

# Validation in the context of pool rating models

An insight into the validation activities of  
a pool provider and the pool participants.

## Validation in the context of pool rating models

Under what we call the Pool Approach, several institutions cooperate to develop a common rating model using the same data and rating philosophy. The advantages of such an approach are obvious: The joint analysis and modelling enable a joint handling of changes – which need to be implemented only once. This creates economies of scale and thus cost savings for the participating institutions.

On the other hand – and this is the more important part for the considerations below – the combined and significantly larger dataset available leads to a permanently more reliable identification and quantification of the relevant risk factors than would be possible for an individual institution with its naturally smaller and more limited database.

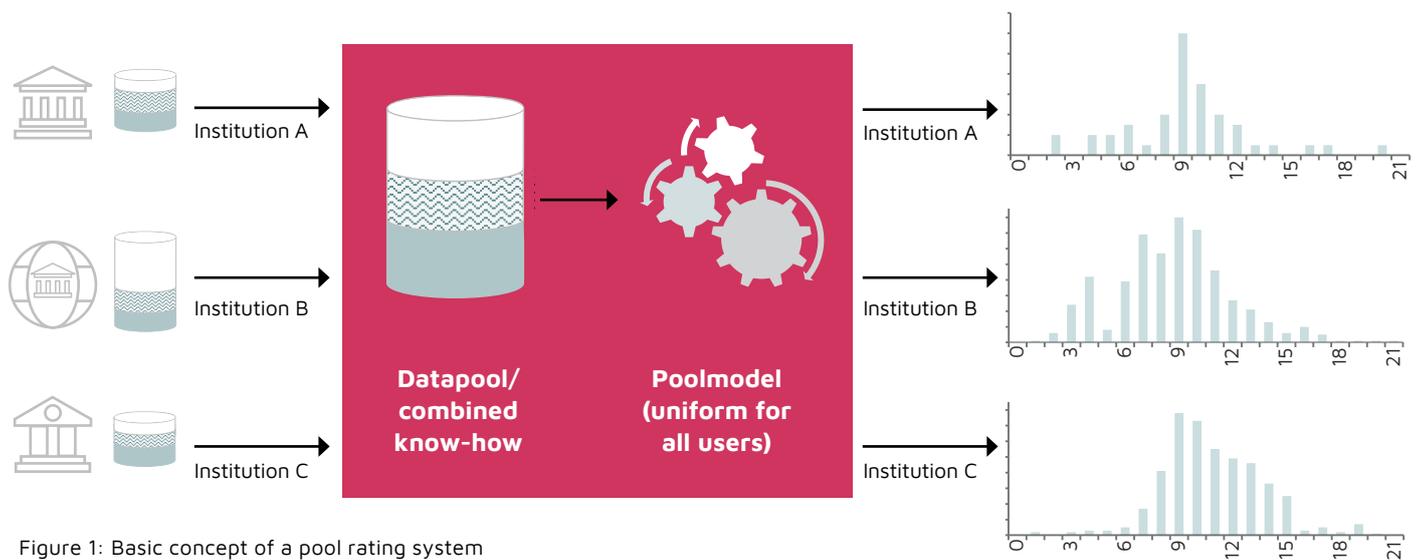


Figure 1: Basic concept of a pool rating system

Unfortunately, these advantages come at the price of new challenges: How does an institution’s data fit with the rest of the data pool, how well does the model work for an institution’s specific portfolio? These questions suddenly become the focus of validation from the institution’s point of view, especially when the actual model validation initially takes place at pool level.

In addition, the institution remains responsible for validating the system for its own portfolio according to all relevant regulatory requirements. A clear division of tasks and responsibilities in this context is imperative.

In the following, the specific challenges of validating pool rating models are examined in more

detail. IRBA rating models for low-default portfolios, for which the requirements are naturally particularly strict, will be considered as a basis.

As the topic of validating IRBA rating models has evolved rapidly in recent years and is continuing to do so, considerations on this subject necessarily only represent a snapshot. In addition, some of the relevant aspects can only be dealt with briefly here. In particular, the methods for validating the “margin of conservatism” as well as the changes that become necessary if the system needs to be separately calibrated for a specific institution are disregarded for the moment. The topic of governance can also only be touched upon in this context.

## Regulatory and governance issues in brief

This section briefly examines the regulatory requirements for pool rating models that concern validation. Direct references to pool rating models can be found primarily in the CRR<sup>1</sup>, the EBA RTS

IMA<sup>2</sup> and in great detail in the EGIM<sup>3</sup>. Even if these are not exclusively related to validation, there are direct implications:

**CRR, Art. 179 (2): Where an institution uses data that is pooled across institutions it shall meet the following requirements:**

- a) the rating systems and criteria of other institutions in the pool are similar to its own;**
- b) the pool is representative of the portfolio for which the pooled data is used [...].**

There are further requirements in this CRR article, but the EGIM/GT also emphasises the importance of items a) and b) for validation (see paragraph 65(h) (iii.b) of EGIM/GT). By using not only pooled data but also a pool model based on it, point a) is in fact automatically fulfilled if the processes are similar enough. From a validation perspective, the focus is therefore particularly on point b), i.e. the issue of representativeness, which in this context includes related issues such as homogeneous processes and use across the pool.

Article 4 of the EBA RTS IMA deals with the requirements for third party involvement in the design, implementation and validation of IRBA rating models, addressing in particular the issue of service provider governance.

<sup>1</sup> Regulation (EU) No 575/2013

<sup>2</sup> Regulation (EU) 2022/439

<sup>3</sup> ECB guide to internal models - especially chapters "General Topics" (EGIM/GT) and "Credit Risk" (EGIM/CR) (as of May 2022)

#### **EBA RTS IMA, Art. 4, Third Party Involvement**

- 1. [...] where an institution has delegated tasks, activities or functions related to the design, implementation and validation of its rating systems to a third party, or has purchased a rating system or pooled data from a third party, competent authorities shall verify that that delegation or purchase does not hinder the application of the methodology referred to in this Regulation...**
- 2. [...]Where a third party is involved in the tasks of developing a rating system and risk estimation for an institution, the competent authority shall verify that: [...] (b) the validation activities with regard to those rating systems and those risk estimates are not performed by that third party; (c) the third party provides the institution with the information necessary for those validation activities to be performed.**
- 3. Where, for the purpose of developing a rating system and risk estimation, the institution uses data that is pooled across institutions and a third party is developing the rating system, the third party may assist the institution in its validation activities by performing those tasks of validation which require access to the pooled data.**

With regard to the topic of validation, paragraph 1 clarifies that the outsourcing of validation to an external service provider does not restrict the requirements for the supervised institution in any way (the requirements for the validation function can be found in chapter 3 of the same regulation). In particular, emphasis is placed on the need for the validation function of a bank to be independent of the developer unit, see Article 10 of the RTS IMA.

Paragraph 3, on the other hand, explicitly specifies for pool service providers that validation activities which require access to the common data pool may also be carried out for the validation units of the

institutions even if the pool service provider is also responsible for developing the rating model. What matters is the authority of the institutions' validation units over the validation approach at pool level as well as over the results of the pool validation as a whole.

Finally, in the EGIM/CR, the ECB provides guidance on the interpretation of the relevant regulations. Here, a wide range of references can also be found regarding pool models. Notable topics are the handling of external and pooled data (sections 3.2/3.4) and the requirements for the use of a pool model (sections 3.5/3.6).

## Enhanced validation options at pool level

The pool approach for the joint modelling of credit risks was born in connection with the implementation of the Basel II framework. For RSU GmbH & Co. KG (hereinafter: RSU) this means not only pooling the data of the participating institutions but using the pooled data to develop, review and validate rating systems.<sup>4</sup>

The advantage of this solution becomes evident quite quickly, especially in whole-sale lending: The most important ingredient for an accurate rating model that can be efficiently validated is a comprehensive dataset comprising relevant financial and

default information on a large number of borrowers. This information must be available on a broad, annual basis for a sufficient history. For many whole-sale segments, however, default information in particular is rather scarce due to the low probability of default and the limited number of customers (especially in what is referred to as low-default portfolios). Pooling data can help overcome this structural shortage.

To illustrate this, the following chart shows two accuracy curves over time, one at pool level and one at institution level:<sup>5</sup>

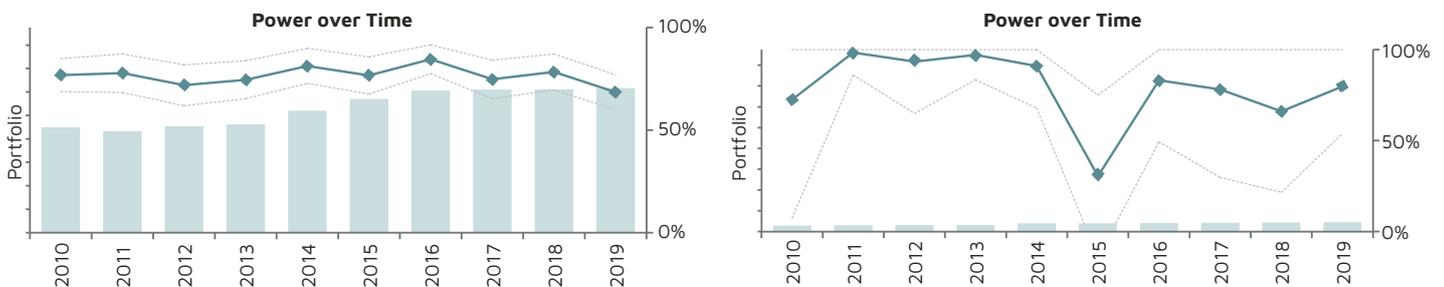


Figure 2: Discriminatory power over time at pool level (left) and institution level (right)

Naturally, there are fewer cases in the institution portfolio and the number of defaults is very low. The example in Figure 2 refers to an important portfolio of one of the top 10 banks in Germany. Nevertheless, it is clear that the discriminatory power at institution level fluctuates strongly and erratically and the confidence intervals are very large.

Modelling at the level of the pool thus substantially reduces the uncertainty in the model estimation or may even enable the data-based estimation of differentiated and accurate models in the first place. In addition, the model/parameters are likely to be more stable over time due to the greater stability of the observations.

<sup>4</sup> More precisely, RSU also implements and centrally operates the rating application for all participants. In addition, RSU offers a number of related products, e.g. migration matrices, stress test models, early warning systems, etc., see also [www.rsu-rating.de/en](http://www.rsu-rating.de/en).

<sup>5</sup> Discriminatory power is measured based on reference dates: The ranking implied in a set of ratings at a given reference date is compared with the default observations of the following year. The metric used is a power/Gini statistic.

With regard to validation, this means that certain tests and validation actions are unlikely to produce meaningful results at institution level. How can the accuracy and calibration level of a model be assessed if the confidence intervals basically allow any conclusion? After all, falsifiability is an important aspect of any meaningful validation process, i.e. the question by how much observations may differ from the predictions without calling into question the existing parameter settings. In model validation, the focus of a pool participant is therefore always on the pool and the results achieved there.

But it is not only in the mathematical-statistical and more test-based validation areas that the pool provides added value: Through joint modelling, specialists from all participating institutions are brought together and can thus consistently assess economic facts, for example: Is a default an exceptional case or an indication of potential for optimising the model? What is the market situation in a particular industry? Is the decline in passenger numbers in the context of the Covid crisis temporary or permanent? Each institution can contribute its own expertise or, to a certain extent, draw on know-how that may not be available to the same extent in-house. In other words, there is not only a pooling of data but above all a pooling of knowledge and expertise.

And yet another aspect opens up completely new possibilities for validation: If a borrower is rated by several banks using the same model ("duplicate"), different approaches can be compared and possible misunderstandings can be analysed, for example regarding the rating inputs. Potential measures to be taken if there are significant discrepancies include improving model guidelines or process specifications or - in the case of errors - correcting the mistake and providing additional training. In the long run, such a repeated analysis of "common obligors" in the pool can result in a more consistent approach than is possible for an individual institution.

So are there only advantages to participating in a pool solution? As is often the case, it is of course not that simple: Although the advantages mentioned above are undisputed and improve validation in many ways, new questions arise: To what extent do the validation results for the pool apply at institution level? Can good model performance at pool level also be assumed to hold for the specific portfolio of an individual institution? These questions, which are summarised under the term representativeness, will be examined in more detail below. The two relevant dimensions have already been addressed above: 1) To what extent do the model-relevant rating processes of the institution match those of the pool? 2) To what extent does the pool model fit the specific portfolio of the institution?

## Representativeness in the rating process

With regard to the rating processes, the model-relevant questions are immediately obvious: The participating institutions need a common understanding regarding the scope of application of the model, the relevant rating inputs and, last but not least, the question of when a rating needs to be updated or when a default has occurred. On the

one hand, the rating processes are the sole responsibility of the institutions. On the other hand, only sufficient homogeneity across the pool can ensure a coherent basis for modelling purposes as well as the suitability of the resulting model for each institution.

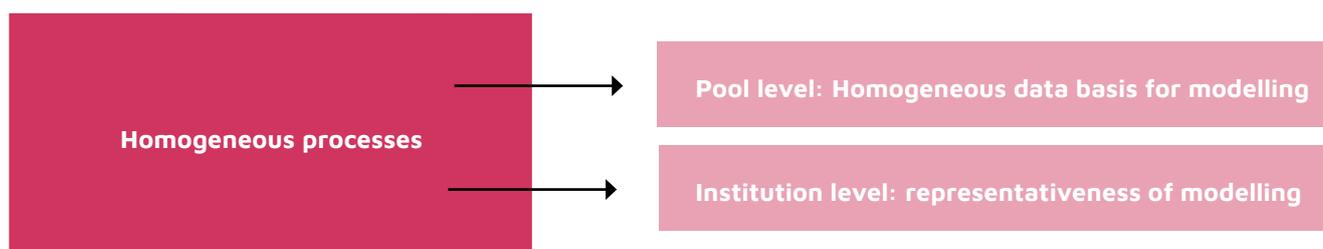


Figure 3: Comparable processes across participants contribute to a homogeneous data pool and improve the applicability of the pool results at institution level.

This becomes immediately obvious with regard to rating inputs: If one institution systematically uses different, perhaps more cautious, values than another, the rating results of the two institutions will not be comparable and in the end the parameter settings won't fit either institution. Likewise, different practices in identifying defaults lead to different default risks between institutions and therefore forecasts won't match the actual probabilities of default.

The pool addresses these issues through comprehensive and uniform specifications for the critical aspects as well as through a, as far as possible, uniform implementation of processes in the IT infrastructure. Because the higher the degree of such a common IT implementation and the higher the degree of integration of this IT with the institutions' IT environments, the less relevant many process-related issues actually are. What helps in addition are common policies and manuals as well as help texts and plausibility checks that are directly incorporated into the rating application.

For example, to facilitate consistent default identification among the participants in the RSU pool solution, the default criteria are directly integrated into the rating application. Nevertheless, default identification is initially carried out at the level of the institution, there are institutionspecific systems for the detection of the 90 days past due criterion and also institutionspecific processes for "specific credit risk adjustments". Homogeneity across the pool is then ensured in the first step by a common default and recovery policy. In addition, potential pitfalls are made transparent by means of a regulatory benchmarking exercise among the pool institutions. In this way, identified issues can be discussed and evaluated among the institutions and, if necessary, further measures can be determined.

In addition, the duplicates analysis for the pool provides further insight: Are the inputs at different institutions comparable, especially for the subset of "common obligors"? This question helps identify circumstances which are not yet sufficiently addressed in the manuals and guidelines.

### Deviations of the ratings over time

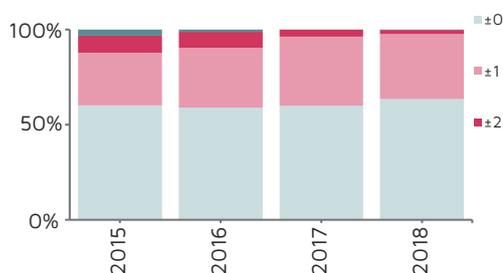


Figure 4: Duplicates analysis, differences between ratings over time.

Samples and ratios					
Year of approval date	2015	2016	2017	2018	
Number of ratings (in sample)	10.000	10.000	10.000	10.000	
Number of ratings with duplicates (≥2)	1.000	1.100	1.000	950	
Number of duplicate families (≥2 valid values)	434	508	477	458	
Ø Ratings per family (≥2 valid values)	2,3	2,2	2,1	2,1	
Ø Range in duplicate families	2,0	1,7	1,3	1,2	
Ø Deviation of the ratings from the median	0,0	0,0	0,0	0,0	
Share of ratings with deviation from the median of	max. ±0	62%	60%	60%	64%
	max. ±1	29%	32%	36%	34%
	max. ±2	9%	8%	4%	2%

That said, the ratings assigned to the same borrower by different institutions are unlikely to be exactly the same: Different rating dates, access to different information as well as different economic assessments can certainly lead to different results in individual cases. It is therefore important to give precise instructions for those inputs for which there

should be no variation. In the case of less objectifiable inputs, it is important that variations between institutions don't always move in the same direction in the sense that one institution systematically assesses certain conditions better than others do. This must be ensured by appropriate rules at pool level.

## Division of tasks for process validation

Such shared rule sets are the starting point for ensuring homogeneity at pool level as described above. The pool service provider (RSU) creates common policies for this and ensures largely uniform process support for the IT (incl. the necessary guidelines and manuals). In addition, however, compliance must be ensured through supplementary analyses and any need for further regulations must be identified. The main focus of the pool service provider naturally is to keep the quality of the data pool high while the institutions focus on the applicability of the pool model to the borrowers to be rated.

The pool service provider therefore carries out data quality checks as part of the validation process and analyses duplicates down to individual case level as well as the information on overrides and the causes of defaults. Anomalies are discussed with the institution concerned. The institutions, on the other hand, ensure compliance with the central requirements, which involves performing appropriate plausibility checks during validation: Which clients barely fall within the scope of application? Which clients can switch between the scopes of different rating systems? Are there any special issues in the

application of the definition of obligor default, the rating manual, etc.? Have there been any anomalies regarding rating updates? At this stage it is important to involve the other participating institutions if the anomalies are issues that should be discussed together or even harmonised across all participants.

The broader the data pool on the one hand, and the dataset available at institution level on the other hand, the more the case-by-case analysis can be scaled down or focused on particularly relevant cases. With enough data it may even be possible to rely entirely on the relevant top-down statistical analysis (especially in retail business, a case-by-case analysis may well be disproportionate). If in this scenario the validation can be carried out with a rather quantitative-statistical approach, then from the institution's point of view, in addition to the relevant analyses at institution level, the comparison of the overall pool level to the institution level is particularly relevant, for example with regard to default rates, override rates and data error rates. The necessary comparative analyses are usually provided by the pool service provider together with the results of the pool validation.

Samples and ratios					
Sample	P_2016	P_2017	P_2018	P_2019	P_2020
Amount Institution	543	534	528	526	499
Amount Pool	1.988	2.001	1.677	1.838	1.895
Overrides Institution	19,0%	15,1%	4,9%	1,5%	3,7%
Overrides Pool	19,8%	13,9%	5,3%	1,6%	4,7%
Negative overrides Institution	17,1%	13,7%	4,9%	1,5%	3,7%
Negative overrides Pool	16,5%	12,4%	4,7%	3,9%	4,9%
Positive overrides Institution	1,9%	1,4%	0,0%	0,0%	0,0%

### Change over time

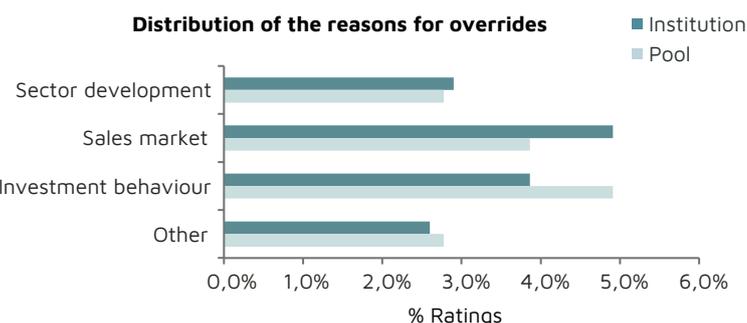
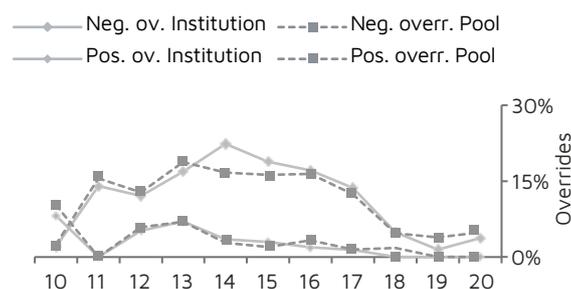
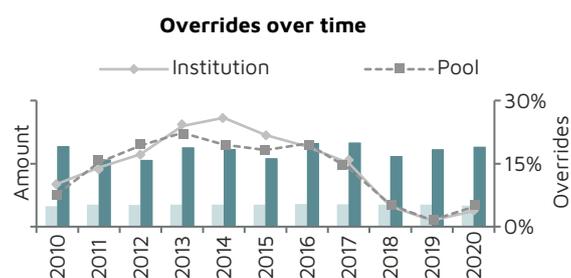


Figure 5: Comparison of override rates, pool vs. institution

In addition to the question of general consistency within the pool, with enough data the duplicates analysis also shows whether an institution systematically produces different ratings than the other pool participants. For this purpose, meaningful measures of deviation can be calculated at pool level, for example the median deviation of an institution within the duplicate groups or the share of ratings within a range of  $\pm 1$  or  $\pm 2$  notches. On the

other hand, the same analysis can also be run for the institution 's portfolio and can thus help identify systematic deviations from the institution 's perspective. In both cases, the analysis is completely in line with Figure 4 and can also be made available to each institution in aggregated form. Unfortunately, a detailed discussion with all participating institutions on the basis of the individual cases is not possible for reasons of confidentiality.

**If anomalies are observed in such an analysis, further analyses need to be performed in consultation with the institution concerned to investigate the causes and answer questions including:**

- Does the discrepancy result from individual strong outliers or are many ratings equally "affected"?
- Which component of the rating model is the primary source of the systematic discrepancy (e.g. manual upgrades or downgrades with a stronger effect, tendency to award better scores for qualitative factors)?
- Do the anomalies occur regularly or only once?

Central tasks	Tasks of each institution
<ul style="list-style-type: none"> <li>- <b>Check compliance with central specifications/ processes by analysing</b> <ul style="list-style-type: none"> <li>- data quality,</li> <li>- duplicates,</li> <li>- causes of defaults,</li> <li>- etc.</li> </ul> </li> <li>- <b>Report anomalies to institutions</b></li> </ul>	<ul style="list-style-type: none"> <li>- <b>Ensure compliance with guidelines, in particular with regard to</b> <ul style="list-style-type: none"> <li>- scope of application,</li> <li>- rating updates &amp; complete inputs,</li> <li>- data quality,</li> <li>- default identification,</li> <li>- 'second pair of eyes' principle.</li> </ul> </li> <li>- <b>Continuous feedback on problems with central guidelines (e.g. via tickets, user questionnaires)</b></li> <li>- <b>Report anomalies that affect the pool</b></li> </ul>
<p><b>If there are any anomalies, RSU and the institution concerned will agree on how these should be looked into.</b></p>	

## Representativeness of the model

The second and essential issue of representativeness is the question of the applicability of the pool model to an individual institution's portfolio. More precisely, the pool rating model must adequately reflect all credit risk factors relevant to the current portfolios of the individual institutions.

The first part of this question has already been answered above: If the borrower to be assessed with a rating model constitutes a typical use case for that model and if there are no process-related differences that would indicate a difference in risk between the banks, then why should the probability of default suggested by the pool model not also apply to an individual institution? Or vice versa: Why should the default risk of a rated borrower depend on the bank that prepares the credit rating? So the presumption of innocence can justifiably apply here, provided that the two conditions mentioned above are met.

But what does "typical use case" mean in this context? The basis for answering this question is the scope of the rating model. In addition, there are the conclusions to be drawn from process validation.

However, within this defined framework, there could be a difference in use with regard to risk aspects. In the simplest case, one bank primarily does business in Germany, another internationally. To what extent such a difference is actually relevant in terms of risk or whether the model is even capable of differentiating precisely between these differences is the core of the question of representativeness.

The easiest way to answer this question is if the structural characteristics of an institution's portfolio are comparable to those of the pool. The underlying similarity allows a simple transfer of the pool validation conclusions to the institution level. This only applies of course if the structural features relate to what the model is supposed to represent, i.e. if they are relevant to credit risk. Such differences can usually be identified quickly by looking at the distributions of the characteristics in question but can also be identified by means of objective statistics. In practice, an analysis of the Population Stability Index (PSI) or the Jensen-Shannon Distance (JSD), for example, has proven useful for a statistical comparison of similarity:<sup>6</sup>

$$JSD(P, I) = \sqrt{\frac{1}{2} \left[ \sum_x P(x) \cdot \ln \left( \frac{2 \cdot P(x)}{P(x) + I(x)} \right) + I(x) \cdot \ln \left( \frac{2 \cdot I(x)}{P(x) + I(x)} \right) \right]}$$

P or I are the frequency distributions of a characteristic in the pool or institution portfolio, values greater than 0.25 indicate a difference between the distributions and should be analysed more closely if necessary. Due to the limited value range between 0 and 1, the interpretation of the JSD is somewhat easier than that of the PSI. Although both ratios take the distribution as a whole into account, they do not depend on the number of observations. Especially if the numbers at the institution level become small, the calculated values should be treated with caution. The more common chi-square test, on the other hand, takes the sample size into account, but in practice its prerequisites are usually substantially violated (normal distribution) and the results differentiate too strongly. For large sets, therefore, hardly any deviations are allowed, so that even minimal differences are considered significant. After all, the aim is not to ensure the greatest possible similarity between the pool and institution distribution but rather to identify cases that need to be examined more closely.

In fact, there's one of the most common misconceptions that pool participants need to battle again and again: While similarity of structural characteristics helps prove representativeness, dissimilarity is not yet a strong indication of non-representativeness. In the example above, the different regional distributions of the institution portfolios are not an indication of limited representativeness if there is a separate set of model parameters for Germany. There is also no problem if the portfolio of an institution is special but the pool model clearly performs well for this special subportfolio (the central criteria here are always calibration and discriminatory power). For this reason, any dissimilarities identified (e.g. by means of JSD) should always be regarded as triggers; such cases should be looked into, but assessing representativeness for one's own portfolio is a complex issue. When in doubt, the close exchange between the pool and the institution helps in the assessment of relevant facts.

<sup>6</sup> The statistics mentioned do not constitute an RSU recommendation but are merely examples of institution procedures that the author has observed at various institutions and considers to be sufficient.

## Division of tasks for model validation

So, what is the division of tasks between the pool and the institutions in model validation? The key task of the pool service provider is the independent validation of the pool model, with the performance of the model being initially assessed at the level of the overall pool portfolio. The requirements for pool validation in this first step are quite similar to those for validation at institution level.

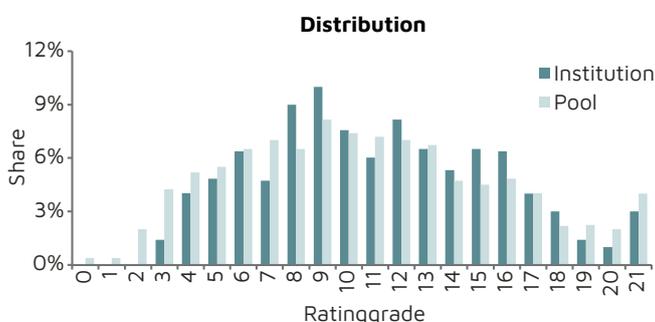
The model 's performance is also assessed for the institution 's portfolio. Naturally, the more data is actually available at the institution level, the more meaningful that assessment is. In extreme cases, there is sufficient data at the institution level to analyse model validity without referring to the pool. The validation methodology used at the institution level should in any case be compatible with that of the pool to avoid contradictory conclusions. The easiest way to achieve this is for the institutions' validation units to agree on a pool validation frame-

work that forms the basis for validation at pool level but is also applied at institution level to the extent possible. Ideally, the pool service provider also supplies the necessary analyses at institution level and keeps an eye on the relevant statistics at the institution level during the pool validation. In this way, identified issues can be discussed bilaterally at an early stage. In addition to ensuring representativeness for the individual institutions, the pool service provider is responsible for ensuring the homogeneity of the data pool.

Since there is usually not enough data available at the institution level to assess the validity of the model, it is always necessary to evaluate and adopt the pool validation results. As explained above, in addition to the analysis of relevant changes in credit processes, the comparison of different distributions and statistics between the institution and pool level may be helpful for this purpose.

Samples and ratios											
Sample	P_2010	P_2011	P_2012	P_2013	P_2014	P_2015	P_2016	P_2017	P_2018	P_2019	P_2020
Amount Institution	835	924	930	932	940	945	963	1.016	1.001	950	846
Amount Pool	3.886	4.066	4.345	4.393	3.902	3.848	3.951	4.343	4.248	4.620	3.806
Internal CT Institution	4,49%	3,98%	3,52%	2,83%	2,32%	2,25%	2,13%	2,05%	1,88%	1,53%	1,89%
Internal CT Pool	4,06%	3,59%	3,37%	2,49%	2,15%	1,83%	1,92%	2,07%	1,86%	1,41%	2,12%

### Overview current portfolio



### Change over time

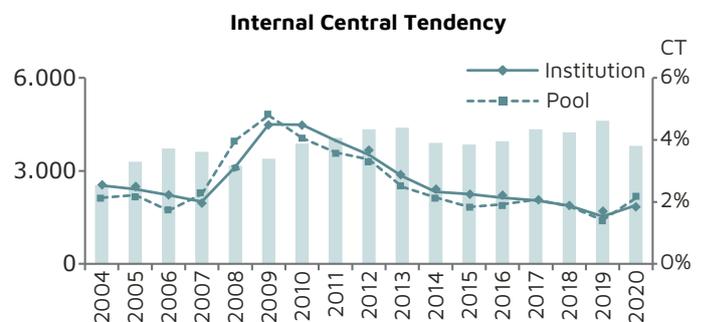


Figure 6: Comparison of rating distributions at institution and pool level for most recent observation period and over time <sup>7</sup>

<sup>7</sup> RSU uses the same grade scale for all rating systems, with fixed PD estimates assigned to each grade. The central tendency is the average PD estimate.

An institution can adopt the pool validation results more easily if the pool and institution portfolios are very similar. If this is not the case, representativeness must be assessed, in particular, on the basis of the model structure and observations on calibration and discriminatory power. More extensive analysis may then be necessary. For example, it may make

sense to examine a subset of the pool that is more similar to the institution portfolio. The results of that analysis may then be easier to adopt at institution level.

The following table summarises the division of tasks under the RSU pool approach to model validation:

Central tasks	Tasks of each institution
<ul style="list-style-type: none"> <li>- <b>Ensure independent validation of the rating model at pool level</b></li> <li>- <b>Perform certain analyses at institution level</b></li> <li>- <b>Support validation/demonstration of representativeness at institution level by</b> <ul style="list-style-type: none"> <li>- providing a central conceptual framework</li> <li>- providing certain quantitative analyses at pool and institution level</li> <li>- supplying the individual institution's data that have been included in the pool-level analyses ("raw data")</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- <b>Analyse model performance for institution portfolio, taking into account the results obtained at pool level</b></li> <li>- <b>Examine to what extent pool validation results can be adopted for own portfolio</b></li> <li>- <b>If there are anomalies at institution level that have implications for the entire pool (e.g. representativeness issues), inform RSU promptly</b></li> </ul>
<p><b>If there are any anomalies, RSU and the institution concerned will agree on how these should be looked into.</b></p>	

## Conclusion

For the validation of low-default portfolios institutions depend on external data sources: Only rarely will a single institution have sufficient data to be able to obtain meaningful validation results.

Low default portfolio or not: Pooling data to develop rating systems rather than using benchmark information from rating agencies provides institutions more transparency regarding model design as well as substantial influence on methodology, not least in the area of validation. In addition, an institution's rating data is generated with the same model as all other data in the pool so that representativeness, although still an issue, is much less of a challenge than when using external data.

The remaining questions about representativeness must be carefully answered by each institution: 1. Do the institution's rating processes match those of the pool where this affects the model? 2. Does the pool model fit the institution's specific portfolio? If so, there is no reason for an institution not to rely on the validation results obtained at pool level. In addition, the know-how gathered in the pool helps analyse overarching issues. Furthermore, data pooling provides more extensive validation options, in particular the comparison of individual model statistics with the pool values or of ratings assigned to the same obligor by different institutions. So from a validation perspective, the pool approach is definitely the way to go!

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