightforward, transparent, and intuitive: it simply combined various indices of size and interconnectedness using arbitrary weights, and tested the sensitivity of country rankings across different combinations of weights around the central values. These advantages were instrumental in ensuring consensus on the landmark decision to make stability assessments under the FSAP mandatory for the members whose financial sectors were identified as systemic in this way.

Table 3. Updated List of Jurisdictions, 2010 Methodology

Rank	2010 list (2008 data)	2013 list (2012 data)
1	United Kingdom	United Kingdom
2	Germany	United States
3	United States	Germany
4	France	France
5	Japan	Japan
6	Italy	Italy
7	Netherlands	Canada
8	Spain	China
9	Canada	Switzerland
10	Switzerland	Spain
11	China	Netherlands
12	Belgium	Australia
13	Australia	India
14	India	Belgium
15	Ireland	Korea
16	Hong Kong SAR	Brazil
17	Brazil	Russian Federation
18	Russian Federation	Sweden
19	Korea	Hong Kong SAR
20	Austria	Turkey
21	Luxembourg	Austria
22	Sweden	Luxembourg
23	Singapore	Singapore
24	Turkey	Ireland
25	Mexico	

Source: Staff estimates.

22. At the same time, experience since 2010 has highlighted a number of areas for improvement.

- The 2010 methodology was heavily skewed toward size, which was given a weight of 0.7 in constructing the composite index of systemic importance, relying on the cluster analysis to ensure that the rankings of jurisdictions in the final list were relatively robust to a range of different weights around this central value. But the experience of the global financial crisis and the sovereign debt crisis in Europe has underscored the paramount importance of interconnectedness: events in relatively small countries that are highly interconnected can have significant spillovers, and thus a systemic impact that far exceeds the size of their financial sector or their economy.

- Limiting the measurement of financial interconnectedness to bilateral bank exposures—mainly reflecting the constraints of the modeling approach adopted in 2010—misses key aspects of cross-border linkages. Again, recent experience has demonstrated the importance of sovereign debt exposures and the sovereign-bank link, as well as the impact of large capital movements across asset classes. While data availability limits the categories of bilateral exposures that can be captured for all, or at least the majority of, members, the case for moving beyond bank exposure data is compelling.

- Defining the global network on the basis of bilateral exposures does not capture channels of shock propagation that depend on "pure" price correlation. It may thus miss jurisdictions that are the source of—or destination for—major cross-border flows reflecting asset return correlation or flight-to-quality phenomena. Such flows have been very pronounced since the onset of the global financial crisis and, in particular, in the more recent period of turbulence in certain emerging market countries. They underscore a dimension of systemic importance that does not depend solely on actual exposures.

C. The New Methodology

Conceptual issues

23. The point of departure for the new approach is the need to incorporate the lessons learned, while adhering to the principles set out in the 2010 Board decision. While still anchored in the concepts of size and interconnectedness as the main determinants of systemic importance, the new methodology

- shifts the emphasis on interconnectedness;
- expands the range of covered exposures; and
- brings into consideration complexity and the potential for price contagion across financial sectors.

Recent advances in understanding and modeling interconnectedness have made it possible to adopt a more sophisticated methodology that captures these factors.[8]

[8] IMF (2012), "Enhancing Surveillance—Interconnectedness and Clusters," Report FO/DIS/37.

24. The new methodology constructs four different global financial networks based of different types of bilateral cross-border linkages. Three of them capture direct exposures: bank claims, debt claims, and equity claims. The fourth captures the potential for "pure" price contagion, approximated by a matrix of cross-correlations of domestic stock market returns. The bilateral exposure and correlation matrix data are weighted by two factors: (i) PPP GDP, to capture *size*, and (ii) the gross derivatives exposures vis-à-vis BIS reporting banks, to capture the *complexity* of financial sectors. The intuition is that the potential systemic importance of each individual bilateral link does not depend only on the size of the link itself but also on the size and complexity of the respective economies: other things being equal, a large exposure (or a strong price correlation) between two small financial sectors should be less systemic than the same exposure (or correlation) between two large or more complex financial sectors. The most recent available data (in most cases, 2012) are used to construct the four networks and the weights.

25. Once the four global financial networks are constructed, the Clique Percolation Method (CPM) is used to identify the core of each network. The CPM, originally developed in physics and subsequently used in economic analysis,[9] offers a practical way to identify the core of a network in the form of fully-interconnected "cliques," groups of jurisdictions that are all connected to each other. The union of these cliques defines the systemic core of the global network (the CPM is explained in more detail in Appendix I). The CPM algorithm has a number of intuitive advantages compared to the 2010 methodology:

- It captures the fact that the systemic importance of a jurisdiction is a global property of the network, i.e., it does not depend only on the number of direct linkages of this jurisdiction to its neighbors but also on the linkages these neighbors have with others.
- It eschews the (unnecessary) ordinal ranking of jurisdictions according to various metrics of size and interconnectedness, focusing instead on network properties.
- It allows overlapping cliques, i.e., jurisdictions may belong to more than one group, acting as "gatekeepers" between groups. In contrast, the clusters used in the 2010 methodology are mutually exclusive and reflect purely statistical properties of the ranking metrics.

26. The group of jurisdictions with systemically important financial sectors is defined as the union of the systemic cores of the four networks. The underlying idea is that each of the four networks identified is important for global financial system stability. Therefore, if a particular jurisdiction is part of the core of any one of the four networks, it should be included in the final list of jurisdictions with systemically important financial sectors.

[9] G. Palla, I. Derenyi, I. Farkas, and T. Vicsek (2005), "Uncovering the overlapping community structure of complex networks in nature and society," *Nature*, vol. 435, pp. 814–818; and K. Youssef (2012), "Cluster analysis: framework and application," in "Enhancing Surveillance—Interconnectedness and Clusters," IMF Report FO/DIS/37.

Implementation

27. The two key parameters for the CPM are calibrated based on theoretical and practical considerations. The CPM is based on two key parameters: (i) the minimum size of the *k-clique*, a set of fully connected jurisdictions; and (ii) the *threshold* above which bilateral exposures are considered in the network.

- The minimum size of the *k-clique* has a direct impact on the size of the systemic core: too low, and most jurisdictions will belong to one or more fully connected cliques, and the resulting systemic core would be too large; too high, and the systemic core would be too small or even non-existent. The optimal size of *k* is determined by the properties of the specific network. In this case, the optimal range for *k* is 5–8 for the three exposure networks and 4–8 for the correlation network (see Appendix I for details). To maximize the size of the systemic core while still remaining within the theoretically-determined optimal range, the size of the *k-clique* is set at $k = 5$ for all four networks. In other words, to belong to the systemic core, a jurisdiction must belong to at least one clique with at least four other fully interconnected members in at least one of the four networks.

- The *threshold* determines which bilateral links (exposures or correlations) are taken into account in the construction of the global network. A low or zero threshold would capture trivially small bilateral links, resulting in a very dense global network and, for any given *k*, a very large systemic core. In theory, the level of the threshold is related to the optimal value of *k*. For this exercise, the theoretically-optimal threshold values (Appendix I) are taken as the starting point, and the final threshold values used for the four networks are calibrated so that the coverage of the resulting systemic core is similar to that in the 2010 exercise.

Results

28. The new methodology identifies 29 jurisdictions as the systemic core of the global financial system. They are listed in Table 4, last column, and represent the union of the systemic cores of the four global financial networks (also illustrated in Figure 1). The systemic core estimated with the new methodology includes all 25 jurisdictions identified in 2010 plus Denmark, Finland, Norway, and Poland.

29. The large number of European countries in the systemic core reflects the fact that these jurisdictions have relatively sizeable financial sectors that are highly interconnected. This is the result of applying a model-based approach that emphasizes interconnectedness, while still taking size into account. Indeed the financial sectors of these jurisdictions are highly interconnected not just with each other but also with other major financial centers. This makes them central nodes in the global financial network and important for global systemic stability, which in turn justifies closer surveillance, consistent with the 2010 Decision.

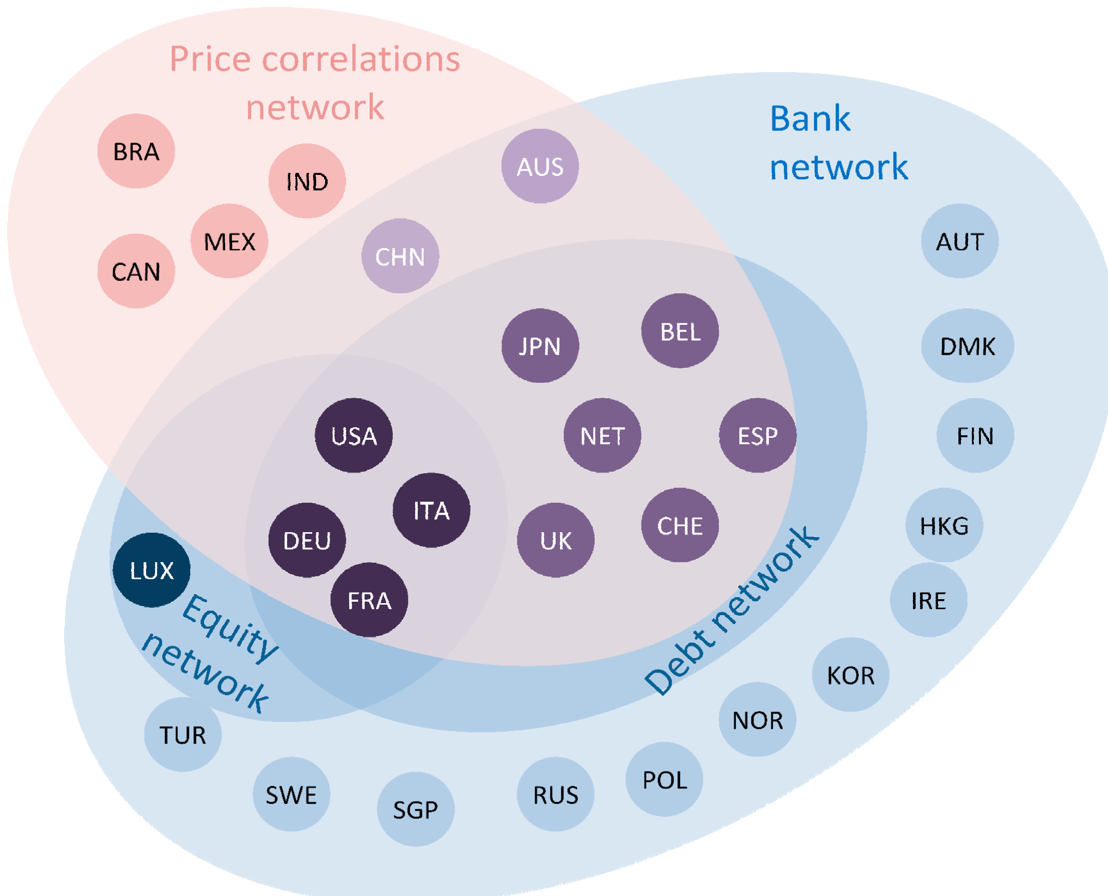
Table 4. List of Jurisdictions with Systemically Important Financial Sectors—New Methodology

Individual network cores				Union of network cores: systemic core
Banking	Debt	Equity	Price correlations	
Number of jurisdictions				
25	10	5	16	29
Australia	Belgium	France	Australia	Australia
Austria	France	Germany	Belgium	Austria
Belgium	Germany	Italy	Brazil	Belgium
China	Italy	Luxembourg	Canada	Brazil
Denmark	Japan	United States	China	Canada
Finland	Netherlands		France	China
France	Spain		Germany	Denmark
Germany	Switzerland		India	Finland
Hong Kong SAR	United Kingdom		Italy	France
Ireland	United States		Japan	Germany
Italy			Mexico	Hong Kong SAR
Japan			Netherlands	India
Korea			Spain	Ireland
Luxembourg			Switzerland	Italy
Netherlands			United Kingdom	Japan
Norway			United States	Korea
Poland				Luxembourg
Russia				Mexico
Singapore				Netherlands
Spain				Norway
Sweden				Poland
Switzerland				Russia
Turkey				Singapore
United Kingdom				Spain
United States				Sweden
				Switzerland
				Turkey
				United Kingdom
				United States
Share of global financial system assets[1]				
86	60	33	77	91

Source: Staff calculations.

[1] Global financial system assets include currency and deposits, pension fund assets, OTC derivatives, hedge fund assets by legal domicile, and international investment assets.

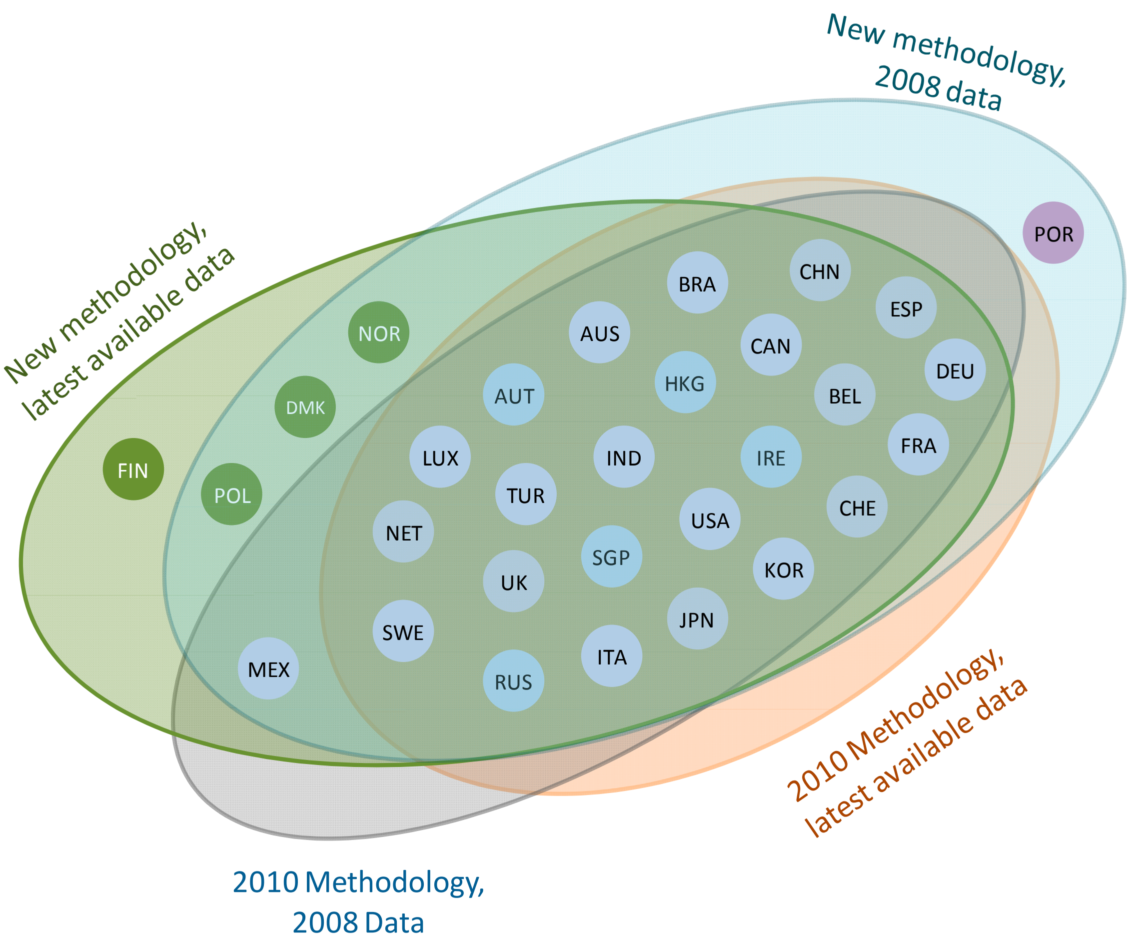
Figure 1. Overlapping Cores of the Four Global Financial Networks



Source: Staff calculations.

30. There is considerable overlap between these results and those obtained using the 2010 methodology. Figure 2 provides a summary comparison of the results of the two methodologies applied to the two data sets: the 2008 data used in 2010, and the latest available data. Applying the new methodology retrospectively to the data used for the 2010 exercise would also yield a systemic core of 29 jurisdictions, which includes 28 of the 29 jurisdictions in Table 4.

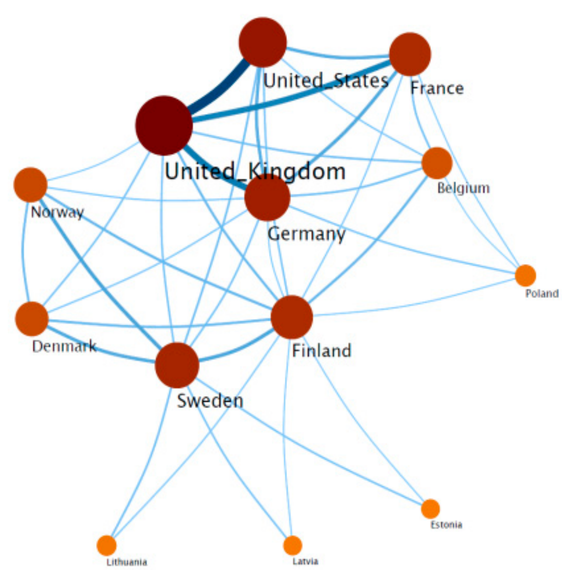
Figure 2. Jurisdictions with Systemically Important Financial Sectors: Comparison of Alternative Methodologies and Datasets



Source: Staff calculations.

31. The differences between the results of the two methodologies highlight the importance of focusing on interconnectedness, as well as of expanding the coverage beyond actual exposures.

- The four jurisdictions added to the original list are highly interconnected with other (not only European) financial sectors. The case of Finland, illustrated in the figure on the right, is representative. Its banking sector has strong linkages to other systemic jurisdictions (Belgium, France, Germany, Norway, Sweden, the United States, and the United Kingdom).



In turn, these jurisdictions are also linked to each other, yielding two overlapping cliques of five countries, one of which includes Finland. The picture is similar for the other three jurisdictions. Because the 2010 methodology placed a large weight on size, it missed these important interconnections (and thus potential channels of shock transmission) of these relatively smaller financial sectors.

- At the same time, as Figure 1 illustrates, measuring interconnectedness by actual exposures alone would leave out of the systemic core a number of financial sectors in large advanced and emerging market countries. Although these economies have significant actual bilateral exposures, many of these are with jurisdictions that are not sufficiently interconnected. As a result, these economies do not belong to any $k = 5$ clique in any of the exposure networks. Nevertheless, their financial sectors are systemic not only because they originate or intermediate substantial cross-border flows but also because they act as "bellwethers" for global financial trends. This dimension is captured by the price correlation network.

32. **The new methodology also appears to capture well the trends resulting from the financial crisis**. As Figure 2 shows, the systemic core calculated on 2008 data also had 29 jurisdictions, but included Portugal instead of Finland. Since 2008, however, Portugal's banking links with a number of European countries, particularly Germany, have slipped below the threshold as these countries reduced exposures to Portugal, implying that Portugal no longer belongs to any $k = 5$ clique. On the other hand, Finland's links with France, Belgium, Norway, and Sweden—all jurisdictions within the systemic core—have moved above the threshold, bringing Finland squarely within the core.[10]

D. Operational Implications

33. **The operational implications of expanding the list of jurisdictions with systemically important financial sectors from 25 to 29 will be small, and the incremental resource impact modest**.

- Of the four additional jurisdictions, Finland and Poland have had FSAPs in the last three years; preparations for an FSAP in Denmark in early 2014 are already underway; and an FSAP in Norway is tentatively planned in 2015. Adding these countries to the list of jurisdictions for which stability assessments under the FSAP are mandatory would therefore have virtually no impact on the FSAP workload in the immediate future.[11]

- Over the medium term, subsequent FSAPs in these four jurisdictions would not materially affect the distribution of mandatory financial stability assessments over time. Figure 3 shows

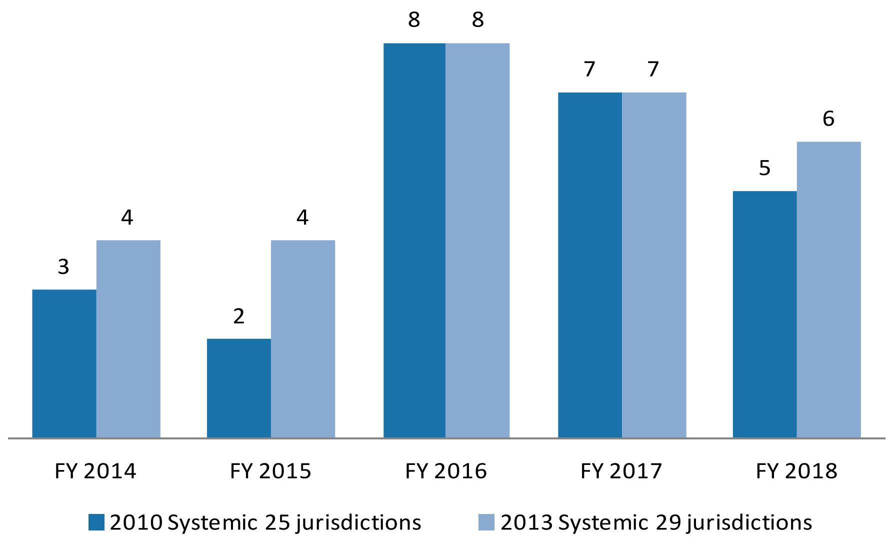
[10] Finland's banking linkages reflect the fact that it hosts branches from banks headquartered in other Nordic countries. These linkages could be potential channels for the transmission of shocks.

[11] At the same time, three of these jurisdictions (Denmark, Finland, and Norway) are currently on the 24-month consultation cycle. This may need to be revisited in light of the determination of systemic importance of their respective financial sectors.

the distribution of stability assessments in jurisdictions with systemically important financial sectors for the next five fiscal years for the original (2010) list of 25 and for the new list of 29 (assuming that an FSAP in Norway take place in FY2015, as planned). The peak years FY2016 and FY2017, in particular, would not be affected by the addition.

- The incremental impact on the overall FSAP resource envelope at the steady state would be modest, amounting to less than one additional FSAP per year on average.

Figure 3. Prospective Mandatory FSAP Stability Assessments FY2014–18



Source: Staff calculations.

34. Nevertheless, unless total program resources are increased, tensions between the mandatory stability assessments in systemic jurisdictions and voluntary FSAPs in the rest of the membership will persist. As the 2010 staff paper also made clear, since the assessments in jurisdictions with systemically important financial sectors are henceforth mandatory not only for these jurisdictions but also for the Fund, they will take priority over all other FSAP requests. Maintaining the same level of delivery of FSAPs to the rest of the membership would therefore require, other things being equal, a modest increase in resources for the program. In the event, the total number of FSAPs was reduced since 2010, and the delivery of FSAPs in non-systemic jurisdictions was squeezed. While the addition of four jurisdictions to the systemic list would only have only a relatively small impact, the fundamental tension between FSAPs in systemic and non-systemic jurisdictions will not be resolved under an unchanged resource envelope. This issue will be taken up again in the forthcoming Board review of the FSAP in late 2014.

35. The modalities of individual FSAPs will be adapted to take into account the particular form of interconnectedness of the jurisdictions' financial systems. For instance, all four major

Nordic countries (Denmark, Finland, Norway, and Sweden) are now deemed to be jurisdictions with systemically important financial sectors. This reflects to a large extent the regional business model of certain large banking groups and the attendant dense web of cross-border claims. While this does not diminish the systemic importance of these individual financial sectors, financial stability assessments under the FSAP in these jurisdictions will take careful account of the regional dimension of their financial systems and leverage information collected in each individual FSAP to enhance the quality of the assessment in all. This also suggests potential benefits in coordinating the timing of these mandatory financial stability assessments, similar to the clustered Article IV consultations with these countries.

PROPOSED DECISION[12]

The following Decision, which may be adopted by a majority of votes cast, is proposed for adoption by the Executive Board.

Decision No. 14736-(10/92), adopted September 21, 2010, is hereby amended to reflect the changes set forth in the Annex to this Decision.

[12] For the information of Directors, Appendix II to this paper contains a clean version of the Decision incorporating the amendments proposed herein.

Annex. Integrating Stability Assessments Under the Financial Sector Assessment Program into Article IV Surveillance

This Decision sets out the scope and modalities of bilateral surveillance over the financial sector policies of members with systemically important financial ~~sectors~~sectors and of multilateral surveillance over the spillovers arising from such policies in accordance with Article IV, Sections 3 (a) and (b) of the Fund's Articles and the Fund's Decision on Bilateral and Multilateral Surveillance ~~over Members' Policies - 2007~~- 2012 Integrated Surveillance Decision (Decision No. ~~13919-(07/51~~15203-(12/72), adopted ~~June 15, 2007~~July 18, 2012 (the "~~2007 Surveillance Decision~~ISD").

Introduction

~~1. Article IV, Section 1 of the Fund's Articles~~1. The obligations of the Fund and its members with regard to bilateral and multilateral surveillance are set forth in Article IV of the Fund's Articles and further elaborated in the ISD.

a. With respect to bilateral surveillance, Article IV, Section 1 requires each member to "collaborate with the Fund and other members to assure orderly exchange arrangements and to promote a stable system of exchange rates" ("systemic stability"). Recognizing the important impact that a member's domestic economic and financial policies can have on systemic stability, Article IV, Sections 1(i) and (ii) establish obligations for members respecting the conduct of these policies, including their financial sector policies.

~~2.~~ In accordance with the framework set out in Article IV, the ~~2007 Surveillance Decision~~ISD provides that systemic stability is most effectively achieved by each member adopting policies that promote its own ~~"external stability"-that is,~~balance of payments stability and domestic stability—that is, policies that are consistent with members' obligations under Article IV, Section 1 and, in particular, the specific obligations set forth in Article IV, Section 1, (i) through (iv). "Balance of payments stability" refers to a balance of payments position that does not, and is not likely to, give rise to disruptive exchange rate movements. In the conduct of their domestic economic and financial policies, members are considered to be promoting ~~external~~balance of payments stability when they are promoting their own domestic stability that is, when they comply with the obligations of Article IV, Sections 1 (i) and (ii) of the Fund's Articles. For this purpose, the ~~2007 Surveillance Decision~~ISD requires the Fund's bilateral surveillance to assess, in particular, whether a member's domestic policies are directed towards domestic stability. It provides that "financial sector policies (both their macroeconomic aspects and macroeconomically relevant structural aspects)" will always be the subject of the Fund's bilateral surveillance with respect to each member.

b. With respect to multilateral surveillance, Article IV, Section 3 (a) requires the Fund to oversee the international monetary system in order to ensure its effective operation, and requires members to consult with the Fund on any issue that the Fund considers necessary for this purpose. The ISD recognizes that the international monetary system may only operate effectively in an environment of global economic and financial stability, and provides that the Fund in its multilateral surveillance will focus on issues that may affect global economic and financial stability, including the spillovers arising from policies of individual members that may significantly influence the effective operation of the international monetary system. The policies of members that may be relevant for this purpose include, among others, members' financial sector policies.

~~3.~~ 2. While an examination of members' financial sector policies is important in all cases of bilateral surveillance, the Fund decides that, taking into account the framework described above and the overall purpose of surveillance, heightened scrutiny should be given in bilateral surveillance to the financial sector policies of those members whose financial sectors are systemically important, given the risk that domestic and ~~external~~balance of payments instability in such countries will lead to particularly disruptive exchange rate movements and undermine systemic stability. Heightened scrutiny should also be given in multilateral surveillance to the spillover effects of the financial sector policies of those members, given the risk that they may undermine global economic and financial stability. As financial stability assessments are a key tool for assessing members' financial vulnerabilities and financial sector policies, it is appropriate that financial stability assessments be conducted with such members as provided for in this Decision.

~~4.~~ 3. This Decision does not impose new obligations on members or, in particular, modify the scope of their obligations under Article IV~~, Section 1~~. The Fund, in its bilateral surveillance, will continue to assess whether a member's domestic economic and financial policies are directed toward the promotion of domestic stability. ~~Scope and modalities of financial stability assessments~~In its multilateral surveillance, the Fund may discuss the impact of members' policies on the effective operation of the international monetary system and may suggest alternative policies that, while promoting the member's own stability, better promote the effective operation of the international monetary system.

~~5.~~ **Scope and modalities of financial stability assessments**

4. **Determination of systemic importance**. The Managing Director, in consultation with the Executive Board, will identify those members that have systemically important financial sectors. This determination will be made in the context of each review that is conducted under paragraph ~~10~~9 below, and will be based on an assessment ~~of~~taking into account the size and interconnectedness of members' financial sectors as contemplated in paragraphs ~~23~~23 to ~~26~~27 in SM/~~10/235~~13/304.

~~6.~~ 5. **Financial stability assessments.** Where the financial sector of a member is determined to be systemically important pursuant to paragraph ~~5~~4 of this Decision, the member shall engage in a financial stability assessment in the context of bilateral and multilateral surveillance under Article IV of the Fund's Articles in accordance with the terms of this Decision. For this purpose, the member shall consult with the Fund and the authorities of the member shall make themselves available for discussions with Fund staff of the issues that fall within paragraph ~~7~~6 of this Decision.

~~7.~~

6. **Scope of financial stability assessments**. The financial stability assessments undertaken under this Decision will consist of the following elements:

a. An evaluation of the source, probability, and potential impact of the main risks to macro-financial stability in the near-term for the relevant financial sector. Such an evaluation will involve: an analysis of the structure and soundness of the financial system; trends in both the financial and nonfinancial sectors; risk transmission channels; and features of the overall policy framework that may attenuate or amplify financial stability risks (such as the exchange rate regime). Both quantitative analysis (such as balance sheet indicators and stress tests) and qualitative assessments will be used to evaluate the risks to macro-financial stability.

b. An assessment of the authorities' financial stability policy framework. Such an assessment will involve: an evaluation of the effectiveness of financial sector supervision; the quality of financial stability analysis and reports; the role of and coordination between the various institutions involved in financial stability policy; and the effectiveness of monetary policy.

c. An assessment of the authorities' capacity to manage and resolve a financial crisis should the risks materialize. Such an assessment will involve an overview of the country's liquidity management framework; financial safety nets (such as deposit insurance and lender-of-last-resort arrangements); crisis preparedness and crisis resolution frameworks; and the possible spillovers from the financial sector onto the sovereign balance sheet.

d. Where relevant, the assessments will also cover the spillovers arising from a member's financial sector policies that may significantly influence global economic and financial stability.

~~8.~~

7. **Modalities of assessments**. The key findings and recommendations of a financial stability assessment under this Decision will be summarized in a Financial System Stability Assessment Report (FSSA) that will normally be discussed by the Executive Board at the same time as the relevant Article IV consultation report.

~~9.~~ 8. **Frequency**. Where the financial sector of a member is determined to be systemically important pursuant to this Decision, it will be expected that a financial stability assessment will be conducted and the FSSA resulting from such an assessment will be discussed by the Executive Board by no later than the first deadline for completion of an Article IV consultation with the member that follows the fifth anniversary of such determination or, in the case of the financial sector of a territory of a member, the first deadline for completion of an Article IV consultation discussion with respect to that territory by the Executive Board that follows the fifth anniversary of such determination. It is expected that subsequent FSSAs for a member with a systemically important financial sector will be discussed by the Executive Board by no later than the first deadline for completion of an Article IV consultation with that member that follows the fifth anniversary of the date of completion of the previous Executive Board discussion of the FSSA respecting that member or, in the case of the financial sector of a territory of a member, the first deadline for completion of an Article IV consultation discussion with respect to that territory by the Executive Board that follows the fifth anniversary of the date of completion of the previous Executive Board discussion of the FSSA respecting the financial sector of that territory.

Miscellaneous

~~10.~~

9. **Review.** It is expected that the Fund will review this Decision no later than five years following the date of its adoption and subsequently at intervals of no longer than five years. In particular, as "systemic importance" is a dynamic concept, the Fund will, in the context of each such review, examine and revise, as necessary, the criteria and methodology for determining members with systemically important financial sectors. Moreover, the Fund may review this Decision at any time to take into account major advances in the availability of data and in the development of methodologies for assessing the systemic importance of financial sectors. ~~(SM/10/235, Sup. 3, 9/20/10) (SM/10/235, Sup. 3, 09/20/10)~~(SM/13/304, 11/18/13).

~~Decision No. 14736-(10/92), adopted~~

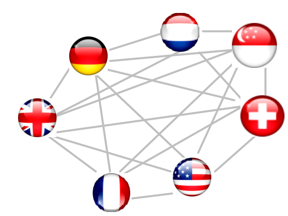
~~September 21, 2010~~

Appendix I. The Clique Percolation Method (CPM): Data and Implementation

36. The Clique Percolation Method (CPM) offers a practical approach for identifying the core of systemic jurisdictions. The CPM identifies all *k*-cliques, i.e., sets of at least *k* jurisdictions that are all fully connected to each other (illustrated in Figure 4). The *k*-clique is intuitive as the basic building block of the systemic core, since a systemic jurisdiction must be connected to several neighbors.

Figure 4. The *k*-clique: An Illustration *(k*=7*)*

In a *k*-clique, the *k* jurisdictions are all fully connected to each other



37. The CPM is applied to four global financial networks representing direct exposures and price correlations. The direct exposures comprise banking, debt, and equity portfolio exposures. The banking network is constructed using bilateral exposures based on bilateral claims reported in the Locational Banking Statistics compiled by the BIS,[13] where two jurisdictions are considered connected if there are bilateral claims between them. The strength of the connection is measured as the higher of the two jurisdictions' mutual exposures. The debt and equity exposures are constructed using the latest portfolio holdings data reported in the Coordinated Portfolio Investment Survey (CPIS). The price correlation network is constructed as a matrix of cross-country equity return correlations, with a jurisdiction's equity returns calculated from the MSCI equity index.[14]

38. Bilateral linkages are weighted by metrics of the jurisdictions' size and complexity. These are the geometric average of both countries' 2012 GDP on a PPP basis and their derivatives exposures vis-à-vis BIS reporting banks.[15] Geometric averages are used to reduce the disproportionate effect of the weighted exposures between a large country and a small country. The relative importance of each country to its partner is captured by scaling bilateral exposures by the geometric average of the two countries' total exposures. The result is a network where links take values ranging from 0 to 1.

[13] Although bank supervision is based on consolidated banking statistics, locational statistics are more useful in identifying vulnerabilities associated with pressures in the balance of payments (which, similar to locational statistics, is a residence-based concept).

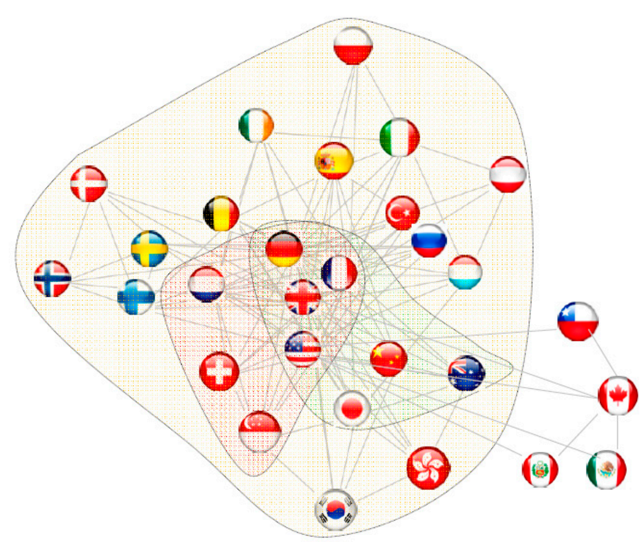
[14] In contrast to the other networks, that include almost all member countries, MSCI indices are only available for 53 jurisdictions. Jurisdictions for which this index is not available are not investable from the perspective of global investors, so they are less likely to pose a systemic risk to the global financial system. Equity price correlations are preferred over sovereign bond yields correlations since equity is a risky asset class whose price movements will react similarly to investor sentiment across countries. In contrast, the sovereign bond yields of safe haven jurisdictions served as benchmarks for all other bonds, so these jurisdictions cannot be easily fitted into the CPM model.

[15] A jurisdiction's derivatives exposure is set equal to total BIS reporting banks' consolidated derivatives claims on an ultimate basis on the jurisdiction. This captures the importance of the jurisdiction as a counterpart to the global banking system.

39. The most recent available data are used for the calculations. For the banking network, 2012 Q3 data were used; for the debt and equity networks, end-2011 data; for the correlation network, weekly equity returns for the period September 2008–September 2013; and for the weights (PPP GDP and gross derivatives exposures), 2012 data.

40. In each network, jurisdictions may be members of several fully connected *k*-cliques, which are similar to a chain of interlocking rings. This is illustrated by the overlapping cliques in Figure 5, constructed using bank exposures. In this illustrative example, the United Kingdom, the United States, Germany, and France, are members of two $k = 7$ cliques: one mostly in Europe (the same as in Figure 2) and one with three Asian countries. These countries, which straddle more than one cluster, can be seen as "gatekeepers" with the potential to amplify or attenuate the transmission of shocks between clusters. Other countries are not in any $k = 5$ or higher clique of fully connected members. In the illustration in Figure 3, for example, Canada is not in any such clique. Canada has strong ties to Mexico, Peru, Chile, the U.S., and the U.K. Peru and Chile, however, only have ties to the U.S. and the U.K. and one other partner country outside the group of countries that Canada is strongly tied to. As a result, no interconnected clique of an order at least $k = 5$ can be found around Canada.

Figure 5. A Chain of *k*-cliques (*k*=5)



41. The minimum size of the *k*-clique is a key parameter of the model. If the minimum size of the *k*-clique imposed on the network is too large, no such set of fully connected jurisdictions may be found, yielding an empty systemic core. If the size of the *k*-clique is too low, then the systemic core would be too large. At the limit, a *k*-clique of size 2—the lowest possible value—would yield a systemic core comprising every single jurisdiction in the network.

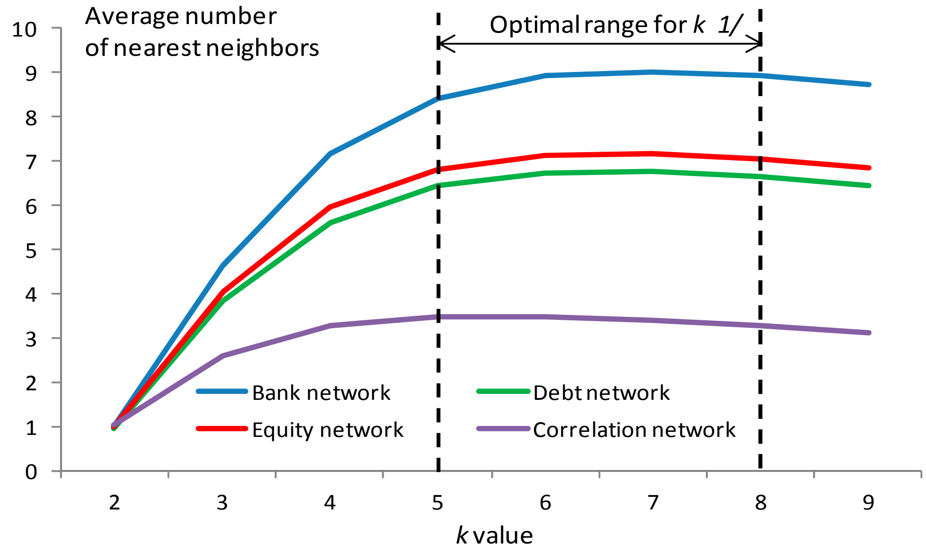
42. Graph theory provides a way to determine the optimal size of *k* based on network properties. Fortunately, the choice of the minimum size of the *k*-clique is not arbitrary: graph theory heuristic algorithms facilitate the determination of an optimal value for *k*. The algorithms attempt to find the clique size that maximizes the average number of nearest neighbors of a jurisdiction. The higher the average number of neighbors, the more likely it is to find overlapping cliques.[16]

[16] See I. Derenyi, G. Palla, and T. Vicsek, 2005, "Clique percolation in random networks," *Phys. Rev. Lett*, 94 1602202; G. Palla, I. Derenyi, and T. Vicsek, 2007, "The critical point of *k*-clique percolation in the Erdos-Renyi graph," *J. Stat. Phys.*

(continued)

43. On this basis, the value of *k* = 5 is selected for the four global financial networks. The optimal range for *k* is 5–8 for the three exposure networks and 4–8 for the correlation network. These values maximize the number of neighbors, as illustrated in Figure 4. The minimum clique size for this exercise is thus set to 5, at the lower end of the optimal range, to maximize the number of jurisdictions in the systemic core.

Figure 6. Optimal Range for the Minimum *k*-clique Size



1/ For the correlation network, the optimal range is [4,8]

Source: Staff calculations.

44. The choice of a minimum threshold for bilateral links is guided by both theory and judgment. The threshold determines which bilateral links (exposures or correlations) are taken into account in the construction of the global network. A low or zero threshold would capture insignificant bilateral links, resulting in a very dense global network and, for any given *k*, a larger systemic core. The algorithm that determines the optimal clique size also helps determine a threshold value below which bilateral links should be dropped from the network.[17] This helps ensure the network is dense enough to generate a systemic core, but sparse enough to avoid the emergence of a global subcomponent encompassing most of the jurisdictions in the network. For a clique of *k* = 5, the threshold values suggested by the heuristic algorithm range in between 1¼-2½ percent of total weighted assets for the bank exposure network; between 3½–7 percent for the equity and debt exposures network; and between 0.01 to 0.08 for the weighted equity return

128, 219-27; and K. Youssef, 2012, "Cluster analysis: framework and application," in *Enhancing Surveilance: Interconnectedness and Clusters* (Washington, D.C.: IMF).

[17] See K. Youssef (2012) "Cluster analysis: framework and application," in *Enhancing Surveillance: Interconnectedness and Clusters* (Washington, D.C.: IMF).

correlations network. With these theoretical values as the starting point, the threshold for this exercise is calibrated such that the coverage of the resulting systemic core financial system is similar to the one in the 2010 exercise. The threshold is set at 1½ percent for all direct exposures network and 0.015 for the correlation network.

45. Sensitivity analysis supports the choice of the selected parameter values (Table 5).

- Varying the minimum size of the *k*-clique quickly leads to suboptimal outcomes. Increasing *k* to 6 or 7, though still within the theoretically-determined optimal range, means that no fully connected clique (thus no systemic core) exists for the equity exposures network. Even keeping $k = 5$ for the price correlation network and increasing it to 6 or 7 for the exposures networks alone would drop a number of important countries, reducing substantially the size of the systemic core both in terms of the number of jurisdictions and in terms of coverage of global system assets. On the other hand, reducing *k* to 4 would not only take the minimum size of the *k*-clique outside the theoretically-determined optimal range for three of the networks but also lead to a large increase in the number of jurisdictions in the systemic core to 34.

- Varying the value of the threshold around the central value has asymmetric effects on the size of the systemic core: lowering the threshold to 1.3 percent has no impact on the systemic core, while raising it to 1.8 percent would result in dropping a number of important jurisdictions and reducing significantly the coverage of the systemic core in terms of global financial system assets.

Table 5. Sensitivity of 2013 Methodology to Different Minimum Thresholds and Size of Clique

k, size of clique (number of countries in clique)					
5	5	5 1/	4	6 2/	7 2/
Minimum threshold					
1.3	1.8	2	1.5	1.5	1.5
Number of countries					
29	24	19	34	25	21
Countries added to or removed from the systemic 29 countries identified with k=5 and threshold of 1.5: 3/					
0	(4)	(10)	5	(4)	(8)
None	India	Brazil	Czech Republic	Brazil	Brazil
	Mexico	Denmark	Indonesia	India	Denmark
	Poland	Finland	Malaysia	Mexico	Finland
	Russia	India	Portugal	Poland	India
	Turkey	Mexico	Saudi Arabia		Mexico
		Norway			Poland
		Poland			Russia
		Russia			Turkey
		Sweden			
		Turkey			
Percent of the global financial system					
92	85	83	93	88	85

1/ k=4 clique for the equity exposures network because no higher-order clique exists for given threshold.

2/ k=5 clique for the equity exposures network because no higher-order clique exists.

3/ Countries added to the list in black; removed from the list in red.

Appendix II. Integrating Stability Assessments Under the Financial Sector Assessment Program into Article IV Surveillance: Text of Amended Decision

This Decision sets out the scope and modalities of bilateral surveillance over the financial sector policies of members with systemically important financial sectors and of multilateral surveillance over the spillovers arising from such policies in accordance with Article IV, Sections 3 (a) and (b) of the Fund's Articles and the Fund's Decision on Bilateral and Multilateral Surveillance - 2012 Integrated Surveillance Decision (Decision No. 15203-(12/72), adopted July 18, 2012 (the "ISD").

Introduction

1. The obligations of the Fund and its members with regard to bilateral and multilateral surveillance are set forth in Article IV of the Fund's Articles and further elaborated in the ISD.

a. With respect to bilateral surveillance, Article IV, Section 1 requires each member to "collaborate with the Fund and other members to assure orderly exchange arrangements and to promote a stable system of exchange rates" ("systemic stability"). Recognizing the important impact that a member's domestic economic and financial policies can have on systemic stability, Article IV, Sections 1(i) and (ii) establish obligations for members respecting the conduct of these policies, including their financial sector policies. In accordance with the framework set out in Article IV, the ISD provides that systemic stability is most effectively achieved by each member adopting policies that promote its own balance of payments stability and domestic stability—that is, policies that are consistent with members' obligations under Article IV, Section 1 and, in particular, the specific obligations set forth in Article IV, Section 1, (i) through (iv). "Balance of payments stability" refers to a balance of payments position that does not, and is not likely to, give rise to disruptive exchange rate movements. In the conduct of their domestic economic and financial policies, members are considered to be promoting balance of payments stability when they are promoting their own domestic stability that is, when they comply with the obligations of Article IV, Sections 1 (i) and (ii) of the Fund's Articles. For this purpose, the ISD requires the Fund's bilateral surveillance to assess, in particular, whether a member's domestic policies are directed towards domestic stability. It provides that "financial sector policies (both their macroeconomic aspects and macroeconomically relevant structural aspects)" will always be the subject of the Fund's bilateral surveillance with respect to each member.

b. With respect to multilateral surveillance, Article IV, Section 3 (a) requires the Fund to oversee the international monetary system in order to ensure its effective operation, and requires members to consult with the Fund on any issue that the Fund considers necessary for this purpose. The ISD recognizes that the international monetary system may only operate effectively in an environment of global economic and financial stability, and provides that the Fund in its multilateral surveillance will focus on issues that may affect global economic and financial stability, including the spillovers arising from policies of individual members that may significantly influence the effective operation of the international monetary system. The policies of members that may be relevant for this purpose include, among others, members' financial sector policies.

2. While an examination of members' financial sector policies is important in all cases of bilateral surveillance, the Fund decides that, taking into account the framework described above and the overall purpose of surveillance, heightened scrutiny should be given in bilateral surveillance to the financial sector policies of those members whose financial sectors are systemically important, given the risk that domestic and balance of payments instability in such countries will lead to particularly disruptive exchange rate movements and undermine systemic stability. Heightened scrutiny should also be given in multilateral surveillance to the spillover effects of the financial sector policies of those members, given the risk that they may undermine global economic and financial stability. As financial stability assessments are a key tool for assessing members' financial vulnerabilities and financial sector policies, it is appropriate that financial stability assessments be conducted with such members as provided for in this Decision.

3. This Decision does not impose new obligations on members or, in particular, modify the scope of their obligations under Article IV. The Fund, in its bilateral surveillance, will continue to assess whether a member's domestic economic and financial policies are directed toward the promotion of domestic stability. In its multilateral surveillance, the Fund may discuss the impact of members' policies on the effective operation of the international monetary system and may suggest alternative policies that, while promoting the member's own stability, better promote the effective operation of the international monetary system.

Scope and modalities of financial stability assessments

4. **Determination of systemic importance**. The Managing Director, in consultation with the Executive Board, will identify those members that have systemically important financial sectors. This determination will be made in the context of each review that is conducted under paragraph 9

below, and will be based on an assessment taking into account the size and interconnectedness of members' financial sectors as contemplated in paragraphs 23 to 27 in SM/13/304.

5. **Financial stability assessments.** Where the financial sector of a member is determined to be systemically important pursuant to paragraph 4 of this Decision, the member shall engage in a financial stability assessment in the context of bilateral and multilateral surveillance under Article IV of the Fund's Articles in accordance with the terms of this Decision. For this purpose, the member shall consult with the Fund and the authorities of the member shall make themselves available for discussions with Fund staff of the issues that fall within paragraph 6 of this Decision.

6. **Scope of financial stability assessments**. The financial stability assessments undertaken under this Decision will consist of the following elements:

a. An evaluation of the source, probability, and potential impact of the main risks to macro-financial stability in the near-term for the relevant financial sector. Such an evaluation will involve: an analysis of the structure and soundness of the financial system; trends in both the financial and nonfinancial sectors; risk transmission channels; and features of the overall policy framework that may attenuate or amplify financial stability risks (such as the exchange rate regime). Both quantitative analysis (such as balance sheet indicators and stress tests) and qualitative assessments will be used to evaluate the risks to macro-financial stability.

b. An assessment of the authorities' financial stability policy framework. Such an assessment will involve: an evaluation of the effectiveness of financial sector supervision; the quality of financial stability analysis and reports; the role of and coordination between the various institutions involved in financial stability policy; and the effectiveness of monetary policy.

c. An assessment of the authorities' capacity to manage and resolve a financial crisis should the risks materialize. Such an assessment will involve an overview of the country's liquidity management framework; financial safety nets (such as deposit insurance and lender-of-last-resort arrangements); crisis preparedness and crisis resolution frameworks; and the possible spillovers from the financial sector onto the sovereign balance sheet.

d. Where relevant, the assessments will also cover the spillovers arising from a member's financial sector policies that may significantly influence global economic and financial stability.

7. **Modalities of assessments**. The key findings and recommendations of a financial stability assessment under this Decision will be summarized in a Financial System Stability Assessment Report (FSSA) that will normally be discussed by the Executive Board at the same time as the relevant Article IV consultation report.

8. **Frequency**. Where the financial sector of a member is determined to be systemically important pursuant to this Decision, it will be expected that a financial stability assessment will be conducted and the FSSA resulting from such an assessment will be discussed by the Executive Board by no later than the first deadline for completion of an Article IV consultation with the member that follows the fifth anniversary of such determination or, in the case of the financial sector of a territory of a member, the first deadline for completion of an Article IV consultation discussion with respect to that territory by the Executive Board that follows the fifth anniversary of such determination. It is expected that subsequent FSSAs for a member with a systemically important financial sector will be discussed by the Executive Board by no later than the first deadline for completion of an Article IV consultation with that member that follows the fifth anniversary of the date of completion of the previous Executive Board discussion of the FSSA respecting that member or, in the case of the financial sector of a territory of a member, the first deadline for completion of an Article IV consultation discussion with respect to that territory by the Executive Board that follows the fifth anniversary of the date of completion of the previous Executive Board discussion of the FSSA respecting the financial sector of that territory.

Miscellaneous

9. **Review.** It is expected that the Fund will review this Decision no later than five years following the date of its adoption and subsequently at intervals of no longer than five years. In particular, as "systemic importance" is a dynamic concept, the Fund will, in the context of each such review, examine and revise, as necessary, the criteria and methodology for determining members with systemically important financial sectors. Moreover, the Fund may review this Decision at any time to take into account major advances in the availability of data and in the development of methodologies for assessing the systemic importance of financial sectors. (SM/13/304, 11/18/13).