

## Market Risk and new Basel regulations beyond plumbing

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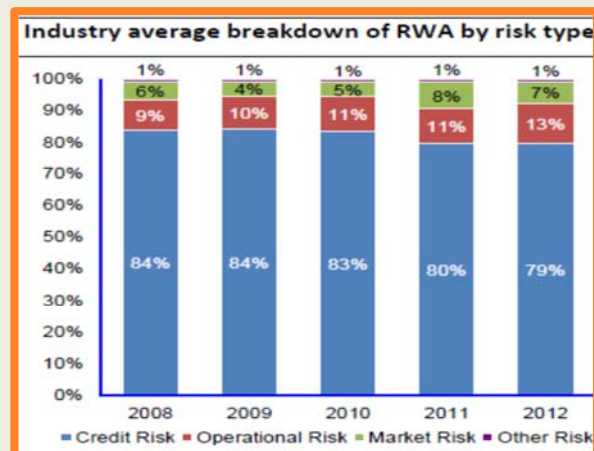
## Outlook

- ▶ From scenario and stress-tests approaches to advanced statistical approaches and backward
  - ▶ Lengthy and unfinished history
- ▶ Market risk intermediation by banks is more capital demanding
  - ▶ Switch from exotic to standardized products
  - ▶ Smaller number of huge players: US banks leading the race
  - ▶ Increased use of systematic trading strategies outside the banking sector
- ▶ Capital requirements regulations increasingly complex
  - ▶ Conflicting statements in new rules
  - ▶ Accountability, role of risk committees within boards
  - ▶ Large discretion provided to supervisors

2

## Market risks: Global outlook

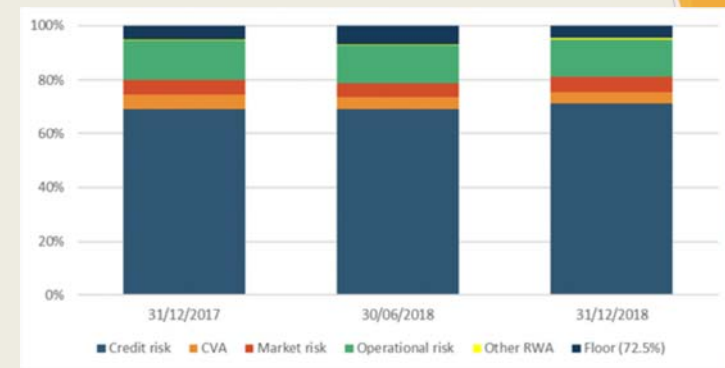
- ▶ Market risks are not the main driver of banks' risks
  - ▶ But are prominent for large dealer banks



Ames, Schuermann, & Scott (2015)

3

## Market risks: Global outlook



Output floor: Minimum regulatory capital floored at 72.5% of capital computed under standard approach as a way to mitigate the internal model approach (i.e. risk models designed by banks, compliant with regulations and supervisory requirements (NB: CVA credit valuation adjustments, RWA risk weighted assets)

EBA impact study on Group 1 EU banks disclosed in October 2019

<https://eba.europa.eu/sites/default/documents/files/Basel%20III%20monitoring%20exercise.pdf>

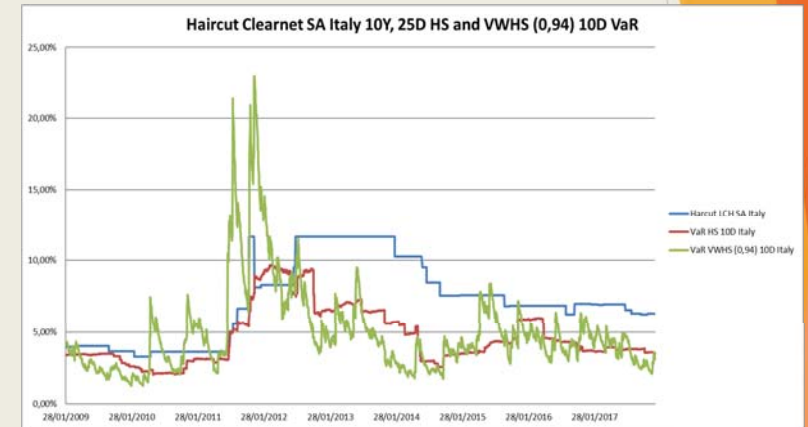
4

## Haircuts on Italian government bonds (Clearnet SA) vs historical 10 D VaR and VWHS (volatility weighted historical simulation)

- ▶ Banks : minimum capital requirements for market risk
- ▶ OTC derivatives regulations: bilateral initial margin models are risk models, similar to the standardised approach (SA) of FRTB: ISDA SIMM (standard initial margin model)
- ▶ Initial margins computed by CCPs are also market risk models and these margin models have become a major issue when dealing with counterparty credit risk
  - ▶ IMM (internal models) and SA-CCR (standardised approach)
- ▶ Haircuts applied to bonds provided as collateral can be derived from quantitative models
- ▶ All such models have major implications regarding financial stability

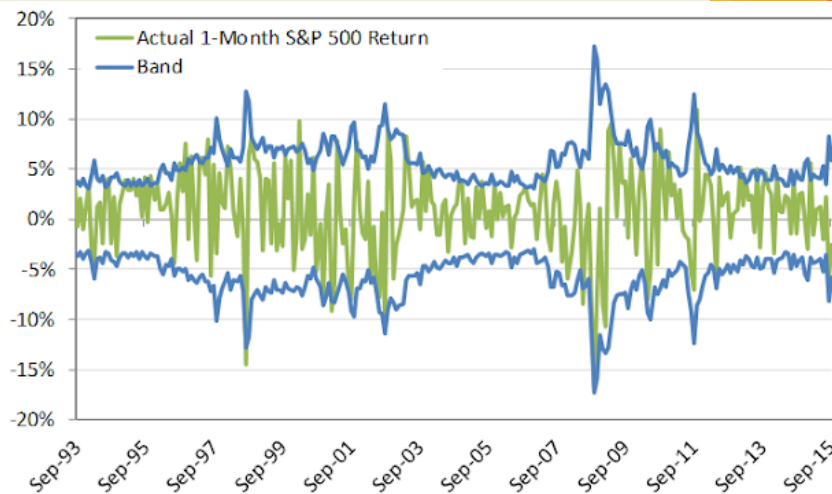
5

## Haircuts on Italian government bonds (Clearnet SA) vs historical 10 D VaR and VWHS (volatility weighted historical simulation)



Les taux de décote des chambres de compensation augmentent avec le risque de marché. S'il faut plus d'obligations pour obtenir du cash, cela implique une contraction de la liquidité et de la masse monétaire : spill-over risques de marché vers économie réelle (effets procycliques ; politique monétaire ?)

6



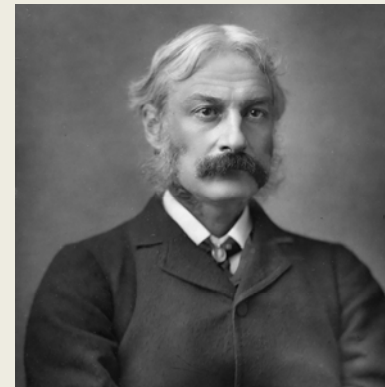
En vert, rentabilités mensuelles du S&P500, en bleu +/- le VIX mensualisé : estimation d'un écart-type du taux de rentabilité le mois à venir.

Les rentabilités restent à peu près dans l'intervalle de fluctuation formé à partir du VIX, ce qui montre sa qualité pr.

NB : Le VIX est exprimé en volatilité annualisée. Pour passer à une volatilité mensuelle, on divise le VIX par  $\sqrt{12}$ .

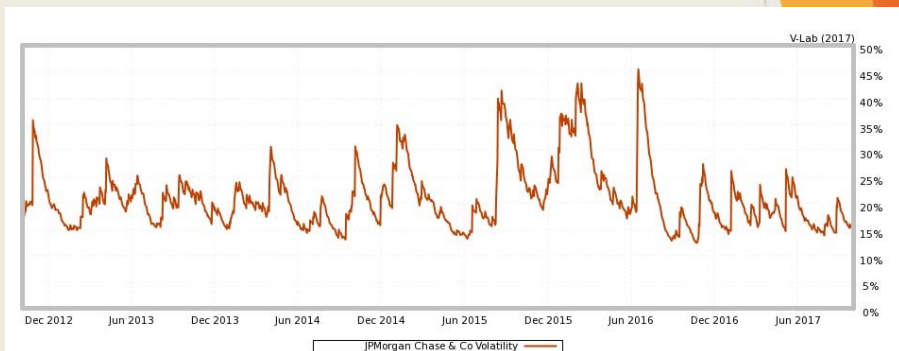
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*An unsophisticated forecaster uses statistics as a drunken man uses lamp-posts – for support rather than for illumination,* Andrew Lang, novelist and anthropologist



8

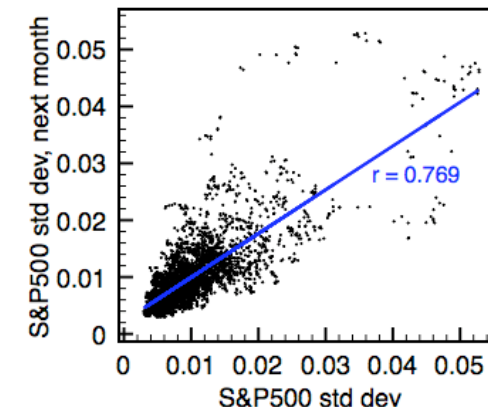
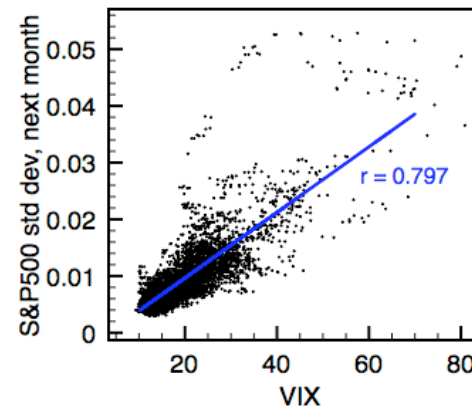
## Predicting volatility is notoriously difficult



From Engle, Vlab, JP Morgan predicted volatility

9

Prévisions de volatilité : en ordonnées, la volatilité réalisée de l'indice S&P 500, le mois à venir (0,05 correspond à 5%) En abscisses à gauche, le niveau de VIX (en %), à droite la volatilité réalisée de l'indice S&P500 le mois précédent. Le VIX et la volatilité réalisée ont à peu près le même pouvoir prédictif.

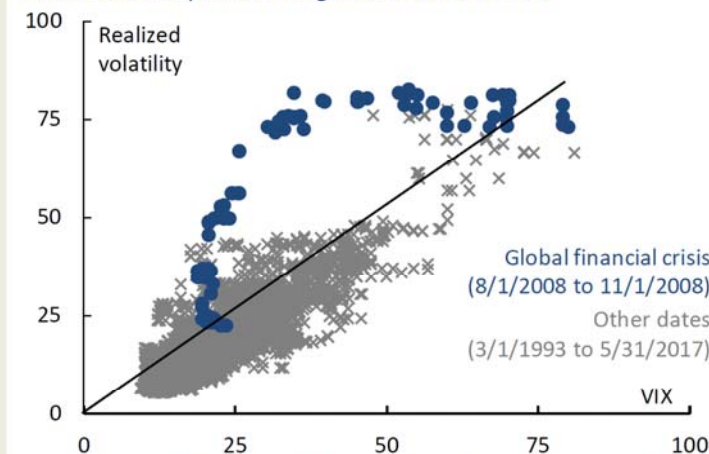


<https://en.wikipedia.org/wiki/VIX>

## Moment de Minsky et "extremistan" de Taleb

Figure 4: VIX and Realized Volatility of S&P 500 Index (percent)

The VIX did not predict the global financial crisis



Note: Realized volatility is the standard deviation of daily returns over 30 days, expressed as annualized percent change.

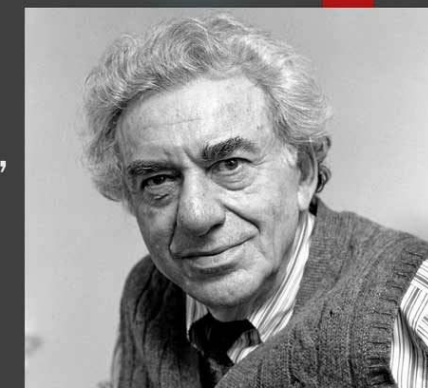
The Volatility Paradox: Tranquil Markets May Harbor Hidden Risks, Office of Financial Research, 2017

11

**Stability leads to instability.**

The more stable things become and the longer things are stable, the more unstable they will be when the crisis hits.

[Hyman Minsky]



12

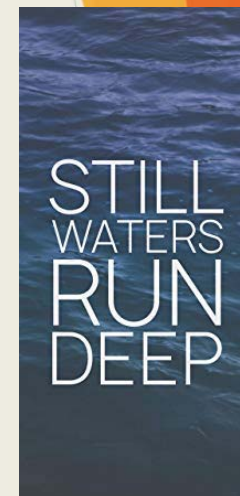
## Le moment de Minsky

- ▶ Théorie de l'instabilité financière endogène
- ▶ Quand la volatilité est faible, les risques sont plus faiblement rémunérés (à ratio de Sharpe inchangé)
  - ▶  $E_M - R_F = \left( \frac{E_M - R_F}{\sigma_F} \right) \times \sigma_F$
- ▶ les investisseurs vont augmenter leur niveau de risque en s'endettant (search for yield)
  - ▶ Effet de levier, déplacement vers la droite le long de la CML (Capital Market Line)
- ▶ Si la volatilité est faible, il est plus facile de s'endetter car les haircuts (taux de décote) sur les titres donnés en garantie sont plus bas

13

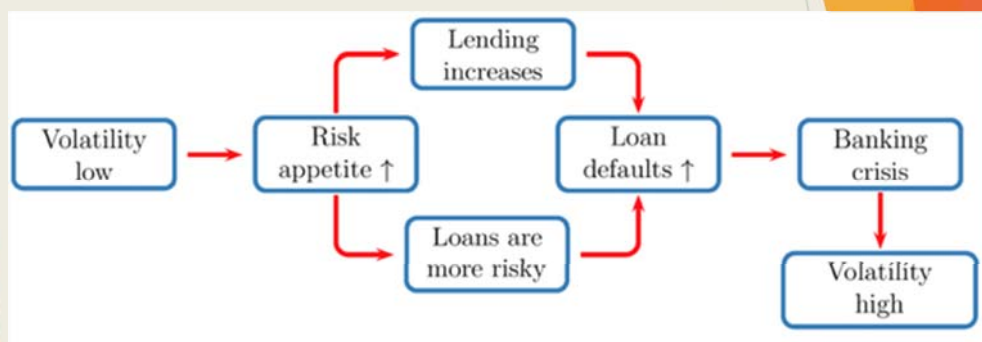
## Le moment de Minsky

- ▶ Selon la théorie de Minsky (1977), il faut se méfier de l'eau qui dort.
  - ▶ « Still waters run deep »
- ▶ Volatility, financial crises and Minsky's hypothesis
  - ▶ <https://voxeu.org/article/volatility-financial-crises-and-minskys-hypothesis>
  - ▶ <https://voxeu.org/article/low-risk-predictor-financial-crises>
  - ▶ Danielsson, J., Valenzuela, M., & Zer, I. (2018). Learning from history: volatility and financial crises. *The Review of Financial Studies*, 31(7), 2774-2805.



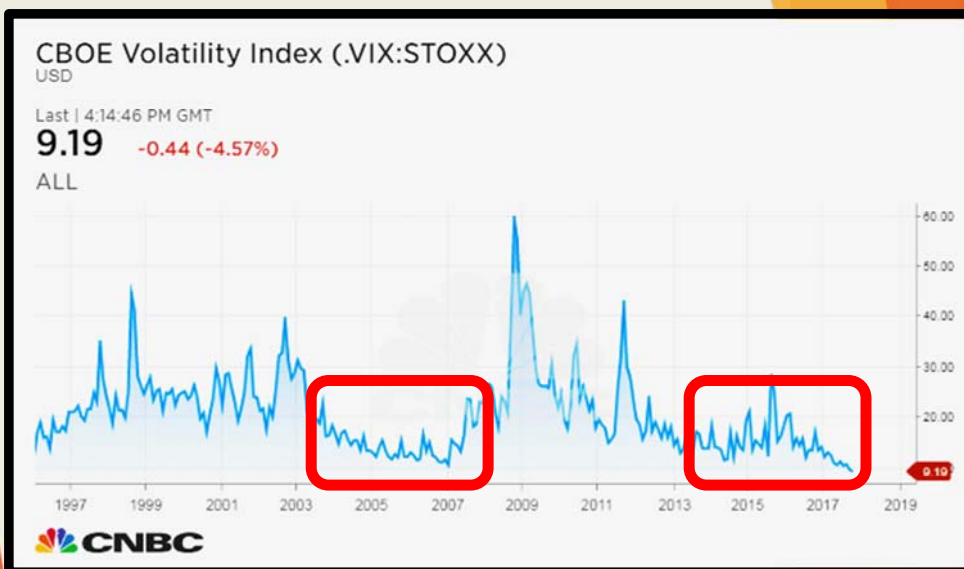
14

## Comment une faible volatilité peut induire de l'instabilité financière



**Boucle endogène déstabilisatrice, via l'augmentation du risque de crédit bancaire**

15



**La crise financière de 2008 a été précédée d'un niveau faible du VIX. Fin 2017, le VIX avait atteint un niveau de 9,2% (60% en 2008)**

16



*“Volatility in markets is at low levels...to the extent that low levels of volatility may induce **risk-taking behavior**...is a concern to me and to the Committee”. Janet Yellen, Chairman of the Fed*



Federal Reserve, Washington

Janet Yellen, ancienne présidente de la banque centrale américaine (Federal Reserve)

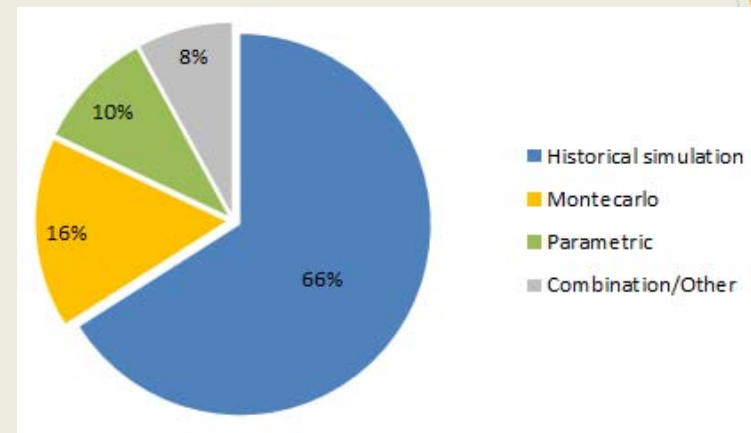
L'indice VIX mesure la volatilité future anticipée pour l'indice SP&500 (via les volatilités implicites des options). La baisse des cours est accompagnée (précédée ?) d'une hausse de la volatilité



Crises financière de 2008 (endogène) et de 2020 (exogène)

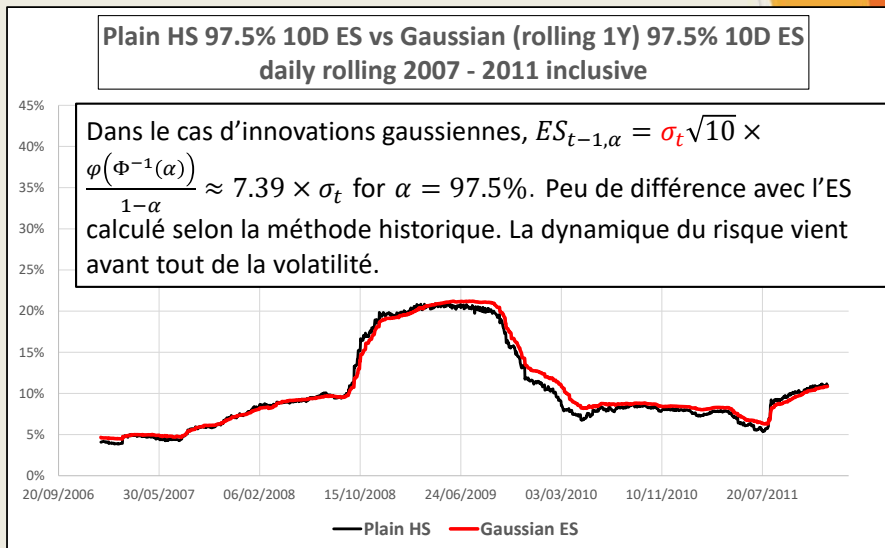


The rise of historical simulation: due to FRTB, almost all large banks will switch to historical simulation



EBA (2017) benchmarking exercise conducted over a (heterogeneous) panel of 50 banks with approved internal models

## Long SPX exposure: Running 1Y 10D 97.5% ES over 2007-2011 plain HS vs Gaussian ES (computed from 1Y rolling volatility)



21

## Historical perspective: The rise and the fall of quantitative analytics

- ▶ Pre-1996 : capital requirements based upon notional values to which regulatory prescribed shocks
  - ▶ Quite similar to CME SPAN or CCP/bank regulatory stress-tests
  - ▶ Not obvious to deal long/short exposures and multiple risk factors/assets
- ▶ 1996 : Markowitz and quantitative analytics step in banking regulations
  - ▶ [Basel amendment for market risks](#) (1996)
  - ▶ [JP Morgan's RiskMetrics](#) (1996)
- ▶ Basel 2.5: Fixing Basel II after 2008 turmoil
  - ▶ Stressed VaR based on year 2008
  - ▶ Credit risk: IRC, CRM, VaR on CVA, ...
- ▶ Basel 3 FRTB: Fundamental Review of the Trading Book

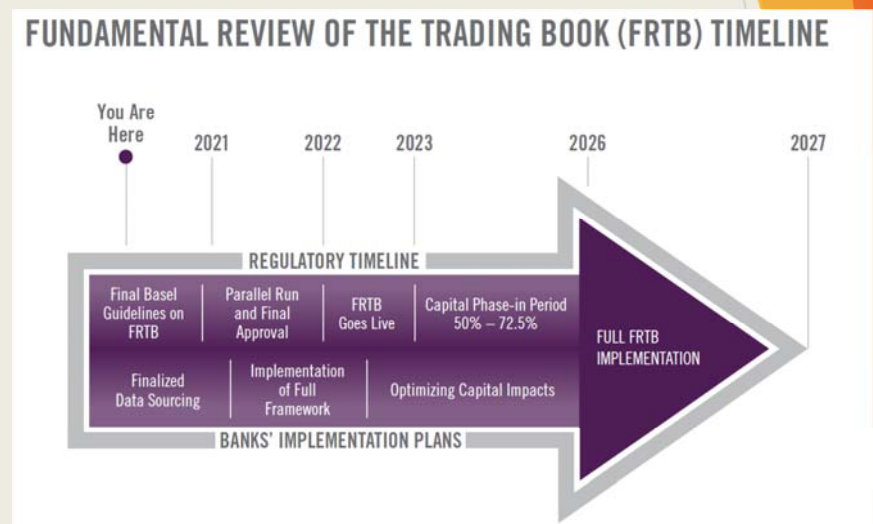
22

## FRTB: an ongoing concern

- ▶ FRTB intended to provide the final touch to post-crisis reforms regarding capital requirements for market risks
- ▶ Several consultation papers (first one back May 2012, <http://www.bis.org/publ/bcbs219.htm>), two Basel Committee working groups, numerous inconclusive quantitative impact studies, first draft in 2016 [Minimum capital requirements for market risk](#) (d352) new draft issued in January 2019 : <https://www.bis.org/bcbs/publ/d457.pdf> , with numerous changes both regarding SA (standard approach) and IMA (Internal Models Approach)
- ▶ No ANPR (Advanced Notice of Proposed Rule Making) yet scheduled in the US by the Fed
- ▶ Besides, unknown implementation post Brexit in the UK by the BoE and the PRA (Prudential Regulation Authority)
- ▶ Most challenging issues (eligibility of internal models, data quality checks, final calibration) waiting for EBA draft RTS, CRR3?
- ▶ What will be the final outcome? Effective implementation date is remote

23

## FRTB: an ongoing concern. Regulatory fatigue ?



24

## Regulatory fatigue ?

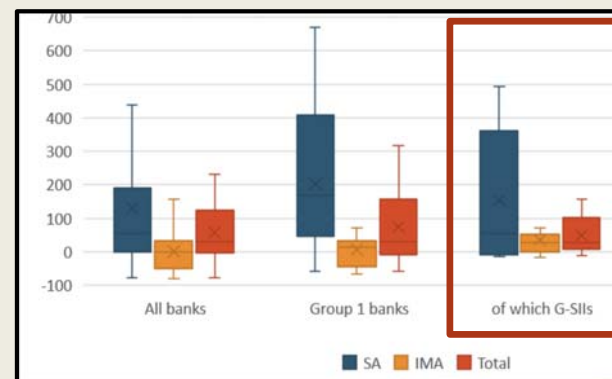
- ▶ “A decade after the start of the crisis, an element of **reform fatigue** is understandable. But giving into it would mean that essential standards are neither completed nor fully implemented”.
- ▶ “Given these risks of fragmentation, G20 Finance Ministers and Governors may wish to consider how best to reinforce international regulatory cooperation”.
- ▶ Letter from Mark Carney, chairman of the FSB (Financial Stability Board) To G20 Finance Ministers and Central Bank Governors, 10 March 2017



25

## FRTB: an ongoing concern

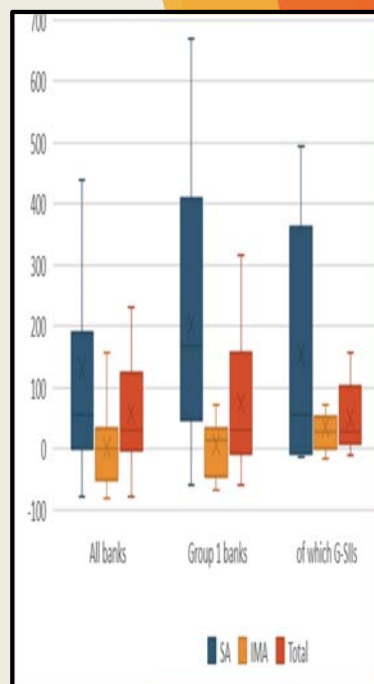
- ▶ EBA impact study (Basel III monitoring exercise) disclosed in October 2019, based on end of year 2018 data and EU banks:
  - ▶ <https://eba.europa.eu/sites/default/documents/files/Basel%20III%20monitoring%20exercise.pdf>
- ▶ Augmentation en % RWA marché : 45 banques. Il faudrait considérer le sous-ensemble des G-SIIs qui ont une activité de marché importante : Deutsche Bank, Société Générale, BNP Paribas, ...
  - ▶ Besoin d'une granularité plus fine



26

## FRTB: an ongoing concern

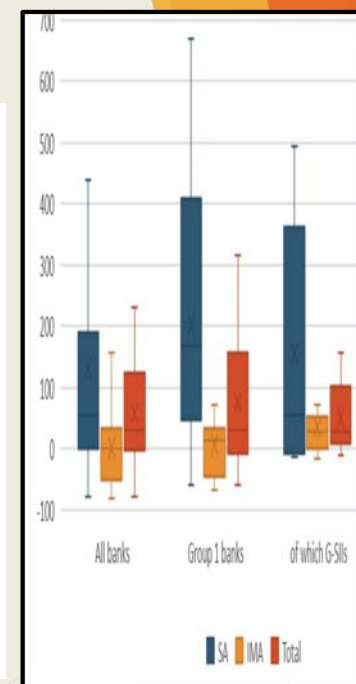
- ▶ Grande variabilité de l'impact sur les portefeuilles actuels
  - ▶ Écart interquartile entre 0% et 100%!
- ▶ Tentative de manipuler les études d'impact (QIS: Quantitative Impact Studies) ?
- ▶ Difficulté d'interprétation des nouvelles règles (approches plus ou moins optimistes ou conservatrices) ?
- ▶ Retards d'implémentation (subis, voulus) ?
- ▶ “Data quality checks revealed some issues and limitations in the information submitted by banks, and the findings should therefore be interpreted with caution.” EBA already quoted reference.



27

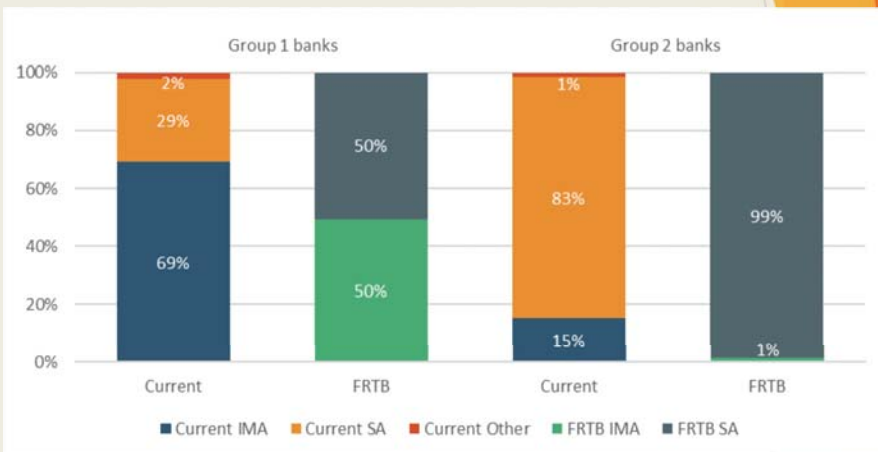
## FRTB: an ongoing concern

- ▶ Substitution IMA/SA
  - ▶ Extension du champ de l'approche standard à la VaR sur CVA, au CTP (Correlation Trading Portfolio).
- ▶ Recalibration de l'approche standard en mars 2019 : diminution des charges
- ▶ Possibilité de bascule de certains desks de l'approche via les modèles internes vers l'approche standard moins risk sensitive (use test ?, limitations de l'approche standard).
- ▶ Au contraire, la complexité de la réglementation, les coûts fixes de compliance peuvent créer des barrières à l'entrée



28

## Seules les banques ayant une activité de marché substantielle recourent aux modèles internes

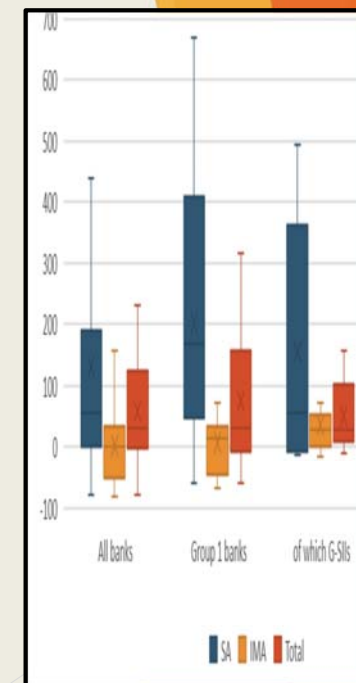


L'augmentation des RWA calculés en approche standard concerne les « grandes » banques (NB : le « gaming » des modèles n'est pas forcément diminué par une utilisation accrue des approches standards)

29

## FRTB: an ongoing concern

- ▶ Si les indications données par les QIS sont valables, on ne peut pas supposer que la structure de risque actuelle reste inchangée
- ▶ Expérience de Bâle 2.5, RWA post-implémentation environ 2 x plus faibles que dans les études d'impact...
- ▶ Optimisation des portefeuilles (couvertures), « optimisation des modèles internes de risque » (dont le périmètre a été réduit) ?
- ▶ Mais aussi risque de fermeture de certains desks, accroissement de la désintermédiation de marché ?



30

## The difficult making of FRTB

- ▶ According to roadmap, FRTB should not lead to an overall increase of capital requirements
  - ▶ Impossible from the outset unless inventories to shrink
  - ▶ Scope of internal models shrunk in favour of standardised approaches plus better accounting of illiquidity
  - ▶ Two (SA and IMA) in one regulations, plus managing switches from one (IMA) to the other (SA)
- ▶ Numerous interactions between regulators and industry, methodological issues discussed behind closed doors
  - ▶ This might not have led to a first best outcome
  - ▶ Poor feedbacks from Basel 2.5 QIS, which provided inflated estimates of RWA
    - ▶ Assessing changes in portfolios to adjust to new rules?
    - ▶ Bank provided poor FRTB QIS data to the Basel Committee

31

## FRTB main changes compared to still in force Basel 2.5

- ▶ Basel 2.5 not yet fully implemented in some jurisdictions
- ▶ Supervisory reviews (TRIM in the eurozone) still require banks to update their current market risk models
  - ▶ Not to quote EBA or Fed stress tests
    - ▶ Large shocks on market risk factors, static approach but requires full re-evaluation of exotic options
- ▶ Final FRTB document issued in January 2019
  - ▶ Wider scope of standardized approaches : changes in market value to changes in CCR (CVA risks), CTP (correlation trading portfolio)
  - ▶ Multiple liquidity horizons (good point) through the use of more challenging “partial” ES (Expected Shortfall)

32

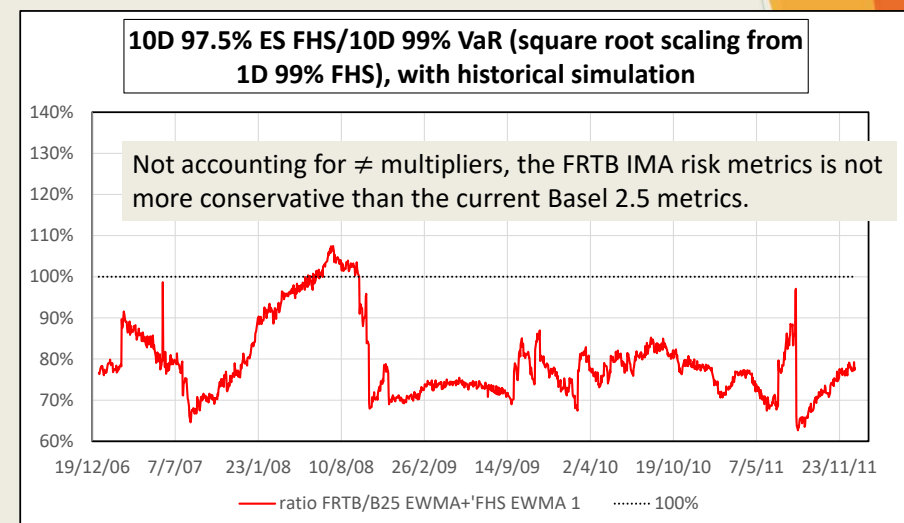


## FRTB main changes compared to still in force Basel 2.5

- ▶ For IMA, capital requirement based upon 100% stressed ES (endogenous computation of stress period with at least monthly update)
  - ▶ As compared with 50% Stressed VaR + 50% current VaR
  - ▶ More stable (**less procyclical**) and larger capital requirements, but RWA will be less informative about current risks.
- ▶ FRTB various features favour plain historical simulations approaches
  - ▶ Implications of this shift are not yet fully investigated and understood

33

Basel 2.5 (10D 99% VaR) vs FRTB (10D 97.5% ES) risk measures  
30k FHS / EWMA 0.94 and EWMA 1 (plain HS), 2007 – 2011 inclusive



Ratios of 10D 97.5% FHS ES to 10D 99% VaR (square root scaling from 1D), 1Y window, daily rolling, 2007-2011 inclusive, **EWMA 1 (plain HS)**

34

## FRTB main changes compared to still in force Basel 2.5

- ▶ Increasing numerical complexities (partial ES, desk-level computation), “profit and loss allocation eligibility test” (apologies for jargon) pushing towards full re-evaluation of options (as opposed to first or second order expansions) and extended use of historical simulation
- ▶ Will tend to reduce risk model bio-diversity resulting in potential herding and simultaneous deleveraging (but will increase model comparability on the other hand).
- ▶ Capital requirements might depend on only (same?) 6 market scenarios over past 15 years for G-SIBs.
- ▶ Huge incentive to outsource this set of extreme risks to unregulated entities

35

## FRTB main changes compared to still in force Basel 2.5

- ▶ FRTB involves huge plumbing, some of which quite useful (i.e. cleaning of data and risk management processes) but this might obscure the risk analysis
  - ▶ High number of technical, challengeable modelling assumptions
  - ▶ Too many data require further investigation to provide meaningful, robust and understandable outcomes
- ▶ A large part (1/3, ½?) of IMA capital requirements might come from the so-called Non Modelling Risk Factors (NMRF)
- ▶ Which are deemed “not modellable” but still require quite specific modelling approaches (good example of oxymoron)

36

## FRTB main changes compared to Basel 2.5: standardised approach (SA)

- ▶ SA for market risk: mostly relies upon the so-called SBA (sensitivity based approach)
- ▶ Risk factors granularity, shocks on risk factors, correlation and mechanisms to compute diversification benefits prescribed by regulation.
- ▶ SBA inputs are based upon sensitivities to risk factors computed from banks' internal pricing models
- ▶ RRAO: residual risk add-on charge for exotic options based upon "notional"
- ▶ Numerous changes through-out the building of FRTB, following QIS (quantitative impact studies)
- ▶ Lack of transparency/accountability regarding the evolving calibration of key parameters

37

## Capital requirements regulation increasingly complex despite stated simplicity goal

- ▶ Market risk is intrinsically complex
- ▶ By regulatory design, 99.9% 1Y VaR (Default Risk Charge) is highly model dependent and can hardly be back-tested.
  - ▶ From an engineer's point of view, it might have been reasonable to consider a 99% 1Y VaR and a larger multiplier
- ▶ As for the correlation trading portfolio (CTP), the prescribed use of a standardised approach makes sense.
  - ▶ However, the offsetting rules (22.39 (2)) are hardly understandable...
  - ▶ And in some cases, Basel FAQ may add to perplexity

38

## Complexity. NMRF Non-Modellable Risk Factors and PLAT are icing on the cake.

- ▶ NMRF deals with a real issue, vanishing liquidity in stressed periods
  - ▶ Partly accounted for through various liquidity horizons
- ▶ Activity not to be confused with market depth
  - ▶ Benefits of pooling data and trade repositories might have been overstated
  - ▶ Hazy assessment of real prices: supervisory discretion, issues with "making markets".

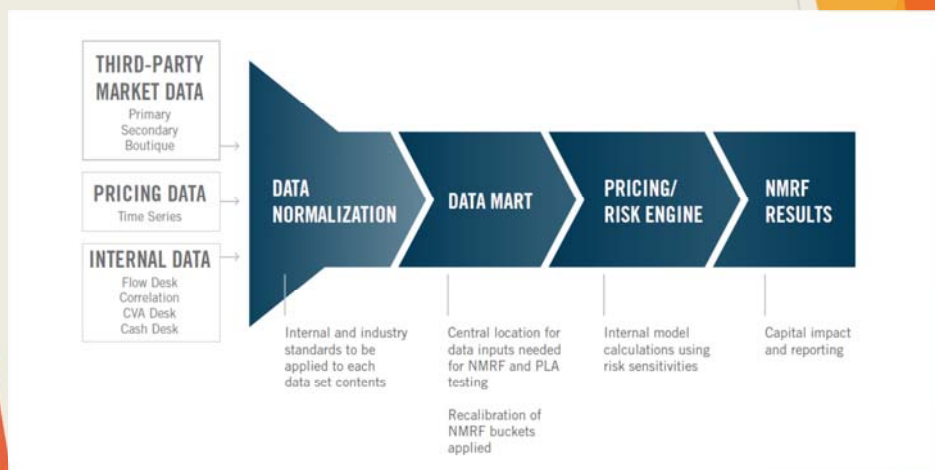
39

## Complexity. NMRF Non-Modellable Risk Factors and PLAT are icing on the cake.

- ▶ NMRF Relies upon the concept of "real prices" as opposed to consensus prices
  - ▶ *"Collateral reconciliations or valuations cannot be considered real prices"*
  - ▶ Even though they imply conditional (at default) risk transfer as well as committed quotes and are not prone to manipulation
- ▶ Modelling NMRF capital charge
  - ▶ Computation of stress scenarios?
  - ▶ Data availability, liquidity horizons, correlations between NMRF?

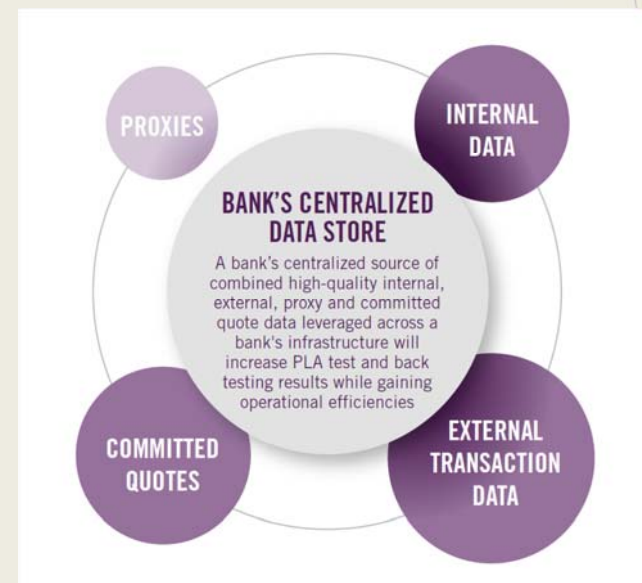
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## Data quality issues hard to cope under EU FRTB implementation ?



41

## Data quality issues



42

## Complexity. NRMF and PLAT (PnL Attribution tests) are icing on the cake.

- ▶ Risk models are related to risk distributions
  - ▶ RTPL (Risk Theoretical PnL) concept not quite well rooted
  - ▶ Might lead to various national implementations and supervisory discretion (reg. capture?)
- ▶ Level playing field? Uncertainty regarding desks eligible to IMA (Internal Models Approach)
  - ▶ Chosen approach (Spearman Rho + Kolmogorov Smirnov tests) challengeable from statistical point of view, difficult to calibrate and opposite to simplicity goal
  - ▶ Simple back-tests (PIT) already used by Fed and in BCBS QIS, well documented in academic papers were dismissed

43

- ▶ La complexité du FRTB induit une fragmentation du travail des risks managers, une attention excessive portée à la “conformité formelle” aussi bien du côté des régulateurs que des régulés.
- ▶ Ceci peut aboutir à une véritable perte de sens financier et humain, à une forme de technocratie de la modélisation, au détriment d’une bonne gouvernance des risques.



Illustration issue de “Playtime” de Jacques Tati

44

## FRTB: good intentions, but fuzziness and thus accountability issues

- ▶ Trapped in complexity due to real challenge:
  - ▶ Modelling market losses for complex and illiquid portfolios ?
- ▶ Difficulties in making quantitative people and lawyers working efficiently together
- ▶ Too many plumbing does not help finding the whale in the room, just the opposite
  - ▶ Back-testing and model governance might have been improved according to good supervision practices (parallel runs, peer review, PIT adequacy tests)
  - ▶ Due to regulatory uncertainties and complexity, running businesses to be trickier and more costly