

Overview of Dual PIT/TTC Ratings Systems

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Agenda

- Key PIT/TTC Presentation Points Highlighted
- Credit Cycles Exist & Can Be Measured
- Background on 'As Is' Ratings Systems vs Dual PIT/TTC Ratings
- Using a PIT/TTC Ratings Framework to Develop a Portfolio-Wide Stress Test Approach Which is Based on Credit Cycle Behaviour
- Key PIT/TTC Presentation Points Summarized

Key Points in the Presentation

- Systematic Credit Cycles are real & they can be empirically measured – their existence motivates Dual PIT/TTC Ratings approaches
- Dual ratings support multiple business objectives – for credit ratings, ‘one size does not fit all’ – capital stability vs. ‘know your real risk’
- Current, legacy credit models do not incorporate empirical credit cycles, they assume systematic factors follow a random walk – moving to a dual rating approach represents a true ‘Kuhnian paradigm shift’
- Dual PIT/TTC ratings are a ‘framework’ – they can be implemented bank-wide
- Wholesale ratings implementation – requires enhanced risk culture, empirically better PD models, & leverages advanced ‘batch’ automation across risk & portfolio management functions
- Portfolio-wide stress testing capabilities are straight-forward to develop once you have developed the PIT/TTC credit-cycle framework
- Provides one consistent framework for stressing PIT PDs, LGD & EAD

Global Credit Deteriorated Rapidly Starting in Mid-2007 **abc**

Systematic Credit Cycles are Prominent in Corp Defaults, Losses & KMV EDFs

*Various Credit Cycles Indices Derived from Various PD, Rating & Loss Measures
MKMV EDFs, S&P Default Rates & C&I Loss Rates*

'Z-Gap'

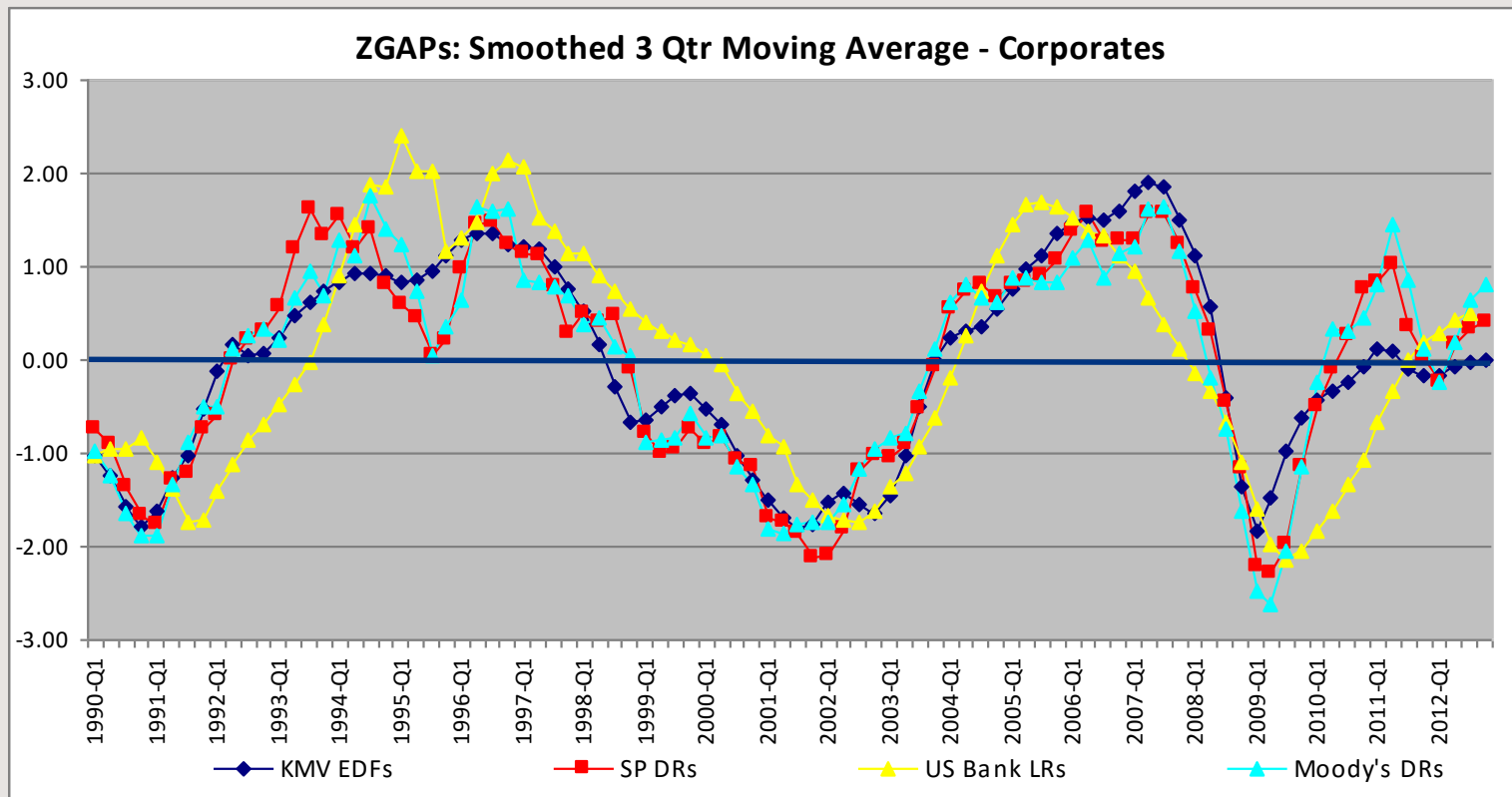
'Good'

Credit Conditions

Neutral Credit
Conditions

'Bad'

Credit Conditions



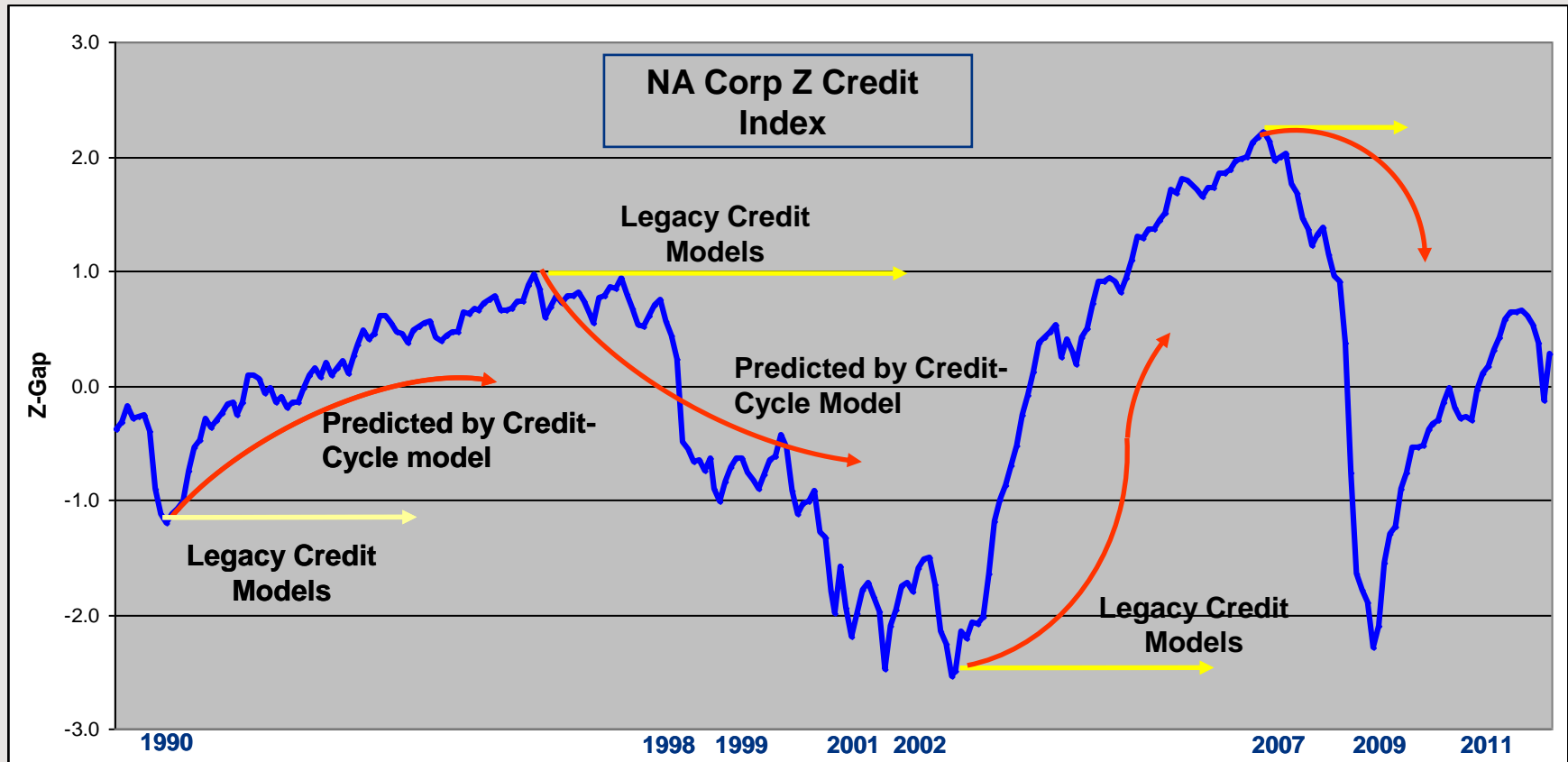
Source: Moody's KMV, S&P, US Federal Reserve & RBS Research

A Component of Credit Cycles is Predictable

Predicting Roughly 20% of the Systematic Cycle is the Foundation of PIT/TTC Ratings

Legacy Credit Models Are Blind ('Empty Glass') to the Predictable Systematic Component of Cycles

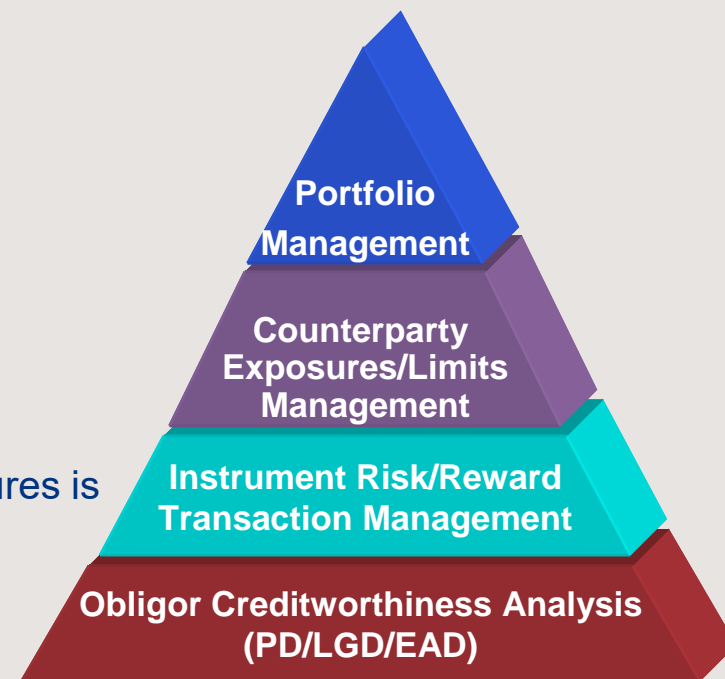
Current Models Assume Credit Factors Follow a Random Walk



Source: Moody's KMV, RBS Research

Multiple Business Objectives Require Multiple Views of Credit Risk

- Dual ratings first developed in 2003/4 as preparation for Basel II – implemented in 2005 under the AIRB Waiver of a large UK Bank
- In most Banks today, internal ratings (PDs) are ‘hybrid’ indicators which are mostly calibrated to ‘Through-the-Cycle (TTC) credit conditions
- But successful Capital Management (Basel II) & Credit Risk Management requires multiple, well-defined views of default risk:
 - 1-Year expected loss prediction – 1-Yr PIT
 - Regulatory Capital under Basel II – 1-Yr TTC
 - Economic Capital (Aggregate) – 1-Yr TTC
 - Discretions/Limits – 1-Yr TTC
 - IFRS – ‘Life of the Loan EL Accounting Measures’ - PIT
 - Risk/Reward & Credit Pricing – PIT PD Term Structures (Including predicted credit cycles)
- A Dual-PD Approach including both ‘pure’ PIT & TTC measures is required to support the bank’s broad objectives:
 - Capital Stability not Pro-Cyclicality -- TTC
 - ‘Know Your True Risk’ -- PIT



Current Issues vs Objectives With Wholesale Credit Ratings

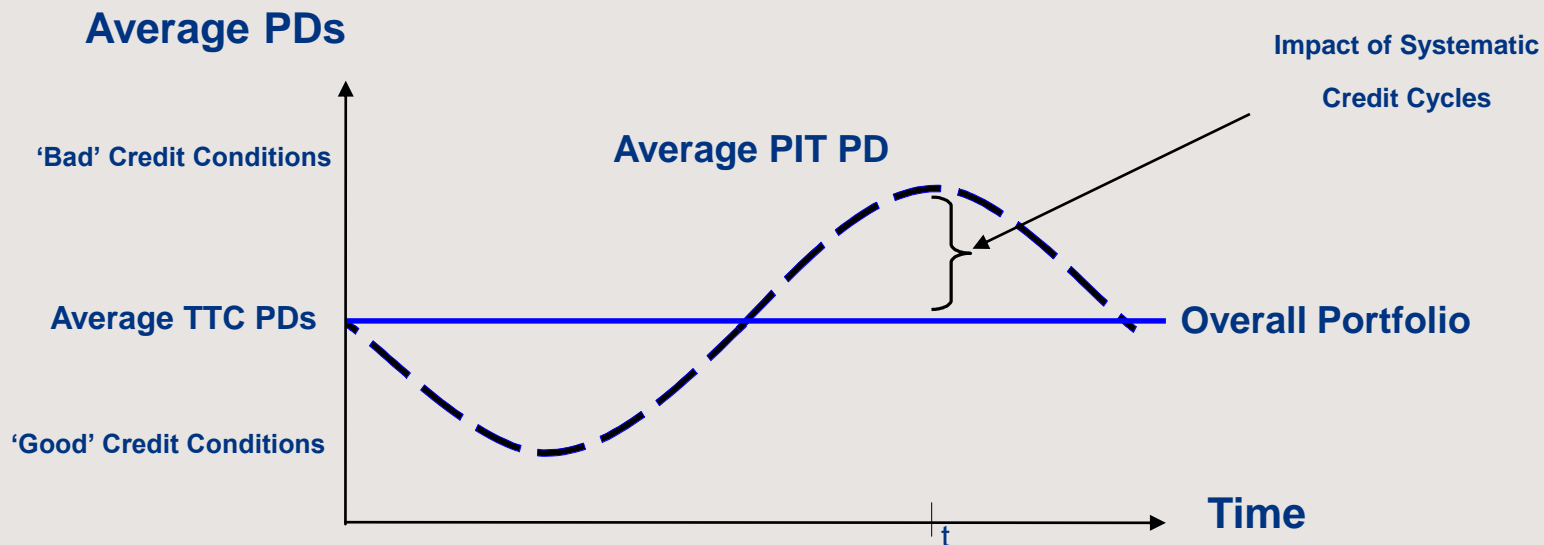
- **Current Issues** -- At most banks, existing credit ratings are hybrid indicators:
 - **No credit cycle** – understate or ignore the cycle & therefore they fail to track broad changes in risk over time,
 - **Apples to Oranges** -- provide inconsistent measures, with the same grade implying different PDs for different asset classes,
 - **Too Static & Not Dynamic Enough** -- get refreshed infrequently ('fire and forget') -- so can be late in signalling financial distress,
 - **Less Accurate Empirically** -- show less counterparty-specific variability than other indicators with better track records
 - **Multiple PDs Required for Multiple Objectives.** – almost all banks have one rating or PD measure
- **Objectives** -- Develop a Dual-PD Ratings approach to more accurately & timely PDs & grades on both a PIT and TTC basis:
 - Consistently supports multiple regulatory, risk & portfolio management objectives
 - Each PD model needs to be classified as PIT, TTC or Hybrid
 - Requires reasonable granularity & spacing in a bank's PD Master Scale
 - Converts all current PD models in 'batch mode' to both 100% PIT & 100% TTC PDs -- creating apples to apples' & 'oranges to oranges' comparisons
 - Explicitly incorporates measureable credit cycles to perform the PIT/TTC conversions -- forecasts credit cycles going forward to form unconditional PD term-structures

Measuring 'Real Risk' vs a 'Conditional Fiction' (TTC)

Impact of Systematic Credit Cycles – PIT PDs Move Much More than TTC PDs

'Point-in-Time' vs 'Through-the-Cycle' PDs or Ratings:

- 'PIT' PDs over 1-year represent 'current credit conditions' & reflect movements in systematic credit cycles
- 'TTC' PDs over 1-year represent 'average credit conditions' & are developed using long-run average historical calibrations -- they are 'conditionally neutral' to systematic credit cycles



Measuring Systematic Credit Cycles Has a Strong Empirical Foundation

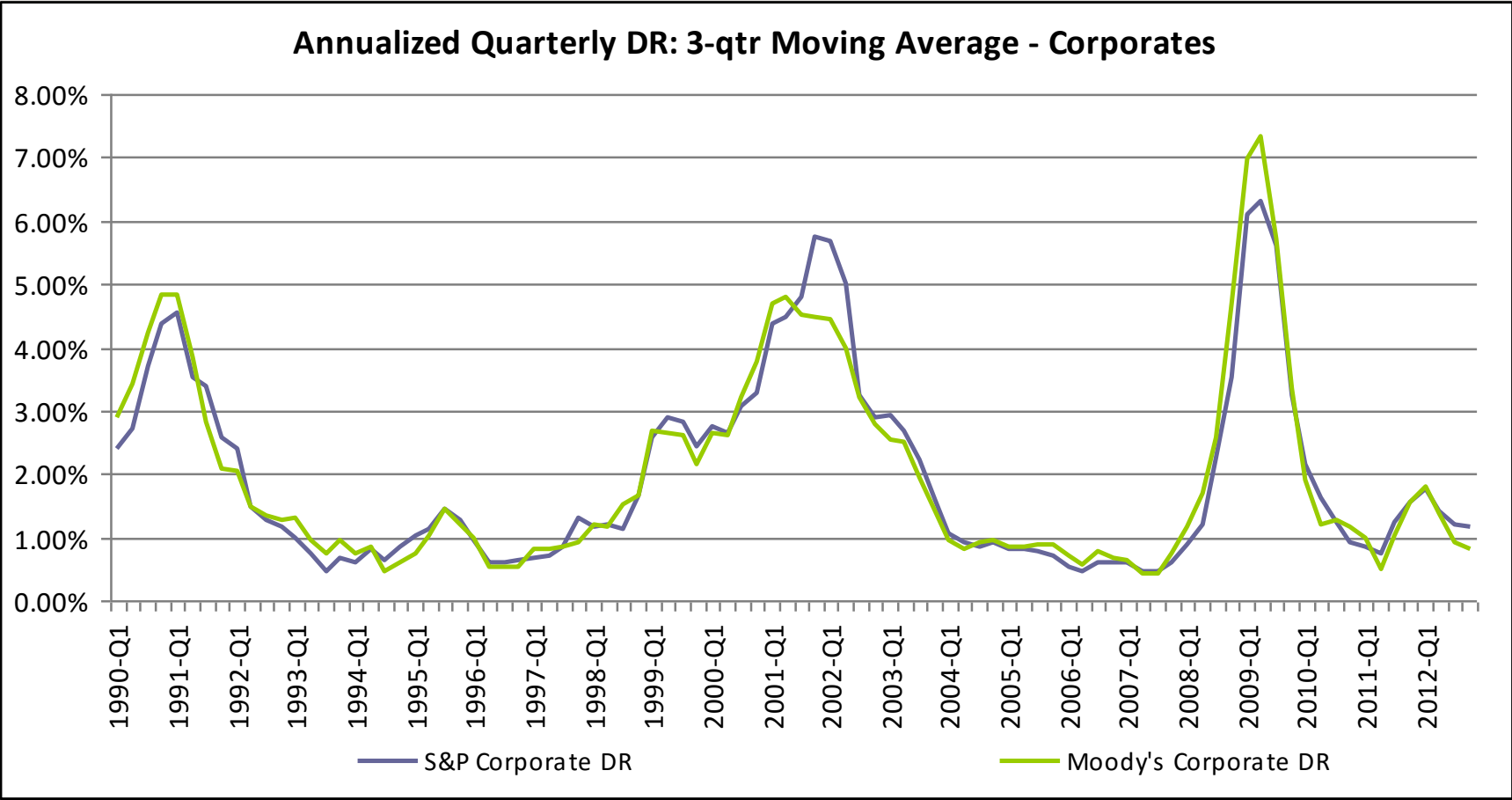
Empirical Support for Believing in Systematic Credit Cycles – ‘20% Full Glass’

- Naked Eye !
- Unemployment rates, inflation rates, relative commodity prices, relative currency values & interest rates are often found to exhibit mean reversion – evidence also found in equity indexes
- Three empirical tests support the existence of credit cycles:
 1. *Forecast equations for systematic Z credit factors show statistically significant mean reversion & momentum*
 2. *In-sample simulations across a naïve model (no credit cycles) & estimated Z models shows statistically significant MSE reductions*
 3. *Out-of-sample – out-of-time back-testing results also demonstrate the validity of credit cycles*

Rated Corporate Defaults Exhibit Strong PIT Cycles



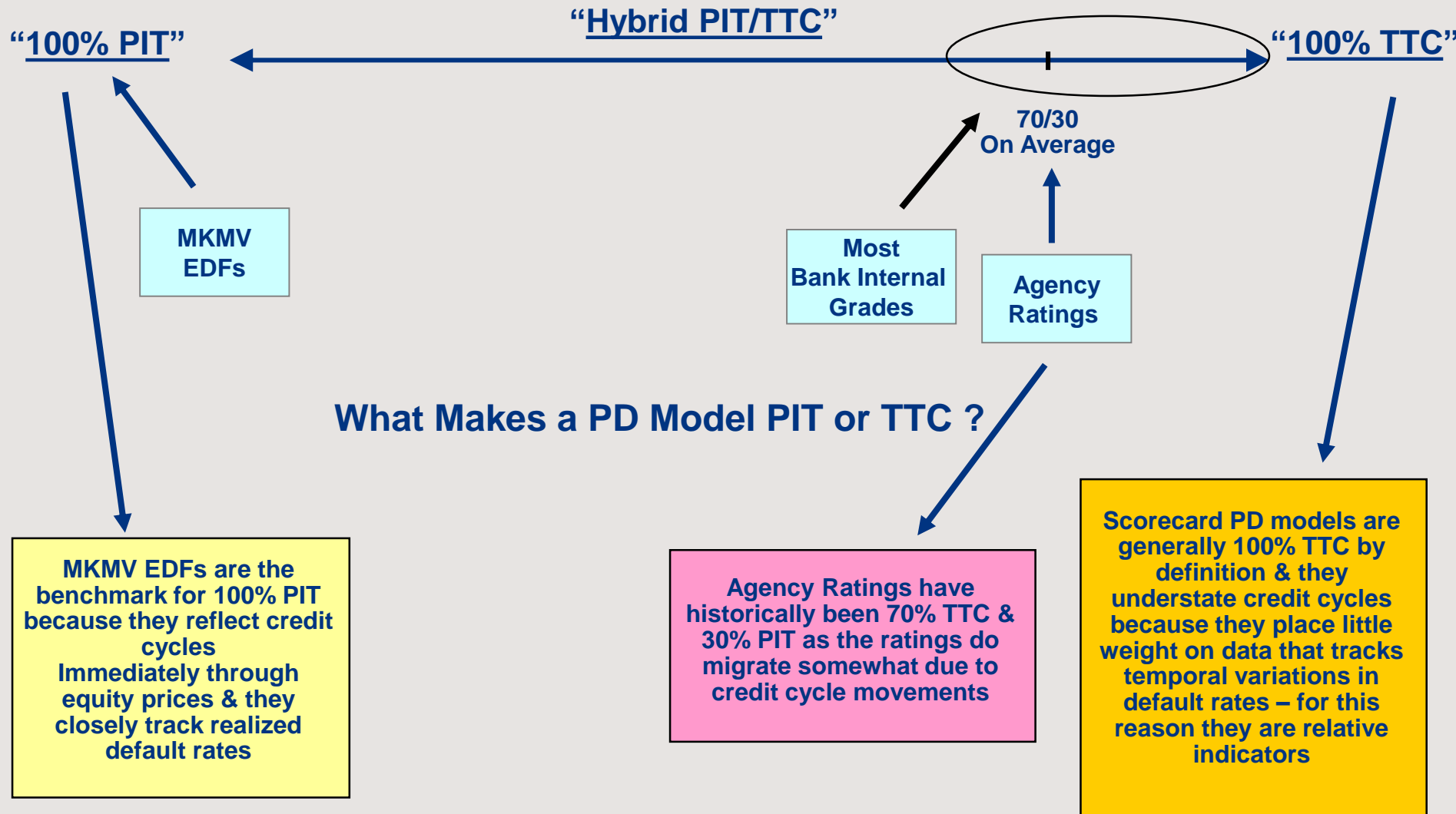
Developing the Most Empirically Accurate PD Models Requires Credit Cycle Measures



Source: Moody's & S&P

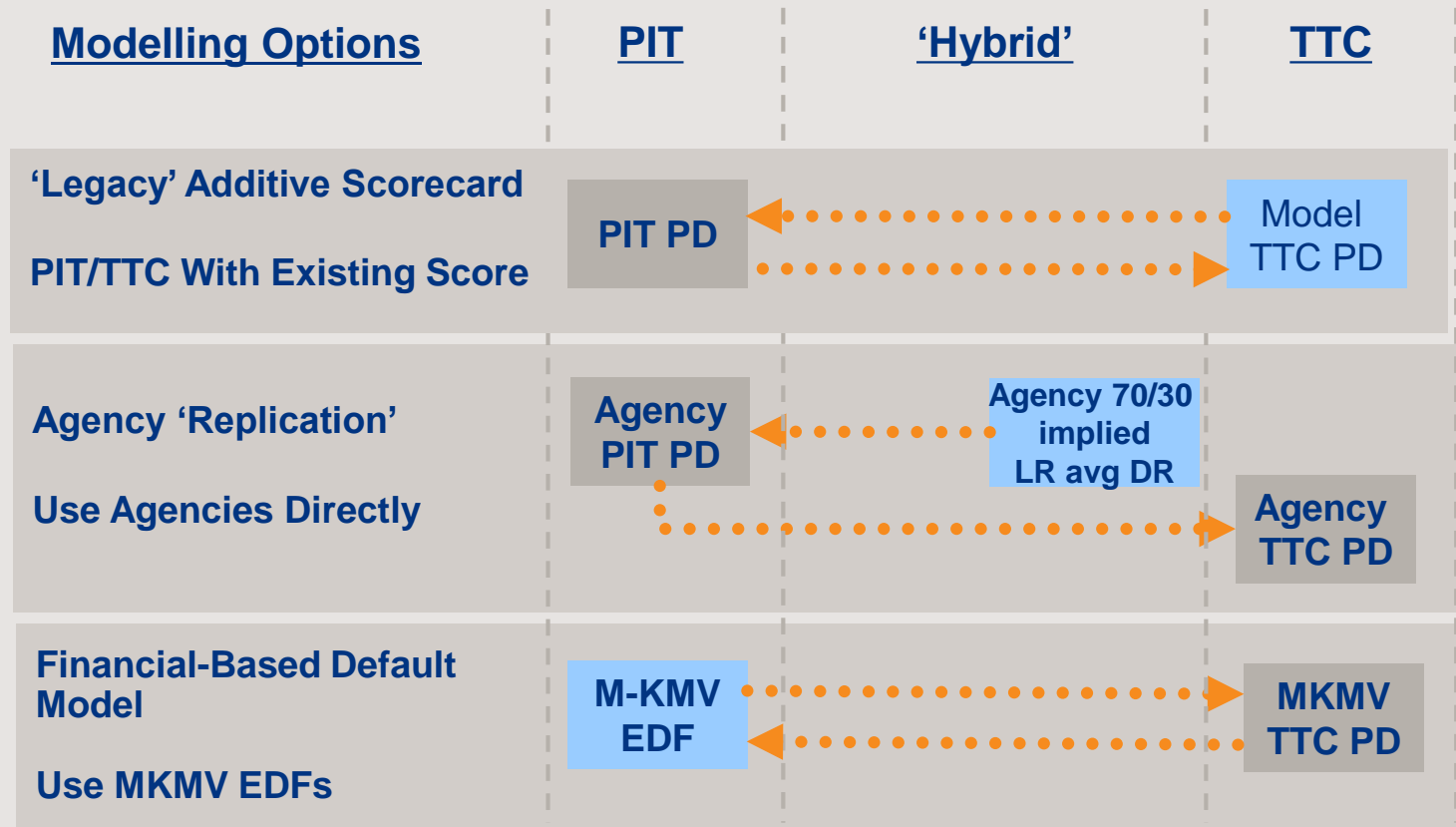
But Banks Use Primarily 'Hybrid' or Mostly TTC Ratings

Obligor-Specific PD Models Come in Various 'Flavours'



Focus on Large-Corp Ratings – Credit Cycle Indices Lead to ‘Pure’ PIT & TTC Ratings

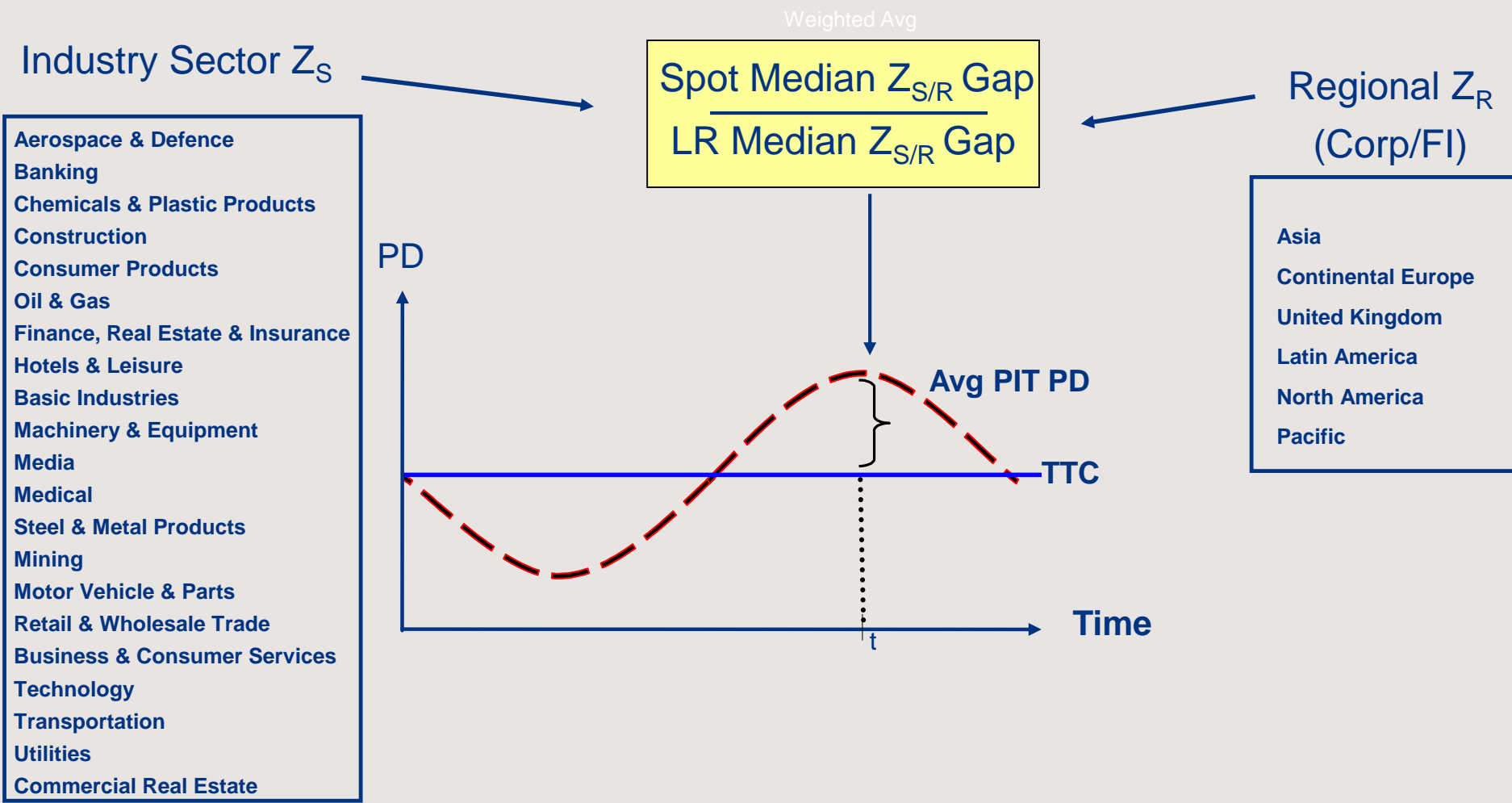
Applying Credit Cycle Adjustments to the Various Large-Corp PD Model Development Options



←●●● Cycle adjustment

Modelling Systematic Credit Cycles

Systematic Factors for Industry Sector & Region are Combined to Credit Cycle Indices

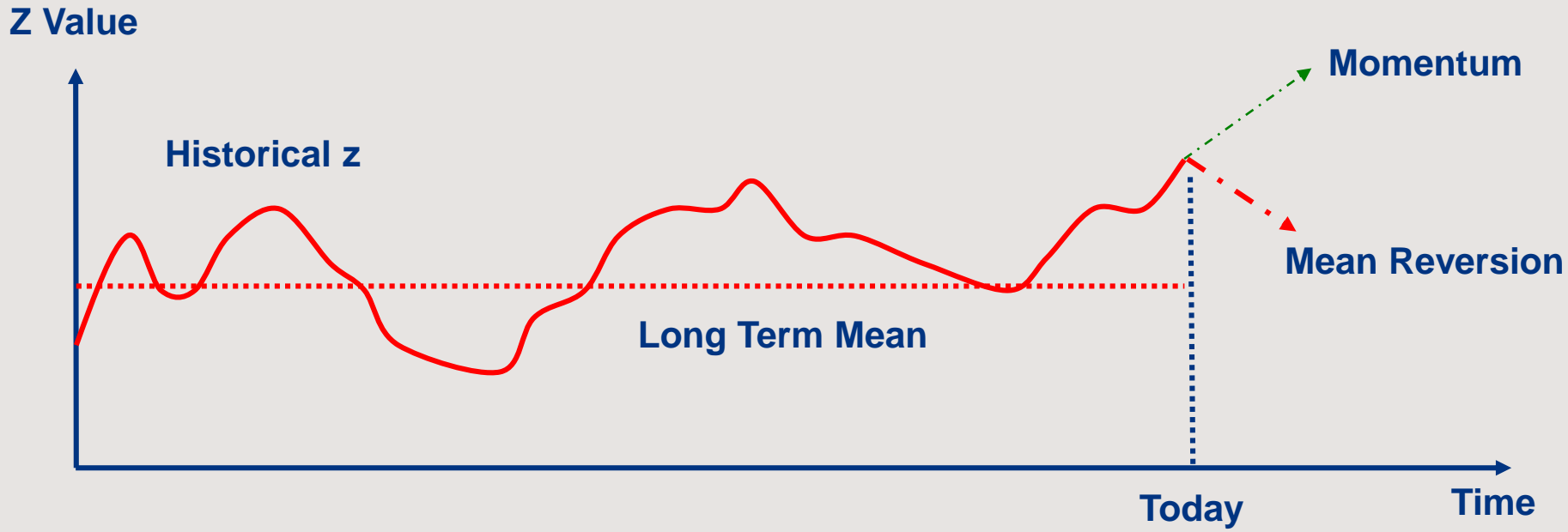


Measuring 'Real Risk' vs 'Conditional Fiction' (TTC)

Integrated Mean Reversion & Momentum Jointly Drive Credit Cycle Behaviour

Credit Cycle Behavior (Z or Z-Gap) is Driven by Two Competing Influences – Mean Reversion & Momentum

Most Data Exhibiting Credit Cycles Shows Two Competing Empirical Influences



Systematic vs Idiosyncratic Changes in Credit Risk

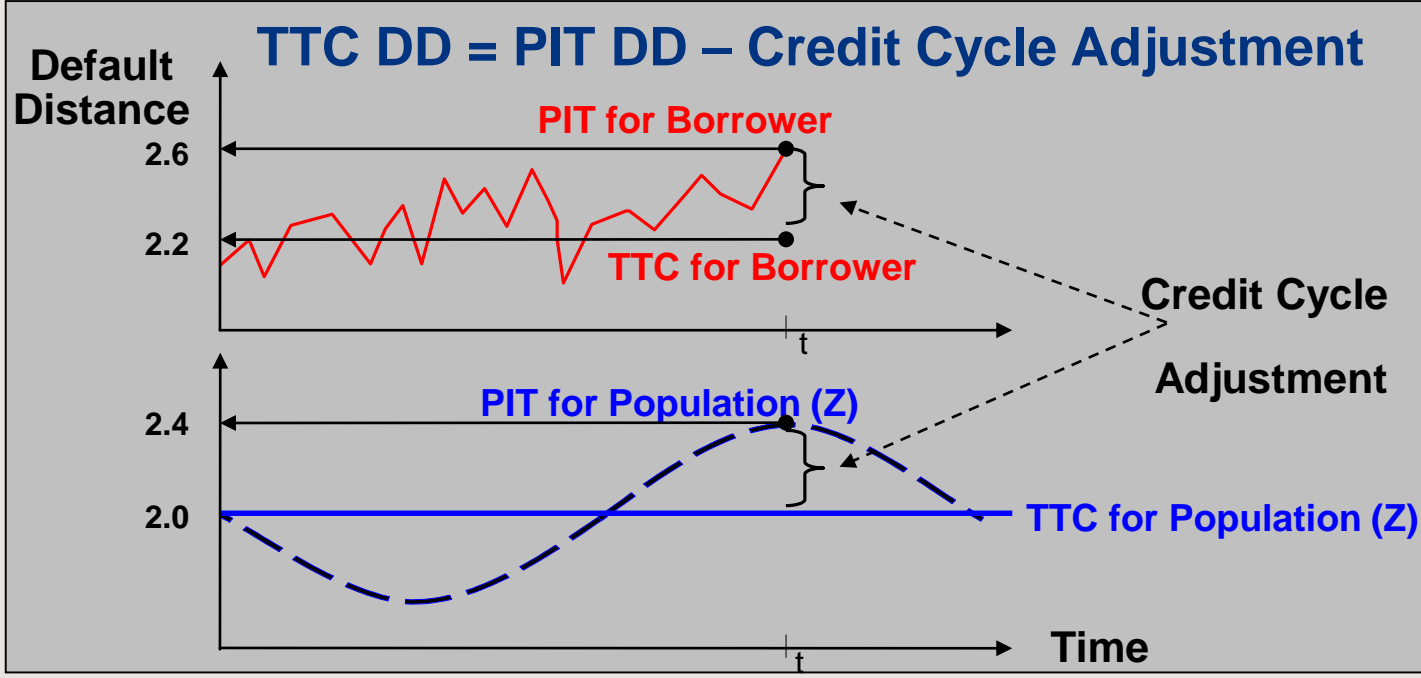
Relationship Between PIT vs TTC Default Distance

- For an obligor, TTC change is synonymous with idiosyncratic (company-specific) variation

$$\text{PIT} = \text{CYCLE} + \text{TTC} \Rightarrow \Delta\text{PIT} = \Delta\text{CYCLE} + \Delta\text{TTC}$$

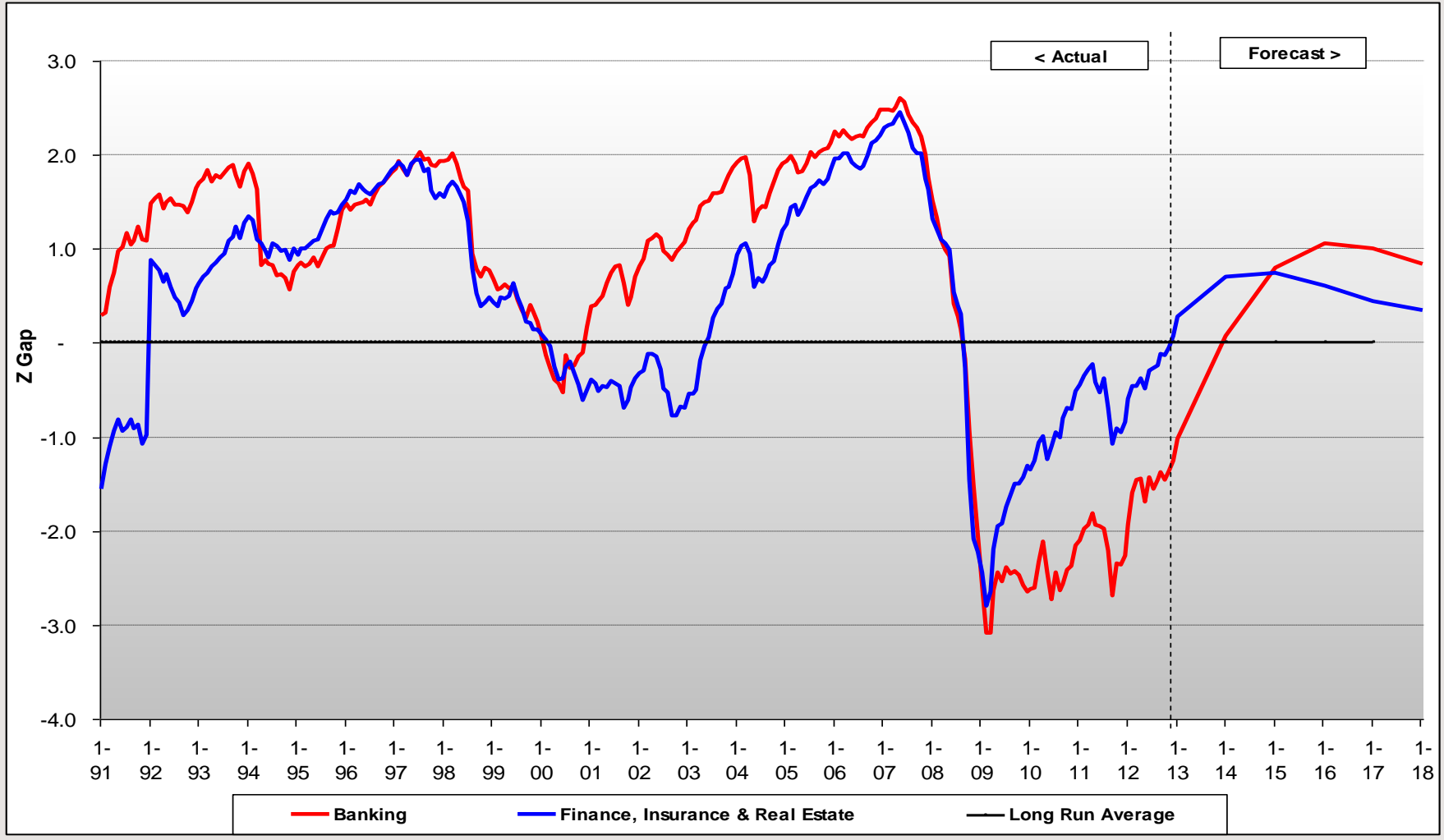
Total
Systematic
Idiosyncratic

TTC PDs Impacted by Only the Borrower Idiosyncratic Factor
 PIT PDs Impacted by Both the Systematic & Idiosyncratic Factors



Examples of Industry Credit Cycle Index Z-Gaps

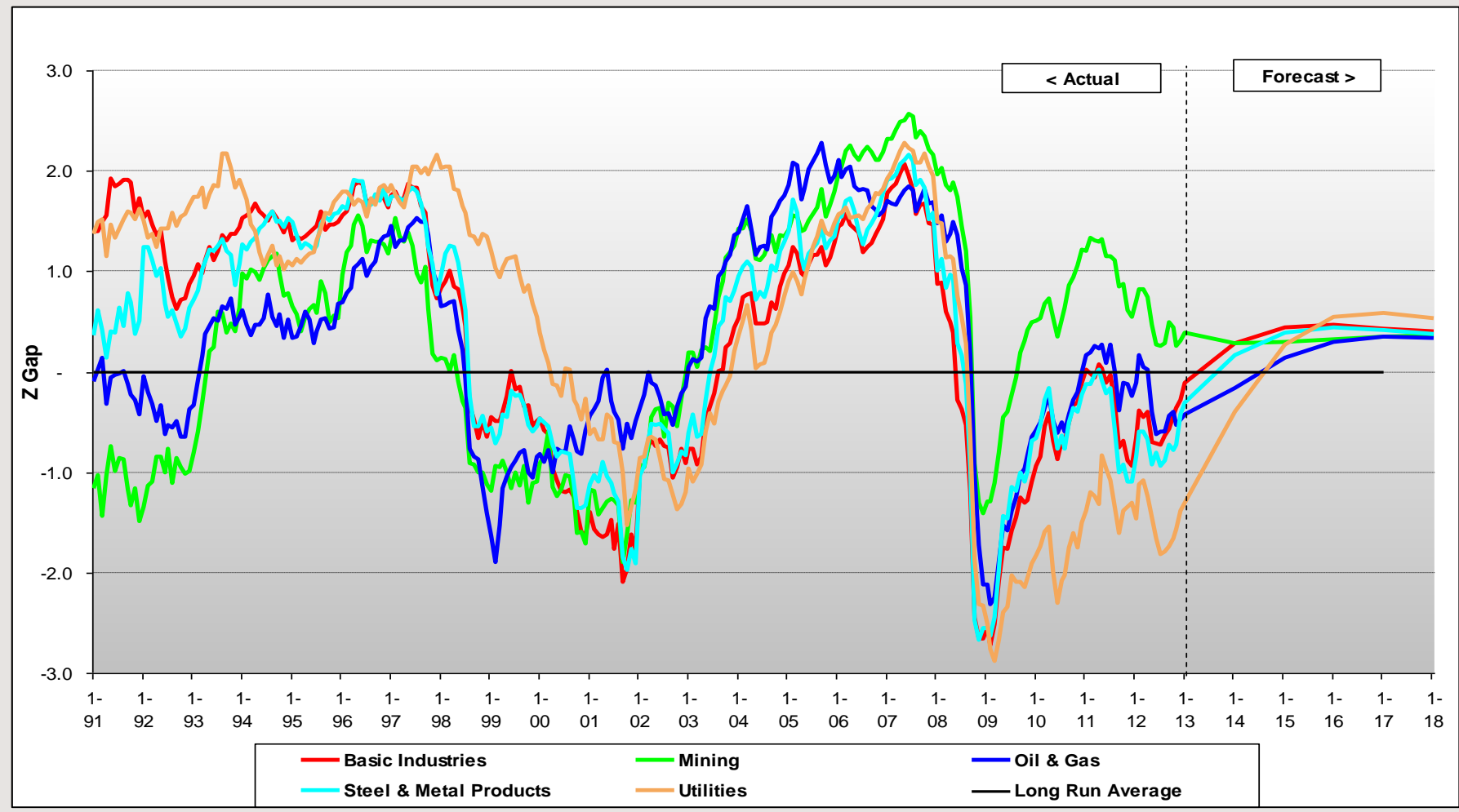
Banking, & Finance, Insurance & Real Estate



Source: Moody's KMV, RBS Research

Examples of Industry Credit Cycle Index Z-Gaps

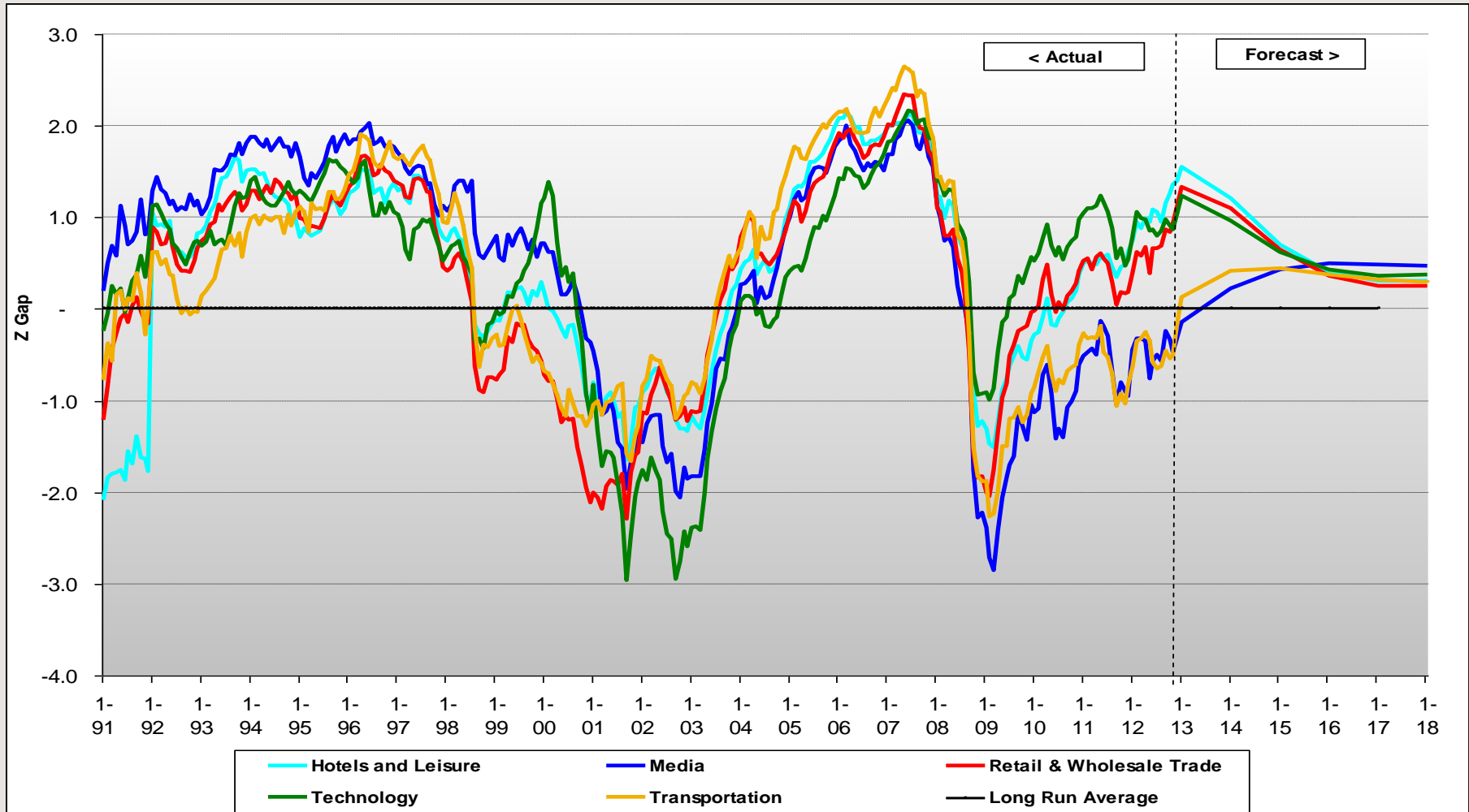
Basic Industries, Mining, Oil & Gas, Steel & Metal Products, Utilities



Source: Moody's KMV, RBS Research

Examples of Industry Credit Cycle Index Z-Gaps

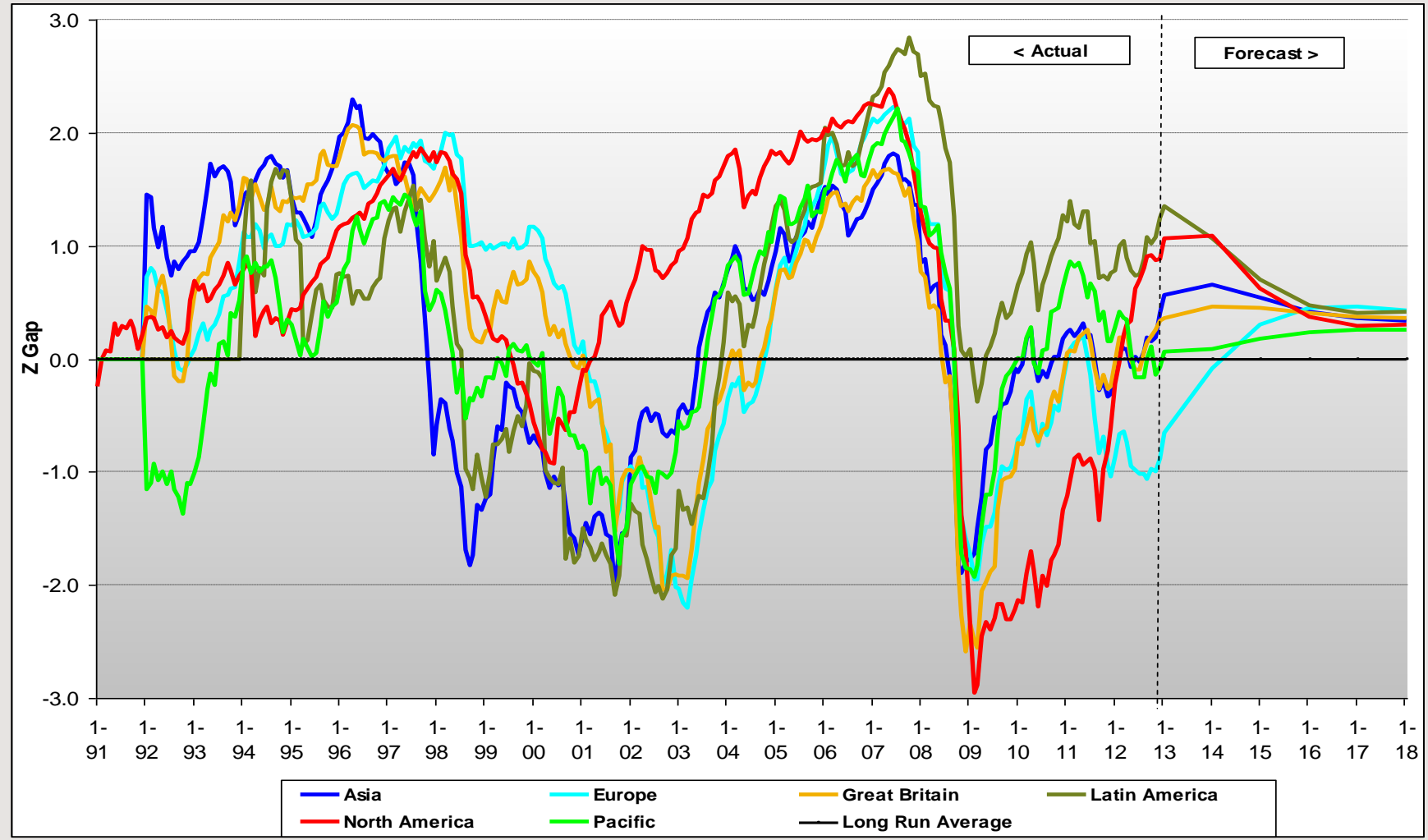
Hotels & Leisure, Media, Technology, Transportation, Retail & Wholesale Trade



Source: Moody's KMV, RBS Research

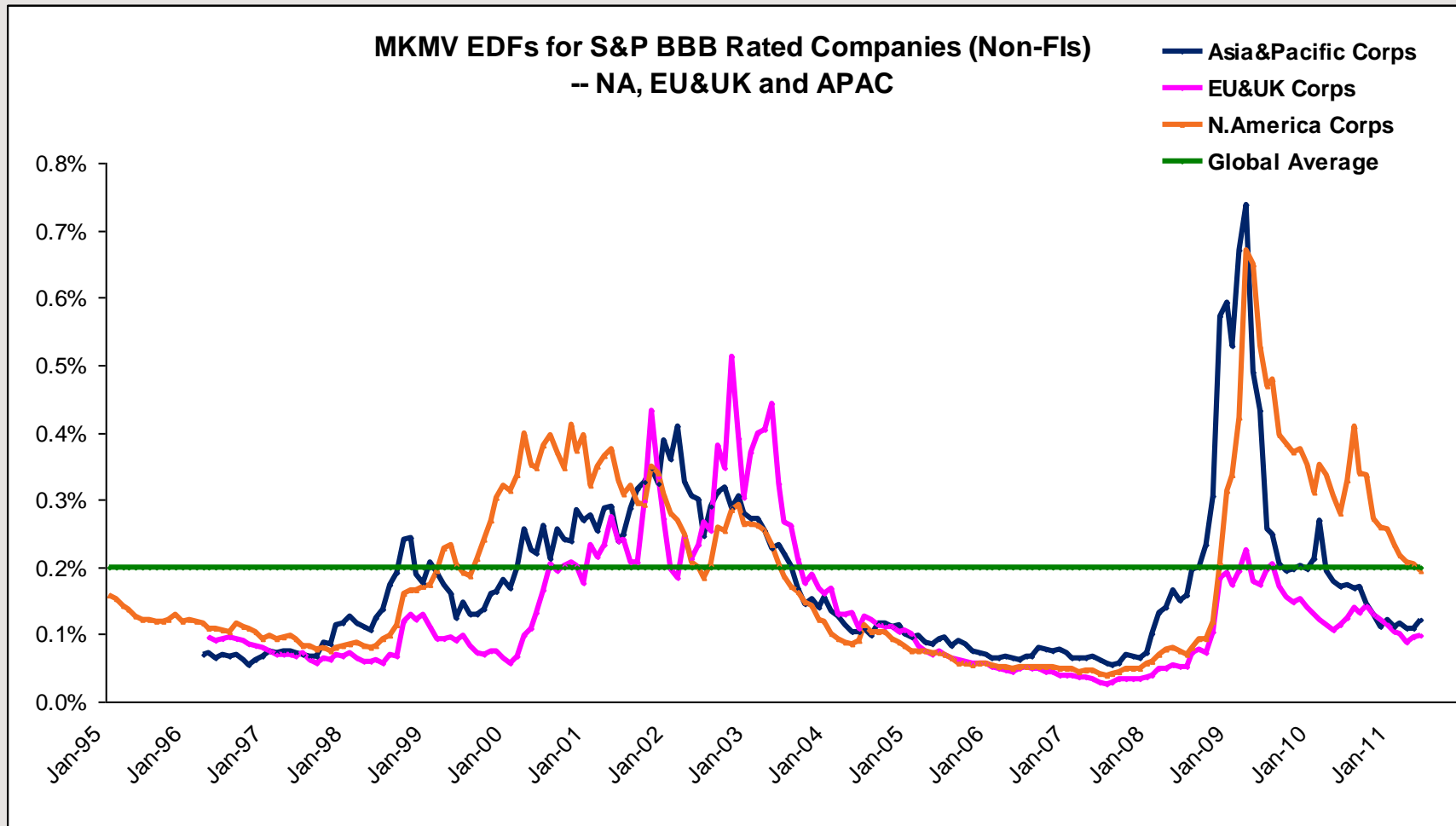
Examples of Region Credit Cycle Index Z-Gaps

Corporates – Asia, Europe, UK, Latin-America, North-America, Pacific & South Africa



Source: Moody's KMV, RBS Research

EDFs for BBB Rated S&P Companies Move Substantially



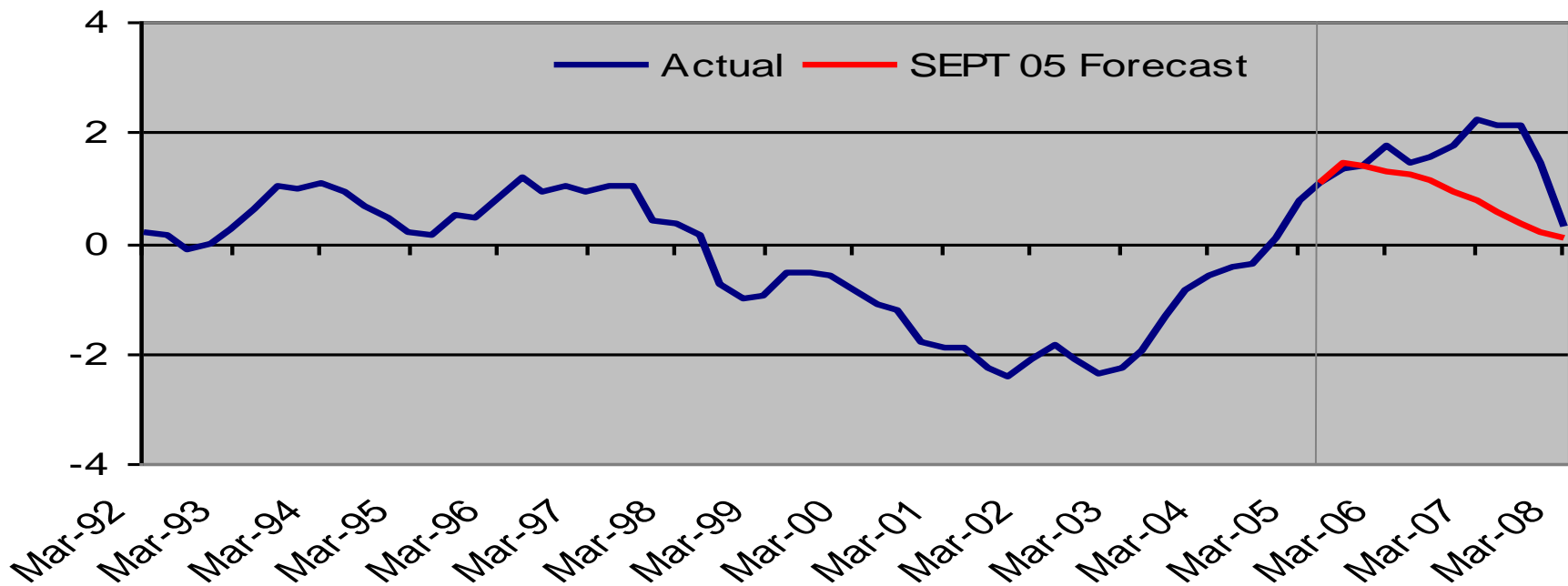
Source: S&P, Moody's KMV, RBS Research

Hotels & Leisure Ex Ante Credit Cycle Forecast vs Observed Outcome

Predicted Credit Downturn in the Hotel/Leisure Sector Occurred Later But Was More Rapid When it Did Occur

Industry Z – Hotel/Leisure Sector – Rapid Declines in Z Behaviour Caught up With the Ex Anta Forecast

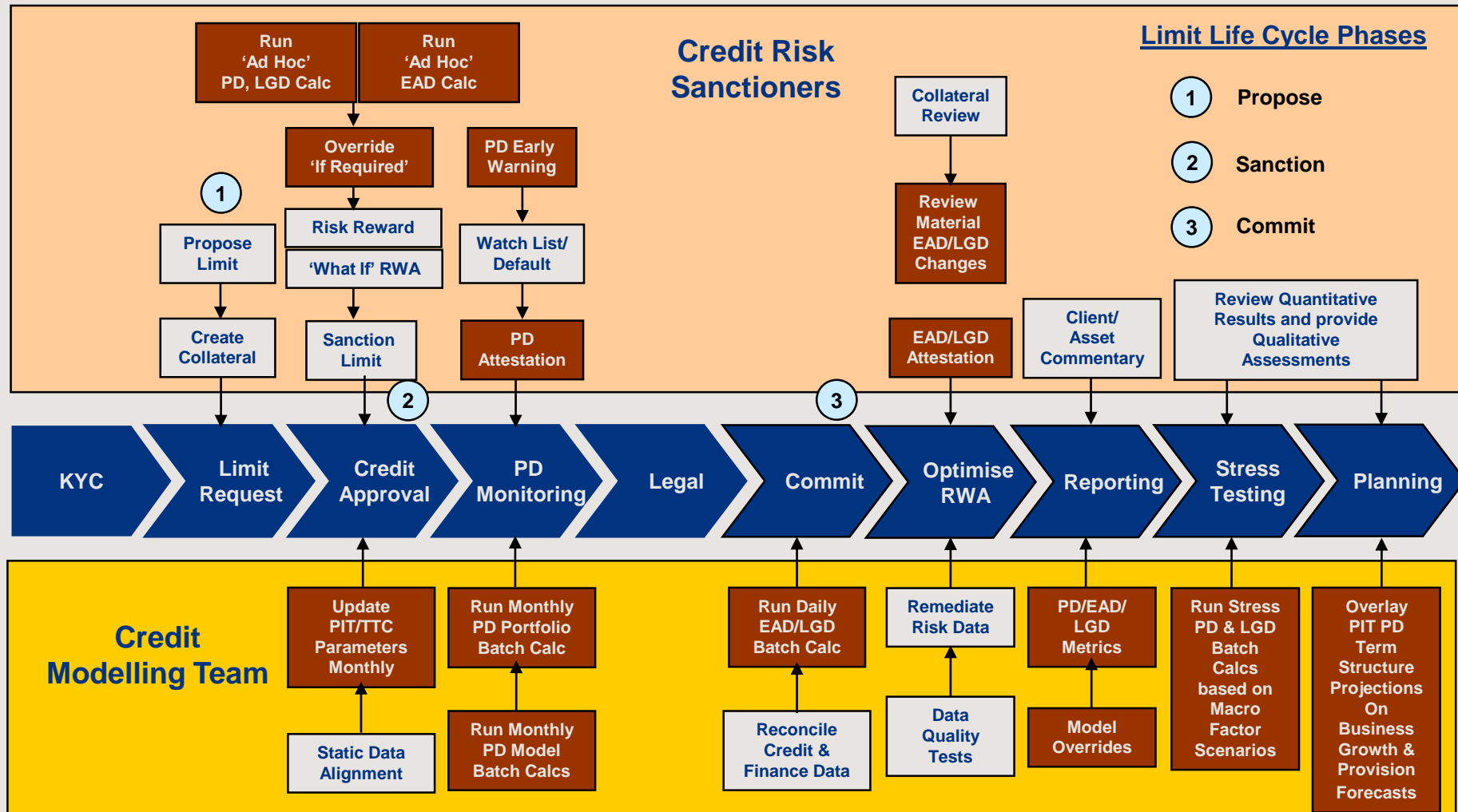
Corporates: Hotels & Leisure



Source: Moody's KMV, PIT/TTC research

Dual PIT/TTC Ratings

Implementing PIT/TTC Ratings - E2E Credit Process Utilises Extensive Batch Processing



Utilizing PIT PD Framework for Portfolio-Wide Stress Testing:

- Developed & applied portfolio-wide or more narrowly for industries, regions or obligor types
- Approach is Banking-Book-centric with simplified Trading-Book assumptions until a full integrated market & credit risk factor structure is completed
- Converts 'unconditional' PIT PDs into 'conditional' PIT PDs to most accurately stress PDs
- Utilizes forecasts of macro risk factors (currently GDP & Equity Indexes) to summarize implications of a 'stress' macro scenario on portfolio credit conditions broadly
- Estimates statistical models between 'Macro-Z' factors & Z-industry/regions
- Applies a 'Macro-Merton' approach – therefore it is consistent with corporate PD modelling
- Develops conditional, 'stress' PIT PD term structures on a multi-year basis
- Implemented in 'batch mode' – sits right on top of the normal PIT PD batch process

Additional Components of the Credit-Cycle Based Stress Test Approach

(1) Develop credit-cycle based, systematic stress scenarios for EAD & LGD:

- EAD & LGD models estimated to include Z-Gap credit cycles
 - $\text{Stress LGD} = f(\text{LGD risk factors, region/sector Z-Gap})$
 - $\text{Stress EAD} = f(\text{EAD risk factors, region/sector Z-Gap})$
- Applying deterministic, stress scenarios to EAD & LGD provide stress values consistent with the stress PIT PD scenarios – all drive off the same Macro Z drivers

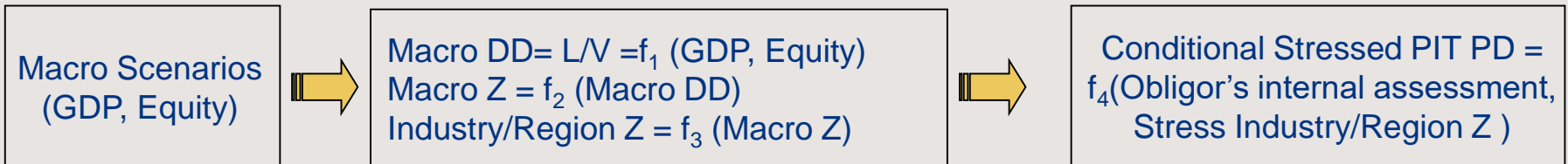
(2) Develop Qualitative Overlay to statistical models:

- Bridge from actuarial view to provision/accounting view – match stress default rates by setting some counterparty PDs to 100% and all the rest to zero
- Apply ‘add-factor’ approach to industry or region losses
- Solicit Credit Officer input by region, sector or counterparty

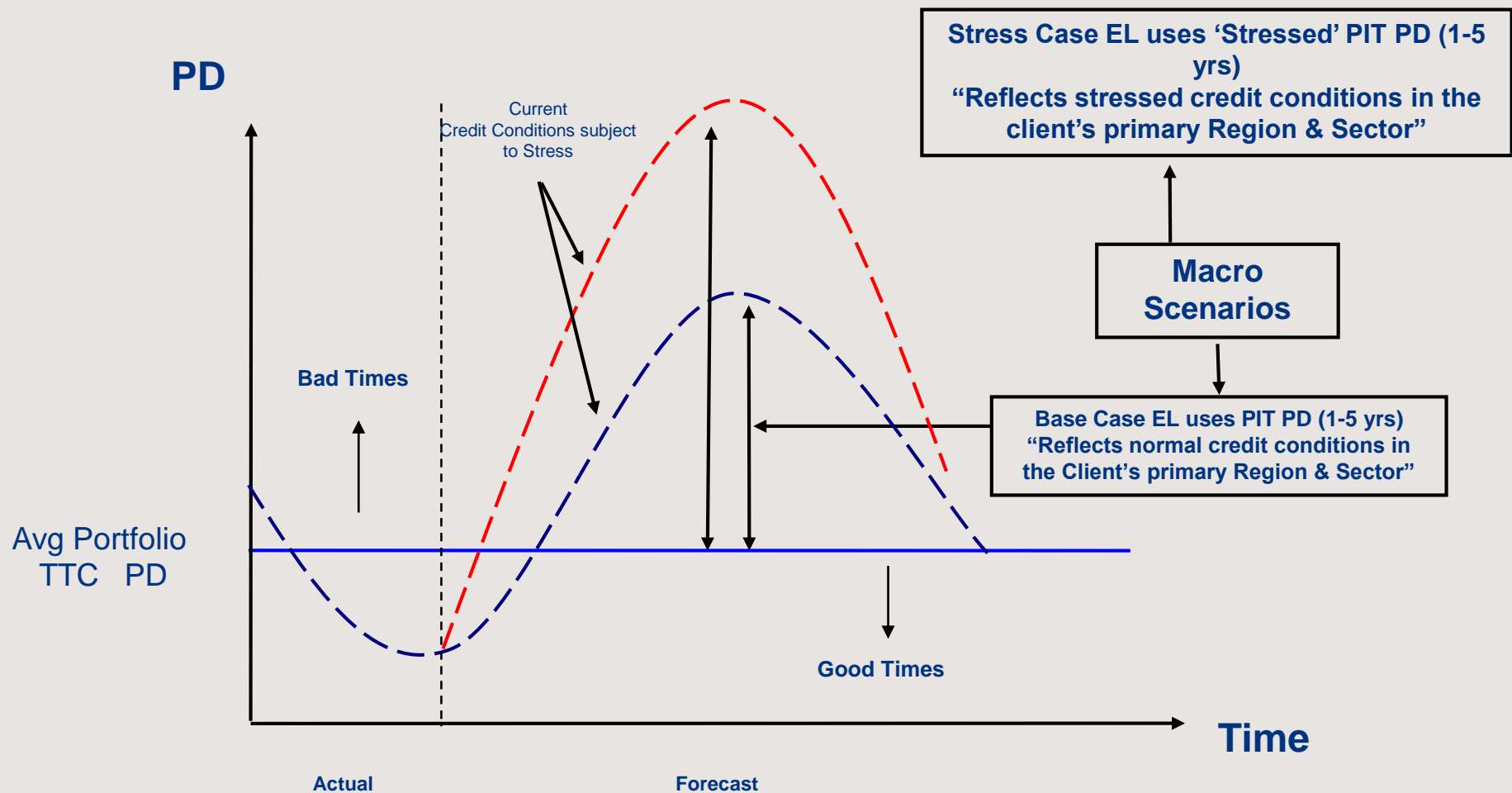
'Macro-Merton' Credit Cycle Portfolio-Wide Stress Test Framework

Systematic Credit Cycle Factors Utilised to 'Bridge' From Macro Risk Factors to 'Conditional' PIT Measures

- View GDP & equity measures as asset-value proxies
- Project macro debt on the basis of trends in asset-value proxies
- Treat Debt/GDP & Debt/Equity as leverage measures
- Derive macro DDs ('Default-Distance') as ratios of leverage to historical, leverage volatility
- Convert macro DDs to macro Zs (by normalising mean & variance)
- Use 'bridging' relationship to derive industry-region Zs from macro Zs
- Enter industry-region Zs into the PD, LGD, and EAD models and derive stress losses

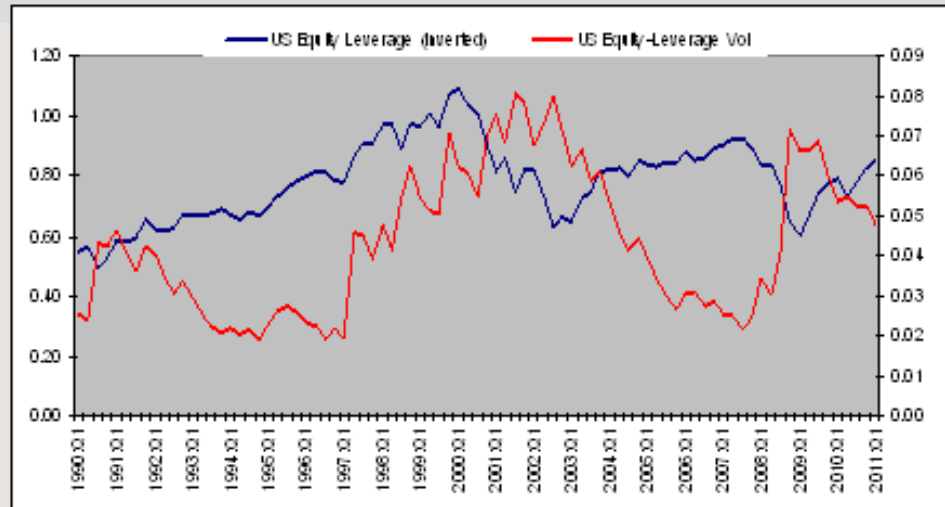


Macro Stress Scenarios Drive Systematic 'Conditional' PIT PD Stresses



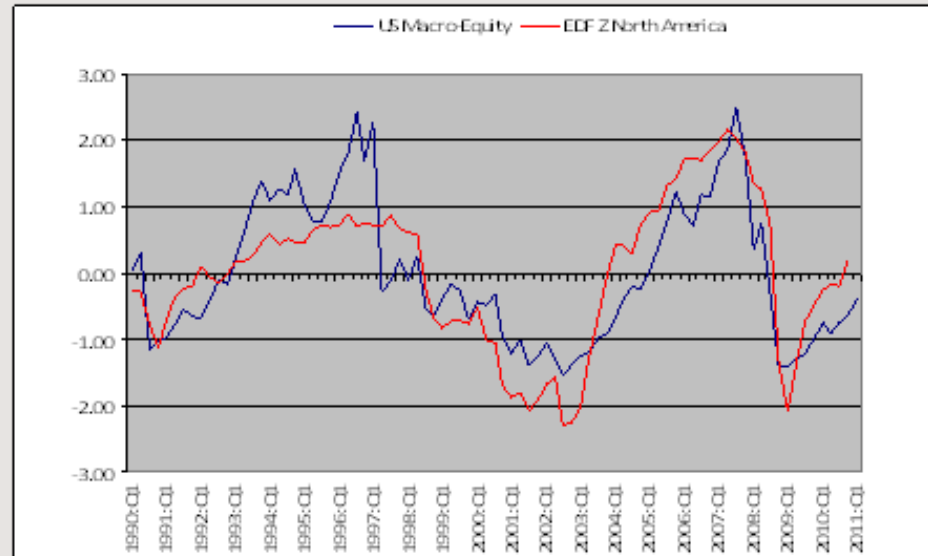
Components of the US Equity Macro Z

On the right see historical values of leverage and leverage volatility, which has larger proportional swings



Leverage (inverted) = $\ln((\text{MtM equity plus debt})/\text{debt})$.

US equity 'Macro Z' tracks North American Corp, EDF-derived Z quite closely

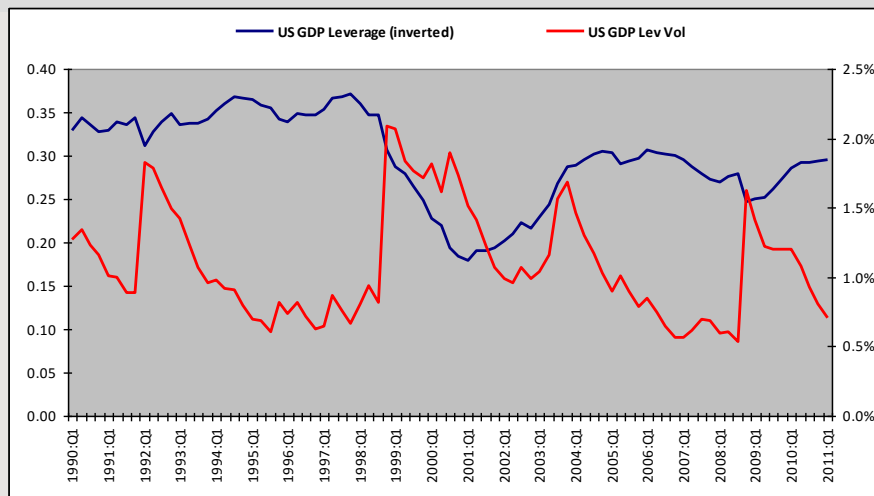


DD = Lev/Lev-Vol;
Z = DD normalized (mean = 0, std dev = 1)

Source: Moody's KMV, RBS research

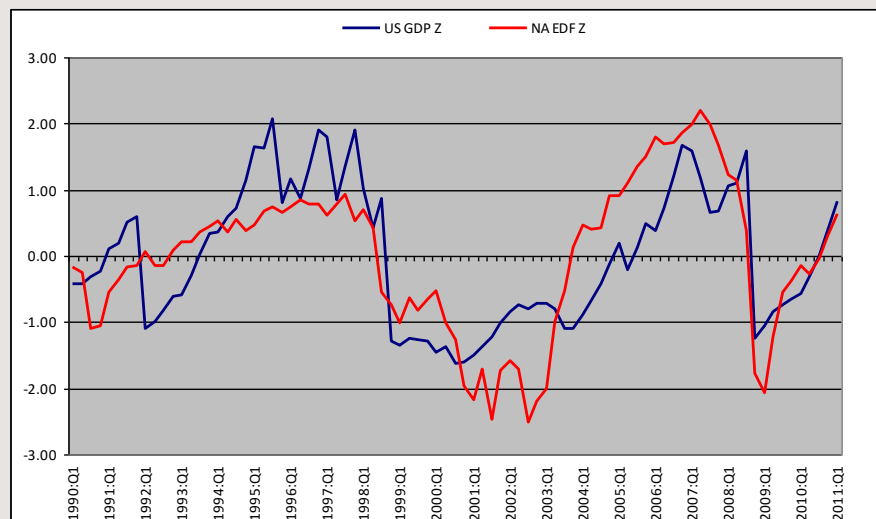
Components of the US GDP Macro Z

On the right see historical values of leverage and leverage volatility, which has larger proportional swings



Leverage (inverted)
= $\ln((\text{GDP}/\text{debt}))$.

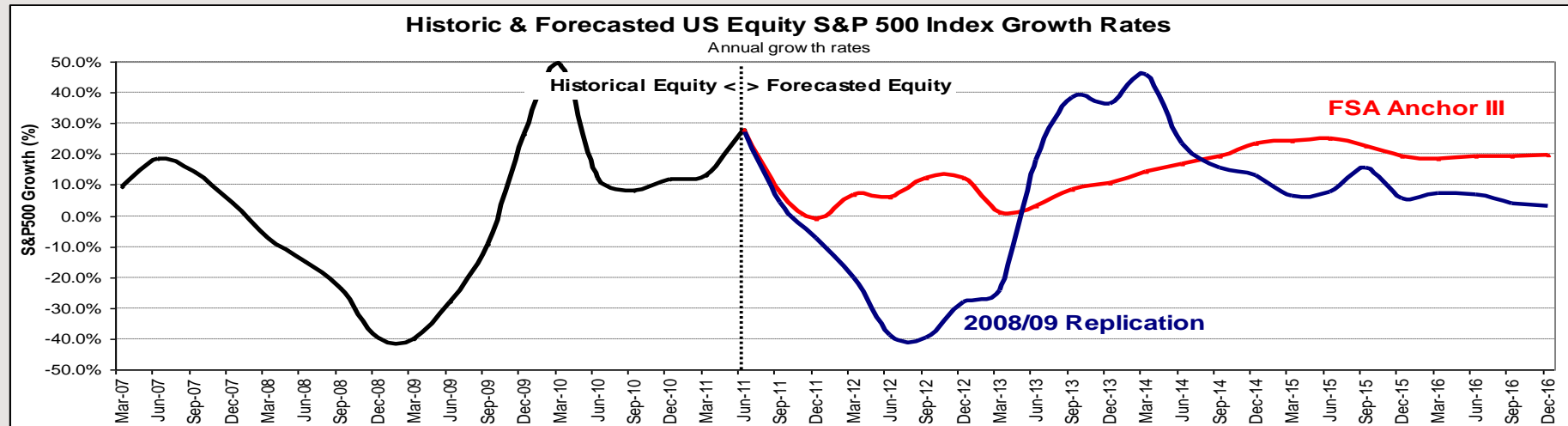
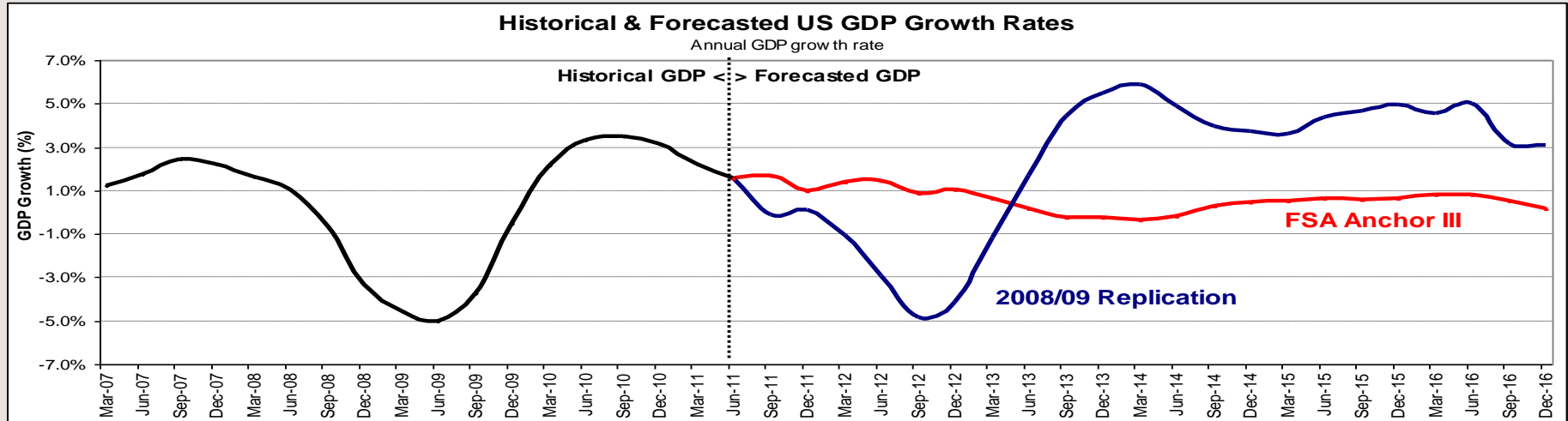
US GDP macro Z tracks North American Corp, EDF-derived Z rather closely



DD = Lev/Lev-vol;
Z = DD normalized
(mean = 0, std dev = 1)

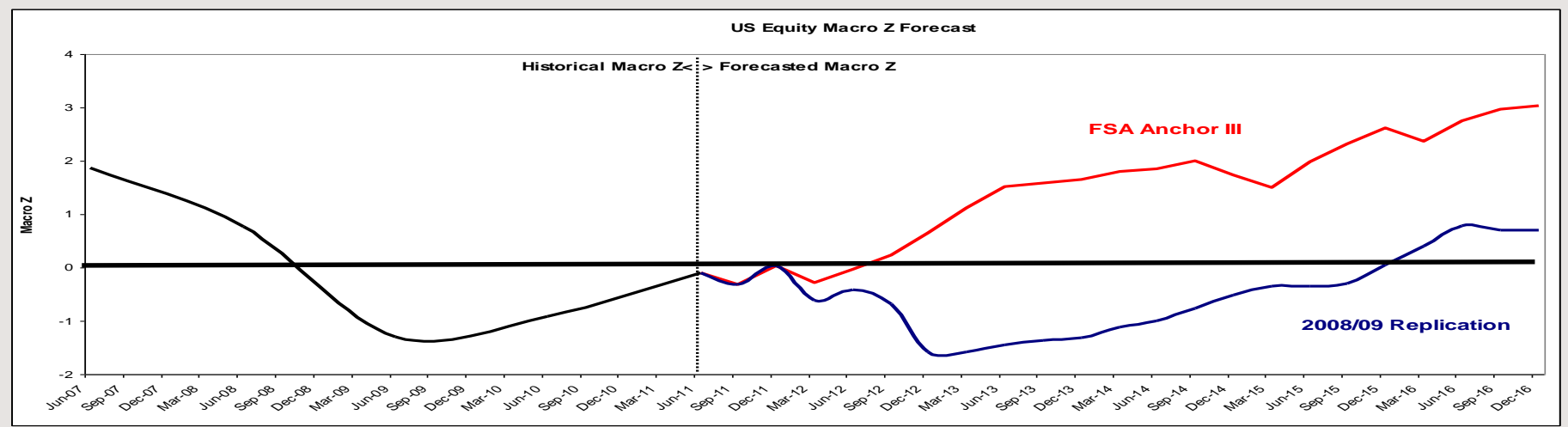
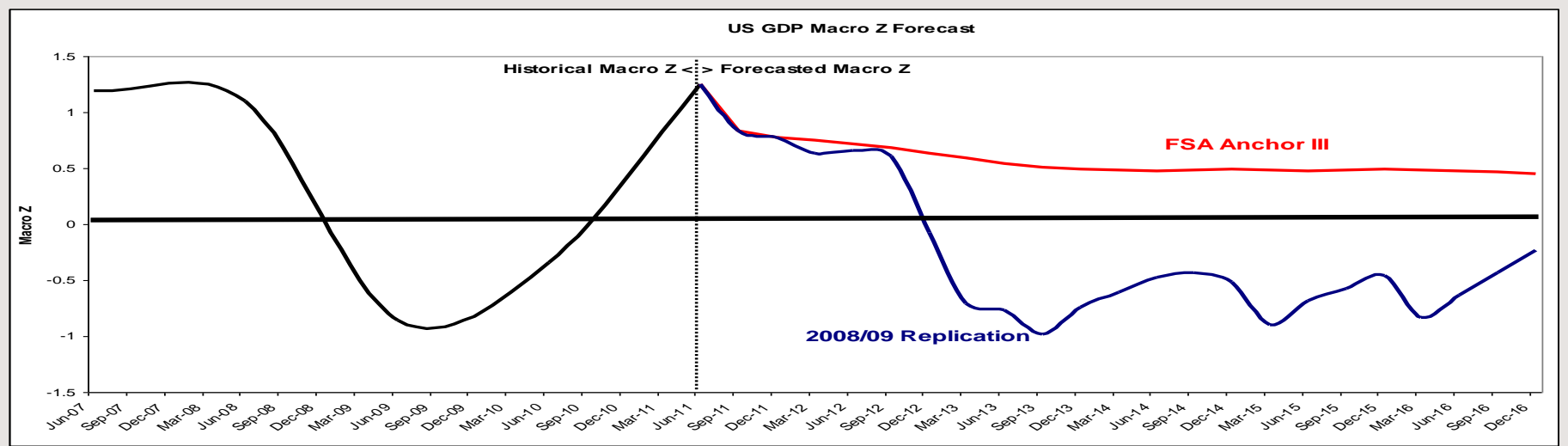
Source:Moody's KMV, RBS research

US -- GDP & S&P 500 -- History & Scenario Forecasts



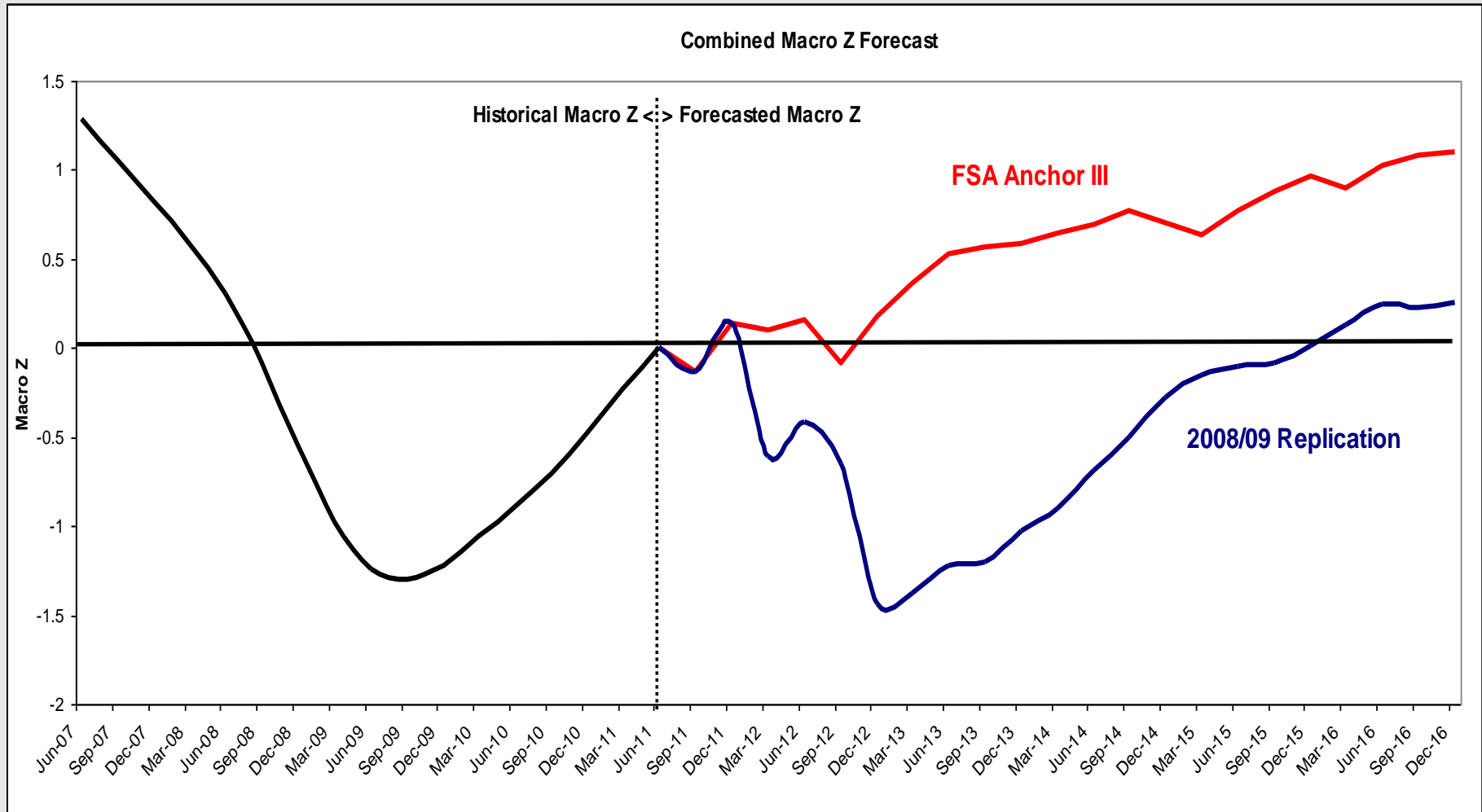
Source: S&P, FSA, US Govt, RBS Research

US -- 'Macro-Z' for GDP & S&P 500 -- History & Scenario Forecasts



Source: S&P, FSA, US Govt, RBS Research

US -- Combined 'Macro-Z' – History & Scenario Forecasts



Key Points in the Presentation

- Systematic Credit Cycles are real & they can be empirically measured – their existence motivates Dual PIT/TTC Ratings approaches
- Dual ratings successfully support multiple business objectives
- Legacy credit models vs Dual PIT/TTC ratings – represent a substantial & positive paradigm shift going forward
- Dual PIT/TTC ratings are a ‘framework’ – they can be implemented bank-wide
- Wholesale ratings implementation – E2E models ‘batch mode’ capability using a ‘Model Server’ architecture is a substantial step forward
- Portfolio-wide stress testing capabilities require ‘conditional’ PIT measures – these flow naturally from the PIT/TTC ratings ‘unconditional’ view of risk

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