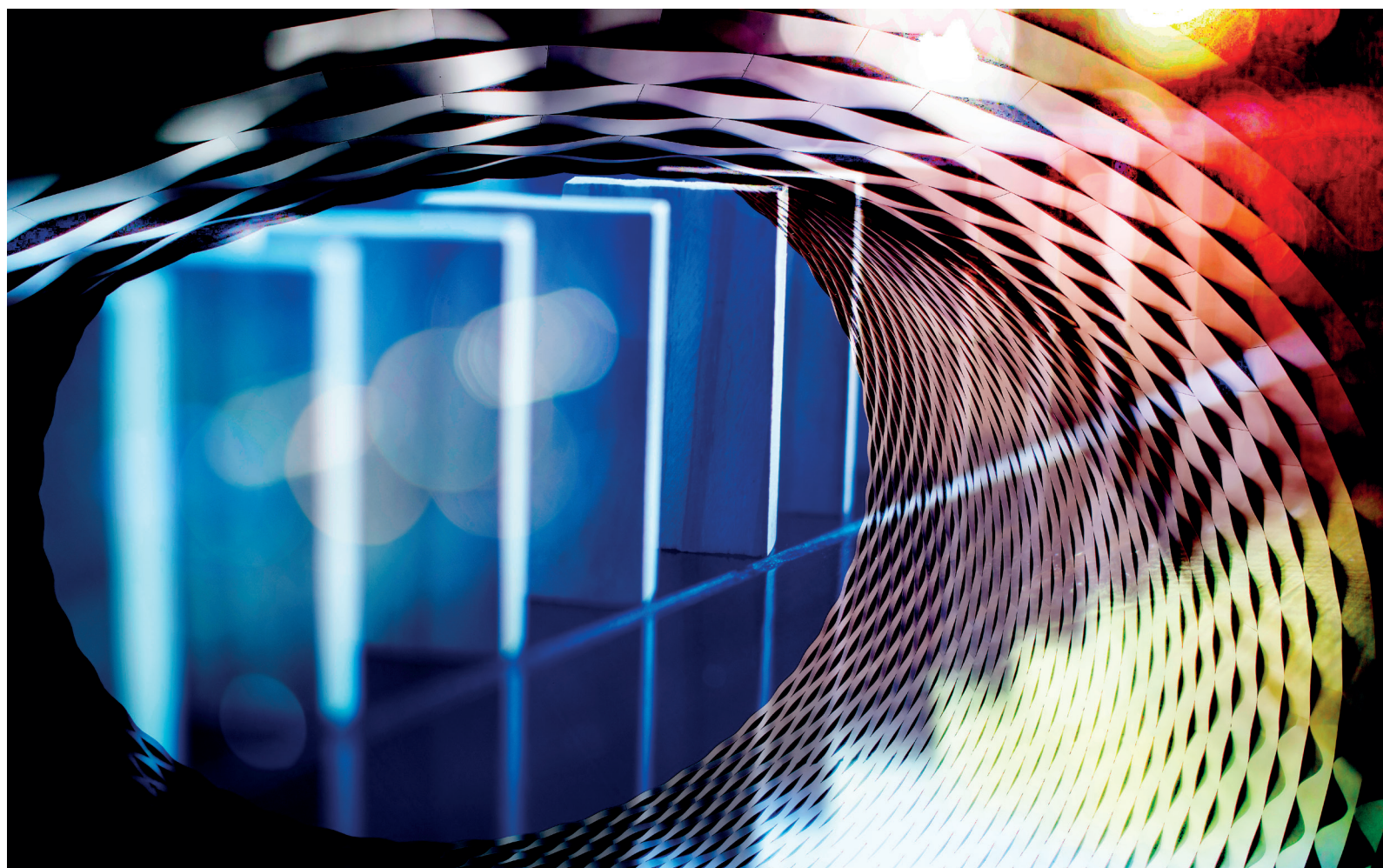


Credit risk & modelling

Special report 2021

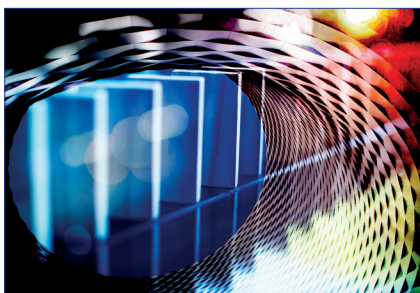
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The wild world of credit models

The Covid-19 pandemic has induced a kind of schizophrenia in credit risk models. When the pandemic hit, banks overprovisioned for credit losses on the assumption that the economy would head south. But when government stimulus packages put wads of cash in the hands of consumers and businesses, the models changed course, leading banks to release reserves back into the income statement. This year, the models have shifted yet again as the stimulus programmes wind down and banks assess the impact on borrowers.

Banks have taken to manually adjusting the outputs to increase reserves. “The models are saying ‘release, release, release’ as we get out of the crisis,” says a credit risk executive at a large US regional bank. “The models are saying: ‘Given a good economic environment, we should be reducing reserves.’ But nobody’s comfortable with that level, given there’s still a lot of uncertainty in the economic environment.”

Banks are required to think ahead and set aside reserves to cover expected losses in their credit portfolios. Lenders outside of the US fall under the International Financial Reporting Standard (IFRS) 9, which divides loans into three groups. Performing loans are considered so-called stage 1 assets, assets that have significantly deteriorated in credit quality are classed as stage 2, and assets that have become impaired or lost value move into stage 3. Banks must hold enough provisions to cover 12 months of expected credit losses (ECLs) for stage 1 assets. For the other types of loans, they must hold reserves to cover the assets’ lifetime.

Under the Current Expected Credit Loss accounting standard in force in the US, the entire loan book is treated as if it contains only stage 2 or 3 assets. ECL provisions must therefore cover the life of the loans.

Deutsche Bank adjusted the outputs of its ECL models this year and last. During the first quarter of 2021, there were questions over consumers’ ability to repay loans as payment moratoria were eased. Therefore, the bank manually increased the provisions produced by its models. It did the same – and to a greater degree – in Q3 and Q4 2020 as the overall economic outlook remained hazy.

While the pandemic has thrown loan loss models into chaos, banks are forging ahead with machine learning algorithms that can replace many of the human tasks associated with credit underwriting. There is a catch, however: banks could leave themselves open to costly lawsuits if their models unwittingly discriminate against particular social groups. But, while the risks may be high, so too are the rewards.

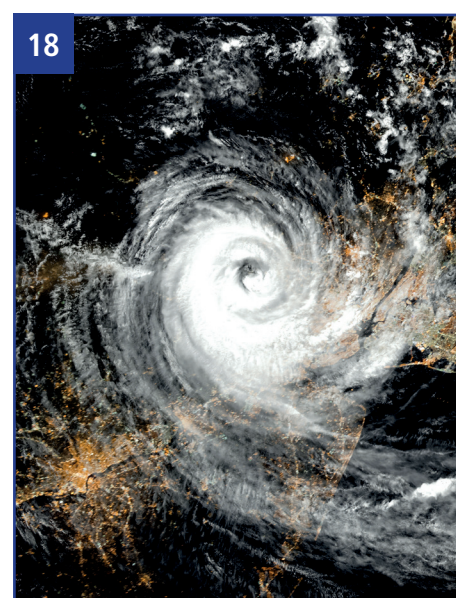
With regulators on both sides of the Atlantic scrutinising the use of machine learning models, banks are adopting a ‘horses for courses’ approach, reserving the more advanced techniques for less sensitive tasks with lower explainability requirements. The more sensitive the application, the easier it must be to explain.

JP Morgan has been developing gradient-boosted decision tree models – where multiple decision trees are combined to reduce prediction error – to generate proprietary credit scores for use in its consumer and community bank. The machine learning models are able to take in hundreds of attributes. The bank says the models provide a finer-grained ordering of risk than traditional credit-scoring models that rely on logistic regressions.

Wells Fargo has developed methods for explaining a widely used form of deep neural network with rectified linear units. One such method decomposes the network into an equivalent set of local linear models that are easier to interpret, the bank says. If the technique proves successful, it may be an important step in helping lenders explain complex machine learning algorithms in credit underwriting.

Steve Marlin

Staff writer, Risk management, *Risk.net*



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US banks step up FX optimisation push

With swaps and forwards hit hard by the new counterparty credit risk capital requirements measure, dealers turn to vendors and bilateral restructuring. By Joe Parsons

US banks are intensifying efforts to optimise their foreign exchange swaps and forwards portfolios affected by the new capital regime for counterparty credit risk, which kicks in for most dealers at the end of 2021 and threatens to increase end-user costs for these instruments.

From January 1, 2022, US banks that have not adopted early must switch to a new measurement for counterparty credit risk capital requirements, known as the standardised approach to counterparty credit risk (SA-CCR). Impacts vary across Wall Street, but market participants believe the new methodology will generally result in higher capital charges for the products.

As a result, more dealers have been looking to FX optimisation vendors to compress and optimise interdealer trades while seeking to restructure existing trades with clients to minimise the impact and capital costs that need to be passed on to clients through pricing.

"FX is the most affected by SA-CCR... [and] it is going to be a big process for the whole industry to deal with that. We are doing a lot in the way of capital optimisation and looking at our exposures to make it work as efficiently as possible," says the head of FX at one US bank.

"[But] most of the counterparty credit risk exposure that exists in FX is driven by end-users. If they don't do anything, they will wear higher costs," he adds.

SA-CCR punch

The move to SA-CCR affects US banks' FX businesses in a couple of ways. First is through the Collins floor, an amendment to the Dodd-Frank Act that requires US banks calculating risk-weighted assets (RWAs) for counterparty credit risk to apply the harsher capital output of their internal model or a standardised model approved by regulators, which changes from the decades-old current exposure method (CEM) to SA-CCR at year-end.

Second is the leverage ratio, which was using CEM to calculate derivatives exposures but will change to SA-CCR.

CEM has long been criticised as risk insensitive and has mostly penalised instruments with large gross notionals, such as interest rate swaps. CEM was also weighted by duration, meaning it was friendly to short-dated products such as FX swaps and forwards.

SA-CCR, on the other hand, gives no benefit to short-dated maturity trades and penalises directional risk heavily. Uncollateralised trades also bring higher exposures, all of which is seen as a particular problem for FX businesses.

The US bank's FX head says swaps and forwards are short-dated but tend to be rolled constantly,

"Most of the counterparty credit risk exposure that exists in FX is driven by end-users. If they don't do anything, they will wear higher costs"

Head of FX at a US bank

meaning they are consistently on the books.

The market structure also means the trades are typically directional – clients often buy bonds in euro and hedge back into US dollar, for instance. Corporates, which tend to be uncollateralised, also tend to use swaps and forwards to hedge a particular risk in a given country, again resulting in directional exposures.

"Even for a one-month FX forward or swap, there's a fairly dramatic increase in capital requirements due to the directionality," says the FX head.

According to a recent study by Quantile of 40 banks and financial institutions on the impact of SA-CCR on their business, 38% of respondents predicted a significant increase in capital requirements for FX.

Testing times

As a result, US banks have been ramping up their efforts with optimisation vendors to reduce the directionality of their books.

"SA-CCR is now very much top of mind for the most senior people within the FX businesses of the banks," says Gil Mandelzis, chief executive of Capitolis, a provider of optimisation services.

"For certain counterparties or activity, you can't do the same thing and impede the cost, as under SA-CCR it will make it uneconomical. There are two ways to deal with this – they can either optimise it, or, where they can't, the banks have to change the revenues generated through fees or spreads, or conclude that it is uneconomical to do with certain trades with certain clients."

In general, the optimisation process sees the dealers enter a series of new trades or novations to flatten risk in either a bilateral or multilateral environment.

SA-CCR does actually help this by allowing netting by currency, no matter the tenor. For example, a bank that is long euro/short US dollar at a short tenor and then short sterling/long US dollar at a longer tenor can net out the positions to arrive at a long euro/short sterling position. That gives optimisation vendors more options when looking for ways to reduce risks.

Capitolis has conducted SA-CCR optimisation runs through its bilateral service, and LMRKTS – a multilateral optimisation vendor that Capitolis acquired in August – has also added SA-CCR to its runs since June 2020.

Hilary Park, co-founder and chief executive of LMRKTS, says the firm currently has two entities

that are optimising to both SA-CCR and CEM, and which have achieved capital savings of 20–40% in the test and live runs. There is also talk of increasing the frequency of the runs as the end of the year approaches.

"There is a lot of engagement around the right frequency of optimisation, either doing [the runs] monthly or maybe even more," says Park.

Tobias Becker, head of business development at Quantile, says the vendor started SA-CCR optimisation pilot runs around nine months ago, with 29 entities participating. The firm is currently running monthly SA-CCR optimisation cycles and is seeing increasing interest, he says.

"On SA-CCR itself, the industry has picked FX as the first asset class to tackle. Many banks are live with our optimisation runs, and we have a lot testing that are not yet live," says Becker.

Capitalab and TriOptima also provide FX compression and optimisation offerings in this space.

Tackling portfolios

Yet the success of these multilateral optimisation services depends largely on the participation of as many dealers as possible to generate the network effect, and some non-US banks with large swaps and forwards books have yet to engage fully.

The vendor solutions also solve only for interdealer activity. Uncollateralised end-users are responsible for a big chunk of exposures, so banks are making a big push to restructure existing portfolios to make them SA-CCR friendly. For instance, the FX head at the US bank says it is looking to do bilateral novations, tear-ups and restriking of individual trades with large present values to reduce exposures with end-users.

"Compression activity has generally been between the banks, but it only gets you so far. We can do better with more banks participating in bilateral and multilateral compression, but most of the counterparty credit risks in the FX ecology is driven by end-users," he says.

Not all clients are interested in optimising right now – some are waiting until price rises hit next year, which the FX head insists they will at some point.

"Banks won't eat all the increased capital costs, nor will they be able to pass every cent on. The answer is somewhere in between. Investors and corporates, unless we do things more efficiently, will have to pay more," he says. ■

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Accelerating the evolution of credit decisioning and modelling

Anthony Mancuso, director, global head of risk modelling and decisioning at SAS, explains the importance of developing a fully capable credit modelling lifecycle to empower non-specialist personnel, and offers insight into its own solutions to this end, which can provide a seamless experience across business lines and improve the speed of credit decisions

Globally, credit modelling has undergone significant transformation, driven by factors such as digitalisation, adoption of artificial intelligence and machine learning, and regulatory demands. Financial services providers – both traditional banks and newer financial technology players – want to provide consumers with a consistent and contextual experience across the credit lifecycle.

In addition, the Covid-19 pandemic has put a greater emphasis on the ability to assess impacts of macroeconomic changes on portfolios using a range of scenarios, but also highlighted inefficiencies in the risk model lifecycle. Given the speed of some of the changes in economic conditions, organisations are looking for more agility to respond by making changes to models and policy rules. As the demand for more and better models increases, firms are looking for efficiency benefits by automating parts of the risk model lifecycle. A key lesson from the pandemic is that organisations that are digitally enabled are much better able to respond to new business and regulatory demands.

These requirements have placed greater demand on financial services providers to deal with large datasets, develop state-of-the-art risk models and integrate analytics in decisioning processes, all while meeting and maintaining model governance requirements. An example of the challenge that banks face is a credit risk decline. When a bank declines any customer for a credit risk reason, it must explain exactly why it is being declined. And, if the bank uses a 'black box' that utilises a complex algorithm around a customer's spending patterns, for example – but the bank cannot explain why – then that is a problem for the bank. Banks have very specific regulatory and compliance regulations that require them to provide the customer with details as to why they may be declined.

So it is important to build more meaningful credit models that are not black boxes that enable the business to better understand credit risk and help the bank's customers fully understand decisions related to their requests for credit.

To meet these demands, SAS developed an integrated environment to support the end-to-end credit lifecycle – from loan originations to account management to collections and recoveries. It offers a standardised process for a comprehensive range of risk models – from regulatory capital and provisioning models, such as through-the-cycle or forward-looking probability of default, loss given default and exposure-at-default estimation, applications and behavioural scoring, to models fulfilling auxiliary functions, such as income estimation, prepayment and propensity models.



Anthony Mancuso

Today's credit modelling lifecycle needs a broad set of capabilities in data preparation and analytics, with open-source integration, model governance and lineage, enabling a guided experience for non-specialist personnel to quickly accomplish what once took specialised resources weeks or months.

Deploying models to decisioning engines

Data engineers and scientists access and onboard any data, be it granular transactional data, data from third-party providers, or traditional or alternative data in structured or unstructured formats.

Data scientists develop risk models, be they statistical or modern machine learning, using their preferred open-source language (such as R or Python), or the easy-to-use SAS interfaces. When ready, these models can be deployed to any

combination of in-memory, in-database, batch, real-time or streaming systems with the click of a button, eliminating the need for recoding. A comprehensive set of model monitoring metrics for backtesting, benchmarking and compliance is built in.

All of the above are available for a variety of model types, including linear and non-linear modelling, scorecard development, including optimal grouping methods, forecasting, optimisation, simulation, machine learning, deep learning and text analytics.

A critical market differentiator is the ease with which models of all types can be deployed to decisioning engines. SAS risk decisioning provides a modernised decision tool for credit decision automation, integrating analytically powered operational decisions into risk management processes, such as loan originations, limit management and collections. By combining business rules management, advanced analytics and decision governance, a range of operational decisions can be automated.

As an illustration of what can be achieved, one of the largest global banks chose SAS to transform their enterprise decisioning platform and build strong digital capability for the future. They want to offer customers a seamless experience across business lines: credit risk, collections and fraud detection. SAS supports these digital transformation objectives to offer consistent and contextual customer journeys. Furthermore, during the proof-of-value process, SAS has greatly improved the speed of credit decisions (straight-through processing rates have risen from 60% to 75%) while the deployment of models, previously six months on average, can now be performed with SAS in minutes – whether open source or SAS. ■

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IMA to retain large role in setting market risk capital post-FRTB

Gyrations over 2020 mean a bigger share of market risk requirements could be underpinned by internal models post-reform.
By Lorenzo Migliorato

Basel III reforms will drastically expand standardised market risk modelling's reach in the European Union – but in-house approaches may retain a bigger role in determining capital than previously estimated, European Banking Authority (EBA) analysis suggests.

Among Group 1 banks – internationally active lenders with more than €3 billion (\$3.5 billion) of Tier 1 capital – some 23% of market risk capital requirements were determined by the standardised approach (SA) at end-2020 (see figure 1).

The implementation of Basel III's Fundamental Review of the Trading Book (FRTB) is expected to increase the share of capital requirements dictated by the SA to 37%, with the rest determined through the internal model approach (IMA).

Though still implying a significant tilt towards the SA, the latest analysis highlights a smaller role for regulator-set approaches than previous monitoring reports, due to the IMA growing its relative weight in determining capital needs over the course of 2020. Last year's exercise, using end-2019 data, forecasted the share of requirements driven by the SA to jump from 30% to 44% pro forma for FRTB.

For smaller banks classified as Group 2, the SA is expected to go from accounting for 62% of requirements as of end-2020 to 90%. That compares with a jump from 81% to 92% in the previous monitoring report – meaning that although the share of capital requirements determined by the IMA grew during 2020, the increase would not have stuck with the introduction of FRTB (see figure 2).

What is FRTB?

FRTB is an international standard that sets out rules governing capital that banks must hold against market risk exposures. It sets a higher bar for banks to use their own models for calculating capital, ensures banks are capturing tail risk events, and cements the boundary between trading and banking books.

In response to criticism, in January 2019 the Basel Committee on Banking Supervision (BCBS) unveiled a package of reforms to the regime designed to ease its complexity and soften its anticipated capital impact.

The Basel III monitoring report, issued semi-annually by the EBA, assesses the effects of new regulatory standards on the EU's large banks. Capital, liquidity and leverage ratio metrics are taken by data submitted by national supervisors on a representative sample of institutions in each country. BCBS countries must implement the final batch of reforms by 2023 and fully adopt them by the start of 2028.

The latest FRTB analysis covers 40 banks. As with elsewhere in the current and previous reports, the EBA noted some data quality issues with the submissions, meaning results should be "interpreted with caution".

The comparison across years is made with the 'reduced estimation bias' analysis for end-2019.



Why it matters

That the standardised approach could have a smaller role in determining capital requirements than previously anticipated may look like good news for EU banks. In reality, it might just be testament to how the Covid pandemic affected charges under the IMA throughout last year.

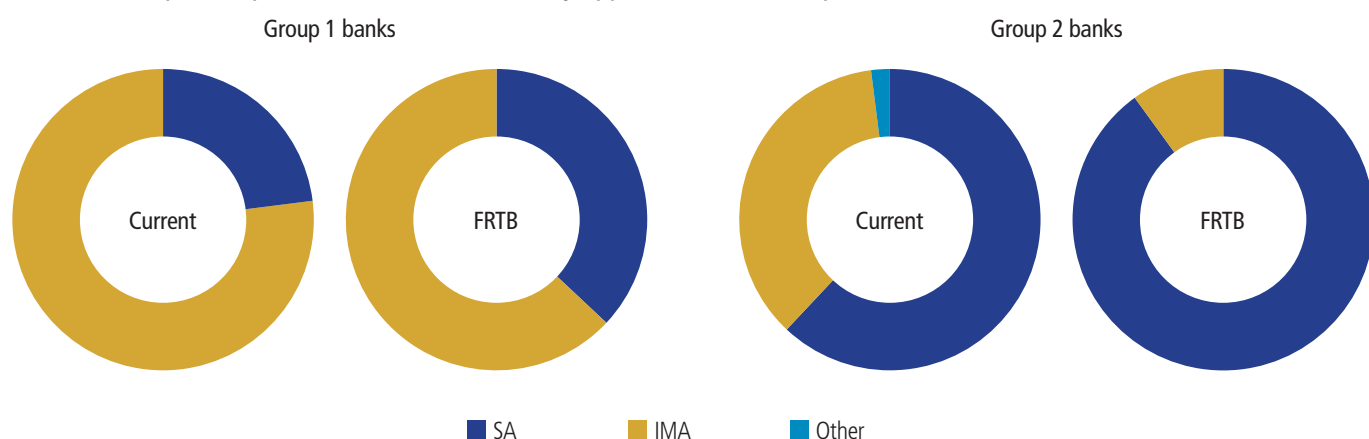
Most IMA-assessed capital requirements arise from value-at-risk and stressed VAR metrics – two measures of how much a bank stands to lose in any given day of market activities. These indicators spiked during last year's market ructions, leading IMA capital requirements to rise faster than the SA – whose reaction times are somewhat longer – and thus came to account for more of banks' own-funds burden.

That changed the composition of the actual portfolios upon which the EBA's analysis was conducted, but not FRTB's forecast effect. The 14 percentage point increase in the share of capital requirements underpinned by the SA for larger banks was the same as shown in the end-2019 analysis.

The next report might see that composition change more radically. This year, banks' market risk models have been by major modifications, after the European Central Bank concluded its targeted review of internal models. The ECB took the occasion to pre-emptively bring some models in line with Basel III reforms, which not only diluted the pro forma impact of FRTB – an average increase of 32.5% for market risk charges at end-2020, compared with 40.8% at end-2019 – but could also result in more in-house models qualifying for use under the new regime. ■

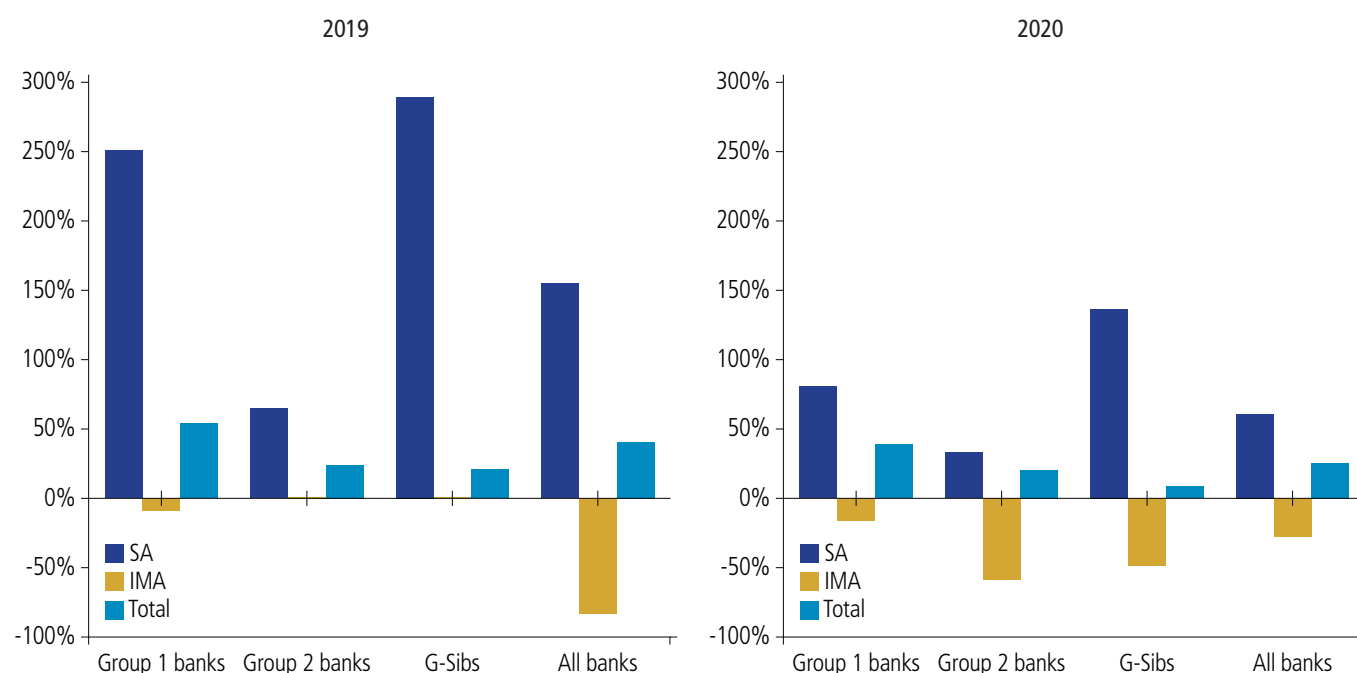
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1 EU banks' capital requirements for market risk, by approach, actual and pro forma for FRTB at end-2020



Source: EBA

2 Change in EU banks' market risk capital requirements pro forma for FRTB, based on end-2019 and end-2020 requirements



Source: EBA

Driving greater value in credit risk and modelling

A forum of industry leaders discusses the challenges facing banks in measuring and mitigating credit risk in the current environment, and strategies to adapt to a more stringent regulatory framework in the future



Terisa Roberts, Director, and Global Solution Lead for Risk Modelling and Decisioning
www.sas.com

What will be the long-term impact of the Covid-19 pandemic on banks' credit risk management strategies?

Terisa Roberts, SAS: The global pandemic has accelerated digital transformation in many organisations, including financial services, but it has also highlighted inefficiencies in the credit risk model lifecycle. Given the speed of some of the changes in economic conditions, organisations are looking for more agility to make changes to models and policy rules. As demand for more and better models rises, firms are looking for efficiency benefits by automating parts of the risk model lifecycle. A key lesson from the Covid-19 pandemic is that organisations that are digitally enabled are much better able to respond to new business and regulatory demands. As the initial wave of digital transformation has become established and we begin to move beyond the limitations and challenges of the pandemic, we are looking at the next technology wave, resulting in further investment in event-driven architectures: two-way communication between core systems and application programming interface-driven modular frameworks. These advances in technology are being complemented with additional investment on the business side. While many of the larger banks have investigated moving to a single vendor for cost/licence efficiency, the current outlook suggests they are returning to more of a best-of-breed modular approach.

Lourenco Miranda, Societe Generale: We observed an immediate impact from Covid-19 last year and witnessed a change in most of the existing models. We have seen a change across the board – whether it is a model that depends on macroeconomic factors or depends indirectly or directly on the market or the economy. Our models (and this is not for the whole industry) were calibrated for not seeing, not experiencing this change that we saw during the pandemic.

We put a lot of emphasis on ongoing monitoring and the covariant shifts. We observed how different models changed or could have changed under new scenarios. In theory, we had to change and recalibrate these models but instead we could apply modelling techniques to estimate the impact of this shift in the economy and in the exogenous – the external variables such as GDP, unemployment, consumer perception, liquidity and all the elements that might be relevant to a credit risk model. We were able to identify the changes in the market and how this would have impacted the model and its parameters. So we were able to bring this to our model risk and credit risk governance, and apply the existing governance to that. For instance, in some of our stress-testing

models, we were able to apply overlays according to existing governance, which is aligned with the regulation, so we could have a credit risk committee for approving or recommending an overlay that would account for the impact of last year's recession.

In terms of long-term impact, we need to evaluate whether models need to be calibrated. We have to extend the calibration and recalibration window to include this period of recession that we observed and from which we are recovering. This requires developers to reconsider, and that is going to be a big undertaking. As well as understanding how credit risk management strategies would be impacted in the short and medium term, we have to understand the rising number of defaults, how that will affect recovery and how the banks will recover – something that should be accounted for in the new model.



Lourenco Miranda
Head of Model Risk Americas
Societe Generale
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How are banks adapting their approaches to regulatory capital under Basel III?

Lourenco Miranda: The Comprehensive Capital Analysis and Review (CCAR), the Capital Adequacy Pillar 2 and CCAR Pillar 2 are related to the Internal Capital Adequacy Assessment Process (ICAAP). This should be accounted for in Pillar 2 – not necessarily in Pillar 1. So liquidity risk, ICAAP and stress-testing are all part of Pillar 2.

Terisa Roberts: For many financial institutions – especially those that are internationally active – the current environment presents several key challenges. Even when financial institutions perform their economic capital calculations and find they have a capital buffer to manage the risks from their business from an economic perspective, regulatory capital requirements still represent a restriction that needs to be known and managed, and to which institutions cannot risk failing to comply with. The regulatory environment is therefore a critical measure that needs to be considered in every significant decision taken by a financial institution.

Capital requirement regulations are continuously evolving, particularly with the roll-out of the latest set of reforms, collectively called Basel IV. These reforms may also be interpreted differently – at a national or regional level – from the generic Basel guidelines, which significantly increases the cost of compliance. In the current regulatory context, financial institutions are preparing for full compliance with the January 2023 Basel IV deadline – by performing gap analysis and quantitative impact studies that allow them to anticipate the impacts of these changes.



Stevan Maglic
Head of Risk Analytics
Celsius
www.celsius.network

Are banks' credit risk models fit for purpose in the current environment?

Stevan Maglic, Celsius: Most banks have a limited history of high-quality data with which to build models. The history spans a limited range of economic outcomes and typically does not have enough granular data at the sector/industry level. Inflation risks in the current environment highlight limitations because inflation has not been a driver of losses in recent history, and therefore is not adequately captured in a model trained on that history.

Fortunately, banks have developed rigorous approaches to identifying model limitations, which can in turn motivate adjustments to modelled output. So, although models are not necessarily fit for purpose, the framework – meaning the model and the disciplined thought process around it – is.

Terisa Roberts: Challenges around delivering credit risk models currently include slow time to value for models, limited usage of advanced modelling and extended datasets in the credit decisioning process, and lack of agile deployment to maximise impact. Even if a credit risk model is considered fit for purpose, many banks will need to start incorporating climate risks in all of their decisions on lending, investing and product design, based on analytics. These enhancements in credit risk modelling will need to accommodate climate risk, environmental, social and governance, and other areas that require increased risk quantification of external events and the likelihood they will occur.

Fintechs are also accelerating the cloud adoption pace of financial institutions. This will allow credit risk solutions to meet the need to evolve and adapt more quickly, and support the need for more sophisticated modelling using artificial intelligence (AI) and advanced analytics more extensively, all without sacrificing strong governance and decisioning transparency internally and towards the regulators.

How can banks drive greater value from stress-testing in this area?

Lourenco Miranda: In theory, stress-testing is a more dynamic method of predicting or foreseeing these losses. Stress tests and scenario analysis are part of the Pillar 2 of Basel III and Basel IV – all the Basel concepts: Pillars 1, 2 and 3. Pillar 3 is disclosures, Pillar 1 is the minimal capital for credit market operational risk and Pillar 2 comprises stress-testing and scenario analysis where liquidity plays a big role. This is where you start seeing the benefits of stress-testing and that's how I think the banks will be adapting the approach of credit risk management to Basel III.

That said, stress-testing models will need to be recalibrated now using the new information we have from the pandemic. This is where statistical analysis and impact assessment of this shift in the economy will need to be applied to the stress-testing model. Instead of managerial overlays, the question would be on how we redesign and recalibrate models.

Terisa Roberts: More advanced banks are investing in building integrated stress-testing platforms, responding to demands for increasingly sophisticated economic stress tests from key regulators. In addition, impact and scenario

analysis are gaining acceptance and adoption across the executive suite. This acceptance is beginning to translate into investment in stress-testing solutions with the ability to manage in a more integrated data-driven consistent platform. Banks really want to automate and invest in the models and the technology for doing that.

At the same time, there is a need to ensure banks are not building something that is not going to be a one-off exercise, and that regulators aren't going to adopt a significantly different approach in the future. As regulators come to consensus around the sort of stress-testing they want to see (for example, climate), then banks will invest in building more automated platforms to achieve that. The key driver will be the short cycles required to see the results, which in many banks can take up to two weeks to pull everything together and get an answer. However, banks with an integrated stress-testing platform, including data, model and workflow management, will get a consistent set of outputs in 24 hours.

How can banks gain a better understanding of credit risk and its relationship with market, liquidity and operational risks?

Terisa Roberts: Industry trends are pushing banks and insurers towards a more holistic perspective, as well as leveraging data and analytics technology across the variety of risk – and finance – domains to address the upcoming challenges. While banks and insurers face many challenges in addressing these developments, the most basic one is probably their organisational silos. To help break down the existing silos, banks can deploy an integrated risk technology framework with one metadata layer connecting the entire solution from data integration to data quality, to data management that employs a single risk engine with in-memory processing across liquidity, market and credit risks, utilising fully integrated business intelligence, leading to lower total cost of ownership. This approach offers an efficient risk and compliance foundation for establishing a competitive edge in the current macroeconomic situation. Modernisation and integration of the risk and finance applications servicing the key risk types will enable closer co-operation between the risk and finance functions.

Lourenco Miranda: Liquidity risk and credit risk are interrelated. Financial institutions and corporations go bankrupt because of liquidity issues. On the client side, liquidity has a very direct impact on the default of a firm or client, and when that client defaults on the bank, it creates a capital, profit-and-loss and asset-liability imbalance for the bank, which impacts liquidity risk as well.

To what extent will new technology such as AI and machine learning influence the future credit risk landscape?

Lourenco Miranda: There are two ways machine learning and AI will influence this landscape – the first is through process automation, which involves optimising decision-making processes, data management, quality control of that data, the decision and the documentation. All of this enables credit analysts to make better decisions in a shorter amount of time.

Machine learning and AI also empower cognitive process automation and robotic process automation. All of these elements at our disposal in the AI and machine learning world should be utilised, while keeping in mind that models have to undergo the model validation process. But it is important that we do think about it. In addition, whenever a machine learning or AI-powered model is used to generate prices or estimate risk, one must be mindful that the machine learning model is fully explainable. It must be transparent for clients because of fair lending risks and ethical AI.

When these models are used for business and client decisions that will affect the client directly, one has to think about ethics, protected attributes, biases – all of which are exacerbated in the machine learning and AI realm.

Banks must think about how they will explain to their clients how a credit decision was made. This is important because some of the machine learning/ AI models are ‘black boxes’ – they don’t have the transparency that was once available in a traditional statistical model.

Terisa Roberts: Financial institutions that deploy AI models are increasingly looking for efficiency gains by automating aspects of the model lifecycle. Models – traditional and newer approaches – are updated more frequently and have faster model development and deployment cycles, and are said to deliver superior accuracy and relevancy. Automated machine learning and self-learning models are particularly well suited to dynamically recalibrate based on new information. AI systems that are dynamically updated (in effect, continuously learning as new data become available) will generate additional workload for model governance teams to validate the calibration process on a continuous basis. This will require more rigour for ‘responsible AI’ – AI that is governed, transparent, interpretable and ethical. In addition to enhanced controls on data and models, the changes and performance of models will entail continuous monitoring, requiring institutions to have robust model risk management systems, extended for AI and machine learning in place.

To enable firms to introduce AI and machine learning into the credit risk landscape, SAS continues investment in AI and machine learning interpretability. For example, we are developing capabilities to improve the robustness of machine learning models with stress-scenario generation in credit scoring, and are undertaking research with the financial services industry and academia to propose a measure based on counterfactuals to globally evaluate the interpretability of a machine learning credit-scoring technique.

SAS is also delivering out-of-the-box responsible AI capabilities through its cloud-native Viya 4.0, automatically tracking model drift and variable drift, and generating alerts for human supervisors if a model fails to meet organisational key performance indicators. For example, a workflow could be set up to check whether a model uses variables that are listed to contain personally identifiable information or are otherwise not acceptable as input for AI models.

What challenges have emerged in this area?

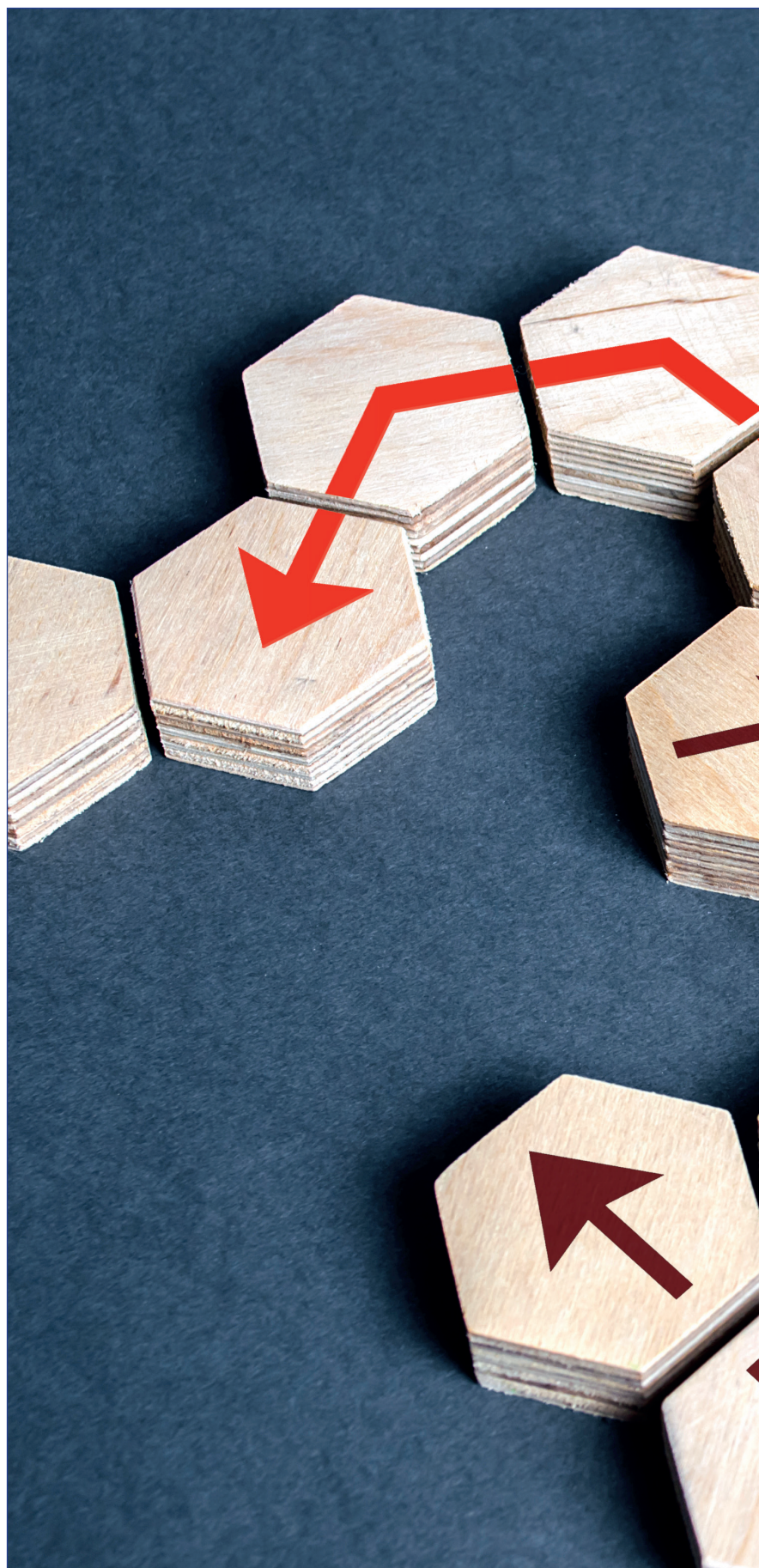
Lourenco Miranda: The challenges are twofold: one is data quality – but that’s not specific to machine learning. Machine learning is able to use more data, but the problems are still the same. The second challenge is explainability and how you are going to be ethical and transparent if you are using machine learning to make decisions that are going to directly impact the client.

Are credit or model risks in the burgeoning cryptocurrency space well understood? What are the biggest challenges?

Stevan Maglic: It’s probably fair to say that, with all the innovation in crypto, there are a good deal of processes and activities that need to catch up. Along these lines, models are continually being adapted to suit crypto-specific business activities. With many new products being introduced into the market, each needs to be thoroughly understood and modelled properly.

Heightened development activity clearly increases model risk, and added vigilance is needed to ensure material risks are understood. In terms of biggest challenges, to manage risks while experiencing extreme growth, the model and risk infrastructure can’t be built soon enough. ■

>> The panellists’ responses to our questionnaire are made in a personal capacity, and the views expressed herein do not necessarily reflect or represent the views of their employing institutions





European banks set for capital hike under Basel III

Output floor expected to push Tier 1 capital requirements up 7.3%, according to the latest Basel Committee on Banking Supervision monitoring report. By Lorenzo Migliorato

Large European banks are expected to see their Tier 1 capital requirements increase by 17.6% under the fully loaded Basel III rules compared with end-2020 levels, figures from the Basel Committee on Banking Supervision shows.

The average capital increase for European Group 1 banks – internationally active firms with more than €3 billion (\$3.5 billion) in Tier 1 capital – is driven by the output floor, which is expected to hike their minimum required capital (MRC) by 7.3% over eight years (see figure 1).

Tweaks to required capital for credit risk would inflate MRC by 4%, and those for operational risk by 3.8%, while changes to required capital for market risk and credit valuation adjustment (CVA) components would push MRC up 2.1% for each. On the other hand, reduced capital requirements linked to the leverage ratio would bring associated Tier 1 minimums down 1.6%.

The reforms' estimated impact on banks in other geographies is much milder. Group 1 lenders in the Americas were projected to see MRC rise by 2.5% as lower requirements for op risk, the output floor and CVA help offset rises elsewhere.

Dealers from the rest of the world stand to see their capital requirements fall the most among Group 1 banks, by 5.8% on average, driven by lower required capital for credit and op risk (see figure 2).

On aggregate, Group 1 banks are set for a 2.9% increase in their capital requirements from end-2020. Global systemically important banks (G-Sibs), which are part of Group 1, would see their expected Tier 1 capital charge rise by 3.5%.

Smaller Group 2 banks – those with less than €3 billion in Tier 1 capital – are expected to see MRC rise by 6.4% on average, with a 13% increase in risk-based requirements partially offset by a 6.6% drop in the leverage ratio constraint. The BCBS did not break down results by region for Group 2 banks.

What is it and why it matters

The Basel III monitoring report, issued semi-annually by the Basel Committee, assesses the effects of new regulatory standards on large banks. Capital, liquidity and leverage ratio metrics are taken from data submitted by national supervisors on a representative sample of institutions in each country. Basel Committee countries must implement the final batch of reforms by 2023 and adopt them fully by the start of 2028. The latest report, based on end-2020 data, covers 178 banks. These include 111 Group 1 banks, 30 of which are G-Sibs, and 67 Group 2 banks. The MRC analysis is based on 89 Group 1 banks and 54 Group 2 banks.

The writing is on the wall for Europe's largest

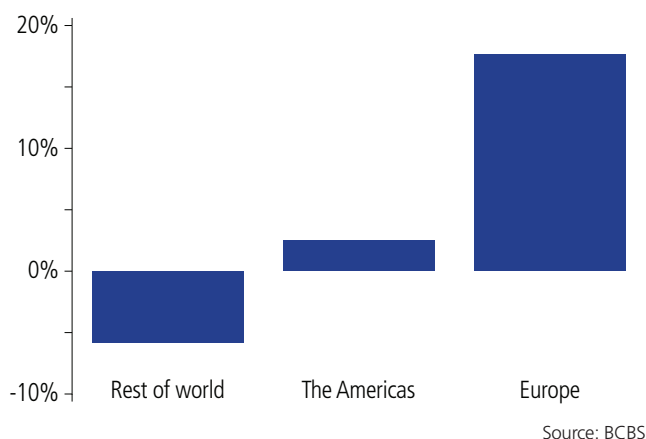
banks, so it's not surprising they have been seeking lawmakers' help to dilute Basel III reforms with country-specific amendments. Proposals to tackle the outsized impact of the output floor – which bars banks from reducing their modelled capital requirements below 72.5% of the amount generated by the revised standardised approach – have not been without controversy. The European Commission, for instance, appears to have backtracked on a 'parallel stack' approach that would have eased the floor's impact, though it is still pursuing amendments to make the reforms easier to digest.

For their part, the continent's national regulators, both inside and outside the European Union, have been already imposing output floors on riskier parts of the credit book, like mortgages. Meanwhile, sweeping corrections imposed by the European Central Bank's years-long targeted review of internal models have reduced the divergence between standardised and in-house risk outputs.

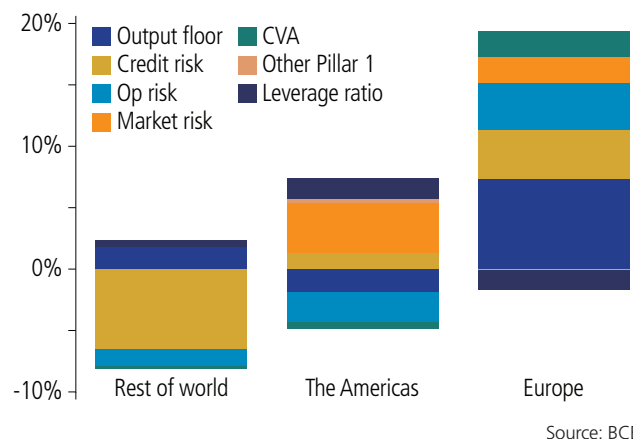
Such regulatory moves may pre-empt a cliff-edge hit to capital adequacy from Basel III, by bringing forward its ultimate effects. They may also make any future, quasi-protectionist adjustments in one jurisdiction more acceptable to fellow Basel Committee board members. ■

Previously published on Risk.net

1 Average percentage changes to Tier 1 capital requirements under Basel III



2 Basel III impact on Tier 1 minimum required capital, by underlying driver



Wells touts new explainability technique for AI credit models

A novel interpretability method could spur greater use of rectified linear units neural networks for credit scoring. By Steve Marlin

A team of researchers at Wells Fargo has begun deploying a novel explainability technique for deep learning models – something the bank hopes will allow it to begin using more complex approaches to power credit decisioning.

Banks have long sought to tap the potential of neural networking – a family of deep learning approaches that works by seeking to replicate human thought patterns – for complex problem-solving in credit risk. Yet the technique finds itself underused, since models that rest on the approach often lack ready explainability as to their outputs, running the risk of falling foul of regulatory scrutiny.

The explainability technique pioneered by Agus Sudjianto, head of model risk at Wells Fargo, works in effect by breaking down models that make use of neural networking techniques into smaller models that can be more easily explained. A paper published by the team describes a method for disentangling the non-linear relationships contained within networks and expressing them as sets of linear equations.¹

The method promises to remove a major stumbling block to using more advanced machine learning models by making the models interpretable without requiring *post hoc* explainability techniques such as Lime and Shap, and is already winning plaudits from peers at rival banks.

“Agus has converted these complex models into linear relationships to make it easier to understand what variables are driving what decisions. He’s taken variables that have non-linear relationships and turned what would be a confusing network of relationships and converted them into simple relationships,” says Jacob Kosoff, head of model risk management and validation at Regions Bank.

The Wells Fargo technique applies to a specialised type of neural network known as rectified linear units, or ReLU. Banks are adopting the Wells Fargo approach and other approaches that are designed to make deep learning networks more interpretable.

One large US bank says it has already begun applying the technique described in the Wells Fargo paper with a machine learning model that reviews credit applications rejected by a more conventional model that relies on Fico scores. About 10% of

“[Sudjianto’s] taken variables that have non-linear relationships and turned what would be a confusing network of relationships and converted them into simple relationships”

Jacob Kosoff, Regions Bank

the decisions to reject credit applications are overturned based on the ‘second-look’ machine learning model.

“We are trying to deploy the methodology ... for disentangling these deep neural network models,” says a model risk executive at the bank.

The non-linearities behind a deep learning model can be complicated to deconstruct. The Wells Fargo technique breaks down or ‘linearises’ a highly complex model into a set of smaller models, eliminating the need for *post hoc* explainability techniques.

“In high-risk areas that impact a person’s financial wellbeing like credit scoring, we can’t afford to use black boxes. You can design a model that is interpretable from the ground so it becomes self-explanatory,” said Sudjianto in a July 22 podcast.²

Fico, the company that produces Fico credit scores, is also using Wells Fargo’s and similar techniques to explain the machine learning models for fraud detection. It is not yet using it for producing the actual Fico scores, which rely on a more traditional logistic regression model.

For example, when trying to detect cross-border fraud activity, the model contains thousands of variables related to fraud, all of which are inter-related. Using techniques such as Wells Fargo’s, it’s possible to constrain the network in such a way as to identify the contribution of each variable by expressing each of those relationships as a linear model.

“The approach suggested [by Wells Fargo] is one of a few for [reducing] the complexity of traditional machine learning models. What is good about all these approaches is that they are focused on deep

interpretability needed for credit lending decisions and exposing of possible bias and stability issues,” says Scott Zoldi, chief analytics officer at Fico.

Financial institutions may also be reluctant to use ‘black box’ models for credit underwriting because of issues related to performance, fairness, ethics, bias and stability of the model. As they explore using advanced machine learning to approve credit in a timely way, the ability to provide transparency and interpretability is key. Approaches such as the one by Wells Fargo are viewed as enabling greater use of machine learning.

“It is going to spur more adoption of machine models for credit underwriting. Banks want to use models where they are comfortable with the decision process. [The Wells Fargo] approach makes it easier to understand the model,” says Kosoff.

A growing number of firms are expressing interest in using inherently interpretable machine learning models, according to surveys by the Institute of International Finance (IIF).

“When we first started looking at what methods firms were using for explainability, initially it was for *post hoc* techniques. But that has changed in the last couple of years, where now there is an understanding that these models are being built from the ground up and you’re not sacrificing performance. That’s why the work that Agus and his team is doing is so important,” says Natalia Bailey, policy adviser for digital finance at the IIF. ■

Previously published on Risk.net

¹ A Sudjianto, W Knauth, R Singh, Z Yang and A Zhang (November 2020), arXiv, *Unwrapping the black box of deep ReLU networks: interpretability, diagnostics, and simplification*, [www.bit.ly/3CpDLuJ](https://arxiv.org/abs/2011.00000)

² IIF (July 2021), *Explainable AI and the US request for information*, with Wells Fargo’s Agus Sudjianto, <https://bit.ly/3BrT3NL>

Evergrande exposes China's lack of credit hedges

Onshore credit derivatives market has been little help during property giant's recent woes, sources say. By Blake Evans-Pritchard, Chris Davis and Karen Lai

An inability to offload risk into China's fledgling credit derivatives market has made it harder for the country's largest banks and securities houses to manage their credit risk exposure to Evergrande, the world's most indebted property company.

China has had an onshore credit derivatives market since 2010, but a host of problems – including a lack of protection sellers, narrow reference obligations and uncertainty around government bailouts – has meant the instruments are highly illiquid. So, when one of the largest credit shocks in China's history hit markets, hedges were simply unavailable to firms that had lent tens of billions of yuan to the stricken property giant.

"I don't think any of the names we heard in the market that had exposure to Evergrande – the big four banks, the joint stock companies – had done any CDS [credit default swaps] to reduce their exposure. We would definitely have heard of this if they had. I think their exposure was just too big for the onshore CDS market," says one senior trader at an international bank.

There are four types of credit derivative in China, with the most popular being credit risk mitigation warrants (CRMWs). These are standardised products that reference a specific bond underlying issued by an entity – unlike CDSs, which reference a number of an entity's debt obligations at once. The products are created by a third party, tradable in the secondary interbank market and cleared by the Shanghai Clearing House. Tenors typically extend to one year.

The notional amount of CRMWs issued has increased significantly over the past few years (figure 1), hitting 110 billion yuan in 2020 across 41 reference entities. Despite this, the sector that has felt the most stress this year – real estate – has only one CRMW issuance, meaning lenders looking for credit protection have been left with no derivatives instrument to use (figure 2).

"What the Evergrande default shows is that China's CDS market is still at a very immature stage of development," says the head of global markets for China at an international bank. "Regulators have

repeatedly tried to create a CDS market onshore, but they're using something that is not the market standard for anyone else in the world, and honestly, there are not many takers for this" (see figure 1).

One Beijing-based lawyer whose firm has been helping with Evergrande debt restructuring says many banks would have bought protection if it had been available.

"As long as there is outstanding debt, there would be heaps of people willing to buy this sort of protection," he says. "The problem is that you couldn't get protection in size from anybody."

Hedging hurdles

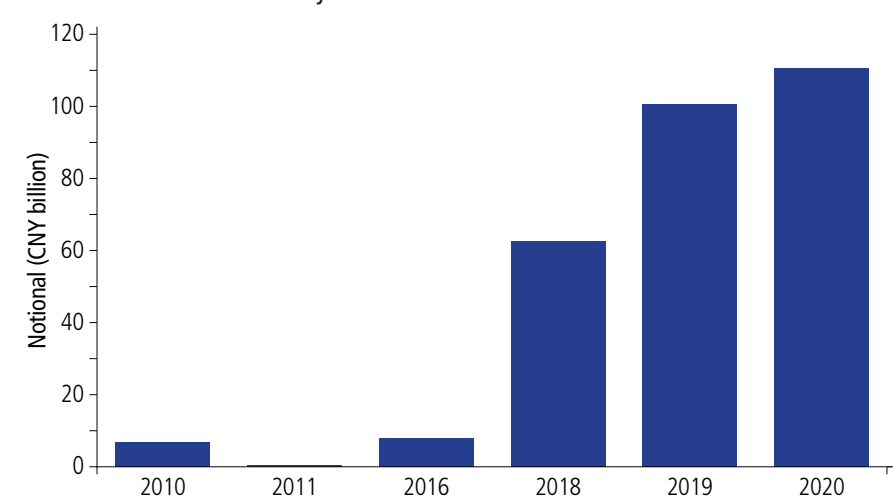
So why has there been so little interest in CRMWs given the current credit stress in the market? First, even if there was CRMW issuance referencing Evergrande, it's not clear whether it would have helped many debt holders. According to Evergrande's latest financial statements, published in June, the firm had 572 billion yuan (\$90 billion) of "interest-bearing debts", with 394 billion yuan of this coming from outstanding loans from banks and other financial institutions.

Evergrande began missing some of its onshore interest payments in June. By September, it had also started defaulting on some of its overseas US dollar bonds. But CRMWs don't tend to reference loan underlyings, so if they referenced a specific bond that the company was still servicing, the products would not trigger, leaving the lenders out of pocket.

As a result, dealers say, when Evergrande started defaulting on its loans, CRMWs prices barely moved – not even in the real estate sector. Compare that with the five-year China sovereign CDS, a common hedge for foreign investors holding Chinese debts, which jumped significantly in September when an Evergrande default on its offshore US dollar debt looked likely.

Another issue is a lack of interest from protection sellers, which has created a one-way market. Part of the problem is structural – the products are only really traded for hedging purposes, so there are no speculators providing the opposite view. Regulators have deterred smaller institutions – which could potentially offer an alternative view of credit risk – from participating. That means the main sellers would be the onshore banks, but they're also the biggest lenders to Evergrande.

1 CRMW issuance over the years



Source: Investment bank research

"We're in a situation where the onshore Chinese CDS market is fundamentally asymmetric," says the Beijing-based lawyer. "The big banks have little interest in selling protection on Evergrande because they already have some form of exposure [to the firm] in the form of loans."

Sellers also face difficulties determining the credit risk of a bond when they don't know whether the company will be bailed out by the government or state-owned banks.

Onshore debt defaults were unheard of in China until 2014. Since then, the government has been selectively allowing defaults to occur as it tries to inject some measure of hazard into the market.

But because some sectors of the economy are considered more important than others – Beijing has made it clear, for example, that it is likely to prioritise core lending over property speculation – it is not always clear which firms will be left to their fate and which ones might get a helping hand.

"People don't realise that for the 2% or 3% premium [issuers] charge for issuing a [CRMW], they are guaranteeing 100% of the principal," says Joe Zhang, co-chairman of SBI China Capital, a boutique investment bank in Hong Kong.

"At a time when default was uncommon, they would look at this and say: 'Great – free money!' They thought the firm was never going to default. But now that defaults are more common, people need to start realising this" (see figure 2).

Market sources say the few CRMW sellers that are active in the market are often there because they have had their arm twisted by the government, as a way of boosting interest in the underlying corporate debt. Dealer sources say investors tend to purchase bonds together with CRMWs to create a credit-enhanced bond.

This has also meant that CRMWs are not distributed equally across sectors. According to research from one investment bank, only one CRMW was written in 2020 for a company in the real estate sector – home to Evergrande – compared with 23 for firms that belong to the 'industry' sector.

Yet another problem is that the credit ratings of the issuers are predominantly AA and above, so CRMWs aren't generally available for protecting debt holders against struggling companies. Evergrande is currently rated C by Fitch.

Ways forward

All these issues have meant international banks have largely stayed out of the market for now. "We get asked a lot: 'Why aren't we using the CDS market more?' Our response is: 'Because it's not tradable, that's why,'" says the international bank's head of global markets.

But an analyst from a large Chinese securities house that has exposure to Evergrande argues the only way to develop a functioning CDS market is to diversify the participants, and that includes foreign banks.

"In a functioning CDS market, investors would have different views on the market due to different assessments. Some will be bullish, some will be bearish – and so they position themselves differently," says the analyst. "But in China, the institutions participating in this market all have the same type of risk appetite."

Reforms to the onshore repo market, however, could allow protection sellers to effectively short the bond underlyings as a hedge of the sold derivatives positions.

There are also some signs that credit risk is becoming more recognised in China. Zhang says this can be seen in the declining number of so-called guarantee companies willing to sell default

protection to banks on their corporate loans in return for premiums of around 2–3%. In 2013 there were 8,349 guarantee companies in China, according to data from the banking regulator.

Zhang says that figure is now below 1,000, which he believes is an indication that the market is starting to take credit risk more seriously, rather than assuming that the government will bail all companies out.

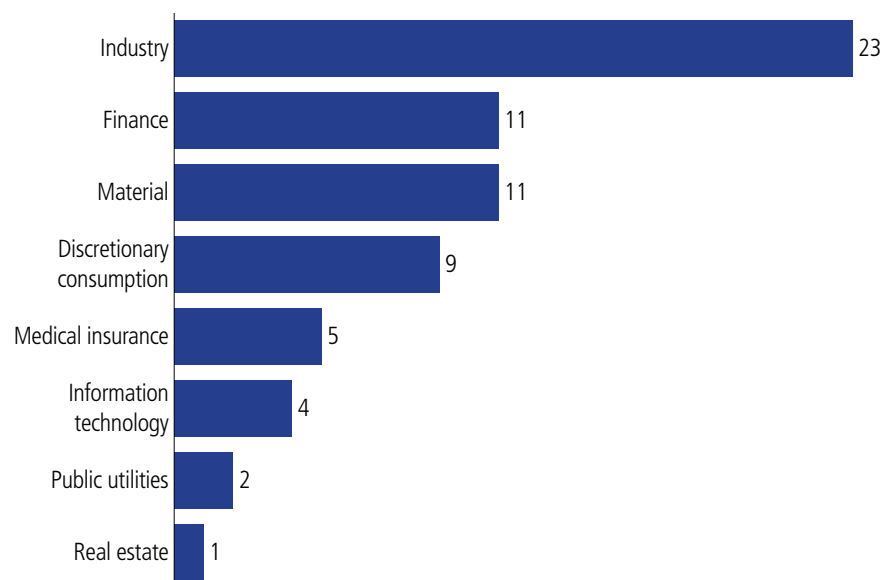
"The fact that people are not rushing to set up new guarantee companies to fill the space shows some people have learnt a lesson from all of this," he says.

The Beijing-based lawyer argues that until credit risk is more easily measured and understood, foreigners are likely to remain wary of entering the market, which will continue to hinder its development.

"For the CDS market to be successful, the risk must be dissipated outside of China, as is the case with cross-border securitisation. From a systemic point of view, why take risk off one bank only to put it on another in the same country?" he says. "But assessing the credit risk of onshore Chinese entities is not an easy thing to do." ■

Previously published on Risk.net

2 Number of CRMW issuances by sector (2020)



Source: Investment bank research

Weather, or not

Is climate risk just part of credit risk?

Practitioners are divided on whether climate risk can fit into existing credit risk weights. By Samuel Wilkes

When regulators face a new risk in the banking sector, their natural response is to decide how much capital banks need to hold against it. The largest emerging risk is from climate change: either the physical risks of extreme weather events and rising sea levels, or the transition risk of policy changes to clamp down on carbon emissions. Both will potentially cause defaults to flow through bank loan books.

The Basel Committee on Banking Supervision has already begun work on how to incorporate climate risk into prudential rules, and two sources believe Basel could produce a paper on this before the end of 2021.

"I'll be frank with you, we are doing work on this topic and thinking through about it and we hopefully are going to be able to say something about it when we have concluded this thinking," Victoria Saporta, the Bank of England's executive director of prudential

policy told an online webinar hosted by the Institute of International Finance on September 13.

But there's one obvious challenge: the existing framework for assessing credit risk – by far the largest part of banks' balance sheets – relies heavily on historical data.

Michel van den Berg, a sustainability adviser who has worked with Dutch banks including Rabobank and ING, says transition risk has barely begun to materialise. Physical risk has developed further, but is still at an early stage. That means historical data is not a particularly useful guide to future risks.

"We can only run hypothetical scenarios that lay out how this will ripple through the economy," says van den Berg.

Experts see two different responses to this, but neither is completely free from drawbacks. The first is to incorporate climate risk into the existing credit risk capital rules. As defaults increase, the data for recalibrating risk-weighted assets (RWAs) will gradually become available. In the meantime, banks and regulators will need to use expert judgement to make qualitative adjustments to RWAs in anticipation of future losses.

"I believe the bank capital framework we have – where we have policies to determine probabilities of default (PD) and loss-given-default (LGD) – should be made to accommodate climate risk, even though [it] can't be modelled in the same way we model traditional credit risk," says van den Berg.

But others believe more drastic alterations to the capital framework are needed, especially as existing RWAs tend to focus on short-term risks. This alternative could involve a separate set of specific climate-driven factors, add-ons or discounts being used to increase or decrease banks' total RWAs.

"The question one can ask is: should climate risk be in PD or LGD estimates themselves for the internal approaches, and credit ratings in the standardised approach [SA], or should it be in the risk weightings as a final 'adjustment at check-out' type factor?" asks Judson Berkey, head of sustainability regulatory strategy at UBS.

Market participants are hoping the Basel Committee will ultimately take a view on this choice,

and provide more detail on how to implement whichever path it chooses.

However, both approaches would still face the data challenge. Robert Begbie, chief executive of NatWest Markets, warned at a press briefing on October 4 that it will take time to amass the appropriate data and methodology.

"Historically, where capital rules have been changed or capital add-ons introduced, it is normally based on having good data, good stress-test analyses of banks' balance sheets, and that is very evolutionary," said Begbie. "So [if] you are going to do capital add-ons at some point, it will need to be based on rigorous assessment, because otherwise you could have unintended consequences if you introduce them too early."

Some climate risk experts, however, have a greater sense of urgency, and fear that waiting for data will only delay the banking sector's necessary response, inhibiting the financing of transition to a low-carbon economy. That implies the need for a make do and mend approach to climate risk capital charges for the time being.

Trust your judgement

Banks must calculate the risk arising from borrowers defaulting on loans or bonds either through their own models, or through the SA that uses ratings from credit rating agencies or regulator-set risk weights. In the internal ratings based approach (IRB), PD and LGD are the key model inputs.

Three sources at banks and consultancies believe regulators don't need to drastically change the framework to reflect climate risk, as banks can incorporate the risks through the IRB approach.

But there's a hitch: IRB models typically look for default risks only over the short term. They will struggle to capture the risks climate change can pose for a borrower, since those consequences may take decades to materialise fully.

PD models, for example, only estimate the likelihood of default over a one-year period. That would only be appropriate for certain short-term lending that banks could manage down rapidly – van den Berg gives the example of trade finance.

Need to know

- The severity and frequency of climate-related risks are expected to increase in the future.
- The credit risk capital framework doesn't adequately capture these risks yet, but it will need to if banks are to be protected against carbon-intensive clients becoming non-viable due to policy responses, or the impact of extreme weather events.
- Regulators could create a climate risk factor that lowers requirements for greener companies or raises them for heavy emitters.
- Alternatively, they could require qualitative modifications to existing credit risk capital requirements, to incorporate climate risk into calculations of probability of default and loss given default.
- In either case, there are limits on the precision of the numbers produced because of the unprecedented nature of the risks themselves.

The way around this obstacle is to adjust IRB outputs with qualitative judgements. James Belmont, a partner and climate risk lead at consultancy Baringa, says those assessments give banks the chance to scrutinise transition plans and alter the internal credit scores they give to counterparties, if they feel the raw model output does not reflect the embedded physical or transition risk of that borrower.

"You can capture climate risk in your Pillar 1 RWAs through embedding climate risks within the annual credit reviews," says Belmont. "Where this results in revisions to the internal credit rating that the bank assigns to the counterparty, this would naturally feed through into RWAs, so that is a more organic way of doing it."

Of course, supervisors will want to take a view on the accuracy of the assessments banks make for each counterparty. This is where the work of regulatory initiatives such as the Network for Greening the Financial System (NGFS) can come into play. The NGFS has already produced a set of climate change scenarios designed to chart macrofinancial pathways to different temperature targets.

"There's enough tools out there to be able to build up a decent opinion of the level of vulnerability to these risks, which you can then factor into your default estimates," says the head of climate risk at a global investment bank. Regulators can weigh an individual bank's qualitative assessment against international benchmarks like the NGFS scenarios. If they find it wanting in terms of undervaluing the risk, Belmont suggests the Pillar 2 supervisory add-ons process already in use in the UK and European Union is the obvious path to correct the problem. He says regulators could apply a top-down assumption that is "more draconian" than the bank's own judgement.

"Regulators have to have some way of enforcing that minimum standard, and an incentive mechanism for doing that," says Belmont.

Don't trust your judgement

However, the head of climate risk at the global investment bank notes that the NGFS scenarios themselves may not always be as rigorous as necessary, with some of the predicted medium-term events already playing out today. For example, under the benign scenario of an early transition that limits the ultimate temperature rise to 1.7 degrees Celsius, carbon prices are assumed to rise to \$70 per tonne in 2030 and \$100 per tonne in 2040.

In reality, end-of-day futures prices for allowances companies based in the European Union must possess if they want to release emissions have almost doubled in price this year, trading at more than €60 (\$70) per tonne since September 2021, according to data sourced from the Intercontinental

Exchange. UK allowances peaked at £76 (\$101) on September 29.

Consequently, regulator-set scenarios and Pillar 2 capital add-ons do not change the fundamental difficulty of this approach. Supervisors are used to heavily scrutinising the accuracy of bank risk models – and therefore their total capital requirements. Two sources say the qualitative add-ons to IRB could be too fuzzy for supervisors to swallow.

One banker points to the huge effort that both the regulator and the banks put into the European Central Bank's targeted review of internal models (Trim).

"There is an inherent contradiction here between on the one hand the Trim-like exercises that seek to establish a high burden of statistical validity for PD modelling, and on the other hand the push to include more qualitative ESG – not just climate – information in capital and pricing, which is hardly ever going to pass statistical scrutiny," says a head of capital management at a UK bank.

A head of modelling at a European investment bank also warns that any attempt to incorporate climate information into PD models themselves will damage the integrity and explainability of the models.

"If you're doing this for a time-horizon of 25 years, the amount of error will be absolutely ridiculous and the validity of these models will be put in question," says the head of modelling. "My models have to be auditable, they have to be valid and they will not [be], so that is a problem."

Standardised approach

If regulators are not inclined to trust banks to incorporate climate risk into their IRB models, there is always the SA.

For corporate credit risk, banks can either derive standardised RWAs from the ratings assigned by a credit rating agency according to a regulator-set matrix, or – in jurisdictions that do not allow the use of external ratings – the regulator sets generic RWAs by type of exposure. Although the largest banks that account for the bulk of lending rely on internal models, the amount of RWAs generated by the SA is still relevant, because an output floor will limit the discount banks can derive from internal models to 72.5% of the RWAs generated by SAs.

External credit ratings run into some of the same problems as the IRB approach. Ratings agencies typically use short-term forecasts to produce a rating that reflects the ability of the issuer to repay its debt over the short term, and rely on reviewing that rating on a regular basis. However, analysts say they do sometimes consider risks that are likely to materialise over the long term.

"It's much more difficult to predict something that's

going to happen so far away," says Janine Dow, senior director at Fitch Ratings. "The greater the distance, the more difficult it is for credit analysts to forecast that and to include it in our financial projections, which often only go out two to three years."

The European Securities and Markets Authority (Esma) is currently looking into how environmental, social and governance (ESG) risks are systematically captured in credit ratings. According to the EU's renewed sustainable finance strategy, Esma must share its findings with the European Commission, which may then take action to ensure the ESG risks are systematically captured in credit ratings.

The situation for standardised credit RWAs not derived from external credit ratings is much worse. For example, EU lawmakers are mulling risk weights for unrated corporate exposures – those that don't tap into security markets and have little public information – that would simply be static. The same technique is already used for all corporate exposures in the US capital framework. Retail exposures such as mortgages are also simply sorted into fixed RWA buckets under the SA.

When regulators originally set these risk weights, climate change wasn't top of the agenda, and so hasn't been factored in.

"The risk weights on unrated exposures aren't granular," says Monsur Hussain, head of financial institutions research at Fitch Ratings. "Their granularity does improve to some degree in the final Basel III framework, but the unrated credit risk assessment for banks and corporates relies on backward-looking credit and governance-based factors."

All change

For those who see these obstacles as insurmountable, the answer is to build a totally separate category of climate risk weights, in the form of add-ons or discounts to the existing framework.

A carbon penalising factor has been suggested, which would have an opposite effect to the EU's supporting factors for infrastructure projects and small and medium-sized enterprises, which give capital discounts to loans granted to those borrowers.

Pierre Monin, a senior fellow of the Council of Economic Policies, specifically favours increased RWAs on polluting assets. This would protect their capital adequacy from climate risk, and discourage investment in polluting assets, which would in turn reduce the financial sector's exposure to climate change transition risks.

"Central banks are saying climate risks are not really taken into account by financial markets, so there is a missing risk in a sense. The solution for missing risk is to increase the capital requirement rather than decrease it," says Monin. "By doing

that, you then also incentivise firms to transition, and a world which has transitioned to a low-carbon economy is the safest scenario for financial stability."

At the NatWest press briefing on October 4, the bank's head of climate and ESG capital markets Caroline Haas said there is already evidence of a 'greenium' – tighter pricing on green bonds, loans and project finance. Consequently, a risk-weight discount for green assets might risk creating an outright bubble, and a penalising factor for carbon-emitting assets would avoid that problem.

"The intent would be to have a higher capital requirement that then evolves down as companies or assets transition, versus just supporting the green efforts – but that enhances the complexity of all this," Haas said.

Monin says there is enough evidence to identify the companies most at risk of transition, as climate metric providers already offer such assessments. This means a risk-weight differential could be justified for transition risk, despite the lack of statistical evidence showing the exact impact it may have on default rates.

For physical risk, however, a recent study released by the University of Zurich finds substantial divergence among metric providers' scores.¹

As a result, specific risk weights for exposure to climate risk wouldn't be any more accurate than adjustments to the IRB outputs.

"It is a kind of catch-22 situation: you probably could do a risk differential, but you don't have the underlying data or forward-looking analysis to support that," says Constance Usherwood, a director at industry group the Association for Financial Markets in Europe. "Our overarching principle is risk sensitivity and ensuring any treatment of a green or brown asset is consistent with the underlying risk."

But those advocating a quicker response to climate change say regulators and banks will just have to live with a lower level of accuracy.

"I think it could be simpler than the very precise formulas that are currently used for risk weights," says Monin. "If a regulator knows that a firm is very exposed to climate risk, then they should apply an extra add-on to the RWA."

Some in the industry sympathise with that improvised approach, if it helps banks to step up their response to the threat of climate change. The head of climate risk at the global investment bank observes: "You don't need to be too tied into trying to be pinpoint accurate – just look at things from a new direction of travel." ■

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¹ L. Hain, J. Köbel and M. Leippold (September 2021), *Finance Research Letters*, Let's get physical: comparing metrics of physical climate risk, <https://bit.ly/3jF6nNr>



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