Wider Fields: IFRS 9 credit impairment modelling

Actuarial Insights Series

2016

Presented by Dickson Wong and Nini Kung

Presenter Backgrounds

Dickson Wong

- **Actuary** working in financial risk management: credit risk, market risk, stress testing, regulatory capital, model validation

- PwC Singapore (previously PwC Australia)

Nini Kung

- **Actuary** working in financial risk management: credit risk, stress testing, IAS 39 auditing, regulatory capital

- PwC Singapore (previously PwC South Africa)

Agenda

Overview of IFRS 9

What's Next

Impairment modelling approaches

Challenges

Banking for Actuaries

The Banking Industry presents a large opportunity for actuaries

Demand for skill set

Credit Risk Modelling roles require similar modelling and programming skills

Actuaries are applying their skill set in different banking areas: Pricing, Treasury, Stress Testing

Regulatory Change

Introduction of IFRS 9 requires a significant increase in modelling skillset

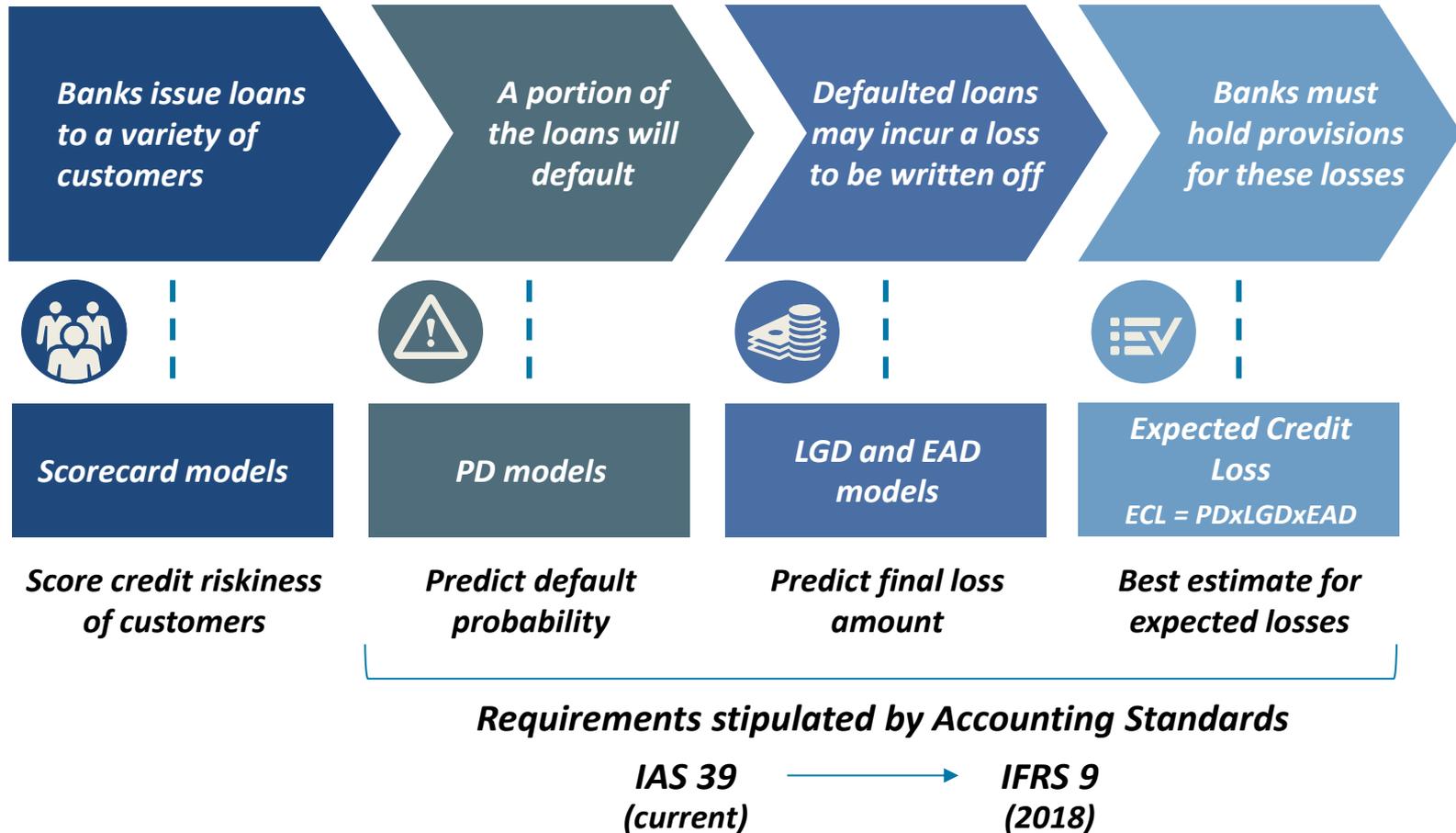**New Basel requirements are providing more technical risk management and modelling opportunities**

Education

Introduction of the Banking specialist courses as part of the Part 3 education system

Focus on wider field presentations covering banking

The Need for Provisions

Banks issue loans to a variety of customers	A portion of the loans will default	Defaulted loans may incur a loss to be written off	Banks must hold provisions for these losses
Scorecard models	**PD models**	**LGD and EAD models**	**Expected Credit Loss** $ECL = PD \times LGD \times EAD$
Score credit riskiness of customers	Predict default probability	Predict final loss amount	Best estimate for expected losses

Requirements stipulated by Accounting Standards

IAS 39 (current) → *IFRS 9* (2018)

Overview of IFRS 9

In response to the financial crisis:

- Existing IAS 39 considered "too little too late"

- Regulators developed a new principles-based Standards IFRS 9
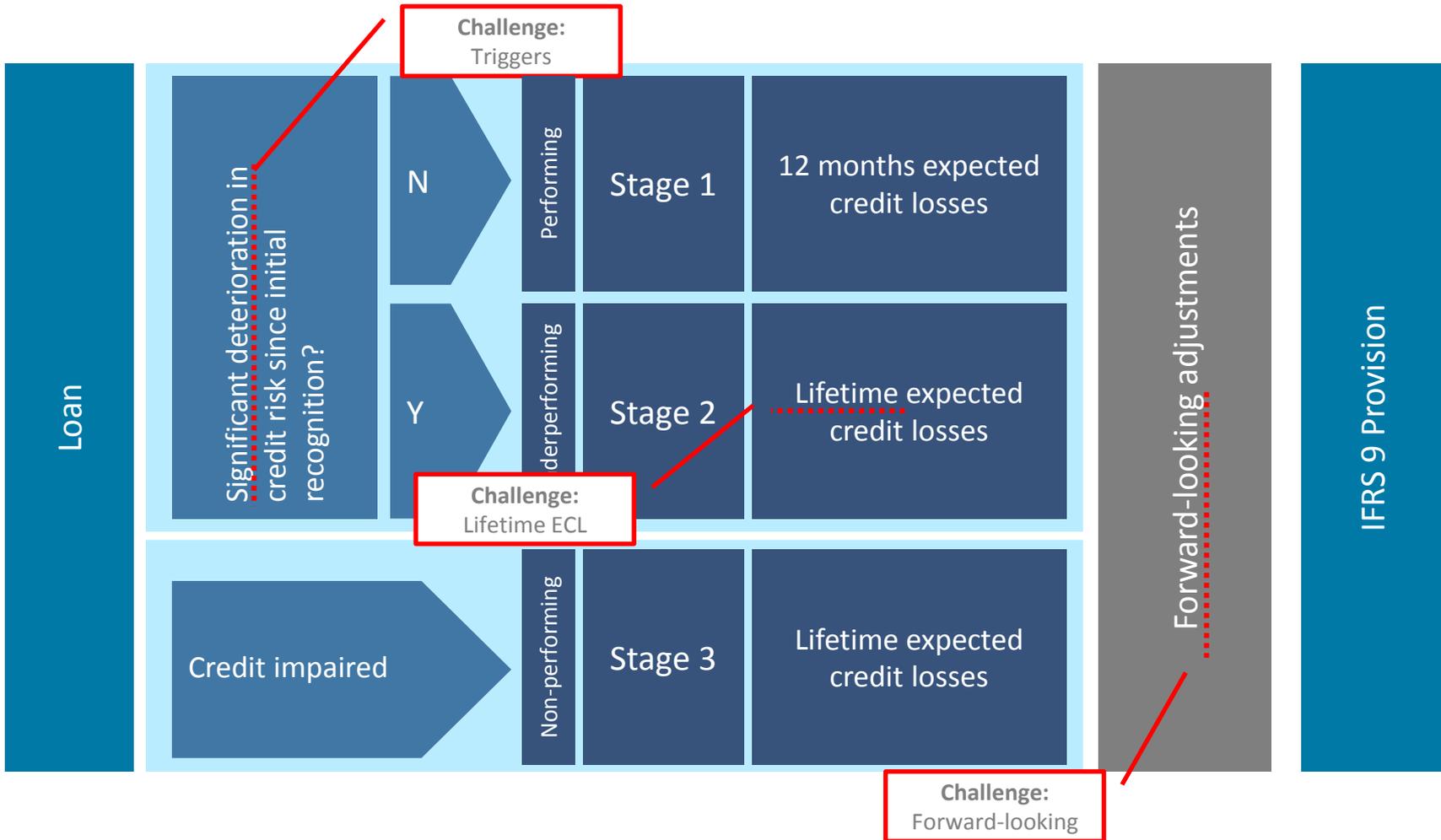
IFRS 9 contains 3 parts:

- P1: Classification and measurement

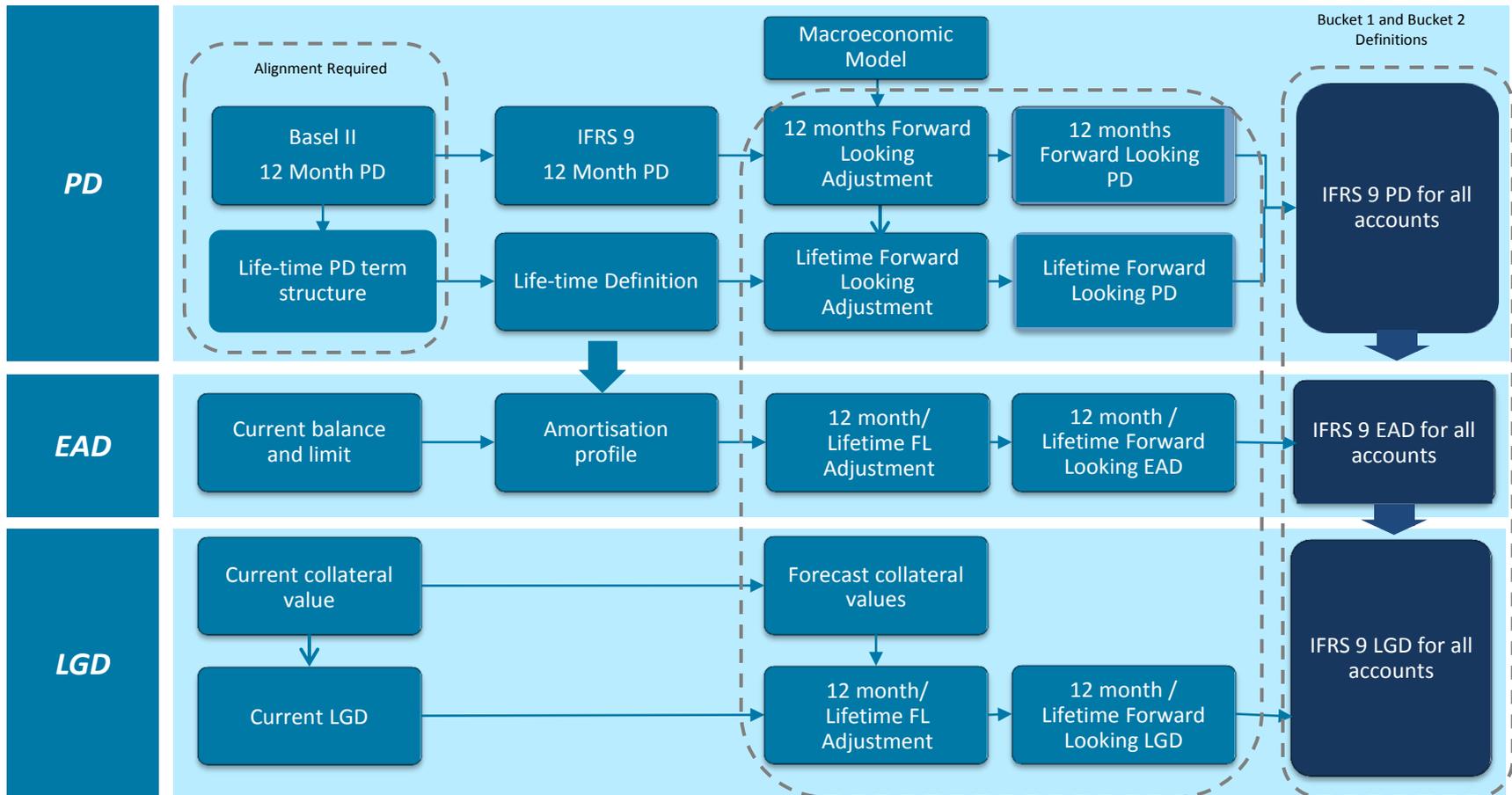- P2: Impairment   ← Focus

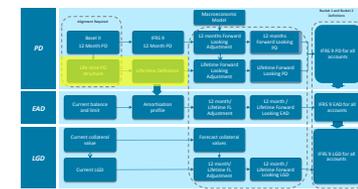- P3: Hedge Accounting

Banks are facing challenges with P2: Impairment:

- Sufficient data

- Complexity Impairment calculation

- Interpretation of requirements

IFRS 9 P2 Impairments Stages

IFRS 9 ECL Model Components

PD

Alignment Required

- Basel II 12 Month PD
- IFRS 9 12 Month PD
- 12 months Forward Looking Adjustment
- 12 months Forward Looking PD
- Life-time PD term structure
- Life-time Definition
- Lifetime Forward Looking Adjustment
- Lifetime Forward Looking PD

Macroeconomic Model

IFRS 9 PD for all accounts

Bucket 1 and Bucket 2 Definitions

EAD

- Current balance and limit
- Amortisation profile
- 12 month/ Lifetime FL Adjustment
- 12 month / Lifetime Forward Looking EAD

IFRS 9 EAD for all accounts

LGD

- Current collateral value
- Forecast collateral values
- Current LGD
- 12 month/ Lifetime FL Adjustment
- 12 month / Lifetime Forward Looking LGD

IFRS 9 LGD for all accounts

ECL model component - PD

Key Challenge: Lifetime PD Term Structure

Method 1: Cohort Analysis

Cumulative Default Rate

(vertical axis: Cumulative Default Rate)
(horizontal axis: Years From Origination)

- Conditional for survival
- Kaplan-Meier estimate of hazard functions to remove potential biases in the data

$$h(t, s + t, \boldsymbol{X}) = \frac{f_{s,\boldsymbol{X}}(t)}{S_{s,\boldsymbol{X}}(t-1)}$$

$h(t, s + t, X)$ = default hazard of a customer t months after observation

$f_{s,\boldsymbol{X}}(t)$ = P(account defaults exactly t months after observation)

$S_{s,\boldsymbol{X}}(t)$ = P(default does not occur within the first t months)

Marginal Default Rate

(vertical axis: Marginal Default Rate)
(horizontal axis: Years From Origination)

Considerations
- Requires a long time series of data (loan lifetime; segmentation and a full economic cycle
- Impacted by calendar based events (e.g. change in business policy)
- Develop lifetime PD given Stage 2

ECL model component - PD

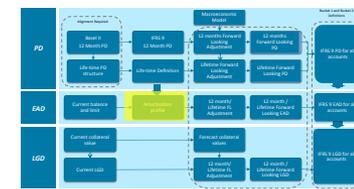## Key Challenge: Lifetime PD Term Structure

Method 2: Regression Modelling

- Relationship between historical PDs and behavioural factors
- Analyse statistical significance and business intuitiveness of factors

Linear regression with logistic transform	Cox regression for survival function
$\ln\left[\frac{P_X}{1-P_X}\right] = \beta_0 + \sum_{i=1}^{p} \beta_i X_i,$	$S_X(t) = e^{h_0(t)e^{\sum_{j=1}^{p} \beta_j X_j}}$
where $P_X = P[D_X = 1]$ and $D_X = \begin{cases} 0 & if\ default\ does\ not\ occur \\ 1 & if\ default\ occurs \end{cases}.$	where $h_0(t)$ is the empirical hazard function, estimated non-parametrically. Under this model, the probability of default at outcome period t is given by: $P_X(t) = 1 - S_X(t).$

Considerations

- Consider transforms of variables to ensure stationarity
- Different regression formats (linear regression with logistic transform preferred by most banks)
- Term structure developed through including a month on book variable

ECL model component - PD

Key Challenge: Lifetime PD Term Structure

Method 3: Transition matrices

Transition matrix

From/ to	AAA	BBB+	B-	CCC	D
AAA	87.0%	0.0%	0.0%	0.1%	0.0%
BBB+	0.0%	73.9%	0.0%	0.1%	0.1%
B-	0.0%	0.1%	52.6%	11.4%	7.5%
CCC/C	0.0%	0.1%	9.1%	43.9%	26.4%

Source: S&P Average One-Year Transition Rates For Global Corporates By Rating Modifier (1981-2014) (%)

Cumulative Default Rate

Marginal Default Rate

Legend: AAA, BBB+, B+, B-, CCC/C

Considerations
- Extrapolation assumes a memoryless process
- Alternative method considered where cohort data is not available

ECL model component - EAD

Key Challenge: Lifetime EAD

Amortising products (e.g. term loans and mortgages)

Loan Repayment Pattern

- ▨ Prepayment
- ▮ Contractual repayment
- — Expected Out. Balance
- — Actual Out. Balance
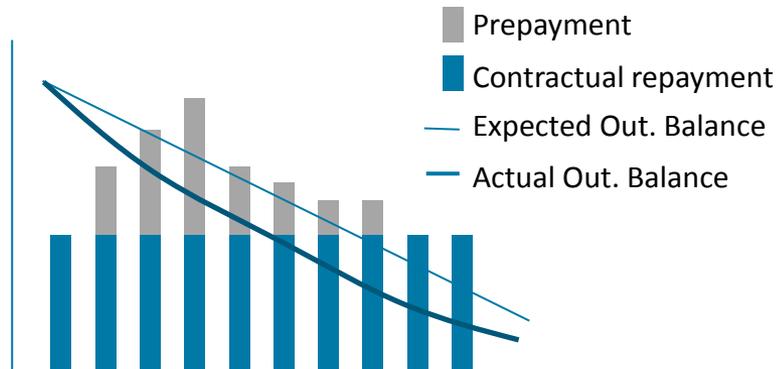
Estimating prepayments

$$Prepayment\ rate_t = \frac{Prepayment_t}{Origination\ Balance}$$

$$Prepayment\ rate_t = \alpha + \sum_{i=1}^{n} \beta_i x_i + \sum_{j=1}^{m} \gamma_j y_j + \epsilon_i$$

β_i = coefficient for macroeconomic variable
x_i = macroeconomic variable
γ_j = coefficient for loan level characteristic
y_j = loan level characteristic

Considerations
- Loan level characteristics (product type, borrower income level, loan-to-value)
- Macroeconomic economic variables (interest rates, unemployment rates, GDP, inflation)
- Additional loan features such as refinancing
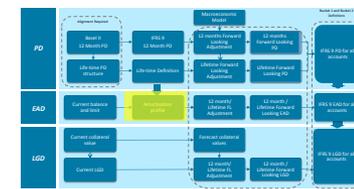
ECL model component - EAD

Key Challenge: Lifetime EAD

Revolving products
(e.g. credit card, line of credit)

$$Utilisation\ Rate_t = \frac{Outstanding\ Amount_t}{Commitment\ Amount_t}$$

Historical utilisation rate

Time to default

Origination year	0	1	2	3	...
2001	80%	75%	68%	74%	
2002	85%	80%	81%		
2003	88%	81%			
2004	81%				
...					

Development pattern projection techniques

Projected utilisation rate

Time to default

Origination year	0	1	2	3	...
2001	80%	75%	68%	74%	
2002	85%	80%	81%	*81%*	
2003	88%	81%	*75%*	*74%*	
2004	81%	*79%*	*75%*	*74%*	
...	...	...	...	...	...

Considerations
- Aggregation of data into homogenous risk groups
- Stability of development patterns and representativeness of historical experience
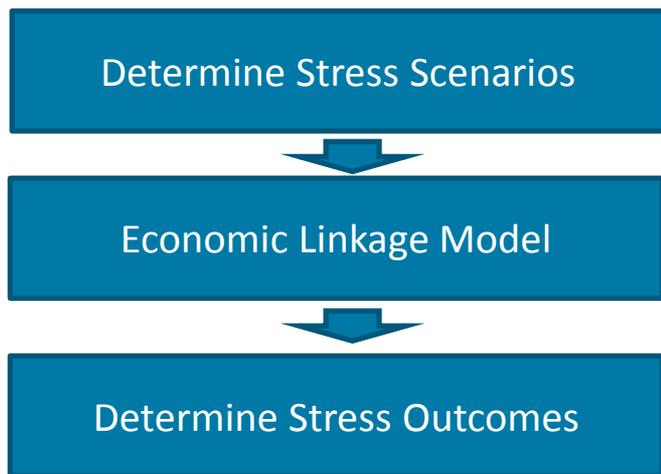- Alternative methods such as developing regression models
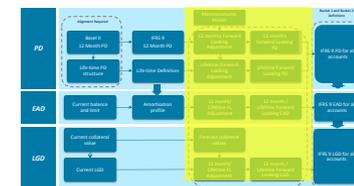
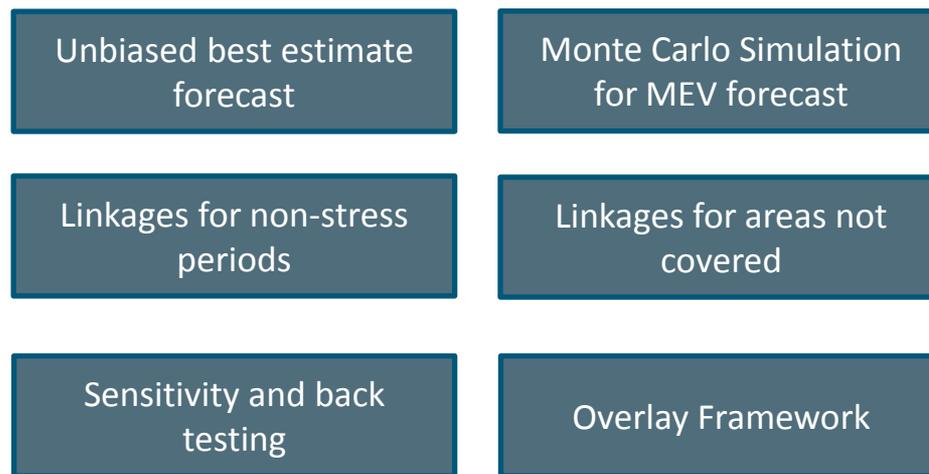# ECL model component – Forward Looking

Key Challenge: Forward Looking

Leveraging Existing Stress Testing Process:

Current Stress Testing Process:

Determine Stress Scenarios

↓

Economic Linkage Model

↓

Determine Stress Outcomes

Additional modification:

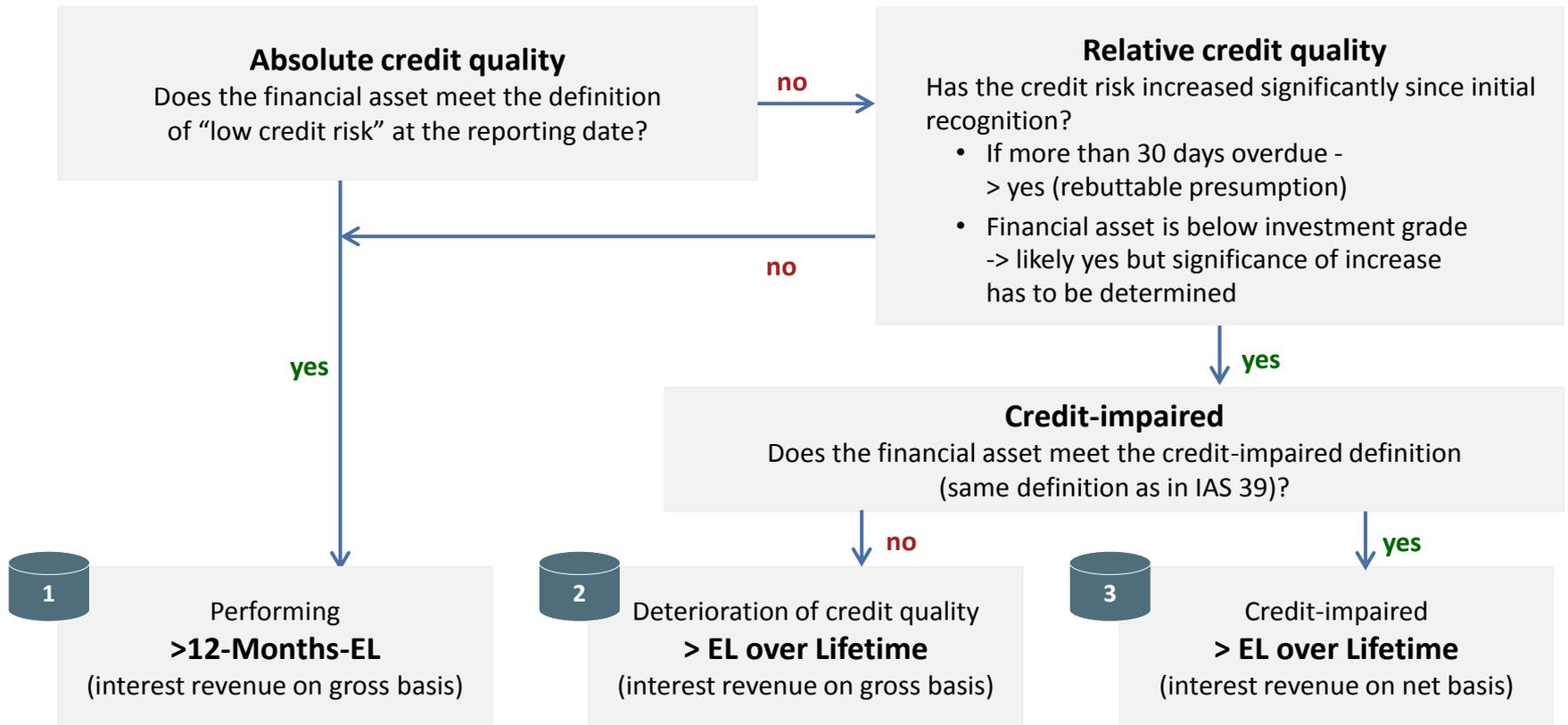| Unbiased best estimate forecast	Monte Carlo Simulation for MEV forecast
Linkages for non-stress periods	Linkages for areas not covered
Sensitivity and back testing	Overlay Framework

Considerations
- Lack of data required to build a statistical model
- Require multiple year of Macro-economic forecast
- Shift in mentality from stress testing to forward looking

ECL model component – Triggers

Key Challenge: Relative and Absolute Credit Quality

Absolute credit quality
Does the financial asset meet the definition of "low credit risk" at the reporting date?

no →

Relative credit quality
Has the credit risk increased significantly since initial recognition?
- If more than 30 days overdue -> yes (rebuttable presumption)
- Financial asset is below investment grade -> likely yes but significance of increase has to be determined

no

yes

yes

Credit-impaired
Does the financial asset meet the credit-impaired definition (same definition as in IAS 39)?

no

yes

1
Performing
>12-Months-EL
(interest revenue on gross basis)

2
Deterioration of credit quality
> EL over Lifetime
(interest revenue on gross basis)

3
Credit-impaired
> EL over Lifetime
(interest revenue on net basis)

ECL model component – Triggers

Key Challenge: Definition of significant increase in credit risk

Quantitative Triggers:

Changes in credit ratings
- Drop in external credit ratings
- Drop in internal credit ratings

Changes in internal price indicators of credit risk
- Significant deterioration of loan to value ratio
- Breaches in financial covenants

Changes in external market indicators
- Drop in borrower's bond prices
- Increase in credit default swap prices for borrower

Qualitative Triggers:

Changes in business, financial or economic conditions
- Industry downturn
- Increase in unemployment rates

Changes in operating results
- Actual or expected decline in revenues/margins
- Working capital deficiencies

Other qualitative inputs
- Trading suspension of listed shares on exchange
- Litigations likely to have material impact Profit warnings

Challenges to comply with IFRS 9

Banks face a number of challenges in meeting their desired level of IFRS 9 compliance

IFRS 9 Requirements	*Challenges*		Desired level of compliance
Range of data requirements	Lack of data	Correct models	Regulatory expectation
Sophisticated modelling expectations	Expert Judgement	Peoples and skills	Industry Practice
Expert judgement based decision	Implementation	Uncertainty in expectation	Auditor expectation
Holistic governance process	Systems and processes	Interpretation of the Standard	High quality implementation
	Timelines	Cross-border exposure	

Results from Latest Survey

There is still a significant amount of work to be done in APAC.
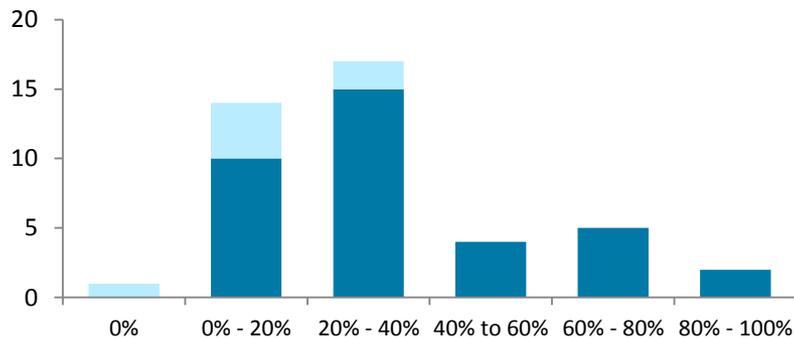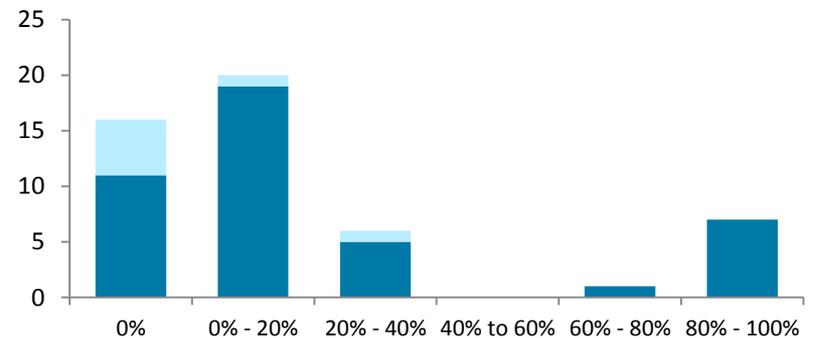

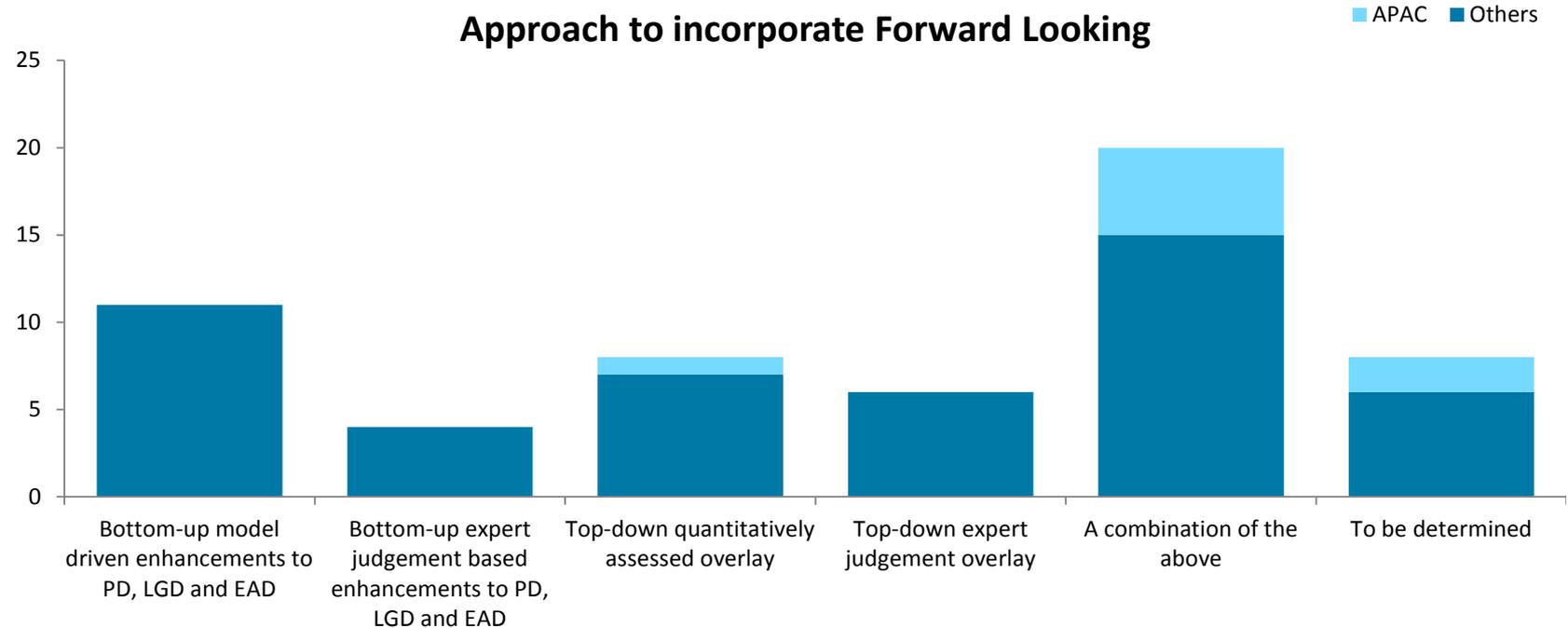Understanding IFRS 9
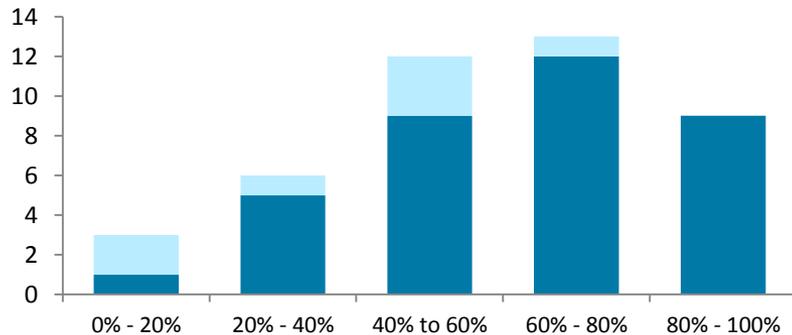
Detailed Design
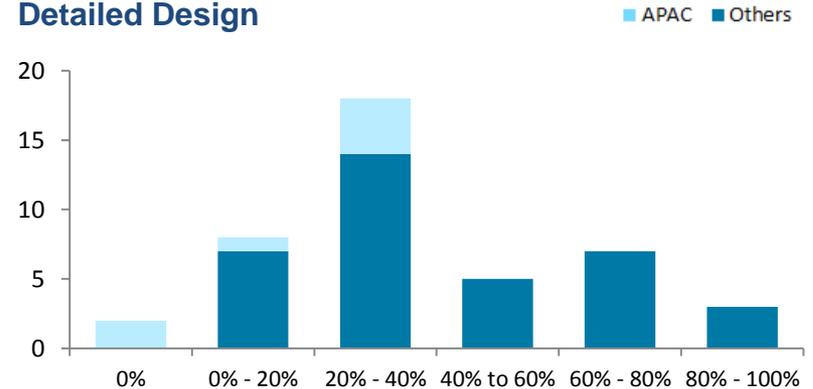
Model Development

Test / Implementation

Results from Latest Survey

The industry view currently varies on the best approach to adopt when it comes to incorporating forward looking in their models
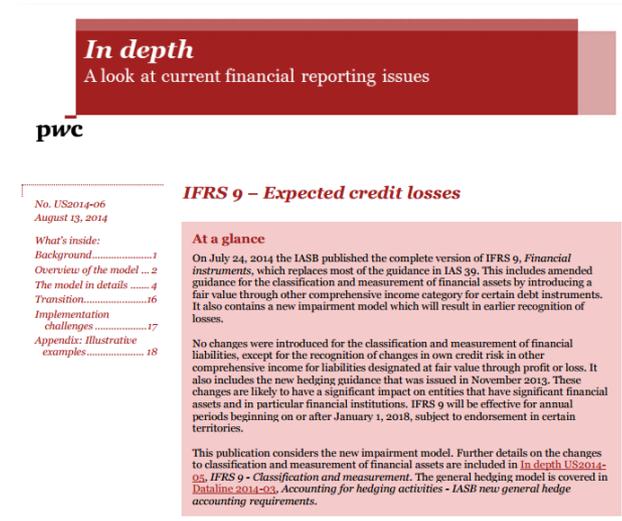
Approach to incorporate Forward Looking

Legend: ■ APAC ■ Others

Chart categories (x-axis):
- Bottom-up model driven enhancements to PD, LGD and EAD — 11
- Bottom-up expert judgement based enhancements to PD, LGD and EAD — 4
- Top-down quantitatively assessed overlay — 8
- Top-down expert judgement overlay — 6
- A combination of the above — 20
- To be determined — 8

Further Reading and Q&A

IFRS 9: Impairment, Global banking industry benchmark

Available on Request

IFRS 9: Expected Credit Losses

https://www.pwc.com/ca/en/accounting-advisory-services/publications/us2014-06-ifrs-9-expected-credit-losses.pdf