

Structured Finance and Covered Bonds Interest Rate Stresses Rating Criteria

Cross-Sector

Scope

This report outlines Fitch Ratings' global methodology for analysing the interest rate change vulnerability of structured finance (SF) transactions and covered bonds (CVB). The interest rate stress criteria are applicable to the analysis of new SF deals and CVB, and in the surveillance of existing ones.

Interest rate stresses are applied in surveillance according to the criteria for each sector, but typically they are only a minor consideration in the assessment of ratings. The criteria are also applied in connection with new and existing ratings assigned under the *U.S. Housing Finance Agency Loan Program Rating Criteria*.

The stresses outlined in these criteria are not forecasts and do not provide an interest rate term structure for use in discounted cash flow analysis. They capture potential movements in short-term reference rates, such as Libor, Euribor, SONIA, SOFR, ESTR and near risk-free money-market term rates replacing Libor. Where an interest rate other than a virtually credit risk-free short term rate is used, this is highlighted in the criteria.

The methodology is meant to apply only to SF transactions or CVB with smoothly distributed cash flows over several years. The criteria do not address the indirect consequences of changes to interest rates (e.g. obligor or counterparty default due to interest rate changes).

In most instances, any interest rate mismatches are hedged and interest rate risk exposure is low. The criteria test the residual interest rate risk that remains after hedging. The report also discloses the overall framework used to analyse the basis risks. This criteria report does not address interest rate risk where interest rate movements are one of the primary risk drivers. Fitch will develop case-specific tests where the rating appears vulnerable to specific interest-rate paths, or scenarios other than the standard stresses described in this report.

The criteria are applied globally in SF and CVB international- and national-scale rating analyses. Any deviations from the criteria are addressed in asset class-specific criteria reports.

Key Rating Drivers

Hedging and macroeconomic expectations are equally important principal drivers and dominate the spot rate and cost of carry in potential rating impact.

Hedging: The criteria are applicable where interest rate risk is a residual risk, i.e. a sufficiently effective natural or third-party hedge is in place.

Cost of Carry: Rising interest rates increase the cost-of-carry of defaults. Transactions with high volumes of expected defaults and/or long expected recovery times are more sensitive to the increasing interest rate stresses described in this report.

Spot and Equilibrium Rate: The position of the spot rate in relation to the equilibrium rate has some impact on Fitch's interest rate stresses, and fluctuations in the spot rate may therefore affect assigned ratings. The magnitude of this impact is limited and more relevant to lower rating categories. For higher ratings, stresses remain relatively stable.

Table of Contents

Scope	1
Key Rating Drivers	1
Criteria Framework	2
Methodological Framework	3
Standard (Positive) Interest Rate Stresses	5
Negative Interest Rate Stresses	8
Interest Rate Stresses Publication	12
Chinese Interest Rate Stresses	12
Variations from Criteria	13
Criteria Limitations	13
Criteria Disclosures	13
Appendix 1: Derivation of Parameters	14
Appendix 2: Data Sources	18
Appendix 3: Sector-Specific Criteria Covering Basis Risk	20

This report updates and replaces *Structured Finance and Covered Bonds Interest Rate Stresses Rating Criteria*, dated 20 September 2021.

Related Criteria

[Global Structured Finance Rating Criteria \(October 2021\)](#)

[Covered Bonds Rating Criteria \(November 2022\)](#)

Model

[Interest Rate Stress Model Web User Interface](#)

Click Here for Rating Criteria Synopsis Video (Parts 1 & 2)



Disclaimer: The information contained in this presentation is a summary of a criteria report made for information purposes only. For a complete explanation of the criteria, this presentation should be viewed or listened to in conjunction with the relevant criteria report which describes Fitch Ratings' methodology for assigning and monitoring credit ratings in a given sector. This presentation does not replace any part of the criteria report and is to be used only as complementary material. Published ratings and current rating criteria are available on Fitch Ratings' public website.

Analysts

Barbara Treccani
+39 02 879087 226
barbara.treccani@fitchratings.com

Thomas Kuehn
+44 20 3530 1023
thomas.kuehn@fitchratings.com

Macroeconomic Expectations: Fitch's macroeconomic views ultimately drive the criteria's structure and their relevance in the rating process. The interest rate stresses are not predictions, but the equilibrium rate reflects Fitch's expectations on where interest rates would settle in a situation of "economic calm"; the other key parameters (path to plateau and plateau level) reflect possible stressed scenarios where interest rates deviate from the equilibrium rate.

Criteria Framework

The criteria provide a set of stress scenarios according to which interest rates can move and may directly influence the structure's cash flows. Interest rate stresses therefore only address issues with respect to interest earned and paid within the structure (e.g. assets, note liabilities and swaps).

The criteria framework allows calibration to specific currencies. This produces interest rate stress scenarios that will be applied to test SF transactions and CVB involving assets or liabilities that reference one of these interest rates.

The framework yields upward and downward stressed interest rate curves for different rating scenarios. These will form part of the stress scenarios applied in asset-specific cash flow analysis and are used to test the vulnerability of SF transactions and CVB to changes in interest rates. In most instances, any interest rate mismatches are hedged and interest rate risk exposure is small.

The methodology described in this criteria report is implemented through a proprietary Fitch model, the SF Interest Rate Stress Model.

Normally, Fitch will test only the standard upward and downward interest rate curves discussed in this criteria report, as these form the outer bounds of the tested interest rate paths. However, if for a particular SF transaction or CVB interest rate paths inside the upper and lower bounds are likely to be significantly more stressful – for example, due to the use of special derivative structures or interest rate caps – Fitch will amend the stressed interest rate path case by case.

Similarly, in cases where the SF or CVB structure appears particularly vulnerable to specific interest rate paths or scenarios other than the standard stresses described in this report, Fitch will amend its testing accordingly.

Characteristics of Interest Rate Stresses

Given their role in the rating process, the stresses are intended to be simple; the results of these stresses on cash flows are transparent. The simplicity of the stresses allows them to be applied in combination with other stresses (e.g. prepayment scenarios and default timing) as outlined in asset class-specific cash flow criteria.

Fitch specified the following characteristics that its interest rate stress framework should possess.

- The methodological framework should be applicable beyond the major currencies (US dollar, euro, UK pound).
- The stresses should not be limited to specific expectations or predictions. Expectations do not reflect the abstract concept of a stress scenario and therefore should not directly be used to specify stresses for rating purposes. However, expectations should be considered to some degree for benchmarking and/or monitoring purposes, as well as timing of stresses.
- The stresses should not be completely fixed as increases/decreases from the spot rate, nor should they strictly define the stress as an absolute interest rate level. The former ignores a mean reverting tendency (especially in an environment of inflation-targeting by the central bank), while the latter ignores the fact that the likelihood of reaching a certain absolute interest rate level may vary substantially over time. The stresses should therefore reach a compromise between these two extremes.
- The stresses should be forward-looking: lower rating scenarios are more sensitive to deviations from expected interest rate paths, while severe stresses are designed to represent stable benchmarks in most scenarios, which are very unlikely to be reached unless a fundamental change in the functioning of the capital markets occurs.

The interest stress criteria are intended for the majority of SF transactions where interest rate risk is not the primary rating driver. If interest rate risk is one of the primary risk drivers in a transaction, this will be analysed case by case.

- Exceptional situations (e.g. expectations of a rapid and sustained change in the interest rate environment) should allow the stresses to be overridden via a review at such time as these situations occur.

Consequently, the interest rate stress methodology has the following characteristics.

- It employs standard scenarios that expose the SF transaction or CVB to theoretical stresses of various magnitudes.
- It is derived from an economic analysis of historical interest rate paths, including a comparison with other currencies and the inflation-targeting of relevant central banks.
- The stresses provide for stability in higher rating scenarios and are more responsive to changes in the spot rate in lower rating scenarios.
- The degree of stress is derived from judgment/opinion as regards a reasonably conceivable range of rates and is dependent on macroeconomic perspectives, and on the inflation targets of the central banks and expected real interest rates.

Methodological Framework

Overview

The criteria address open interest-rate positions and are based on an economic review of historical movements of the three-month spot rate as this is historically the most common index rate of SF notes and CVB. As the dynamics of other commonly used rates (one month and six months) are considered to be sufficiently similar for rating purposes, the same stresses as for three months are applied.

The methodology is not driven by market expectations, but it remains forward-looking to the extent that the calibration process defines possible future scenarios and is not constrained to historical observations. In particular, it specifies extreme scenarios at the highest stress levels, which in Fitch's opinion are remote and will remain so unless a fundamental change in the relevant financial market occurs.

The interest rate stress criteria have a common framework for all currencies and can be tailored to specific interest rate indices across jurisdictions. In addition, the criteria remain responsive to changes in the outlook for interest rate movements in that they assume a natural tendency to mean reversion. To achieve a simple and transparent framework that can be benchmarked against historical events, it is intentionally not closely related to expectations as expressed in forward markets.

The aim of the historical review was to arrive at an understanding of potential economic drivers of rate changes and of the speed of rate adjustments over time. The analysis of UK pound Libor and US dollar Libor is based on data since the early 1980s, going through several economic cycles. In the case of sterling Libor, the data history also includes a change in the monetary policy regime in the UK.

Historical Analysis

The available data are interpreted in the context of the economic and political events that happened at the time. In particular, changes in the monetary policy regime (e.g. making the UK central bank independent of the government in May 1997), periods of exceptional inflation (e.g. the oil price crisis in the 1970s) and singular events (e.g. 11 September 2001) are explicitly considered in the evaluation of the likelihood of corresponding interest rate movements to re-occur in the future.

The result of this analysis is the formulation of an expected equilibrium interest rate and long-term upward and downward plateaus at the 'AAA's' and 'B's' ratings for each interest rate base. Fitch's opinion on the possibility of various strengths of interest rate movements is reflected in the parameters that are explained in more detail below.

Fitch's approach to setting parameters is largely identical for each interest rate base and is therefore not discussed in a basis-specific manner. Rather, this report provides a discussion of the general approach supported by detailed examples for the US dollar Libor, UK pound Libor

The interest rate stresses are in principle applicable to transactions that are exposed to interest rate bases with a tenor between one and 12 months. This includes the backward-looking averages of overnight rates used as replacement of IBOR rates (e.g. SONIA).

and Euribor; see the sections *Standard (Positive) Interest Rate Stresses* and *Negative Interest Rate Stresses*, and *Appendix 1* for details.

The interest rate stress parameters for each interest rate base are published separately in the [Interest Rate Stress Model Web User Interface](https://www.fitchratings.com), available at www.fitchratings.com, which also acts as an interface to access Fitch's SF Interest Rate Stress Model; see the section *Interest Rate Stresses Publication* in this report.

Scenarios Considered

Fitch's methodology includes two sets of stresses: standard (positive) interest rate scenarios (upward and downward stresses) and negative interest rate scenarios (downward stresses).

For jurisdictions where Fitch believes the risk of negative interest rates is limited, due to the level of current and expected inflation and the relatively high spot rates, only the standard (positive) interest rate scenarios (upward and downward stresses) will be considered in the rating analysis.

For jurisdictions that Fitch believes may face the risk of negative interest rates, the downward stresses are replaced by negative interest rate stresses. In these jurisdictions, Fitch may apply the standard (positive) interest rate scenarios (upward and downward stresses) in those deals that are naturally or structurally hedged against negative interest rates, e.g. where the interest rate base to which assets and/or swaps are indexed are floored at or above zero. Where negative interest rate stresses are not applied in the cash flow analysis of a particular asset class, disclosure is made in the relevant sector-specific criteria reports.

Fitch tests upward and downward (positive or negative) scenarios separately, as SF or CVB structures can be negatively affected by movements in either direction. In addition, the agency will test a stable interest rate scenario (i.e. fixed at the spot rate).

For any specific reference rate, the continued application of the interest rate stresses described below is subject to the circumstances being consistent with the environments for which the equilibrium was derived. Exceptional circumstances trigger a review of the rate-specific assumptions by Fitch, as discussed below under *Criteria Limitations*.

Basis Risk

In situations where portfolio assets and note liabilities reference different interest reference rates, a haircut on the portfolio weighted average spread would be modelled unless the basis risk is immaterial.

If the reference rates of the assets and note liabilities are from the same interest rate family but with different tenors (for example, Euribor three months and Euribor six months) Fitch would typically consider this risk an immaterial risk driver and no adjustment would be made to the portfolio weighted average spread. However, in transactions where basis risk is a prominent rating driver, for example for the US Federal Family Education Loan Program Student Loan ABS, the methodology to size basis risk will be described in the relevant sector criteria.

For transactions that reference different interest rate types, Fitch will analyse the basis risk and its materiality. The analysis will take into account any swap in place that can fully or partially offset the basis risk. While a basis risk swap can cover the risk at closing, as the portfolio evolves over time through natural amortisation or defaults, basis risk can become material, except for transactions subject to balance-guaranteed swaps that mirror the performing portfolio notional amount.

The basis risk analysis attempts to size the magnitude of the difference between the liability and asset reference rates. Historical data analysis provides useful insight on movement correlation of different rates; however, it may not always be a good indication of future rate movements.

Structured finance bonds and covered bonds typically reference floating rate indices, such as Libor, Euribor, SONIA, SOFR, ESTR and other IBOR successor rates. However, assets can reference a wide range of rate types that may be unrelated to these short rates. For example, loans may reference rates that are set by the originating bank. These bank rates are influenced by a wide range of factors that do not affect short rates. These factors include the bank's cost of funding, the bank's risk appetite, how competitive the market is and regulatory constraints, all of which can change over time. Fitch therefore will form a view on how rates will be set in a

A minimum of three scenarios will be tested for each rating scenario: up, down and stable (i.e. fixed at the spot rate).

stressed environment and make a qualitative assessment on how relevant historical data is to derive a haircut. The haircut will be used to assess whether basis risk is material to transactions. The basis risk haircut will be disclosed in the relevant sector-specific criteria (see *Appendix 3*).

For transactions referencing different currencies and therefore different reference interest rates, the various interest rate scenarios described in the above section will be applied for each referenced interest rate, in conjunction with foreign exchange stresses. No haircut will be applied to the portfolio spread.

Starting Rate

In most cases the starting spot rate will reflect the index value or market rate prevailing at the time of the deal analysis. However, in some circumstances Fitch may use another starting rate in its rating analysis. Examples include:

- For transactions with a revolving period, where Fitch often only models the amortisation phase, Fitch may use the higher of the current rate and the equilibrium rate.
- At times of very volatile short term money market rates, for example during times of changing monetary policy, Fitch may use a forward-looking rate that could be informed by Fitch's interest rate forecasts (where available).
- For new transactions Fitch might use a more conservative forward-looking rate (which could be higher or lower than the spot rate) than the current spot rate as starting rate, to avoid undue volatility between expected and final ratings.

In each case, rating committees will determine the use of a starting rate other than the relevant current spot rate.

Standard (Positive) Interest Rate Stresses

The standard (positive) interest rate stresses assume that interest rates are naturally bounded at, or close to, 0% at the lower end.

The basis of the standard (positive) interest rate stress curve is a monotonically increasing or monotonically decreasing vector that reaches a plateau after four years. The plateau levels at the 'Bsf' and 'AAAsf' rating stresses are determined by historical levels of high/low interest rate environments for that jurisdiction and forward-looking macroeconomic considerations. Plateau levels for intermediate rating stresses are determined via a linear interpolation for each notch on the rating scale.

Setting Standard (Positive) Interest Rate Stress Parameters

Fitch determines its standard (positive) interest rate stresses (upward and downward) for an interest rate base by following four steps:

1. determination of equilibrium case;
2. choice of plateau;
3. path to plateau; and
4. dynamics of plateau over time.

A more detailed description of the parameter setting for the US dollar, sterling and euro can be found in *Appendix 1*. The parameters for other interest rate bases are available in the [Interest Rate Stress Model Web User Interface](#).

Step 1: Determination of Equilibrium Case

The first step is to establish the equilibrium situation for the given interest rate base. Fitch's SF and sovereigns groups interact to establish an equilibrium rate at a level where it is believed the rate would settle in a situation of economic calm and an inflation rate that is close to the target rate of the relevant central bank's monetary policy.

For example, for sterling, Fitch views a 3% short rate as a typically reasonable mean scenario under the current monetary policy regime. This is in line with the average of the sterling Libor three-month rates over the past 25 years. As additional support for the choice of the long-term

The equilibrium rate is the level at which Fitch believes the interest rate would settle in a situation of economic calm and with an inflation rate close to the target rate of monetary policy.

equilibrium interest rate, the agency analysed the market expectations resulting from the applicable interest rate curves.

Step 2: Choice of Plateau

The second step is to determine plateau interest rate levels that may be reached under various rating scenarios over a certain period, starting from an equilibrium rate. Such plateaus are derived for each interest rate base, taking into account historical levels and interest rate outcomes under potential future stress scenarios commensurate with the rating level. Interest rate levels attached to high stress scenarios will be beyond those that have occurred historically in the context of the current monetary regime.

For sterling, the 'Bsf' and 'AAAsf' upward stress plateaus are set at 4.5% and at 10.0%, respectively, yielding a 'BBBsf' long-term upward stress plateau of 6.9% (linearly interpolated). In comparison, under the current interest rate regime, the maximum sterling Libor was 8% in 1998, whereas rates previously peaked at around 15% in 1990 and at around 19% in 1980.

The 8% peak is mirrored by the 'Asf' long-term upward plateau (8%); earlier peak rates were of limited duration. For sterling, downward stress plateaus were set at 1.5% and 0.1% for the 'Bsf' and 'AAAsf' rating scenarios.

Under the methodology described in this report (see Step 4 below), derived stress rates will automatically be lower than the downward plateaus whenever spot rates are lower than the equilibrium levels.

For other interest rate bases, Fitch will follow a similar process based on historical data. Depending on the agency's view of how likely it is that historical observations will be repeated, a similar scaling towards historical benchmarks will be performed for each interest rate.

The plateau levels as explained in Step 2 represent the maximum (minimum) stress level in the up (down) scenarios.

Step 3: Path to Plateau

The next step in the methodology is to construct the path towards the plateau starting from the current spot rate. The plateau levels are reached gradually over a certain period, starting from the current spot rate.

The stress path is designed to correspond to historical stress paths, i.e. so that moves soon after the start of the stress phase are relatively steep and flatten out as the plateau is approached. The implementation follows a logarithmic function. See *Appendix 1* for more details.

For non-revolving SF transactions, the path to plateau for all rating levels below 'AAAsf' is relatively less steep for the euro, US dollar and sterling than for other interest rate bases. This reflects Fitch's view that the likelihood of an accelerated deviation from levels expected in times of economic calm is low compared with economic areas that can exploit interest rates differentials to run their economic policy.

The relative gap between the paths to plateau of these rates compared with other rates is differentiated by rating scenario and is more significant at the 'Bsf' category than at the 'AAAsf' category.

Step 4: Dynamics of Plateau over Time

The plateau levels at different stress scenarios are designed to move according to changes in the spot rate. For lower stress scenarios, the plateau moves largely in parallel to the spot rate, while it remains relatively fixed at higher stress scenarios.

The agency believes that the plateau levels would not appropriately address the interest-rate-related risk if they were fixed independently of the spot rate. For example, an increase in the spot rate would then mean that the distance to the high upward stress scenario diminishes, i.e. the stress relative to the spot rate reduces. Likewise, to keep the distance between the current spot rate and the stress level constant while the spot rate changes would not be appropriate in all scenarios either.

For this reason, stress plateaus are semi-responsive in the direction of the move (e.g. down plateaus are responsive to downward movements in the spot rate below the equilibrium) while

The plateau levels are reached gradually over a certain time, starting from the current spot rate. The stress path is designed to correspond to historical observations.

The plateau levels in different stress scenarios are designed to move according to changes in the spot rate. The plateau moves in parallel to the spot rate at the lower rating levels, while it remains relatively fixed at higher rating levels.

The methodology by which plateau levels are determined is asymmetric in the sense that the Progression Factors for the high interest rate scenario differ from those for the low interest rate scenarios.

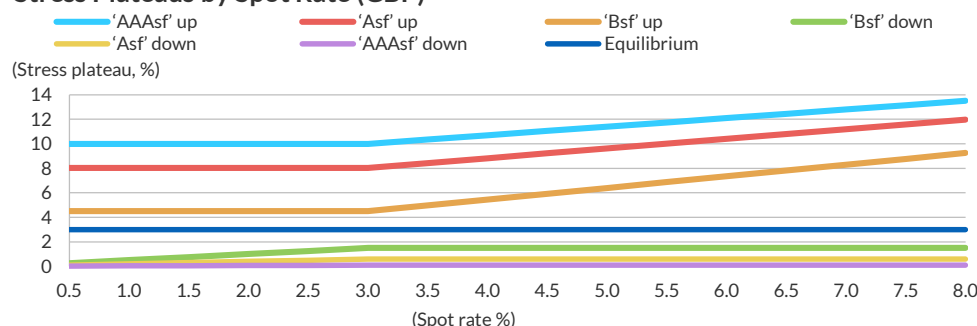
not being responsive in the opposite direction (e.g. the up plateaus will remain constant if the spot rate reduces below the equilibrium). This point is illustrated by comparing the stresses in the chart *GBP Interest Rate Stresses – Spot at 3%* with those derived from a different spot rate in the chart *GBP Interest Rate Stresses – Spot at 2%* (see text box *Illustration of Interest Rate Stresses*).

The standard (positive) interest rate stresses assume that interest rates are naturally bounded at or close to 0% at the lower end. As a consequence, the methodology by which plateau levels are determined is asymmetric in the sense that the scaling factors for the upward interest rate scenario (when the spot rate is higher than Fitch's equilibrium case) differ from those for the downward interest rate scenarios (when the spot rate is lower than the equilibrium case).

Fitch uses a formula to move the plateau according to a fraction of the difference between the spot rate and equilibrium case (absolute difference in case the spot rate is above the equilibrium rate and relative difference if the spot rate is below the equilibrium rate). In addition, the upward stresses are fixed at the levels relating to the equilibrium spot rate once the spot rate moves below the equilibrium level and similarly the downward stresses are fixed at the level relating to the equilibrium spot rate once the spot rate moves above the equilibrium level. See the section *Step 4: Dynamics of Plateaus Over Time* in *Appendix 1* for details of the formula.

The semi-responsive relationship between the stressed plateau rate and the spot rate is further illustrated below in the chart *Stress Plateaus by Spot Rate (GBP)*. It shows that at high spot rates the distance between the spot rate and the stressed plateaus is compressed.

Stress Plateaus by Spot Rate (GBP)



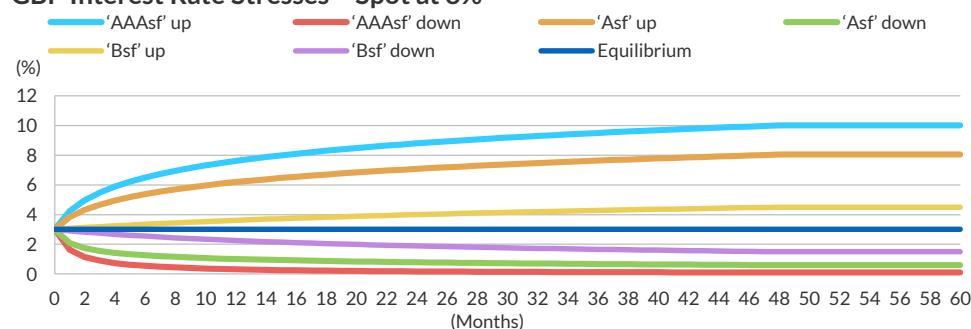
Source: Fitch Ratings

The plateau levels are designed so that they move in the same direction as movements of the spot rate away from its equilibrium case. As the spot rate moves to levels higher than the equilibrium case, the difference between the spot rate and upward stress plateau diminishes. As the spot rate moves to levels below the equilibrium rate, the difference between the spot rate and the upward stress plateau increases. This is consistent with an assumption of mean reversion of the interest rate path, and this sensitivity is assumed to hold under a relatively normal environment.

Illustration of Interest Rate Stresses

The chart below shows interest rate stresses for sterling Libor, assuming an equilibrium rate of 3.0% and a 'AAAsf' upward stress of 10%.

GBP Interest Rate Stresses – Spot at 3%

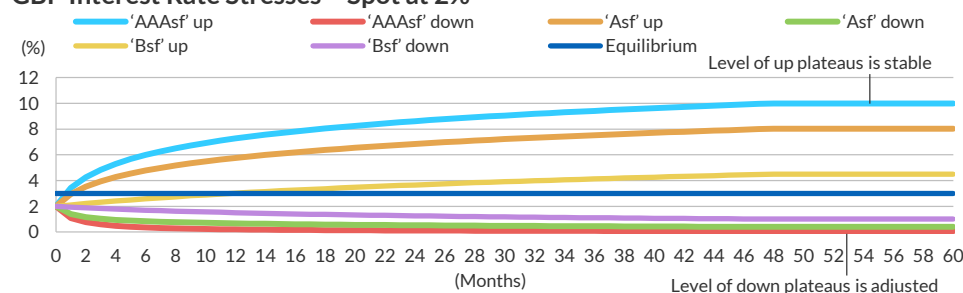


Source: Fitch Ratings

The above chart illustrates how the plateau is reached from a starting spot level of 3.0%.

The standard (positive) interest rate stress methodology provides for the stress plateaus to be dynamic over time, to take into account the actual spot rate at the time of the rating analysis. The chart below illustrates the interest rate stresses applicable if the spot rate was 2% at the time of closing, again shown for sterling Libor with an equilibrium rate of 3.0%. In this scenario the plateaus remain fixed for the up scenarios while plateaus for the down scenarios are adjusted to reflect the lower starting spot rate of 2%.

GBP Interest Rate Stresses – Spot at 2%



Source: Fitch Ratings

Under the low interest rate scenario (i.e., where the spot rate of 2% is lower than the equilibrium rate of 3.0%) the plateaus reflect the gap between the equilibrium and the spot rate, although not to the full extent of 1.0%, especially at the 'AAAsf' level. In addition, the down scenarios are floored at 0% (0% is considered the Long-Term Floor; see the [Interest Rate Stress Model Web User Interface](#) for more details).

The chart above illustrates the mechanism whereby, at lower stress scenarios, standard (positive) interest rate stresses are more responsive to the current spot rate, whereas at higher stress scenarios they are influenced less by changes to the spot rate.

Negative Interest Rate Stresses

The negative interest rate downward stresses are meant to test the vulnerability of a transaction to a period of negative interest rates in countries that are facing negative interest rates or that are, in Fitch's opinion, likely to experience negative interest rates in stressful scenarios.

Fitch applies its negative interest rate stresses in the following jurisdictions: the eurozone, the UK, Switzerland, Denmark, Norway, Sweden, the Czech Republic, Poland, the US, Canada, Japan, Australia and New Zealand.

If Fitch expects transactions would not be affected by negative interest rates (for example, where the interest rate base to which assets and/or a swap are indexed is floored at zero, or at a positive level greater than zero), Fitch may apply its standard (positive) downward stresses, instead of the negative interest rate stresses, in its analysis. Where relevant to the rating analysis, Fitch will explain in its rating communication whether the negative interest rate (downward) stress or the standard (positive) interest rate (downward) stress has been applied.

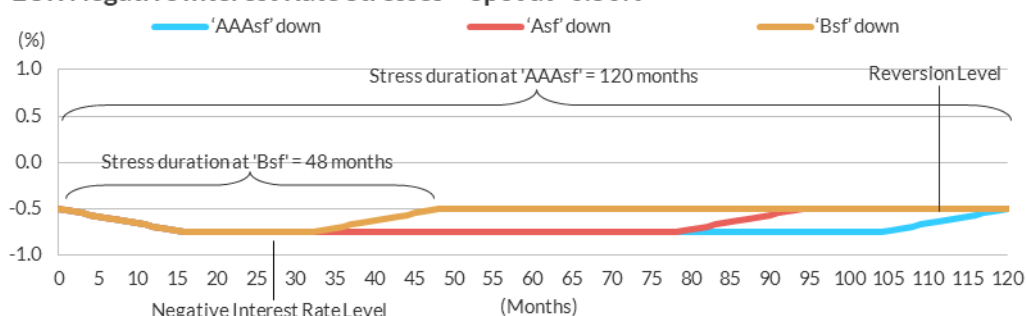
Fitch applies its negative interest rate stresses in the eurozone, the UK, Switzerland, Denmark, Norway, Sweden, the Czech Republic, Poland, the US, Canada, Japan, Australia and New Zealand, to transactions that the agency expects to be affected by negative interest rates.

The negative downward interest rate stress assumes that, after a stressed period of negative rates, rates will revert to the lower of the starting spot rate and the Long-Term Floor level (which is set at 0% for all currencies – see the [Interest Rate Stress Model Web User Interface](#) for more details).

The negative downward interest rates are designed to be – at each point in time – lower than (or at most equal to) the standard (positive) downward interest rates.

The chart below illustrates the dynamic of the negative interest rate stresses for the euro, starting from a spot rate of -0.50%.

EUR Negative Interest Rate Stresses – Spot at -0.50%



Source: Fitch Ratings

In applying its negative interest rate stresses, Fitch will assume in its cash flow analysis that the total interest (interest rate base plus spread) to be paid on the notes will be floored at zero. This assumption is based on the market practice for rate setting in SF transactions affected by this issue.

In the absence of contrary evidence, Fitch will also assume in its cash flow analysis that the total interest (interest rate base plus spread) to be paid by obligors on floating rate loans/receivables will be floored at zero.

In SF transactions that include cross-currency swaps, Fitch's analysis will consider whether negative interest rates on the swapped currencies could have a rating impact. A potential unhedged FX position may arise, as a result of negative interest rates, if the issuer of SF notes has to make additional payments to the currency swap provider in the relevant foreign currency and must buy this foreign currency on the market at spot exchange rates.

This could be the case in our rating analysis of SF transactions denominated in a currency not affected by negative interest rates, where floating rate notes are issued in a currency affected by negative interest rates, for example, an Australian dollar-denominated SF transaction issuing a tranche in euros and including a euro-Australian dollar currency swap, whereby the swap documentation does not envisage a non-negative floor on the swap counterparty paying leg. In these instances, Fitch will assess the rating impact of such unhedged FX positions by assuming the stressed FX rates published in the Excel file [Fitch's Foreign-Currency Stress Assumptions for Residual Foreign-Exchange Exposures in Covered Bonds and Structured Finance](#), available at www.fitchratings.com. A detailed description of Fitch's methodology for deriving these currency stresses is provided in the *Covered Bonds Rating Criteria*.

Setting Interest Rate Stress Parameters

Fitch determines its downward negative interest rate stresses for an interest rate base using the following steps:

1. determination of the Reversion Level;
2. determination of the Down Baseline Level;
3. determination of the Negative Interest Rate Level; and
4. determination of the Length of the Negative Interest Rate Stress period.

Reversion Level

The Reversion Level is the level at which the rate settles after the stress period. It is given by the lower of the starting spot rate and the Long-Term Floor of 0%:

$$\text{Reversion Level} = \text{Min}(\text{Spot}, \text{Long-Term Floor})$$

For example, euro short rates have fluctuated close to -0.50% since the autumn of 2020. If -0.50% is used as spot rate assumption, this is the terminal level to which the rate will transition at the end of the stress period and at which it will remain for all subsequent periods. This is illustrated in the chart *EUR Negative Interest Rate Stresses – Spot at -0.5% below*.

Down Baseline Level

Fitch's SF and sovereign groups interact to establish the Down Baseline Level, which is the level of negative interest rates expected in a period of persistent undershooting of the inflation target for currencies, which are not already experiencing negative rates approaching this level.

Fitch has set the Down Baseline Level at -0.65% for all currencies.

The determination of the Down Baseline Level is based on rate observations in countries where interest rates are or have been negative. Jurisdictions' sustainable levels of negative rates vary depending on a number of factors, including their size and the use of currency interventions; the Down Baseline Level therefore represents an approximation and is most relevant for currencies that, at the time of deal evaluation, are not already deep in negative territory. More severe stresses for jurisdictions already experiencing substantially negative rates (e.g. Switzerland, where the short rate has been hovering around -0.75% since 2015) are catered for by the multiplier of 1.5 introduced in the next section.

Negative Interest Rate Level

Fitch acknowledges that currencies with a track record of negative rates at or even beyond the Down Baseline Level (e.g. the Swiss franc and the euro), can have the capacity to move further into negative territory. This risk is captured by considering the (negative) current spot rate as a starting point for an additional drop of 50% of the current spot level. If this hypothetical level (1.5 times the starting spot) is lower than the Down Baseline Level of -0.65%, Fitch will use it for testing in its cash flow modelling analysis. The Negative Interest Rate Level is therefore given by the lower of the Down Baseline Level of -0.65% and 1.5 times the starting spot rate.

However, in Fitch's view cost-of-carry arguments associated with cash-holding strategies as alternatives to maintaining deposits with the central bank mean rates are unlikely to drop below what is known in the literature as the Effective Lower Bound. Theoretical Effective Lower Bounds vary across jurisdictions. Fitch assumes a uniform Effective Lower Bound across currencies of -0.90%.

In addition, should the starting spot rate already be lower than the Effective Lower Bound, the Negative Interest Rate Level will be capped at the starting spot rate.

The Negative Interest Rate Level is therefore given by the lower of: i) the Down Baseline Level; and ii) 1.5 times the spot rate, floored at the Effective Lower Bound of -0.90%, and with a final overall cap at the starting spot rate:

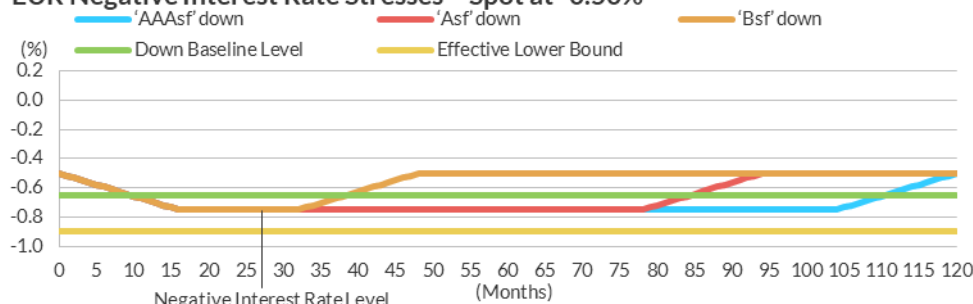
$$\text{Negative Interest Rate Level} = \text{Min}\{\text{Spot}, \text{Max}[-0.90\%, \text{Min}\{1.5 \times \text{Spot}, -0.65\%\}]\}$$

For example, as indicated by the chart below *EUR Negative Interest Rate Stresses – Spot at -0.50%*, for a spot rate of -0.5% the Negative Interest Rate Level is -0.75% (the lower of -0.5% multiplied by 1.5 and the Down Baseline Level of -0.65%).

If the spot rate is -0.8%, the Negative Interest Rate Level is set at -0.9% (as the lower of -0.8% multiplied by 1.5 and the Down Baseline Level of -0.65% is below the -0.9% Effective Lower Bound), as shown in the chart *EUR Negative Interest Rate Stresses – Spot at -0.8%*.

If the spot rate is 0.10%, the Negative Interest Rate Level is set at -0.65% (the Down Baseline Level), as shown in the chart *EUR Negative Interest Rate Stresses – Spot at 0.10%*. Assumed Negative Interest Rate Levels are therefore semi-responsive to the direction of spot rate movements.

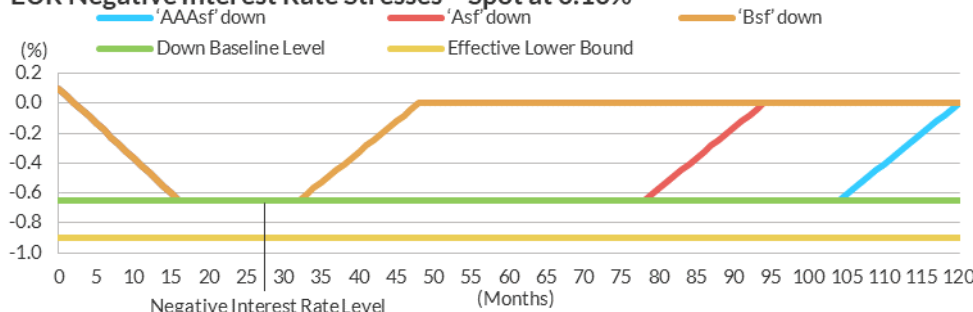
EUR Negative Interest Rate Stresses – Spot at -0.50%



EUR Negative Interest Rate Stresses – Spot at -0.80%



EUR Negative Interest Rate Stresses – Spot at 0.10%



Length of the Negative Interest Rate Stress Period

The magnitude of negative rate stresses is constrained to a narrow band between 0% and the Effective Lower Bound of -0.90% (or the starting spot rate, if already lower than the Effective Lower Bound). Given this bounded and compressed nature of negative interest rate stresses and the experience of currencies with a negative rates track record, Fitch differentiates stress levels by the length of the stress period rather than the magnitude of the (additional) drop into negative territory.

Fitch's SF and sovereign groups interact to establish the length of the negative interest rate stress, which represents the maximum number of months during which the short rate is assumed to remain below the Reversion Level.

The length of the Negative Interest Rate Stress Period is set at 48 months in a 'Bsf' scenario and at 120 months in a 'AAAsf' scenario. Lengths for intermediate rating stresses are determined by a linear interpolation for each notch on the rating scale. For example, at 'BBB+sf', the stress period is 84 months (linear interpolation of 'Bsf' and 'AAAsf' lengths).

Negative Interest Rate Stress Dynamic Over Time

	AAAsf	Bsf
Rates gradually reach the negative interest rate level ^{a,c}	Months 1-16	Months 1-16
Rates remain at negative interest rate level	Months 17-104	Months 17-32
Rates linearly increase to Reversion Level ^c	Months 105-120	Months 33-48
Total length of stress ^b	120 months	48 months

^a The negative downward interest rates are designed to be, at each point in time, lower than (or a maximum equal to) the standard (positive) downward interest rates. Depending on the spot rate, it may happen that, during the first 16 months, the standard (positive) downward interest rates are lower than the ones determined by assuming a linear decrease of the spot rate to the negative interest rate level. During these months, the negative downward interest rates will therefore be equivalent to the standard (positive) downward interest rates.

^b Lengths for intermediate rating stresses are determined via a linear interpolation for each notch on the rating scale

^c If the starting spot rate is at or below the Effective Lower Bound, the Negative Interest Rate Stresses will be flat at the starting spot rate in all rating scenarios.

Source: Fitch Ratings

Interest Rate Stresses Publication

On its website Fitch Ratings provides an [Interest Rate Stress Model Web User Interface](#), which incorporates all interest rate stress parameters set for the various countries and serves as an interface to Fitch's SF Interest Rate Stress Model.

The SF Interest Rate Stress Model and the web user interface are updated when the interest rate stresses are amended or when this methodology is applied to additional currencies. If interest rates enter an exceptional environment (see *Criteria Limitations*), Fitch's SF Interest Rate Stress Model will also include the temporary stresses for that exceptional situation.

Fitch will review the criteria annually, but it does not expect frequent changes to the framework (and therefore to the output interest rate stresses).

The detailed interest rate stresses for specific currencies and related interest rate indices are published on Fitch's website.

Chinese Interest Rate Stresses

Fitch has developed Chinese interest rate stresses to analyse the interest rate risk in securitisation transactions where both the notes and underlying assets are indexed to either the one-year or the five-year loan prime rate.

The interest rate parameters for the Chinese yuan one-year loan prime rate (CNY 1Y-LPR) and for the Chinese yuan five-year loan prime rate (CNY 5Y-LPR) are published in the [Interest Rate Stress Model Web User Interface](#).

In developing Chinese interest rate stresses, Fitch employed the methodology outlined in this report, but applied additional considerations when setting key criteria parameters (the equilibrium rate and plateau levels). Given the political nature of Chinese interest rates, the upward plateau levels for Chinese interest rate stresses is based mostly on Fitch's interest rate expectations over a two-year term, rather than on observed historical indexes.

For this reason, the application to each specific transaction of the upward interest rate stresses for the CNY 1Y-LPR and for the CNY 5Y-LPR, shown in the [Interest Rate Stress Model Web User Interface](#), is subject to the following additional considerations and limitations:

- Where a transaction is exposed to rising interest rates, the upward interest rate stress assumptions shown in the [Interest Rate Stress Model Web User Interface](#) are applicable only if the notes are expected, in the absence of prepayments and defaults, to be repaid in full within two years.
- Where a transaction is exposed to rising interest rates and the two-year repayment condition is not met, the rating team will assess the appropriateness of the upward plateau levels shown in the [Interest Rate Stress Model Web User Interface](#) for the specific transaction and might apply a different transaction-specific assumption.

Fitch will consider a transaction to be exposed to rising interest rates, if, in a scenario where no prepayments and no defaults are assumed, the nominal amount of the floating rate assets, after

considering the effect of any hedging, is not at least equal to the nominal amount of the floating rate liabilities at each point in time over the entire life of the deal.

In the surveillance review of transactions where the liabilities reference rate was still the legacy People's Bank of China one-year benchmark lending rate or the legacy People's Bank of China five-year benchmark lending rate, Fitch will also consider a scenario where these reference rates will not be converted to the new CNY 1Y-LPR or to the new CNY 5Y-LPR benchmark rates. In particular, for those transactions where the conversion process has not yet been legally executed, Fitch will also consider a scenario where the reference rate is assumed to be, in absence of contrary evidence, a fixed-for-life rate at its current value.

Variations from Criteria

Fitch's criteria are designed to be used in conjunction with experienced analytical judgment exercised through a committee process. The combination of transparent criteria, analytical judgment applied on a transaction by transaction or issuer by issuer basis, and full disclosure via rating commentary strengthens Fitch's rating process while assisting market participants in understanding the analysis behind our ratings.

A rating committee may adjust the application of these criteria to reflect the risks of a specific transaction or entity. Such adjustments are called variations. All variations will be disclosed in the respective rating action commentaries, including their impact on the rating where appropriate.

A variation can be approved by a rating committee where the risk, feature, or other factor relevant to the assignment of a rating and the methodology applied to it are both included within the scope of the criteria, but where the analysis described in the criteria requires modification to address factors specific to the particular transaction or entity.

Criteria Limitations

Ratings, including Rating Watches and Outlooks, assigned by Fitch are subject to the limitations specified in our Ratings Definitions and available at <https://www.fitchratings.com/site/definitions>.

In addition, ratings within the scope of these criteria are subject to the following specific limitation.

The scope of this methodology is limited to relatively "normal" times and would be reviewed should a dramatic change in the market environment occur.

When the financial markets enter an exceptional state, interest rate stresses may not follow the standard algorithmic specification. Under those circumstances, Fitch will perform a comprehensive review of the situation and potentially assess stresses different from those implied by the methodology. Any adjustments to the parameters of the stresses under such exceptional circumstances will be incorporated into the published stresses for the respective interest rates on Fitch's web site.

Fitch will perform this analysis and will assess whether the application of the standard approach remains appropriate (see also *Interest Rate Stresses Publication* above).

In extreme cases of excessive exposure to interest rate risk, Fitch may limit the category of ratings that can be assigned, or even decline to rate the SF transaction or CVB.

A review of the interest rate stress criteria will be triggered by exceptional circumstances.

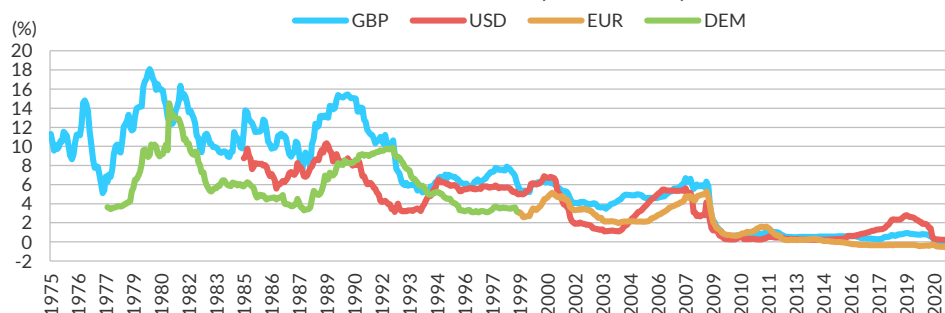
Criteria Disclosures

Fitch expects to disclose the following items in its initial transaction reports and/or rating action commentaries:

- variations to this criteria report (as mentioned above); and
- any transaction-specific interest rate stress assumption, when different from the standard interest rate stresses described in this criteria report and in the applicable sector specific criteria report (if any).

Appendix 1: Derivation of Parameters

Historical 3-Month Interbank Offered Rates (1975-2021)



Source: Fitch Ratings, Datastream, Bloomberg

Derivation of Parameters

Based on the review of historical rates, knowledge about fiscal and monetary policies in the past, historical event parameters and long-term swap rates and its own expectations on future macroeconomic and monetary policy developments, Fitch arrived at the following parameters for its standard (positive) interest rate stress methodology.

Step 1: Determination of Equilibrium Case

In all three jurisdictions/currency blocs described in this section (the US, UK and eurozone) the current monetary policy regimes with explicit inflation targeting are considered to promote average interest rates below those of the 1980s until the early 1990s and more in line with the average rates in the past 25 years.

Fitch regards 3.0% for the US dollar and sterling and 2.0% for the euro to be reasonable steady-state rates, given Fitch's expectations for real interest rates and the respective central banks' effectiveness in achieving the inflation target of 2% (with the Federal Reserve now permitting temporary overshooting and targeting an average of 2%).

Step 2: Choice of Plateaus

Plateaus at the 'AAAs' and 'Bsf' rating levels were derived from historical experience and expectations for likely actions by central banks in critical situations and other qualitative considerations. Plateau levels for intermediate rating levels are linearly interpolated between the 'AAAs' and 'Bsf' anchor points and are cross-checked against actual historical observations.

For all three currencies the 'AAAs' downward plateau was set to marginally above zero, given the three central banks' track record in lowering policy rates to virtually zero.

US Dollar

In the case of US dollar Libor, historically the maximum rate under the current regime was 10.6%, but was only reached for short periods. Fitch considers reaching a 10% interest rate from a 3% equilibrium case and remaining there for a period of several years to be commensurate with a 'AAAs' rating scenario. The agency similarly considers reaching and staying at 8% to be an 'Asf' stress scenario.

A plateau of 8% at the 'Asf' level is commensurate with a 'Bsf' plateau of 4%. However, the 'Bsf' plateau was calibrated independently before evaluating the resultant (interpolated) 'Asf' plateau. The 'Bsf' calibration was aided by a benchmarking tool for comparing jurisdictions along a range of qualitative factors, such as the size and openness of the economy and vulnerability to external shocks. This resulted in a 'Bsf' level cushion to the equilibrium case of 100bp for the US dollar, which is applied for both the upward and downward stress cases, resulting in 'Bsf' plateaus of 2% (down) and 4% (up).

Euro

Fitch's analysts, in cooperation with the economics team, arrived at the same 'Bsf' level cushion to the equilibrium rate of 100bp for the euro, giving an upward 'Bsf' plateau of 3% and a

downward 'Bsf' plateau of 1%. The difference to the US dollar 'Bsf' up and down plateaus therefore reflects the euro's 100bp lower equilibrium rate.

The European Central Bank's lower effectiveness in raising inflation expectations to its inflation target than the Federal Reserve and other structural differences mean the 'AAAsf' upward plateau for the euro was set at 8%, 2pp lower than for the US.

UK Pound

In rising rate environments sterling Libor has historically moved in closer coordination with the US dollar than the euro, and, like the Federal Reserve, the Bank of England has been more successful in anchoring inflation expectations than the ECB.

These were the two principal considerations that guided Fitch's analysts when setting the 'AAAsf' at the level of the US dollar's, i.e. 10%. Together with a 'Bsf' plateau of 4.5% this yields an 'Asf' plateau of 8%, a level that was last reached in 1990, two years before sterling's exit from the European Exchange Rate Mechanism and seven years before the Bank of England was given statutory independence.

The 'Bsf' upward plateau of 4.5% implies a cushion to the equilibrium rate of 150bp (4.5% - 3%), 50bp higher than the cushions for the US dollar and the euro. This is due to the likely greater vulnerability of the UK economy to external shocks, especially in the context of the exit from Europe's Single Market at the beginning of 2021.

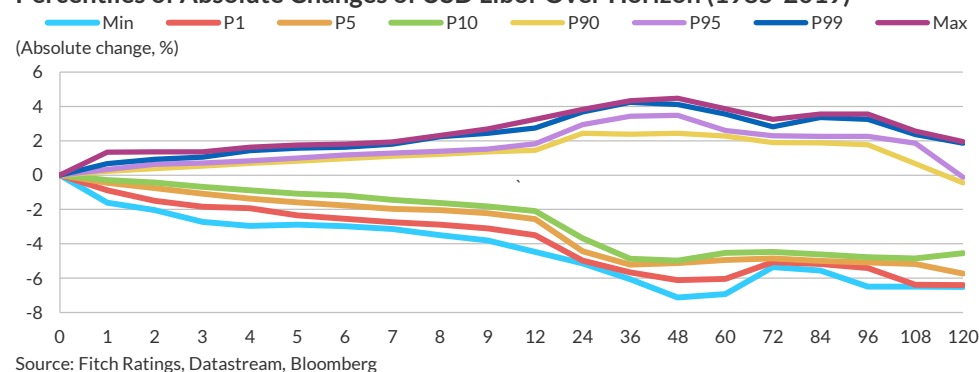
As is assumed for the US dollar and euro, Fitch set the 'Bsf' down plateau symmetrically to the 'Bsf' upward plateau at 150bp below the equilibrium rate, giving a downward plateau level of 1.5%.

Step 3: Path to Plateau

Fitch analysed the speed of change in interest rates over various time horizons for the historical data available and found that, from the onset of a sudden change, rates tend first to increase rapidly before flattening after 24 to 36 months and finally dropping back towards previous levels.

Percentiles of historical cumulative changes in interest rates over varying horizons are shown for US dollar Libor in the chart below, *Percentiles of Absolute Changes of US Dollar Libor Over Horizon (1985-2019)*.

Percentiles of Absolute Changes of USD Libor Over Horizon (1985-2019)



Fitch found that a logarithmic function describes the nature of stressed paths reasonably well and incorporated this into the calculation of the path from the current spot rate to the plateau level.

Step 4: Dynamics of Plateaus Over Time

For the methodology to remain applicable even for significant departures of the spot rate from the equilibrium rate, plateau levels are assumed to move proportionally to such departures in the direction relevant to the plateau:

- **Spot rate > equilibrium rate.** If the spot rate moves above the equilibrium rate, the upward plateaus are adjusted upwards by a fraction of the distance. This fraction is called the Progression Factor. The downward plateaus do not change from their calibrated values:

$$Plateau_{Spot > EquRate}^{up} = Plateau^{up} + ProgressionFactor^{up} \times (Spot - EquRate)$$

$$Plateau_{Spot > EquRate}^{down} = Plateau^{down}$$

- **Spot rate < equilibrium rate.** If the spot rate moves below the equilibrium rate, the downward plateaus are moved downwards proportionally to the ratio of the spot rate over the equilibrium rate; the upward plateaus remain at their calibrated value:

$$Plateau_{Spot < EquRate}^{down} = Plateau^{down} \times \left(\frac{\max(Spot, 0\%)}{EquRate} \right)^{ProgressionFactor^{down}}$$

$$Plateau_{Spot < EquRate}^{up} = Plateau^{up}$$

- **Spot rate = equilibrium rate.** In this boundary case both the upward and downward plateaus are at their unchanged calibrated “steady state” values:

$$Plateau_{Spot = EquRate}^{up} = Plateau^{up}$$

$$Plateau_{Spot = EquRate}^{down} = Plateau^{down}$$

For certain asset classes (such as credit cards) this boundary case can be the standard assumption for cash flow modelling.

This semi-responsive dependence of plateaus on the spot rate in relation to the equilibrium rate reflects the mean reversion assumption underpinning the equilibrium rate as anchor for upward and positive downward plateaus: interest rates can revert towards the equilibrium after a sudden large move in one direction before overshooting in the opposite direction. This possibility supports leaving the plateaus in the opposite direction to the spot rate’s move unchanged.

However, if rates have already substantially departed from the equilibrium rate, the likelihood of hitting a given plateau in the direction of the departure increases for the assumed timeframe. This increased likelihood (reduced remoteness) is compensated for by moving the plateau further away from the spot rate. In its Progression Factor calibration Fitch has balanced this conditionality with the intended relative stability of stresses at higher rating levels. The upward Progression Factor at ‘AAAsf’ of 0.70 is therefore smaller than the ‘Bsf’ upward Progression Factor of 0.95. In the chart *Stress Plateaus by Spot Rate (GBP)* this is reflected in the plateau curves’ different slopes.

In the falling rates scenario this remote stress stability criterion is not an issue, given the bounded nature of the stresses and the fact that major jurisdictions have already tested zero interest rate policies. Fitch has therefore set the downward Progression Factors for the two anchor levels ‘AAAsf’ and ‘Bsf’ at 0.99.

Plateaus for intermediate rating levels are interpolated linearly between the ‘AAAsf’ and ‘Bsf’ anchor levels.

US dollar example: if the spot rate reaches 10%, the ‘Bsf’ upward plateau increases from the calibrated “steady-state” value of 4% to 10.7%, and the ‘AAAsf’ plateau increases from 10% to 14.9%. If the spot rate drops to 2%, the ‘Bsf’ downward (positive) plateau is lowered from 2% to 1.3%, and the ‘AAAsf’ downward (positive) plateau drops from 0.2% to 0.13%.

This inbuilt adaptability of plateau levels to spot rates does not replace a review of the methodology and calibrated stress parameters following significant changes in the political and market environments, as noted in *Criteria Limitations*.

These stresses assume that the structures have reasonably smoothly distributed cash flows. Structures exposed to interest rate risks over shorter periods, such as days or weeks, or longer tenors with pronounced clustering would be analysed in a bespoke manner.

A summary of parameters for the US dollar, euro and sterling is presented below.

Summary of Parameters - Standard (Positive) Interest Rate Stress

US Dollar

	Equilibrium and plateau levels (%)		Progression Factors	
	LT up	LT down	Up-high	Down-low
AAA _{sf}	10.00	0.20	0.70	0.99
B _{sf}	4.00	2.00	0.95	0.99
Equilibrium rate	3.00			

Source: Fitch Ratings

Euro

	Equilibrium and plateau levels (%)		Progression Factors	
	LT up	LT down	Up-high	Down-low
AAA _{sf}	8.00	0.10	0.70	0.99
B _{sf}	3.00	1.00	0.95	0.99
Equilibrium rate	2.00			

Source: Fitch Ratings

Sterling

	Equilibrium and plateau levels (%)		Progression Factors	
	LT up	LT down	Up-high	Down-low
AAA _{sf}	10.00	0.10	0.70	0.99
B _{sf}	4.50	1.50	0.95	0.99
Equilibrium rate	3.00			

Source: Fitch Ratings

The Progression Factors for all other currencies are set at the same level as for euro, sterling and US dollar. The other parameters applicable to each individual currency can be retrieved via Fitch's Interest Rate Stress Model Web User Interface.

Appendix 2: Data Sources

Fitch has reviewed historical interest rate movements for the most common reference rates for each currency.

Historical market rates are typically available for at least the previous 20 years. Where there are limited historical data, Fitch reverts to appropriate proxy data from other reference rates and government yields. For example, for the Euribor index, a specific time series is only available since 1999, but certain conclusions from the US dollar and sterling Libor history can be inferred to arrive at meaningful stresses backed by significant historical data for euro interest rates. Fitch data for the Deutsche mark were also used as a proxy for the pre-euro era. With the exception of China, proxy information is available for more than 20 years for every currency reviewed so far.

The table below lists the main historical interest rate time series used in the calibration of the criteria. In calibrating the criteria, Fitch has also considered its own expectations of interest rate movements in each specific country or area.

Historical Interest Rate Database^a

Jurisdiction/rate	Time frame covered ^b
Eurozone	
* Euro Short Term Rate (ESTR)	March 2017
Euribor 3 month	January 1999
Deutsche Mark Interbank 3 month – offered rate	January 1978-January 1999
US	
* Secured Overnight Financing Rate (SOFR)	August 2014
US Libor 3-month	January 1985
US Treasury Bill Rate – 3 month (EP)	January 1972
Overnight Treasury GC Repo Primary Dealer Survey Rate	February 1998-February 2018
UK	
* Sterling Overnight Index Average (SONIA)	January 1997
UK Libor 3 month	February 1975
Japan	
* Tokyo Overnight Average Rate (TONA)	January 1998
Japan Libor 3 month	February 1986
Switzerland	
* Swiss Average Rate Overnight (SARON)	July 1999
Swiss Interbank 3M (Zrc:Snb) – bid rate	February 1974
Denmark	
* Denmark Short Term Rate (DESTR)	March 2017
Denmark Interbank 3-month – offered rate	July 1988
Sweden	
* Swedish Krona Short Term Rate (SWESTR)	January 2016
Sweden Interbank 3-month – offered rate	February 1987
Norway	
* Norwegian Overnight Weighted Average (NOWA)	October 2011
Norway Interbank 3-month – offered rate	February 1986
Canada	
* Canadian Overnight Repo Rate Average (CORRA)	August 1997
Canada Bankers Accept. 3-month – middle rate	February 1980

Historical Interest Rate Database^a (Cont.)

Rate	Time frame covered ^b
South Korea	
* Korea Overnight Financing Repo Rate (KOFRR)	January 2018
Seoul Interbank 3-month – offered rate	August 2004
Korea Ncd 91 days – middle rate	February 1992
India	
Mumbai Interbank three month – middle rate	December 1998
In prime lending rate (Ep)	December 1978
Taiwan	
Taiwan Interbank 3-month – offered rate	August 2005
Taipei Interbank Rates (TAIBOR) 1 Week	October 2005
Tw commercial paper rate: Primary market – 31 to 90 day	November 1980
Singapore	
* Singapore Overnight Rate Average (SORA)	July 2005
Singapore Interbank 3-month – middle rate	April 1986
Australia	
* Australian Interbank Overnight Cash Rate (AONIA)	April 1996
Au Interbank Rate – 3-month (Ep)	March 1986
New Zealand	
NZ Interbank Rate – 3 Month	April 1986
Poland	
* Polish Overnight Index Average Rate (POLONIA)	January 2005
Warsaw Interbank 3-month – middle rate	January 1995
Mexico	
Interbank Equilibrium Rate (TIIE)	March 1995
Turkey	
* Turkish Lira Overnight Reference Rate (TLREF)	December 2018
3 Month Offered Turkish Lira Reference Interest Rate	August 2006
China	
1 Year Medium Term Lending Facility Rate (MLF)	March 2016
1 Year Loan Prime Rate (1 Year LPR)	Nov. 2013
5 Year Loan Prime Rate (5 Year LPR)	August 2019
Czech Republic	
* Czech Overnight Index Average Rate (CZEONIA)	January 2002
Prague Interbank 3-Month – offered rate	April 1993
Brazil	
Interbank Deposit Certificates Rate (CDI)	July 1986

^a The rates in the table are the benchmarks used for each region/jurisdiction. Benchmarks were selected after a comprehensive survey of short-term reference rates in the same region/jurisdiction. As term rate versions of overnight rates replacing legacy IBOR rates are developed and markets evolve, the basket of benchmark rates considered for a given currency area might change. Where applicable, the main benchmarks used at the time of publication of this criteria report are prefixed with an asterisk (*).

^b All series cover up to November 2022, unless differently stated. At the time of the publication of this criteria report some of the legacy IBORs already existed in a synthetic form, with final discontinuation imminent.

Source: Fitch Ratings, Haver

Appendix 3: Sector-Specific Criteria Covering Basis Risk

Sector-Specific Criteria Covering Basis Risk

Country	Index rate (No. 1)	Index rate (No. 2)	Sector criteria
UK	Originator mortgage rate (SVR)	GBP Libor, SONIA	UK RMBS Rating Criteria
UK	Bank of England Base Rate (BBR)	GBP Libor, SONIA	UK RMBS Rating Criteria and EMEA Equity Release Mortgage Rating Criteria
Ireland	Originator mortgage rate (SVR)	Euribor	European RMBS Rating Criteria
Ireland	ECB	Euribor	European RMBS Rating Criteria and EMEA Equity Release Mortgage Rating Criteria
Netherlands	Reset to fixed originator mortgage rate	Euribor	European RMBS Rating Criteria
Netherlands	Reset to floating originator mortgage rate	Euribor	European RMBS Rating Criteria
Spain	IRPH	Euribor	European RMBS Rating Criteria
Cyprus	Originator mortgage rate	Euribor	Originator-Specific Residential Mortgage Analysis Rating Criteria
Denmark	Originator mortgage rate	CIBOR	Originator-Specific Residential Mortgage Analysis Rating Criteria
Norway	Originator mortgage rate	NIBOR	Originator-Specific Residential Mortgage Analysis Rating Criteria
Sweden	Originator mortgage rate	STIBOR	Originator-Specific Residential Mortgage Analysis Rating Criteria
USA	Prime	USD Libor	U.S. Private Student Loan ABS Rating Criteria
USA	T-bill	USD Libor	U.S. Federal Family Education Loan Program Student Loan ABS Rating Criteria
USA	CP	USD Libor	U.S. Federal Family Education Loan Program Student Loan ABS Rating Criteria
USA	SIFMA	USD Libor	U.S. Federal Family Education Loan Program Student Loan ABS Rating Criteria
South Korea	Cost of Fund Index (COFIX, 6 months)	Certificate of Deposit (CD, 3 months)	Originator-Specific Residential Mortgage Analysis Rating Criteria
South Korea	Bank Debenture Rate (6 and 12 months)	Certificate of Deposit (CD, 3 months)	Originator-Specific Residential Mortgage Analysis Rating Criteria

Source: Fitch Ratings, as of August 2021

DISCLAIMER & DISCLOSURES

All Fitch Ratings (Fitch) credit ratings are subject to certain limitations and disclaimers. Please read these limitations and disclaimers by following this link: <https://www.fitchratings.com/understandingcreditratings>. In addition, the following <https://www.fitchratings.com/rating-definitions-document> details Fitch's rating definitions for each rating scale and rating categories, including definitions relating to default. Published ratings, criteria, and methodologies are available from this site at all times. Fitch's code of conduct, confidentiality, conflicts of interest, affiliate firewall, compliance, and other relevant policies and procedures are also available from the Code of Conduct section of this site. Directors and shareholders' relevant interests are available at <https://www.fitchratings.com/site/regulatory>. Fitch may have provided another permissible or ancillary service to the rated entity or its related third parties. Details of permissible or ancillary service(s) for which the lead analyst is based in an ESMA- or FCA-registered Fitch Ratings company (or branch of such a company) can be found on the entity summary page for this issuer on the Fitch Ratings website.

In issuing and maintaining its ratings and in making other reports (including forecast information), Fitch relies on factual information it receives from issuers and underwriters and from other sources Fitch believes to be credible. Fitch conducts a reasonable investigation of the factual information relied upon by it in accordance with its ratings methodology, and obtains reasonable verification of that information from independent sources, to the extent such sources are available for a given security or in a given jurisdiction. The manner of Fitch's factual investigation and the scope of the third-party verification it obtains will vary depending on the nature of the rated security and its issuer, the requirements and practices in the jurisdiction in which the rated security is offered and sold and/or the issuer is located, the availability and nature of relevant public information, access to the management of the issuer and its advisers, the availability of pre-existing third-party verifications such as audit reports, agreed-upon procedures letters, appraisals, actuarial reports, engineering reports, legal opinions and other reports provided by third parties, the availability of independent and competent third-party verification sources with respect to the particular security or in the particular jurisdiction of the issuer, and a variety of other factors. Users of Fitch's ratings and reports should understand that neither an enhanced factual investigation nor any third-party verification can ensure that all of the information Fitch relies on in connection with a rating or a report will be accurate and complete. Ultimately, the issuer and its advisers are responsible for the accuracy of the information they provide to Fitch and to the market in offering documents and other reports. In issuing its ratings and its reports, Fitch must rely on the work of experts, including independent auditors with respect to financial statements and attorneys with respect to legal and tax matters. Further, ratings and forecasts of financial and other information are inherently forward-looking and embody assumptions and predictions about future events that by their nature cannot be verified as facts. As a result, despite any verification of current facts, ratings and forecasts can be affected by future events or conditions that were not anticipated at the time a rating or forecast was issued or affirmed.

The information in this report is provided "as is" without any representation or warranty of any kind, and Fitch does not represent or warrant that the report or any of its contents will meet any of the requirements of a recipient of the report. A Fitch rating is an opinion as to the creditworthiness of a security. This opinion and reports made by Fitch are based on established criteria and methodologies that Fitch is continuously evaluating and updating. Therefore, ratings and reports are the collective work product of Fitch and no individual, or group of individuals, is solely responsible for a rating or a report. The rating does not address the risk of loss due to risks other than credit risk, unless such risk is specifically mentioned. Fitch is not engaged in the offer or sale of any security. All Fitch reports have shared authorship. Individuals identified in a Fitch report were involved in, but are not solely responsible for, the opinions stated therein. The individuals are named for contact purposes only. A report providing a Fitch rating is neither a prospectus nor a substitute for the information assembled, verified and presented to investors by the issuer and its agents in connection with the sale of the securities. Ratings may be changed or withdrawn at any time for any reason in the sole discretion of Fitch. Fitch does not provide investment advice of any sort. Ratings are not a recommendation to buy, sell, or hold any security. Ratings do not comment on the adequacy of market price, the suitability of any security for a particular investor, or the tax-exempt nature or taxability of payments made in respect to any security. Fitch receives fees from issuers, insurers, guarantors, other obligors, and underwriters for rating securities. Such fees generally vary from US\$1,000 to US\$750,000 (or the applicable currency equivalent) per issue. In certain cases, Fitch will rate all or a number of issues issued by a particular issuer, or insured or guaranteed by a particular insurer or guarantor, for a single annual fee. Such fees are expected to vary from US\$10,000 to US\$1,500,000 (or the applicable currency equivalent). The assignment, publication, or dissemination of a rating by Fitch shall not constitute a consent by Fitch to use its name as an expert in connection with any registration statement filed under the United States securities laws, the Financial Services and Markets Act of 2000 of the United Kingdom, or the securities laws of any particular jurisdiction. Due to the relative efficiency of electronic publishing and distribution, Fitch research may be available to electronic subscribers up to three days earlier than to print subscribers.

For Australia, New Zealand, Taiwan and South Korea only: Fitch Australia Pty Ltd holds an Australian financial services license (AFS license no. 337123) which authorizes it to provide credit ratings to wholesale clients only. Credit ratings information published by Fitch is not intended to be used by persons who are retail clients within the meaning of the Corporations Act 2001.

Fitch Ratings, Inc. is registered with the U.S. Securities and Exchange Commission as a Nationally Recognized Statistical Rating Organization (the "NRSRO"). While certain of the NRSRO's credit rating subsidiaries are listed on Item 3 of Form NRSRO and as such are authorized to issue credit ratings on behalf of the NRSRO (see <https://www.fitchratings.com/site/regulatory>), other credit rating subsidiaries are not listed on Form NRSRO (the "non-NRSROs") and therefore credit ratings issued by those subsidiaries are not issued on behalf of the NRSRO. However, non-NRSRO personnel may participate in determining credit ratings issued by or on behalf of the NRSRO.

Copyright © 2023 by Fitch Ratings, Inc., Fitch Ratings Ltd. and its subsidiaries. 33 Whitehall Street, NY, NY 10004. Telephone: 1-800-753-4824, (212) 908-0500. Fax: (212) 480-4435. Reproduction or retransmission in whole or in part is prohibited except by permission. All rights reserved.