Forward-looking and Incentive-compatible Operational Risk Capital Framework

Marco Migueis
Federal Reserve Board

FRB of Richmond Operational Risk Research Conference

July 2018

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Operational Risk Capital Framework

- Advanced Measurement Approach (AMA) still in effect for large, internationally active US banks
- In December 2017, the BCBS revised the operational risk capital framework introducing a new standardized approach (NSA)

$$NSA\ Capital = f(IncomeStatement, AveragePastLosses)$$

- H.R. 4296 would require the operational risk capital framework to be based on "current" risks, be forward-looking, and allow for operational risk mitigants

Criticisms of AMA and NSA

- AMA
  - Gameable
  - 99.9th percentile estimates have large uncertainty
  - Unclear whether risk sensitive
  - Lacks comparability across banks and jurisdictions
  - Burdensome for banks and regulators
  - Limited usefulness for risk management
- NSA
  - Lacks risk sensitivity
  - No forward-looking view
  - Not useful for risk management

Improving the Framework - Incentive Compatibility

- Incentive compatibility in this context means banks having the incentive to reveal their best estimates of future losses
- The AMA is not incentive compatible
  - To maximize ROE, banks have incentives to underestimate exposure (and thus capital)
  - AMA does not include mechanisms to automatically penalize underestimation
- Market risk capital framework penalizes underestimation of exposure through back-testing requirements

Incentive Compatibility (1/3)

- Gneiting and Raftery (2007) showed that the function S can be used to provide incentive for estimation of any quantile α (under risk neutrality)

$$S(r; x) = \alpha \cdot s(r) + [s(x) - s(r)] \cdot 1\{x \leq r\} + h(x)$$

  where x is an observation of the variable of interest, r is the quantile estimate, s is a non-decreasing function, and h is an arbitrary function.

- S can be multiplied by -1 to turn it into a minimization problem (in this case, it will be a capital minimization problem)

$$S'(r; x) = -\alpha s(r) + [s(r) - s(x)] \cdot 1\{x \leq r\} - h(x)$$

Incentive Compatibility (2/3)

- If s is assumed to be the identity function, S' can be re-written as follows

$$S'(r; x) = (1 - \alpha)r + Max\{-x, -r\} - h(x)$$

- If we want to break the capital requirement (S') into a requirement at time t (corresponding to the quantile estimate) and a requirement in future periods, this can be accomplished by multiplying the expression by 1/(1- α) (assuming no time discounting)

$$S''(r; x) = r + \frac{Max\{-x, -r\} - h(x)}{(1 - \alpha)}$$

Incentive Compatibility (3/3)

- If h was set to zero, the formula providing incentive compatibility would lead to capital decreases in future years. But if h is set to –x, S'' becomes

$$S''^{(r;x)} = r + \frac{Max\{x - r, 0\}}{(1 - \alpha)}$$

- Regulators may wish to increase conservatism by scaling requirements instead of increasing the estimation quantile (as is done in market risk). This can be done by scaling the whole expression

$$S'''(r;x) = \beta r + \beta \frac{Max\{x - r, 0\}}{(1 - \alpha)}$$

Example Framework (1/4)

- Assume α = 95% and β=2. Capital requirements could be given by:

  $$OpRiskCapital\_Option1_t = 2Q^{95}(t|t-1) + 40Max\{Loss_{t-1} - Q^{95}(t-1|t-2), 0\}$$

- Assume that the annual operational losses of a bank are distributed according to a lognormal(20,1).

Statistics of Total Annual Loss Distribution given by Lognormal(20,1)			
Average	Median	95th Percentile	99.9th Percentile
$800Mln	$485Mln	$2,513Mln	$10,665Mln

Example Framework (2/4)

- Assuming the bank estimates the quantile accurately, the distribution of capital requirements under Option 1 has the following statistics

Statistics of Capital Requirements (Option 1)			
Median & 95th Percentile	Average	Standard Deviation	99th Percentile
\$5,027Mln	\$8,315Mln	\$24,672Mln	\$103,480Mln

- Capital would suffer from meaningful volatility in the 5% of years where losses are above the 95th quantile

Example Framework (3/4)

- Incentive-compatibility can be achieved while spreading out the penalization over more years and limiting its size.

$$OpRiskCapital\_Option2_t = 2Q^{95}(t|t-1) + Penalty_{t-1}$$

Where: $Penalty_t = min\{ExceedenceStock_t, 2AvgLoss_t + Penalty_{t-1}, 12AvgLoss_t\}$

$$ExceedenceStock_t = ExceedenceStock_{t-1} - Penalty_{t-1} + 40Max\{Loss_t - Q^{95}(t|t-1), 0\}$$

$$AvgLoss_t = \frac{\sum_{i=0}^{9} Loss_{t-i}}{10}$$

Example Framework (4/4)

- Under Option 2, the distribution of capital requirements would have the following statistics (and be much less volatile)

Statistics of Capital Requirements (Option 2)			
Median	Average	Standard Deviation	99th Percentile
$5,027Mln	$8,315Mln	$5,477Mln	$26,231Mln

Additional considerations

- Banks could reduce potential capital volatility further by overestimating the regulatory quantile
- Losses used on date of accounting to allow apples to apples comparisons with quantile estimates
- Predictable large losses (e.g., certain legal losses) should not lead to exceedances of the 95th percentile estimate because they should be included in estimate
- To comply with Basel III, capital would need to floored by the NSA, but the version of the NSA with no losses could be used

Advantages of this approach

- Forward-looking
- Modeling flexibility
- Risk sensitive
- Not gameable
- Should be useful for risk management

Conclusion

- AMA is gameable, complex, and not forward-looking enough
- NSA is not forward-looking, nor useful to risk management
- The US op risk capital framework should be risk sensitive/forward-looking, while limiting gaming opportunities
- The key is to adopt a framework that allows forward-looking inputs while maintaining incentive-compatibility