Applying the Pre-Commitment Approach to bottom up stress tests

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2019 EBA Policy Research Workshop, Paris, 27 November 2019

Summary

- Goals:
  - Incentivize banks (bank managers...) to report results of bottom-up stress tests to supervisors *truthfully*.
  - Allow banks to run their own risk models, without thorough scrutiny.
- Setup of bottom-up stress tests:
  - Regulator defines stress test scenario(s).
  - Bank runs own model to forecast key figures conditional on the scenario. Bank could use a model $\mathbf{P}^{report}$ different from its "best belief" $\mathbf{P}^{honest}$.
- Devices:
  - Self-revelation: Bank reports its forecast future loss rate (or related).
  - An ex-post charge paid by the bank(er), equivalent to the mean squared error in regression analysis

$$charge = \delta\left(LR_{t+h} - \mathbf{E}_t^{report}(LR_{t+h})\right)^2$$

  - Important: $\mathbf{E}_t^{report}(LR_{t+h})$ is not the stress testing result but the „plain" unconditional forecast of LR_{t+h}.

A major concern (I think...)

- The charge would actually incentivize truthful reporting of the unconditional forecast: the bank would choose a reporting model such that

$$\mathbf{E}_t^{report}(LR_{t+h}) = \mathbf{E}_t^{honest}(LR_{t+h}) \qquad \text{(H)}$$

  because this minimizes $\mathbf{E}_t^{honest}\left(LR_{t+h} - \mathbf{E}_t^{report}(LR_{t+h})\right)^2$

- Does it imply $\mathbf{P}^{report} = \mathbf{P}^{honest}$? No.

- What are we actually interested in? Truthful stress testing results:

$$\mathbf{E}_t^{report}(LR_{t+h}|STScen) = \mathbf{E}_t^{honest}(LR_{t+h}|STScen)$$

- Can we backtest/incentivize this? No, stress scenarios are rare.

➔ Underlying assumption: A manipulated model would hurt (H) and hence raise the expected charge.

- Can we hope for that? → See next slide.

Example from the paper's appendix

- "Agreed" macro model: GDP growth $y_t \sim AR(1)$, stress scenario $\{y_{t+1} = y^*\}$
- Default rate model $\mathbf{P}^{honest}$: $DR_{t+1} = d + \rho DR_t + \theta y_{t+1} + \epsilon_{t+1}, \quad \theta < 0$

- Cheating strategy (in the paper): constant bias, i.e.

$$\mathbf{P}^{report}: \; DR_{t+1}^{rep} = d + \rho DR_t + \theta y_{t+1} + \epsilon_{t+1} - \boldsymbol{b}$$

- This shows up in the charge! ➔ Incentive device works.

- Another cheating strategy: Choose $C > y^*$ and limit the impact of bad y_{t+1}

$$\mathbf{P}^{report}: \; DR_{t+1}^{rep} = d + \rho DR_t + \boldsymbol{\theta \max(y_{t+1}, C)} + \epsilon_{t+1}$$

- Most of the time, the model is honest:

$$\mathbf{E}_t^{report}(DR_{t+1} | y_{t+1} > C) = \mathbf{E}_t^{honest}(DR_{t+1} | y_{t+1} > C)$$

- But not conditional on stress:

$$\mathbf{E}_t^{report}(DR_{t+1} | y_{t+1} = y^*) = \mathbf{E}_t^{honest}(DR_{t+1} | y_{t+1} = C) < \mathbf{E}_t^{honest}(DR_{t+1} | y_{t+1} = y^*)$$

➔ Incentive device is blind to "tail cosmetics"

Conclusion

- The incentive device is not reliable if banks can distort the model's relationship between frequently observed events and rarely observed scenarios (of interest in stress tests)

- Two ways out:
  - A: Thorough scrutiny of bank's own models;
  - B: Prescribe the model (at least, the relationship mentioned above).

- Designers of the Basel 2 IRB approach chose option B:
  - Let banks determine PDs (+ LGDs, EADs in AIRBA), require PD backtests.
  - Impose the Vasicek model on all banks to determine loss tails.

Minor Comments

- Charge is symmetric to under- and overestimating the effect of stress
  ➔ targeted at “being right as often as possible”.
- But these errors have different costs and, more importantly, different externalities. Intuitively, underestimation is worse.
- Compare with credit scoring tools, virtually all standard medical tests: they rarely make alpha errors but frequently beta errors.
- Think about tilted charges derived from costs. General framework:
  - Gneiting, T., & Raftery, A. E. (2007). Strictly proper scoring rules, prediction, and estimation. *JASA* 102(477), 359-378.

- Relevant reference not in the paper:
  - Migueis, M. (2017). Forward-looking and incentive-compatible operational risk capital framework. *SSRN* 2964945.