

# ***Capturing Model Risk & Uncertainty in Capital Planning***

PwC Survey Results

November 2013



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# *Executive Summary*

### **Survey Goal**

In August 2013, PwC launched an industry benchmarking study of Comprehensive Capital Analysis and Review (“CCAR”) and Capital Plan Review (“CapPR”) banks regarding current practices and methodologies for capturing model uncertainty in capital plans. The goal of this study is to provide participants with an independent and objective view of the range of practices being used to quantify model risk / uncertainty in the capital plans.

### **Survey Design**

All 29 CCAR and CaPR banks were invited to participate by either returning their answers in a provided spreadsheet-based survey questionnaire, or by participating in a discussion of the questions via phone.

While PwC was hoping to collect both the qualitative as well as quantitative information that would allow us to analyze the range of model risk / uncertainty add-ons, not enough institutions provided quantitative responses to allow meaningful analysis. Consequently, this presentation is limited to information about the methodological practices.

## **Executive Summary – Regulatory Expectations**

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From “Capital Planning at Large Bank Holding Companies: Supervisory Expectations and Range of Current Practice”, August 2013, Board for Governors of the Federal Reserve System:

*“...a BHC should identify and assess all risks as part of its risk-identification process and should capture the potential effect of all risks in its capital planning process. A BHC’s capital planning process should assess the potential impact of these other risks on the BHC’s capital position to ensure that its capital provides a sufficient buffer against all risks to which the BHC is exposed.”*

*“There is a wide range of practices around how BHCs account for other risks as part of their capital planning process. Many BHCs used internal capital targets to account for such risks, putting in place an incremental cushion above their targets to allow for difficult-to-quantify risks and the inherent uncertainty represented by any forward-looking capital planning process. Other BHCs assessed the effect of in terms of some combination of reduced revenue, added expenses, or a management overlay on top of loss estimates. BHCs with lagging practices did not even attempt to account for other risks in their capital planning process.”*

*“For those BHCs that did not incorporate the potential impact of these other risks into their capital targets, stronger practices included a clear articulation of which risks were being addressed by putting in place a cushion above the capital target, and how this cushion is related to identified risks. BHCs should clearly support the method they used to measure the potential effect of such risks. Using a simple rule (such as a percent of capital) or expert judgments to determine the cushion above the capital target, without providing analysis or support, is a lagging practice.”*

## ***Executive Summary – Regulatory Expectations (continued)***

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From “*Capital Planning at Large Bank Holding Companies: Supervisory Expectations and Range of Current Practice*”, August 2013, Board for Governors of the Federal Reserve System:

*“BHCs should also maintain a process to incorporate well-supported adjustments to model estimates when model weaknesses and uncertainties are identified.”*

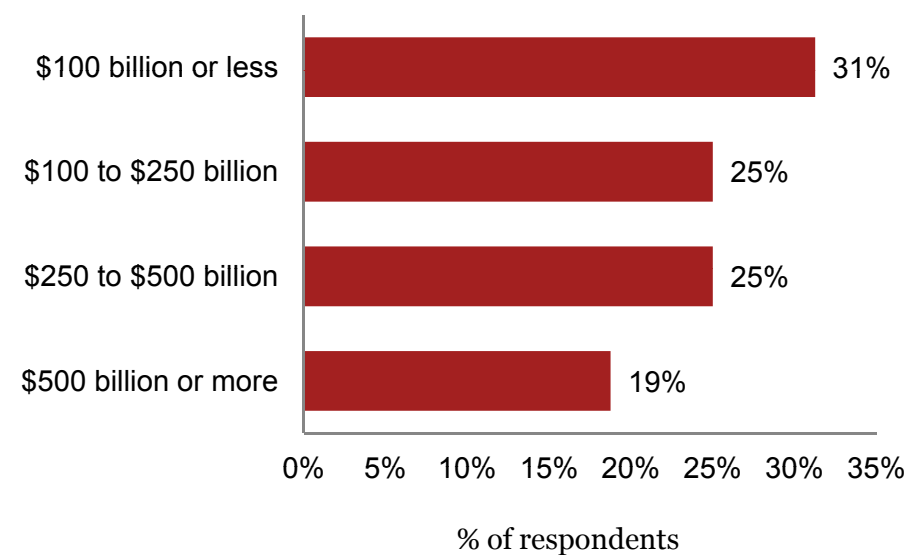
*“It is important for BHCs to understand the uncertainties around their estimates, including the sensitivity of the estimates to changes in inputs and key assumptions.”*

*“Given the uncertainty inherent in a forward-looking capital planning exercise, the Federal Reserve expects BHCs to apply generally conservative assumptions throughout the stress testing process.”*

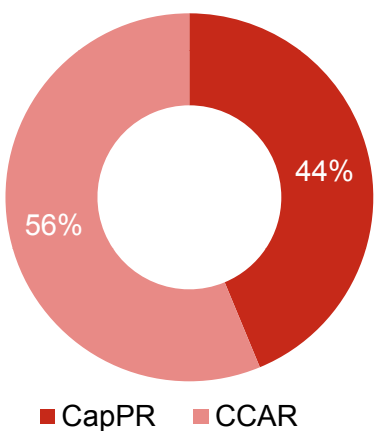
*“To the extent possible, BHCs should incorporate the effect of these other risks into their projections of net income over the nine-quarter planning horizon.”*

***Of the 29 CCAR and CaPR institutions invited to participate, 16 institutions have responded***

**Breakdown of Respondents by Asset Size**



**Breakdown of Respondents by CCAR vs. CaPR**



## ***Overview of Survey Results***

- All institutions participating in the survey currently employ practices to address model risk / uncertainty management and quantification, yet the approaches utilized vary in their degree of complexity and maturity
- Additionally, the manner in which institutions address model risk in their capital management frameworks illustrates differing philosophies or strategies for incorporating uncertainty
- Overall, capital planning practices exhibit a lack of convergence of methodologies for capturing model risk / uncertainty.
  - Lack of specific regulatory guidance is driving continued use of very diverse methodologies and introduction of new approaches
  - Some institutions are hedging their regulatory risk by adopting multiple methodologies
  - Practices also vary with respect to inclusion of model risk / uncertainty adjustments and capital add-ons on form Y-14A\*. Larger institutions tended to include model uncertainty / risk measures in the Y-14A estimated stress losses more frequently than smaller institutions

*\* For DFAST institutions, the equivalent forms are FDIC DFAST 10-50, FR Y-16 and OCC DFAST 10-50*

## ***Overview of Survey Results (continued)***

- Top-down qualitative model risk / uncertainty buffer estimation methodologies are still popular, but bottom-up methodologies are becoming prevalent
  - There is an increased reliance on Residual Model Risk assessment methodologies
  - Some bottom-up approaches are very complex and involve multiple layers of judgment
- Some institutions choose not to create model risk / uncertainty buffers or adjustments. Instead, they argue that actively managing model risk and using conservative assumptions to reduce uncertainty is sufficient



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# *Survey Results*

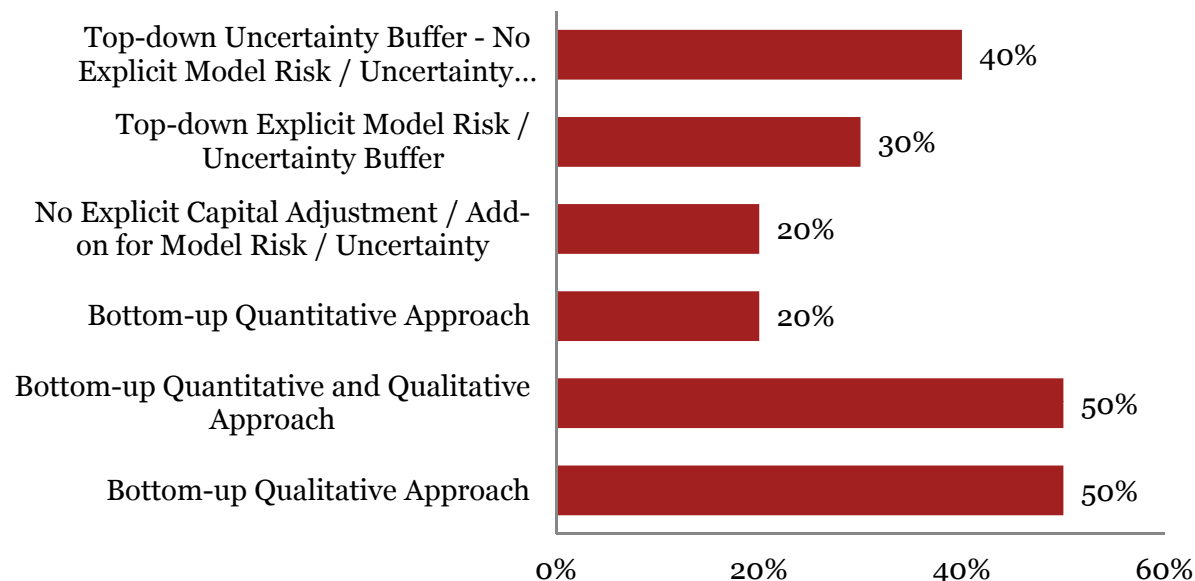
## *There is a lack of convergence of methodologies for capturing model risk / uncertainty in capital plans*

- **Lack of specific regulatory guidance is driving continued use of very diverse methodologies and introduction of new approaches:**

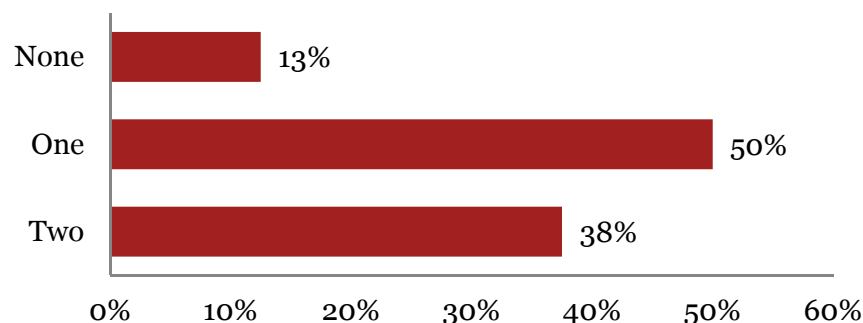
Current practices range from not quantifying model risk / uncertainty at all, to using high-level qualitative buffer estimation methods, to very complex model-specific measurements of residual model risk and quantitative uncertainty. There appears to be little correlation between the complexity of the methodologies and the size of the institutions.

- **Some institutions are hedging their regulatory risk by adopting multiple methodologies:** More than a third of the participants reported using two distinct approaches for capturing model uncertainty / risk. This typically included a bottom-up (more quantitative) approach as well as a top-down (more qualitative) buffer.

Percent of Respondents Using a Particular Approach Type



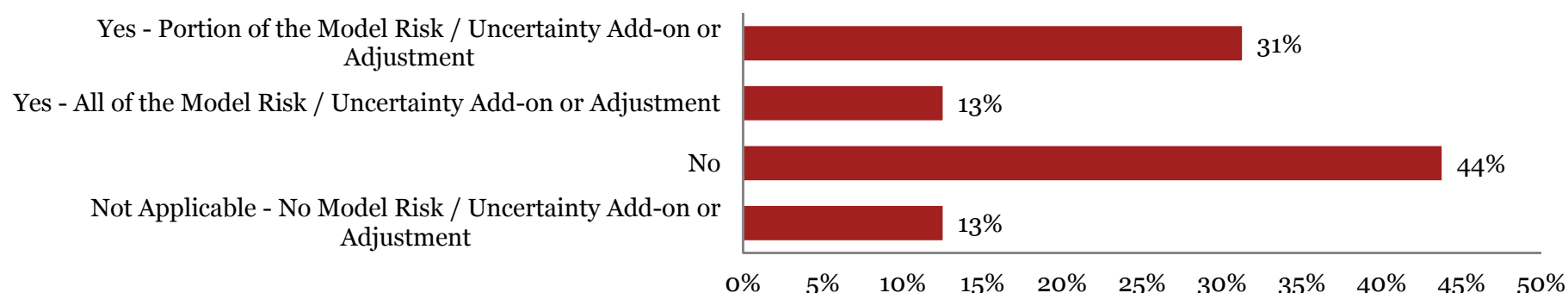
Number of Distinct Methodologies in Use Within the Bank for Capturing Model Risk / Uncertainty in Capital Planning



## ***There is a lack of convergence of methodologies for capturing model risk / uncertainty in capital plans (continued)***

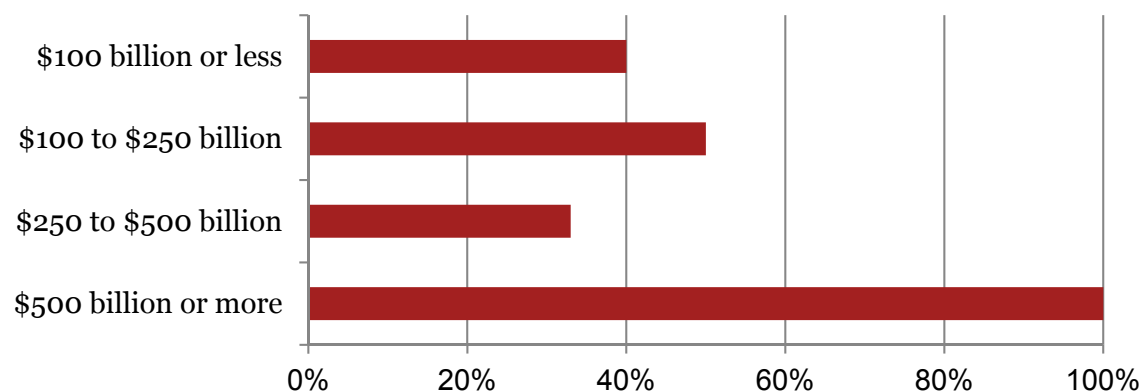
- **Practices also vary with respect to inclusion of model risk / uncertainty adjustments and capital add-ons on form Y-14A:** At some institutions that relied on more than one model risk / uncertainty measurement methodology, only the outcomes from one of the methodologies were passed through Y-14A.

**Is Model Risk/Uncertainty Adjustment or Add-on Passed Through Form Y-14A?**



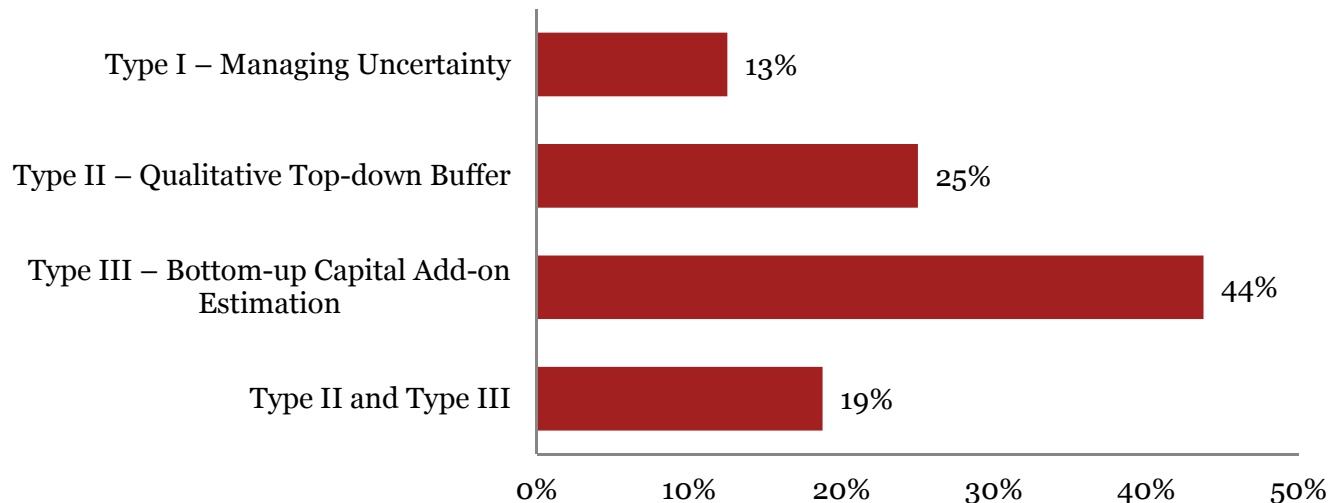
- **The largest institutions among the study participants all choose to include model uncertainty / risk measures in the Y-14A estimated stress losses.**

**Percentage of Respondents in Each Size Group That Include Model Risk/Uncertainty Add-ons in Y-14A**



***Existing methodologies for dealing with model risk and uncertainty in capital planning can be grouped into the following three broad categories:***

- **Methodology Type I – Managing Uncertainty:** Rather than attempting to quantify model risk and uncertainty, some institutions chose to only actively manage and minimize it through the use of rigorous model risk management practices and use of conservative inputs and assumptions. These institutions do not have model risk / uncertainty capital add-ons or buffers.
- **Methodology Type II – Qualitative Top-down Buffer:** A number of institutions estimate top-down qualitative buffers for model risk / uncertainty. These buffers are typically determined based on the assessment of management's capital targets against stress loss estimates. Frequently, this methodology is supplemented by a bottom-up model-specific risk and uncertainty estimate.
- **Methodology Type III – Bottom-up Capital Add-on Estimation:** The most complex of the three categories, this methodology can take a number of different forms, and may rely on both quantitative and qualitative approaches for estimating model-specific risk and uncertainty measures. This is a dominant methodology type with 10 out of 16 respondents using it exclusively or supplemented with the Type II approach.



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# *Methodology Type I – Managing Uncertainty*

***Only two of the respondents did not have any model risk / uncertainty buffer or add-on. The following key points reflect their position:***

- **Model Risk / Uncertainty Cannot be Fully Measured:** That is, while some of the known quantitative aspects of uncertainty (e.g., statistical uncertainty of outputs of certain models, historical model error, sensitivity of outputs to certain factors) can be measured, a significant portion of model risk (e.g., misstatement of losses driven by production data errors) and many types of unknown uncertainty (e.g., caused by unpredictable future events) cannot be quantified.
- **Model Risk / Uncertainty Should Be Managed and Minimized:** Rather than attempting to quantify model risk and uncertainty, these institutions chose to only actively manage and minimize it through:
  - Use of rigorous model risk management practices, and
  - Use of conservative inputs and assumptions to compensate for known model weaknesses / limitations and uncertainties.

*Most other respondents also use model risk management practices and conservative inputs and assumptions to manage and reduce uncertainty. The difference is that the institutions with Type I methodology actively argue that no further action is necessary.*

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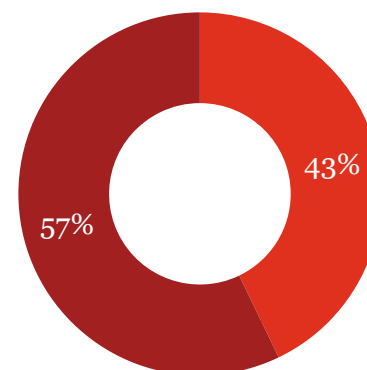
# *Methodology Type II – Qualitative Top-down Buffer*

***Use of Top-down buffer methodologies is widespread, but specific practices vary greatly:***

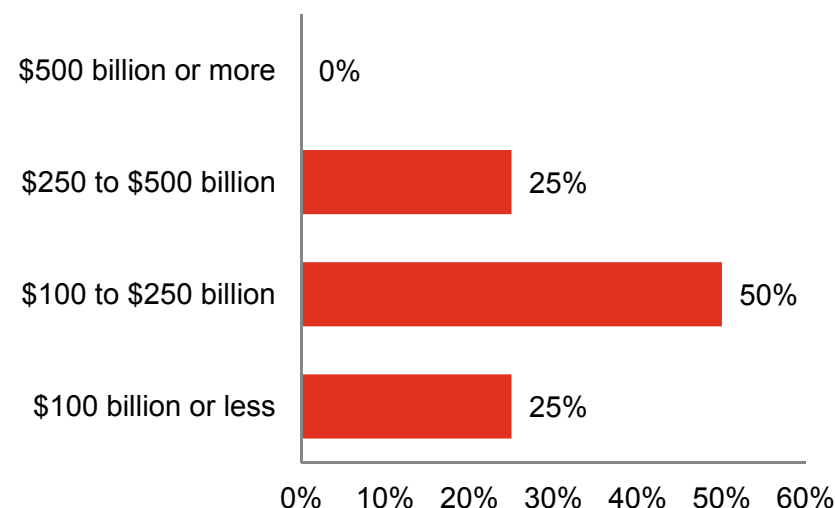
- **Supplementing Bottom-up Methods:** Of the seven institutions that rely on a bottom-up qualitative model risk / uncertainty buffer methodology, three institutions use it as a supplement to their bottom-up methodology. That is, the top-down buffer is designed to capture those risks and uncertainties not already captured explicitly by the bottom-up capital add-on.
- **Clear Size Effect:** The institutions that rely exclusively on the top-down qualitative buffer methodology tend to be smaller.

**Is the Bank Using Exclusively the Top-down Approach?**

■ Top-down and Bottom-up ■ Top-down Only



**Breakdown of Banks Exclusively Relying on the Top-down approach?**



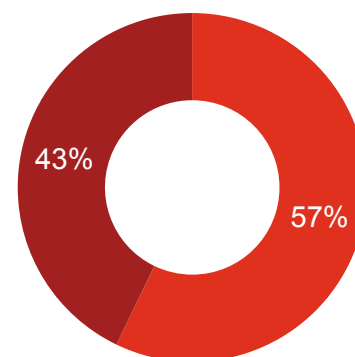


## *Use of Top-down buffer methodologies is widespread, but specific practices vary greatly (continued):*

- **The Size of the Buffer is Usually Based on Capital Target:** Most of the institutions relying on a top-down buffer approach calculate it as the difference between management's target capital level and the combined stress losses estimated directly by models and other methods. A portion of such buffer may then be judgmentally allocated specifically to model risk / uncertainty.
- **Lumping Together Uncertainty Sources:** Most of the institutions using the Top-down buffer methodology have aggregate buffers that include various types of uncertainties and hard to quantify risks, including model risk / uncertainty, but the model risk / uncertainty portion is not explicitly quantified.

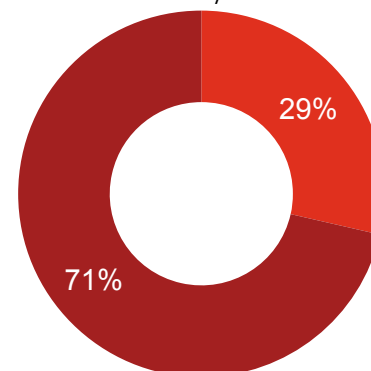
### What is the Buffer Based On?

- Buffer Based on Capital Target
- Buffer Based on Other Considerations



### Is There a Dedicated Model Risk / Uncertainty Buffer?

- Buffer Covers All Unquantified Risks and Uncertainties
- Specific Model Risk / Uncertainty Buffer



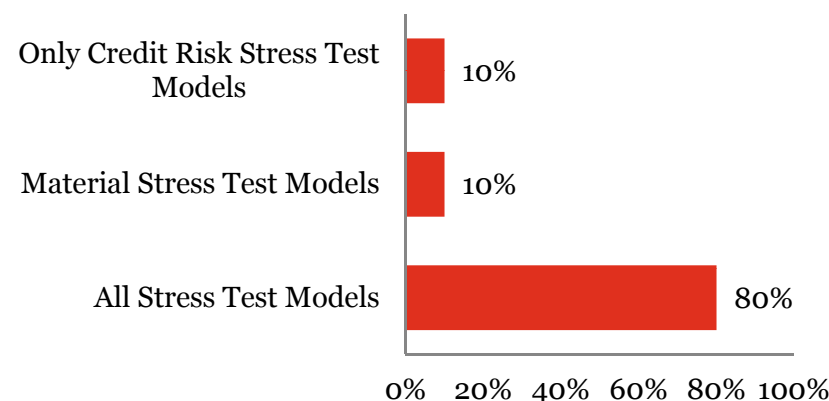
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# ***Methodology Type III – Bottom-up Capital Add-on Estimation***

***Bottom-up methodologies are becoming wide-spread, and increasingly rely on quantitative measurement techniques. Of all respondents, 63% relied on a bottom-up methodology exclusively or partially***

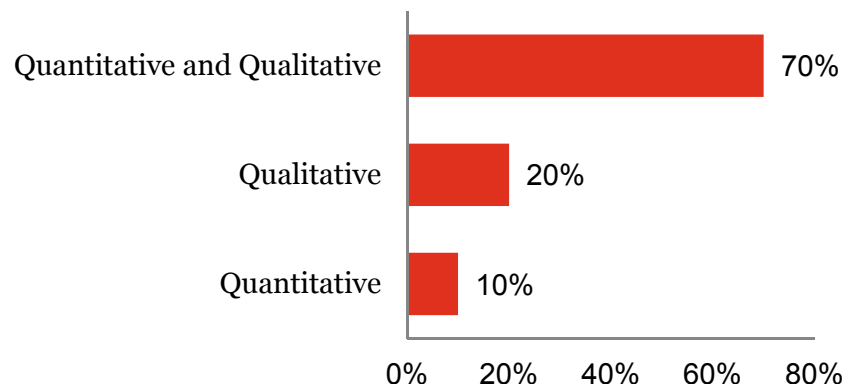
- **Model Risk / Uncertainty Analysis Typically Applied to All Stress Testing Models:** Only one bank applied the measurement methodology to a subset of stress testing models – those used only for credit loss estimation.

Which Models are Covered by the Methodology?



- **Qualitative Judgment Plays Key Role:** While many of the institutions rely on quantitative analysis to measure some degree of model uncertainty, ultimately there is a significant reliance of qualitative judgment to determine dollar loss impact.

Are Measurement Methodologies Quantitative or Qualitative in Nature?



### *There is a number of variations of bottom-up approaches, including:*

- **Adjustments / Overlays to Estimated Losses:**  
Such adjustments / overlays are typically based on quantitative considerations. Output adjustments / overlays are typically passed through Y-14A.
- **Calculation of Residual Risk Measures:** A number of institutions are assessing Residual Model Risk on a model-by-model basis and then translating the resulting measure into percentage or dollar capital add-on.
  - Residual risk level is determined based on both the quantitative analysis of model uncertainty, as well as a number of qualitative considerations.
  - Some banks use complex scorecards while others use a simple High/Medium/Low classification system.
- **Direct Calculation of Capital Add-ons:** Some of the banks bypass Residual Model Risk measurement step and directly calculate capital add-on using similar considerations.
- **Some Banks Use Multiple Versions of Bottom-up Methodologies.**

### **What are the Most Common Drivers of Bottom-up Adjustments, Overlays, and Add-ons?**

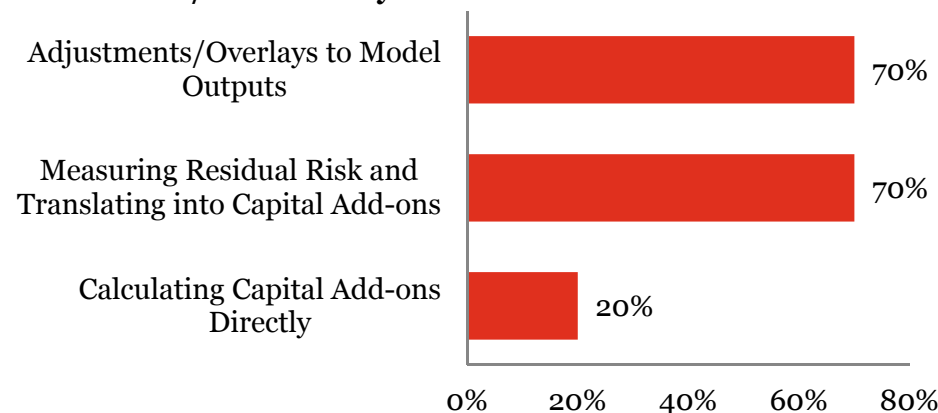
#### Quantitative:

- *Analysis of historical model error (e.g. through backtesting)*
- *Sensitivity analysis*
- *Benchmarking to challenger models*
- *Measures of statistical uncertainty (confidence interval)*

#### Qualitative:

- *Model weaknesses / limitations. Number and criticality of validation findings*
- *Quality of the data, including length of available history*
- *Maturity of the model*
- *Comprehensiveness of independent validation testing*

### **What is the Overall Approach for the Bottom-up Model Risk / Uncertainty Measurement?**



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