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Systemic Risk Identification in Securities Markets

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I. Introduction

The financial crisis highlights the need to identify and monitor systemic risk in the securities markets, before we can manage it. In this context, IOSCO has adapted its *Mission and Goals*; added two principles regarding the identification and management of systemic risk to its *IOSCO Objectives and Principles of Securities Regulation*[1]*;* developed high level guidance in its *Methodology for Assessing Implementation of the IOSCO Objectives and Principles of Securities Regulation;* published an exploratory paper that discusses the tools securities regulators can use in mitigating systemic risks;[2] and produced a *Securities Markets Risk Outlook* that discusses some of the major potential systemic risks arising from the securities markets.[3]

Adding to this body of work, this Consultation Paper outlines a systematic approach to assist securities market regulators specifically, in the identifying and monitoring of systemic risks and risk build-up in entities, market infrastructures, products and activities. The "system" presented in this report relies on a list of practical and concrete indicators and offers a flexible and coherent process within which to use them.[4] Ultimately, the system will serve a dual purpose in (1) providing a standardized approach to systemic risk identification and monitoring across jurisdictions and (2) guiding data collection. As well as securities regulators, this system may prove beneficial to IOSCO, other organizations with an interest in financial stability and researchers.

This report does not attempt a literature review as comprehensive reports offering such analysis are already in the public domain.[5] Rather this report attempts to take one step further towards building a practical methodology for identifying and measuring systemic risk in securities market by outlining a practical approach and testing its potential value using case studies (see annexes). Of course, since there is no precedent or existing methodology available for systemic risk identification in securities market, a system like this can only be thoroughly tested in practice.

The paper is structured as follows. Section 2 outlines the various elements of this system. Section 3 provides a step-by-step application of the system. Appendix 1 presents the case studies on financial *entities* (LTCM hedge fund) and *products* (unit linked products in the Netherlands). Appendix 2 gives a full list of indicators that can be used within the system.

[1] IOSCO, *Objectives and Principles of Securities Regulation*, 2010, Principles 6 and 7 https://www.iosco.org/library/pubdocs/pdf/IOSCOPD323.pdf

[2] IOSCO, *Mitigating Systemic Risk – A Role for Securities Regulators*, 2011

[3] This Outlook will be produced annually by the Research Department of IOSCO.

[4] The list of indicators identified by the system should be expanded, refined and adapted by regulators for use in their own markets. Furthermore, data will need to be gathered for the selected indicators and analysed.

[5] See for example Dimitrios Bisias, Mark Flood, Andrew W. Lo, Stavros Valavanis, A Survey of Systemic Risk Analytics, Office of Financial Research, Working Paper 1, January 5 2012; Bernd Schwaab, Siem Jan Koopman, Andre Lucas, "Systemic Risk Diagnostics: Coincident Indicators and Early Warning Signals", Working Paper Series, No. 1327, April 2011.

II. Describing the System

This systemic risk identification system has five main elements:

1. **Multi-level indicators** – macro, micro and thematic
2. **Systemic Risk Factors** – to distinguish *systemic* risk and guide the development/use of indicators
3. **A two-sided approach** – top-down and bottom-up to ensure external and internal risk factors are taken into account.
4. **Adaptability** – indicators in the system can be applied meaningfully to different jurisdictions with different systemic risk concerns.
5. **Flexibility** – to allow the system to evolve as data is gathered and new risks emerge.

1. Multi-level Indicators – micro, macro and thematic

The aim of this system is to encourage the use and development of indicators that are practical[6], coincidental, forward looking and dynamic. The indicators are divided first into macro level and micro level indicators. The macro level indicators help to provide signalling on emerging risks stemming from the broader environment, such as the macro-economy, the political and regulatory environment, technology and socio-economic trends. The micro indicators signal risks emanating from securities markets themselves, which could have systemic implications.

Macro level indicators include indicators on financial stress, market imbalances, macro-economic issues, fiscal debt sustainability and asset prices/spreads and can provide indications of risks developing in the financial system. A summary of some macro-level indicators are provided in Table 1.

Micro-level indicators can be broken down into 'broad' securities market indicators and 'thematic' securities market indicators. Broad indicators provide high-level information *across* activities, participants and securities markets. In essence, they provide a general health gauge of securities markets and can assist in picking up 'hot points' in terms of activities, firms, products, and infrastructures that may signal the build-up of systemic risk.

Thematic indicators can, in general, be applied to *specific* activities, participants and securities markets. Thematic indicators may be used after alternative information gathering exercises, such as surveys, market intelligence, and expert observation, have identified particular risk areas that could potentially become systemic. For example, if the build-up of risk in hedge funds has already been flagged through other means, regulators would use their discretion and expertise to choose the relevant thematic indicators from the list of indicators in the system that are relevant to hedge funds to discern whether this risk could become systemic. Broad and thematic indicators may overlap in some cases.

[6] Taking into account data availability issues, it is important that calculating the indicators is not prohibitive.

Table 1: Summary of Macro-level indicators

Macro level indicators	
Financial Stress	Financial stress indexes Deviations from long-term value of assets
Market Imbalance	Market significantly above long-term average Strong inflows into an asset class Levels of leverage at historical highs
Macro-economic data	Interest-rate fluctuation Negative real-interest rates connected to size of country - liquidity abundant, risk pricing will be blurred. Credit-bubble indicator. Price/earnings indicator of global markets Inflation Economic growth rates Flows of funds Changes in the money supply and credit growth Interbank lending Asset purchase programs by central banks
Fiscal debt sustainability	Sovereign debt Overall indebtedness of market participants, issuers or individuals in aggregate
Asset prices and spreads	Asset prices and spreads (credit, equity and commodity markets)
Other	Movement of international capital flow Geopolitical environment

Source: IOSCO Research Department

2. Systemic Risk Factors to distinguish systemic risk and guide the development/use of indicators

Indicators for measuring risk in the securities markets should be succinct and practical. When grouped in a framework, these indicators should describe as much about a market and relevant interactions as possible. Particular 'Systemic Risk Factors' have been developed for this system to act essentially as indicator categories. In this way they highlight descriptive elements of an activity, participant, entity or market (e.g. size, complexity etc.) that could signal the build-up of risk or the potential for a risk concern to become systemic.

Table 2: List of Systemic Risk Factors for securities markets

• **Size** • **Liquidity** • **Cross-Jurisdictional** • **Transparency** • **Interconnectedness** • **Substitutability and Institution structure** • **Market Integrity and efficiency**	• **Concentration** • **Behaviour** • **Incentive Structure** • **Leverage** • **Regulation** • **Complexity**

Source: IOSCO Research Department

Individual indicators are grouped according to these systemic risk factors. For example, market size would be categorized under the 'Size' systemic risk factor, market manipulation indicators

would be under the 'Market integrity and efficiency' systemic risk factor. This is especially important when we consider that, in some cases, individual indicators cannot tell a story about systemic risk unless grouped together i.e. multiple aspects of a market, entity, activity etc. need to be presented in order to identify potential systemic risk build-up. By providing a list of indicators for each element of a risk that could make it potentially systemic, comprehensive systemic risk identification frameworks can be derived from this system. Table 3 provides an example of the types of micro-level indicators that can be grouped in this way. (See Box 1 for more information on how the systemic risk factors were derived).

Table 3: Micro-level indicator types by Systemic Risk Factor

Systemic Risk Factors	Consolidated Indicators for Securities Markets (Thematic)
Size	Market-size indicators (Value, growth, footprint)
	Asset and flow of money indicators
Liquidity	Liquidity in market indicators and dependence of specific liquidity on global/market liquidity (e.g. LIBOR spreads)
	Credit market/bond market stability indicator
	Securitization and collateral indicators (e.g. level of collateralization)
Cross Jurisdictional	Cross-jurisdictional claims and liabilities indicators
Transparency	Consumer confidence on financial advisors and markets
	Change in proportion of activity on non-transparent markets (year on year) indicator
Interconnectedness	Correlation between markets, products and institutions Indicator (e.g. IMF network analysis of banks)
	Intra-financial system assets and liabilities indicators (e.g. for non-bank SIFIS and G-SIB)
	Counterparty concentration/exposure and collateralization indicators
Substitutability and institution structure	Scale of exposure to individual assets, markets and institutions indicators
	Risk-neutral probability of default for each institution indicator
	Qualitative assessments of availability of alternatives/substitutes
Market Integrity and Efficiency	Market manipulation indicator
	Broker/client conflict indicators
	Insider-trading indicator
Concentration	Scale of exposure to individual assets, markets and institutions indicators
	Risk-neutral probability of default for each institution indicator
Behaviour	Herding/flow of funds (e.g. top 5 biggest products invested into, top 5 most aggressive firms and their most beneficial activities)
	Trends in selling practices (e.g. surveys, regulatory compliance)
Incentive Structure	Margining schedule/haircuts (e.g. for Repo markets)
	Trends in remuneration practices
Leverage	Leverage and speed of money indicators
Regulation	Proportion of unregulated transactions indicator (alternative trading schemes, dark trading, non-listed exchange traded funds etc.)
	Existence and nature of under-regulated areas of markets
Complexity	Complexity indicator (Number/value of complex product)
	Portfolio penetration (pp) indicator (e.g. % of avg. household pp)
	Qualitative assessment of investor/market participant understanding of products in markets (e.g. surveys)

Source: IOSCO Research Department

Box 1: Indicators in the regulatory literature on systemic risk

The range of Systemic Risk Factors, with the initial batch of associated indicators, has been derived from a comparison of existing work presented by the Basel Committee on Banking Supervision on so-called globally systemically important banks (G-SIBs), IOSCO's Task Force on Unregulated Entities (TFUE) work on hedge funds, the Financial Stability Board on so-called non-bank systemically important financial institutions (SIFIs), the market integrity framework developed by the private firm Capital Markets CRC Limited (CMCRC), the Office of Financial Research's (U.S. Department of the Treasury) Survey of Systemic Risk Analytics, and findings from the authors in developing IOSCO's annual Securities Market Risk Outlook. A summary and comparison of the Systemic Risk Factors identified in this literature is provided in Table 3.

Table 4: Summarized comparative list of Systemic Risk Factors[7]

Non-Bank SIFIS (FSB, 2012)	Hedge Funds (IOSCO, 2012)	Securities Market (IOSCO, 2011)	GSIB (Indicator weighting) (BCBS, 2011)	General Systemic Risks (IOSCO SC on Risk and Research – Work Stream 1)	Market (CMCRC Market Integrity Framework)	Survey of Systemic Risk Analytics (OFR, 2012)
Size	Size	Size	Size (20%)	Size		
Cross-jurisdictional Activity	Cross-jurisdictional		Cross-jurisdictional activity (20%)			
Interconnectedness	Interconnectedness	Interconnectedness	Interconnectedness (20%)	Interconnectedness		Granular Foundations and Network Measures/ Cross-sectional Measures
Substitutability/ Financial institution infrastructure	Substitutability	Substitutability and Concentration	Substitutability/ Financial institution infrastructure (20%)	Concentration and market structure		
Complexity	Complexity		Complexity (20%)			
	Leverage	Leverage		Leverage		
	Liquidity risk/maturity transformation			Liquidity, price formation and volatility		Measures of Illiquidity and Insolvency
	Transparency	Lack of transparency and knowledge gaps		Lack of transparency		
		Behaviour issues		Behavioural issues		
	Existing regulation	Regulatory gaps				
				Incentive structure		
					Market integrity and efficiency	

Source: IOSCO Research Department

There are clear similarities and differences between the various approaches in the literature. Certain Systemic Risk Factors such as leverage, liquidity, price formation and volatility, lack of transparency, behavioural issues and incentive structure are applied for systemic risk analysis for securities markets but not by prudential regulators. On the other hand, some factors such as cross-jurisdictional activity and complexity are not applied in all securities market methodologies. The final list of Systemic Risk

[7] Factors derived from FSB (2012), non-bank SIFIS methodology; IOSCO (2012), hedge funds methodology (March 2012 updates); IOSCO (2011) discussion paper on systemic risk in securities markets; BCBS methodology for globally systemically important banks; Dimitrios Bisias, Mark Flood, Andrew W. Lo, Stavros Valavanis, *A Survey of Systemic Risk Analytics*, Office of Financial Research, Working Paper 1, January 5 2012; and from IOSCO Standing Committee on Risk and Research (Workstream 1).

Factors for this system takes into account these gaps, inconsistencies and overlaps to provide one coherent list of factors relevant for identifying systemic risk in securities markets (Table 4).

3. A two-sided approach – top-down and bottom-up to ensure external and internal risk factors are taken into account.

The use of macro- and micro-level indicators allows for a top-down and bottom-up approach to systemic risk identification and monitoring. In this way, internal and external risk factors (within and outside of securities markets) can be taken into account by securities regulators, minimizing the chance of risk build-up 'falling through the cracks'.

From a top-down approach, macro indicators provide signalling on emerging risks stemming from the broader environment. Once there is an identification of a risk or abnormality, regulators would then dig deeper into the securities markets, using both broad micro-level indicators and thematic indicators (around flagged potentially emerging risks) to see if they can identify the potential impact on and/or source from the markets within their remit.

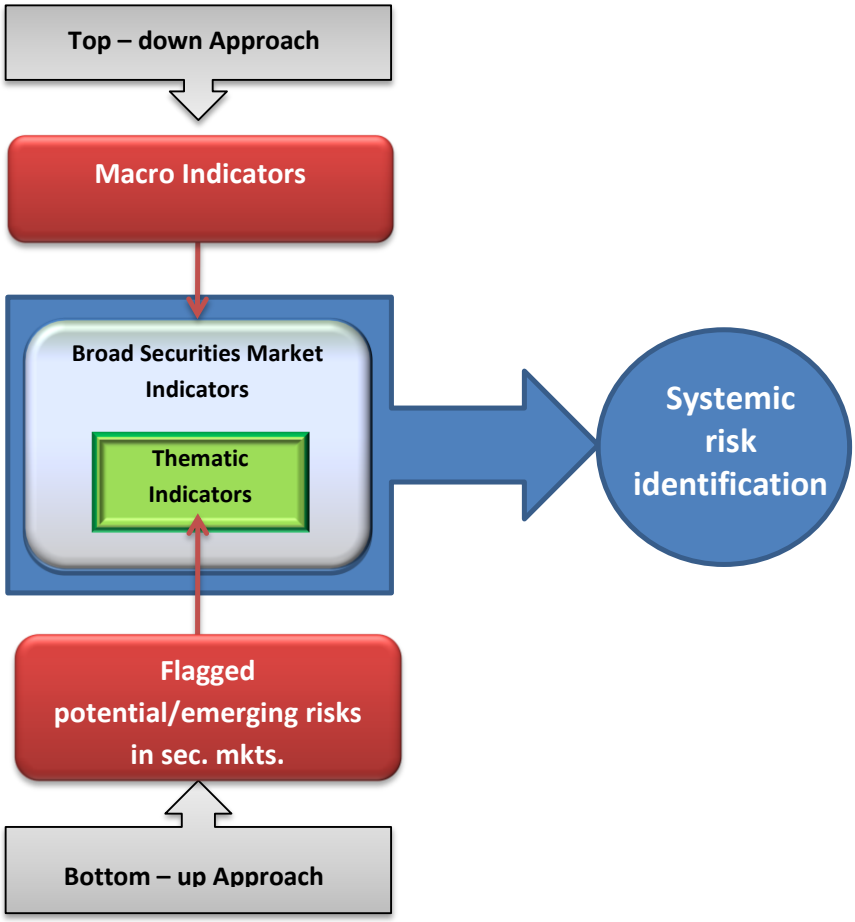
For example, monitoring macro-level indicators might show negative real-interest rates[8], driving purchase of credit products and stimulating credit markets; home equity line of credit is driving up consumer debt; and financial-stress indexes confirm the existence of stress for securities market.

The broad securities-market indicators can then be used to pinpoint which factors (e.g. complexity, transparency etc.) and elements (e.g. particular activities, participants, products etc.) are contributing to this risk. For example, broad micro-level indicators such as trade flows of top 5 players (size), proportion of unregulated markets (Transparency and Regulation), incentive structures across markets (Incentive structure) and excessive fee raising (Behaviour) could provide general information on where risks may be building up (e.g. risk build-up in shadow banking). Thematic indicators could then be applied appropriately to assess the risk.

From the bottom-up, potential emerging risks already flagged would be assessed for potential systemic importance using thematic indicators (e.g. growth and complexity in credit products such as money markets, leverage of money market funds etc. In this case, regulators would harness information from the market (through market intelligence work, surveys and general observation) and use expert judgement to choose the participants, activities and products that could be of concern for their jurisdiction. Regulators would in some cases use a reference point such as pre-determined thresholds or industry averages, to assess whether certain indicators are suggesting a systemic risk concern. This top-down and bottom-up approach is represented in Figure 1.

[8] When interest rates are below consumer price index, real interest rate is considered to be negative.

Figure 1: Two-sided approach



Note: Flagged potential/emerging risks refer to those highlighted from market intelligence, surveys etc.
Source: IOSCO Research Department

As Figure 1 reveals, using a top-down and bottom-up approach simultaneously allows for a triangulation of systemic risk identification in securities markets and ensures new, poorly understood and emerging risks can be taken into account. A top-down approach is necessary because unknown and new systemic risks may be missed using a bottom-up approach only, especially since it is not possible to thoroughly monitor every activity, product and market at all times. Furthermore, regulators and the market may be unaware of potential new risk areas if they have not occurred before. Lastly, there may be a case where a whole industry is performing abnormally – meaning there is no clear reference point against which to compare micro-indicators. In all these cases, abnormalities at the macro-level can signal the need to dig a little deeper, even if nothing has yet been picked up at the micro-level.

At the same time, micro-level indicators allow securities regulators to pinpoint emerging systemic risk before it has significant impact on the real economy, by harnessing the full range of information gathering exercises. Taking this two-sided approach of supervision of securities markets would ensure that securities regulators are prepared to tackle risks from both angles – the securities market and macro-level.

4. Adaptability – indicators in the system can be applied meaningfully to different jurisdictions with different systemic risk concerns.

This system has been developed with the understanding that not all risks can be measured with the same set of indicators – one size does not fit all risks. Thus, not all indicators provided through this system will be relevant for all risk concerns, nor will all indicators have the necessary data or information for calculation. Furthermore, regulatory constraints may prohibit data collection in some jurisdictions. The system thus contains a list of high-level indicators that can, for the most part, be adapted to the type of entity or participant under observation.

Given the different factors influencing risk in securities markets (size, interconnectedness, complexity etc.) and the variety of market participants, products, market infrastructure and activity across jurisdictions, this system aims to provide a 'skeleton' for systemic risk identification efforts rather than prescribe a strict methodology.

Users of this system should utilize their discretion to discern the appropriate Systemic Risk Factors and indicators feasible for their particular assessments and monitoring needs and leave out the ones that are not. When an indicator is deemed immediately relevant for assessment of a particular potential systemic risk concern but data is not available, such cases should be used to signal urgent data gaps and guide future data collection efforts. Expert judgment, market intelligence, development of proxies or a combination of approaches can also be exercised to get past data constraints.[9]

In this way, this system allows regulators to essentially fashion their own specific frameworks for the identification and monitoring of systemic risk in their individual markets. At the same time, the two-sided approach and coherent, practical list of multi-level indicators offered through this system can ensure that a standardised and comprehensive approach towards systemic risk identification is taken across jurisdictions.

5. Flexibility – to allow the system to evolve as data is gathered and new risks emerge.

The full list of indicators provided in Appendix 2 is a menu of indicators that can be applied in and across securities markets. It should be noted that the list is not exhaustive and requires further development. The list is flexible in the sense that new indicators and Systemic Risk Factors can be added as they are developed and new risks emerge.

[9] A prime example is the methodology used of the IOSCO Securities Markets Risk Outlook where a survey of experts and market intelligence were the primary source in the risk-identification process.

Potential data sources and suggested tools for collecting necessary data will also be provided alongside each indicator, as they are identified. Thresholds should also eventually be assigned for relevant indicators to provide a reference point for distinguishing entities, activities etc. that may pose systemic risks.

As each individual user of the system generates and uses their own unique frameworks of indicators from the system to monitor systemic risk in their markets, a centralized 'living archive' of systemic risk measurement efforts will effectively be built.

Since regulators are basing assessment on the same core list of indicators, these measurements will be comparable, allowing regulators to learn from each other and for a picture of systemic risk in securities markets to be aggregated at the global level. This dynamism and coherency is currently missing from more fragmented approaches to building indicators.

III. Using the System

The Spread sheets in Appendix 2 contain a list of practical micro and macro indicators compiled and categorized so far, to be input in the system. A sample of the micro-level indicator spread sheets is provided in Figure 2.

Figure 2: Cut-out of micro-level indicator spread sheet

	A	B	C
1	**Systemic Risk Factors**	**Consolidated Indicators for Securities Markets (broad and thematic)**	**Data Source**
2	Size	Broad absolute, relative and rate-of-growth size measures of sectors, markets, products, market participants and key gatekeepers and market activities. These measures can be used to discern the volume of financial services provided by a component of the financial system, the systemic importance of a particular entity in the market and the size of a market in comparison to other markets, the growth of complex product markets and historical trends to identify potential systemic risk.	Databases, market intelligence, surveys, reports etc.
3		**Type A Indicators**	
4		**Main investor-base indicators**	
5		Top 5 largest investor classes (e.g. high-net worth, institutional)	
6		**Market-size indicators**	
7		Value of turnover/number of transactions in each asset class	
8		Relative, aboslute and rate of growth for dominant markets	
9		Level of HFT (share of turnover, share of order)	
10		**Asset and flow-of-money indicators**	
11		Top 5 most aggressive institutions and size and growth of most beneficial activities (e.g. Investment banks, hedge funds)	
12		**Type B Indicators**	
13		Quantitative	
14		**Market-size indicators**	
15		Relative, absolute and rate of growth of particular market	
16		Value of turnover/number of transactions for asset class	
17		**Main funding-base/dependency indicators**	
18		Number of qualifying funds (e.g. for hedge fund)	
19		**Asset and flow-of-money indicators**	
20		Firm assets under management	
21		NAV of total fund and strategy assets	
22		Qualitative	
23		**Predominant investment strategy for firm. (e.g. for hedge funds)**	
24		**Size and nature of ilssuers, intermediaries, institutional investors, CRAs, auditors etc.**	
25		**Nature of investor base**	
26		Liquidity indicators can measure changes in liquidity. Evaporation of liquidity can signal risk in the securities market as firms struggle to meet obligations. This can have knock-on effects for the securities markets.	
27		**Type A Indicators**	
28		**Liquidity-in-market indicators**	
29		Amount of trading through CCPs and OTC markets	
30		Short selling (volume, outstanding, net short positions)	
31		Market concentration and concentration of holdings	
32		**Credit market indicators**	
33		Amount of encumbered assets and collateralizations for banks issuing covered bonds	
34		**Type B Indicators**	
35		Quantitative	
36		**Liquidity-in-market indicators**	
37		Portfolio, investor and financial liquidity	

Source: IOSCO Research Department

Note: Type A indicators = broad securities market indicators, Type B indicators = thematic indicators.

It is envisioned that these spread sheets will be put into a computerized system/database whereby regulators, after identifying a possible systemic risk concern or noticing abnormalities at the macro-level, can check off the indicators they think will be needed to assess risks.

Next to each indicator will be information on how and where to find the necessary data. Some data will not be easily retrievable, so other methods such as surveys, market intelligence exercises, proxies etc. may be suggested. Frameworks of indicators generated by users for particular risk concerns[10] will be stored on the system as templates for other regulators especially those in emerging markets, who may lack the resources and capacity, to base their own risk identification efforts.

Once the system is up and running, there will be three main ways in which it can be used. A step by step is offered for each below. Appendix 1 presents back-tested examples of using the system.

[10] Specific data and information will not be stored, only the types of indicators used and the specific risk concern.

1. Using the system to identify systemic risk step-by-step

The preferable execution of this system for systemic risk identification would be as follows:

Start with bottom-up approach

Each individual securities regulator to:

1. Identify possible emerging systemic risks in their own markets e.g. using market intelligence, survey, expert judgement, IOSCO reports etc.
2. Select from the systemic risk identification system a useful, feasible and manageable number of thematic indicators relevant for their identified risks.
1. Calculate indicators based on data sources suggested through system, additional data sources they are aware of or have access to and alternative data collection methods (e.g. proxies, surveys etc.)
2. Define thresholds, use judgement and other relative measures to discern whether emerging risks could be or are potentially systemic.
3. Monitor macro-level indicators in order to note link between risk build-up in securities market and impacts on the real economy (taking into account that certain risks may be relevant for securities market but not apparent at the macro-level e.g. growth of shadow banking sector).
4. Feed the findings into supervisory and policy discussions about how to manage the risks and let them guide further research work.

Follow on with the top-down approach

Each individual securities regulator to:

1. Monitor macro-level indicators in order to identify any abnormalities.
2. If abnormalities are identified, select from the system a useful, feasible and manageable number of broad micro-indicators to help pinpoint impact on or potential source from securities markets.
3. Calculate indicators (as in bottom-up approach).
4. If potential source/impact is identified, which is not covered in bottom-up approach, thematic indicators used (as in bottom up approach).
5. Feed the findings into supervisory and policy discussions and let them guide further research work. If systemic risk identified, securities regulators need to signal macro prudential regulators of the emerging risk and take actions to address the risk within their remit.

2. Using the system to identify and plug data gaps

The preferable execution of this system for identifying and plugging data gaps/issues would be as follows:

1. Users to make note of any data gaps (i.e. indicators that cannot be calculated) both on the system and for their personal reference, while undertaking systemic risk identification efforts.

2. On an ongoing basis, users should include on the spread sheets stored on the system, any additional data sources they have discovered or created and/or suggest possible data collection methods for navigating data constraints.

3. Using the system to keep track of systemic risk identification/monitoring efforts and aggregate a global picture.

The preferable execution of this system for building a 'living archive' of systemic risk efforts and to support the aggregation of a global picture on systemic risk would be as follows:

1. Each individual regulator to store a template of the indicators they selected from the system and the dashboard they created for identifying a specific risk (without data if preferred). These templates will help build a 'living archive' of risk identification efforts.
2. Each individual indicator to add additional practical indicators as they are developed to the system.

IV. Further Work

Regulators should have at their disposable specific tools that can be practically applied to their securities markets. This system is a first step towards this goal, however it is still in its drafting stages and further thinking, development and collaboration is needed.

Many key aspects of this system will be worked out and addressed as it evolves. For example:

- Indicators currently listed in the system will need to be refined and expanded;
- Potential data sources will need to be added where possible;
- Thresholds to signal potential systemic concerns will need to be assigned to indicators where other relative measures such as 'industry average' cannot be used;
- Guidance around selecting emerging risks to feed into the bottom-up approach and analysing outputs will need to be put together;
- Avenues for presenting and sharing information on systemic risk garnered from this system will need to be developed.

It must be noted that the system will never be 'finished' and that building it will be an on-going process but a valuable one.

Appendix 1

Case study 1 - Identifying LTCM as a source of systemic risk

The recent financial crisis has illustrated that risks can develop in parts of markets that are not tracked and where data is not readily available. In addition, perverse incentive structures may hinder market participants, without direct exposure to embedded risk, to disclose these risks. As such, limited and fragmented systemic risk identification/monitoring efforts may fail to capture risk build-up in securities markets.

One historical example concerns the risk developed through the highly leveraged operations and exposure to sovereign debt market by the hedge fund Long Term Capital Management

(LTCM). Although initially successful after its start in 1994, it eventually closed down operations in 2000 after experiencing severe losses of nearly 40 per cent in 1998. Its imminent failure was recognised as a systemic risk too late with macro-prudential regulators needed to step in to minimize its impact on the financial system. Given the high level of interconnectedness of LTCM, it had to be 'bailed out' by the U.S. Federal Reserve so that there was no systemic risk materialisation to LTCM's counterparties.

It is proposed that the comprehensive form of risk identification proposed in this paper may have increased the chances of identifying LTCM as a systemic risk concern sooner. The example provided below will demonstrate how the system could have been applied as well as revealing how the system can be customized based on a regulator's own needs.

There is of course a caveat around the issue of hindsight. It is only now that we can look back on the LTCM episode and extract data that shows the obvious growing risk surrounding the entity. Much of this data was not available at the time (for example, reporting of hedge fund open positions) and would have hindered a true assessment of the situation.

Bottom-up approach

LTCM and activities of hedge funds in general may not have been identified as a potential areas of concern at the time. Thus, a bottom-up approach may not have picked up LTCM as an entity that needed to be investigated further.

Top-down approach

However, the monitoring of macro-level indicators may have indicated some abnormalities. During the period when LTCM started its operations, the U.S. economy has already started to recover from the recession of early 1990s. Emerging countries that were going through structural and political changes presented opportunities for hedge funds such as LTCM to profit from the spectacular economic growth in these regions.

The continued economic growth during the Clinton administration also meant easy access to credit, as it tends to be pro-cyclical in nature. Hedge funds with a proven reputation, as was the case with LTCM, enjoyed preferential access to credit from prime brokers. This allowed the fund to leverage extensively.

Digging further, securities regulators may have selected some broad micro-level indicators from the system to see whether they were sourced from or impacted on securities markets. Leverage and asset flow indicators may have prompted regulators to dig further into the hedge fund industry. They could have then elected, for example, to focus on the 5 biggest hedge funds or 5 fastest growing hedge funds.

From here, regulators would consult the system and select a number of Systemic Risk Factors that would be relevant to entity based assessment.[11] Next, using their discretion, they would

[11] Different systemic risk factors may be relevant for assessment of products, activities etc.

select specific thematic indicators relevant to hedge funds and adapt broad indicators in order to generate the following framework for their assessment:

Table 5: Systemic risk factors, Indicators and data sources for LTCM assessment

Systemic Risk Factors	Indicator	Data source(s)/methods
Size	• *Hedge Fund AUM* • *Growth rate in hedge fund numbers*	*External vendor data providers; other surveys; reports*
Interconnectedness	• *Open positions*	*External vendor data providers;*
Leverage	• *Absolute borrowings* • *Leverage ratio*	*External vendor data providers; results from regulatory survey*
Substitutability	• *Portfolio diversification*	*Hedge fund specific reporting; results from regulatory survey;*
Complexity	• *Size of gross exposures* • *Use of complex trading strategies*	*Hedge fund specific reporting; regulatory survey*
Liquidity/ Maturity	• *Overall footprint* • *Time to liquidate portfolio* • *Use of side-pockets or gates*	*results from regulatory survey*
Incentive Structure	• *Do owners have "skin in the game"*	*Hedge fund specific reporting*

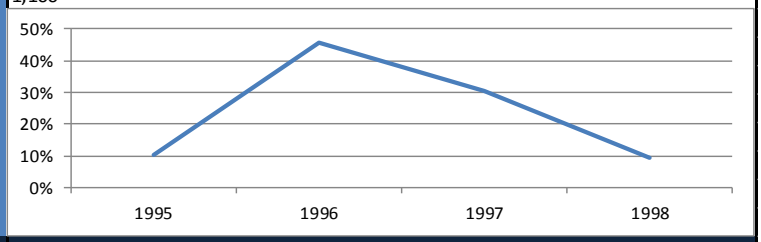
Source: IOSCO Research Department

This framework would be saved to the system and serve as a template for other regulators interested in making a similar type of assessment of systemic risk.

The recommended data sources would be used where available to calculate the indicators. Where data doesn't exist, alternative methods e.g. surveys would be used as a supplement. If this was also not possible, the lack of data around a relevant indicator for assessing systemic risk would be noted as a data gap that needs to be addressed. Thresholds and industry averages (where appropriate) would also be taken into account.

Once enough indicators have been calculated, the following completed dashboard could be generated:

Table 6: Risk Assessment dashboard - LTCM

Size	
Hedge Fund AUM	110,000,000,000
LTCM AUM	5,000,000,000
as % of industry	5%
Number of funds	1,100
Growth rate of funds	
Interconnectedness	
mkt wide open positions (t bonds)	360,000
open positions of LTCM	60,000
as % of mkt ≈	17.00%
Rest of industry	no readily available data to benchmark
Leverage	
LTCM Net Borrowings	125,000,000,000
Rest of industry	Borrowed amount 4 times larger than nearest hedge fund
Leverage ratio	25
Market average	1.5 times
Position on leverage distribution	Top 1.5% of hedge funds
Substitutability	
Portfolio diversification	80% invested in one product
Complexity	
Size of gross exposures	
Futures contracts	$500,000,000,000
Swaps	$750,000,000,000
Options and other OTC	$150,000,000,000
Use of complex trading strategies	Yes
Liquidity/ maturity	
Footprint	
Foreign Exchange Market	10% of foreign exchange market
Swaps contracts	2% of global Swaps market
Options and other OTC	11% of Other OTC market
Time to liquidate	no data
Liquidity management tools in place (eg, side pockets, gates, redemption suspension)	no data
Incentive Structure	
Owners capital in fund	Yes

Source: IOSCO Research Department

The generated table clearly flags areas of concern:

- The hedge fund industry was growing at a rapid rate in the years up to 1997. In 1997, hedge funds AUM were USD 110 billion. LTCM at the same time had AUM of USD 5 billion, which was equivalent to 5% of the entire hedge funds markets. So based on this indicator, LTCM was a sizable player in the hedge fund space.
- LTCM mainly used absolute-return trading strategies and was highly leveraged (estimated to be at times more than 250-to-1) and had a large presence in the bond markets, in particular to Russia.[12]

[12] The default of Russia on its sovereign bond market was an unexpected outcome during 1998, which led to loss of over 52% for LTCM.

- A High level of interconnectedness with the rest of the financial system is apparent. As measured, by open positions LTCM accounted for 17% of all Treasury bond open positions (the product they were most engaged with). This coupled with the fact that they had over 80% of their portfolio in one product (treasury bonds), makes the concentration risks with such large holdings obvious. Although, treasury bonds are liquid, having such concentration of portfolio holdings in one product indicates that in the need to liquidate, large discounts to face value would be required.
- With net leverage levels of USD125 billion, LTCM was highly leveraged. But just by how much is evident when determined as a proportion of their investor capital. At 25 time leverage, LTCM was the highest leveraged fund by a long way (as it turned out, over 4 times more than their nearest competitor). Additionally, their leverage levels put them right at the tail of the leverage distribution; in the top 1.5% of funds.
- In terms complexity, LTCM was engaged in the use of complex trading strategies. Although, not a necessary or sufficient condition to signal systemic risk concerns, LTCM's complex footprint in the market at least highlights that further investigation may be required. This is especially true given at LTCMs large gross exposures in a number of derivative products at the time.
- Like all hedge funds, LTCM was engaged in liquidity and maturity transformation. Hedge fund liquidity means something very different to the macro prudential definition of liquidity where banking institutions are required to have sufficient capital buffers. Many hedge funds can initiate liquidity protection measures such as side pockets or redemption gates that protect their holdings from investor runs. A better idea of how a hedge fund may perform in the event of a shock is through time to liquidate measures.[13] As a proxy it captures how many days it would take for a hedge fund to unwind positions without a significant material loss. Obviously, the larger and more complex the portfolio, the longer the time to liquidate the portfolio. There is no data on this for LTCM, signalling a data gap.
- LTCM had a sizable footprint in many securities markets. Not only did it account for 5% of the hedge fund market and a large proportion of government bonds, it also before its collapse, accounted for 10% of foreign currency trading too. This intimates that in the event of a shock, large discounts to face value would be required.
- Perverse incentives have been blamed for many of the risk build up leading to the financial crisis. GFC. There has subsequently been a call for a change in many of the incentive structures, for example, product originators retaining "skin in the game". Many boutique hedge fund operators retain some financial ownership in their funds, aligning the incentives with those of the investors. This was the case in LTCM, the owners also retained a financial interest in the fund, and actually increased it in 1997.

[13] It is planned for this indicator to be collected in the next IOSCO Hedge Fund survey, due September 2012.

Case Study 2 - Unit Linked Products in the Netherlands

In 2003 and 2004, the Dutch securities markets regulator, the Authority for the Financial Markets (AFM), carried out a monitoring exercise on collective investment schemes[14] and noticed some potential issues with unit-linked products[15] as well. Since these products fell partly within the regulatory perimeter of the AFM at that time, the AFM decided to execute an exploratory analysis into this area.

The conclusions of the analysis caused great concern over the viability of unit linked products. In response, firms volunteered to find a market wide solution e.g. voluntary pay back schemes. However, in 2008 the AFM produced, on request of the parliament, an in-depth analysis of the market,[16] including calculations of around a hundred products of around 50 financial firms. This report exposed the widespread economic inefficiency of a number of these products and triggered a complete overhaul of the market for unit linked products. This could be regarded as a systemic event with pay backs of firms ascending to around € 3 billion, a number of class actions and legal cases still pending (estimates of pay backs of firms ascending € 20BN), a complete collapse of the € 60BN market, and intensified regulation.

A run through of how the systemic risk identification system could have been used in this case study on a product follows below. Again, as in the first case study, there is a caveat around hindsight.

Bottom-up

From the bottom-up, harnessing publicly available data and information and the use of market intelligence would have flagged unit-linked products as a potential risk area in the Netherlands (as is what actually happened while pursuing research on collective investment schemes).

Regulators would then choose relevant systemic risk factors and thematic indicators, relevant to unit-linked products for their identification of systemic risk. Possible indicators are presented in Table 7.

[14] AFM, *Monitoring Collective Investment Schemes*, 2004

[15] Unit linked products, also called unit-linked policies and investment-linked policies, are structured products where investment in a collective investment scheme is combined with a life insurance policy. The value of a policy varies according to the current net asset value of the underlying investment assets. Unit linked products are usually bought by investors for long term investments e.g. for retirement, the payment of a mortgage or general capital generation.

[16] AFM, *Feitenonderzoek belleggingsverzekeringen*, 2008

Table 7: Systemic risk factors and potential indicators for U/L product assessment

Systemic Risk Factors	Indicator	Data Source(s)
Size	• *Sales volume (€, number)* • *Sales volume relative to other investment products* • *Growth year on year and relative to other products* • *net asset value of outstanding products*	
Interconnectedness/ concentration	• *top 5 firms/percentage*	
Cross-jurisdictional	• *Unit-linked products in other jurisdictions*	
Substitutability	• *Existence of substitute products?*	
Leverage and Complexity	• *Product non-linearity* • *Administrative complexity*	Back tests based on real data on investments, costs
Transparency	• *Point of sales transparency*	
Market integrity and efficiency	• *economic efficiency of sample of products* • *Competition*	
Liquidity/maturity	• *Lock-in/term length*	
Incentives	• *Incentive structure for clients, intermediaries and firms.*	
Regulation	• *Type and level of regulation*	

Source: IOSCO Research Department

As in Case Study 1, this framework would be saved to the system and serve as a template for other regulators interested in making a similar type of assessment of systemic risk. The recommended data sources would be used where available to calculate the indicators. Where data doesn't exist, alternative methods e.g. surveys would be used as a supplement. If this was also not possible, the lack of data around a relevant indicator for assessing systemic risk would be noted as a data gap that needs to be addressed. Thresholds and industry averages (where appropriate) would also be taken into account.

Once enough indicators have been calculated, the following completed dashboard could be generated:

Table 8: Risk Assessment dashboard – U/L in the Netherlands

Size	
Sales volume (£, number)	The yearly invested sum in all products (new + outstanding) rose to € 6 billion per annum in the mid 2000´s, spread over more than 7 million products in total. Peak in new products in 1990s with 3,000,000,000 new products per annum.

Sales volume relative to other investment products	
Growth year on year and relative to other products	
net asset value of outstanding products	6,000,000,000 total outstanding products in 1990s. Growth in NAV of Outstanding (1994-2005) -- rose from 2 billion in 1994 to 50 billion in 2005 - 25 times increase.
Interconnectedness/concentration	
top 5 firms/percentage	The top 5 firms had 50% of the market.
Cross-jurisdictional	
Unit-linked products in other jurisdictions	UK firms brought Unit linked products to the Dutch market. U/L market in the UK had collapsed due to high costs and high complexity.
Substitutability	
Existence of substitute products?	Yes: collective investment schemes, individual life insurance products.
Leverage and Complexity	
Product non-linearity	The unit linked product had non-linear pay off due to implicit leverage over time. Some of the products could even destroy the net asset value entirely due to the high costs and negative effects of leverage. Non-linear steepener in cases of high and low returns, and high insured capital.
Administrative complexity	The complexity in the products led to administrative complexity. The complexity led to a lack of competition on product features and quality, which in turn restrained the efficiency of the products.
Transparency	
Point of sales transparency	In 75% of cases, insufficient information provided to investor on costs etc.
Market integrity and efficiency	
Economic efficiency of sample of products	40% of the investment in an average unit linked product absorbed by costs.
Competition	A comparison with the combination of separate similar collective investment scheme and life insurance product showed that in 90% of the cases the combination of separate products was (far) cheaper that the unit linked product.
Liquidity/maturity	
Lock-in/term length	Clients locked-in for long periods.
Incentives	
Incentive structure for clients, intermediaries and firms.	Clients: offered tax deductions, potential high returns. Intermediaries: motivated to maximise trading commissions, large profit available through upfront sales fees. Firms: products provide growing stable income stream.
Regulation	
Type and level of regulation	Market largely unregulated.

The generated table clearly flags areas of concern:

- The indicators show that unit linked product is sizeable in the market for investment products in the Netherlands.
- However, with the top 5 players having around half of the market and not more, it would appear there was little potential for market power abuse that could result in inefficient pricing.
- Since UK firms were responsible for bringing U/L products to the Netherlands, the collapse of the U/L market in the UK provided a red flag. In particular, issues around costs and complexity from the UK example were paralleled in the Dutch example.

- The costs absorbed in a product meant that in many cases U/L products were less efficient than other similar products such as collective investment schemes and life insurance policies.
- It was found that in three quarter of cases there was not sufficient information given to the investor on the investment and the costs. Half of the products stated only partly the value of the product. This showed a massive lack of transparency, a potential cause for massive mis-selling.
- Unit linked products were a sizeable and under regulated market segment of expensive and complex products, sold with a lack of transparency by fee hunting intermediaries to consumers.
- The conclusion of the bottom-up impact factor analysis was that unit linked products could pose a systemic risk to the Dutch financial system, due to the size, the economic inefficiency (costs), and complexity and leverage.

Top-down

The top down approach looks at broader impact factors and macro indicators. Most of them are qualitative and have been subtracted from a study of the literature and the market. Below are the impact factors that have been used by the identification of the risk of unit linked products.

Table 9: Top-down systemic risk factors and indicators for U/L product assessment

Systemic Risk Factors	Indicator
Macro financial	
(Real) Savings interest rate	Savings rate declining, real savings rates around zero
Disposable household income	Steep growth of disposable income (GDP and tax cuts)
Equity prices	Era of the ´New Economy´ (year on year growth of stock prices)
Macro institutional	
	Withdrawal from markets (e.g. state provision of pensions income)
Government	Tax incentives changed (deduction for investment products as U/L)
	Introduction competition banking and insurance sector
Technology	Computer technology enables spread of complex products
Socio-economic trend	Individualism

Source: IOSCO Research Department

Macro financial impact factors

The impact factors measured by indicators ´real savings rate´ and ´disposable income´ supported the indications of unit linked being a sizeable and growing market segment for retail investment. While the savings rate adjusted for inflation fell in the 1990´s and 2000´s to levels near to zero, households were driven to investment products offering higher returns. Among these alternatives unit linked products. Also, the average household income sharply increased

due to strong economic growth and tax reductions which made more savings available for investment. Economists and the press discussed whether we had entered into a ´New Economy´, a period where recessions would not exist.

Macro institutional impact factors

Government also provided a fertile soil for unit-linked products. It withdrew from markets such as the pension market which feed the growth of third pillar individual pension products. Unit linked products are products that can be used as such. In addition the government changed tax incentives that benefited directly the unit-linked products making investment deductible from income tax. Moreover the government cleared the barriers between banking and insurance, and invoked competition between unit-linked products and collective investment schemes.

Another more long-term and structural impact factor was the development of the technology. The introduction of the computer made it possible to develop this type of complex products.

A final long term factor is the socio-economic trend of individualism which made people more susceptible to make their own decisions, including those on investments, products for pensions and mortgages. This was new to Dutch households.

Top-down impact factor conclusion

The conclusion of the top-down impact factor analysis was that unit-linked products rose in for these products favourable circumstances. However, as people did not have a great deal of experience with personal portfolio management and the unit-linked products were sold in an era of high growth and high returns that potentially blurred the view on the real value and structure of the products.

Combined bottom-up and top-down impact factor conclusion

Combined bottom-up and top-down impact factors the conclusion was that unit linked products could pose a systemic risk to the Dutch financial system. The size, the economic inefficiency (costs), complexity and leverage posed red flags while the macro factors worsened this by above normal growth of the economy, disposable household income, equity prices and tax incentives that blurred the view of millions of new and inexperienced investors in these products.

Final remarks

The examples above illustrates that using the top-down and bottom-up approach are ways in which securities regulators can develop a systemic risk assessment approach that is practical and simple to exercise on a regular basis. In some cases, the top-down approach may be appropriate whereas in other cases, the bottom-up approach is suitable. It is recommended that both approaches be applied at the same time to make the risk identification system robust.

Appendix 2 – Micro and Macro indicator lists

Macro-level indicators

Type	Macro-level indicators
Financial stress	Quantitative
	Financial Stress Indexes
	Beta for banking sector
	Volatility of the 3-month EURIBOR rate or TED spreads (GARCH models) for money market
	Corporate bond yield minus long-term government bonds for bond market
	Non-financial sector equity market index
	Stock market returns (equity market)
	Volatility of exchange rates
	Deviations from long-term value of assets
	FS Index
	Shillers CAPE
	Tobins Q
Market imbalance	Quantitative
	Market significantly above long-term average
	Strong inflows into an asset class
	Levels of leverage at historical highs
	Qualitative
	Underwriting standards failing
Macro-economic data	Quantitative
	Interest rates
	Negative real-interest rates connected to size of country - liquidity abundant, risk pricing will be blurred. Credit-bubble indicator.
	Credit markets
	Global GDP and negative interest rates for U.S., EU and Japan. (How negative is it? If it grows, liquidity overflows grows and risk of credit bubble.)
	Price/earnings indicator of global markets
	Inflation
	Economic growth rates
	Flows of funds
	Changes in the money supply and credit growth
	Inter-bank lending
	Qualitative
	Asset-purchase programs by central banks
Fiscal-debt sustainability	Quantitative
	Sovereign debt
	Overall indebtedness of market participants, issuers or individuals in aggregate
Asset prices and spreads	Quantitative
	Asset prices and spreads
	Credit spreads
	Equity markets
	Commodity markets
Other	Qualitative
	Movement of International capital flow
	Quantitative
	Geopolitical environment

Micro-Level Indicators

Systemic Risk Factors	Consolidated Indicators for Securities Markets (broad and thematic)	Data Source
Size	Broad absolute, relative and rate-of-growth size measures of sectors, markets, products, market participants and key gatekeepers and market activities. These measures can be used to discern the volume of financial services provided by a component of the financial system, the systemic importance of a particular entity in the market and the size of a market in comparison to other markets, the growth of complex product markets and historical trends to identify potential systemic risk.	Databases, market intelligence, surveys, reports etc.
	Type A Indicators	
	Main investor-base indicators	
	Top 5 largest investor classes (e.g. high-net worth, institutional)	
	Market-size indicators	
	Value of turnover/number of transactions in each asset class	
	Relative, aboslute and rate of growth for dominant markets	
	Level of HFT (share of turnover, share of order)	
	Asset and flow-of-money indicators	
	Top 5 most aggressive institutions and size and growth of most beneficial activities (e.g. Investment banks, hedge funds)	
	Type B Indicators	
	Quantitative	
	Market-size indicators	
	Relative, absolute and rate of growth of particular market	
	Value of turnover/number of transactions for asset class	
	Main funding-base/dependency indicators	
	Number of qualifying funds (e.g. for hedge fund)	
	Asset and flow-of-money indicators	
	Firm assets under management	
	NAV of total fund and strategy assets	
	Qualitative	
	Predominant investment strategy for firm. (e.g. for hedge funds)	
	Size and nature of iIssuers, intermediaries, institutional investors, CRAs, auditors etc.	
	Nature of investor base	
Liquidity	Liquidity indicators can measure changes in liquidity. Evaporation of liquidity can signal risk in the securities market as firms struggle to meet obligations. This can have knock-on effects for the securities markets.	
	Type A Indicators	
	Liquidity-in-market indicators	
	Amount of trading through CCPs and OTC markets	
	Short selling (volume, outstanding, net short positions)	
	Market concentration and concentration of holdings	
	Credit market indicators	
	Amount of encumbered assets and collateralizations for banks issuing covered bonds	
	Type B Indicators	
	Quantitative	
	Liquidity-in-market indicators	
	Portfolio, investor and financial liquidity	
	Volume, depth of market	
	Market concentration and concentration of holdings	
	Fund assets subject to special arrangements arising from their illiquid nature (hedge funds)	
	Dependence of specific liquidity on global/market liquidity and liquidity risk indicators	
	LIBOR-OIS (liquidity and default risk)	
	LIBOR-TBILL	
	Bid/Ask spread (quoted, realized and effective)	
	Credit market indicators	
	Distribution of holdings of covered bonds	
	Securitization and collateral indicators	
	Concentration and correlation of types of collateral accepted	
	Successive re-securitizations	
	Length of re-hypothecation chains	
	Qualitative	
	Composition of the investor chain	
	Collateral management	
	Asset eligibility	
	Quality and complexity	
	Haircuts applicable	
	Ability to gate or suspend funds and any restrictions in place (e.g. for hedge funds)	

Cross-jurisdictional	Cross-jurisdictional indicators can provide information on the geographical scope of activities of a particular entity, market activity or market.	
	Type A Indicators	
	Political environment	
	MMOU and data sharing arrangements	
	Differences in settlement regimes between national jurisdictions	
	Type B Indicators	
	Quantitative	
	Cross-jurisdictional claims and liabilities indicators	
	Value of cross-jurisdictional claims (e.g. for non-bank SIFIs and G-SIB)	
	Value of cross-jurisdictional liabilities (e.g. for non-bank SIFIs and G-SIB)	
	Qualitative	
	Details of regional investment focus for each fund (e.g. for hedge funds)	
Transparency	These indicators can show areas in the market that lack transparency and the level of systemic risk associated with them. Low levels of transparency can result in the mispricing of risk and the distribution of complex assets, asset bubbles etc.	
	Type A Indicators	
	Quantitative	
	Change in proportion of activity on non-transparent markets (year on year) indicator	
	Dark pools/internalization/dark liquidity/alternative trading platforms activity (% of total, times series)	
	Performance indicators	
	Litigation costs and fines linked to mis-selling of products	
	Qualitative	
	Knowledge gaps around short selling, alternative-investment funds, debt and derivatives markets and OTC markets in general	
	Type B Indicators	
	Quantitative	
	Change in proportion of activity on non-transparent markets (year on year) indicator	
	Non-exchange traded derivatives (% of total, times series)	
	Proportion of exempt market transactions	
	Off-balance sheet operations of broker dealers (i.e. rehypothecation)	
	Amount of unsolicited sales	
	Performance indicators	
	Level of failed settlements	
	Qualitative	
	Level of continuous disclosure of firm etc.	
	Measures of investor education/literacy (e.g. surveys)	

Interconnectedness	These measures reveal linkages between components in a system, including the breadth, depth and degree of reliance. Increases from linkages due to globalization, financial innovations, business strategies, technology and products can be identified. Firms, activities, markets etc. that may not appear large may have systemic importance due to interconnectedness, which introduce spillover effects in the case of failure.	
	Type A Indicators	
	Correlation between markets, products and institutions indicators	
	counterparty network graph (IMF, 2009)	
	default intensity model (IMF, 2009)	
	Clearing	
	Identification of primary CCPs	
	Network analysis of market segment participants and Systemic Financial Linkages	
	Network Analysis and Systemic Financial Linkages	
	Granger-Causality Networks	
	Tybe B Indicators	
	Quantitative	
	Correlation between markets, products and institutions indicators	
	Intra-financial system assets and liabilities indicators (e.g. for non-bank SIFIS and G-SIB)	
	Wholesale funding ratio (e.g. for non-bank SIFIS and G-SIB)	
	Clearing indicators	
	Estimated percentage of derivative transactions cleared (trade volumes) - by a CCP vs. bilaterally (e.g. for hedge funds)	
	Repo trades cleared (in terms of market value) - by a CCP vs. bilaterally vs. tri-party (e.g. for hedge funds)	
	Counterparty arrangements and collateralization indicators	
	Number of retail investors in structured products, ETFs etc.	
	Net/Gross amount of structured products, ETFs etc. outstanding	
	Extent of rehypothecation of collateral and other credit support by counterparties (e.g. for hedge funds)	
	Clustering of default risk indicator	
	Changes of CDS spread for individual firms in the CDX index, CDS returns for all firms	
	Marginal contribution of individual institution(s) to overall risk indicator.	
	Change in CoVaR and change in CoES (where CoVaR is the whole-system value at risk conditioned on an institution being in distress)	
	Ownership of assets (a measure of exposure to price falls)	
	Qualitative	
	Network analysis of market segment participants and Systemic Financial Linkages	
	Network analysis for brokers, CCPs, structured retail products etc.	
	Trade repositories	
Substitutability and market infrastructure	These measures provide information on the extent to which other elements (e.g. products, providers, and markets) can offer the same or similar service in the event of failure. They can identify activities, markets, services etc. that are particularly concentrated or that lack substitutes (e.g. clearing and settlement systems). Identification of a large, concentrated number of these elements can signal the potential for systemic risk as in the event of their failure, market infrastructure would be impacted.	
	Type A Indicators	
	Type B Indicators	
	Quantitative	
	Payment-system indicator	
	Payments cleared and settled through payment systems (e.g. for non-bank SIFIs)	
	Scale of exposure to individual assets, markets and institution indicators	
	Size and value of positions held in different categories in terms of securities, derivatives, physical assets, collective investment undertakings, investments (e.g. for hedge funds).	
	Participant market shares in various segments	
	Short-term funding rates (e.g. for repo markets)	
	Total repo contracts outstanding (e.g. for repo markets)	
	Assets under custody (e.g. for non-bank SIFIs)	
	Risk-neutral probability of default for each institution indicator	
	Combining bond price and CDS spreads	
	Quantitative	
	Qualitative assessments of availability of alternatives/substitutes	

Concentration	Leverage related indicators.	
	Type A Indicators	
	Market concentration and competition indicators	
	Top largest principal markets (where trading represents significant proportion of overall daily volume)	
	Top 10 positions as % of gross market value	
	Counterparty concentration/exposure and collateralization indicators	
	Top 5 counterparty players in markets and total percentage concentration	
	Primary counterparties in terms of net counterparty credit exposure	
	Type B Indicators	
	Quantitative	
	Market concentration and competition indicators	
	Hertfindhal-Hirschamn Index for competition	
	Counterparty concentration/exposure and collateralization indicators	
	Top 5 counterparty players in markets and total percentage concentration	
	Primary counterparties in terms of net counterparty credit exposure	
	Nature of market participants and concentration	
	Counterparty exposure information	
	Estimate of dealer's level of risk (ratings etc.)	
Behaviour	The behaviour of participants can lead to the accumulation of risk in the financial systems. Particular behaviours can indicate excessive risk-taking, excessive leveraging and loss of investor confidence/panic.	
	Type A Indicators	
	Consumer confidence in financial advisors	
	Investor confidence in financial markets	
	Consumer willingness to invest in the future	
	Type B Indicators	
	Quantitative	
	Value of leveraged capital gains investing	
	Herding/flow of funds	
	Qualitative	
	Trends in selling practices (e.g. surveys, regulatory compliance)	
	Changes in investment strategy	
Incentive structure	This can provide information on perverse incentives in the market and the likelihood of mis-selling and excessive risk taking.	
	Type A Indicators	
	Qualitative	
	Trends in remuneration practices	
	Auditor pay structure	
	Type B Indicators	
	Quantitative	
	Proportion of fees charged for product (%)	
	Margining schedule/haircuts (e.g. for repo markets)	

Leverage	Leverage related indicators. Leverage indicators are important as a non-systemic activity can become systemic through leverage.	
	Type A Indicators	
	Household debt and leverage	
	Trends in product leverage	
	Type B Indicators	
	Quantitative	
	Leverage and speed-of-money indicators	
	Total exposures (based on Basel III Leverage Ratio)	
	Value of borrowings (unsecured borrowing, collateralized borrowing, synthetic borrowing) (e.g. for hedge funds)	
	Securities lending (amount on loan, %)	
	Margin-lending levels and haircuts	
	Amount of unencumbered cash (e.g. for hedge funds)	
	Degree of leverage on institution balance sheets	
	Leverage levels of funds	
	OTC derivatives notional value (e.g. for non-bank SIFIs)	
Regulation	This indicator pinpoints regulatory gaps or inconsistencies across jurisdictions. Such gaps can allow for the accumulation of risk.	
	Type A Indicators	
	Quantitative	
	Proportion of unregulated-transactions indicator	
	Qualitative	
	Existence and nature of under-regulated areas of markets	
	Shared jurisdiction assessment	
	Type B Indicators	
	Evidence of regulatory or supervisory arbitrage	
	Complexity and volume of regulation covering firm, activity, product etc.	
Complexity	Complexity indicators reveal financial vulnerabilities in markets. Complexity in the market signals information asymmetry between investors and financial intermediaries/providers.	
	Type A Indicators	
	Qualitative	
	Qualitative assessment of investor/market participant understanding of products in markets (e.g. surveys)	
	Type B Indicators	
	Quantitative	
	Complexity indicator	
	Number and value of complex/structured products issued (volume sold - in % of bank deposits, growth rate)	
	Number of products using complex formulas to derive returns profiles.	
	Risk/return profiles of top 10 popular complex products.	
	Portfolio penetration indicator	
	Structured retail products in % of household financial assets	
	Number of open positions	
	Level 3 assets (e.g. for non-bank SIFIs)	
	Qualitative	
	Qualitative assessment of investor/market participant understanding of products in markets (e.g. surveys)	