IFRS 9 Scenario Implementation and ECL Calculation for Retail Portfolios

Alaistair Chan, Economist | Olga Loiseau-Aslanidi, Senior Economist and Risk Modeler

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Speakers

Alaistair Chan

ECONOMIST

Covers national and metropolitan economic issues across the Asia-Pacific region.

Olga Loiseau-Aslanidi

SENIOR ECONOMIST & RISK MODELER

Designs and implements models for stress-testing and forecasting.

Agenda

1. Economic Scenarios in a Probability Weighted Environment
2. Global Macroeconomic Forecasting Models
3. Retail Credit Methodology Challenges

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Economic Scenarios in a Probability-Weighted Environment

Addressing IFRS 9 Forward-Looking Aspects

*"An entity shall measure ECL of a financial instrument in a way that reflects an **unbiased and probability-weighted** amount that is determined by **evaluating a range of possible outcomes**." (5.5.17)*

*"When measuring ECL, an entity need not necessarily identify every possible scenario. However, it shall **consider the risk of probability that a credit loss occurs** by reflecting the possibility that a credit loss occurs and the possibility that no credit loss occurs, even if the possibility of a credit loss occurring is very low." (5.5.18)*

*"This may not need to be complex analysis. In some cases, **relatively simple modelling may be sufficient**, without the need for a large number of detailed simulations of scenarios." (B5.5.42)*

"…an entity need not necessarily identify every possible scenario." (5.5.18)

Key Take-Aways

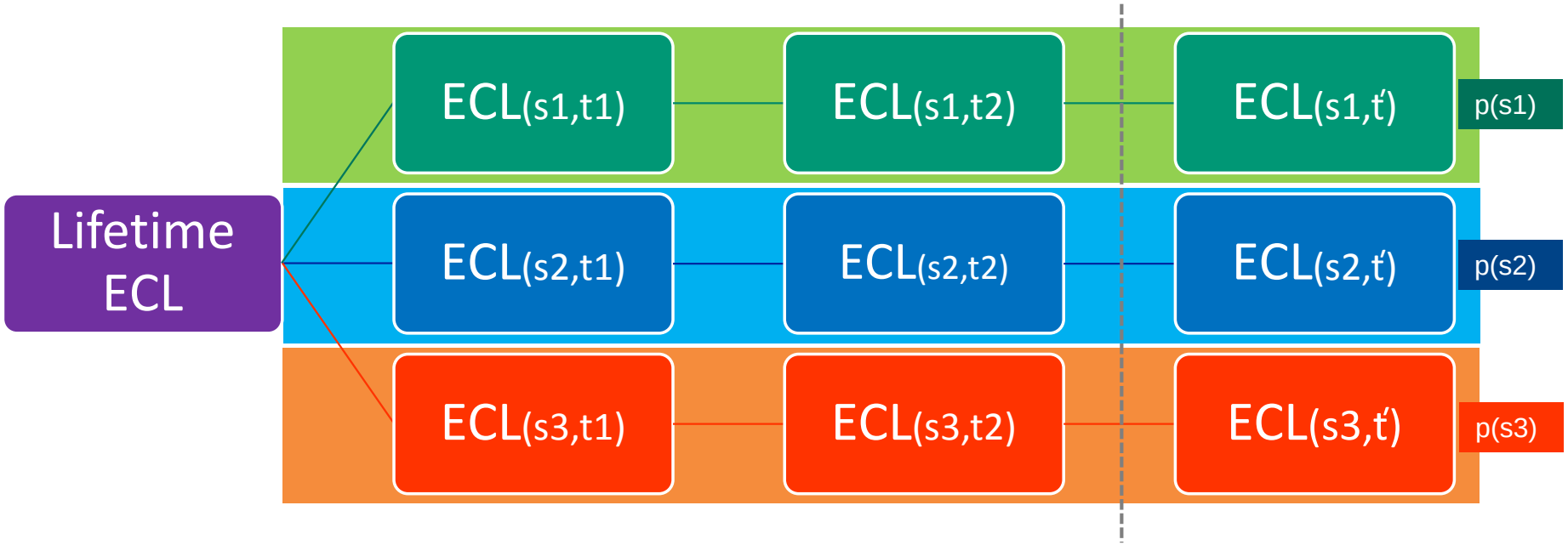
Forward Looking & Probability-Weighted Outcomes

- Requires expected credit losses (ECL) to account for forward-looking information
- Requires probability-weighted outcomes when measuring expected credit losses
  - Estimates should reflect the possibility that a credit loss occurs and the possibility that no credit loss occurs

Macroeconomic modelling satisfies both requirements above

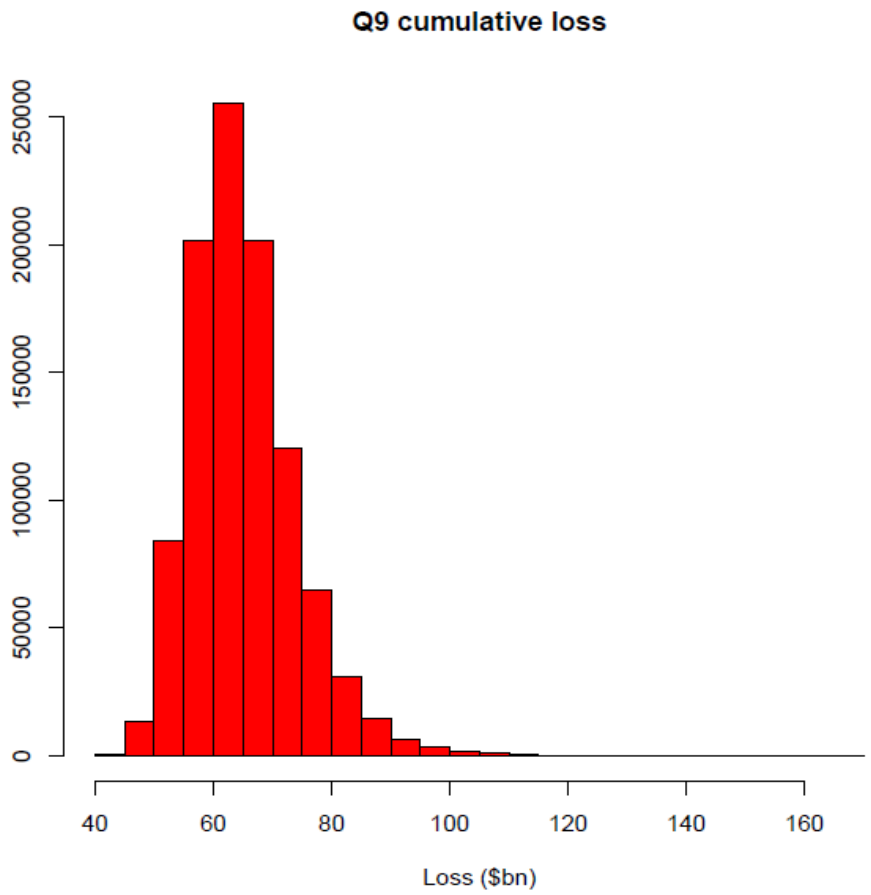
ECL Calculations – Lifetime Example

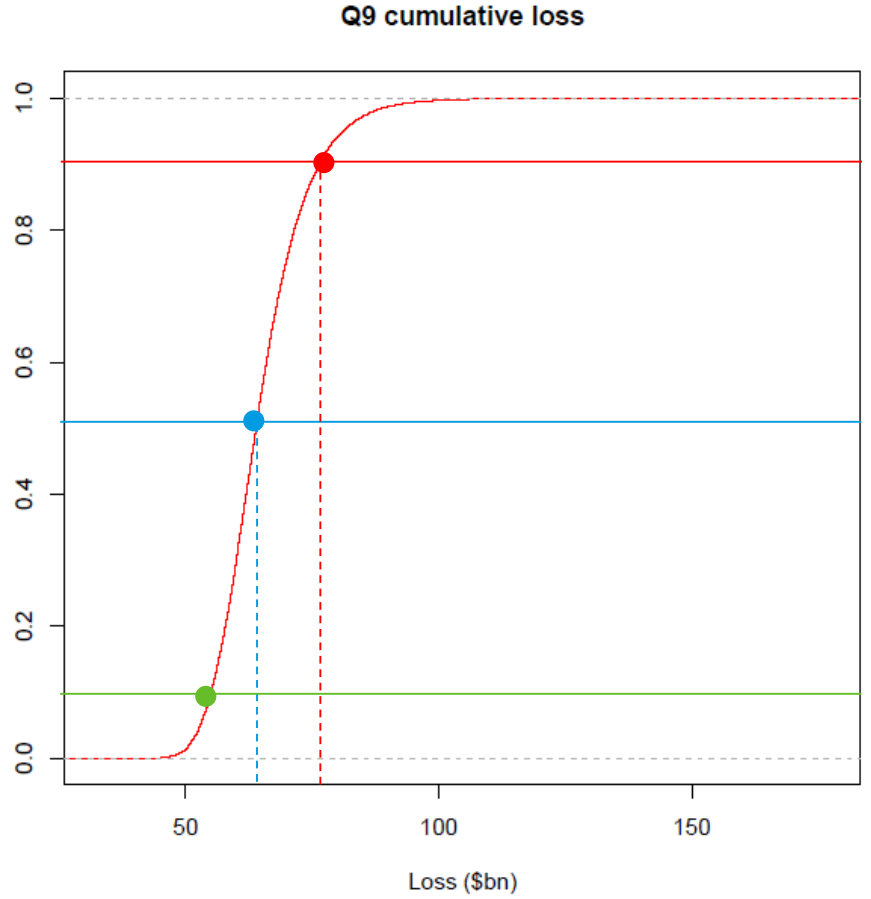
Example with 3 Scenarios (s1, s2, s3) & (1, 2,…, t') Periods



Forward Looking Probability Weights

On the Number of Scenarios and Probability Targets





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Global Macroeconomic Forecasting Models

Macroeconomic Forecasts

Mix of Theory and Data

Theory

- Quality of forecast and scenarios
- Complex
- Limited quantity of forecasts

Data

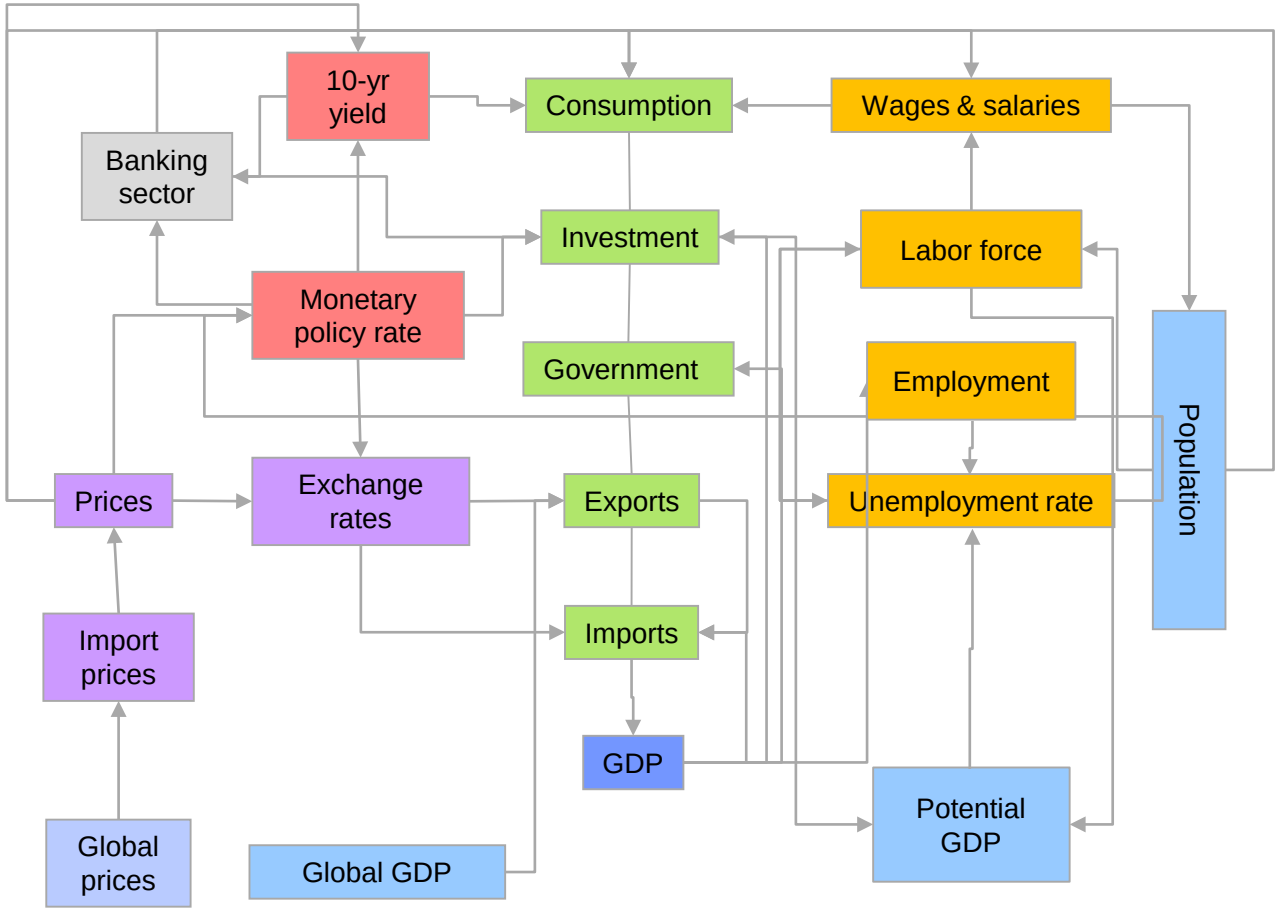
- Quality and quantity of forecasts
- Easy to produce
- Not ideal for scenario analysis

Our Models

Intersection of purely data- and purely theory-based Models

Structural Forecast Model Methodology

With Detailed Quantitative & Qualitative Testing



Specification choice

- Theoretical reasoning versus statistical properties

In-sample equation fit

- R-squared, RMSE, information criteria
- Fitted values and residuals

Forecasting performance

- Back-testing: conditional and unconditional evaluation
- Benchmarking during important past episodes

Sensitivity to shocks

- Forecasts across scenarios
- Response to individual shocks

Comprehensive Coverage

More Than 1,800 Forecast Variables for 60+ Countries

Core economic concepts:

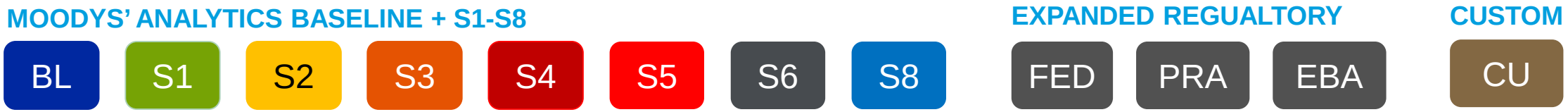
- National Accounts
- Balance of Payments
- Government Finance
- Industrial Production
- Producer Price Index
- Retail Sale Index
- Interest Rates
- Stock Markets
- Money Markets
- Labor
- Home Price Indices
- and many more…

Moody's Analytics Scenarios

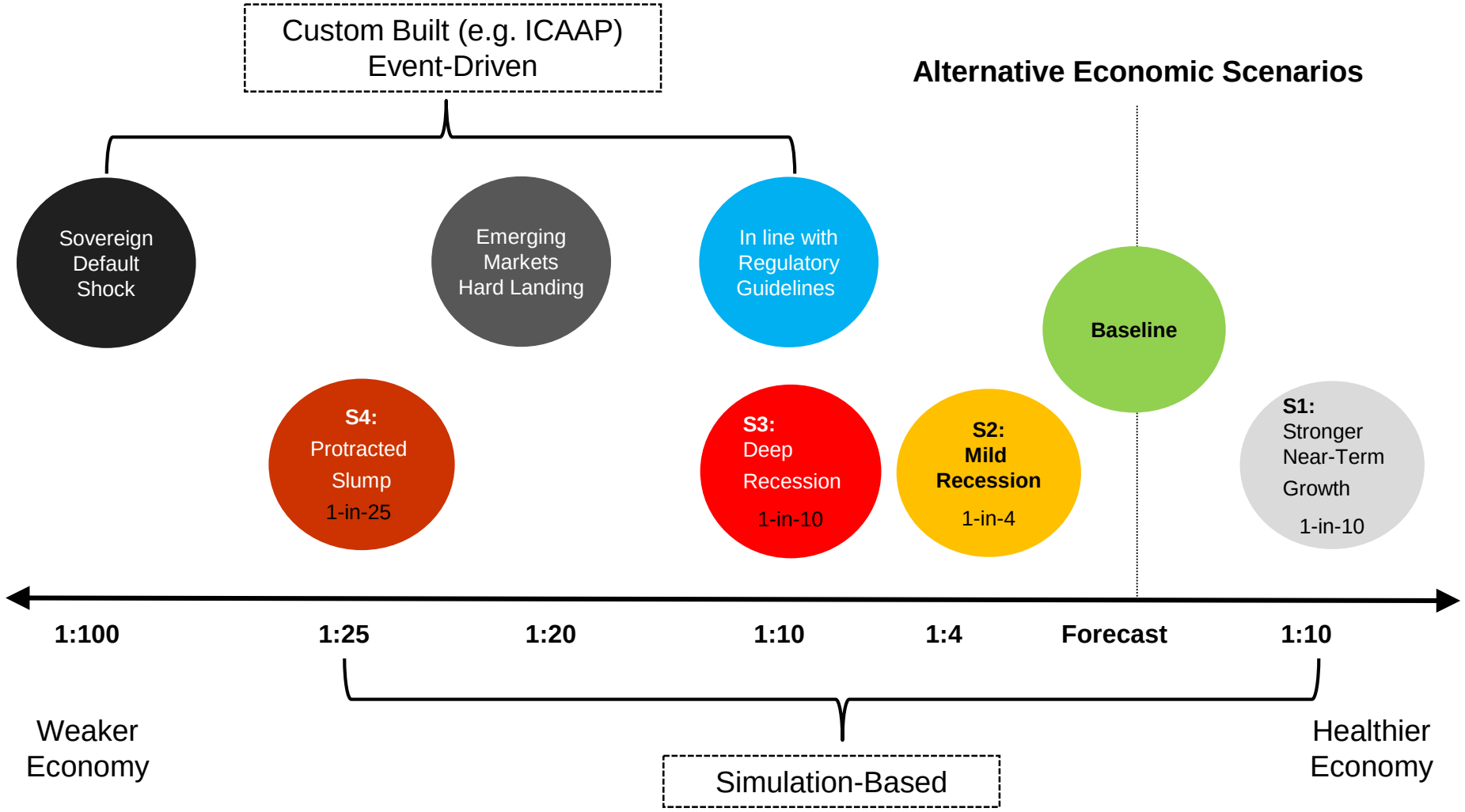
Reasonable and Defensible Forecasts from Moody's Analytics

Key Features

- **30-year horizon**, for baseline forecast plus up to **eight** alternative scenarios
- Coverage of more than **1,800** economic, financial and demographic variables
- Available for **60+ countries** globally
- Forecasts updated **monthly,** history updated in **real-time**
- **Fully documented** model methodology; scenario assumptions published monthly
- **Model validation** reports available



Moody's Analytics Scenarios



From Severity to Probability of Occurrence

How Do we Gauge Severity and Probability of a Particular Scenario?

Severity: Probability that particular economic statistic is less than in a given scenario -> IFRS 9

Different metrics:

- Real GDP growth over a period
- Real GDP start-to-trough
- Unemployment rate start-to-trough

Historical analysis:

- Compute historical mean and standard deviations of variables of interest; e.g. GDP growth rate
- Compare scenarios in terms of standard deviation
- Assume normality to estimate probabilities
- Drawback: history only one realization of the stochastic process; not many periods to compare

Shocks and Scenarios

Points of Calibration

- Severity (e.g. peak to trough of real GDP, peak unemployment rate)
- Probability (where does severity fall in distribution of outcomes?)

Methods of Calibration

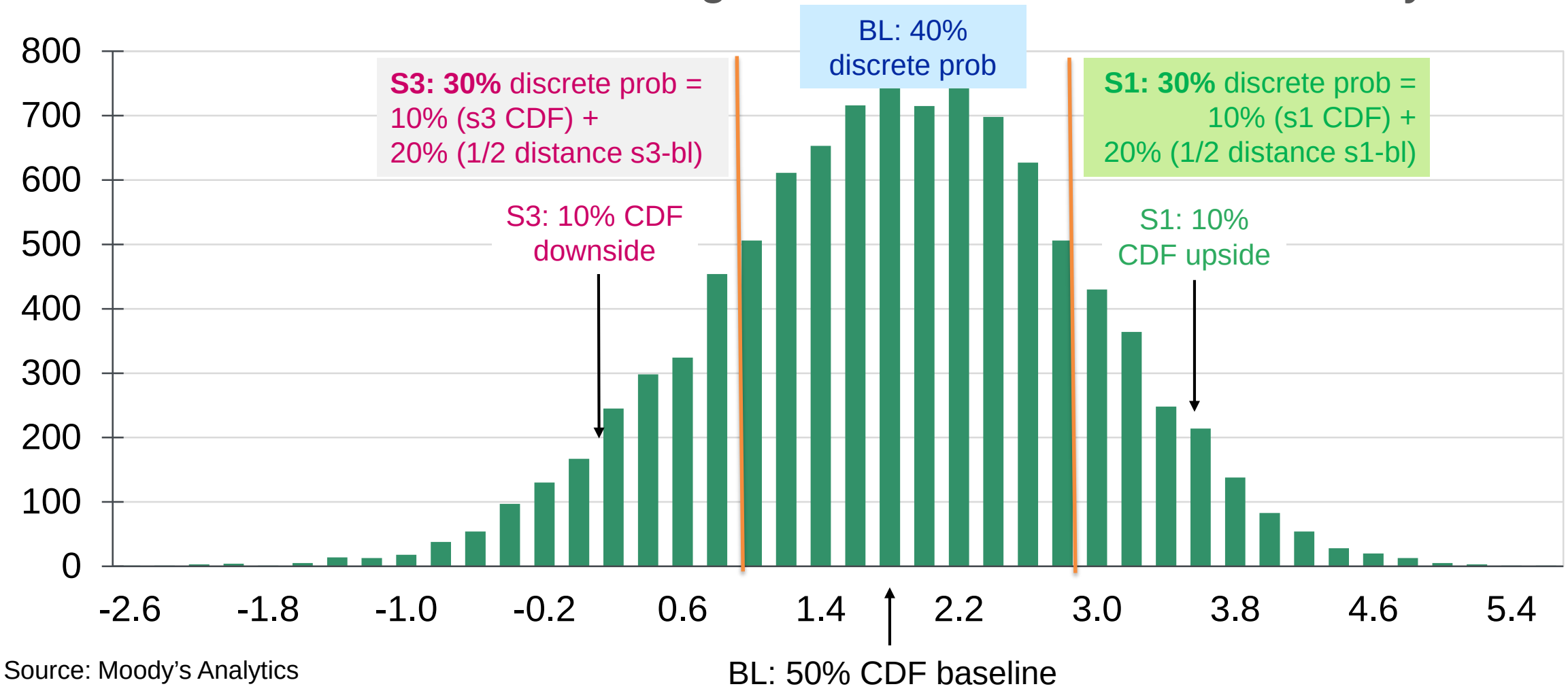
- Historical analysis: empirical distribution of a given metric
  - Example: a histogram of the unemployment rate, or real GDP growth rates
  - Drawbacks: Limited data samples, reflects an unconditional distribution

- Monte Carlo simulation
  - Estimate a stochastic model (e.g. VAR of growth, inflation and interest rates)
  - Simulate forecast paths and compute distribution of 5-year growth rates.
  - Assign probabilities based on the distribution of simulated paths

- IFRS 9 – convert continuous CDF probabilities to discrete PDFs.
  - 10th percentile – low stress
  - 50th percentile – baseline
  - 90th percentile – high upside

Scenario Calibration: Discrete Scenario Prob.

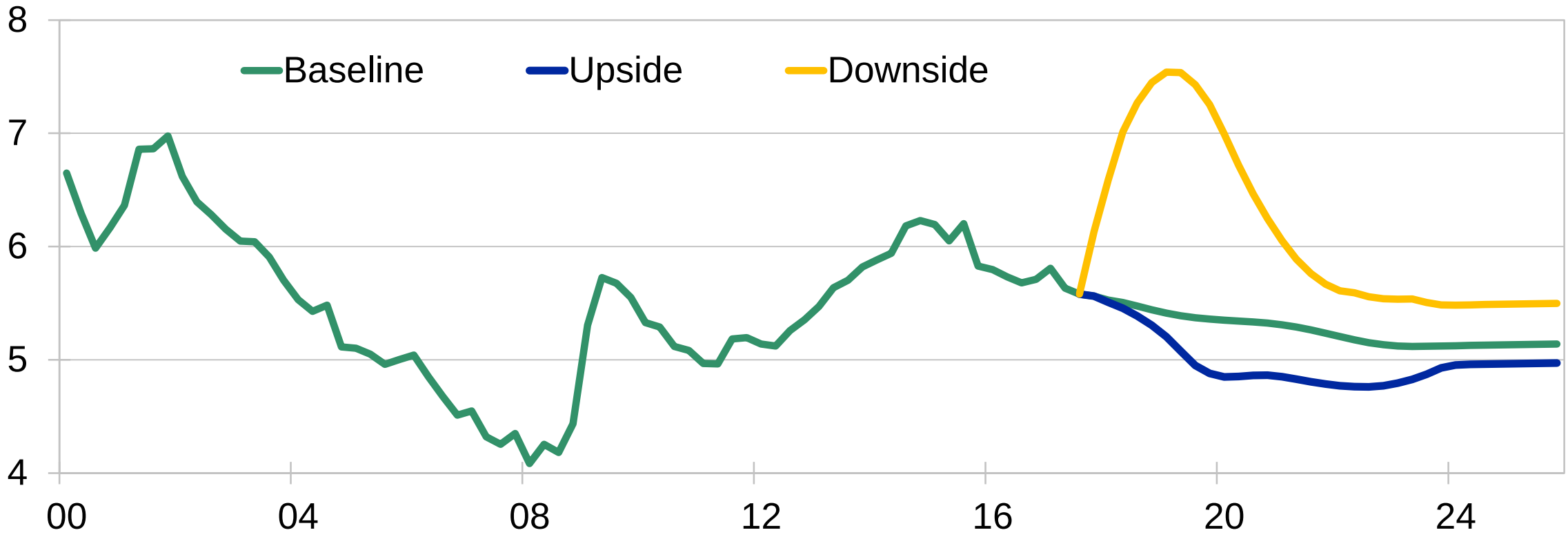
GDP Growth %, Annualized avg, 10,000 Simulations over a 5-yr Period



Source: Moody's Analytics

Australia, Scenario Forecasts

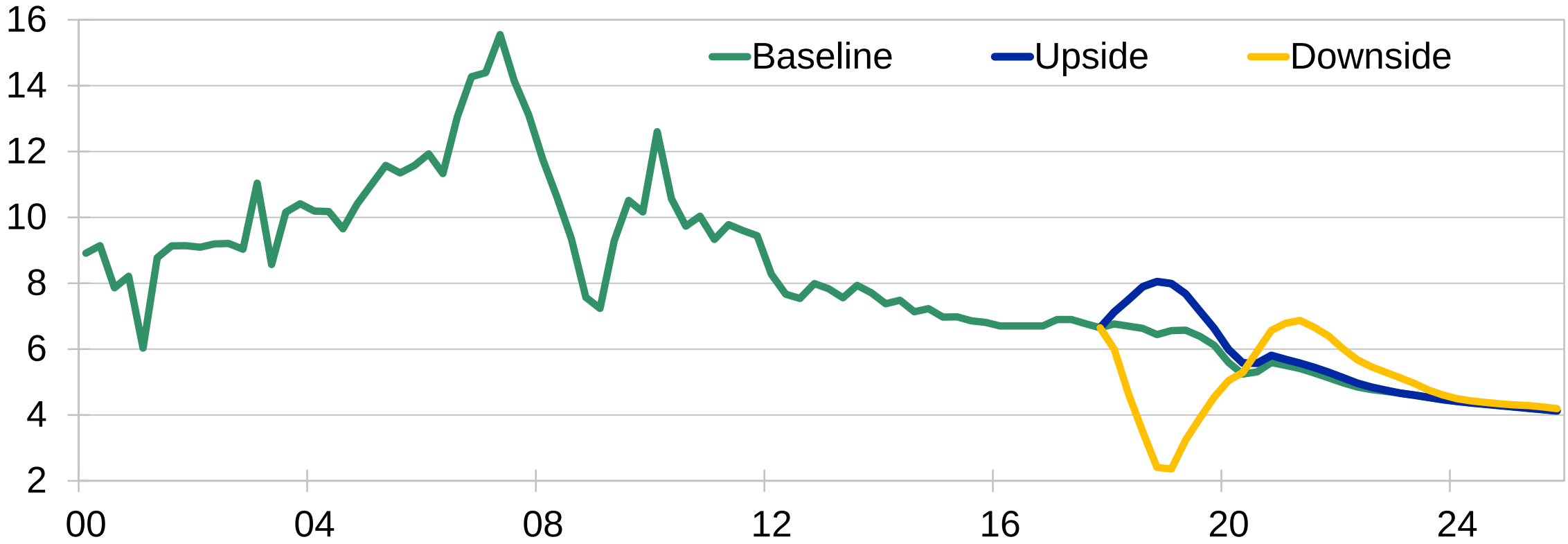
Unemployment rate, %



Sources: Australia Bureau of Statistics, Moody's Analytics

China, Scenario Forecasts

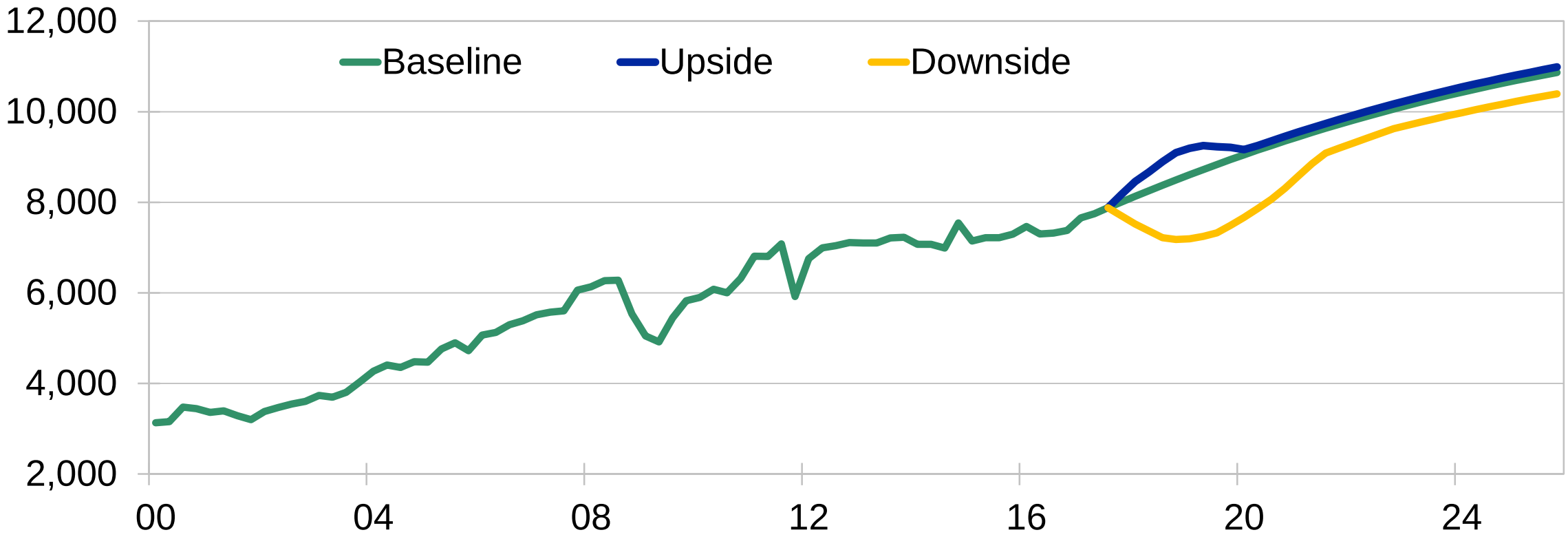
GDP, % change yr ago



Sources: National Bureau of Statistics, Moody's Analytics

Thailand, Scenario Forecasts

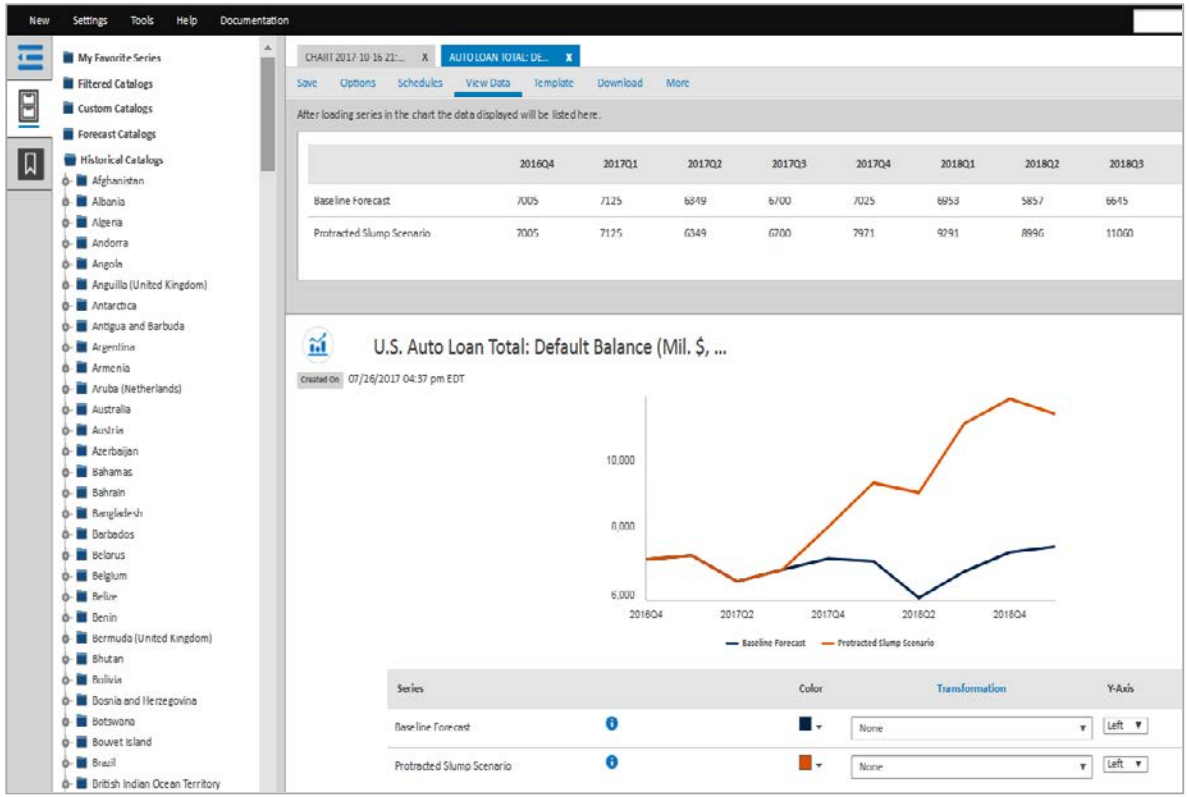
Exports, 2002 THB bil, SAAR

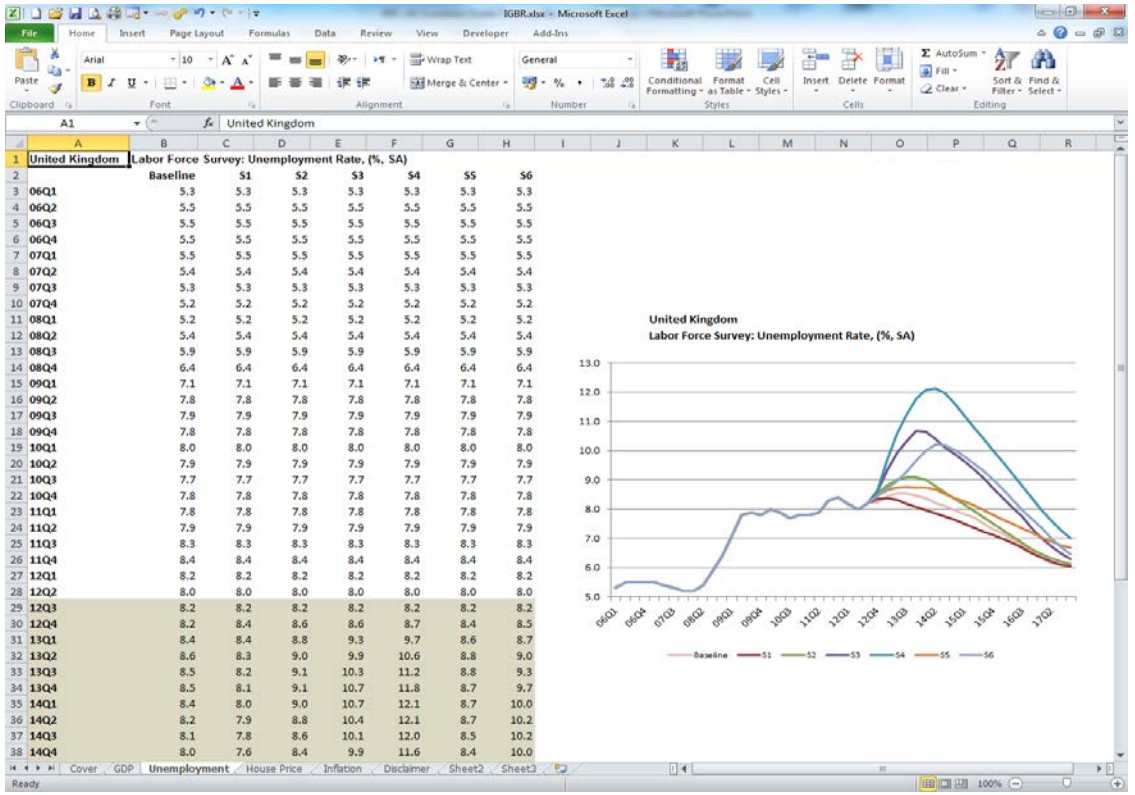


Sources: National Bureau of Statistics, Moody's Analytics

Web Based Interface, Office Add-In, or API

View, Manipulate and Automate Delivery of Data in a Variety of Formats





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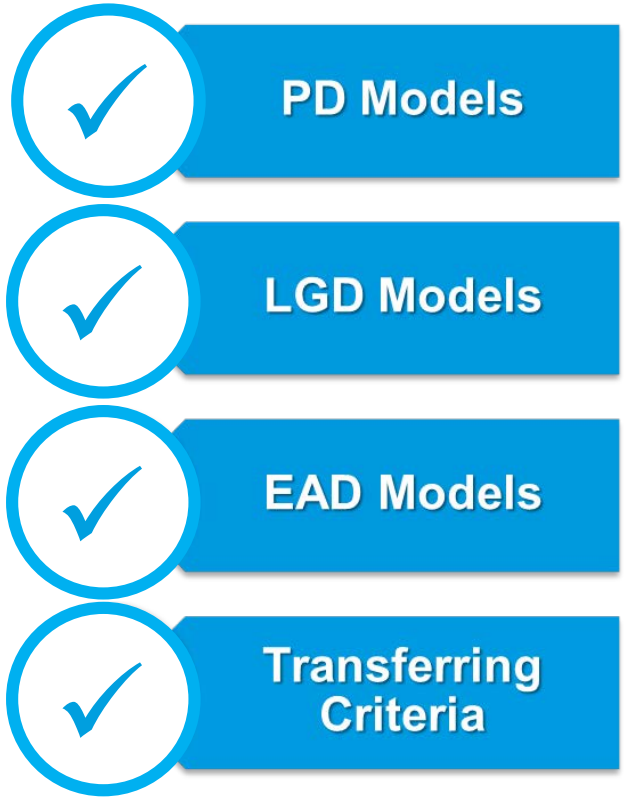
Retail Credit Methodology Challenges

Retail Credit Methodology Challenges

Ensuring Consistency with Stress Testing, ICAAP & Pricing Models



- **PIT PD**
- **Lifetime PD/PD Term Structure**

- **PIT LGD**
- **Lifetime LGD/LGD Term Structure**
- **Discounting (EIR)**

- **Lifetime EAD/EAD Term Structure**
- **Discounting**
- **Prepayment**

- **Threshold Definition**
- **Intra-stage Movements**

Retail Credit Methodology Challenges

Ensuring Consistency with Stress Testing, ICAAP & Pricing Models

- Dynamic panel data models, cluster-based combined with vintage/cohort analysis
  - Well suited to capture lifecycle aspect of credit behavior and bring macroeconomic factors explicitly

- Alternative methods can be tested for default rates or losses, such as
  - Roll-rate/transition approaches
  - Loan or obligor-level logistic regression models
  - Survival analysis models, or simpler top-down time-series models

Retail Credit Methodology Challenges

Ensuring Consistency with Stress Testing, ICAAP & Pricing Models

- Historical data used to build the econometric equations
  - Optimal variable search methods leveraged to select the macroeconomic “best drivers” into the model
- Historical data integrity is imperative, and the main dependency
  - Granularity, frequency, consistency, completeness, and quality
  - Limitations can put constraints on the type of modelling techniques that can be utilized

Retail Credit Methodology Challenges

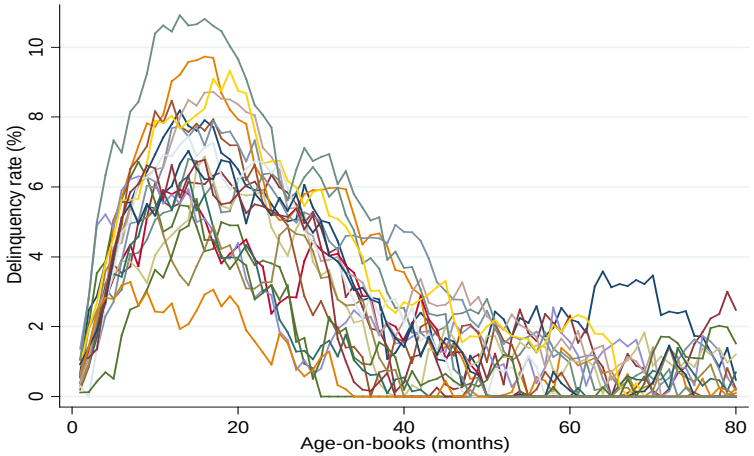
Ensuring Consistency with Stress Testing, ICAAP & Pricing Models

- Selected macroeconomic variables tested to bring the forward-looking dimension
  - PDs and secured LGDs explicitly connected to macro data
  - EAD and unsecured LGDs often modelled independently of economic factors

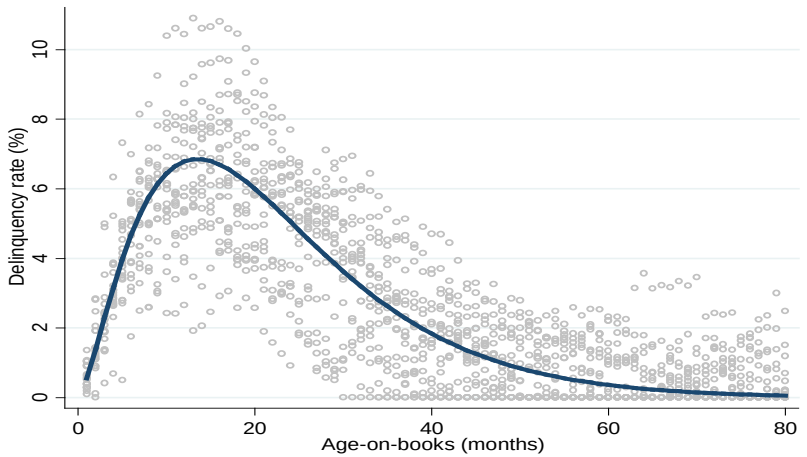
- Explicit, closed-form equations, ensuring 100% transparency in our approach
- Detailed model documentation and validation
- Feedback from validation team & auditors incorporated
- Model governance, re-calibration updates, monitoring, use test

Leading Example: Vintage Panel-Data Structure

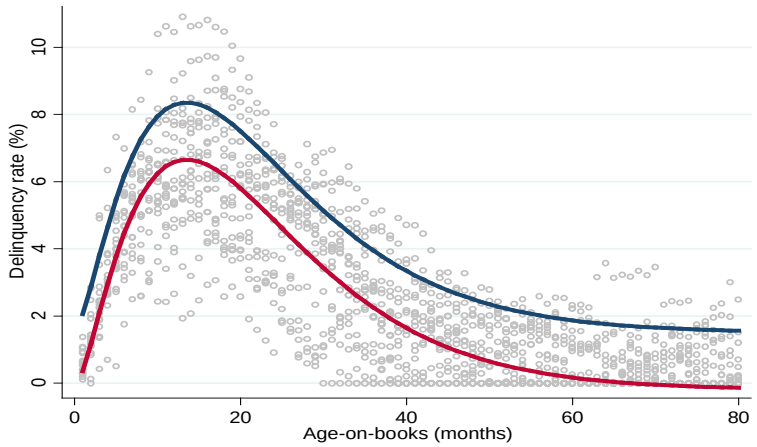
Hypothetical Data (over age)



Lifecycle Effect (over age)



Vintage Quality (over age)



Business Cycle Effect (over time)

Leading Example: Vintage Panel-Data Structure

Time series performance for a given vintage of loans $= f$

(1) Lifecycle component

- Dynamic evolution of vintages as they mature
- Nonlinear model against “age"

(2) Vintage-quality component

- Vintage attributes (LTV, asset class/collateral type, geography, etc.) define heterogeneity across cohorts
- Early arrears serve as proxies for underlying vintage quality
- Economic conditions at origination matter
- Econometric technique accounts for time-constant, unobserved effect

(3) Business cycle exposure component

- Sensitivity of performance to the evolution of macroeconomic and credit series

Macroeconomics of Credit Risk: Data Input

Examples of Economic and Internal Drivers

Economic Data (Macro & Regional)	Portfolio Data
» Labour Market Indicators Employment, Unemployment, Wage/ Salary Growth » Housing Market Indicators Home Prices, Home Sales, Housing Starts, Permits » Financial Market Indicators Policy Rate, Debt-Service Ratios, Revolving Consumer Debt » Economic Performance GDP Growth, Disposable Income Growth » Industry/Sector Drivers Sales, Employment, Pricing	» Observed Performance Delinquencies, Defaults, Losses, Prepayments » Credit Score Cut-offs » Credit Applications » LTVs » Payment-to-Income » Marketing Activity » Collection Treatments

Credit Risk Model Building Example

Variable Selection Algorithm

C_m^k *k:* right-hand-side variables
m: potential economic & internal drivers

All combinations of size ***k*** from vector ***m***

Pairwise Correlations
(optional)

Exclude models with collinear drivers

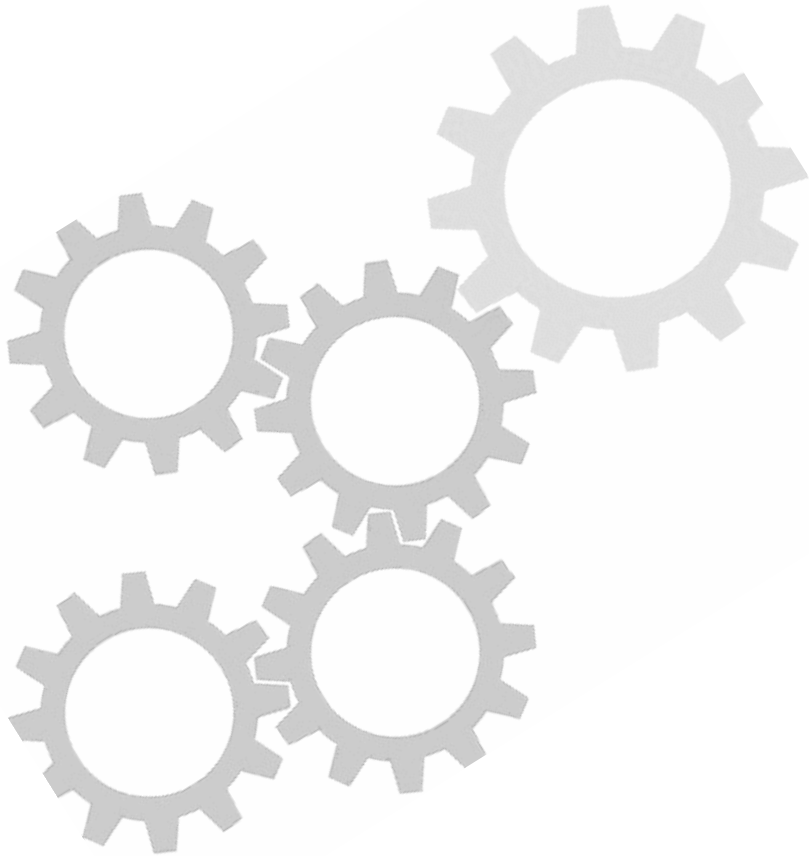
Selection Criteria
(optional)

- Expected estimated signs on drivers
- Statistically significant drivers

Ranking Criteria

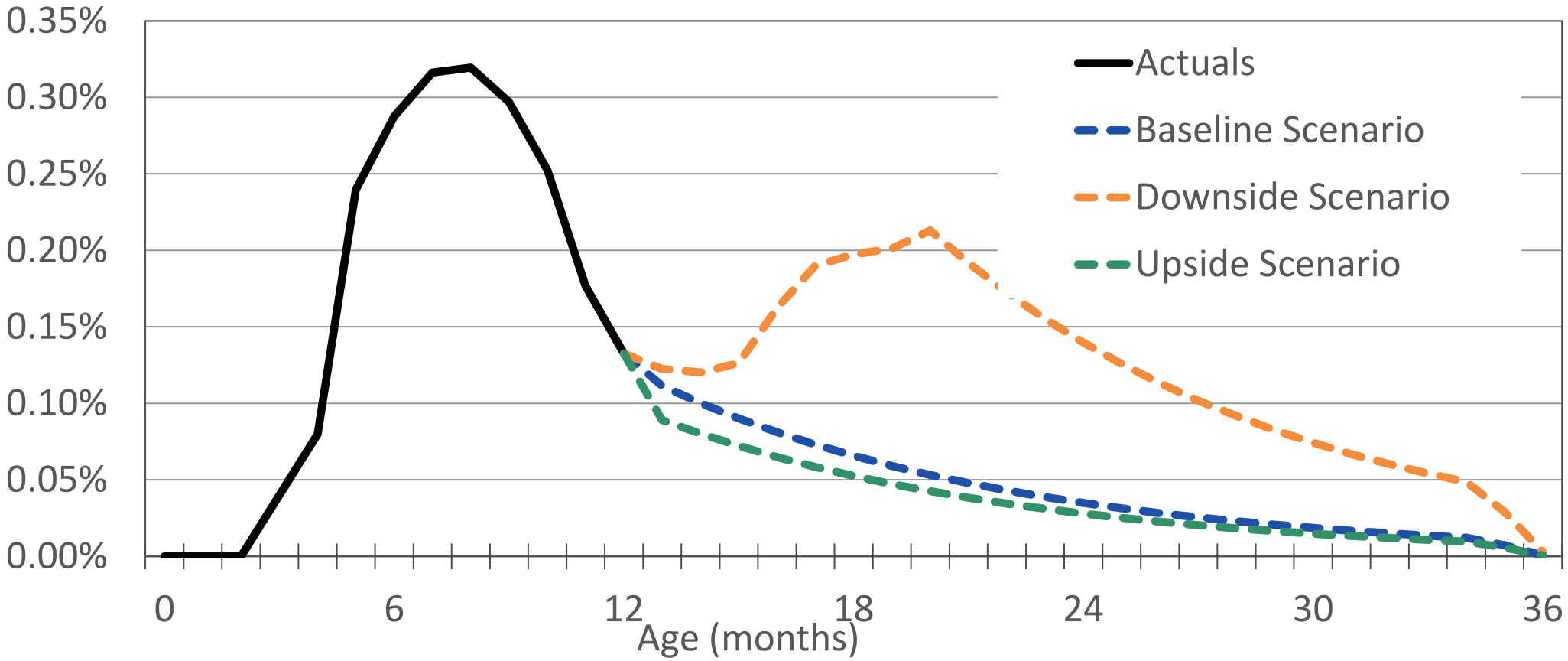
- Adjusted R^2/RMSE
- Likelihood-based criteria
- Stationarity and cointegration
- Validation

Optimal Model



Scenario-based Projections Example

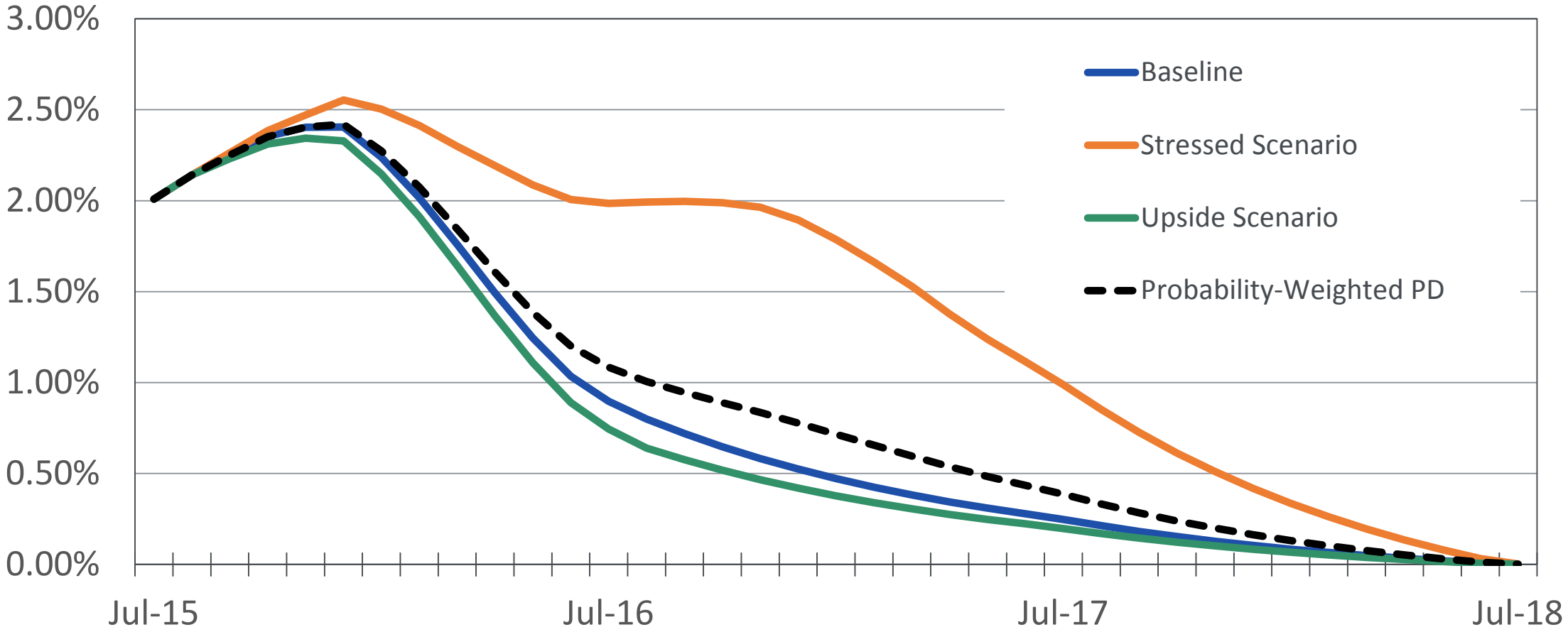
Marginal Default Rate (MDR), Vintage Model Outputs



Sources: Moody's Analytics

Scenario-based Projections Example

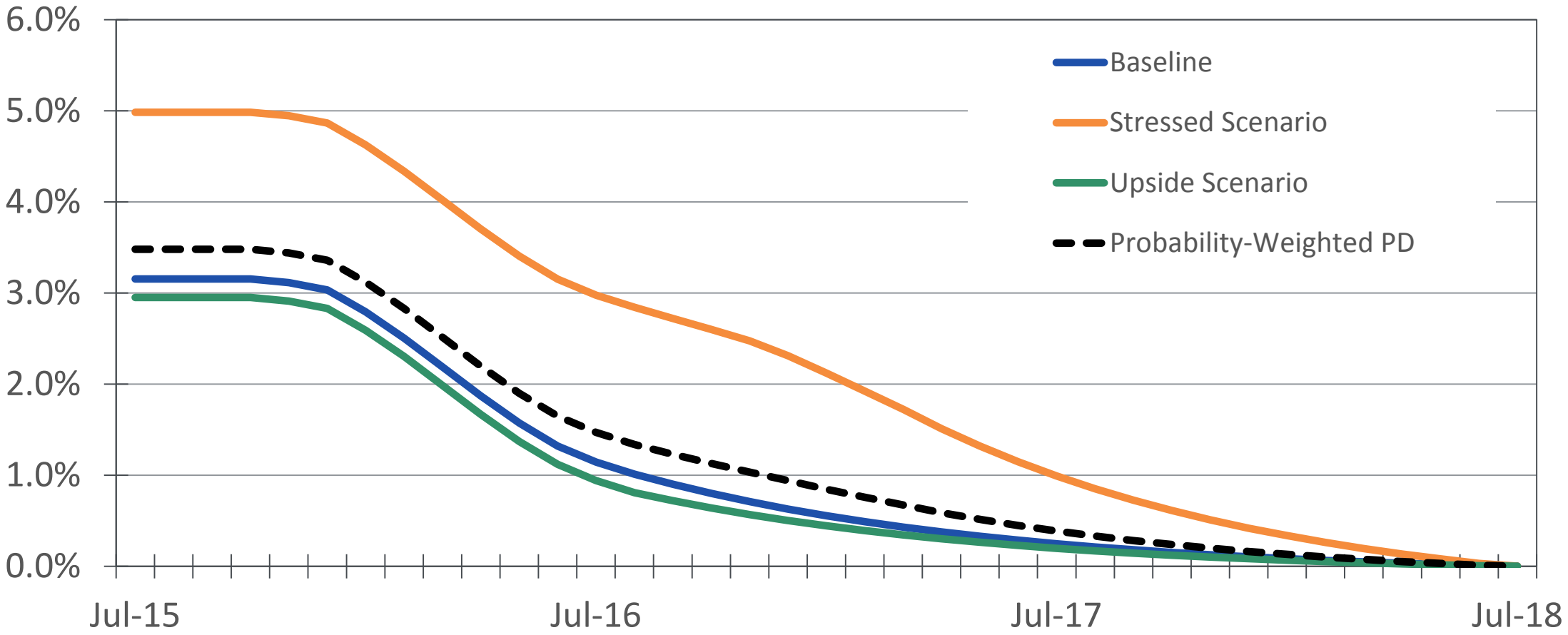
1-Yr PD (Jul-15 vintage example), Aggregating MDR



Sources: Moody's Analytics

Scenario-based Projections Example

Lifetime PD (Jul-15 vintage example), Aggregating MDR



Sources: Moody's Analytics

ECL Calculation Example

Current Reporting Date, Stage 2 Accounts

1) Calculate ECL for each account i, time t, portfolio j, and scenario s

$$ECL(i,j,t|s) = PD(i,j,t|s) \ * \ \ LGD(i,j,t|s) * EAD\ (i,j,t|s) * DF\ (i,j,t|s)$$

2) Sum ECL across the lifetime (or 1 year for stage 1 accounts)

$$ECL(i,j|s) = \sum_t ECL(i,j,t|s)$$

3) Compute scenario-weighted expected ECL using associated probabilities

$$ECL(i,j) = p_1 ECL(i,j|s_1) + p_2 ECL(i,j|s_2) + \ \ldots + p_S ECL(i,j|s_S)$$

4) Sum across accounts to get overall portfolio-level ECL

$$ECL(j) = \sum_i ECL(i,j)$$

IFRS 9 Model Validation

Credit institution should have policies and procedures to appropriately validate models used to calculate ECL.

Quantitative Validation

- Macro models used to generate scenarios
- Credit risk models for PD, LGD, EAD
- Staging criteria
- Scenario probabilities
- Lifetime ECL

Qualitative Validation

- Theoretical model assumptions
- Econometric techniques
- Documentation quality
- Data quality
- Regulatory requirements compliance

Q&A

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Alaistair Chan
+612.9270.8148
alaistair.chan@moodys.com

Olga Loiseau-Aslanidi
+420 (224) 106-435
olga.loiseau-aslanidi@moodys.com

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