Meet the Data Challenges in Wholesale Credit Stress Testing

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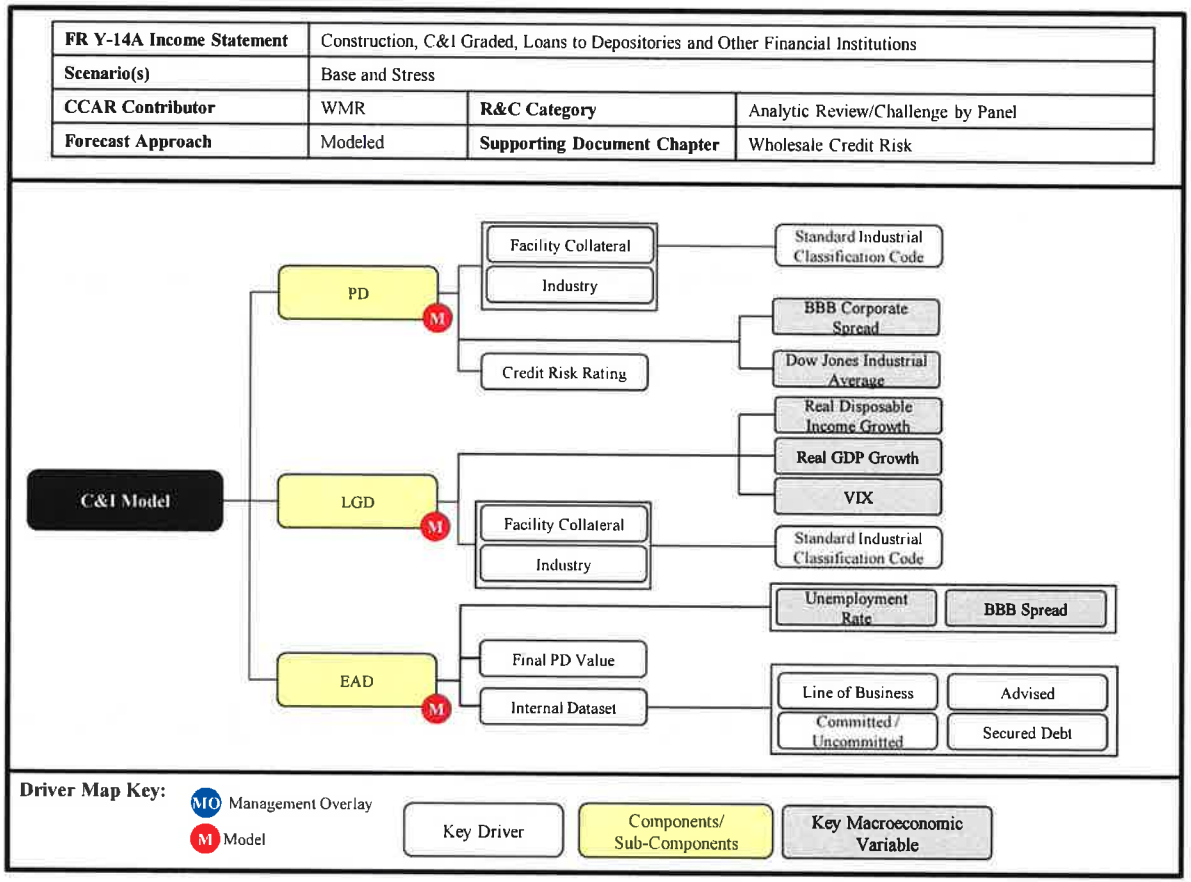
HSBC

Wholesale Probability of Default Modeling Methodology

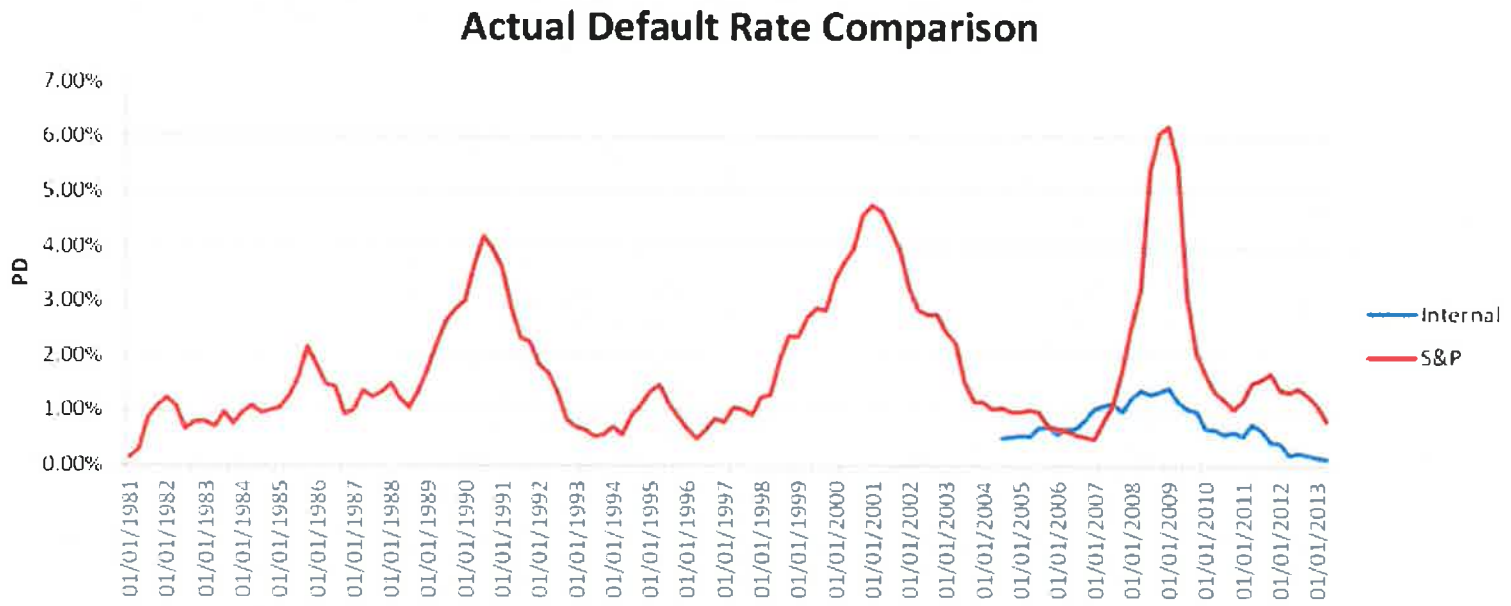
- Wholesale credit loss estimation usually decomposes to loss components: default probability (PD), loss given default (LGD) and exposure at default (EAD) estimation

FR Y-14A Income Statement	Construction, C&I Graded, Loans to Depositories and Other Financial Institutions		
Scenario(s)	Base and Stress		
CCAR Contributor	WMR	**R&C Category**	Analytic Review/Challenge by Panel
Forecast Approach	Modeled	**Supporting Document Chapter**	Wholesale Credit Risk



Agenda

- Wholesale credit loss estimation
  - ✓ To obtain consistent definitions between internal and external data sets,
  - ✓ Historical data time series used internal or external relevant to current portfolio,
  - ✓ Should cover at least two economical cycles to better capture growth and downturn credit drivers;
  - × Do we have sufficient internal historical default data, or
  - × Do we have sufficient historical representation for today's portfolio



  - × We are not going to discuss details of modeling methodology rather to discuss how data sets should be prepared or transformed to be suitable for current portfolio.
  - × Discuss C&I data sets first, then discuss CRE as collateral.

Default Definition Mapping and Transformation – C&I PD

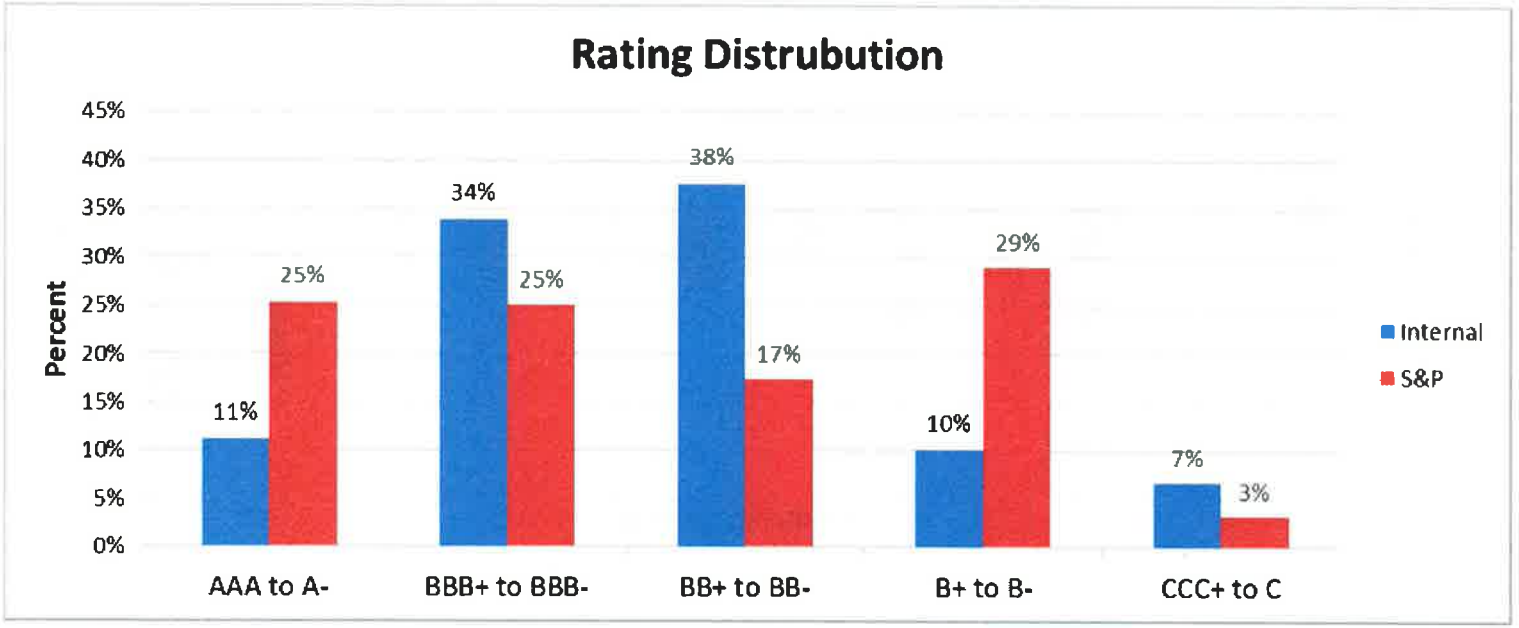
- C&I PD data sets, S&P CreditPro vs. Internal Definition of Default:

	External Data	Internal Data
Source	S&P's CreditPro Data	Bank's C&I Data
Definition of Default	• On the day a financial obligation, rated or unrated, is due and is not paid. An exception is made if the payment is made within the contractual grace period; • Completion of a distressed exchange; • Upon voluntary bankruptcy filing or similar action.	• The bank considers that the obligor is unlikely to pay its credit obligation in full, without recourse by the bank to actions such as realizing collateral (if held); • The obligor is past due more than 90 days on any credit obligation (an overdraft is past due once the obligor has breached an advised limit or has been advised of a limit smaller than the current outstanding balance).

- ✓ The definition of default for internal data and S&P data are Basel compliant.
- ✓ "Distressed exchange" and "bankruptcy" fall into "unlikely to pay" category, as per HBUS Credit Policy.
- ✓ "On the day a financial obligation is past due with exception of contractual grace period" is comparable to "90 days past due". S&P CreditPro mostly consists of public debt and will be considered as default when 1-day past due. When the obligor debt defaults the loan obligation within HSBC will be considered as "unlikely to pay" or default for the same obligor.

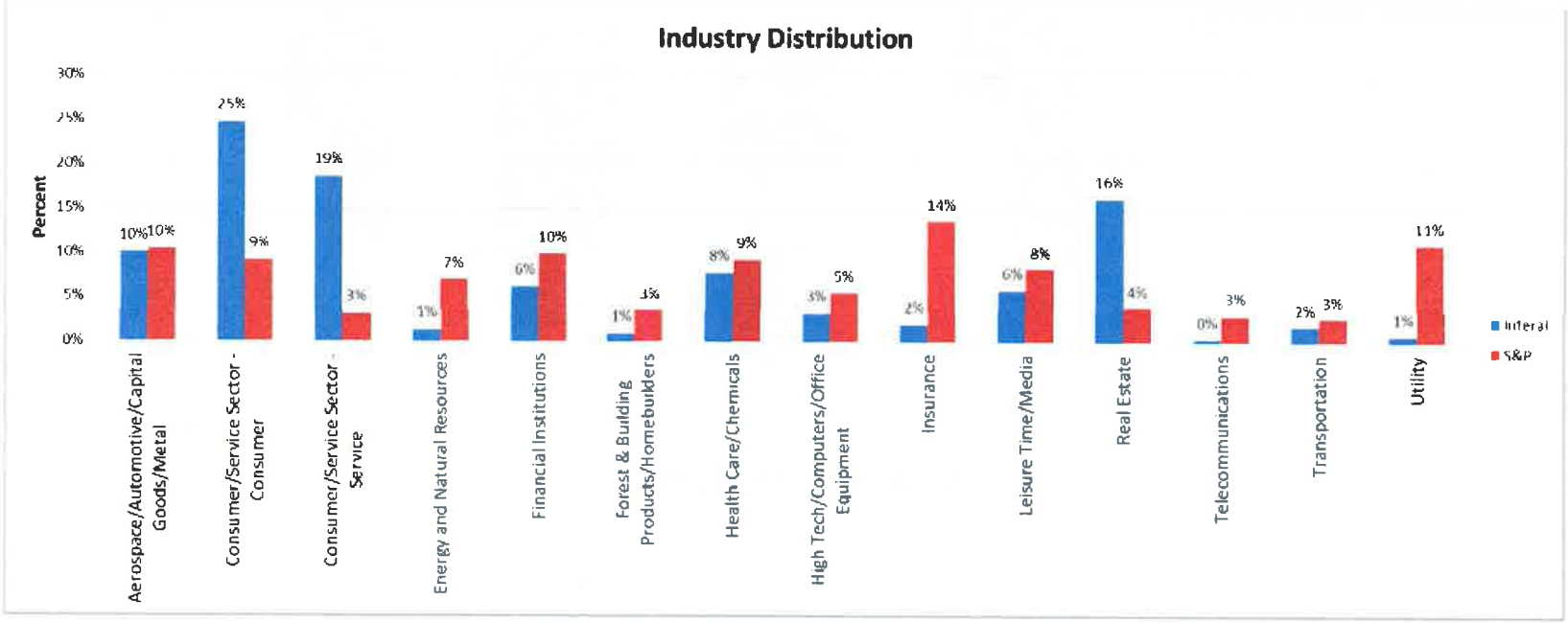
Rating distribution: internal vs external datasets – C&I PD

- C&I PD data sets, distribution of key factors, Rating Distribution:
  - ✓ All main rating categories in internal data are well represented by S&P data.
  - ✓ Difference in rating distribution is addressed by incorporating rating as a factor in the model.



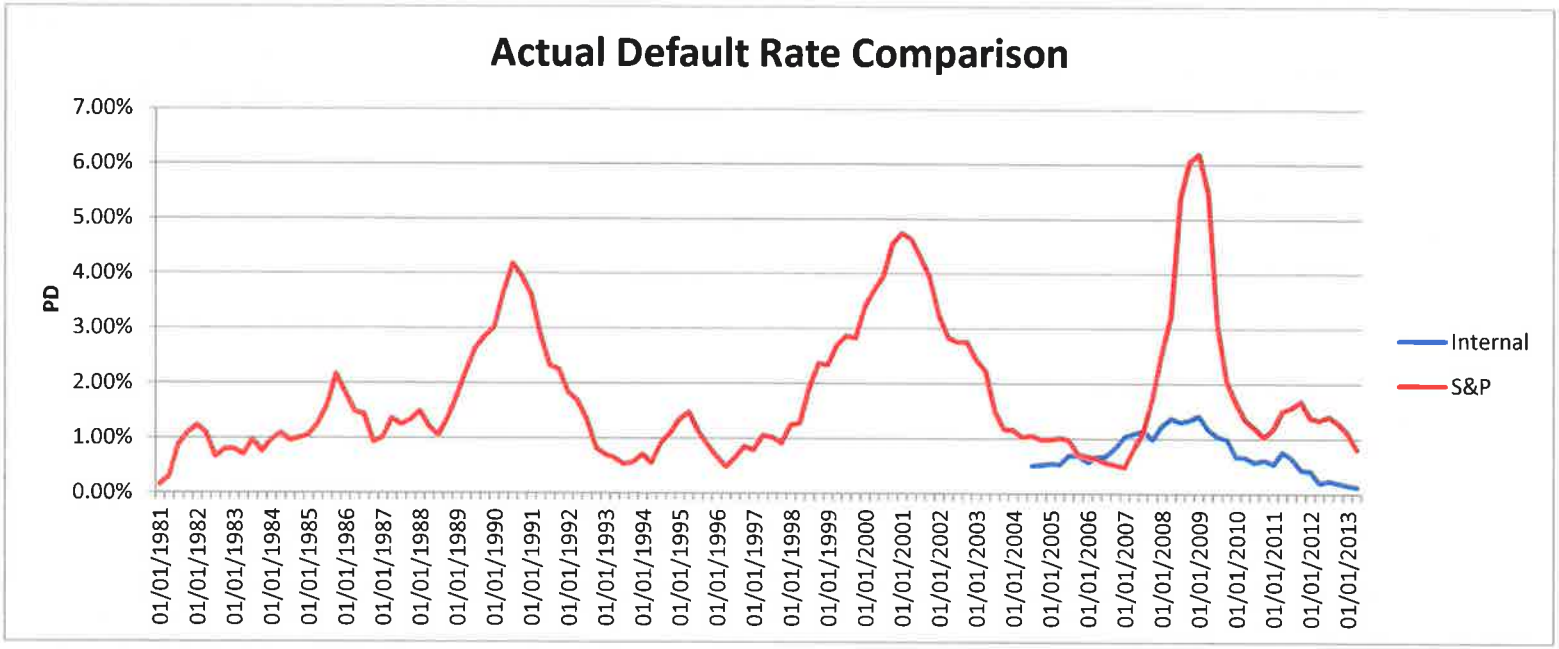
Industry distribution: internal vs external datasets – C&I PD

- C&I PD data sets, distribution of key factors, Industry Distribution:
  - ✓ All main industry categories in internal data are well represented by S&P data.
  - ✓ Difference in industry distribution is addressed by incorporating industry specific risk as an adjustment in the model.



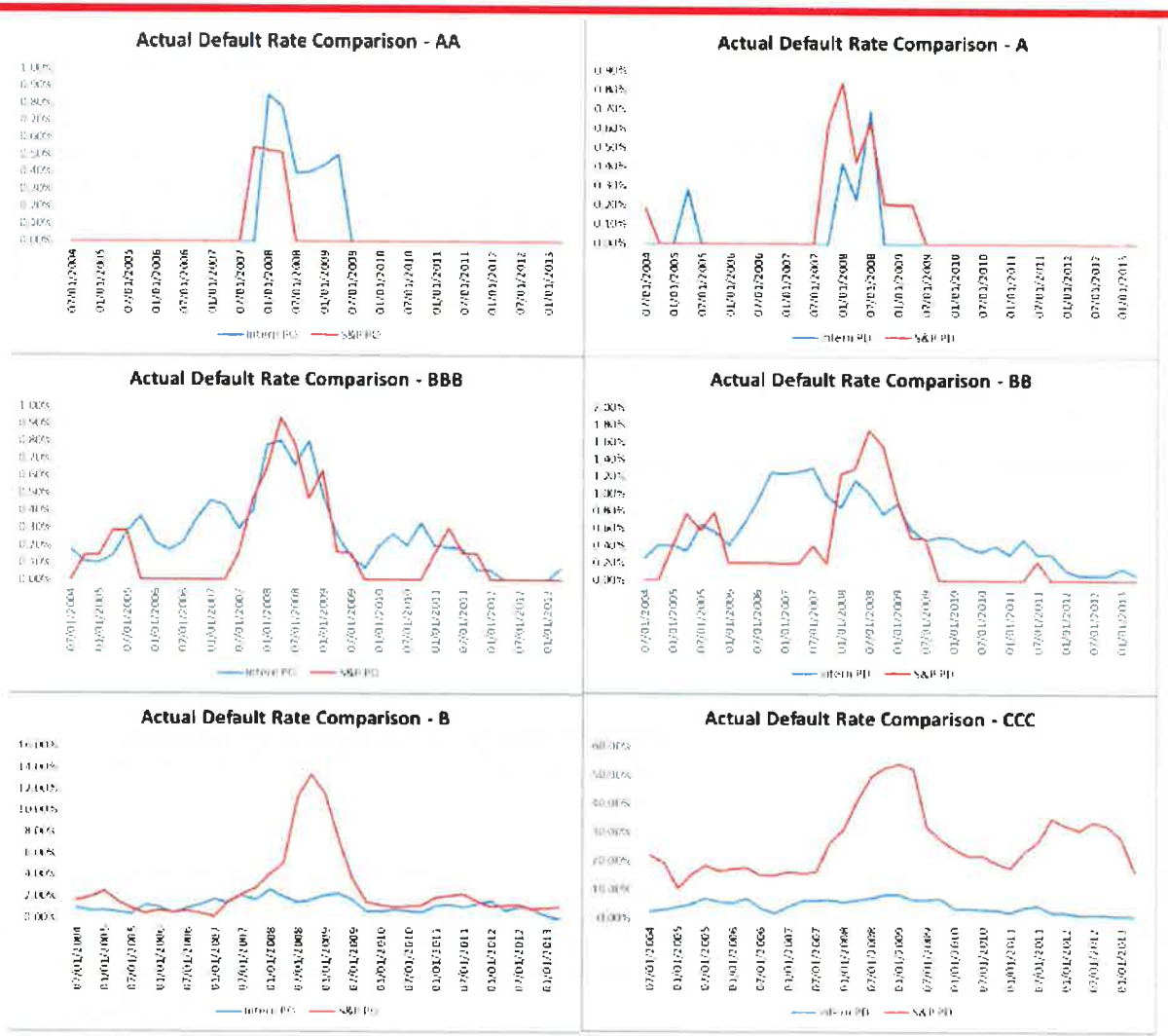
Historical default distribution: internal vs external datasets

- C&I PD data sets, Actual Default Rate:
  - ✓ Correlation between S&P and internal actual default rate is 65%.
  - ✓ Actual default rate of S&P data is higher than that of internal data during the 2008 economic downturn, which is mainly driven by non-investment grade.



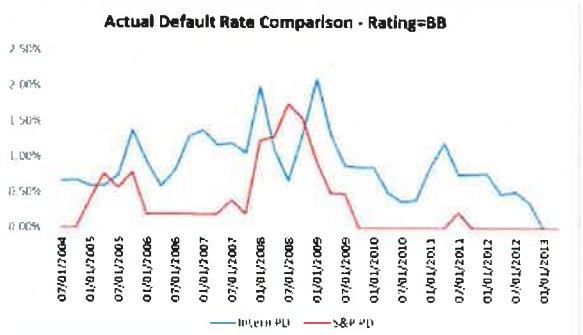
Historical default rating mapping: internal vs external

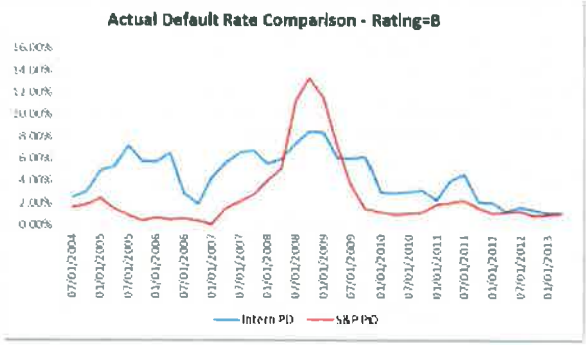
- ✓ By Rating Grade: more granular – investment grades AA, A and BBB ranges match much better than NIGs.
- ✓ Grades BB internal peak were lower, B and CCC internal were significantly lower.

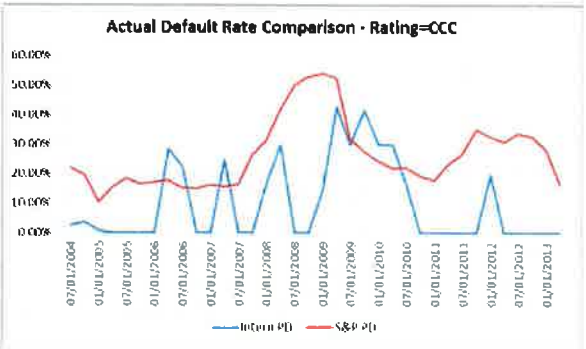


Historical default rating mapping: internal vs external

- ✓ By Rating Grade: IGs very comparable.
- ✓ Internal BBs upgrade by 3 notches comparable with S&P peak defaults.
- ✓ Internal B and CCCs upgrade by 4 notches then comparable.







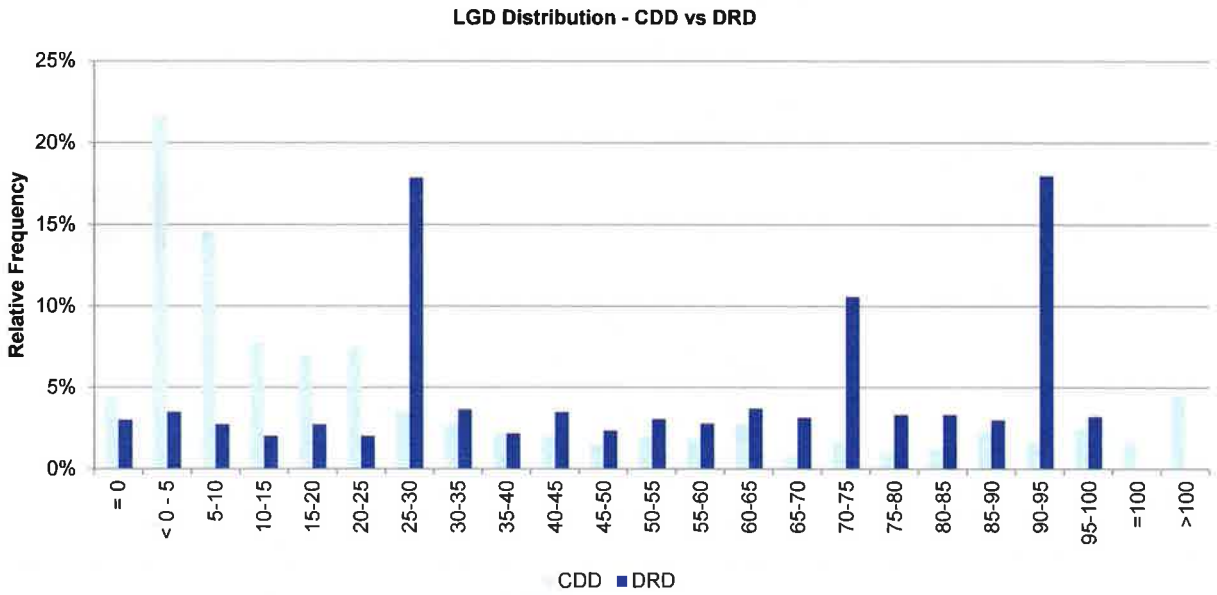
Default Definition: External vs Internal Datasets

- For LGD models, Moody's DRD database has been used in the model development,
  - ✓ Basel II compliant default definition Moody's URD vs. HSBC.
  - ✓ Removing non-Basel defaults defined as full recovery and resolution within 90 days.

Default Type	HSBC Default Definition
Bank Holiday	Unlikely to Pay – BASEL Default
Bankruptcy	Unlikely to Pay – BASEL Default
Bankruptcy, Section 77	Unlikely to Pay – BASEL Default
Chapter 10	Unlikely to Pay – BASEL Default
Chapter 11	Unlikely to Pay – BASEL Default
Chapter 7	Unlikely to Pay – BASEL Default
Chapter 9	Unlikely to Pay – BASEL Default
Conservatorship	NON-BASEL Default
Cross default	Unlikely to Pay – BASEL Default
Deposit Freeze	Unlikely to Pay – BASEL Default
Distressed exchange	Unlikely to Pay – BASEL Default
Dividend omission	NON-BASEL Default
Grace period default	NON-BASEL Default
Indenture modified	Unlikely to Pay – BASEL Default
Liquidated	Unlikely to Pay – BASEL Default
Loan forgiven	Unlikely to Pay – BASEL Default
Missed interest payment	Past Due More than 90 Days – BASEL Default
Missed principal and interest payments	Past Due More than 90 Days – BASEL Default
Missed principal payment	Past Due More than 90 Days – BASEL Default
Payment moratorium	NON-BASEL Default
Placed under administration	NON-BASEL Default
Prepackaged Chapter 11	Unlikely to Pay – BASEL Default
Receivership	Unlikely to Pay – BASEL Default
Seized by regulators	NON-BASEL Default
Suspension of payments	Past Due More than 90 Days – BASEL Default
Ultra Vires	Unlikely to Pay – BASEL Default
War	Unlikely to Pay – BASEL Default

Use of External Datasets – C&I LGD

- For LGD models, Moody's URD vs. HSBC, LGD distribution



- LGDs are calculated with coupon rate as discount rate vs internally defined discount rate, can be 15% or higher considering all costs.

- Additionally portfolio composition remapping with current portfolio weights to ensure portfolio representation.

CRE Portfolio

- Wholesale credit model risk drivers in relationship with supervisory macroeconomic factors are summarized as below.

FR Y-14A Income Statement	Non-Owner Occupied (Office), Owner Occupied (Office)		
Scenario(s)	Base and Stress		
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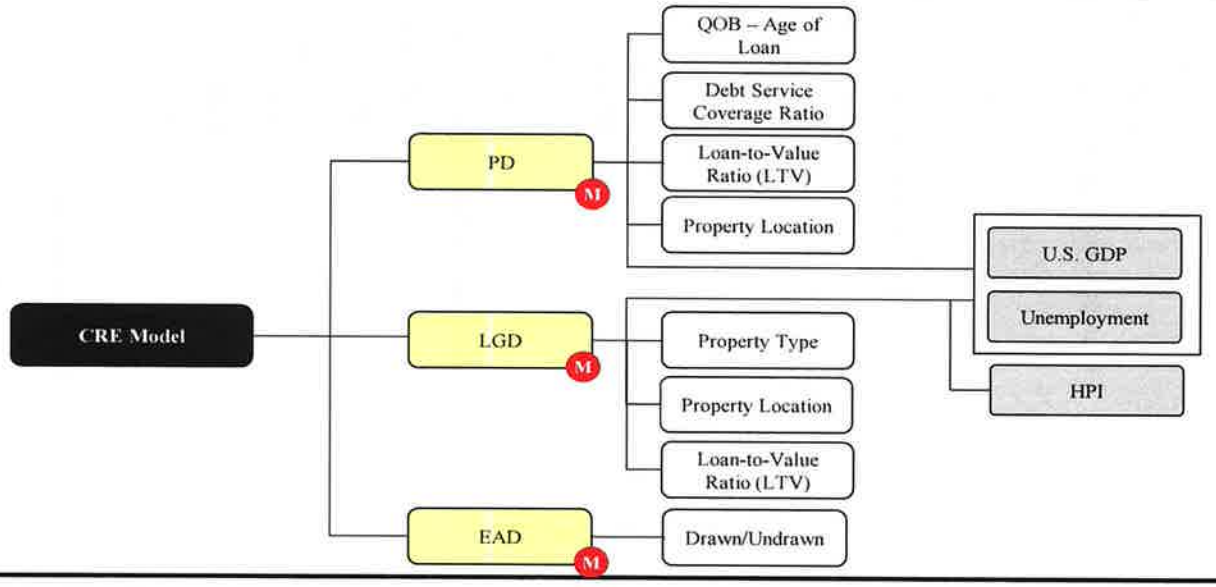
Forecast Approach	Modeled	**Supporting Document Chapter**	Wholesale Credit Risk



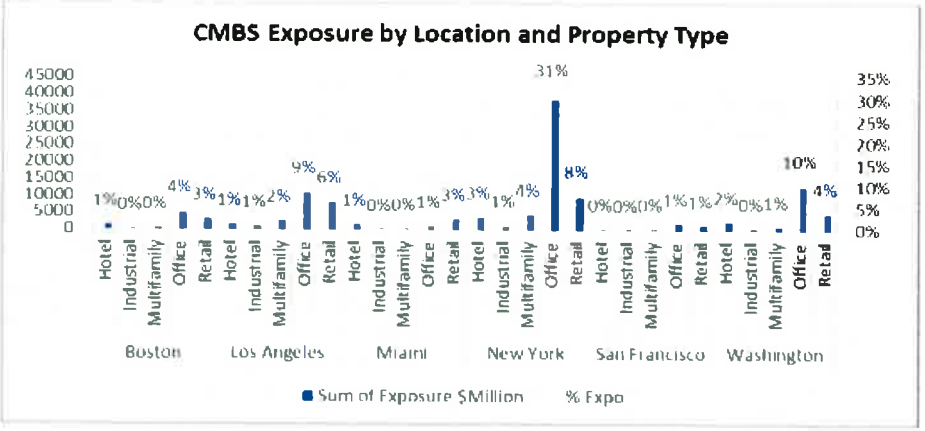
Use of External Datasets – CRE PD and LGD

- CMBS data limitation and HSBC transformation:

Data Limitation	Remediation through Data Construction /Cleaning
Default indicator: the CMBS data does not have a default indicator	The WRRA team used loan status and other parameters to simulate its default definition to align with HBUS. These simulations included: Loan status "90 day + delinquent" or "Foreclosure in Process" or "REO" Loan filed bankruptcy PD external defaults were totalled at an obligor level while LGD external defaults were totalled at the loan level.
Deal type: **1) Not all deal types are relevant to the HSBC portfolio** **2) A CMBS deal can have different and changing deal types throughout its history**	Only loans with CMBS deal types equal to Conduit, Large Loan or Single Asset Borrower were chosen from the external dataset (single borrower transactions are characterized by a single large loan or by multiple cross-collateralized/cross-defaulted loans with common sponsorship; large-loan transactions usually consist of a small number of large loans that are made to multiple unrelated borrowers; while conduit/fusion transactions are normally backed by larger pools of loans that are more diversified by loan count, property type, sponsorship, and geographic location). The loans within these deal types were chosen due to their relevance to the HBUS portfolio. Only deal types categorized as being in the USA were included in the external dataset. Other categories (Europe, Canada, and CDO) were excluded. Only loans that remained within the same CMBS deal type from 1998 through 2014 were included in the external dataset. Any loans with multiple deal types throughout this time period were excluded from the external dataset due to the risk of receiving a biased result.
Presence of stale or outdated loan to value information	For LGD model development, the property value information was updated using the NCREIF Property Value Index information. The NCREIF Property Value Index ("NPI") is a quarterly time series composite total rate of return measure of investment performance of a very large pool of individual commercial real estate properties acquired in the private market for investment purposes only. NCREIF requires that properties be valued at least quarterly, either internally or externally, using standard commercial real estate appraisal methodology.

Use of External Datasets – CRE PD and LGD

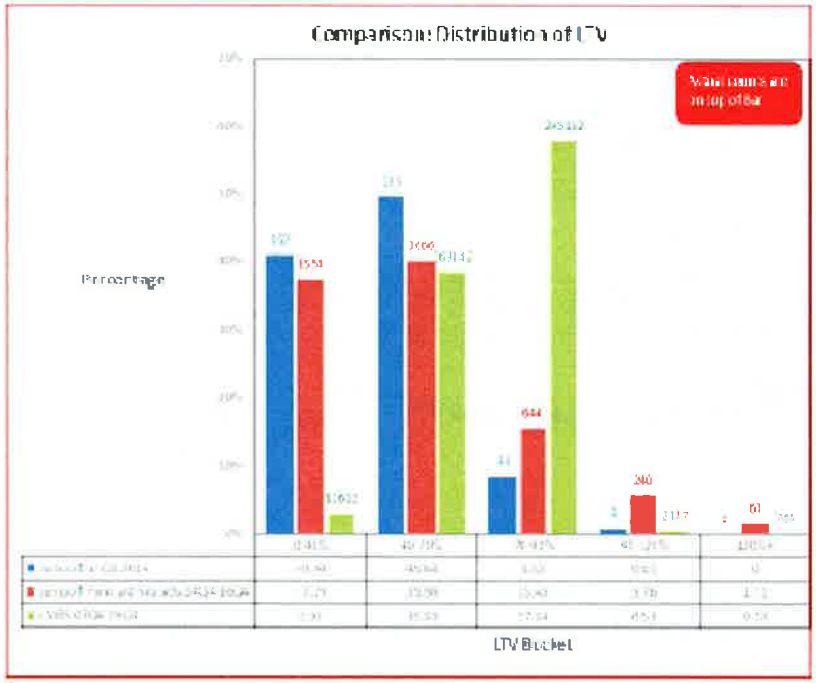
- CMBS data relevance
  - ✓ The comparison between external and internal data was done along the following dimensions: Distribution by Geographic location, Property type, DSCR and LTV, Historical default rate, and Historical LGD.
  - ✓ The property type and location will be used as the segmentation of model development.

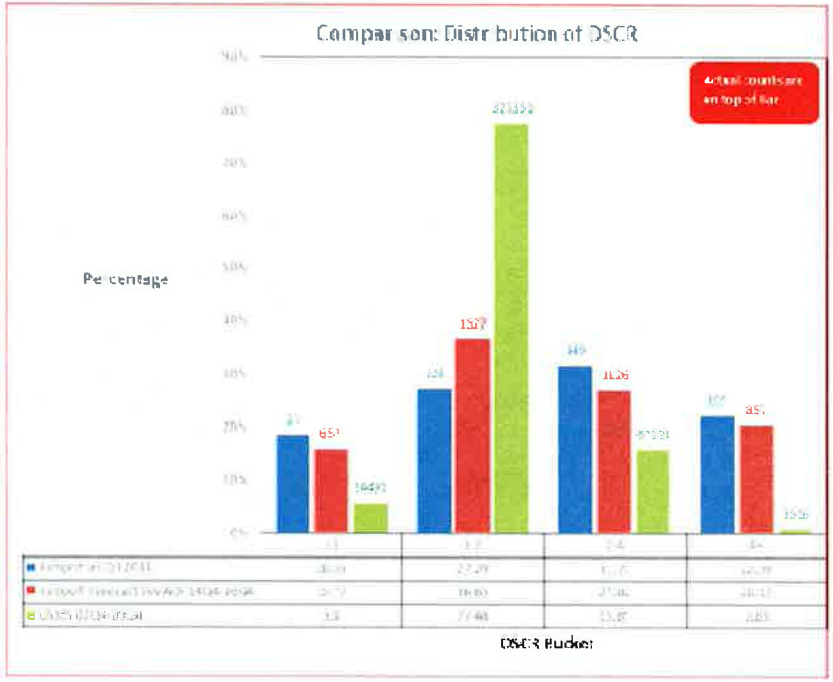


  - ✓ Bank's corresponding exposures to be compared similarly, and focus on location and property type coverage.
  - ✓ Methodology such as Bayesian Analysis can be used to combine the internal and external data sets to further improve the model performance.

Use of External Datasets – CRE PD and LGD

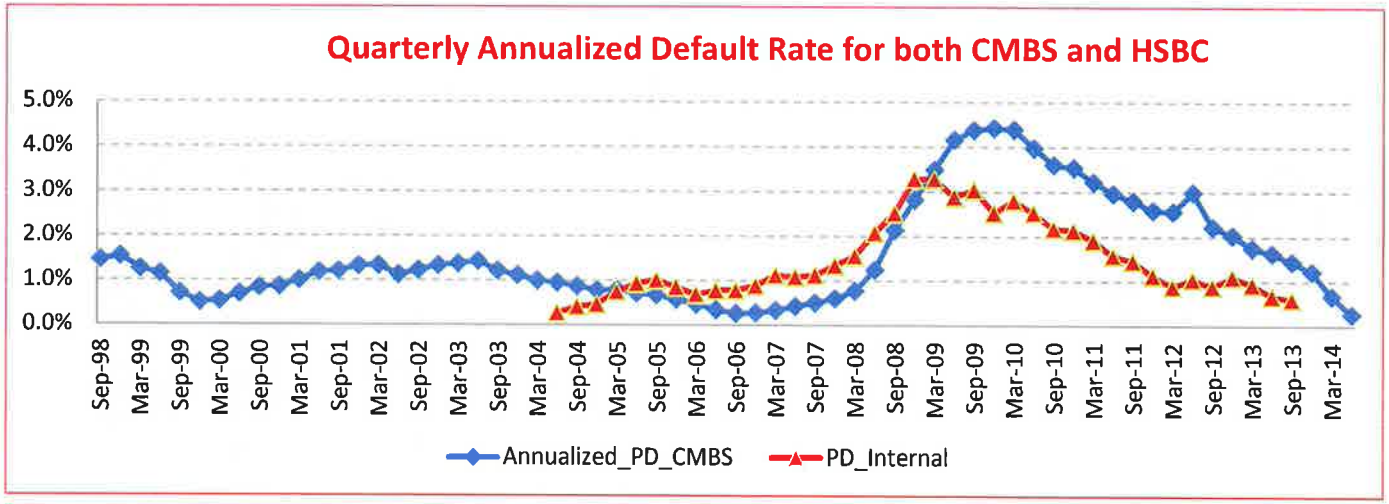
- CMBS data relevance, LTV and DSCR comparison
  - ✓ CMBS data has more observations than HBUS among all buckets (numbers on top of each bar in each graph).
  - ✓ CMBS data covers a broader range of LTVs and DSCRs. This is statistically significant, because adequate observations will ensure that the model is capturing the behaviors among those buckets (such as LTV 120 %+). Under the stress scenario, internal portfolio may move to those higher risk buckets.

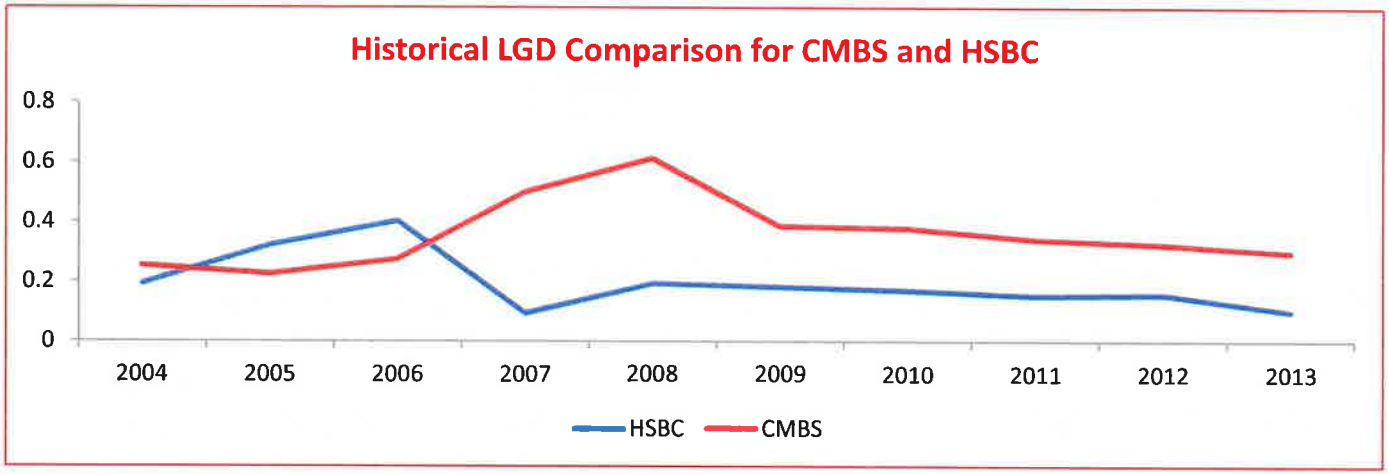




Use of External Datasets – CRE PD and LGD

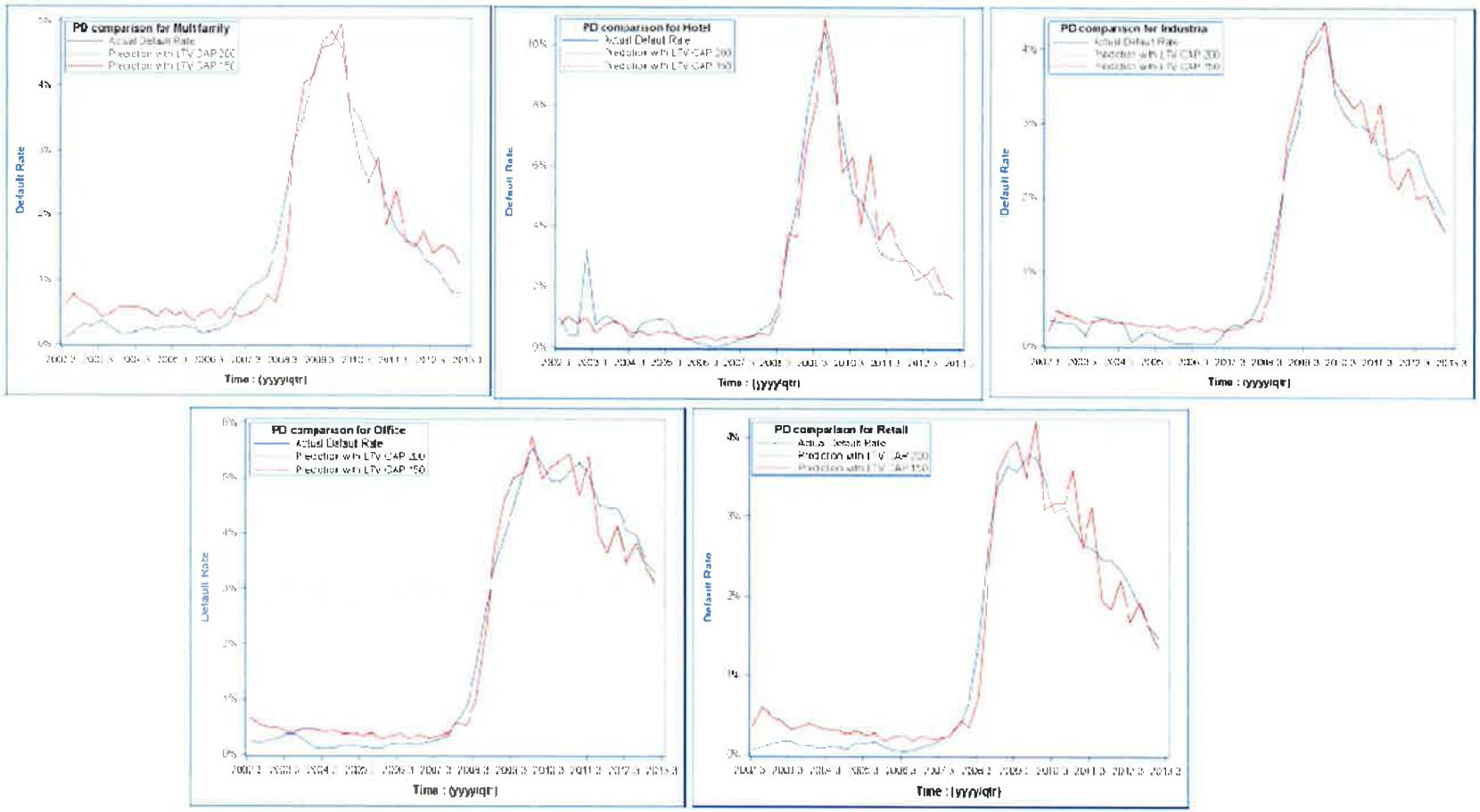
- CMBS data relevance, PD and LGD comparison





Model performance

- Backtesting, CRE model development as example.



Use of Historical Data with Caution

"History does not repeat itself, but it rhymes."
-- Mark Twain

Historical data does not lie, but it did not tell the whole truth.
-- Gordon Liu