# Public consultation
# Guide to the use of stress tests as part of risk management within asset management companies

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Contents

The UCITS[1] and AIFM[2] directives, both of which are transposed into French law, require asset management companies that manage UCITS or AIFs to perform periodic stress tests.
This Guide aims to clarify the expectations of the *Autorité des Marchés Financiers* (AMF) as regards the use of stress tests as part of the broader risk monitoring system of asset management companies (AMCs)
The Guide is intended for asset managers that manage UCITS or AIFs or provide a discretionary portfolio management service.

# I. Objective and scope of stress tests

## A. What are stress tests and what do they aim to achieve?

In order to manage and monitor their business risks, AMCs implement a risk management policy that enables them to verify and measure at any given moment the risks associated with their positions and how these affect the overall risk profile of the portfolios. This involves the AMCs **performing periodic stress tests in order to address risks that might adversely impact <u>the collective investment schemes or individual portfolios</u>** they manage[3].

A stress test **simulates extreme or unfavourable, yet plausible, economic and financial conditions in order to study the consequences** on both the performance of a collective investment undertaking or investment mandate and its ability to honour redemption requests, even at a discounted net asset value.
Primarily, stress tests are **tools that help to analyse the strength of the strategies that have been put in place**. They provide scenario periodic analysis in order to address risks arising from potential changes in market conditions that might adversely impact the portfolios managed. During normal periods, the stress test identifies the weaknesses of an investment strategy and helps AMCs to prepare themselves operationally for a crisis; during crisis periods, the stress test helps to manage the crisis and chose resolution strategy. As such, stress tests are risk management and decision-making tools.

## B. Stress tests are part of the permanent risk management function

As part of its risk management strategy, in compliance with article 313-53-7 (II) of the AMF's General Regulation and Position-Recommendation 2014-06[4], the investment services provider shall establish and implement, among other things:

1) **risk mapping**, taking account of the risks of each position of the collective investment undertaking or individual portfolio it manages, and the interaction between those individual risks;
2) **relevant risk indicators** and a system of risk limits that is consistent with the risk profile of the collective investment undertaking or individual portfolio under its management;
3) **an alert mechanism** to prevent and detect any breaches of the limits, and remedial procedures in the event of any actual or anticipated breaches of the limits.

It updates them regularly to ensure they are relevant and effective.
**Stress tests are part of risk management and require these same stages.**

The implementation of stress tests first requires the asset management company to identify the risks associated with investing in the financial assets that it manages or to which it wishes to become exposed.

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[1] Article 51 of Directive 2009/65/EC of the European Parliament and of the Council of 13 July 2009 (the "UCITS Directive")
Articles 38 and 40 of Implementing Directive 2010/43/EU
[2] Articles 15 and 16 of Directive 2011/61/EU of the European Parliament and of the Council of 8 June 2011 (the "AIFM Directive")
Articles 45 and 48 of Delegated Regulation 231/2013 supplementing the AIFM Directive
[3] For AMCs that manage UCITS or AIFs and are governed by Book III, Title I of the AMF's General Regulation, article 313-53-7 (II) c) of the AMF's General Regulation. For AIFMs governed by Book III, Title I bis of the AMF's General Regulation, article 318-41 contains a similar requirement to perform appropriate stress tests.
[4] Guide to the organisation of the risk management system within asset management companies

Based on this risk mapping, the implementation of a stress test involves defining scenarios that represent the risks then introducing a regular schedule for calculating the impact of these scenarios on one or more portfolios. Once in place, the results of these scenarios are calculated periodically in order to detect anomalies with the help of predefined alert thresholds.

Lastly, the results of the stress tests should be largely disseminated within the asset management company, in particular to executive and decision-making bodies, so that any corrective measures can be taken.

**The aim of stress tests is to improve risk analysis by dedicated teams or senior managers, and to highlight the limits of risk measurement and management strategies. In particular, they flag up the consequences of, or conditions that might lead to, extreme scenarios, highlighting risks that have not been taken into account by the investment team.**

**The stress test system of an asset management company therefore consist of:**

- **identifying** — **identifying the risks to which its managed portfolios are exposed;**
- **implementing** — **establishing and implementing suitable stress tests for said portfolios;**
- **distributing** — **distributing the results of the stress tests, whether by developing measurement indicators or implementing and disseminating alert mechanisms;**
- **acting** — **taking all necessary measures to respond to the results of the tests;**
- **checking** — **checking the suitability and effectiveness of the system that has been implemented.**

# II. Identifying risks and establishing stress test scenarios

Work on constructing stress test models begins by using a mapping process to identify risk.
Identifying risk is part of the **risk management policy** which, in compliance with article 313-53-5 (II) of the AMF's General Regulation, *"shall comprise such procedures as are necessary to enable the management company to assess for each collective investment scheme […] or individual portfolio it manages the exposure of that collective investment scheme […] or individual portfolio* ***to market, liquidity and counterparty risks****, and the exposure of the collective investment schemes […] or individual portfolios to all other risks, including* ***operational risks****, which may be material for each collective investment scheme […] or individual portfolio it manages."*


AMCs tend to distinguish **market stress tests**, which simulate the impact of turbulence on one or several markets on the fund's net asset value, from **liquidity stress tests**, which simulate the impact of a high volume of redemption requests on the fund's liabilities (possibly during a period of low market liquidity). There are also stress tests that simulate **counterparty default** or the materialisation of **operational risk**.

The risk factors used for stress tests must include extreme risk factors, such as the full or partial erosion of liquidity of certain assets, that occur only in stressed periods. It is also crucial to reconsider how these risk factors interact. As a general rule, stressed periods mean greater correlation between certain risk variables (greater impact of exogenous variables) or, to a lesser extent, distortion of the sensitivities of a certain number of positions that an asset management company may have in its portfolio.
As such, rather than just rigidly simulating traditional risk factors, stress test scenarios should aim to **expand the risk analysis scope by including more risk factors and interactions.**

This section of the Guide contains examples and good practice with regard to identifying risk and then establishing scenarios, firstly for market and liquidity risks, then for aggregate risk across several funds and finally for particular cases such as illiquid asset classes and index funds.

## A. Market risks

Market risk[5] is the risk of loss for the collective investment scheme or the individual portfolio resulting from fluctuation in the market value of positions in the portfolio attributable to changes in market variables such as interest rates, foreign exchange rates, equity and commodity prices, or an issuer's creditworthiness. These risks may be independent of each other or correlated, depending on the financial instruments within the fund's asset base.

### *1. Identifying risks*

[5] Article 313-53-3 of the AMF's General Regulation.

The way in which market risk is mapped should be adapted to the instruments and strategy implemented by the fund.

**Example of identifying risks associated with the instruments used during fund management:**

| Instruments | Associated risk factors | Risk indicators |
|---|---|---|
| Forex products:<br>• Forex spots<br>• Forex forwards<br>• Forex derivatives<br>• Forex swaps | Foreign exchange risk<br>Volatility risk<br>Liquidity risk<br>Counterparty risk | • Exposure<br>• Volatility<br>• VaR<br>• CVaR<br>• Sensitivity / Greeks<br>• Leverage |
| Equity products:<br>• European large caps<br>• International mid and small caps<br>• Equity/index derivatives<br>• Equity UCITS | Equity risk<br>Foreign exchange risk<br>Volatility risk<br>Liquidity risk<br>Counterparty risk | • Exposure<br>• Volatility<br>• VaR<br>• CVaR<br>• Sensitivity / Greeks<br>• Leverage |
| Fixed income products:<br>• Corporate and interbank loans<br>• Sovereign debt (fixed/variable rate)<br>• Corporate debt (fixed/variable rate)<br>• Securities lending<br>• Repos/reverse repos<br>• Interest rate derivatives (interest rate swaps / interest rate futures / forward rate agreements)<br>• Fixed income UCITS or AIFs (money market UCITS)<br>• Bond UCITS or AIFs | Interest rate risk<br>Repo rate risk<br>Credit risk<br>Volatility risk<br>Liquidity risk<br>Counterparty risk | • Exposure<br>• Volatility<br>• VaR<br>• CVaR<br>• Sensitivity / Greeks<br>• Repo rate sensitivity<br>• Leverage |
| Commodity products<br>• Commodity futures index options | Commodity risk<br>Volatility risk<br>Liquidity risk<br>Counterparty risk | • Exposure<br>• Volatility<br>• VaR<br>• CVaR<br>• Sensitivity / Greeks<br>• Leverage |
| Credit derivatives<br>• Credit default swaps (CDSs)<br>• Credit linked notes (CLNs) | Interest rate risk<br>Credit risk<br>Volatility risk<br>Liquidity risk | • Exposure<br>• Volatility<br>• VaR<br>• CVaR<br>• Sensitivity / Greeks<br>• Leverage |

The **stress tests scheme** should cover a wide range of scenarios of varying severity affecting as many risk factors as possible. The AMC should assess the most relevant risks based on its underlying strategies and portfolio assets.

## 2. Defining market stress test scenarios

Once the risk factors have been identified, the AMC should set about defining the stress test scenarios.
The simplest approach is to reproduce the parameters of previous crises and deduce the impact they would have had on the fund (**historical scenario**). This approach can obviously lead to questions about the fund's ability to deal with future crises. Clearly, there is nothing to suggest that future crises will be similar to previous ones. Moreover, it is difficult to precisely replicate past crises because data (for example in terms of the historic correlation of risk factors) are often incomplete, particularly going back more than a decade, and may produce very different scenarios.
Alternatively, **hypothetical scenarios** involve anticipating a crisis by imagining its parameters. These scenarios, often based on historical scenarios, should be relatively realistic and are sometimes formulated with the help of fund managers, whose expertise complements the purely statistical approach.

By way of example, here are some commonly used scenarios:

- **Historical scenarios**: junk bonds in 2001, subprime mortgages in 2007, the Greek crisis in 2009 and the Chinese stock market crash in 2015. These scenarios can include independent or correlated shocks depending on the model.
- **Credit-linked scenarios**: widening of spreads, credit crunch[6], flight to quality[7], jump to default[8].
- **Single-factor or multi-factor scenarios**

- uncorrelated (fixed income, equity, real estate, counterparty, commodities, forex, volatility, correlation, etc.).
- correlated: a particular shock may spread to all risk factors, depending on the correlation table used.

- **Hypothetical scenarios** based on economic shocks, particularly risk by country or business segment (e.g. bankruptcy of a sovereign state or crash in an industrial sector). This type of scenario requires the creation of a dashboard of all changed risk factors, a correlation matrix and a choice of financial behaviour model.
- **Probabilistic scenarios** based on implied volatility.
- **Fund strategy-specific scenarios**, where there is little influence from previous scenarios and real sensitivity to traditional risk factors is hard to calculate. This can be the case for a long/short investment strategy.

Stress scenarios can take very different forms. It is advisable to use as varied scenarios as possible provided they are relevant to the funds or individual portfolios in question.

**Good practice:**

1) Use highly varied scenarios based on rare hypotheses imagined by fund managers. For example, a long/short fund may be particularly sensitive to market movements that were not taken into account by historical stress tests. New scenarios can highlight correlations or sensitivities that were not otherwise taken into account.
2) Vary the time windows for historical scenarios in order to process as many scenarios as possible and avoid getting stress test results that depend overly on an arbitrary time window (e.g. one period with low interest rates and another with higher rates).
3) Use aggregate stress test scenarios on a range of funds or even on all the funds managed by the AMC. Aggregating results provides an overview and can show, for example, the total volume of assets held by all an AMC's funds in a particular position, and the potential impact of several portfolios selling out of said position at the same time during a liquidity crisis.

**Methods to avoid:**

[6] Significant and sudden contraction of credit.
[7] During a stock market crisis, significant flows of capital to safe (and generally more liquid) investments. The price of financial assets affected by credit risk falls sharply because it is harder for borrowers to get financing, and even if they succeed, they have to pay a higher rate of interest.
[8] Very significant increase in counterparty risk as default approaches, particularly if default risk is hedged by a CDS where the margin calls, which hedge against counterparty risk, are increasing more slowly than the risk.

1) Using scenarios from a past period which, following a sustained period of stability, no longer contains examples of extreme events. For example, if an AMC uses a five-year track record for volatility, it is possible that all major volatility peaks occurred before the start of that period, which changes the scenario considerably.
2) Using scenarios that are too old and are not updated regularly. For example, it may no longer be relevant to use a matrix of correlation between country risk factors and equities that is not updated regularly, particularly if a company changes the location of its registered office or expands into new markets.

## B. Liquidity risk

Liquidity risk[9] is the risk that a position in the portfolio cannot be sold, liquidated or closed out at limited cost in an adequately short time frame and that the ability of the collective investment scheme to comply at any time with the third paragraph of articles L. 214-7 or L. 214-24-29 or articles L. 214-8 or L. 214-24-34 of the French Monetary and Financial Code (units and shares are redeemable on demand), or the ability of the investment services provider to liquidate positions in an individual portfolio in accordance with the contractual requirements of the portfolio management mandate, is thereby compromised.

It is very hard to measure liquidity risk using a single measure because it may result from: (i) significant redemptions; (ii) illiquid assets; or (iii) a combination of the two.

### *1. Significant redemptions*

First of all, a liquidity stress test includes **a simulation of redemptions**. This simulation is calibrated based on stability analysis of the liabilities, which itself depends on the type of investor (institutional, retail, private bank, etc.) and the concentration of the liabilities.

**Understanding and analysing the fund's liabilities is essential to understanding the risks faced by the AMC**. At present, this is made difficult by, on the one hand, a lack of transparency among the distribution channels (insurance companies, private banks, network of distribution to retail investors) and, on the other hand, the lack of a theoretical investor behaviour model.

The particular characteristics of the liabilities and any cyclical changes to redemptions need to be taken into account when establishing redemption scenarios. However, there are many ways to stress liabilities and redemptions. In this section of the Guide, we will look at four examples of redemption scenarios, but these scenario types can be combined to simulate redemptions from a fund.

Examples of significant redemption scenarios:

A. **Redemptions of a percentage of the liabilities (typically between 20% and 50%)** defined based on the frequency of calculating the net asset value, any redemption notice period and the type of investors

**Example:**
**What percentage of redemption requests is the fund able to honour based on the percentage of liabilities subject to redemption requests?**
For the purpose of this example, we assume that under normal market conditions the fund will liquidate positions with no major distortion of portfolio allocation, and that a maximum of 20% of the daily average volume can be sold on the underlying market.

| Fund | AuM (€m) | 10% redemptions | 20% redemptions | 30% redemptions | 40% redemptions | 50% redemptions | 60% redemptions | 70% redemptions | 80% redemptions | 90% redemptions |
|---|---|---|---|---|---|---|---|---|---|---|
| AMF equity Europe | 1353 | 100% | 99.5% | 98.9% | 97.9% | 96.9% | 95.9% | 94.7% | 93.4% | 92.2% |
| AMF equity France | 350 | 92.2% | 83.4% | 78.3% | 73.4% | 68.7% | 64.6% | 61.3% | 58.8% | 56.2% |

[9] Article 313-53-3 of the AMF's General Regulation.

In this example, we can see that the fund AMF equity France is far more sensitive to redemption risk: even if only 10% of liabilities are subject to redemption requests, the fund is only able to honour 92.2% of requests, i.e. 9.22% of the portfolio.
This means that if more than 10% of the fund's liabilities are subject to redemption requests, the AMC will have to sell at a loss or reduce the portfolio's average liquidity by distorting its allocation, which threatens the principle of fair treatment of investors. The assumptions we have used do not seem extreme, because more than 10% of liabilities may be subject to redemption requests when asset liquidity is also worse and the fund may not be able to liquidate up to 20% of the average daily volume.

Liquidating positions without distorting portfolio allocation requires a technique known as slicing, whereby the same percentage of each asset type (or each liquidity class if the assets are categorised according to their liquidity, also known as *bucketing*) is sold, rather than selling the most liquid assets first. In the example, the fund can liquidate only 9.22% of the portfolio if 10% of liabilities are subject to redemption requests (because at least one of the assets cannot be at 10%). The following solutions would be possible: i) creating a side pocket[10] for the asset with insufficient liquidity; ii) selling more than 10% of one of the least liquid assets to adjust the portfolio's average liquidity; or iii) failing to honour the redemption requests. The scenarios presented in these examples are based on the use of side pockets or a slight distortion of portfolio liquidity.

B. **Redemption of units by the largest investor(s)**

Rather than defining an arbitrary redemption percentage like in the previous scenario, we can use information about a fund's investor base to refine the stress test. Specifically, the scenario involving redemption of units by the largest investors should be calibrated based on the concentration of the fund's liabilities and the relationships between the AMC and the fund's primary investors (i.e. is it a long-term, equity-based relationship or are the investors deemed volatile?).

C. **Redemptions equal to the largest redemptions ever seen** in a group of similar (geographically or in terms of fund type) funds or across all the funds managed by the AMC

Liability-side stress scenarios can also be based on historical redemptions from the same fund, from all the AMC's funds or from other similar funds.

However, the largest redemptions witnessed in the past are not necessarily a reliable indicator of the worst redemptions that may occur in the future, and we would therefore recommend also using a more extreme scenario based on one of the two previous approaches.

D. **Redemptions based on an investor behaviour model,** in accordance with the breakdown of liabilities by investor category.

This type of scenario simulates the behaviour of each type of investor and establishes a simulation based on the composition of the fund's liabilities.

**Example of investor classification and simulation of their behaviour** (the figures shown are not real):

| Investor type | Record redemptions for this investor type | | | Stressed redemptions for this investor category |
|---|---|---|---|---|
| | Over one day | Over one week | Over one month | |
| Large institutionals | 25% | 75% | 100% | 75% |

[10] If the sale of assets is not in the interests of the UCI's unit- or shareholders, they can be transferred to a side pocket AIF under the terms of articles L. 214-8-7 and L. 214-24-41 of the French Monetary and Financial Code.

| | | | | |
|---|---|---|---|---|
| Group entity (bank, insurance, own account) | 20% | 40% | 40% | 0% (in agreement with the AMC) |
| Investment fund | 20% | 65% | 100% | 65% |
| Small institutionals | 10% | 25% | 40% | 25% |
| Private banking network | 15% | 40% | 75% | 40% |
| Retail investor with distributor A | 5% | 10% | 20% | 10% |
| Retail investor with distributor B | 7% | 15% | 20% | 15% |

In order to build a simulation of this kind, the AMC needs to make assumptions about the behaviour of each investor type, based in part on historical redemptions (just like in the previous kind of stress test). In the example above, the AMC has noted that the retail investors who invested through distributor A are historically slower to exit in the event of difficulty (see the maximum redemptions at one day and one week), but that they exhibit the same behaviour over one month as retail investors who invested through distributor B.
The stress scenario used in this example (stressed redemptions) is based on hypothetical redemptions over one week, except for funds invested by the parent company of the group, because the parent is a long-term investor and is therefore less likely to redeem immediately.[11]

This fictitious example demonstrates a possible classification that AMCs can use based on the data available to them as regards liabilities and behaviour.
Historical redemption data should enable the fund redemption scenarios to be more accurately calibrated.
Any differences in investor behaviour based on the distributor are often attributable to the different characteristics of investors (e.g. different tax regimes in different countries).

**It is good practice for AMCs to use all available information about the investors of the funds they manage, including their historical redemptions by investor or distributor type, and to gather more detailed data from distributors on the profile of the investors so they can model investor behaviour and calibrate redemption scenarios as accurately as possible.**

**Note:**
The ownership limits applicable to institutional investors pose a specific risk of **snowballing redemptions** in certain funds with insufficiently diversified liabilities. In effect, if several investors are invested up to their ownership limit, the exit of one investor may cause others to reach their ownership limit and also be obliged to redeem their units. Understanding of this type of constraint can enhance the liability modelling process.

### 2. *Liquidity risk on the asset side*

Liquidity stress tests should also take account of the liquidity of portfolio assets. Although the liquidity of an asset is extremely subjective, there are several traditional methods of monitoring the ability to sell assets without having a major effect on the price.

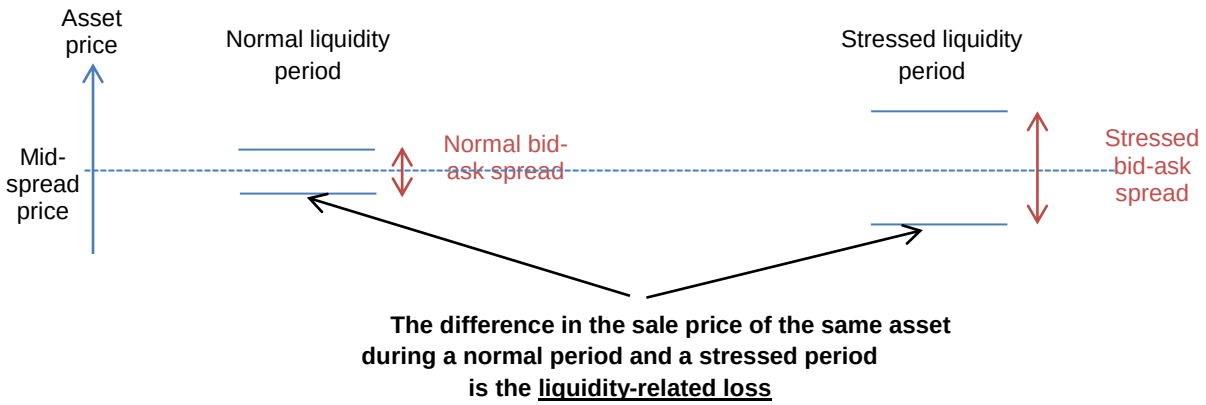
A non-exhaustive list of ways to measure asset liquidity is provided below to assist AMCs, which should above all adapt them to their funds' portfolios and understand their limitations.

**1 st asset liquidity measure - *Loss incurred following an increase in the bid-ask spread*.**

If an asset becomes less liquid, the gap between the "bid" and the "ask" (the purchase and sale prices generally proposed by the market-makers) tends to increase, partly because the risk taken by the market-makers is greater.

[11] These assumptions are purely indicative and should under no circumstance be generalised, including the assumption that the units or shares of the management company's parent are not redeemed in the event of a crisis.

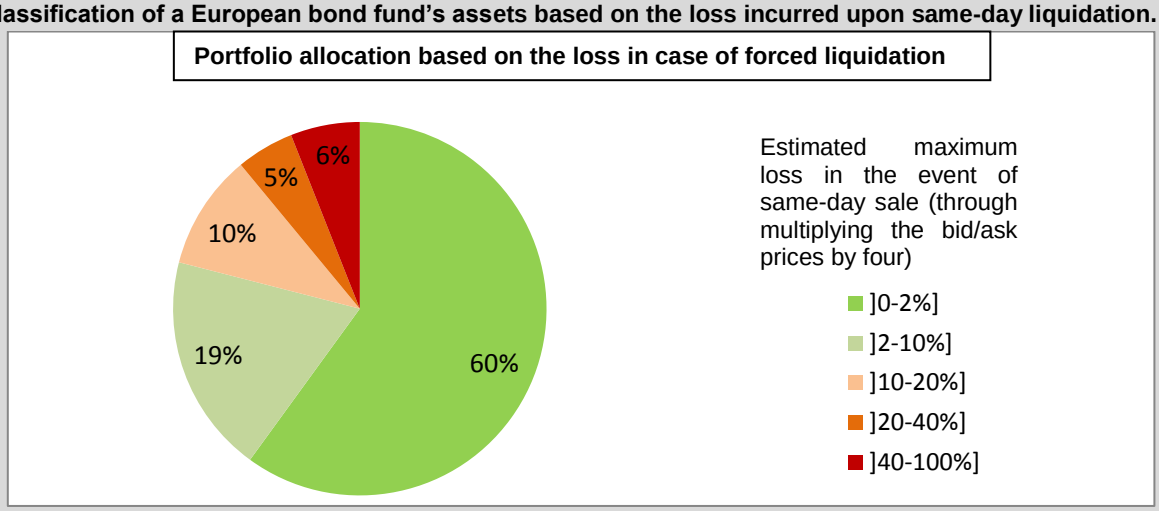
Therefore, when a fund sells assets in stressed conditions, it will do so at a lower ask price than it would have obtained under normal liquidity conditions.




This loss is usually calculated on the basis of multiplying normal bid-ask spreads by three or four during a stressed period. On the other hand, this method is based on the premise that assets can always be sold immediately with a possible discount, which is no longer the case in an exceptional crisis with no buyer. As such, this is a fairly optimistic approach and should not be used for illiquid assets.

**Example: Estimate of loss arising from illiquid assets**

**Classification of a European bond fund's assets based on the loss incurred upon same-day liquidation.**




According to this estimate of the loss incurred in the event of a forced liquidation, the fund may lose between 5% (optimistic scenario based on the minimum loss for each range[12]) and 13% (conservative scenario based on the maximum loss for the range[13]) if it were forced to liquidate all its assets on the same day.
However, this is a very rough and optimistic estimate because during a major liquidity crisis, it would in all likelihood be impossible to sell certain bonds and there would probably no longer be a bid-ask spread for larger volumes.

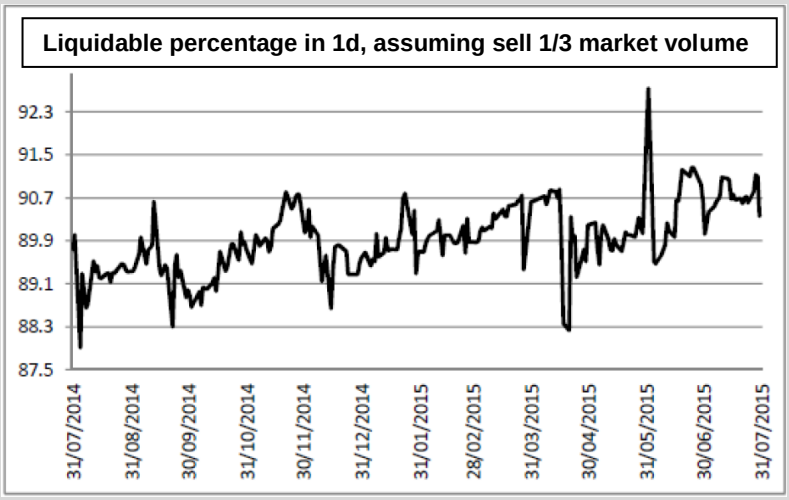
**2 nd asset liquidity measure - *Maximum liquidation possible in a single day*.**

[12] $60\% \times 0 + 19\% \times 2\% + 10\% \times 10\% + 5\% \times 20\% + 6\% \times 40\% = 4.78\%$ loss

[13] $60\% \times 2\% + 19\% \times 10\% + 10\% \times 20\% + 5\% \times 40\% + 6\% \times 100\% = 13.10\%$ loss.

This method is based on analysing daily exchanges on the underlying markets for each type of asset in the portfolio. For any given asset, a calculation is made of the maximum share of the volumes exchanged on the underlying market that the AMC believes can be liquidated (typically 10% or 20% for equities). By estimating this maximum amount for each portfolio asset, the daily liquidity of a portfolio can be worked out.
This estimate of a fund's ability to sell out of its positions should take into account the other funds managed by the AMC, which may simultaneously be subject to the same redemptions but cannot simultaneously liquidate the same assets at 20% of the market volume. If an AMC has several funds invested in the same security, the maximum amount of this security that can be liquidated most include all the securities held by the funds it manages.

**Example of a bond fund's ability to liquidate its portfolio in a single day, assuming it can sell at 30% of the market volume on that day:**




In this example of a fund consisting of 50 listed bonds, we consider the average volume exchanged every day for each security[14] in the portfolio, then we assume that 30% of this volume can be sold in a single day. Based on an analysis of each portfolio security, we can calculate the percentage of assets across the entire portfolio that can be liquidated in a single day.
This work is carried out every day on the basis of the new volumes exchanged, which is how we arrive at the data shown in the chart above. The daily changes on the graph, which represent the changes in volumes exchanged on the underlying markets, are not decisive, but the long-term trend of the graph provides an indication as to the liquidity of the portfolio.
In view of the extremely optimistic assumptions used in this example (30% liquidation of the volume exchanged daily on the underlying markets), it would appear as though the fund can sell between 88% and 92% of its assets in a single day.

It is difficult to estimate a fund's ability to sell an asset, and its ability to do so will probably be considerably less during a liquidity crisis than under normal conditions. More generally, the volumes exchanged on a market are not always a good indicator of the liquidity of an asset because some assets are held by long-term investors and are therefore exchanged only occasionally.
**Because of the uncertainty surrounding the liquidity of an asset, AMCs should exercise caution and imagine several different scenarios.**

**Example of a large-cap equity fund:**
Estimate of the share of assets that can be liquidated if we assume that a maximum of X% of the daily volume exchanged on the market can be sold (and with no portfolio allocation constraints).

[14] Where bonds are concerned, it is sometimes useful to study the exchanged volumes of similar bonds (with a different coupon or slightly different maturity) because if some issues are majority held by buy-and-hold investors, the volumes exchanged may be small even if the securities are liquid.

| | | Percentage that can be liquidated in a single day | | | |
|---|---|---|---|---|---|
| Fund | AuM (€m) | Hypothesis 1 1% of the daily volume | Hypothesis 2 5% of the daily volume | Hypothesis 3 10% of the daily volume | Hypothesis 4 30% of the daily volume |
| AMF equity France | 350 | 9% | 45% | 91% | 100% |

For the purpose of this example, we assume that the average volume exchanged daily and weighted by portfolio composition over one year is €3.2 billion. If we assume that the fund can liquidate 1% of the daily volume, it can therefore sell €32 million of assets, or 9% of its portfolio.

For an equity fund investing in large caps, the markets can be considered fairly transparent and the daily exchange volume and changes thereto can therefore be reliably determined. However, this method is much less reliable for smaller markets (see the example below) and OTC markets, where trust between operators can easily be eroded.
This makes it extremely difficult to precisely estimate the share of liquid assets, but it is useful to have several scenarios in order to be aware of the level that would threaten the AMC's ability to honour redemption requests.

**3 rd asset liquidity measure - *Estimate of liquidation time based on breaking down fund assets by liquidity (or bucketing)***

This method uses a breakdown by liquidity buckets (bucketing) to estimate the time needed to sell under normal conditions. It is similar to the previous method, but measures the total liquidation time rather than the volume that can be liquidated.
It makes a distinction between the portfolio's estimated liquidation time frame with a constant liquidity profile and with the most liquid assets sold first.

**Example of a small-cap fund:**
**Let us take the example of an equity fund that has invested €15 million in mid-tier firms (known as ETIs in France), most of which are listed on Compartment C of Euronext (market capitalisation of less than €150 million) and on Alternext. The fund has a portfolio of companies with an average capitalisation of €75m. We will assume that for the stressed scenario, 25% of the average daily volume exchanged can be sold.**

**Five biggest holdings:**

| Name of stock | % of assets | Capitalisation (€m) | Daily volume exchanged (€k) | Amount that can be liquidated assuming redemptions of 25% of the daily volume (€k) | Number of days to liquidated the holding |
|---|---|---|---|---|---|
| **A** | **6%** | **300** | **80** | **20** | 5 |
| **B** | **5.3%** | **205** | **400** | **100** | 1 |
| **C** | **4.5%** | **105** | **45** | **11.2** | 6 |
| **D** | **4.1%** | **70** | **5** | **1.25** | 49 |
| **E** | **3.3%** | **85** | **10** | **2.5** | 20 |

**With regard to the table above and assuming that 25% of the daily exchanges can be sold each day, the assets can be classified by the length of time needed to fully liquidate the holding.**

**However, this assumption appears optimistic <u>in the event of a liquidity crisis</u> because:**
**- the exchange volume is likely to be well below average during a liquidity crisis;**
**- even if the exchange volume remains close to the average, other players will want to sell. Specifically, if five funds hold shares in company B, they cannot possibly all sell 25%. This will make a significant dent in the volume of the assets that the fund will be able to sell, and therefore also the redemption requests it can honour;**
**- this model assumes that 25% of the historical daily exchange volume can be sold every day over a long period, which is hugely optimistic.**

**The following factors may affect the liquidity of the holding during a crisis:**
**- the free float of listed companies' equities;**
**- the type of investors in the target companies.**

**More generally, the exchange volume is an uncertain indicator, and it is useful to compare the exchanged volumes with those of other stocks in the same segment or with a similar market capitalisation.**

One of the other ways in which several management companies have gone about measuring changes in a fund's ability to sell its assets, is by implementing multi-criteria models that can be applied to each asset type and estimate the liquidation time frame based on the order characteristics (bid-ask spread, size of the issue, rating, country, credit default swap, etc.).

The above list of ways in which liquidity can be measured shows that many different approaches are possible. Whatever the method or methods chosen by the AMC to estimate the liquidity of its assets, it must also be aware of the limitations. In view of the difficulties of measuring liquidity, it is just as useful to analyse changes in liquidity as the absolute value.

**Avoid relying on just one liquidity measurement method:**
Of the three liquidity estimation methods presented above, the simple multiplication of the bid-ask spreads (method A) should not be deemed sufficient for estimating the impact of the worst liquidity simulation scenario. At the very least, a scenario should allow for the impossibility of selling certain assets.

### *3. Combined asset and liability liquidity risk*

There are three separate elements of liquidity risk management: liquidity risk on the asset side, liquidity risk on the liability side (portfolio liquidity and investor behaviour) and combined asset and liability liquidity risk (the fund's ability to meet its redemption obligations).

**Example of a short-term money market fund**

Money market funds need to be dealt with specially because of their size and the significant levels of redemption requests they have to honour.

Let us take the example of a money market fund with €15 billion under management, whose three largest investors account for 25% of net assets and with just 10% of highly liquid assets or deposits. In addition, 15% of its assets under management are held by very stable investors.
The table below estimates the losses incurred by the money market fund in the event of redemptions or market stress (credit or interest rate shocks).

| | | | Three largest investors (25%) ↓ | | | | | | Very stable investors (15%) ↓ | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Redemptions** | 0% | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% |
| **Initial portfolio** | | | 2 bps | 3 bps | 5 bps | 6 bps | 8 bps | 9 bps | 11 bps | 12 bps |
| **First scenario** | 7 bps | 9 bps | 13 bps | 18 bps | 24 bps | 32 bps | 45 bps | 66 bps | 110 bps | 236 bps |
| **Second scenario** | 3 bps | 4 bps | 6 bps | 9 bps | 12 bps | 16 bps | 21 bps | 28 bps | 38 bps | 85 bps |
| **WAL (days)** | 105 | 117 | 131 | 149 | 169 | 192 | 219 | 249 | 290 | 320 |

**First scenario: credit premium shock of 25 bps**
**Second scenario: interest rate shock of 25 bps**

This stress test shows that a redemption by the three largest investors (25% of net assets) would push the weighted average life (WAL) beyond the 120-day regulatory threshold (for a short-term money market fund) and cause the portfolio to lose in the region of 2-3 bps under normal conditions. The same level of cumulative redemptions with a 25 bps rise in interest rates would cause a loss of around 13-18 bps.

It is useful for **liquidity stress test scenarios to combine a liability shock** (significant redemptions) and an asset shock because it is highly likely that investors will exhibit abnormal behaviour during stressed market periods.

**Multicriteria approach to evaluating the combined asset and liquidity liability of a fund:**

One way of simulating a combined asset and liability shock is to use a multicriteria approach known as scoring, which measures changes in a fund's liquidity risk over time.

This method involves calculating a daily score for each fund, based on these elements:
- an evaluation of asset liquidity with a stressed asset score (stressed bid-ask spread to simulate daily exchanged volume or liquidation cost);
- a liability score estimating investor stability, based on distribution and concentration by investor type.

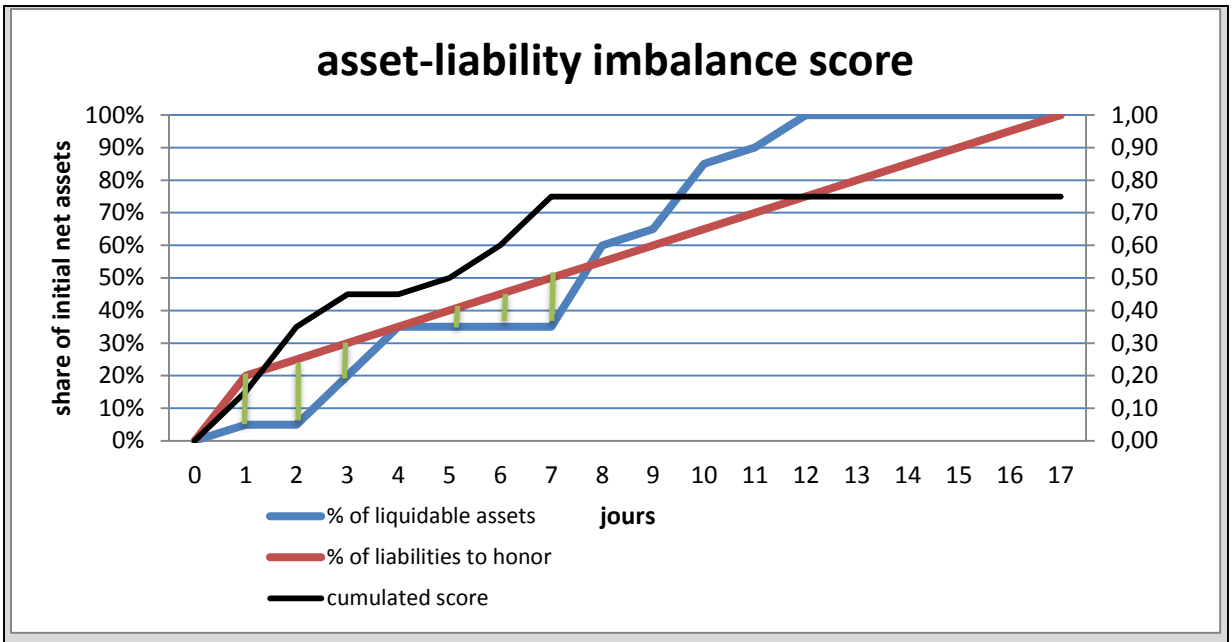
The final score has no value in and of itself, but it can be used to classify the different funds managed by the AMC based on their sensitivity to liquidity risk and to set up an alert system for when there is a significant change in a fund's score.

**Example of multicriteria scoring showing an asset-liability imbalance under stressed conditions:**

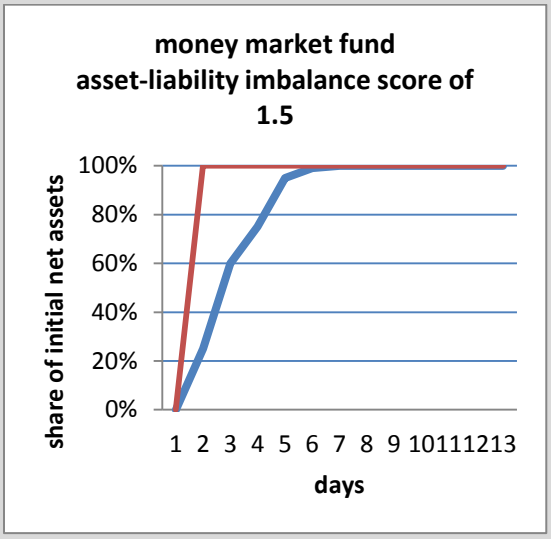
In this case, the score is the sum over one year (250 days) of estimated daily cash deficits (expressed as a percentage of net assets). The cash deficit (or redemption requests that are not honoured) is calculated every day as the difference between the maximum possible redemption requests and the amount generated by the liquidation of assets.

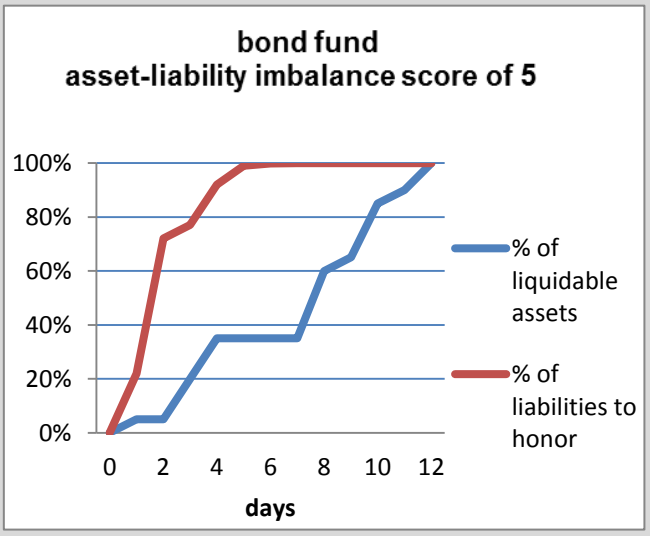
$$score = \sum_{250\ days} cash\ deficits = \frac{1}{net\ assets} \sum_{250\ days} [\,redemption\ orders_{\,day} - \ assets\ to\ liquidate_{day}]$$

**This means that the score is a measure of the gap between the redemption requests and the ability to sell the assets.**
In this example, the score varies from 0 (adequate asset-liability balance) to 250 (the worst possible situation in which redemptions are equal to total net assets, and the assets simply cannot be sold).




In the example above, **the score is equal to the hatched green area, i.e. the gap between the worst possible redemption requests and the ability to sell the assets.**




This score provides a comparison between the asset-liability balance of several funds. The higher the score, the harder the fund will find it to honour redemption requests.

### *4. Collateral liquidity risk*

It is also helpful to subject **the liquidity of assets received as collateral to stress testing**. For example, companies that bonds as collateral simulate the forced sale of 40% of the nominal value of the collateral received in a portfolio, at an identical discount to the one applied in the stress tests carried out on bond funds.

## C. Counterparty risk

Counterparty risk[15] is the risk of loss for the collective investment scheme or the individual portfolio from the fact that the counterparty to the transaction or to a contract may default on its obligations prior to the final settlement of the transaction's cash flow.

[15] Article 313-53-3 of the AMF's General Regulation.

Counterparty risk does not play a particular role in stress tests, but it is useful to simulate the default of one or more counterparties in a few stress test scenarios, including by combining this risk with liquidity and market risk.

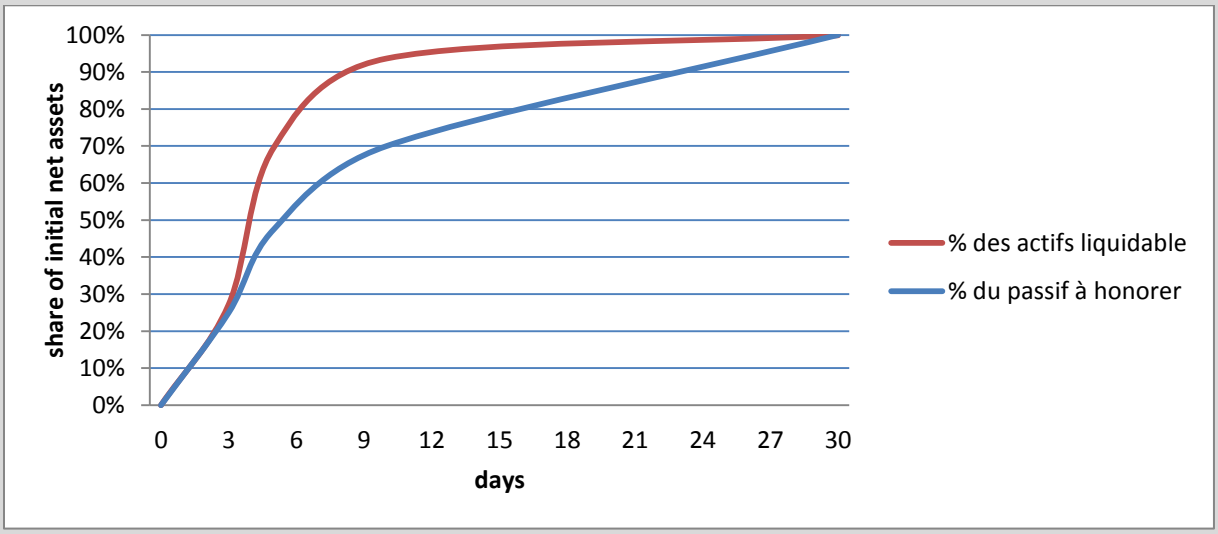
### D. Aggregate stress tests for all an AMC's funds and mandates.

An AMC's ability to liquidate a fund's assets in the event of redemption requests during a stressed period should be considered within a global stressed scenario in which investors are short on liquidity. In such a situation, the AMC should consider the possibility of receiving significant redemption requests across all the open-ended mandates and funds it manages.

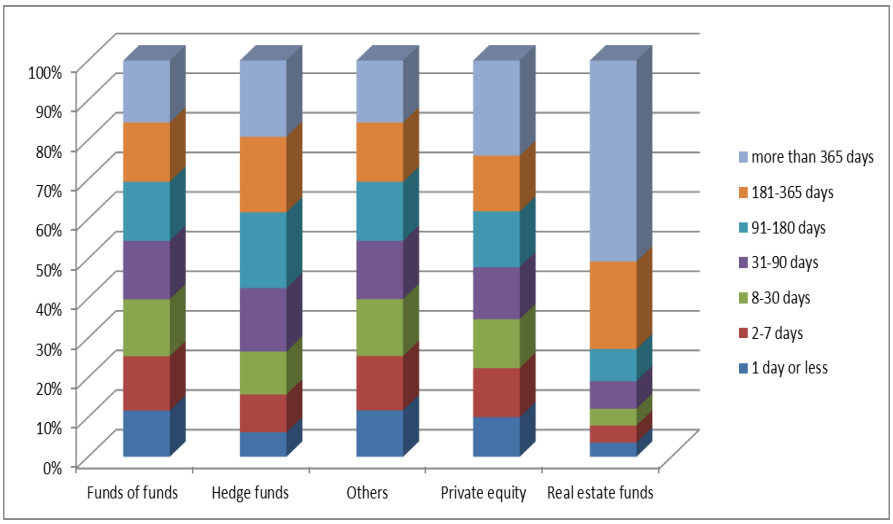
**For example: Summary of the securities held across all an AMC's equity portfolios**

| Estimated liquidation time frame (days) | 0 – 3 | 3 - 5 | 5 - 10 | 10 – 30 | > 30 |
|---|---|---|---|---|---|
| Share of net assets of all the AMC's funds | 27.18% | 42.42% | 24.05% | 6.22% | 0.14% |

**If 30% of the units of an AMC's equity funds are held by entities from the same group (considered to be stable investors) and the three largest other investors cumulatively account for 25% across all funds, the redemption requests across all the AMC's funds can be simulated and compared with the liquidation capacity across all equity funds:**




Equally, aggregating all funds by liquidity bucket provides an overview of the liquidity of all funds by asset class. This method is the one proposed on the back of the obligations arising from the AIFM Directive in relation to transparency vis-à-vis competent authorities (AIFM Reporting).




Source: AIFM Reporting (December 2014), calculation by the AMF

It is good practice for AMCs to **implement stress tests across all the funds they manage (positions and counterparties, etc.) and not just for each AIF, UCITS or mandate**. By aggregating the stress tests for each fund at AMC level, the company can take into account the interaction between the different funds and integrate reputational risk into the fund redemption simulations. Specifically, when considering the ability of an illiquid market to absorb asset sale requests for liquidity stress tests, it is useful to consider redemptions across all an AMC's funds rather than dealing with each fund separately.

**Good practice:**
**Simulate the reputational risk** that would arise following significant redemptions in a short period of time in all the portfolios managed by the AMC.

## E. The particular case of certain asset classes

### *Stress tests on illiquid or closed-end assets*

Pursuant to article 318-44 of the AMF's General Regulation, liquidity stress tests (simulating both normal and exceptional liquidity conditions in order to assess the liquidity risks of the AIFs) are compulsory only for open-end funds. On the other hand, AMCs should conduct "periodic appropriate stress tests and scenario analyses to address risks arising from potential changes in market conditions that might adversely impact the AIF[16]". **This requirement applies to all AIFs, including closed-end and illiquid funds[17].**

In particular, market stress tests on assets with little or no liquidity are useful **at the time of the investment choice**. Although stress tests are less crucial if no mitigation measure can be taken, **liquidity stress tests are still needed for funds that may experience redemptions in exceptional circumstances, particularly where non-professional investors are concerned**. Moreover, stress tests can also be a useful tool in preparing for the resale of assets ahead of the **liquidation of the fund**.

**For closed-end funds:**
- market stress tests should be implemented and used at key stages in a fund's life (creation, merger, liquidation, etc.)
- liquidity stress tests are useful in preparing for liquidation or whenever the fund expects premature exits caused by exceptional events such as death or incapacity.

[16] Commission Delegated Regulation (EU) No 231/2013 of 19 December 2012, article 45, paragraph 3.
[17] Pursuant to article 313-53-7 (II) of the AMF's General Regulation, companies that manage sub-threshold AIFs and have not opted in to the AIFM regime must also conduct stress tests.

### Stress tests on property funds

Real estate is an illiquid asset class that requires long-term investment. Market stress tests can be used prior to an investment and during the lifetime thereof to anticipate movements that may prompt a sale of the underlying assets (the duration of which may be a problem in the event of significant redemptions).

By way of example, here are a few risk factors that can be simulated:

- Rent (-5% or -10%);
- Simulation of renovation works (+5% or +10%);
- Interest rate curve;
- Change in property price;
- Change in default rate;
- Change in vacancy rate; and
- Liquidity risk (risk of premature sale and delays to the sale).

Just like for the other fund types, it is important to have scenarios that combine several risk factors. In particular, a reduction in assets generally goes hand in hand with significant redemption requests.

### Private equity funds

Private equity actors do not perform many stress tests during the life of a fund because of the closed-end nature of the funds. As mentioned above, it is still useful to put liquidity stress tests in place if a fund is not totally closed-end, particularly in the case of funds available to non-professional investors, and when the fund is liquidated. Stress tests can also be used during the pre-liquidation period[18].

### *Exchange-traded funds (ETFs)*

Market stress tests are of limited use to ETFs with a systematic, non-discretionary strategy and for which few corrective measures can be implemented.
Having said that, synthetic ETFs can have a major **counterparty risk** and implementing specific stress tests can allow AMCs to plan solutions or mitigating measures in the event of a default or any other major event resulting in a breach of obligation between the ETF and its counterparty or counterparties.
With regard to liquidity risk, physical ETFs can experience replication difficulties if the underlying market becomes illiquid, meaning that it is a good idea to implement liquidity stress tests that combine assets and liabilities. Since ETFs are known as being highly liquid, they are particularly vulnerable to significant redemptions during a liquidity crisis, which means that using particularly extreme stress test scenarios is merited. They are also exposed to counterparty risk when engaged in securities lending/borrowing with their assets.
On the liability side, it is particularly useful to simulate the extreme scenario whereby authorised participants (APs) no longer lead the secondary market and investors directly request redemption at the net asset value.

To summarise, stress tests for ETFs may include the following:

- Severe asset and liability liquidity shocks;
- Counterparty defaults;
- Bankruptcy of authorised participants or market makers.

### *Funds of funds*

For funds of funds, it is good practice to try to get the underlying portfolios (including ex post) for the purpose of conducting transparent stress tests, particularly in the case of alternative funds of funds.

## F. Conclusions on the implementation of stress tests

[18] The pre-liquidation period is governed by articles R. 214-40 and R. 214-41 of the French Monetary and Financial Code for FCPRs (retail private equity investment funds), articles R. 214-53 and R. 214-54 for FCPIs (retail venture capital funds) and articles R. 214-71 and R. 214-72 for FIPs (retail local investment funds).

### *Stress tests designed specifically for the strategy of each fund*

Article 411-79 of the AMF's General Regulation states that AMCs should implement "2° A rigorous and comprehensive stress-testing programme adjusted to the risk profile of the CIS that can be used to simulate the behaviour of the CIS under stress. " Equally, for AIFs, in compliance with article 318-41, the AMC shall "2° Ensure that the risks associated with each investment position of the AIF and their overall effect on the AIF's portfolio can be properly identified, measured, managed and monitored on an ongoing basis, including through the use of appropriate stress testing procedures." More specifically, article 422-58 of the AMF's General Regulation states that "the asset management company shall install […] 2° A set of stress tests that are stringent, complete and appropriate to the risk profile of the retail investment fund capable of simulating how the retail investment fund behaves in crisis situations. "

In order for the stress tests to be appropriate, AMCs should establish **fund-specific stress tests** if the strategies, underlying assets or other factors to which the collective investment schemes or individual portfolios that they manage are exposed are not sufficiently taken into account by the traditional stress test scenarios or those common to other funds.

It is bad practice to implement stress tests only on model portfolios that are different from actual portfolios.

It also unwise to implement a large number of generalised stress tests applicable to all the funds that an AMC manages. AMCs typically have between 10 and 50 stress tests that they apply regularly to each fund. Using a large number of stress tests makes it hard to analyse their results and therefore makes them less effective.

### *Regularly updated stress test scenarios*

In accordance with article 313-53-6 of the AMF's General Regulation, the permanent risk management function periodically reviews the risk management policy and ensures it remains in line with the AMC's business and with market and product changes[19].

This obligation also applies to the stress-testing policy that features within the risk management policy:

- **Stress test parameters (correlations, redemption levels, estimates of liquidation time frame for each asset class, etc.**) should be updated periodically**, particularly in the case of liquidity stress tests** because an asset's liquidity characteristics can change a lot over time. The stress-testing policy should specify which parameters should be updated regularly and which should be updated as market conditions change.

- Stress tests are **calculated and analysed at appropriate intervals based on the programme of activity (complexity of the strategies, complexity of the underlying assets, frequency of the net asset value calculation, etc.)**.

### *Stress tests can be based on services from external providers provided the AMC has the internal expertise required.*

**Stress tests supplied by external providers**, including data providers, can be used only if the permanent risk management function has a perfect understanding of the simulation models used and remains responsible for setting the parameters. In compliance with article 4 of Instruction 2012-01 on the outsourcing of risk management activities, the AMC should have the necessary expertise and resources to verify the stress test calculations, even if these calculations are performed by an external services provider or using software supplied by such a provider.

[19] Equally, for management companies governed by Title I bis of Book III of the AMF's General Regulation for their AIFM business, article 318-41 of said General Regulation states that the AMC shall at least:
"1° Implement an appropriate, documented and **regularly updated** due diligence process when investing on behalf of the AIF, according to the investment strategy, objectives and risk profile of the AIF;"

# III. The use of stress tests

Stress tests can be used to provide **a dynamic analysis of the risks** to which funds are exposed (on both the asset and liability sides) during their lifetimes (e.g. creation, investment strategies and liquidation).

## A. Using stress tests for the investment strategy, creation or liquidation of a fund.

Stress tests are used at the different stages of a fund's life from creation to liquidation, via the investment decisions made to manage it during its lifetime. Specifically, AMF Instruction DOC-2011-15 on the calculation of global exposure states that the "results of these tests should be archived and taken into consideration when making any investment decisions".

AMCs should take liquidity risks into account as soon as the fund calibration. When a fund is created, stress tests can be used **to define the main parameters of the fund** (how often net asset value is calculated, frequency of possible redemptions, critical mass or hard cap).
For example, if a company wishes to create a fund eligible for the PEA-PME scheme (a share savings plan aimed at financing SMEs), when it calculates the size of the fund it should take into consideration the limited market depth and the funds already present on the market.

**Example: implementation of stress tests across the lifetime of a high-yield global bond fund.**

When the fund is created, the asset management company's risk management function assesses the liquidity profile on both the asset and liability sides.
The asset target is €1 billion. In view of the considerable credit risk and the relative liquidity of high-yield bonds, it may be decided that:
- redemptions can take place on a weekly basis;
- the fund will retain a minimum of 5% of liquid assets at any moment (corresponding to the 95th percentile of monthly outflows observed as a share of AuM);
- the fund's assets under management will be capped at €1 billion.

An institutional investor invests €150 million, and the risk management function establishes a specific stress test simulating the exit of this investor. It also sets up an alert for when this investor's holding exceeds 20% of the fund's liabilities.
An emergency plan for liquidity crisis management (including the operational measures to be implemented) is prepared in case of redemption requests of more than 20%.

During the fund's lifetime:
- liquidity stress tests are conducted on a weekly basis;
- the parameters of these liquidity stress tests (asset liquidity and redemption scenarios) are reviewed at least once every three months following consultation with fund managers, traders and sales personnel;
- in the event of reduced liquidity on a market, stress tests can be conducted more frequently, for example on a daily basis;
- any redemptions exceeding 0.5% of net asset value will be communicated immediately to the risk management team, who will decide whether to update the stress test scenarios;
- if the fund reaches its target of €1 billion, the AMC should assess whether to close the fund to new investment or introduce special liquidity management measures such as less frequent calculation of net asset value, swing pricing or a five-day notice period before each redemption.

**During a fund's lifetime**, stress tests can be used on a day-to-day basis to monitor changes in risk and make any necessary changes to the portfolio, or when specific investment decisions need to be made in such a way as to measure both the market risk of an investment and how it will affect portfolio liquidity.

**Ahead of the liquidation of a fund**, stress tests can be used to establish several stressed scenarios and get a clearer picture of liquidity risk in order to inform investors and manage their exit as efficiently as possible.

### B. Ensuring stress tests are used throughout the AMC in order to improve risk monitoring

In accordance with article 313-53-4 (III)[20] of the AMF's General Regulation, "the permanent risk management function shall [...] provide regular reports to the board of directors and, where it exists, the supervisory function, on:

i) the consistency between the current levels of risk incurred by each managed collective investment scheme or individual portfolio and the risk profile agreed for that collective investment scheme or portfolio;
ii) the compliance of each managed collective investment scheme or individual portfolio with relevant risk limit systems;
iii) the adequacy and effectiveness of the risk management process, indicating in particular whether appropriate remedial measures have been taken in the event of any deficiencies"

**The results and analysis of the stress tests should be available at all times and distributed to all necessary decision-making and hierarchical levels**. In particular, the permanent risk management function's regular report to the board of directors or executives must contain an overview of the main results of the stress tests. Stress tests are indeed helpful to monitor whether risk levels are consistent with the objectives and thresholds that have been set.

When presenting to executive and risk management committees, many AMCs display the results of stress tests in a summary table known as a dashboard, which groups together the different stress tests for the main funds or the funds with particular difficulties.
More generally, the risk management teams submit a report to financial managers when a set of tests have been devised to assess changes in risk with a view to adjusting portfolio positions.
Stress tests should be able to evolve on a regular basis and be the subject of internal exchanges between the different teams. In order for this to happen, AMCs need to limit the operational barriers to interaction between teams, thereby enabling regular reviews of any new risks.

**Good practice:**
Stress tests are increasingly part of the strategic decisions of certain AMCs, which include them in their governance, commercial or internal (interdepartmental) communications policies.

**Bad practice:**
However, communicating the results of stress tests to investors may be misleading if the investors do not have all the details of the models used and, in particular, all the assumptions used to obtain the result. It may be unwise for investors to compare stress tests for different funds, unless these tests are conducted using identical scenarios and methods or by the investors themselves.

### C. Implementation of stress test thresholds and appropriate remedial measures in cases of breach.

It is important to present stress tests in a clear and synthetic way in order to successfully transmit information within the AMC. Alert thresholds on the results of certain stress tests can ensure that the risk management team, executives and fund managers are alerted more quickly.

In compliance with article 313-53-7 (II) d)[21], the asset management company shall "establish, implement and maintain a documented system of internal limits concerning the measures used to manage and control the relevant risks for [each UCITS or AIF]".

As such, AMCs should set up **alert thresholds** on the results of regular stress tests. The risk management policy lays down **the procedures to be implemented in the event that a stress test alert threshold is breached**, in particular any remedial measures to be implemented at portfolio level.

[20] See also article 39 of Commission Delegated Regulation 231/2013 for AIFMs
[21] see also article 42 of Commission Delegated Regulation No 231/2013 of 19 December 2012 for AMCs governed by Title I bis of Book III of the AMF's General Regulation for their AIFM business

- If stress tests show a considerably higher liquidity risk than expected, the AMC should assess whether to amend its strategy or use exceptional preventative liquidity management techniques (limiting or suspending redemptions), if allowed by the fund's regulations or bylaws.

- If stress tests flag up a particular vulnerability to certain market conditions, the AMC should assess whether to take remedial measures.

The reports on compliance and risk control, which are sent to the senior managers on a regular basis (at least once a year), in compliance with article 313-7 of the AMF's General Regulation, may provide a summary of breaches of stress test thresholds and remedial measures taken.

Note: If regular analysis of the stress test results for all an AMC's funds is difficult because of the sheer number of funds, the AMC should **select a list of funds that represent the strategies put in place and then analyse those funds carefully.** This system of selecting certain funds for more in-depth analysis **does not however negate the need for conducting stress tests for all funds and requires the implementation of predefined alert thresholds for the stress tests on funds that are not analysed regularly.** In addition, funds with specific risks (CPPI funds, formula-based funds, regulatory VaR funds, guarantee funds, funds with complex underlying assets, etc.) should be specially monitored.

# IV. Organising stress tests as part of the risk management process

**Stress tests are part of the risk management process**. They provide a global analysis of the impact of shocks on indicators, positions (individual or cumulative) and portfolios, taking account of any compensation or leverage effects.

**The stress testing policy is an integral part of the permanent risk management function. This function ensures that stress tests are carried out regularly in both normal and exceptional liquidity conditions. It includes an appropriate and documented stress testing policy that identifies the risks to which the collective investment schemes or individual portfolios that the AMC manages are, or could be, exposed.**

At the very least, the stress testing policy should make provision for[22]:

a) the design of stress test scenario analysis including calibration, certification and sensitivity analysis;
b) an empirical approach to impact assessment, including back-testing of liquidity risk estimates;
c) reporting frequency and limit/loss tolerance threshold/s; and
d) mitigation actions to reduce loss including haircut policy and gap risk protection.

The list of stress test scenarios, the models used, how often the results are calculated and analysed, and how they are spread out should be set out in the risk management policy or in a specific stress testing policy. This policy should be tailored to the company's business and reviewed and approved periodically by the senior managers, who make sure it is effective.

**Good practice:**
It is helpful to dedicate a chapter of the risk management policy to stress tests in order to:
- document the methodologies (scenarios, assumptions and results);
- document the reasoning behind these scenarios.

To avoid it becoming something of a "black box" accessible only to a handful of experts, the risk management function should ensure that the stress testing system is sufficiently flexible to respond quickly to any additional requests for information.

## A. Independence, permanence, control and conflict-of-interest management

✓ Independence and permanence:

The management of stress tests, which is part of the broader risk management framework, must be permanently operational and independent of the operational units, under the same conditions as risk management.

✓ Conflict-of-interest management:

AMCs should establish and maintain policies, procedures and measures that are suitable for dealing with conflicts of interest and enabling the risk controller to implement a reliable stress testing system. In particular, when the stress test systems are being implemented, portfolio managers or external operators may provide a certain number of parameters and a certain amount of information. A conflict of interests traditionally occurs when a liquidity estimate is made on the basis of the fund manager's observations of volumes exchanged on the market.

## B. Control

Pursuant to articles 313-53-4[23] and 313-53-7 of the AMF's General Regulation, **the permanent risk management function** implements the risk management procedures and validates the risks measurement techniques that are defined in these procedures:

[22] AMF Position DOC-2013-06 on ETFs and other UCITS issues states that a UCITS receiving collateral for at least 30% of its assets should have an appropriate stress testing policy in place, but the content of the crisis management policy can be transferred to the management of other funds or mandates.

1° It **checks that the theoretical basis** is relevant and that the assumptions made are appropriate for the characteristics of the investment and the management strategy in place;
2° It **ensures that the parameters used are reliable**, robust and suited to the management strategies in place and to the market behaviour, and that the market data used are accurate;
3° It **approves the scope of validity and the limits of each technique** or tool used to measure risk, particularly with regard to the specific characteristics of the management strategy in place and the assets employed, and to particular market situations;
4° It **ensures the proper digital implementation** of each risk measurement tool or technique.

With regard to stress tests, the permanent risk management function should verify that:

- the choice of stress test models is based on prior analysis;
- the scope and scenarios are relevant;
- the models used have been subjected to upstream testing;
- the performance of these models is subjected to back-testing;
- the parameters used are reliable, robust and suited to the management strategies in place, and the market data used are accurate (with no conflict of interest).

It ensures the proper digital implementation of each risk measurement tool or technique.

[23] III. - The permanent risk management function shall:
a) implement the risk management policy and procedures;
b) ensure compliance with the collective investment schemes referred to in Article 311-1 A or individual portfolios [*sic*] risk limit system [Order of 11 December 2013], including statutory limits concerning global exposure and counterparty risk [Order of 11 December 2013] in accordance with Articles 411-71-1 to 411-83 [Order of 11 December 2013] or Articles 422-50 to 422-63;

# Annexes:

## Relevant texts mentioned in the Guide:

**Article L. 533-10-1 of the French Monetary and Financial Code.**
**Articles 411-73, 411-73, 318-41 and 318-40 to 318-44 of the AMF's General Regulation.**
**Articles 313-1, 313-2, 313-7, 313-53-3, 313-53-4, 313-53-7 and 313-60 of the AMF's General Regulation.**
**Position-Recommendation DOC-2014-06, Position DOC-2013-06, Instruction DOC-2012-01**

## Regulatory environment for stress tests

### European directives

The obligations incumbent upon management companies with regard to stress tests come primarily from regulations, whether for UCITS, AIFs or individual mandates (French regulations have been modified in order to apply UCITS IV Directive stress test requirements to individual mandates), and are supplemented by certain elements of doctrine, particularly with regard to debt and liquidity management for real estate UCIs[24] or formula-based funds[25].

**Commission Directive 2010/43/EU implementing Directive 2009/65/CE (the UCITS IV Directive) states, in chapter VI, section 2, article 40**:

"[…] Member States shall require management companies to take the following actions for each UCITS they manage:
[…]
b) conduct, where appropriate, periodic back-tests in order to review the validity of risk measurement arrangements which include model-based forecasts and estimates;
c) conduct, where appropriate, periodic stress tests and scenario analyses to address risks arising from potential changes in market conditions that might adversely impact the UCITS
[…]
Member States shall ensure that management companies employ an appropriate liquidity risk management process in order to ensure that each UCITS they manage is able to comply at any time with Article 84(1) of Directive 2009/65/EC [article 84: "A UCITS shall repurchase or redeem its units at the request of any unit-holder. …"].
Where appropriate, management companies shall conduct stress tests which enable assessment of the liquidity risk of the UCITS under exceptional circumstances. "

**Similarly, article 16.1 of Directive 2011/61/EU (the AIFM Directive) states:**

"Liquidity management
1. AIFMs shall, for each AIF that they manage which is not an unleveraged closed-end AIF, employ an appropriate liquidity management system and adopt procedures which enable them to monitor the liquidity risk of the AIF and to ensure that the liquidity profile of the investments of the AIF complies with its underlying obligations.
AIFMs shall regularly conduct stress tests, under normal and exceptional liquidity conditions, which enable them to assess the liquidity risk of the AIFs and monitor the liquidity risk of the AIFs accordingly. "

**Supplemented by Implementing Regulation 231/2013**

[24] Note submitted to the AMF Board on 8 July 2009 concerning Recommendations on Debt and Liquidity Management in Real Estate UCIs (OPCIs) with Streamlined Operating Rules

[25] Regulation of formula-based UCITS, decision statement and summary of results of the public consultation, 11 December 2002

**Article 40**
Risk management policy

1. An AIFM shall establish, implement and maintain an adequate and documented risk management policy which identifies all the relevant risks to which the AIFs it manages are or may be exposed.
2. The risk management policy shall comprise such procedures as are necessary to enable the AIFM to assess for each AIF it manages the exposure of that AIF to market, liquidity and counterparty risks, and the exposure of the AIF to all other relevant risks, including operational risks, which may be material for each AIF it manages.
3. The AIFM shall address at least the following elements in the risk management policy:
a) the techniques, tools and arrangements that enable it to comply with Article 45;
b) the techniques, tools and arrangements that enable liquidity risk of the AIF to be assessed and monitored under normal and exceptional liquidity conditions including through the use of regularly conducted stress tests in accordance with Article 48;
c) the allocation of responsibilities within the AIFM pertaining to risk management;
d) the limits set in accordance with Article 44 of this Regulation and a justification of how these are aligned with the risk profile of the AIF disclosed to investors in accordance with Article 23(4)(c) of Directive 2011/61/EU;
e) the terms, contents, frequency and addressees of reporting by the permanent risk management function referred to in Article 39.
4. The risk management policy shall include a description of the safeguards referred to in Article 43, in particular:
a) the nature of the potential conflicts of interest;
b) the remedial measures put in place;
c) the reasons why these measures should be reasonably expected to result in independent performance of the risk management function;
d) how the AIFM expects to ensure that the safeguards are consistently effective.
5. The risk management policy referred to in paragraph 1 shall be appropriate to the nature, scale and complexity of the business of the AIFM and of the AIF it manages.

**Article 45, point 3**:

"[...] the AIFM shall take the following actions for each AIF it manages:
[…]
b) conduct periodic back-tests in order to review the validity of risk measurement arrangements which include model-based forecasts and estimates;
c) conduct, periodic appropriate stress tests and scenario analyses to address risks arising from potential changes in market conditions that might adversely impact the AIF;"

## AMF's General Regulation

### *For UCITS*

### Article 313-53-7 of the AMF's General Regulation

I. - Investment services providers shall adopt adequate and effective arrangements, processes and techniques in order to:

a) measure and manage at any time the risks which the collective investment schemes referred to in Article 311-1 A and individual portfolios they manage are or might be exposed to;

b) ensure compliance with limits applicable to collective investment schemes referred to in Article 311-1 A concerning global exposure and counterparty risk, in accordance with Articles 411-72 and 411-73 or 422-51 and 422-52 and Articles 411-82 to 411-83 or 422-61 to 422-63.

Those arrangements, processes and techniques shall be proportionate to the nature, scale and complexity of the business of the investment services providers and of the collective investment schemes referred to in Article 311-1 A and individual portfolio they manage and be consistent with the risk profile of these collective investment schemes and individual portfolios.

II. - For the purposes of I, investment services providers shall take the following actions for each collective investment scheme referred to in Article 311-1 A or individual portfolio they manage:

a) put in place such risk measurement arrangements, processes and techniques as are necessary to ensure that the risks of taken positions and their contribution to the overall risk profile are accurately measured on the basis of sound and reliable data and that the risk measurement arrangements, processes and techniques are adequately documented;

b) conduct, where appropriate, periodic back-tests in order to review the validity of risk measurement arrangements which include model-based forecasts and estimates;

c) **conduct, where appropriate, periodic stress tests and scenario analyses to address risks arising from potential changes in market conditions that might adversely impact the collective investment schemes referred to in Article 311-1 A or individual portfolios they manage;**

d) **establish, implement and maintain a documented system of internal limits concerning the measures used to manage and control the relevant risks for** each collective investment scheme referred to in Article 311-1 A or individual portfolio taking into account all risks which may be material to the collective investment scheme referred to in Article 311-1 A or individual portfolio as referred to in Article 313-53-3 and ensuring consistency with the risk-profile of the collective investment schemes referred to in Article 311-1 A or individual portfolios;

e) ensure that the current level of risk complies with the risk limit system as set out in d) for each collective investment scheme referred to in Article 311-1 A or individual portfolio;

f) establish, implement and maintain adequate procedures that, in the event of actual or anticipated breaches to the risk limit system of the collective investment scheme referred to in Article 311-1 A or individual portfolio, result in timely remedial actions in the best interests of unit holders or shareholders or principals.

III. - Investment services providers shall use an appropriate liquidity risk management process for each collective investment scheme referred to in Article 311-1 A and individual portfolio they manage.

This procedure shall enable them in particular to ensure that all the collective investment schemes referred to in Article 311-1 A they manage comply at all times with the requirement set out in the third paragraph of Articles L. 214-7 or L. 214-24-29 or Articles L. 214-8 or L. 214-24-34 of the Monetary and Financial Code or investment services providers' ability to liquidate positions in an individual portfolio in accordance with the contractual obligations in the investment mandate.

**Where appropriate, investment services providers companies shall conduct stress tests which enable assessment of the liquidity risk of the collective investment schemes referred to in Article 311-1 A under exceptional circumstances.**

IV. - Investment services providers shall ensure that for each collective investment scheme referred to in Article 311-1 A they manage the liquidity profile of the investments of the collective investment scheme referred to in Article 311-1 A is appropriate to the redemption policy laid down in the fund rules or the instruments of incorporation or the prospectus.

### Article 411-73

[…]

The VaR approach is supplemented by a stress-testing programme.

### Article 411-79

The management company shall establish:

1° A programme for back-testing the model's calculations using historical data to check the precision and performance of the VaR model;

2° A rigorous and comprehensive stress-testing programme adjusted to the risk profile of the CIS that can be used to simulate the behaviour of the CIS under stress.

3° Where required by the risk profile and investment strategy, risk management tools and methods suited to the scheme's risk profile and investment strategy may be used to supplement the programmes referred to in 1° and 2°.

### Position DOC-2013-06 on ETFs and other UCITS issues

37. A UCITS receiving collateral for at least 30% of its assets should have an appropriate stress testing policy in place to ensure regular stress tests are carried out under normal and exceptional liquidity, in order that the UCITS can evaluate the liquidity risk associated with the collateral. At the very least, the stress testing policy should make provision for:

a) the design of stress test scenario analysis including calibration, certification and sensitivity analysis;
b) an empirical approach to impact assessment, including back-testing of liquidity risk estimates;
c) reporting frequency and limit/loss tolerance threshold/s; and
d) mitigation actions to reduce loss including haircut policy and gap risk protection.

***For AIFs***

### Article 318-40

The asset management company shall implement adequate risk management systems in order to identify, measure, manage and monitor appropriately all risks relevant to each AIF investment strategy and to which each AIF is or may be exposed.

In particular, the asset management company shall not make exclusive or mechanical use of credit ratings issued by credit ratings agencies within the meaning of Article 3, Paragraph 1, point b of Regulation (EC) n° 1060/2009 of the European Parliament and Council of 16 September 2009 on credit ratings agencies, to assess the creditworthiness of AIF assets.

The asset management company examines the risk management systems, at appropriate intervals and at least once a year, and adapts them if necessary.

### Article 318-41

Asset management companies shall at least:

1° Implement an appropriate, documented and regularly updated due diligence process when investing on behalf of the AIF, according to the investment strategy, objectives and risk profile of the AIF;

2° Ensure that the risks associated with each investment position of the AIF and their overall effect on the AIF's portfolio can be properly identified, measured, managed and monitored on an ongoing basis, including through the use of appropriate stress testing procedures;

3° Ensure that the risk profile of the AIF shall correspond to the size, portfolio structure and investment strategies and objectives of the AIF as laid down in the AIF rules or instruments of incorporation, prospectus and offering documents.

Section 12 - Liquidity Management

### Article 318-44

Asset management companies shall, for each AIF that they manage which is not an unleveraged closed-end AIF, employ an appropriate liquidity management system and adopt procedures which enable them to monitor the liquidity risk of the AIF and to ensure that the liquidity profile of the investments of the AIF complies with its underlying obligations.

Asset management companies shall regularly conduct stress tests, under normal and exceptional liquidity conditions, which enable them to assess the liquidity risk of the AIFs and monitor the liquidity risk of the AIFs accordingly.

### Article 318-45

Asset management companies shall ensure that, for each AIF that they manage, the investment strategy, liquidity profile and redemption policy are consistent.

### Article 318-46

The asset management company shall comply with Articles 46 to 49 of Commission Delegated Regulation (EU) n° 231/2013 of 19 December 2012.

### Article 422-58

The asset management company shall install:

1° An ex-post control mechanism for calculations using the model on previous data, in order to monitor the accuracy and performance of the value at risk model;

2° A set of stress tests that are stringent, complete and appropriate to the risk profile of the retail investment fund, capable of simulating how the retail investment fund behaves in crisis situations.

3° Where required by the risk profile and investment strategy, risk management tools and methods appropriate to the risk profile and investment strategy of the retail investment fund, in addition to the resources specified in 1° and 2°.