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**To count or not to count –
The future of internal models in banking regulation**

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1 Introduction

Ladies and gentlemen

Dear Andrea Enria

Thank you for the invitation and your kind introduction. After I accepted to give the keynote at this risk modelling conference, a colleague shared with me an unflattering comparison of financial risk modellers with weather forecasters. He asked: Why do you think weather forecasters like financial risk modellers so much? His answer: Because the only kind of storm less well predicted than hurricanes and tornadoes are financial storms.

In my keynote today, I will frame this conference in a more positive tone, as I see a lot of merit in financial risk modelling – and in weather forecasting, too, for that matter.

Yet during and after the financial crisis we witnessed severe instances of risk model failure – where internal calculations of many banks grossly underestimated actual risks. Remember for example the systematic underestimation of a market freeze or a price bubble before the sub-prime crisis broke. The many unexpected lawsuits pointed to further blind spots – all of which suddenly led to capital cushions melting away.

However, focusing on these failures alone misses the fact that, overall, financial risk modelling has improved risk measurement substantially. It has inspired us to reconsider the role and the liberties of internal modelling.

And this is partly why you are at today's EBA workshop – to improve internal models. Your agenda includes challenging topics. My aim is far more modest. In my statement this morning I will take stock of risk modelling and the “lessons learned” from the financial crisis. I will highlight both the limitations and the strengths of internal modelling. Second, I will present general principles that should guide future work. And, third, I will outline my take on where current and future EU projects on internal models should be heading.

2 Financial crisis, regulatory reform and internal models

But first, let's take a step back. Fifteen years ago, internal risk models were considered the gold standard for optimising capital allocation. What made them so successful was the efficient use of capital and their high risk sensitivity – which was made possible by granting banks substantial freedom

in using their internal models for regulatory capital calculation. Even though Basel II limited the freedom of banks by setting several parameters for the internal ratings-based (IRB) approaches, IRB banks had substantial room for manoeuvre when calculating their capital ratios.

This made internal risk models prone to abuse. But those who pointed to these shortcomings, or just to their unrealistic assumptions, have frequently been called unscientific and opposed to innovation.

Then the financial crisis erupted, changing almost everything in finance. Models played their part in contributing to the turmoil. Risk modelling moved from panacea to placebo or even steroid. Individual calculations of many banks were not crisis-proof, as their assumptions were way too optimistic. In fact, some models even fostered herding behaviour.

In 2010, the Basel Committee decided to take a closer look at the root problems of internal models. The core question was whether differences in capital ratios of banks were due to differences in portfolios or due to illegitimate differences in modelling practices. In 3 studies we assessed the risk-weighting of banking and trading book assets. Material variances in regulatory capital ratios were found. Only a part of these could be explained by differences of risk profiles. But another substantial part of the variation arose not from differences in the riskiness of bank portfolios, but instead from other factors that are due to modelling problems – for example, some banks gamed model weaknesses, and some of the terms specified by supervisors proved to be problematic.

One of the main reasons for these unwarranted differences is that models were even applied to portfolios where the statistical presumptions are violated. For example, in low default portfolios you simply do not have enough historical cases of default to calculate a reliable credit default figure. Another prominent example is that extreme events, meaning crises, occur more often in real life than the distribution of most models assumes.

But there is an even bigger threat when applying modelling techniques. The big mistake is to believe that financial risk models can ever be fully accurate or even close to it. The point is fundamental, yet simple: risk models have fundamental limits that can never be fully remedied – which is why strong regulatory boundaries and supervisory controls are indispensable.

To make my point, I have to get a bit philosophical. There are two types of limits, and let us turn to a great economist to define their nature. In 1921, Frank Knight differentiated between risk and uncertainty.¹ Uncertainty describes the unexpected events. The first limit of models is that they cannot capture uncertainty. Uncertainty is fundamental, because we do not know what the future will bring – it is hardly manageable. It is quite substantial when it comes to financial risk modelling. That's because financial risk modelling is a social science. The models can only provide a simplified heuristic of real social interaction, but it is impossible to fully grasp the complexity.

¹ Knight, F. H. (1921) Risk, Uncertainty, and Profit. Boston, MA: Hart, Schaffner & Marx; Houghton Mifflin Company.

The second limit of models concerns how Knight defined risk. Risk is what we can somehow manage, thanks to the law of large numbers, with a margin of error. Risk is what we can model. Yet, even in this comfort zone of risk models some limitations exist: real events can only be forecasted, like weather, but cannot be predicted – data as well as methods face natural limitations.

All in all, this means: Modelling is probably as scientific as it can get in banking regulation. However, models can never get a calculation fully right. To limit mis-measurement, we have to deal with risk and uncertainty:

- First, close gaps in the regulation of risk measurement. This includes data limitations: we can only model where sufficient data are available. Defaults in sovereign bonds, for example, clearly do not fulfil this condition.
- Second, work is needed on methodological shortcomings: we have to insist on robustness checks and need to limit the degrees of freedom for financial institutions, for example with regard to assumptions about distributions.
- Third, one has to accept Knightian uncertainty and protect regulation against it – human behaviour changes, irrational exuberance prevails, extreme events like herding behaviour repeat themselves, and market actors will always test the limits of models. We cannot model these challenges away. That's why we need backstops. Models need checks

and balances, since a sole focus on model-based capital minimisation would be dangerous for financial stability.

3 Benefits of internal models

So, internal risk modelling for regulatory purposes clearly has its weaknesses. Nevertheless, I am convinced that the benefits very much outweigh the drawbacks.

The first advantage of risk models doesn't sound very encouraging, but it is nevertheless quite important. Their strength is that they get it less false than any other approach we have. For as long as we work on the approach of risk-based regulation, we have to somehow quantify risks; and there is no way we can do without educated guessing. Any minimum capital requirement we impose on institutions requires more or less uncertain assumptions about the riskiness involved.

This holds true not only for internal models, but also for standardised approaches to risks. Even the rather conservative regulatory risk weights of standardised approaches may result in over-optimistic capital charges – just look at sovereign bonds. Moreover, institutions using standardised approaches can engage in “risk shifting” – that is the search for the most profitable, but also the most risky assets among equal risk weights.

Thus, even if we banned models entirely from regulation, we would still end up with a vulnerable way to measure risk. Risk models are the better imperfect options.

The second strength of models actually is their variation. For not all of the variability of internal models is necessarily undesired. There may be good reasons for divergent capital requirements based on similar credit portfolios, for instance because of dissimilar effectiveness of risk management in banks or given a different legal environment in which banks are operating. Also, model variability reduces the risk of herding behaviour, which would arise if every bank were to use the same standardised approach.

The third – and in my view most important – strength of risk models is their high degree of risk sensitivity. For each type and each category, capital requirements calculated by an institution's own models is typically a lot more in line with historically observed risk. And this, in turn, has positive consequences. For example, it incentivises risk-adequate behaviour in financial institutions in general. From a supervisory point of view, we are especially interested in the additional incentives it offers to banks to develop and maintain a thorough risk assessment approach – which also supports and strengthens the internal risk management.

4 To count or not to count: internal models after regulatory reform

So far I have reminded us why internal model-based capital calculation – despite its weaknesses – remains a worthwhile regulatory tool. Accordingly, the post-crisis regulatory agenda still builds on the principle of risk-based regulation and still encourages the use of internal modelling techniques. The Basel Committee has decided to remove only one internal approach in its entirety – the Advanced Measurement Approach for operational risk, AMA for short. Apart from that, models still play an important role in the Basel III finalisation package. And as I have mentioned, there are good reasons for that.

Yet, moving forward, we need to incorporate the “lessons learned” into regulation and into supervisory processes.

We have done this by installing additional constraints and backstops to close gaps that internal models cannot close – most prominently the leverage ratio and the output floor. Further safeguards are implemented by more rigorous methods, data rules and input floors. This means that regulation has become multi-polar –supervisors rely on various, complementary requirements.

But at the same time there is also a need to support the benefits of internal models. On the Basel Committee, the German representatives resolutely argued in favour of maintaining risk sensitivity in regulation, because this is the best way to capture the actual risks of a financial institution and to set the right incentives, thereby discouraging excessive risk-taking. This especially concerns the subject of calibrating the output floor, which is – as most of you know – a limit to internal model calculations based on the standardised approaches. With the advantages of internal modelling in mind, this topic is

understandable. And for me, the current state of negotiations – an output floor of 72.5 per cent – is too high; but it is still enough for models to remain an attractive tool. While risk sensitivity will be diminished by setting the output floor at this level, it still represents a far better outcome than the originally envisioned output floor of 80 per cent.

Basel III is better than its critics claim: While some countries may gold-plate their national regulations through a ban of internal models – the new standard also enables the Basel countries to continue the use of internal models. And this is an important outcome.

5 You can count on that: better models for the future

Now we have to look ahead. We should take the Basel III reforms and implement them in a manner that improves risk models further.

Banks have to build better models, models that not only focus on the efficient use of capital but also ensure that a bank can weather future storms. Both goals must weigh equally, meaning that the storm-forecasting part has to be given much more attention.

Authorities like the SSM and EBA on the other hand will have to roll up their sleeves and build a regulatory and supervisory framework for the future of risk measurement.

This will be challenging not only for the sheer technical complexity, but also because we have to strike two balances at once:

- The first balance is to maintain the incentives for fine-tuned risk measurement and management on the one hand, while improving the checks and balances on risk models on the other.
- When pursuing this balance, we obviously have to do this on EU level. In that context, we need to strike the second balance: in order to guarantee the same high standards in the entire SSM, we have to achieve EU- and SSM-wide harmonisation on the one hand; on the other hand, however, we should not go too far, meaning that we cannot achieve an exhaustive list for each and any model decision. While we need harmonisation of definitions and supervisory procedures – in order to close relevant gaps – supervisory agencies should not be condemned to taking a box-ticking approach. Since every model is different, the box-ticking approach would only undermine a critical review of a bank's model.

I believe it to be important that we keep these balances in mind when we come to design new rules or redesign old ones.

Let me now outline the priorities for future work on improving internal models in the EU from the Bundesbank's point of view.

With regard to credit risk and the boundaries for the IRB approaches, it's important that we implement the Basel III compromise in a rigorous way.

This means that input and output floors will prevent the internal calculations of regulatory capital requirements from going too low. But at the same time, it maintains the internal modelling approach and, with that, substantial freedoms for banks to calculate regulatory capital.

Another important point concerns credit risks, but also other risk type models. The targeted review of internal models, the TRIM project, by the SSM should be conducted in a responsible and considered manner – it needs to strike the two balances that I highlighted. This means specifically:

- The biotope of risk modelling approaches must be kept diverse. A right understanding of harmonisation means not only treating equal things equally, but also treating unequal things unequally. TRIM must ensure, that the playing field for banks is levelled, but not create a monoculture of models driven by supervisory rules.
- Furthermore, it means that we have to balance conservatism and precision. Supervisors will always be tempted to make risk estimates more conservative – which is, of course, prudent. Being too conservative, however will make risk models less attractive for banks to use it not only as a regulatory instrument but also as an effective internal risk management tool.
- Finally, changes that we will introduce through the TRIM project must be implemented in a reasonable manner. Banks need a transitional period for to adopt the new standards.

Let me close these policy guidelines with a clear statement: Throughout all regulatory and supervisory projects to finalise the reform agenda for internal modelling, the Bundesbank will advocate the retention of risk sensitivity.

6 Conclusion

Ladies and gentlemen,

You have a full agenda of challenges in risk modelling ahead of you. Moreover, during the coming years you hopefully will help to make financial risk models better. My key take-aways for these one and a half days and your future work are:

First, internal models have rightfully lost their sacrosanct status, as they revealed big weaknesses during the last financial crisis. Models will never be perfect. We always have to be aware of the underlying assumptions and their shortcomings.

Second: after regulatory reform, internal models rightly continue to play a big role, but now a complementary one. Limits have been set. But we shouldn't overreact. It is also important to maintain incentives for banks with regard to a risk-sensitive framework. This is why, on the Basel Committee, German authorities have resolutely argued in favour of sufficient incentives for internal models.

Third: on the basis of the limits set by the Basel III reforms, we have to look forward now, and NCAs, EBA and SSM have to set about improving internal models further so that they can contribute to efficient and stable financial markets – at the service of the real economy.

Again, many thanks for inviting me – I wish all of you a fruitful workshop.
Thank you for your kind attention.