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Cobweb charts as a tool for summarising the stability assessment

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The assessments of financial stability and the systemic risks that threaten financial stability that the Riksbank publishes in its Financial Stability Reports are based on a large number of quantitative variables and indicators. A range of tools can be used to illustrate and summarise the prevailing financial stability assessment and systemic risks. This Commentary presents how cobweb charts can be used for this purpose. The Commentary also gives example of how cobweb charts are used in the Riksbank's Financial Stability Report.

This Commentary presents a method for quantifying and summarising the financial stability assessment. The method highlights a set of variables and indicators that are relevant to the stability assessment. The values of the variables and indicators are determined on the basis of a stability perspective. They are then grouped into a number of main categories. Finally, the assessments of the different variables and indicators are illustrated in a cobweb chart. This makes it possible to present a picture of the financial stability assessment. This applies to the status and development of the main categories, as well as to the status and development of the respective variables and indicators within the different main categories.

It is difficult to quantify and summarise financial stability

One of the functions of the Riksbank is to promote a safe and efficient payment system. This means that the Riksbank must act to ensure that the financial system maintains its basic functions, such as the mediation of payments and the conversion of savings into funding. In addition, the Riksbank should act to ensure that the financial system is resilient to disruptions that threaten its functions. This is because a situation in which the financial system cannot perform its basic functions can have serious consequences for the development of large parts of the real economy.

The Riksbank thus continually monitors developments in the financial system and assesses the risks that may threaten stability. The financial stability assessments are published twice a year in the Riksbank's Financial Stability Report.

The Riksbank's assessments of financial stability are largely based on the analysis of a range of quantitative variables and indicators. This applies to the assessment of the current situation as well as the assessment of risks that may threaten financial stability in the future. The fact that the analysis is based on a large number of variables and indicators in combination with a degree of judgement can make it difficult to communicate the conclusions of the analysis. This Commentary discusses a method that can be used to make communication easier.

Several central banks, including the Bank of Finland, Norges Bank (the central bank of Norway) and the Reserve Bank of New Zealand, use cobweb charts to present a summary of their assessments of financial stability.[2] The central banks design the charts in slightly different ways. A common feature of these cobweb charts is, however, that they highlight aspects that are considered important to the assessment of stability at the same time as they illustrate how these aspects are expected to affect financial stability. This commentary presents not only a description of the cobweb charts as a tool for summarising the stability assessment but also an example of how such charts are used in the Riksbank's Financial Stability Report.[3]

The Commentary consists of four sections. The first section describes the basic principles for the design of cobweb charts. This is followed by a section with an example of how a summarising cobweb chart may look when it is used in the

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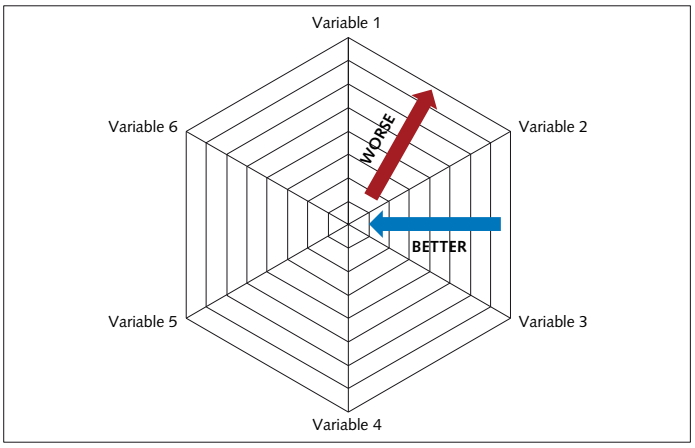
2. See the Bank of Finland (2012), Norges Bank (2012) and the Reserve Bank of New Zealand (2012).
3. When cobweb charts are used in the Riksbank's Financial Stability Report to provide a summary of financial stability they are referred to as Stability webs.

Riksbank's Financial Stability Report. The third section discusses how the summarising cobweb chart and the main categories in the chart can be built up on the basis of sub-categories and individual variables. The Commentary concludes with a discussion of important aspects that must be taken into account when cobweb charts are produced and of aspects that may be of interest in future development of the cob webs. A more detailed description of how individual variables and indicators have been incorporated into the cobweb charts included in this Commentary is presented in Appendix 1.

Cobweb charts reflect quantitative stability variables and assessments

When using quantitative variables and indicators to analyse financial stability or systemic risks in the financial system, it is usual to first obtain the values of the variables and indicators and thereafter assess their implications for financial stability. Cobweb charts can be used to concretise and formalise this assessment. More specifically, one chooses a number of quantitative variables and indicators that are regarded as being relevant to the stability assessment and include these in the cobweb charts. Before the variables and indicators can be presented in the charts, their individual values must be translated to a common scale so that they can be compared. Using this scale, it should be possible to see to what extent each variable or indicator reflects financial instability or financial systemic risks. Higher values, which lie at the edge of the chart, reflect a greater degree of instability or a higher systemic risk, while lower values, which lie close to the centre of the chart, reflect less instability or a lower systemic risk. In the examples presented in this Commentary, all the variable values are translated to the scale 0-8 (see Chart 1).

Chart 1. Example of a general structure for cobweb charts.



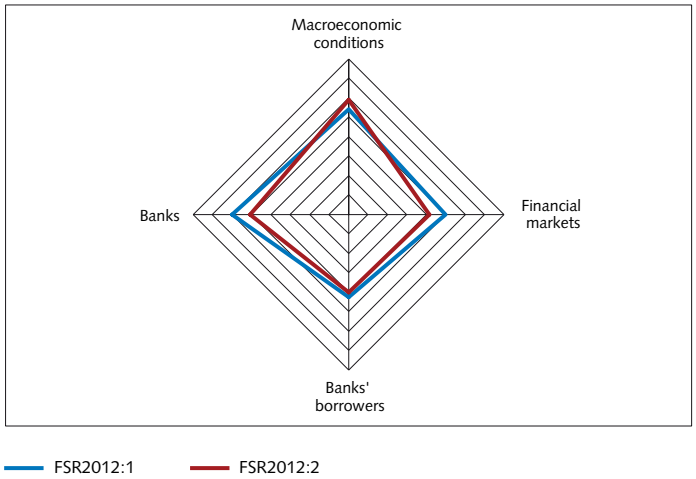
It is important to note that the information presented in a cobweb chart consists of a large degree of judgement, as the values of the variables in the chart depend on how each specific value has been classified and thus converted to the cobweb-chart scale. Examples of how different variable values can be translated to a cobweb-chart scale are presented in Appendix 1.

Apart from giving each variable a value on the cobweb-chart scale, one often needs to group the different variables into a number of categories in order to enable the cobweb chart to provide a clear overview of financial stability. The following section gives an example of the form such a grouping may take in the Riksbank's Financial Stability Report.

The main categories in the summarising cobweb charts are based on the structure of the Financial Stability Report

The cobweb charts normally used to illustrate aspects of financial stability often contain a number of categories that correspond to areas of particular importance to the stability assessment. In the Riksbank's Financial Stability Report, the presentation of the stability assessment is divided into a number of chapters that focus on the financial markets, the Swedish banks' borrowers and the Swedish banking groups. The analyses in these chapters are based on current macroeconomic developments in Sweden and abroad. The main categories "Macroeconomic Developments", "Financial Markets", "The Banks' Borrowers" and "Banks" are therefore included in a summarising cobweb chart in the Financial Stability Report.

Chart 2. Example of a summarising cobweb chart.



As the structure of the Financial Stability Report is seldom altered, these four main categories do not need to be changed too often either. Nevertheless, the cobweb charts make it possible to focus especially on one or more aspects of stability depending on what is of particular interest at different points in time. This can be done by changing the variables that are contained in the respective main categories of the summarising cobweb chart.

The use of several variables in the respective main categories facilitates a nuanced stability assessment

To arrive at a value for each main category in the cobweb chart, a number of variables and indicators within the respective categories are used as a starting point. These variables and indicators are then given a value on the cobweb-chart scale. The average of the values included then constitutes the value for the main category concerned.

The variables and indicators included in the respective main categories in the summarising cobweb chart in Chart 2 are presented in Charts 3-6.

Chart 3. Macroeconomic developments.

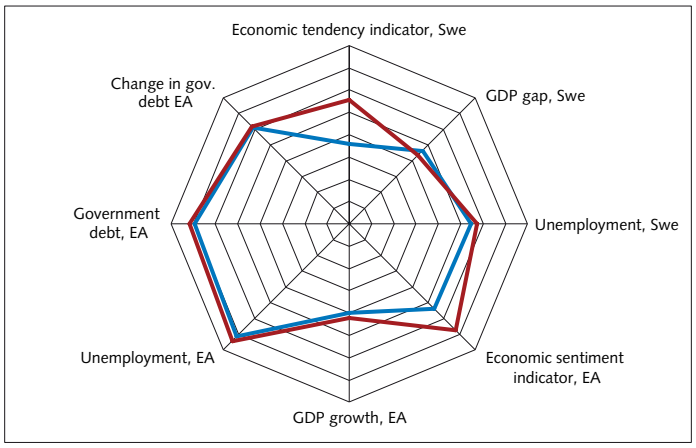


Chart 4. Financial markets.

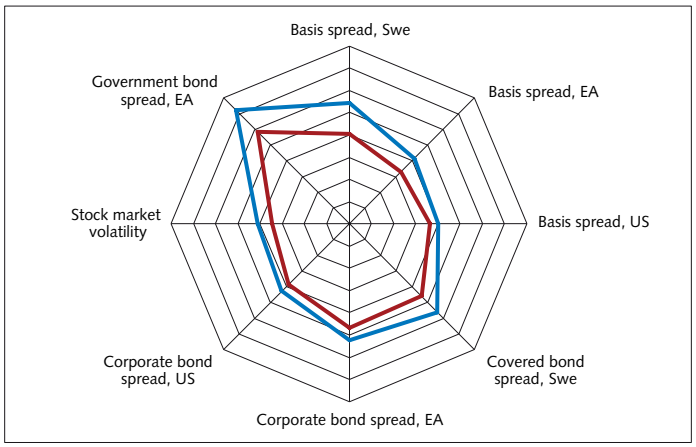


Chart 5. The banks' borrowers.

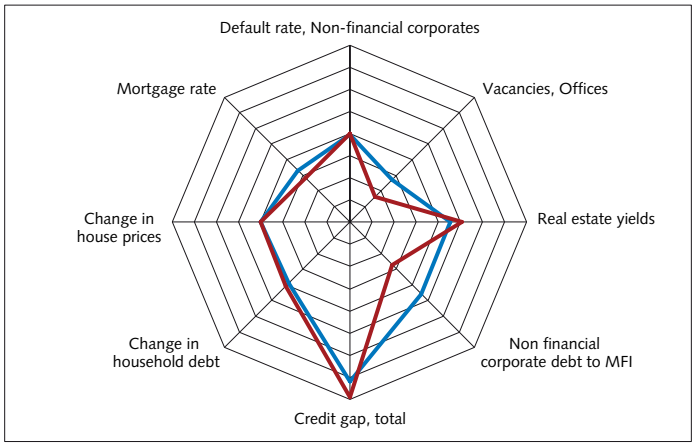
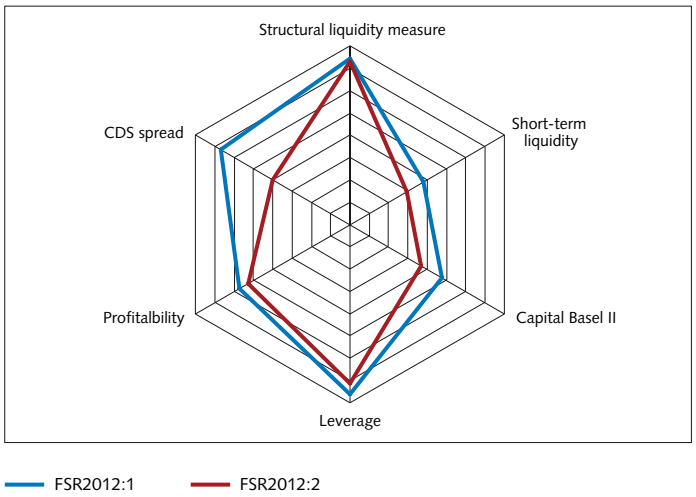


Chart 6. Banks.



Although important aspects of the stability assessment can be highlighted and emphasised by replacing variables and indicators in the cobweb charts, there are also a number of disadvantages to doing this. One such disadvantage is that the picture in, and thus the message of, the summarising cobweb chart can change even if the variables that originally formed the basis for the chart have not been changed. If one then compares the old picture, which was based on one set of variables, with the new picture, which is based on another set of variables, one may thus get an incorrect picture of the development of financial stability. It is therefore important to provide a correct basis for comparison over time.

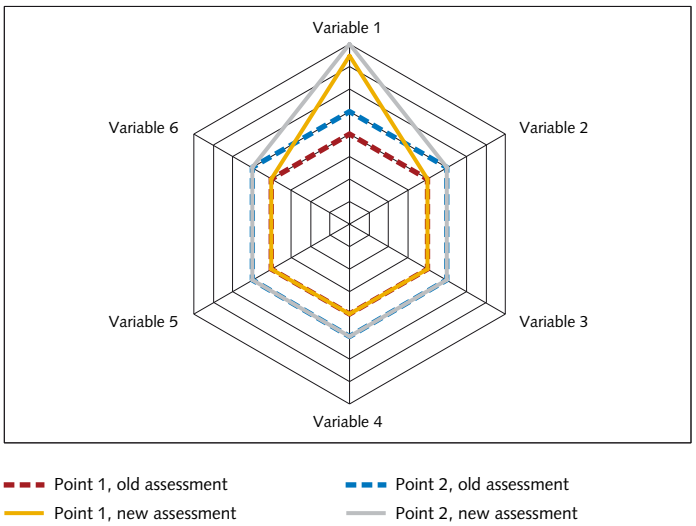
It is important to show both levels and changes over time in the cobweb charts

The assessment presented in the summarising cobweb chart may thus change if the variables and indicators are replaced, and not only as a result of a change in the values of the variables and indicators. This makes it important to include a comparison over time in the charts so that we can see how the assessed stability has developed. For the sake of comparison, one thus needs to create a chart that shows what the assessments would have been at earlier points in time with the variables and indicators used now.

However, it is not only the replacement of the variables included that can change the appearance of a cobweb chart. If the assessment of a certain variable changes, that is if it is assessed that the value of a certain variable corresponds to a new figure on the cobweb-chart scale, the chart may also change. This is another reason why both levels and changes over time should be illustrated in a cobweb chart.

To illustrate how a new assessment of a variable or indicator affects cobweb charts we assume that we have a chart with six variables (see Chart 7). All of the variables originally have the value four on the cobweb-chart scale at point one, and the value five at point two. However, a new assessment of the value for variable one means that it is now thought that a certain variable value should correspond to a higher figure on the cobweb-chart scale. In order to be able to perform a new assessment of the status and development of financial stability, the value that variable one has in the cobweb chart must now be updated for point one and for point two. Unemployment can be used as an example here. An unemployment rate of 12 per cent, for instance, may previously have been assessed as equivalent to four on the cobweb-chart scale. Following new deliberations, it may be concluded that this unemployment rate should be valued at seven on the scale instead. By updating the cobweb chart at both point one and point two, the development of stability over time can be fairly illustrated. The update thus makes it possible to illustrate current status as well as development over time in the chart.

Chart 7. Example of how a cobweb chart can be revised in the event of a new assessment.



In conclusion, it can be noted that the continuous development of the cobweb charts can lead to an even better illustration of financial stability. The cobweb charts presented in the Commentary should therefore not be seen as a finished product but rather as a starting point for further development with the aim of providing a picture that summarises financial stability in the best possible way.

References

Bank of Finland (2012), Bank of Finland Financial Stability Report, Bank of Finland Bulletin 2/2012.

Norges Bank (2012), Norges Bank Financial Stability 1/2012.

Reserve Bank of New Zealand (2012), Financial Stability Report, May 2012.

Appendix 1. Description of the variables included in the cobweb chart

The charts presented as examples in this Commentary show four main categories: "Macroeconomic Developments", "Financial Markets", "The Banks' Borrowers" and "Banks". The variables and indicators included in each category are presented below.

Macroeconomic Developments

As there is an interaction between macroeconomic developments and financial stability it is important to study variables and indicators relating to the development of the economy when summarising the stability assessment. Chart 3 contains three different macro variables and macro indicators for Sweden. These are the Economic Tendency Indicator, the GDP gap and unemployment. The corresponding variables and indicators for the euro area (the Economic Sentiment Indicator, GDP growth and unemployment) are also included in this category. As the sovereign debt crisis in the euro area is of great significance to the development of financial stability in Sweden, there is also an indicator for sovereign debt in the euro area and an indicator for the change in this debt in the cobweb chart. Table 1 presents the variables and indicators included in the main category "Macroeconomic Developments" and describes how these variables acquire a value on the cobweb-chart scale.

Financial Markets

Developments on the financial markets are also an important component of the stability analysis as they are so important to the funding and risk management of the banks and companies. In international terms, Swedish banks have a large element of market funding. Approximately two-thirds of this funding is in foreign currencies, above all euros and US dollars. This means that the European and US markets are also of interest in the analysis. Chart 4 thus reflects developments on the capital markets in Sweden, Europe and the United States. The capital markets comprise the stock markets and credit markets, which in turn comprise the shorter money markets and the longer bond markets. Given the current situation regarding the debt crisis in the euro area, government bond yields are also included as an indicator in this category. Table 2 contains a more detailed description of the different variables and indicators.

The Banks' Borrowers

An important part of every stability assessment is to study the banks and the banks' credit risks. For this reason, the Riksbank usually presents an in-depth analysis of the banks' borrowers. The cobweb charts therefore underline aspects that relate to the banks' borrowers and the stability risks that may arise as a result of their situation. In Chart 5, the borrowers are divided into two main groups, companies and households. In the case of the companies, a range of variables and indicators for default risk, indebtedness and profitability are included. In the case of the households, indicators and variables that provide a picture of indebtedness in the household sector, the development of housing prices and the level of mortgage rates are included.

The major Swedish banks have large exposures to real estate companies. The Swedish banking crisis of the 1990s demonstrated that the development of the real estate companies can be very important to financial stability. Variables and indicators for the Swedish real estate companies are therefore also included in the cobweb charts. The variables and indicators used in Chart 5 are the vacancy rate for office premises and the direct return of the real estate companies.

Apart from the situation of the real estate companies, the Riksbank also analyses developments in other non-financial companies. The default rates for these companies and their debts to banks and other credit institutions are included as variables and indicators in the cobweb charts.

As the Swedish banks' lending to households constitutes a large part of their operations, it is important that the cobweb charts also include variables and indicators that illustrate the risks that may arise in the household sector. The indicators included in Chart 5 are changes in the households' debt ratio and the development of housing

prices and mortgage rates. The credit gap is also included in the chart in order to illustrate the general debt situation in the Swedish economy.

The variables and indicators included in the cobweb chart for "The Banks' Borrowers" category are presented in Table 3.

Banks

Some aspects that are important in relation to the banks are captured by the indicators in the main category "The Banks' Borrowers". However, there are other aspects, in addition to the credit risks associated with certain borrowers, which should be highlighted. These aspects are included in the main category "Banks".

Maturity transformation is a central part of the banks' operations. This involves the banks converting short-term investments into long-term lending to cover a funding need. However, such operations entail a risk that the banks will be forced to stand by their long-term commitments to customers even during periods when they find it difficult to fund their banking operations. Reducing potential problems of this type makes different demands of the banks' liquidity positions. Chart 6 therefore includes two different indicators for the banks' liquidity positions: The Riksbank's structural liquidity measure and the Riksbank's short-term liquidity measure.

In addition to liquidity aspects, the banks' capital ratios, and thus their solvency, are factors that are important to financial stability. The indicators for the banks' solvency included in Chart 6 are capital ratios, profitability, CDS spreads and leverage.

The variables and indicators included in the category "Banks" are presented in Table 4.[4]

Table 1. Indicators in the main category "Macroeconomic Developments"

VARIABLE/INDICATOR	DESCRIPTION	COBWEB-CHART FIGURE	COMMENT
Business Tendency Indicator, Sweden	Leading indicator of the development of economic activity and the business cycle	Set on the basis of how many standard deviations the indicator is from its long-term mean value	The long-term mean value is 100. Indicator for maximum/ minimum values at 80/120
GDP gap in Sweden	Indicator for the business cycle	4 minus the size of the GDP gap in percentage points.	Assumes maximum/minimum values at -4/4 percentage points GDP gap
Unemployment, Sweden	Indicator for the business cycle	4 plus deviation from NAIRU	NAIRU is assumed to be 6%
Economic Sentiment Indicator, euro area	Leading indicator of the development of economic activity and the business cycle	Set on the basis of how many standard deviations the indicator is from its long-term mean value	The long-term mean value is 100. Indicator for maximum/ minimum values at 80/120.
GDP growth in the euro area	Indicator for the development of economic activity	Set on the basis of percentage growth	Maximum/minimum values at -2/2%
Unemployment, euro area	Indicator for the business cycle	4 plus deviation from NAIRU	NAIRU is assumed to be 8%
Government debt, euro area	Indicator of state of public finances	Set on the basis of the deviation between the sovereign debt's percentage of GDP and 60%	Maximum/minimum values at 100/20%
Change in government debt, euro area	Indicator for the development of public finances	Set on the basis of the change in the sovereign debt's percentage of GDP	Maximum/minimum values assumed to be 4/-4 percentage points

4. "Banks" refers only to the four major Swedish banks Handelsbanken, Nordea, SEB and Swedbank.

Table 2. Indicators in the main category "Financial Markets"

VARIABLE/INDICATOR	DESCRIPTION	COBWEB-CHART FIGURE	COMMENT
Basis spread, Sweden	Indicator of stress on the money market	Number of historical standard deviations from the historical mean value plus 4. Historical reference period is 10 years back in time	Difference between STIBOR rate and STINA rate at maturity of three months
Basis spread, euro area	As above	As above	Difference between EURIBOR rate and OIS rate at maturity of three months
Basis spread, United States	As above	As above	Difference between LIBOR rate and OIS rate at maturity of three months
Covered bond spread, Sweden	Indicator of stress on the bond market	As above	Difference between five-year mortgage bond rate and five-year government bond rate
Corporate bond spread, euro area	As above	As above	Difference between iBoxx Euro Non-Sovereigns BBB-rate and a maturity-matched swap rate
Corporate bond spread, United States	As above	As above	Difference between Merrill Lynch, BBB Rated, Corporates Index and maturity-matched swap rate
Stock market volatility	Indicator of stress on the stock market	As above	Aggregated implicit share index volatility in Sweden, the euro area and the USA
Government bond spread, euro area.	Indicator that illustrates the euro crisis	As above	GDP-weighted difference in rates between ten euro countries' ten-year government bonds and the German equivalent. The ten countries are Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain.

Table 3. Indicators in the main category "The Banks' Borrowers"

VARIABLE/INDICATOR	DESCRIPTION	COBWEB-CHART FIGURE	COMMENT
Default rate, non-financial companies	Indicator of debt-servicing ability	Deviation from mean value as a percentage of the maximum observed deviation	The mean value is 0.8% and the maximum value of the indicator is reached at 3%
Vacancy rate, office premises	Indicator of debt-servicing ability of real estate companies	Deviation from mean value	The mean value is assumed to be 6%
Real estate yield	Indicator of debt-servicing ability of real estate companies	Set on the basis of how many standard deviations the indicator is from its long-term mean value	The mean value is 2.22% and the standard deviation is 0.96%
Non-financial companies' debts to MFI*	Indicator of build-up of debt in the corporate sector	Growth of debts	
Credit gap	Indicator of rate of build-up of debt	Set on the basis of the size of the credit gap	The indicator reaches its maximum/minimum values at 10/-10 percentage points
Change in household debt	Indicator of change in burden of household debt	Set on the basis of the change in the household debt-to-income ratio	The indicator reaches its maximum value at 8%
Change in house prices	Indicator of developments on the housing market	Set on the basis of the growth of house prices	The indicator assumes the lowest value is four when the growth in house prices is between -4 and 4% In other intervals the indicator is set at the absolute value of house-price growth
Mortgage rate	Indicator of the households' debt-servicing ability	Set on the basis of the deviation between the mortgage rate and 5%	The indicator reaches its maximum/minimum values at 9%/1%

*MFI stands for Monetary and Financial Institutions.

Table 4. Indicators in the main category "Banks"

VARIABLE/INDICATOR	DESCRIPTION	COBWEB-CHART FIGURE	COMMENT
Structural liquidity measure	Indicator of liquidity risk	Set on the basis of the number of standard deviations from the desired value	The figure for the bank that has the lowest liquidity is used
Short-term liquidity measure	Indicator of liquidity risk	Set on the basis of the number of standard deviations from the desired value	The figure for the bank that has the lowest liquidity is used
Capital Basel II	Indicator of solvency risk	Set on the basis of the number of standard deviations from the desired value	The figure for the bank that has the lowest capital adequacy is used
Leverage	Indicator of solvency risk	Set on the basis of an international comparison	The figure for the bank that has the lowest figure is used. The indicator reaches its maximum/minimum values at 4%/9%
Profitability	Indicator of solvency risk	Set on the basis of the number of standard deviations from the mean value	
CDS spread	Indicator of assessed credit risk and measure of funding cost	Deviation from mean value over time as a percentage of the maximum observed deviation	Annual cost for buying a CDS contract