Paper 131-2009 **Case Study**

Risk Management: Using the SAS Platform at CIBC

Rick Miller
Vice-President, Credit Risk Data Solutions
Risk Management, CIBC

For what matters.

Disclaimer

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Today's Discussion

- **A Brief Overview of the Basel II Framework**
- **Increased Spotlight on Credit Risk Data**
- **Key Data Challenges**
- **The Journey Ahead**

About CIBC

All amounts in C$

- Canadian Imperial Bank of Commerce (CIBC) is a leading North American Financial institution

- we offer a full range of products and services to almost 11 million individuals and small businesses, corporate and institutional clients

- At year-end (October 31, 2008):
  - Market capitalization was $20.8 billion
  - Tier 1 capital ratio was 10.5%
  - employed nearly 40,000 employees worldwide
  - had 1,050 branches in Canada and more than 3,700 ABMs

- constituent of the Dow Jones Sustainability Index (DJSI) for seven consecutive years (one of 25 banks worldwide)

The Basel II Framework Goals

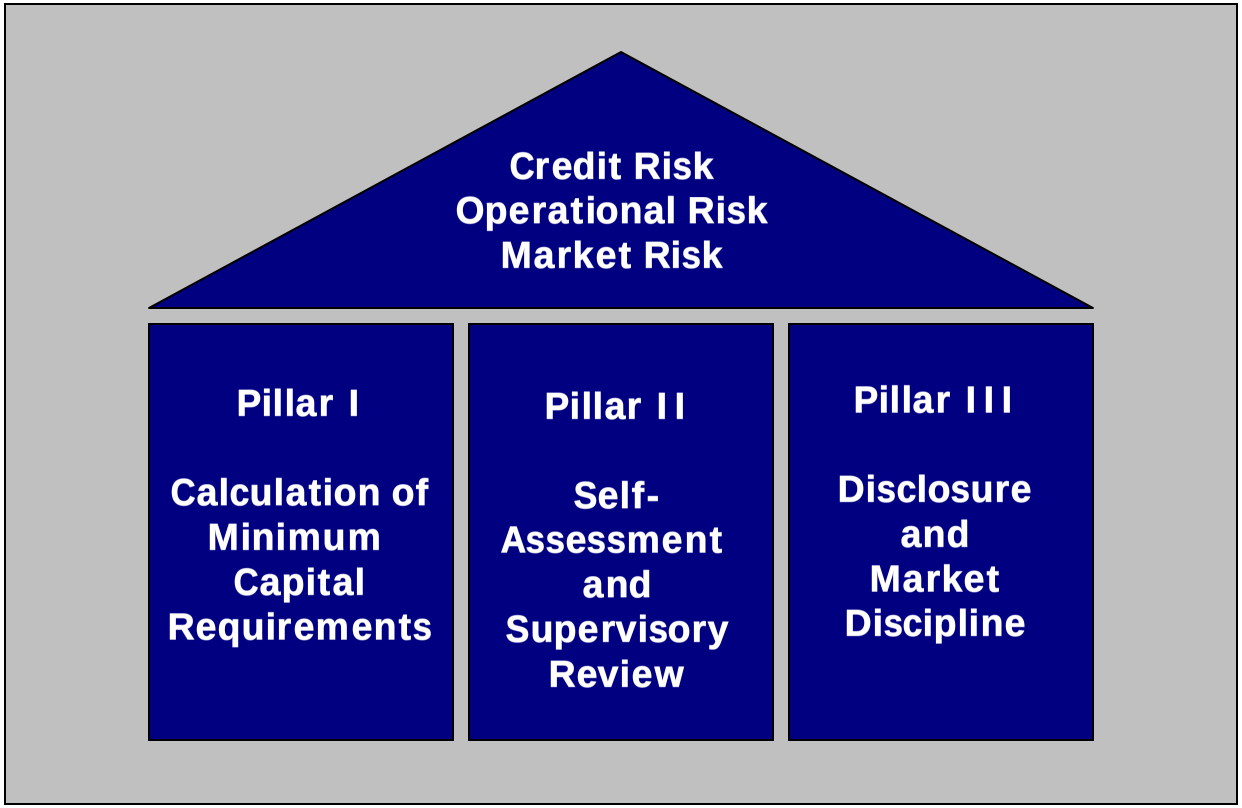
- a global framework issued by Bank of International Settlements (BIS) and managed by national supervisors

- developed over the period 1999 – 2005 with broad consultation globally along with quantitative impact studies

- The Basel II Committee Goals were:
  - to enhance risk sensitivity of capital requirements
  - greater emphasis on banks own assessment of risk
  - improve transparency for market discipline

- Basel II was implemented November 1, 2007 by CIBC and other major banks in Canada

The Basel II Framework



Distribution of Credit Risk

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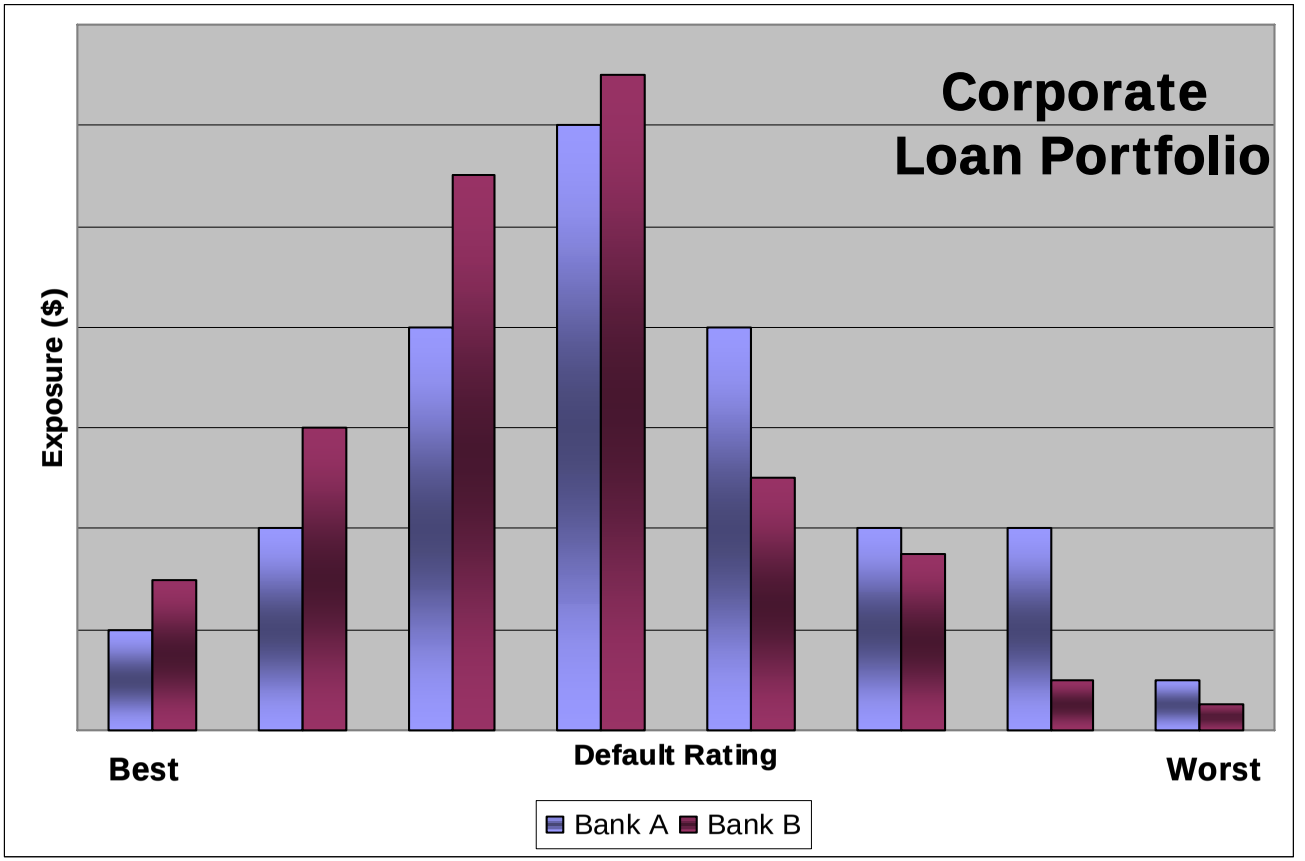

- assume credit portfolio size is identical for both banks but with a different mix of credit risk

Previous CAR: No Differentiation

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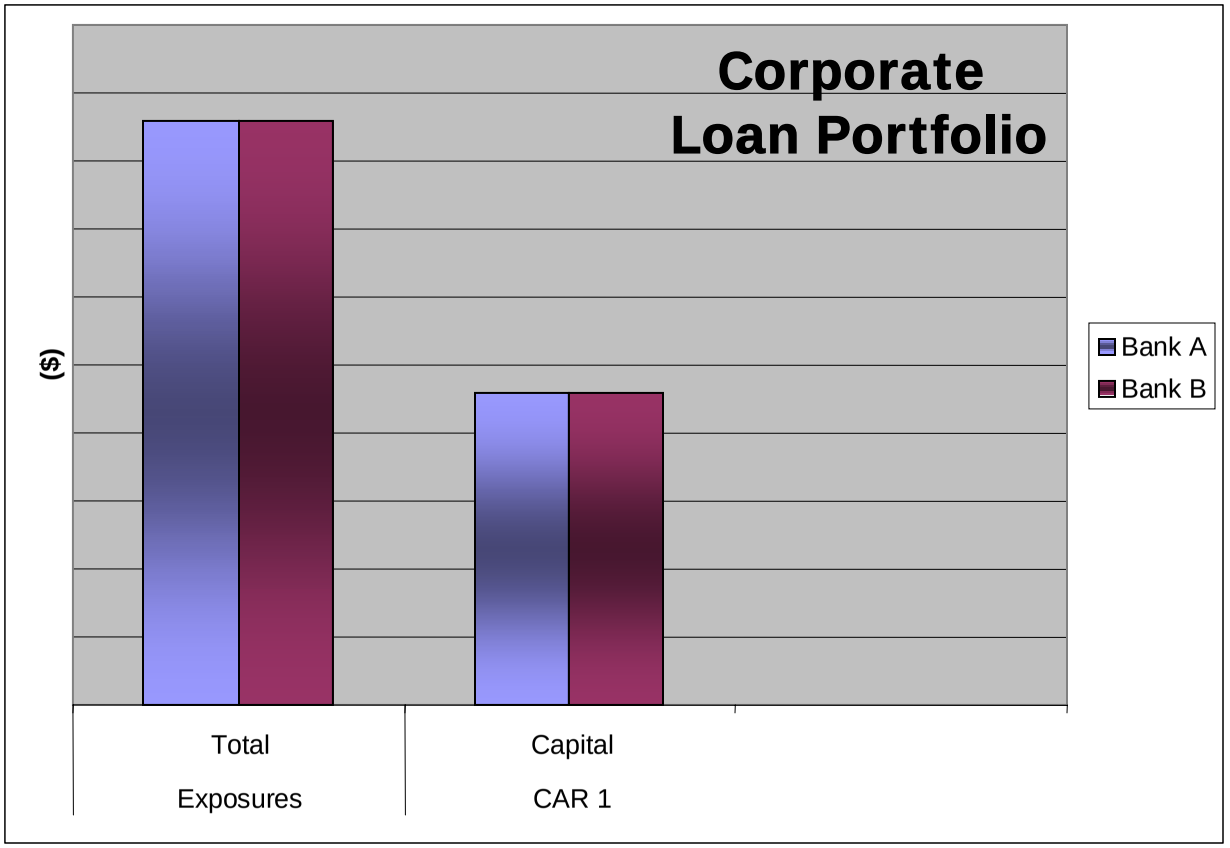

- **Under previous Capital Adequacy rules, both portfolios would require the same amount of minimum regulatory capital**

Basel II: Risk Sensitive, More Capital

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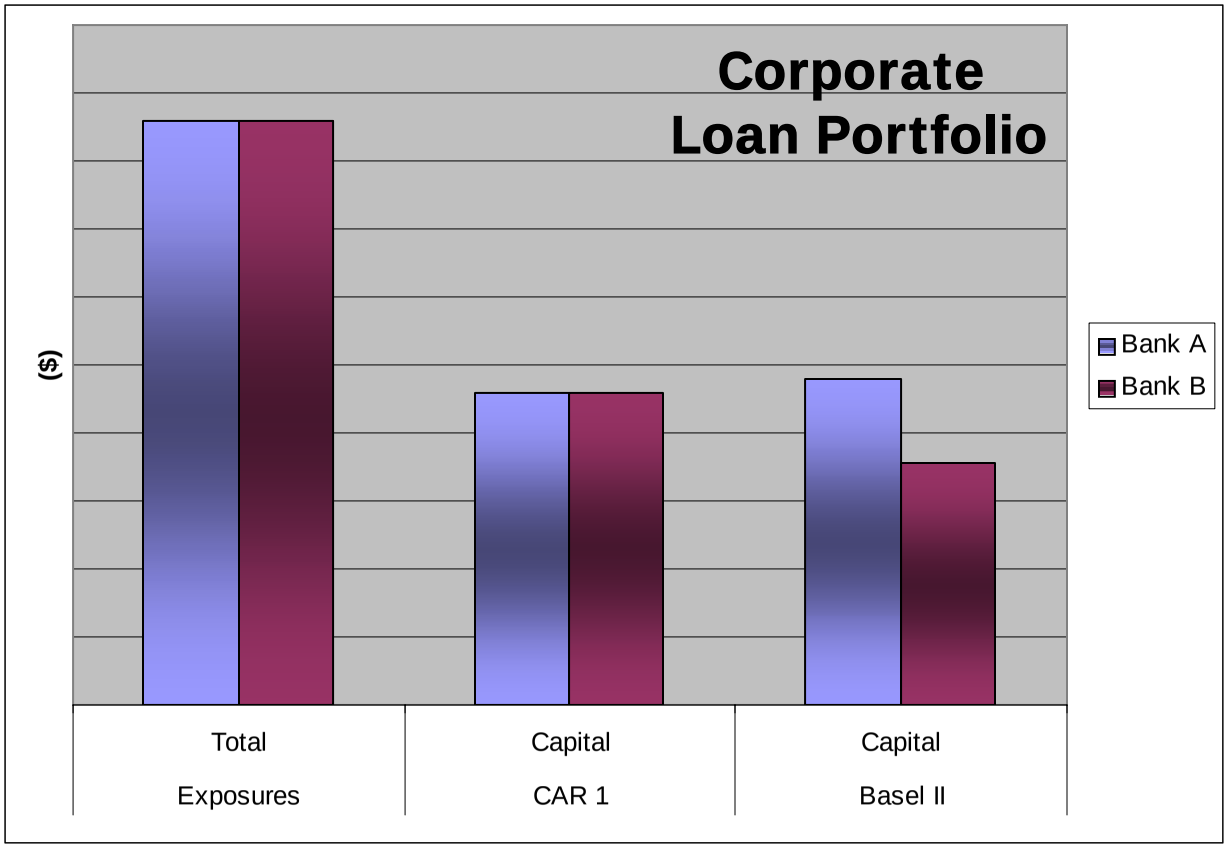
AIRB Approach



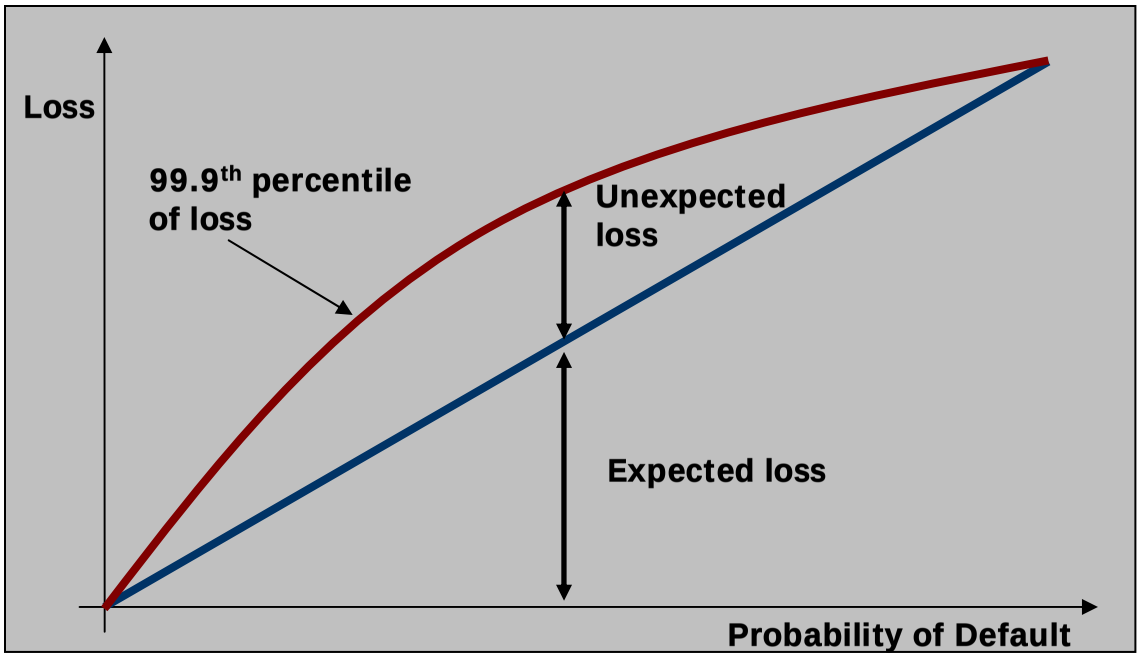
- **The strategic implication is that banks with riskier portfolios will have higher minimum regulatory capital requirements**

Basel II Glossary: Credit Risk Capital

- **The Basel II Framework allows the use of bank-specific estimates of risk components in determining the capital component for a given exposure:**
  - **Probability of default (PD)**
  - **Exposure at default (EAD)**
  - **Loss given default (LGD)**
  - **Effective maturity**
  - **Firm-size adjustment for Small Medium Enterprises (SME)**

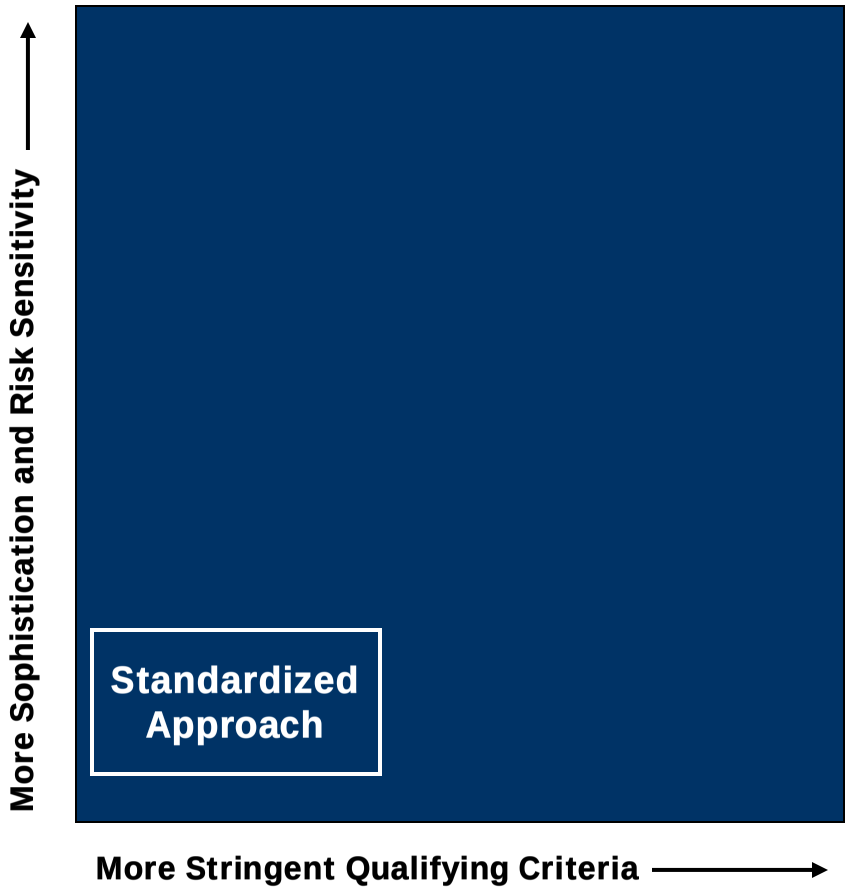
Basel II Glossary: Credit Risk Capital

- **Expected Loss (EL) = PD * EAD * LGD**
- **Unexpected Loss (UL) calculated using sophisticated Basel II formulae incorporating PD, EAD, LGD**



- **minimum regulatory capital is a function of the calculation of unexpected loss (UL) and expected loss (EL)**

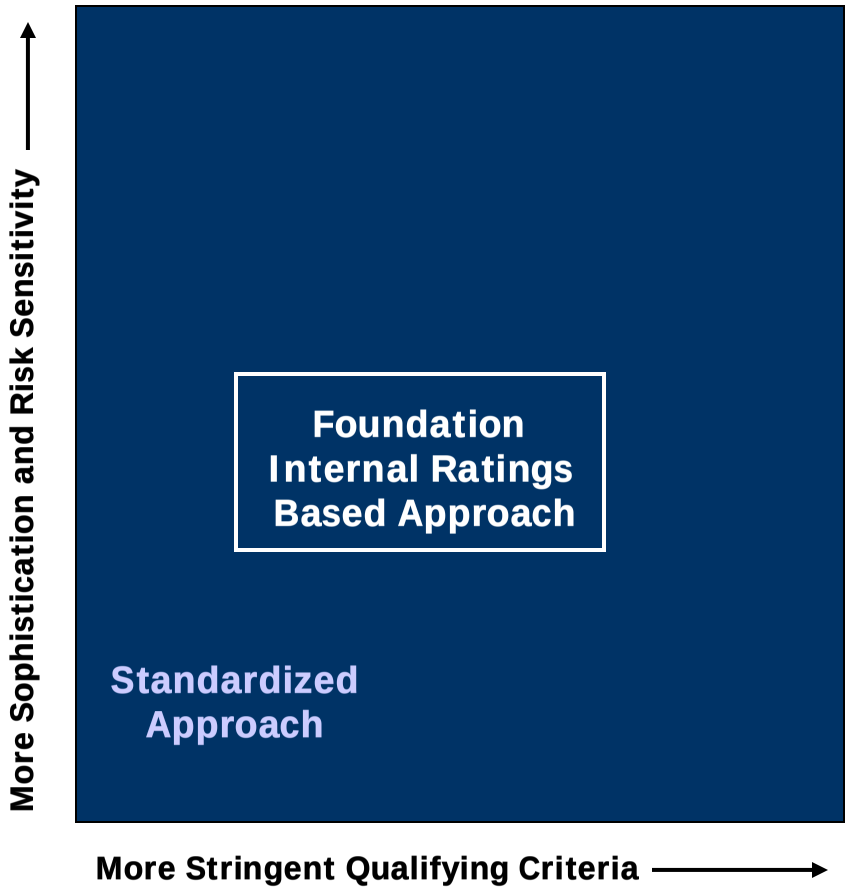
Basel II: Three Options for Credit Risk



STANDARDIZED APPROACH

- similar to existing BIS'88
- more gradations of risk
- banks can use external credit ratings
- some capital relief for credit risk mitigation (e.g., collateral)

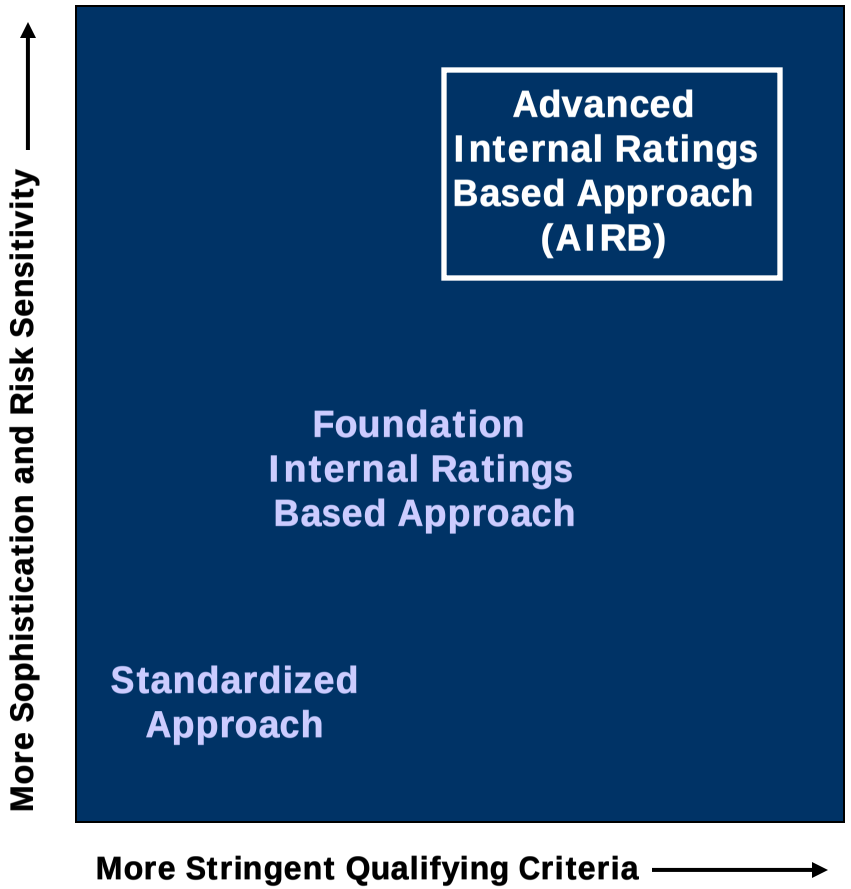
Basel II: Three Options for Credit Risk



FOUNDATION INTERNAL RATINGS BASED APPROACH (FIRB)

- based on internal data and risk ratings
- banks use their own estimates of:
  Probability of Default (PD)
- supervisors provide estimates for:
  Loss Given Default (LGD) and
  Exposure At Default (EAD)
- expected Minimum requirement for internationally active banks

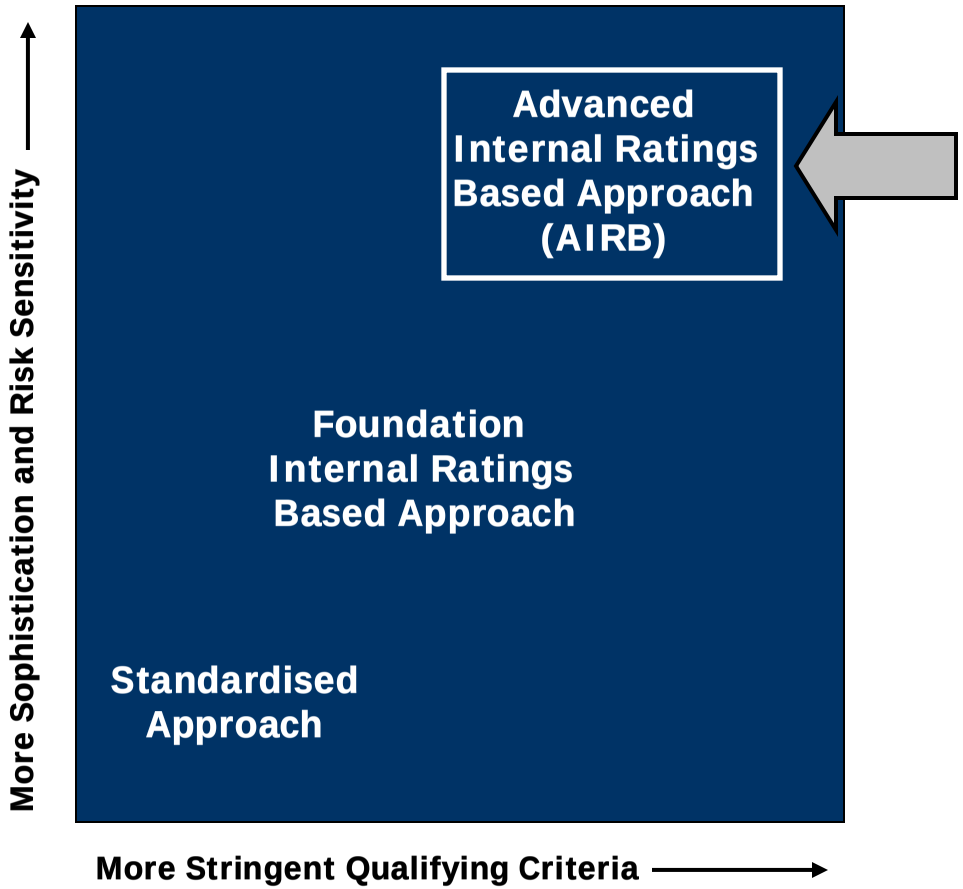
Basel II: Three Options for Credit Risk



ADVANCED INTERNAL RATINGS BASED APPROACH (AIRB)

- based on internal data and risk ratings
- banks use their own estimates of:
  - Probability of Default (PD)
  - Loss Given Default (LGD)
  - Exposure at Default (EAD)
- complex and internationally active banks encouraged to move to this approach

Basel II: Three Options for Credit Risk



- Banks must meet broad risk-quantification standards for own estimates of PD, LGD, EAD
- Banks must have a robust system in place to validate the accuracy and consistency of:
  - rating systems,
  - processes, and
  - estimation of all relevant risk components
- Supervisor expects all major Canadian banks to implement AIRB

Basel II Glossary: Exposure Classes

- under the IRB approach, banks must categorize banking-book exposures into broad classes of assets, specifically:
  - CORPORATE
  - SOVEREIGN
  - BANK
  - RETAIL
    - Residential Secured
    - Qualifying Revolving Retail
    - All Other Retail
  - EQUITIES (non-traded)
- the work here was focused on ensuring that the identifiers to classify exposures were available, accurate, complete, and persistent in the source data

Basel II Glossary: Exposure Types

- **additional granularity of reporting using counterparty type**

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Credit Exposures by type for the period ending...						
(Canadian $ millions)	**Drawn**	**Undrawn**	**Repo style transactions**	**OTC derivatives**	**Other**	**TOTAL**
Residential secured	xxx	xxx	xxx	xxx	xxx	xxx
Qualifying revolving retail	xxx	xxx	xxx	xxx	xxx	xxx
Other Retail	xxx	xxx	xxx	xxx	xxx	xxx
Corporate	xxx	xxx	xxx	xxx	xxx	xxx
Sovereign	xxx	xxx	xxx	xxx	xxx	xxx
Bank	xxx	xxx	xxx	xxx	xxx	xxx
Total Gross Credit Risk Exposures	**xxx**	**xxx**	**xxx**	**xxx**	**xxx**	**xxx**

Data Maintenance Focus by Regulators

- Implementation Note by the Canadian supervisor (OSFI), "Data Maintenance at IRB Institutions"
  - provides general guidance on data maintenance and principles to apply

- supervisor will monitor ongoing data maintenance compliance

- Data Maintenance Principles include guidance on:
  - Senior Management Oversight Accountabilities
  - Data Life-Cycle Management

So, What Is the Prize?

- regulatory compliance is critical
- for CIBC's mix of business, using the Basel II AIRB approach results in a small overall reduction of capital for credit risk
- for line of business operations, ties the allocation and use of regulatory capital to the risk profile of the business
- promotes an enterprise-wide focus on the importance of accurate and complete risk data
- introduces formal requirements for "back testing" and "stress testing" of rating systems and parameter estimates to supplement and enhance existing practices

CIBC Case Study

- **Getting Started**
- **Developing Parameter Estimates**
- **Calculating Basel II Regulatory Capital**

CIBC Case Study: Where We Started

- developed a broad understanding of the Basel II Framework requirements

- assessed what already existed, in terms of:
  - People
  - Processes
  - Data
  - Systems / tools

- developed a "gap analysis" and secured senior management support and funding for projects to close the gaps

- strategy was to leverage existing capability, wherever possible

The Data Approach

- use the Basel II Framework document to understand and then define the "mandatory risk data"
- create a logical model to consolidate and organise the data
- determine where the data exists and identify any data gaps
- enhance systems to collect and store the required data
- harmonise different data definitions through the application of business logic
- implement a data maintenance framework to include:
  - risk data stewardship roles & responsibilities
  - data standards for accuracy, completeness, timeliness
  - data controls, measurement, and monitoring
  - data security and access

Different Credit Risk Data Challenges

	CORPORATE, SOVEREIGN, BANK, EXPOSURE CLASSES	RETAIL EXPOSURE CLASSES
VIEW OF CREDIT RISK	Borrower-centric (across all org units and all products)	Product-centric (homogeneous pools)
ASSIGNMENT OF RISK PARAMETERS	Assigned to each borrower	Assigned to each pool
EXPOSURE DIMENSIONS	Large authorization / outstanding balances per borrower - multiple facilities	Small authorization / outstanding balances
BORROWER VOLUME	Hundreds of thousands	Many millions
RATING SYSTEMS	Requires sophisticated “risk rating” systems	Requires less complex “credit scoring”
RECONCILIATION: EXPOSURES TO G/L	Challenging across exposure classes and exposure types	More straightforward

Key Challenges: Credit Risk Data

- significant amount of data is required
- require numerous feeds from different kinds of source systems
- state of current credit risk data
- how to reconcile credit risk balances originating in these disparate systems to the General Ledger
- systems constraints / timing

What Data Do We Need?

- **decompose Basel II Framework clauses into "mandatory" credit risk data for AIRB compliance**

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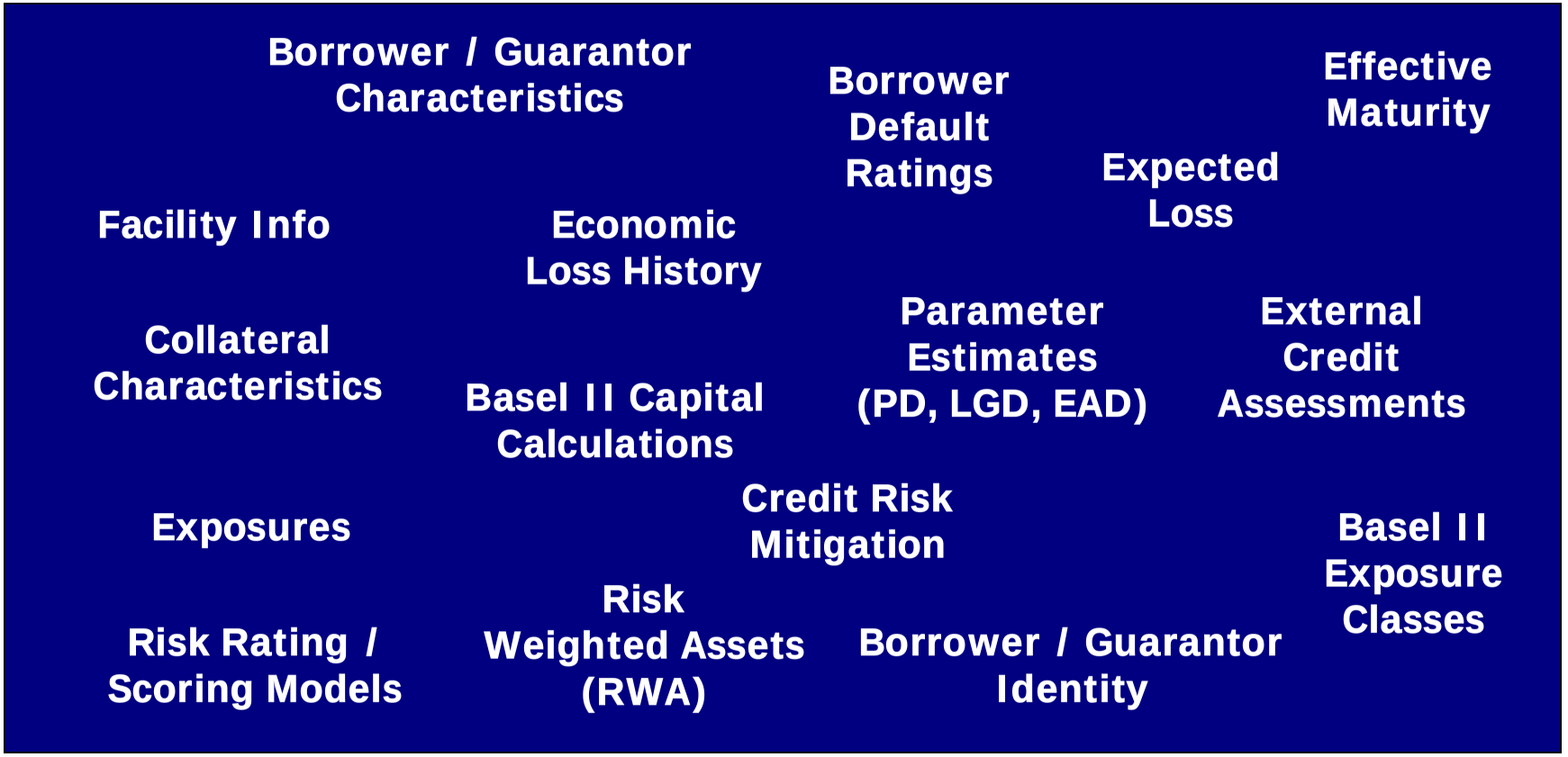
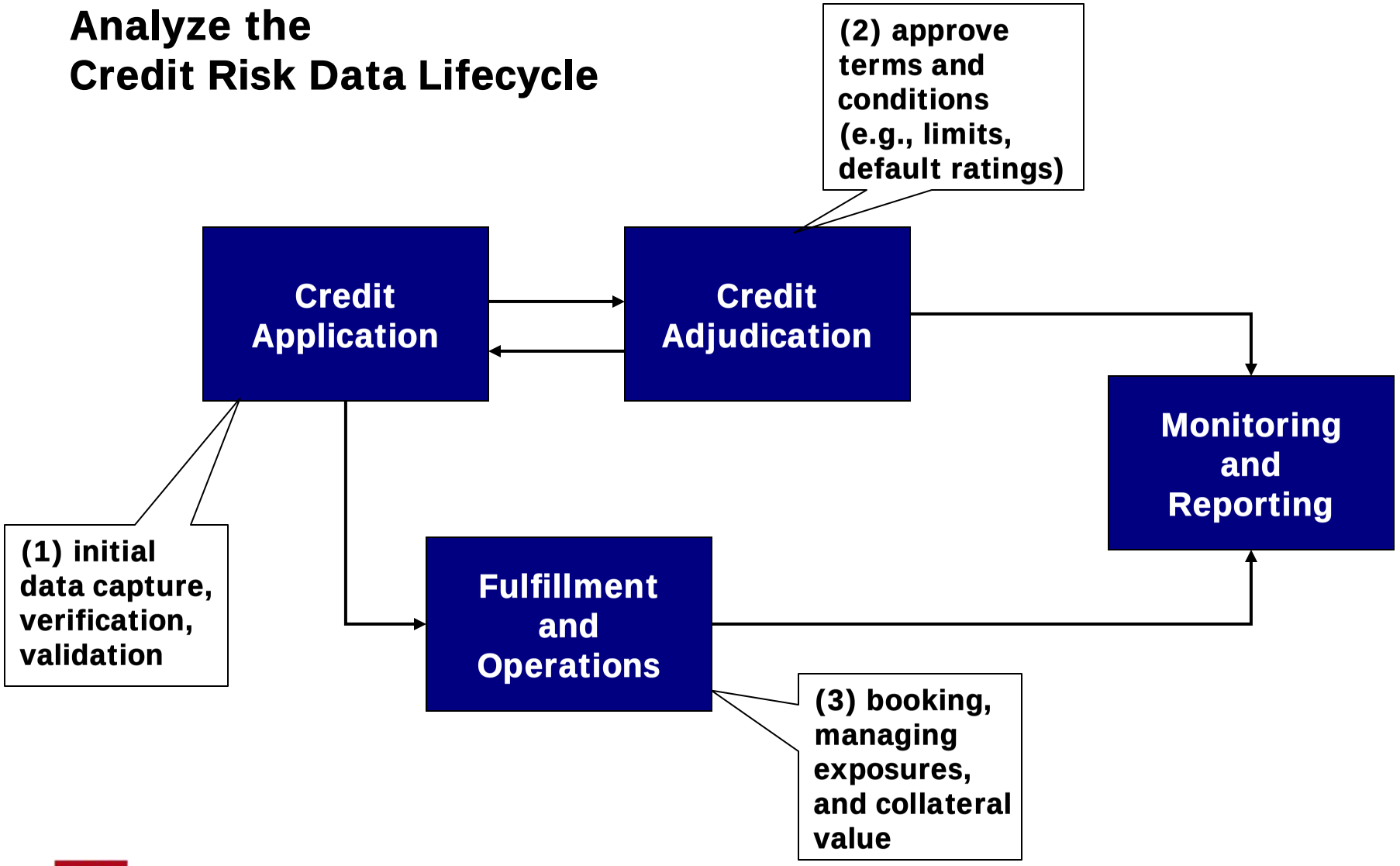


Where To Look For The Data

Analyze the Credit Risk Data Lifecycle



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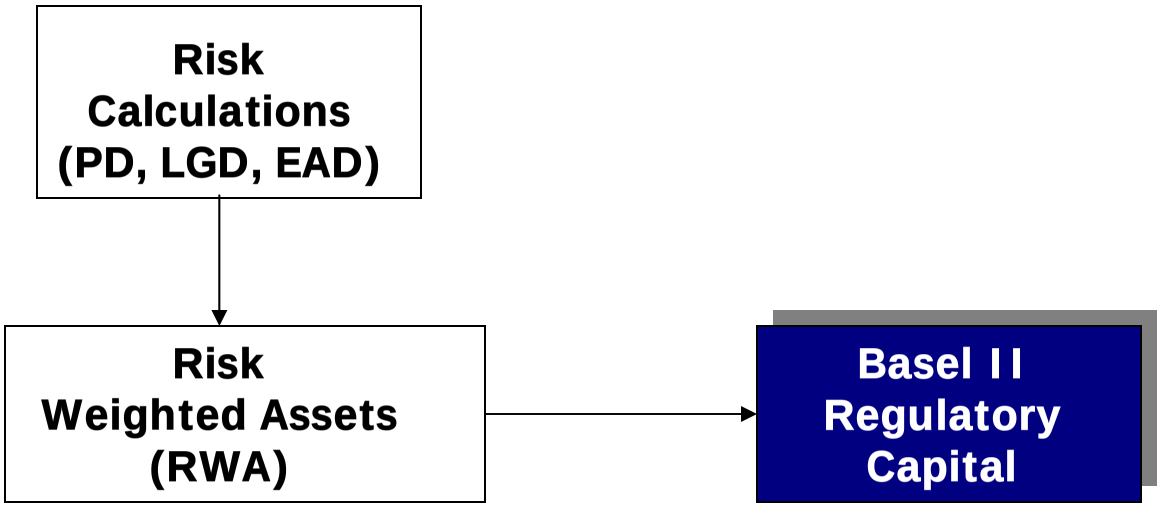
How Do We Organize The Data?

"Mandatory" Credit Risk Data



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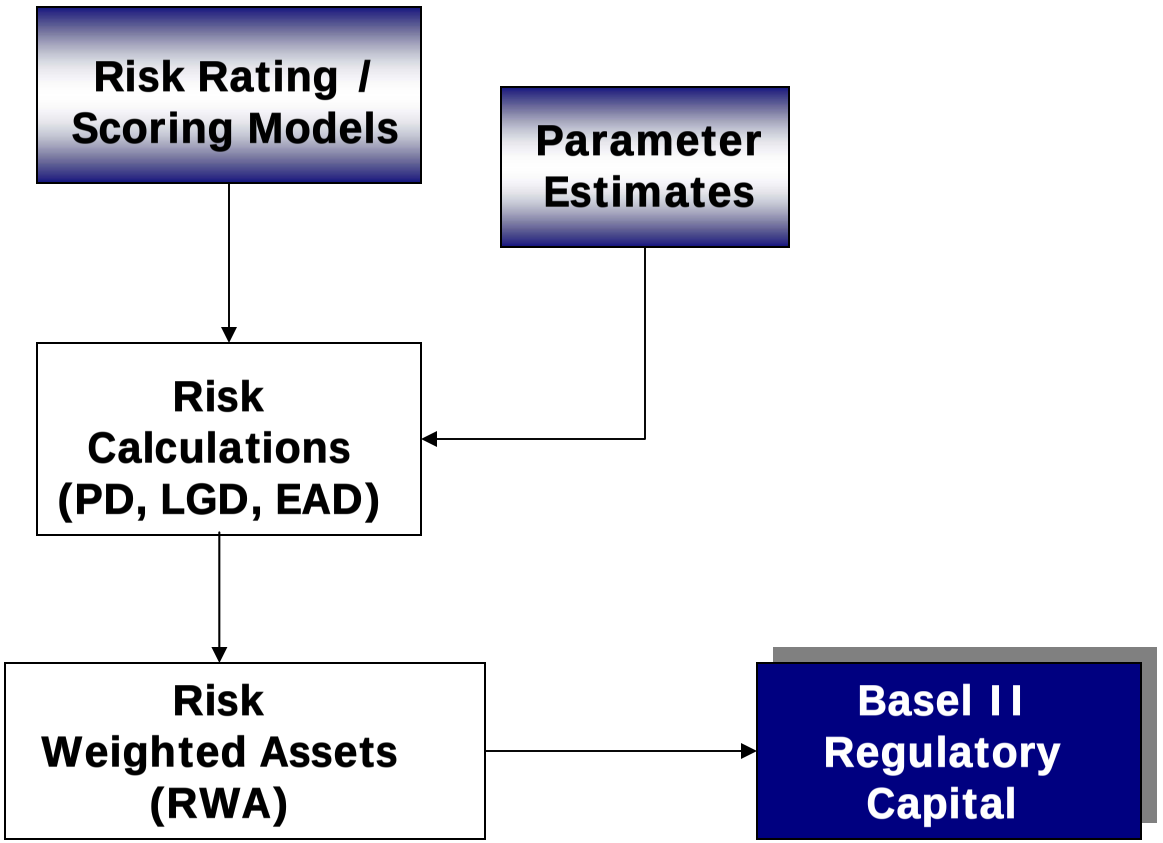

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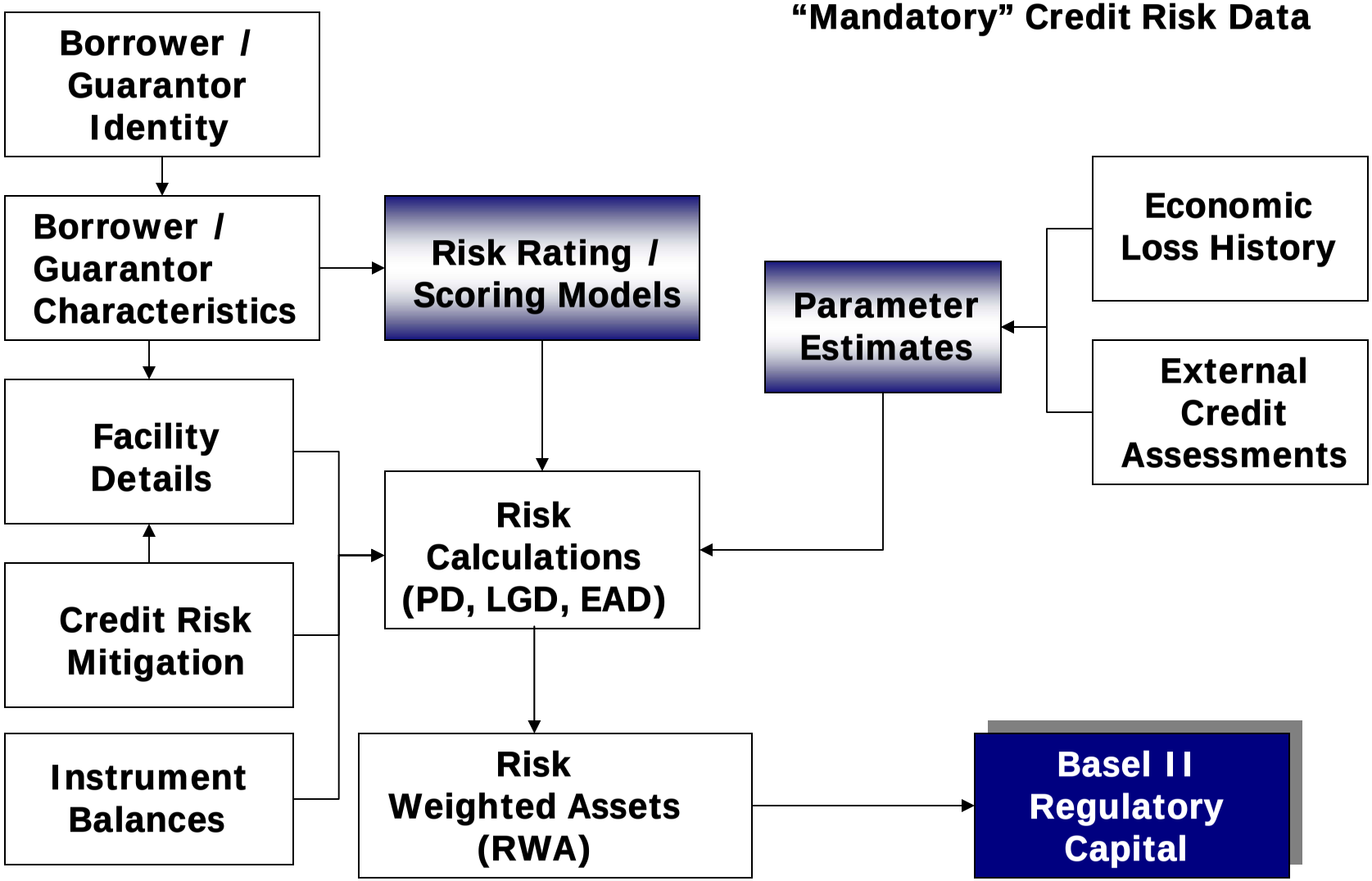
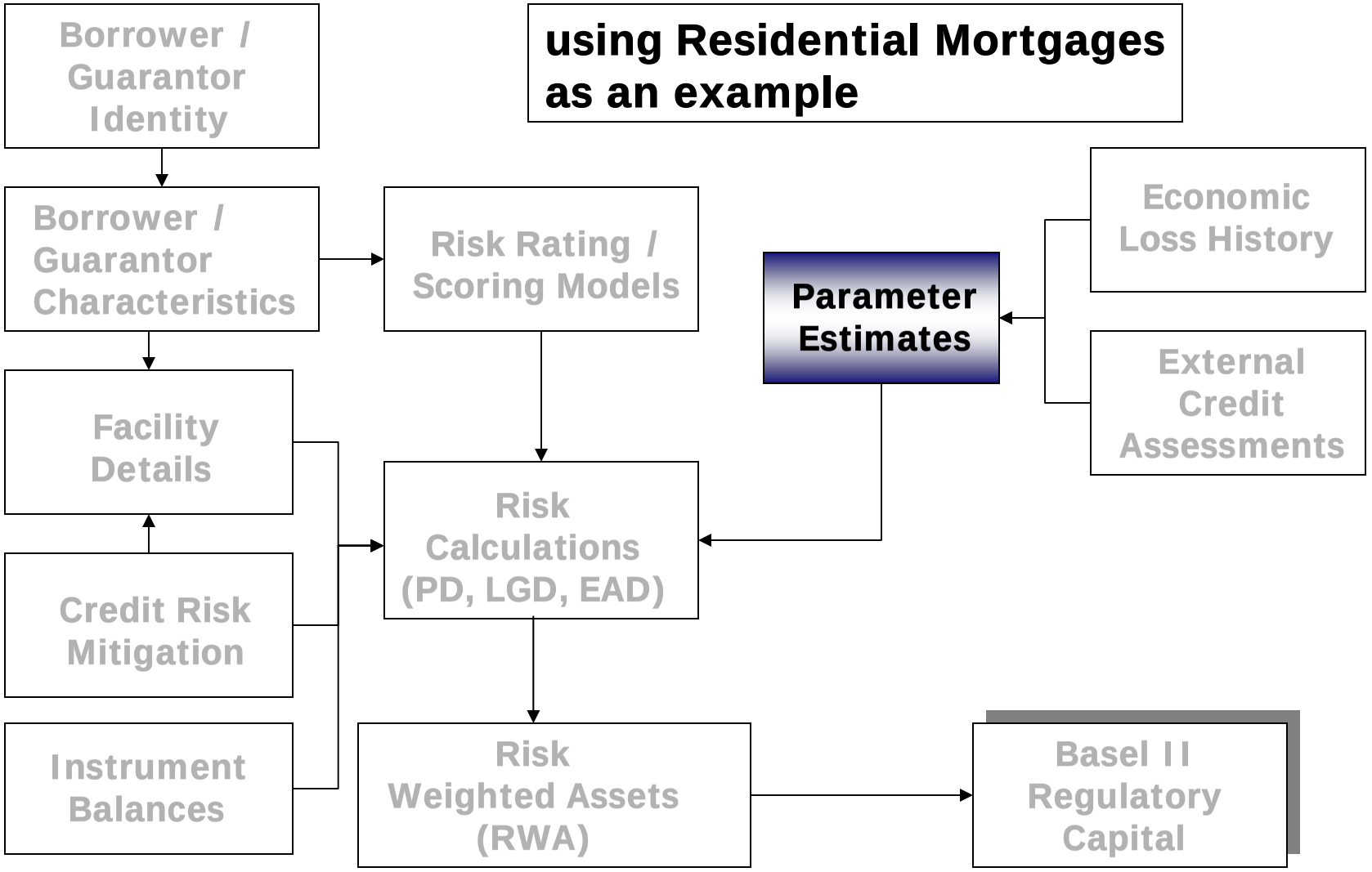


What We Learned About Our Data

- the most challenging task was mapping data
- there was no common data model
- there were some “data breaks”
- we didn’t have granular enough historical data
- data definitions were inconsistent
- as the parallel year progressed, we measured success by the reduction in the use of “defaults” for RWA calculations

Case Study #1: Parameter Estimation



Overview: Parameter Estimation

- risk rating systems rank order the quality of individual credit risk exposures and groupings of exposures

- there are three important dimensions:
  - the risk of the borrower defaulting (PD)
  - factors specific to individual transactions to estimate the economic loss, given default (LGD)
  - the calculation of exposure amount at default (EAD)

- the estimates for PDs need to be long-run averages of the actual one-year default rates

- LGDs must be developed from historical losses and recoveries

- these parameters must be good predictors of future loss events

- banks are expected to reflect conservative estimates

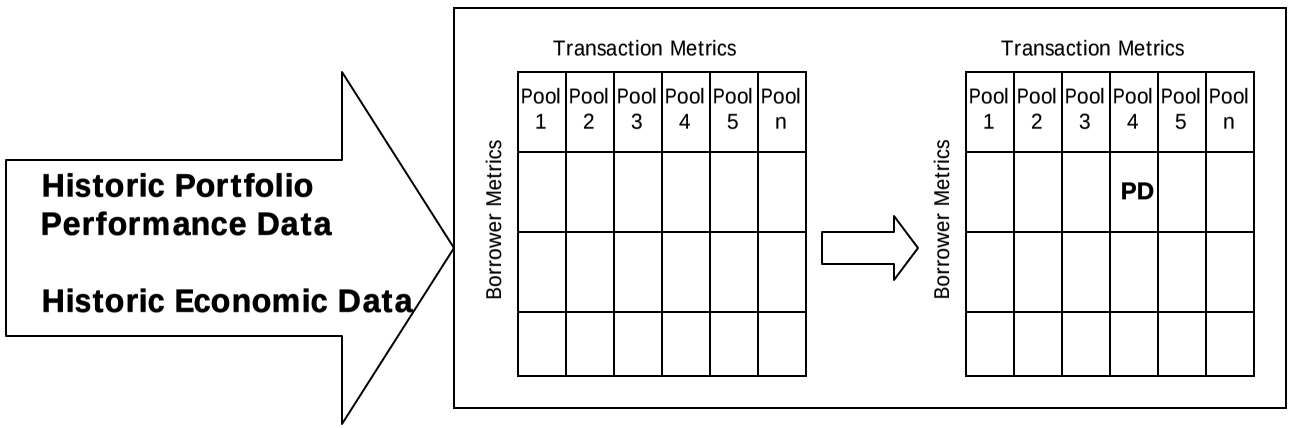
Key Challenges: Parameter Estimation

- required history (at least one full economic cycle) not readily available for some required attributes
- scarcity of CIBC-specific default data (e.g., Sovereigns, Banks)
- granularity of data not always available
- persistence of key data over time due to systems changes
- requires unique analytical skill sets to build parameter estimation models
- parameter estimation models must be independently validated

Developing Retail PD Estimates

- **Basel II requires banks to pool retail exposures with similar risk characteristics and estimate the Probability of Default (PD)**

- **each individual exposure within the pool then acquires the parameters of the pool to which it belongs**



Analytic Engine:
- **determines pools**
- **forecasts PD for each pool**
- **revises pools to ensure appropriate Capital**
- **stress testing**

Basel II Definitions: Probability of Default (PD)

- Probability of Default (PD) is a measure of the likelihood of an uncertain future event.

- the Basel II Residential Mortgages Exposure Class includes mortgages for:
  - single-family homes, whether they are owner-occupied or not
  - multi-family buildings with maximum of 4 units

- Basel II definition of default (clauses 452-453), either or both of:
  - obligor is past due 90 days on credit obligation to the bank
  - the bank considers the obligor unlikely to pay credit obligations in full

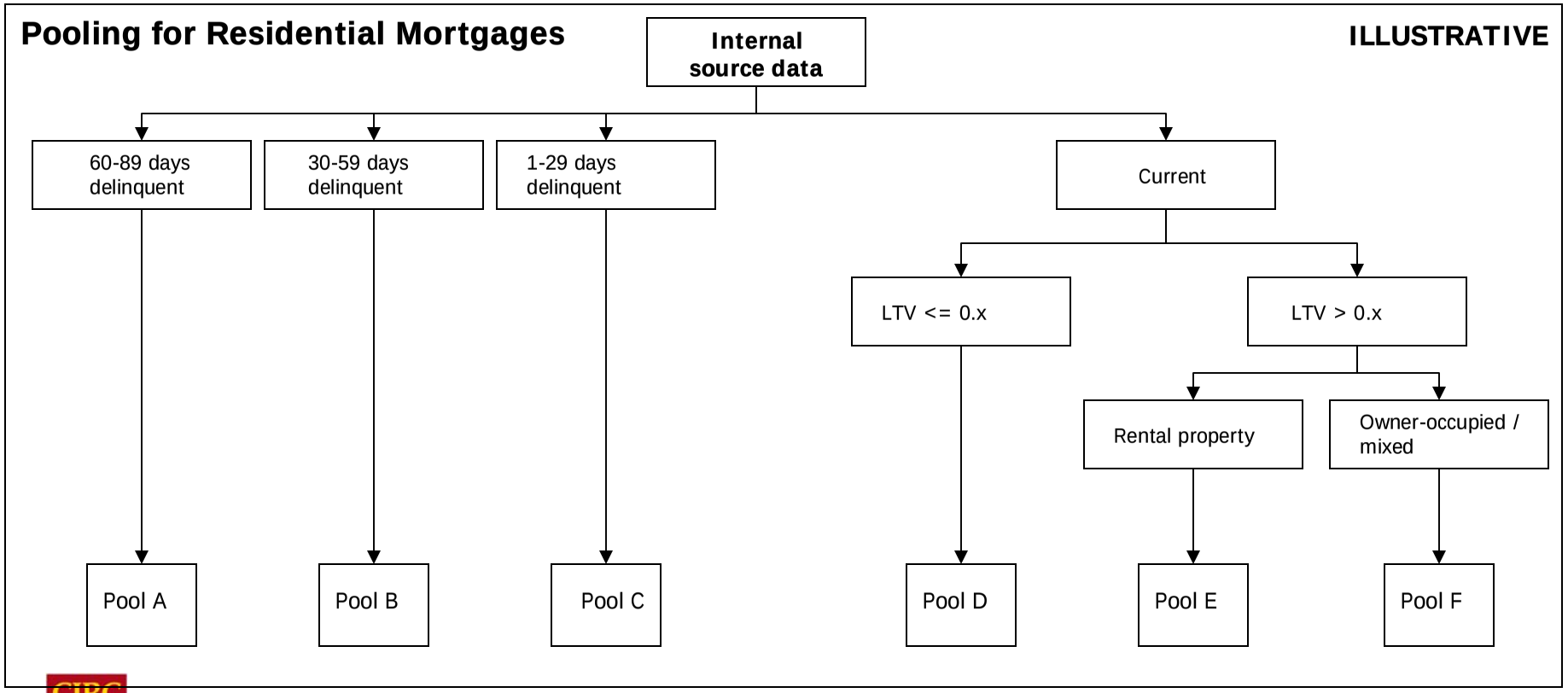
- Basel II time horizon (clause 466) specifies historical observations of at least five years

- Basel II data sources (clause 464) specifies “banks must regard internal data as the primary source of information for estimating loss characteristics”

For what matters.

Creating Pools for Residential Mortgages

- through analysis, we derived the key available risk factors
- we pooled mortgage loans on the following criteria:
  - arrears status in bands, e.g., current, 1-29 days delinquent, etc.
  - Loan-To-Value (LTV) ratio
  - Occupancy Status, e.g., rental, owner-occupied, etc.



Meeting the Basel II Requirements

To conform to the Basel II requirements, we ensure that:

1. **The pools clearly differentiate the PDs (clause 401)**
   - **PD in one pool should not significantly intersect with others**

2. **Each pool contains enough borrowers and defaulted borrowers to allow for meaningful quantification and validation of loss characteristics at the pool level (clause 409)**

3. **PD pools display sufficiently homogenous behaviour over time**
   - **subject to policy changes, etc.**

4. **If any pool would have a PD less than 3 basis points, we assign the Basel II floor of 3 basis points (clause 331)**

Reviewing the Historical Performance Data

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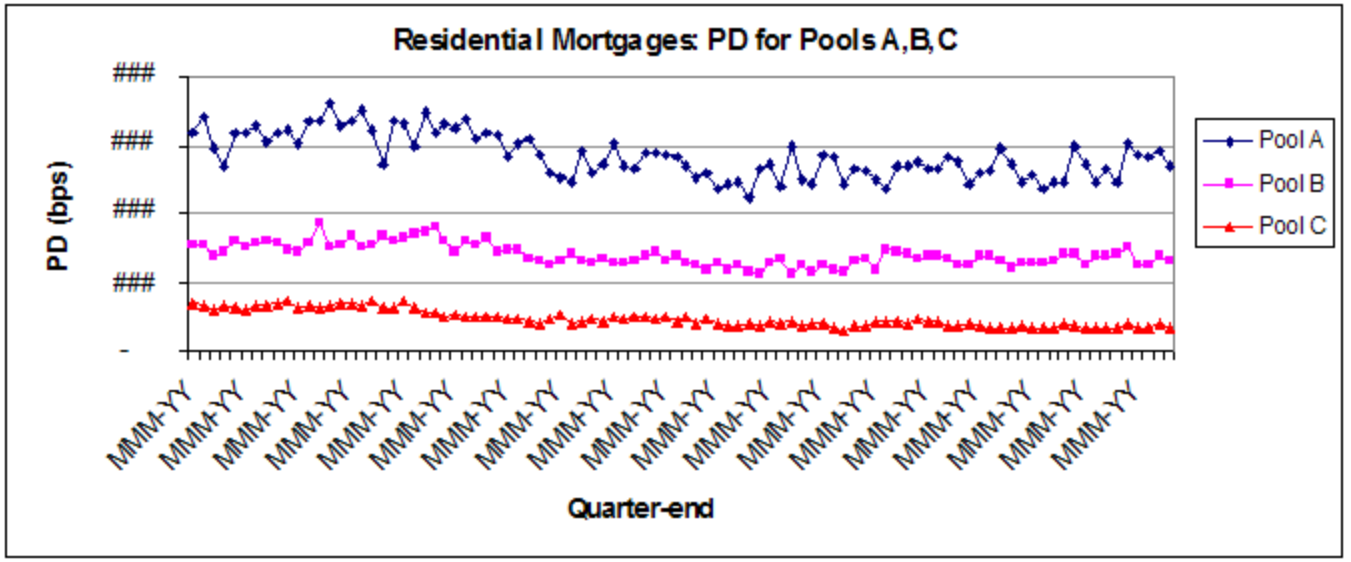

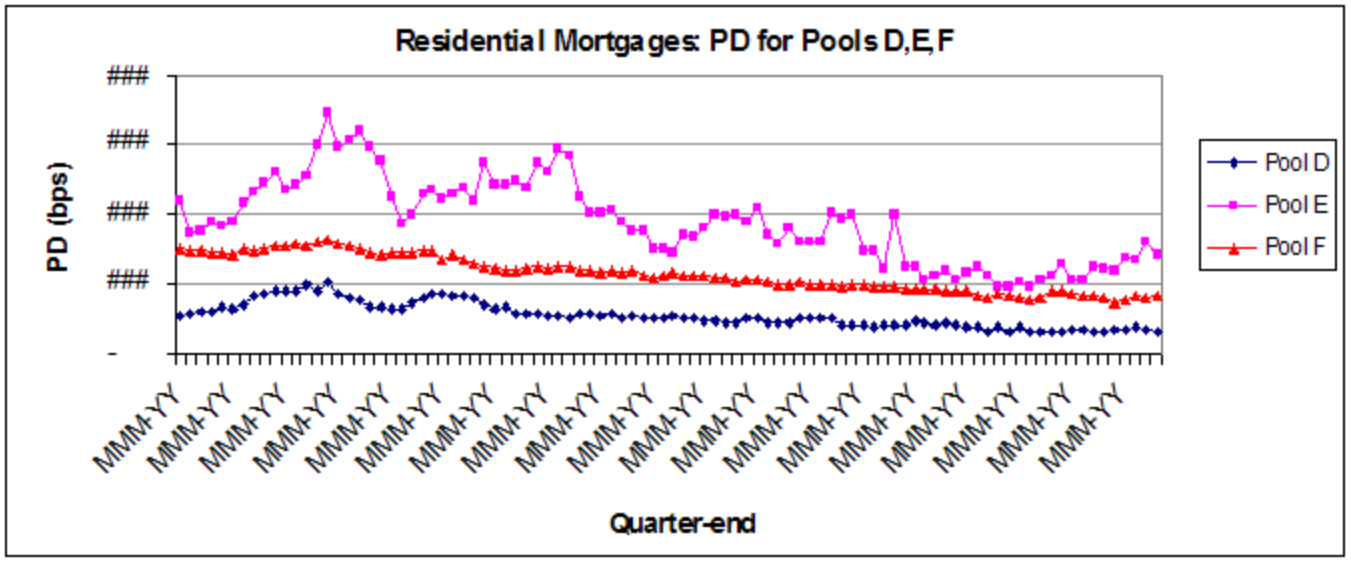

Next Steps – Deriving the PDs

- **for each Residential Mortgages pool, data was analyzed to produce lower quartile, median, and upper quartile values**

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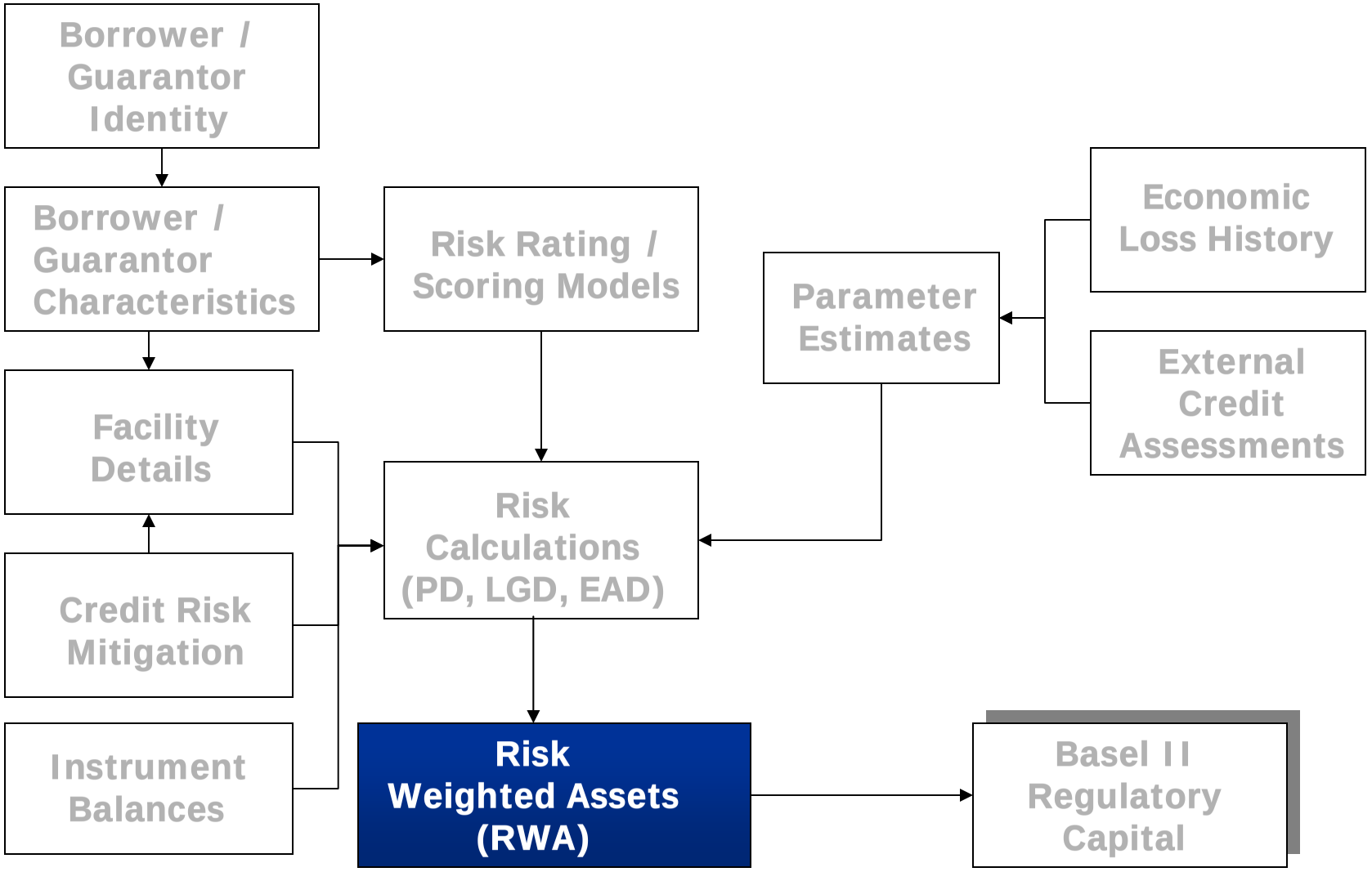
PD (bps)							
Pool ID	Mean PD	Std	Min	Max	Adjusted PD	PD Estimate	Average Balance
A	0000.00	0000.00	0000.00	0000.00	0000.00	0000.00	00.0
B	0000.00	0000.00	0000.00	0000.00	0000.00	0000.00	00.0
C	0000.00	0000.00	0000.00	0000.00	0000.00	0000.00	00.0
D	0000.00	0000.00	0000.00	0000.00	0000.00	0000.00	00.0
E	0000.00	0000.00	0000.00	0000.00	0000.00	0000.00	00.0
F	0000.00	0000.00	0000.00	0000.00	0000.00	0000.00	00.0

Next Steps – Implementing & Monitoring

- statistical analysis was performed to test for:
  - meaningful distribution of borrowers across pools
  - homogenous behaviour within pools
  - trending
  - adjustment needed for sampling error(s)
- we derived our estimate of long-run average PD for each pool
- we tested the accuracy of our predictions
- we implemented the PD model into production for calculation of Risk Weighted Assets (RWA's) for Residential Mortgages
- we monitor and analyze the observed default rate over time against the estimate
- reports to senior management highlight performance over time

Case Study #2: Calculating Risk Weighted Assets



The Road to Basel II Risk Weighted Assets

- minimum regulatory capital under Basel II is based on the calculation of Risk Weighted Assets (RWAs)
- RWAs are calculated according to established mathematical formulae utilizing PDs, LGDs, EADs, and in some cases, maturity adjustments
- Sourcing, processing, and reconciling data in order to calculate, store, and report on RWAs for the calculation of minimum regulatory capital is the core of the Basel II data challenge
- The Basel II Capital Adequacy Requirements (BCAR) Return provides Canadian regulators with quarterly status on the Bank's capitalization in relation to the risks it has assumed
- In Canada, the minimum ratio for Total Capital to Risk Assets and Total Assets is 8%

Credit Risk Data Architecture Overview

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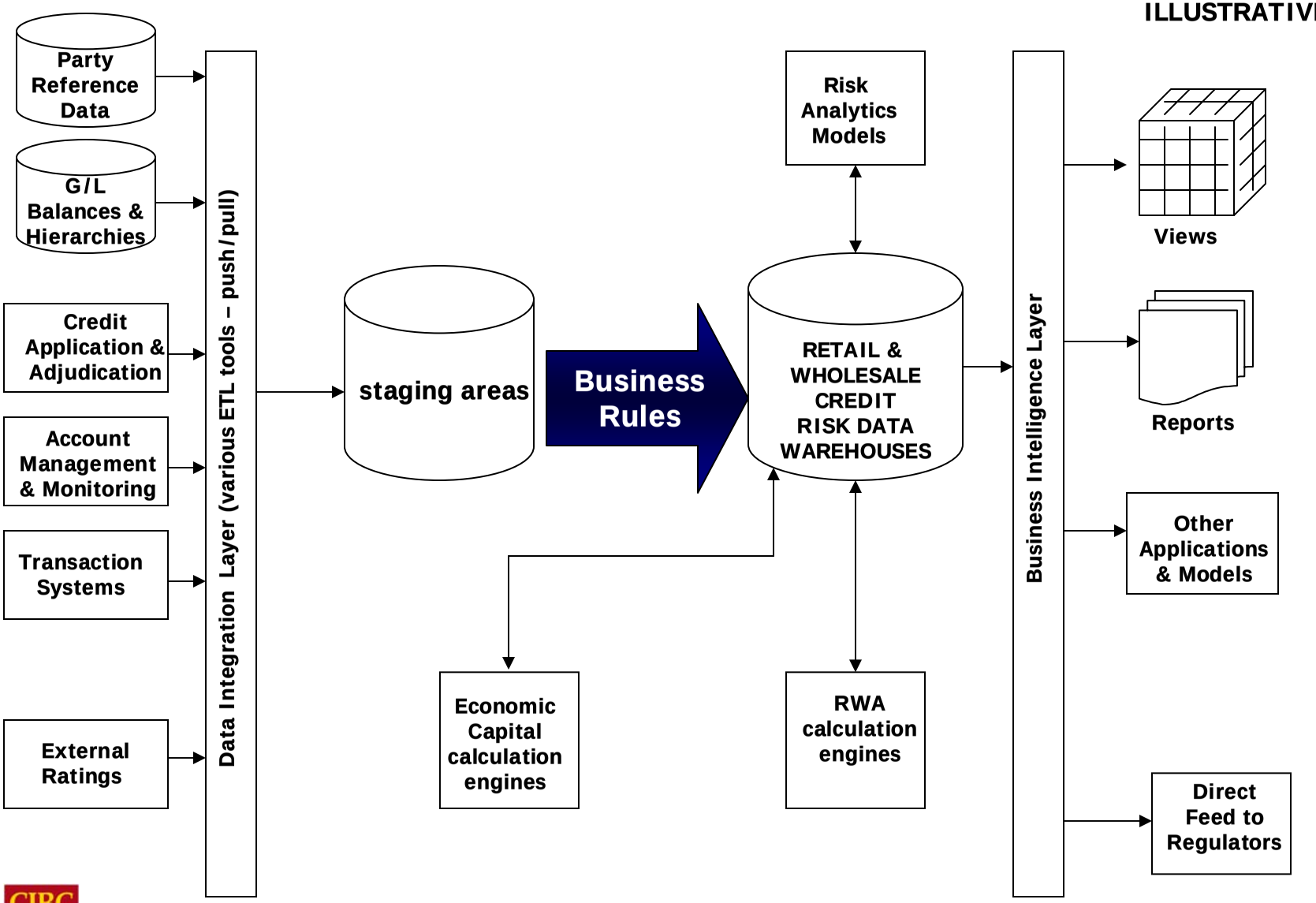

The Process for RWAs – Retail Credit Risk

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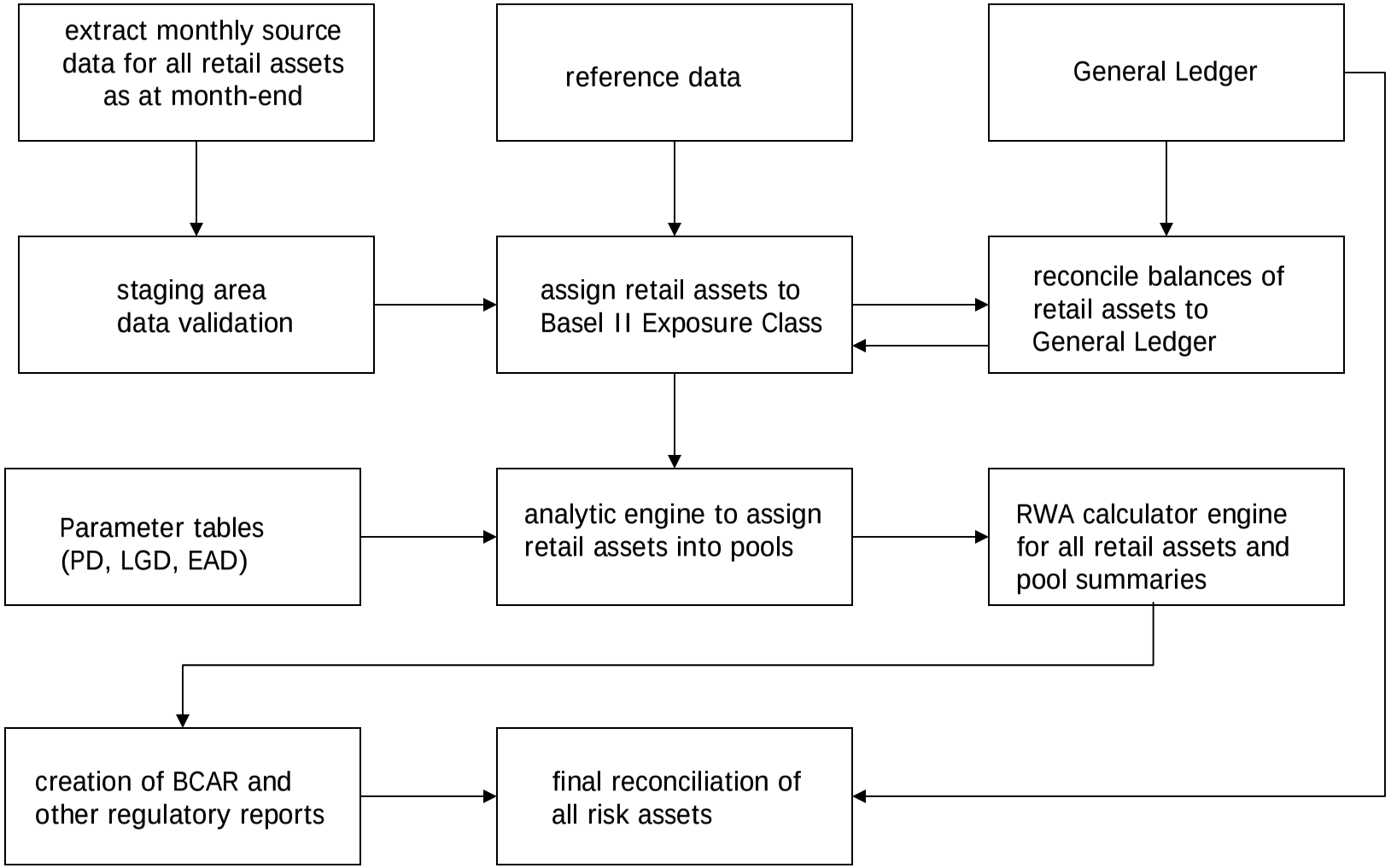
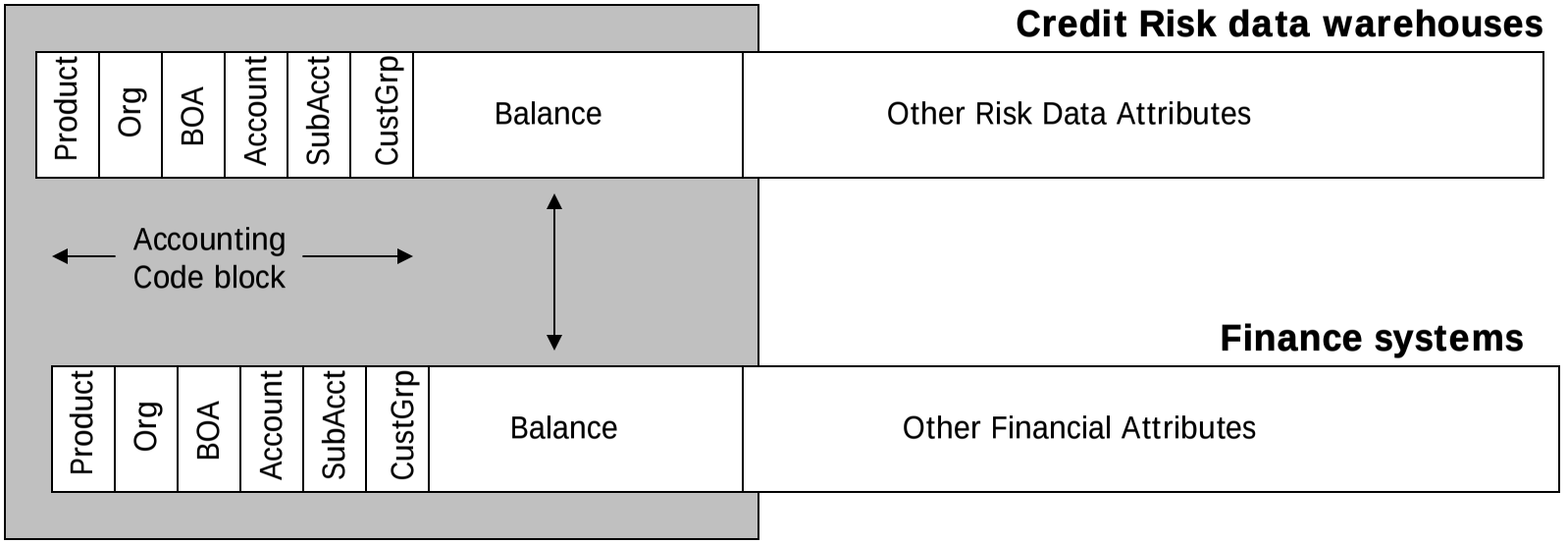
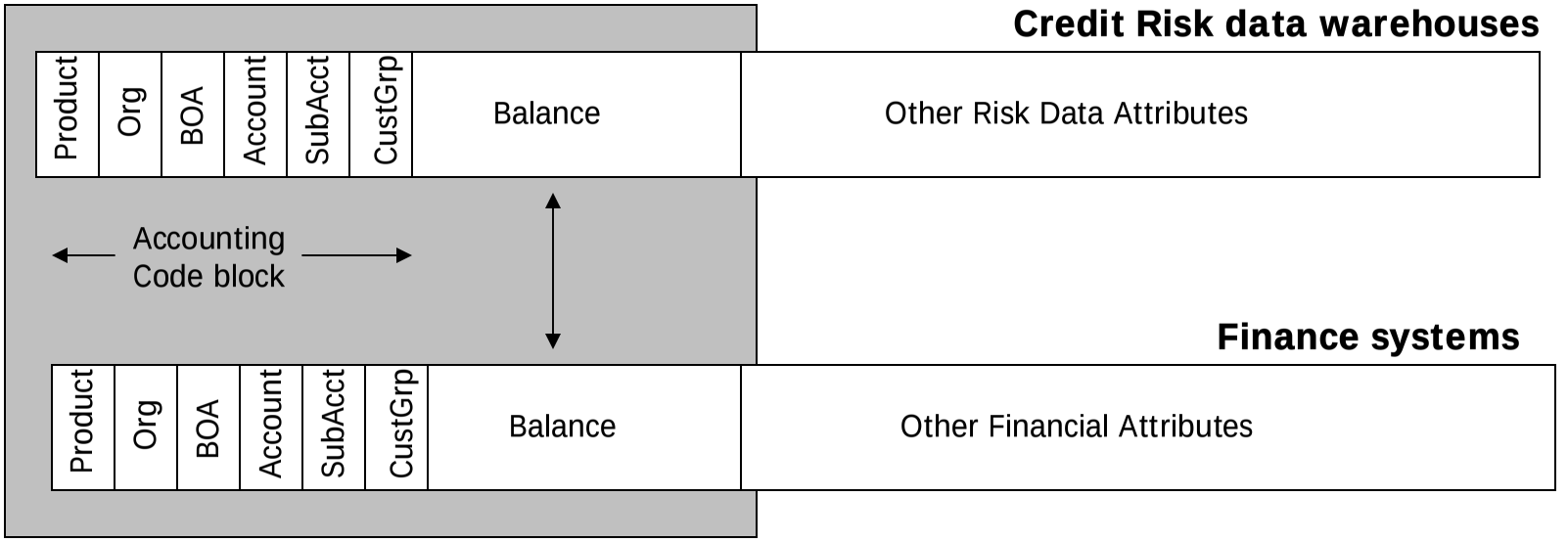


Reconciliation To The General Ledger



- **reconciliation is required for all Basel II Exposure Classes and Exposure Types (drawn, undrawn, other off-balance sheet)**

Reconciliation To The General Ledger



- reconciliation is required for all Basel II Exposure Classes and Exposure Types (drawn, undrawn, other off-balance sheet)

Challenges:

- **source systems are not unique by Basel II Exposure Class**
- **ensuring accurate booking of transactions across multiple source systems**

Analysis and Reporting

- multiple business stakeholders have regulatory and management reporting needs for credit risk data

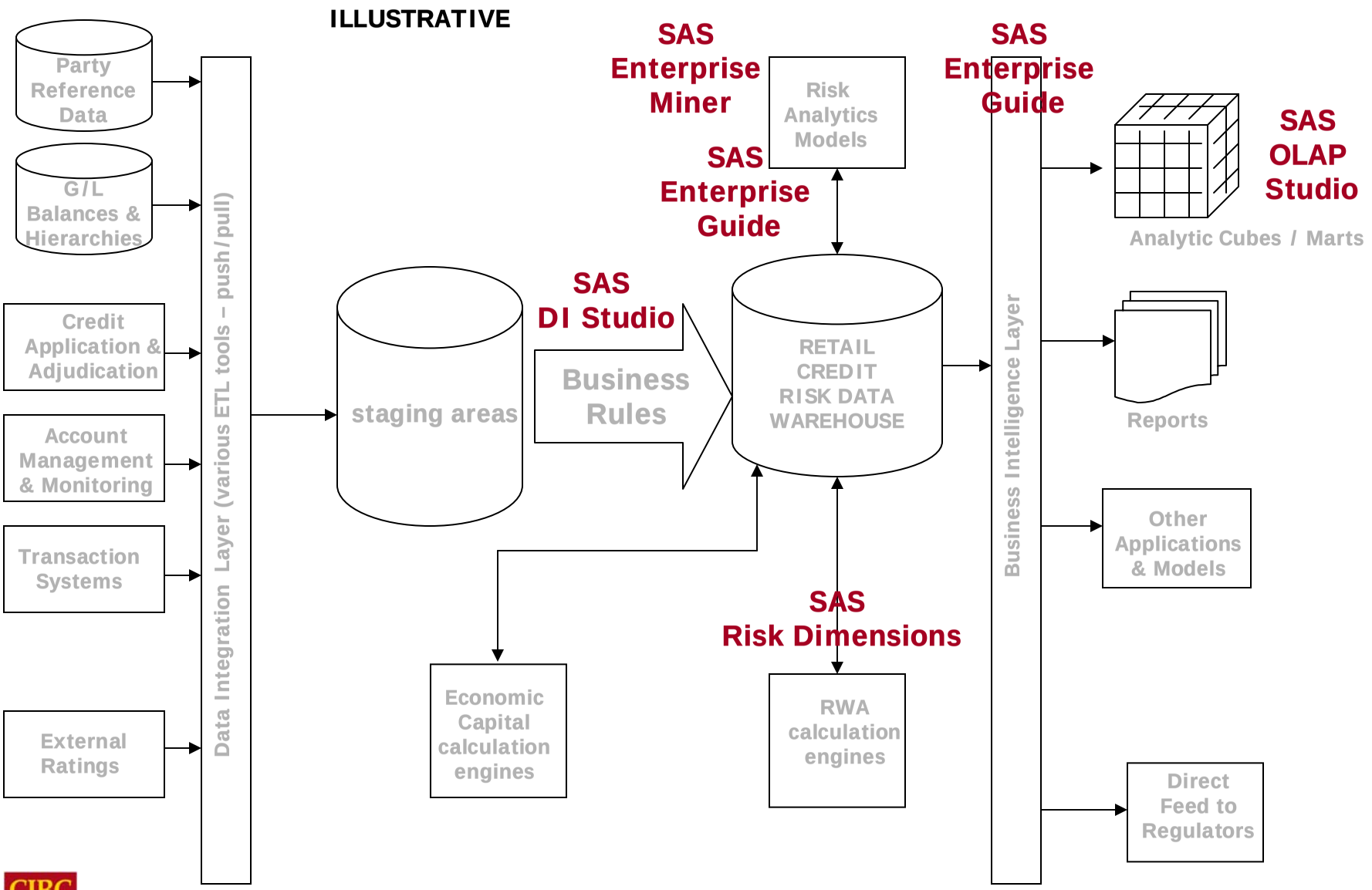
- Regulators require specific credit risk reports quarterly, due 30 days after fiscal quarter-end:
    - BCAR (Basel II regulatory capital)
    - NCR (new credit risks)

- Board of Directors and senior management oversight

- Line of Business Analysis of:
    - exposures, risk calculations (e.g., EAD, EL, RWA, etc.)
    - risk profiles - ODR/LGD distributions, etc.
    - portfolio metrics – geographic, industry, etc.

- Performance measurement of risk analytics models for continuous improvement

SAS Platform for Retail Credit Risk



Summary

- under Basel II AIRB, a bank will be able to self-assess and report minimum regulatory capital for credit risk

- approval and ongoing compliance is dependent upon banks demonstrating the integrity of their risk rating methodologies and data used to calculate regulatory capital

- senior management has accountability for establishing and monitoring the enterprise-wide observance of the risk data management framework

- the "payback on the Basel II investment" comes from the use of the new regulatory capital information for businesses to more effectively manage risk

While we are well on our way at CIBC, the journey continues…

Thank You

contact: rick.miller@cibc.ca