# Beyond the Capital Tax: Re-centering RWA as a Tangible Risk Metric

*Bridging the gap between regulatory calibration and observable phenomena*

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*The views expressed are solely those of the authors and do not represent EBA policy.*

## The Conflict of Perspective:

**The "Cost" View:** Financial institutions often perceive Risk-Weighted Assets (RWA) and capital requirements as a "regulatory tax" to be minimized to improve ROE.
**The "Prudential" View:** Regulators often see capital as a safety buffer that can never be "too high," leading to a push for more conservative requirements.
**The Result:** A zero-sum game where simplification is feared by one side as an increase in costs and by the other as a dilution of safety.

## The Missing Link: Risk Measurement

To move past this impasse, we suggest shifting the debate from the *consequences* of the measure (capital levels) back to the *nature* of the measure itself (risk).

**Simplification does not mean reduction; it means clarity.** Like a thermometer, a risk metric is only useful if its "degrees" can be compared to a known reality (the "fever").

# Making RWA "Visible": From Abstract Percentages to Observable phenomena

## The Core Insight of the EBA Staff Paper:

- The rw is often seen as a "black box". The paper demonstrates that abstract rw can be "translated" into two easily interpretable figures:

- **Worst-Case Default Rate (WCDR):** The conditional probability of default in an extreme economic event.

- **Haircuts:** the expected reduction of the value of the collateral

- **Worst-Case Loss (WCL):** The total loss the portfolio would suffer under that extreme stress.

**In this presentation we discuss two practical examples: the SA rw for RRE and the IRB rw for Corporates**

# Agenda

OVERVIEW

## SA RW

**35% it too low for the EU…**

Understand to Decide —
Is rw = 35% appropriate?
From RWA to WCL

## IRB RW (1)

**Another Paper about R?**

Four data sources, eight estimators, comparison with regulatory calibration

## IRB RW (2)

**Prudential Framework & WCDR**

How R drives the stressed PD — an economically interpretable perspective

## IRB RW (3)

**From Risk Weights to WCL**

Concentration, bias corrections, tail dependence and Expected Shortfall

## Conclusions

Justifying regulatory calibration; improving transparency through WCL

# Understanding the Risk Weight: From 35% to a 3.03% Worst-Case Loss

SECTION 0

## From Risk Weight to VaR — step by step

$$rw = 12.5 * UL$$

$$UL = VaR(99.9\%) - EL$$

$$VaR(99.9\%) = \textit{the highest loss that it is expected to be observed with a given confidence level}$$

A definitively better metric is the Basel concept of minimum required capital (MRC):

$$MRC = 8\% * rw = UL$$

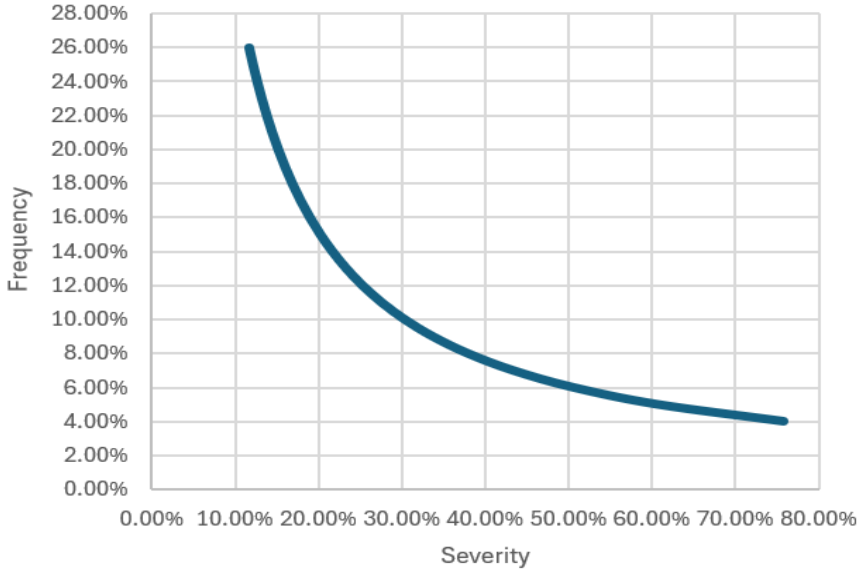
The MRC is meant to cover the UL:

An even more intuitive metric is the VaR. It is obtained by adding back the expected loss.

$$VaR(99.9\%) = UL + EL$$

| 35% | ×8% | = UL | +EL | 3.03% |
|---|---|---|---|---|
| Risk Weight (Residential RE) | = Min. Required Capital (MRC) | Unexpected Loss (99.9% VaR−EL) | Add Expected Loss back | VaR(99.9%) of EAD |

## Combinations of Frequency × Severity that give VaR = 3.03%




3.03% = Frequency × Severity (= default rate × loss given default)

*High PD + low LGD ↔ Low PD + high LGD — both yield the same worst-case loss.*

# From Severity to Haircut: Bringing Collateral Values into the Picture



## Why Haircut instead of LGD?

It is common in Italy that banks do not grant more than 80% of the house value when stipulating a mortgage. This implies that, let's say, if the value of the house is V=100 then the loan will be L=80.

An LGD equal to X% over an exposure of 80 implies a recovery equal to:

$$R = (1 - LGD) * Loan$$

This in turn it implies an expected haircut equal to:

$$H_{equivalent} = 1 - \frac{(1 - LGD) * Loan}{Value} = 1 - (1 - LGD) * LtV$$

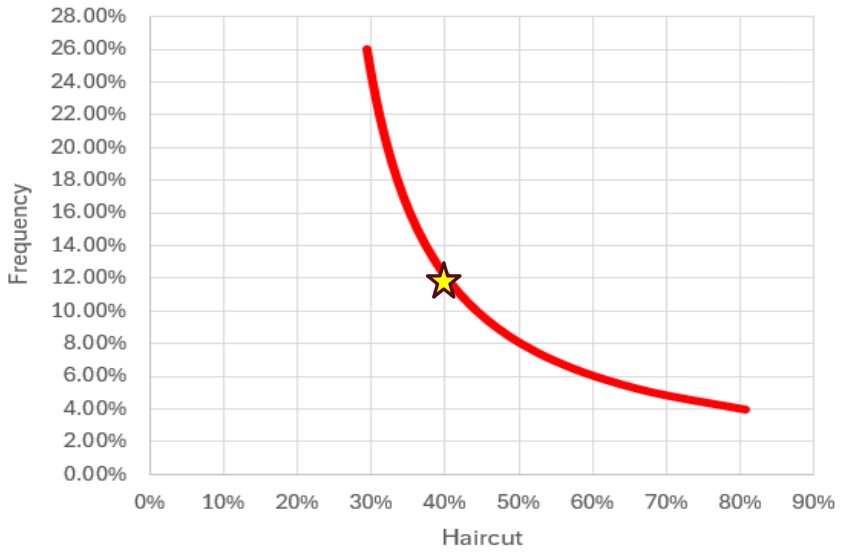
In Italy, banks typically lend up to 80% of house value (LTV = 80%). So Loan = 0.8 × Value.

The equivalent haircut H = 1 − (1−LGD)×LtV links LGD directly to house price movements.

A 50% LGD with 80% LTV coverage is very different from 50% LGD with 160% coverage — same LGD, very different collateral protection.

This allows us to compare the implicit assumption (3.03% WCL) directly with observed house price data.

## Combinations of Frequency × Haircut that give VaR = 3.03%



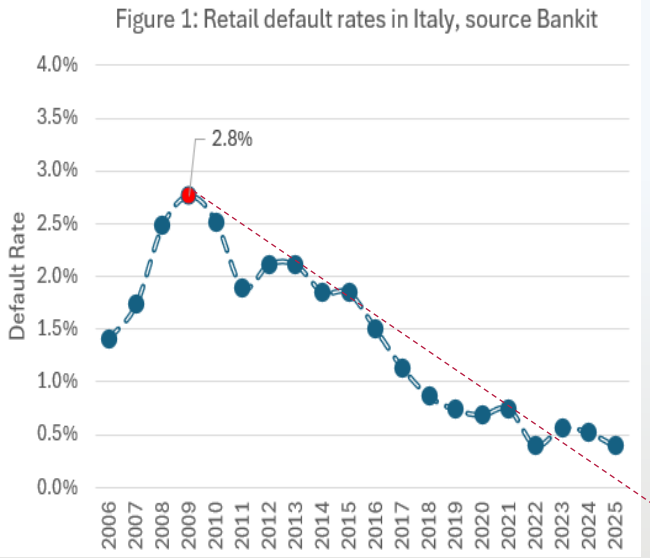

Same 3.03% WCL — now expressed as: **Frequency (default rate) × Haircut (house price drop)**

★ *Example: 12% default rate + 40% haircut on house value both are needed simultaneously to breach the 3.03% threshold.*

# Understanding through Comparisons: What Do We Actually Observe?

SECTION 0

Figure 1: Retail default rates in Italy, source Bankit




Peak observed: **2.8% (2009, GFC)** — well below the 3.03% VaR threshold.

We translated the 35% risk weight into 3.03% VaR expressed as Frequency × Haircut. **Now it is easier to do a comparison**

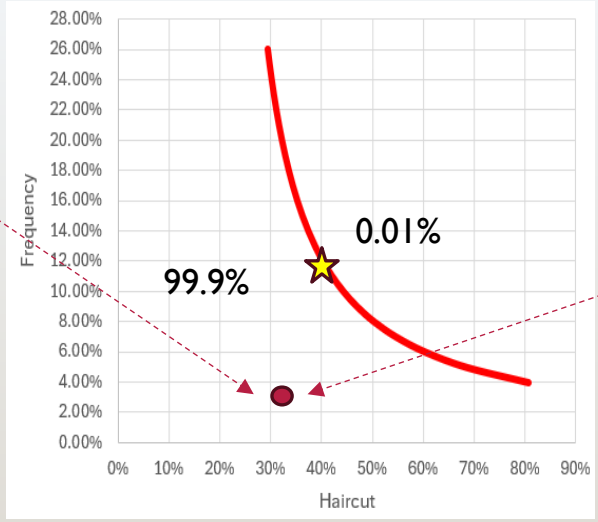
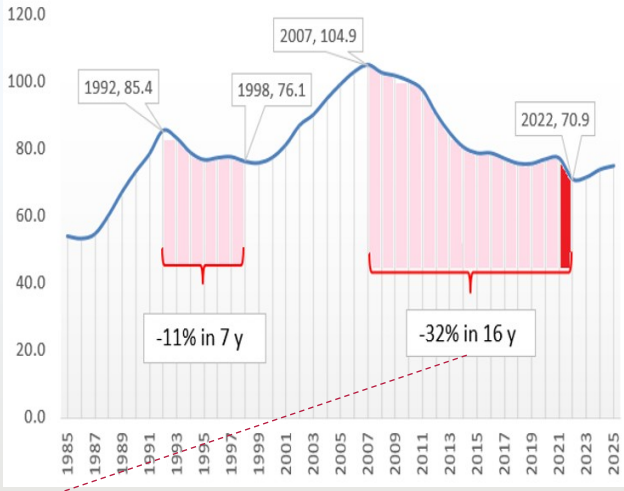



*Figure 3: House prices index for Italy, Source BIS*




Worst observed haircut: **–32% over 16 years (2007–2022)** — below the 40%+ haircut implied by a 3.03% VaR threshold at observed default rates.

# *Conoscere per deliberare*

*Understand to Decide*

*Luigi Einaudi — President of Italy 1948–1955*

**Simplify vs. Understand**

a necessary trade-off in prudential regulation.

## This Paper's Answer

**01** The IRB formula contains implicit assumptions. Making them explicit is not just an academic exercise — it is a prerequisite for sound decision-making.

**02** We translate the abstract risk weight into the Worst-Case Default Rate (WCDR) and Worst-Case Loss (WCL) — quantities with a direct economic meaning.

**03** We show that the regulatory conservatism can be justified — but invisible. The gap between empirical and regulatory R reflects model corrections that are never made explicit.

**04** Transparency ≠ Complexity. Disclosing WCL in Pillar 3 would simplify interpretation while improving understanding.

# Another Paper about R? Motivation and Data Sources

SECTION 1

Several studies find empirical asset correlations well below regulatory calibration. But comparing R values is not economically interpretable. What does R=3.7% vs R=13.9% mean in practice? We propose translating R into the Worst-Case Default Rate (WCDR), directly comparable with observed default rates.

## Data Sources

*Table 2: Data Sources Used*[11]

| Source | time series range | time series T | Ratings | Definition of default | Portfolio |
|---|---|---|---|---|---|
| **Moody's** | 1981-2022 | 42 | 2 grades | Market | Traded Corporates |
| **Bankit** | 2006-2022 | 17 | No | Basel 2/3 | Non Fin. Corps |
| **Cerved** | 2008-2022 | 15 | 8 grades | Judiciary | Non Fin. Corps |
| **Bank1** | 2007-2022 | 16 | 9 grades | Basel 2/3 | Corporates |
| **Bank2** | 2009-2022 | 14 | 15 grades | Basel 2/3 | Corporates |

## Eight Estimators

Method of Moments (MM1–MM5)
Maximum Likelihood (ML1, ML2)
Estimated at rating-grade level

## Key Finding

Empirical R: 0.3%–12%
Regulatory R: 12%–24%
Difference wide but hard to interpret

## Our Contribution

Translate R → WCDR
Compare stressed PD vs historical
Quantify implicit corrections in reg. R

# Regulatory vs. Estimated R: The Gap is Wide — But What Does It Mean?



## Table 3: Regulatory vs. Estimated Asset Correlations by Rating Grade and Data Source

| Data Source | Rating | PD | Regulatory R | Estimated R | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Method of Moments | | | | | Maximum Likelihood | |
| | | | | MM1 | MM2 | MM3 | MM4 | MM5 | ML1 | ML2 |
| Cerved | 3 | 0.05% | 23.68% | 0.3% | 0.7% | 0.2% | 0.7% | 0.2% | 0.9% | 0.4% |
| | 4 | 0.18% | 22.97% | 0.6% | 0.8% | 0.5% | 0.8% | 0.5% | 0.7% | 0.4% |
| | 5 | 0.52% | 21.25% | 1.3% | 1.4% | 1.2% | 1.3% | 1.2% | 1.2% | 0.9% |
| | 6 | 1.36% | 18.07% | 2.5% | 2.6% | 2.4% | 2.3% | 2.4% | 2.4% | 1.5% |
| | 7 | 3.19% | 14.43% | 2.9% | 2.9% | 2.7% | 2.6% | 2.7% | 2.6% | 1.5% |
| | 8 | 6.14% | 12.56% | 2.6% | 2.7% | 2.5% | 2.2% | 2.5% | 2.6% | 1.3% |
| | 9 | 12.79% | 12.02% | 2.1% | 2.1% | 1.9% | 1.7% | 1.9% | 2.0% | 1.2% |
| | 10 | 42.23% | 12.00% | 2.4% | 2.5% | 2.2% | 2.0% | 2.2% | 2.5% | 1.9% |
| Moody's | IG | 0.09% | 23.47% | 11.1% | 12.4% | 10.7% | 12.7% | 10.5% | 7.3% | 7.2% |
| | SG | 4.26% | 13.42% | 7.2% | 7.4% | 6.9% | 7.3% | 6.9% | 7.5% | 5.8% |
| Bankit | | 3.70% | 13.89% | 3.4% | 3.4% | 3.2% | 3.1% | 3.2% | 3.70% | 1.0% |
| Bank1 | 1 | 0.06% | 23.64% | 3.4% | 12.2% | 1.4% | 11.0% | 1.2% | 1.4% | 0.4% |
| | 2 | 0.17% | 23.02% | 4.1% | 6.9% | 3.3% | 6.3% | 3.5% | 5.0% | 5.1% |
| | 3 | 0.34% | 22.14% | 0.7% | 2.3% | 0.5% | 2.1% | 0.5% | 3.6% | 4.1% |
| | 4 | 0.69% | 20.48% | 1.6% | 2.4% | 1.5% | 2.3% | 1.5% | 2.8% | 2.3% |
| | 5 | 1.30% | 18.26% | 1.0% | 1.5% | 0.9% | 1.4% | 0.9% | 1.8% | 1.2% |
| | 6 | 2.54% | 15.37% | 1.5% | 1.9% | 1.4% | 1.6% | 1.4% | 2.0% | 1.6% |
| | 7 | 5.09% | 12.94% | 4.3% | 4.6% | 4.0% | 3.5% | 4.0% | 5.0% | 3.8% |
| | 8 | 10.85% | 12.05% | 5.3% | 5.4% | 4.9% | 4.2% | 4.9% | 5.7% | 4.1% |
| | 9 | 30.13% | 12.00% | 4.4% | 4.6% | 4.0% | 3.8% | 4.0% | 4.6% | 3.1% |

## Key Findings

- ⚠ Estimated R: 0.3%–12%
  Regulatory R: 12%–24%
  Gap is systematic and large
- ⚠ Low-PD grades show widest gap — e.g. Moody's IG: Reg R=23.5%, Est R=7.3%
- 💡 Decreasing R(PD) trend present in estimates too, but only up to a PD threshold
- ✓ Simple comparison of R insufficient — we need to compare the resulting WCDR

# The Prudential Framework: From Asset Correlation to Stressed PD

SECTION 2

## The Merton-Vasicek WCDR Formula — core of the IRB Supervisory Formula:

$$rw = 12.5 * UL$$

$$UL = VaR(99.9\%) - EL$$

$$VaR(99.9\%) = \textit{the highest loss that it is expected to be observed with a given confidence level}$$

A definitively better metric is the Basel concept of minimum required capital (MRC):

$$MRC = 8\% * rw = UL$$

The MRC is meant to cover the UL:

An even more intuitive metric is the VaR. It is obtained by adding back the expected loss.

$$VaR(99.9\%) = UL + EL$$

| PD | R | α |
|---|---|---|
| Long-run through-the-cycle PD — estimated by the bank | Asset correlation — set by the Regulator (12%–24%) | Confidence level = 99.9% — set by Basel Committee |

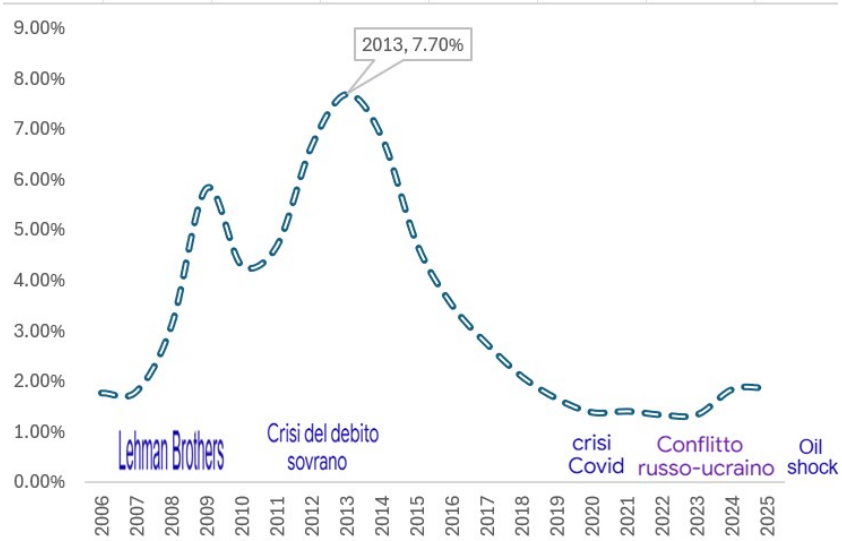
### Key Insight: The Supervisory Formula as a Stressed PD Algorithm

**Long-run PD (bank estimate)** → **Supervisory Formula (regulatory R, α=99.9%)** → **Stressed PD (WCDR)** → **Worst-Case Loss (WCL = WCDR × LGD × EAD)**

# Observed Default Rates vs. Stressed PD: Italian Non-Financial Firms



## Figure 2: Annual Default Rates — Italian Non-Financial Firms (Source: Banca d'Italia)




*PD (avg) = 3.70% | Observed WCDR (2013) = 6.20% | Estimated WCDR (MV, R=3.7%) = 11.21% | Regulatory WCDR (R=13.9%) = 22.60%*

## WCDR Comparison (Bankit)

| | |
|---|---|
| Avg PD (long-run) | **3.70%** |
| Observed WCDR | **6.20%** |
| Estimated WCDR (emp. R=3.7%) | **11.21%** |
| Regulatory WCDR (reg R=13.9%) | **22.60%** |

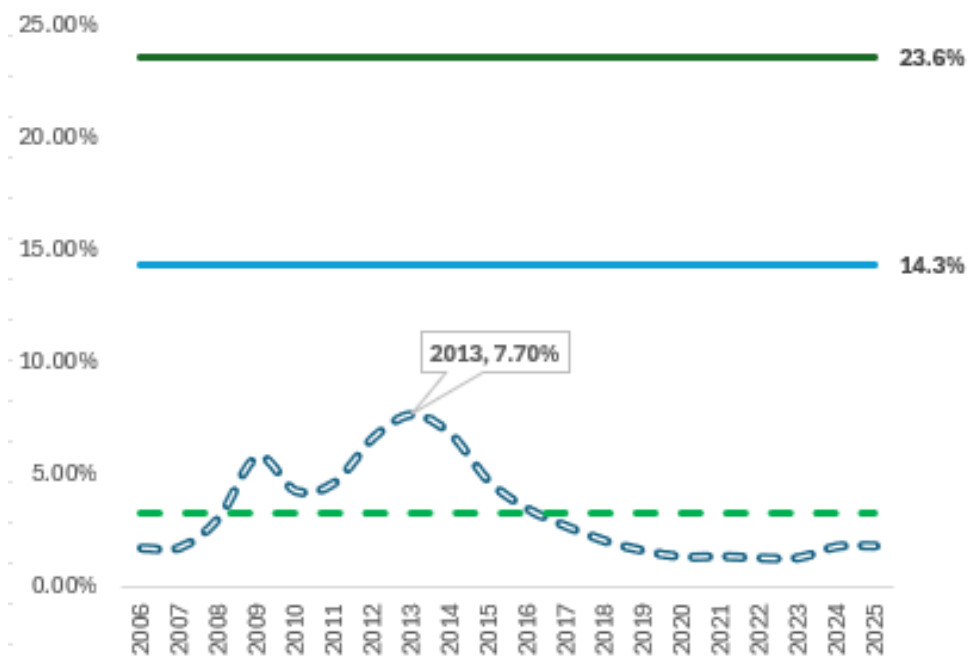
**Multiplier vs Observed WCDR**

Estimated (emp. R): **~1.8×**
Regulatory: **~3.6×**

# Regulatory vs. Estimated WCDR: A Simpler and More Informative Comparison

SECTION 2

## Regulatory vs. Estimated WCDR — Corporate Portfolio, Bank 2




## Case: Bankit (PD=3.70%)

| | Observed | Est. R | Reg. R |
|---|---|---|---|
| WCDR | 6.20% | 11.21% | 22.60% |
| Worst-Case Loss (€1M, LGD=50%) | €31,022 | €56,068 | €113,022 |
| Unexpected Loss | €12,528 | €37,573 | €94,528 |

**Regulatory WCDR > 3× Estimated — the gap needs economic justification**

# From Risk Weights to Worst-Case Loss: A Clearer Economic Interpretation

SECTION 2

## Worked Example

| | |
|---|---|
| EAD | € 1,000,000 |
| LGD | 25.00% |
| Maturity (M) | 1 year |
| PD | 1.00% |
| Regulatory R | 19.28% |
| WCDR (stressed PD) | 14.03% |
| Expected Loss | € 2,500 |
| Risk Weight | 43.20% |
| RWA | € 431,528 |
| Min. Required Capital (8%×RWA) | € 34,522 |
| **Worst-Case Loss (MRC + ELA)** | **€ 37,022** |
| **WCL / EAD** | **3.70%** |

## Loss Distribution: EL, UL, VaR (99.9%)

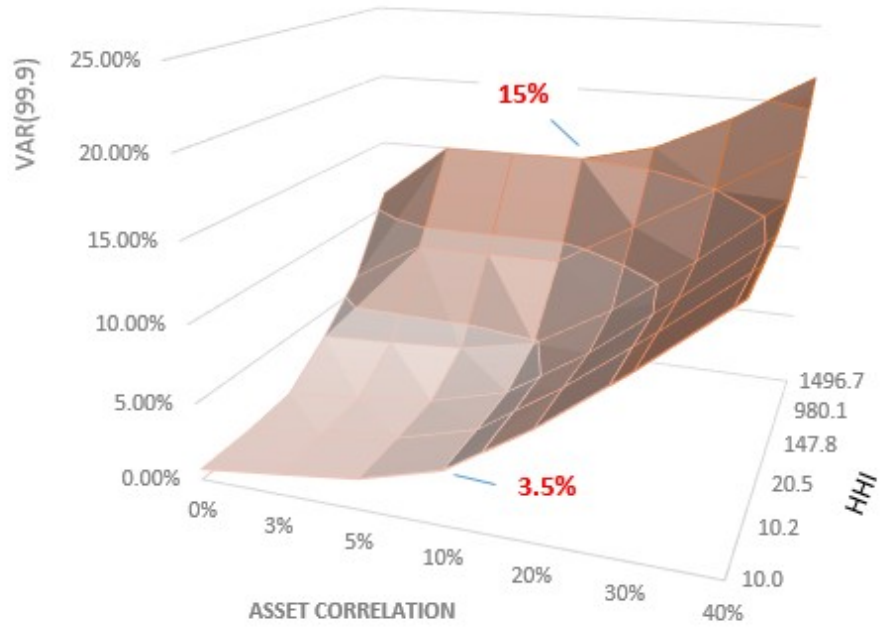

## Why WCL Is More Intuitive

- 43.2% risk weight is abstract. A WCL of €37,022 (3.7% of EAD) is immediately interpretable.
- WCDR of 14.03%: in only 1 in 1,000 years would defaults exceed this — the capital must cover this stress.
- WCL = Expected Loss (provisions) + Unexpected Loss (capital) — visible and comparable across banks.

# Back to the Supervisory Formula: The Concentration Effect



## VaR(99.9%) as function of Asset Correlation and Concentration (HHI)




R=3.5% + high HHI → VaR ≈ **15%**
R=3.5% + low HHI → VaR ≈ **3.5%**

## Perfect Granularity: a Heroic Assumption

The IRB SF requires **perfect granularity** to yield a closed-form solution.

Real corporate portfolios are **highly concentrated.**

**Implications:**

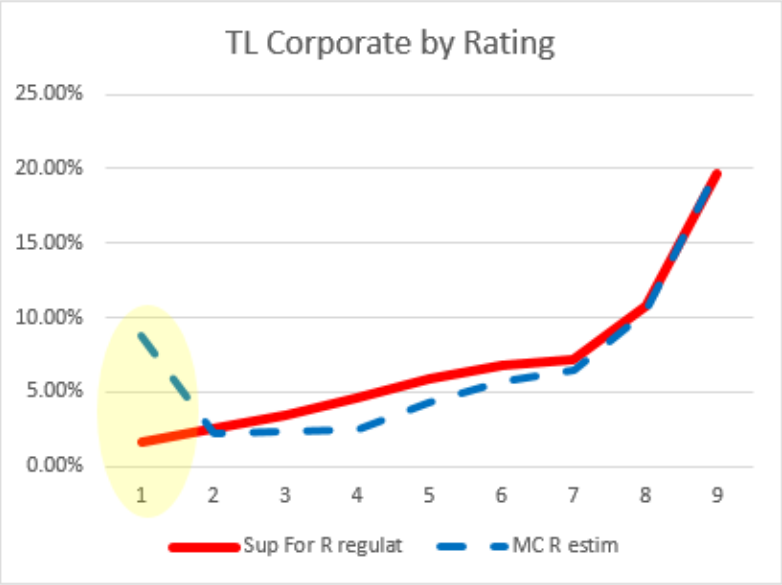
- Idiosyncratic risk not fully diversified
- MC simulation captures actual structure
- High concentration can push VaR above SF

*The Basel Committee removed the granularity adjustment in 2003 — embedding it implicitly in the asset correlation calibration.*

# Concentration Effect at Rating Grade Level — Bank 1 Corporate Portfolio

SECTION 3

**Figure 6: SF (Regulatory R) vs. MC WCL (Estimated R) by Rating Grade, Bank 1**




| rating | N | Herfindhal |
|---|---|---|
| R1 | 53 | 0.18261 |
| R2 | 347 | 0.01319 |
| R3 | 345 | 0.01724 |
| R4 | 424 | 0.01475 |
| R5 | 361 | 0.0219 |
| R6 | 285 | 0.03281 |
| R7 | 170 | 0.0407 |
| R8 | 104 | 0.07221 |
| R9 | 102 | 0.10503 |

## Key Takeaways

⚠ Most grades: MC < SF (reg R). Concentration alone does not offset lower empirical R.

⚠ R1 (HHI=18.3%) and R9 (10.5%): MC > SF — concentration can exceed the regulatory buffer.

💡 R1 (low PD, high concentration) shows higher MC loss than R7 (higher PD). PD is not the only driver.

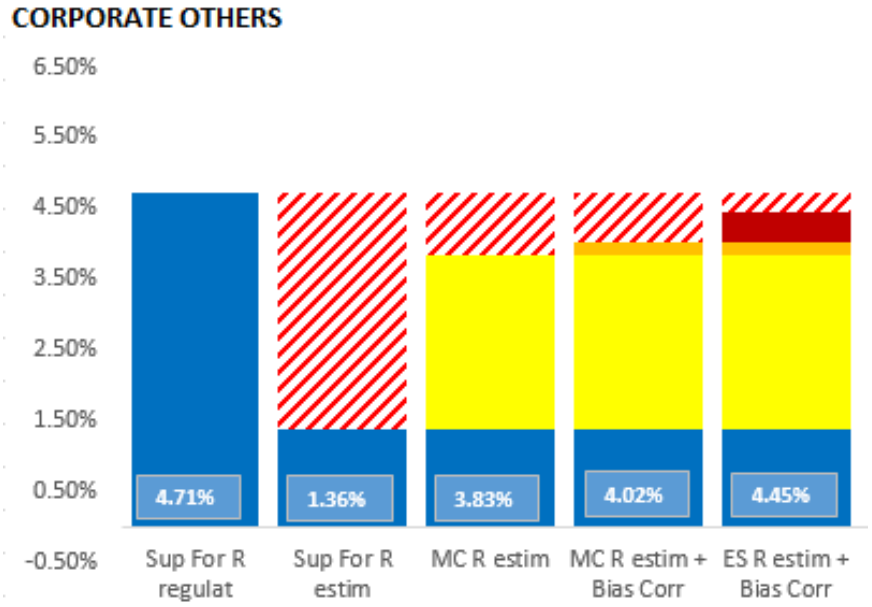
✓ Regulatory calibration broadly adequate in aggregate, but may be insufficient for concentrated grades.

# Full Decomposition: Bridging the Gap Between Regulatory and Estimated WCL

SECTION 3

*Step-by-step corrections to MC estimate (estimated R). Total Loss as % of EAD, confidence level 99.9%*

## Figure 7: Bank 1 — Total Loss Decomposition




## Four Corrections Applied

**1 — Concentration**

MC simulation with portfolio-specific HHI

**2 — Estimation Bias**

Estimated R × 2 (Resti 2008 correction)

**3 — Tail Dependence**

T-distribution for common factor (5% tail dep.)

**4 — Model Risk**

Expected Shortfall instead of VaR(99.9%)

# Conclusions

SECTION 4

## Regulatory calibration is broadly justified…

The SF with regulatory R embeds corrections for concentration, tail dependence, estimation bias, and model risk — factors the Basel Committee deliberately left out for simplicity.

## …but the justification is not transparent

No decomposition of implicit margins of conservatism. This hinders cross-bank comparisons and limits market discipline.

## WCDR and WCL: a better interpretive framework

Expressing risk measures as stressed PDs (WCDR) and Worst-Case Losses (WCL) provides immediate economic meaning and enables comparison with historical default rates.

## Policy: include WCL in Pillar 3 disclosures

For IRB-validated banks, WCL analysis in Pillar 3 would strengthen market understanding, enable benchmarking and improve transparency — without adding complexity.

# Thank You

*Questions & Discussion*

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