Z-RiskEngine®
Unlocking Credit Cycles

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IFRS9 Credit Model budgets can be **reduced by up to 30%** - by utilizing more efficient model architecture

Satisfying multiple regulatory and risk management objectives for banks today requires sophisticated credit modelling and a flexible architecture. At the same time, the complexity of the Global Covid Pandemic has made risks much more dynamic and uncertain. Add all of this together and CROs and CFOs require credit model solutions, which support all of these complex objectives, that are both more accurate and more flexible – and which actually reduce model build and maintenance costs at the same time.

Supporting IRB credit model requirements together with newly established IFRS9 requirements is a good example of the complexity banks face. IRB requires Through-The-Cycle (TTC) based credit models, whereas IFRS9 for wholesale credit portfolios requires 'forward-looking', Point-In-Time (PIT) models. This has led many banks for their wholesale credit portfolios to build IFRS9 models that are closely related to their IRB models.

In this fairly common approach, banks have adapted their IRB Probability of Default (PD) models for the Wholesale book to use for IFRS9, by adding a PIT layer or adjustment on top of the IRB models. This approach couples their IRB models with various macro-economic data, by creating a second stage model which is generally more forward-looking. [1] [2]

However, the creation of a direct functional dependence between IRB and IFRS9 models, by banks using this approach, is generally not the lowest cost or more accurate solution for satisfying IFRS9.

1 IFRS9 models today generally utilise macro-economic data in various ways to try to convert 'TTC' credit models to the 'PIT' measures IFRS9 requires. For the benchmark analysis presented here, we assume IFRS9 PD models are estimated separately in a second-stage model, **but as a direct function of IRB PD models**. This is one approach many banks are currently using and, in future articles, we will survey all of the various methodologies currently used.

2 In this discussion our focus is on IRB PD models, as they involve a substantial amount of work. For simplicity we exclude IRB LGD and EAD models from this discussion and the following, illustrative benchmark analysis.

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We argue that this multi-layer two-stage, linked modelling approach, unfortunately, requires potentially ***double the number of PD models*** – making it more costly than it should be to design, implement, and maintain. In Europe in fact, the EBA-sponsored 'IRB Repair Programme' which requires all European banks to re-develop their IRB credit models will also require banks with a dependent IRB-IFRS9 model architecture to need new IFRS9 models as well. This clearly demonstrates that having dependent models incurs excessive model development, review and implementation costs compared to an independent model architecture.

We calculate in an illustrative benchmark exercise described in this article, that *banks* ***could save up to 30% of their credit model operating budgets*** – by utilizing a single, holistic IFRS9 model architecture – where IFRS9 models are independent of IRB models. As opposed to building separate IFRS9 PD models for every IRB model, it's possible to apply macro-economic and more detailed credit cycles in a batch architecture that takes IRB models as direct inputs.

Not only can CROs and CFOs save substantial model operating costs – they can also obtain roughly ***double the accuracy*** for projecting IFRS9 credit losses using a single, holistic model architecture coupled with more robust industry and region credit cycles.[3]

Macro-economic variables combined with industry/region cycles is simply more accurate and costs less.

Banks could save up to 30% of their credit model operating budgets – by utilizing a single, holistic IFRS9 model architecture

3 See bibliography for research papers motivating statistically significant improvements in IFRS9 ECL projections.

In this article we use an illustrative benchmark analysis to;

- Compare, two different credit model architectures – one requiring two sets of dependent IRB and IFRS9 models, with one applying a central model architecture – cutting nearly in half the number of PD credit models,
- Develop illustrative E2E benchmark bank operating budgets for both model architectures, and,
- Show for an example, that an illustrative Tier 1 EMEA bank, could save roughly 30% of operating costs over 5 years.[4]

4 We use a European bank as an example because they face the added need to redevelop all, of their IRB models in addition to redeveloping their IFRS9 models if they use a two-stage IRB-IFRS9 credit model approach. Therefore, they face the highest redevelopment and implementation costs. **The benchmark analysis presented here however applies to all banks using a dependent IRB-IFRS9 approach.**

A. Two Approaches to Developing IFRS9 Wholesale Credit Models:

Since Basel II arrived, banks have spent substantial budgets developing and refining IRB models to support their regulatory capital assessments. In the last 5 years, IFRS9 has added the requirement to develop companion PIT PD, LGD and EAD models to go with the IRB TTC models.

For a large, global bank with substantial wholesale, commercial and corporate portfolios, across multiple regions, building these models requires substantial staff to develop and support. Add newly required IFRS9 model costs and bank's credit model operating budget requirements can be substantial.

For banks using this two-stage approach, the first set of models develops mostly TTC calibrations for IRB – the second set of dependent models adjusts IRB PD models on a model-by-model basis, in a second-stage model to apply cyclical macro-economic adjustments. Relative to IRB models, this second stage typically produces improvements in Point-in-Time measures but doesn't go far enough in improving ECL accuracy.

As already highlighted, this approach to wholesale PD models requires ***potentially double the number of PD models***.

The **Figure** below provides a graphic that compares two different approaches, on the left is the current approach many banks use, that develops two PD models for each obligor type, an IRB TTC model and an IFRS9 model dependent functionally in some way on the IRB model. On the right is an IFRS9 model architecture that applies macro-economic and credit cycle variables in a single batch adjustment to a bank's IRB PD models. The centralised model architecture shown on the right requires development of a **single model approach and applies this model to obtain PIT PDs directly in a single step**.

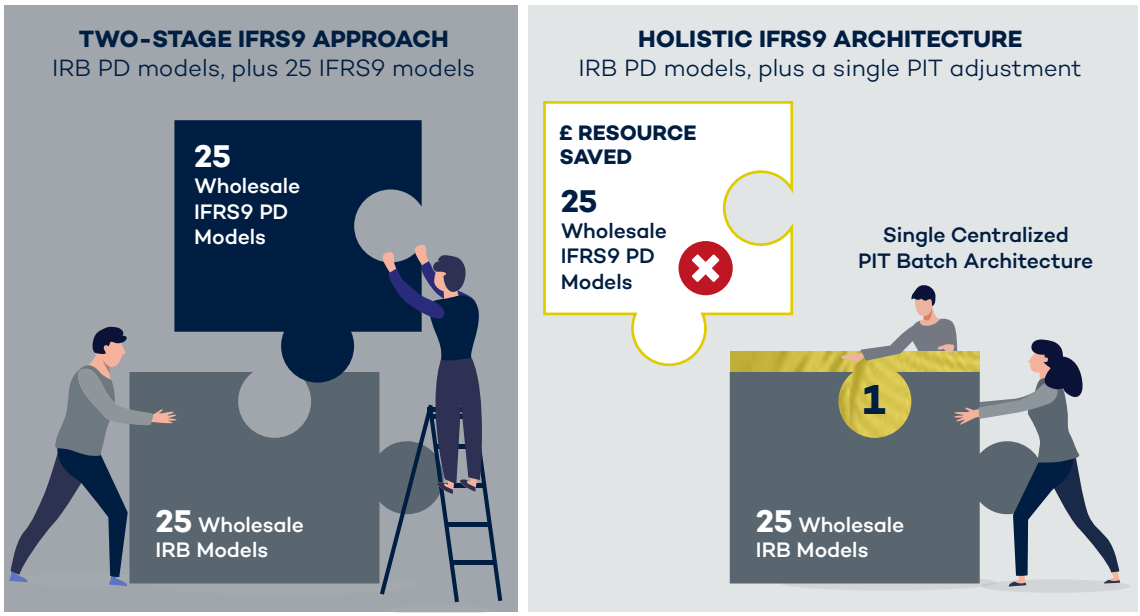

Figure graphic showing on the left, IRB PD models in stage 1 and equal numbers of IFRS9 PD models in stage 2, and, on the right, IRB PD models and a single IFRS9 Batch model architecture.

The PIT adjustments shown on the right in the **Figure** can be thought of as, adding or subtracting detailed credit cycles from TTC PDs. Accomplishing this objective as a single model framework has been possible for over 15 years and was developed, implemented, and agreed under the Basel II Waivers of Barclays in 2007 and RBS in 2013. In both successful IRB Waivers, a centralized PIT-TTC ratings approach, using, industry and region credit cycles in conjunction with macro-economic variables was used to obtain more accurate PIT credit measures.

Applied on a centralised, automated basis to all IRB models simultaneously, this model architecture is implemented, as a single model, not multiple models. For IFRS9 today, utilizing this kind of single-model approach instead of a two-stage approach is what leads to substantial credit model operating cost savings.

For IFRS9 today, utilizing a holistic single-model approach instead of a two-stage approach is what **leads to substantial credit model operating cost savings**

B. Reducing Credit Model Operating Costs – Benchmarking the Two Approaches:

To illustrate the potential operating costs savings available to banks that switch to a single PIT model architecture we present an illustrative bank example. Based upon our experience running E2E bank model teams, we describe the potential staffing and credit model budgets for a hypothetical Tier 1 EMEA bank with a global balance sheet of about £900 bil in total assets. Our focus will be on the commercial and corporate portfolios that by assumption are global, covering multiple geographic areas.[5]

The illustrative bank used in this benchmark analysis being headquartered in Europe, has faced the substantial IRB and IFRS9 model rebuilding effort the IRB Repair Programme will require over 2019-22. In this analysis, we assess example budget requirements for:

- E2E modelling (data and quantitative analysts),
- Internal model validation teams,
- BAs, and developers required to implement the commercial and corporate IRB and IFRS9 PD, LGD and EAD credit models.

The illustrative benchmark analysis is assessed for;

1. common IFRS9 model development approaches requiring separate, and dependent two-stage IRB and IFRS9 models, and,
2. the application of a holistic IFRS9 architecture that applies macro variables and empirical credit cycle adjustments to each borrower implemented as a single, automated batch process.

5 The focus is on wholesale portfolios because; (1) the IRB models for these portfolios are mostly TTC and, (2) most retail portfolios already utilise IRB models that are mostly PIT. The implication is the bigger problem banks have, is the more complex conversion of their wholesale IRB models to IFRS9 PIT measures.

Illustrative Benchmark Bank example assumptions;

- 35-40 total commercial and corporate PD models across regions, obligor types, customer segments, and globally
- Example bank also has IRB LGD and EAD models to develop but the focus across the two architectures is on PD models
- Hypothetical £900 bil balance sheet centred in Europe but global
- 5-year operating budget horizon for 2020-2024
- Illustrative budgets cover staffing costs for E2E model development, implementation including formal model review and sign-off with the bank's Regulators and Accountants for IRB and IFRS9.
- **The logic of this benchmark analysis applies to all banks globally, using the two-stage or similar IFRS9 approaches.**

We have been developing credit models for roughly 25 years, including supporting two successful Basel II Waivers, and our experience running large model teams and budgets for Barclays and RBS over 2003-2014 informs our illustrative staffing and budget assumptions. We also had formal E2E cross-functional responsibility for analysts, quants, BAs, and model implementation to support the IT staff, so our experience is used to estimate these benchmark budget requirements for the E2E illustrative example presented here.[6]

Table 1: Benchmark Illustrative E2E Credit Model Resources Required – Interdependent IRB-IFRS9 Model Approach

Annual average staffing requirements – FTE equivalents

	2020	2021	2022	2023	2024	2020-24
Data/Quant Analysts	50	50	35	20	20	
Model Validation Analysts	20	20	15	12	12	
Ba/Model Developers	25	25	18	14	14	
Project Managers	7	7	6	5	5	
Total	**102**	**102**	**74**	**51**	**51**	**380 FTE**
Avg Annual Staff Cost - £110k						
Total 5 Year Wholesale Model Budgets Required						**£41.8 MIL**

6 Banks organise their modelling and implementation teams in different functional and organisational ways. Across Group and business unit functions - this example is simplified and presented for the aggregate credit model budget costs for brevity.

Table 2: Benchmark Illustrative E2E Credit Model Resources Required – Centralised IFRS9 Architecture

Annual average staffing requirements – FTE equivalents

	2020	2021	2022	2023	2024	2020-24
Data/Quant Analysts	36	36	22	14	14	
Model Validation Analysts	14	14	10	8	8	
Ba/Model Developers	18	18	12	10	10	
Project Managers	5	5	4	3	3	
Total	**73**	**73**	**48**	**35**	**35**	**264 FTE**
Avg Annual Staff Cost - £110k						
Total 5 Year Wholesale Model Budgets Required						**£29 MIL**

Assumptions:

- Average annual staff costs assume:
  - They are fully loaded for benefits
  - Represent a mix of senior and junior, contract and permanent staff
  - A mixture of higher and lower cost geographic regions
  - The credit data, modelling, model review and model implementation staff are internal[7]
- The bank's regulatory and modelling approach:
  - The bank is an IRB bank for regulatory capital purposes
  - As a European bank, all IRB models will be re-developed in 2020-2022
  - The credit models in 2023-4 go through a normal internal annual review, with some being updated for new data and revised calibrations

As shown in this illustrative example, large banks with substantial wholesale credit portfolios face the need to develop and manage a whole portfolio of complex credit models in support of regulatory and accounting objectives. The choice of modelling methodology and architecture is a complex one as it can directly impact credit model operating costs. In the example presented, the approach some banks use for IFRS9 modelling is too dependent upon the bank's IRB models. ***These modelling choices in turn can require substantial costs to develop support and sign-off, for example in Table 1 for the two-stage approach.***

7 The costs outlined in this illustrative example, could be potentially higher, everything else the same, for banks who are utilising external consultants in addition to their internal modelling teams, to support their IRB model development for the IRB Repair Programme in Europe.

Alternatively, there is a well-developed PIT methodology available today using a centralised IFRS9 and stress testing architecture that has been approved by regulators and accountants, and which can reduce, credit model operating costs by up to 30% or more.[8] In **Table 2**, for this centralised architecture, compared to the two-stage modelling approach, the illustrative bank **reduces E2E modelling costs by about £13 million over 5 years**.

So how does a large bank today migrate away from decentralised IFRS9 models that are dependent upon the bank's IRB models? Banks in this situation have two choices – they can build their own centralised IFRS9 model architecture at substantial cost, or they can utilise an external solution that is customised to their own portfolio footprint, is fully approved, and which then takes as input the output from their IRB, PD, LGD and EAD models directly.

The ***Z-Risk Engine® Solution*** is available now and is fully compliant with IFRS9 and Stress Testing requirements and which has been formally approved for IFRS9. Z-Risk Engine (ZRE) can be licenced and implemented for a fraction of the cost of an internal build. Utilizing a centralised IFRS9 architecture in an automated batch process, banks have the potential to reduce their operating cost budgets as this example has shown if they are using the two-stage IFRS9 model approach.

Utilizing a centralised IFRS9 architecture in an automated batch process, banks have the potential to reduce their operating cost budgets

In addition, adding detailed industry and region credit cycles to macro-economic factors using the ZRE approach, has been shown empirically ***to roughly double PIT model accuracy in predicting credit losses.***

Overall, reducing credit model operating costs, and improving loss prediction accuracy can provide substantial business benefits.

8 The holistic IFRS9 architecture described here, can support both IFRS9 and Stress Testing in the single architecture described.

Developed by Aguais And Associates Ltd, Z-Risk Engine® (ZRE) provides a highly accurate, centralised, and integrated solution supporting global bank's compliance for IFRS9, CECL and Stress Testing regulations.

ZRE is a proven and efficient route to regulatory compliance for CROs and CFOs that also delivers up to a 30% reduction in IFRS9 modelling operational costs. As an advanced suite of Python or SAS® based software that works with a bank's own IRB wholesale internal credit models, ZRE unlocks complex industry and regional credit cycles to accurately convert TTC PD, LGD and EAD models into PIT measures. Whilst lowering implementation risk, the solution is also highly configurable and customisable to support large bank's detailed portfolio mix of commercial, corporate and bank clients.

BIBLIOGRAPHY

Aguais, S. D., Forest, L. R. Jr., Wong, E. Y. L., and Diaz-Ledezma, D. (2004). Point-in time versus through the-cycle ratings. In The Basel Handbook: A Guide for Financial Practitioners, Ong, M. (ed). Risk Books, London.

Aguais, S. D., Forest, L. R. Jr., King, M., Lennon, M. C., and Lordkipanidze, B. (2007). Designing and implementing a Basel II compliant PIT–TTC ratings framework. In The Basel Handbook II:A Guide for Financial Practitioners, Ong, M.(ed).Risk Books, London.

Forest, L and Aguais, S (2019), "Inaccuracies Caused by Hybrid Credit Models and Remedies as Implemented by ZRE."

Forest, L and Aguais, S (2019), "Scenario Models Without Point-in-Time, Market-Value Drivers Understate Cyclical Variations in Wholesale/Commercial Credit Losses."

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