Financial Risk Management and Model-Based Design

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Introducing HSBC
HSBC – today
One of the world’s most important global financial institutions

HSBC is a market participant within the wider financial system
How is HSBC Structured as a Bank?

Global business

- RBWM
  - Deposits
  - Accounts services
  - Credit and lending
  - Asset management
  - Wealth solutions and financial planning
  - Broking
  - Life insurance manufacturing

- CMB
  - Deposits
  - Payments and cash management
  - Credit and lending
  - International trade and receivables finance
  - Commercial insurance and investments

- GB&M
  - Deposits
  - Payments and cash management
  - Balance sheet management
  - Credit and lending
  - Asset and trade finance
  - Corporate finance
  - Markets
  - Securities services

- GPB
  - Deposits
  - Account services
  - Credit and lending
  - Asset management
  - Financial advisory
  - Broking
  - Corporate finance (via GB&M)
  - Alternative investments

**Retail Credit Risk**

**Wholesale Credit Risk**
Introduction to Wholesale Credit Risk
Relationship Life-cycle (Retail vs Corporate)

Individual Customer

- Contribution Margin
- Break-Even
- Children account
- Credit is acquired
- House Building
- Retirement
- Saving for retirement
- Professional life
- Birth of child

Commercial Customer

- Business Activities
- International market
- Regional market
- Domestic market
- Years in Business
Customer Maturity Life Cycle
An example with Eli’s cheesecake factory

Eli’s Cheesecake Co. Life Cycle

- 1940: Ogden Huddle
- 1962: Eli’s Stage Delicatessen
- 1965: 1st Taste of Chicago
- 1980: 1st Wholesale Bakery
- 1984: Eli’s the Place for Steak opened doors
- 1990: 1993 International
- 1994 Fundraising
- 1995 Internet
- 1996 New State of the Art Eli’s Cheesecake World
- 2000 National Chain Accounts
- 2002 Mass Merchandisers and Club Stores
- 2003 Eli’s Cheesecake Bakery Tour named “Top Food Tour” in US by the Food Network
- 2008 Introduction of Skinny Eli
- 2009 Eli’s served at President Obama’s Inaugural Commander-in-Chief’s Ball

Global Risk
Corporate Customer Journey and Banking Needs

Starting A New Business
- Providing advisory services to estimate challenges in the new business
- Raising capital

Begin the operations

Operating as BAU
- Meet financial requirements in form of term loans, ODs, guarantees, etc
- Meet leasing requirements
- Meet the short term financing needs to manage initial hiccups in business
- Provide credit management services

Managing Investments and treasury
- Payment and cash management system
- Structured finance and loan syndication

Bringing in more efficacy in managing business

Expanding business
- Mergers and acquisitions
- Underwriting services
- Corporate investments
- Hedging all relevant risks
- Liquidity management

Life cycle of Business

Services & Products offered

Begin the operations
### Wholesale Banking Balance Sheet Composition and Risk Types

<table>
<thead>
<tr>
<th>Sources of Funds</th>
<th>Use of Funds On Balance Sheet</th>
<th>Use of Funds Off Balance Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savings / Demand Deposits</td>
<td>Fixed Assets</td>
<td>Guarantees</td>
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<tr>
<td>Time Deposits</td>
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<tr>
<td>Money Market -</td>
<td>Business Loans -</td>
<td>Stand by Letter of credit</td>
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<tr>
<td>Call, Notice Money</td>
<td>Working capital, Term Loans, LOC, Syndication, LBO, Commercial Real estate, Project Finance, Fx Loans, DC, Equipment Financing</td>
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<tr>
<td>Other Banks &amp; FIs</td>
<td></td>
<td>Derivatives -</td>
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<tr>
<td>Issuing Debt, Bonds</td>
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<td>Forwards, Swaps, etc.</td>
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<td>Refinance</td>
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<td>Securitisation</td>
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<tr>
<td>Capital from Shareholders</td>
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<td>Central Bank or Government</td>
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</tbody>
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**Credit Risk**

**Market Risk**
Global Risk Analytics
Global Risk Analytics
Our global function supports HSBC’s global businesses

Just as HSBC is a global business, GRA is a global function, with 650+ staff in offices across 17 cities in 10 countries. We provide support to all of the 67 countries and territories in which HSBC operates.
Risk exists in client relationships, our product offering, the markets we participate in and resulting transactions. These risks need to be identified, then measured, monitored and managed within the bank’s appetite and tolerance.

What is our Purpose?

➢ Provide cutting-edge tools to help manage risk and ensure compliance with both our internal policies and the requirements of our regulators.

Our Objectives are simple

➢ We build and manage solutions (models) to meet business & client needs, and provide end-to-end management of the models’ lifecycle, ensuring governance, control and appropriate usage.
Model Risk Management Framework

HSBC’s Model Risk Management Framework underpins everything GRA do. It ensures appropriate model risk management policies and governance framework exist; that models are developed and implemented robustly and appropriately; and that those models undergo appropriate validation and independent reviews pre and post implementation.

Notes

1 - Understand the reasons behind the creation of a model and the expectations for how the model output will be used

2 - Model is logical, developed robustly and appropriately for its intended purpose and is consistent with global standards.

3 - FLOD control to ensure model is conceptually sound, data used is appropriate and results meet intended purpose

4 - SLOD control where key models undergo an independent review to provide credible challenge and additional assurance to management, helping to identify limitations prior to model’s use.

5 - Model has received appropriate approval from the relevant authority or accountable individual(s) before use or implementation of the model

6 - Model has been implemented as per its original design and purpose and that appropriate testing have been performed before implementation

7 - Model is performing satisfactorily and being used as per its original design and purpose. This includes a number of activities including first line monitoring and validation, and independent validation and review

Compared to the Model Based Design V Diagram…

Key

- GRA responsibility
- Joint GRA responsibility
- Non GRA responsibility
Example Case Study: Long-dated Credit Exposure

➢ The trading book contains long-dated transactions.

➢ We need to simulate potential market outcomes to maturity of transaction (up to 70 years).

➢ The current approach is to consider 1,000 outcomes at up to 135 future time points.

➢ The result is that we need to re-calculate the portfolio up to **135,000 times**.

➢ This highly quantitative process requires extreme optimisation of simulation, pricing and aggregation algorithms.
Our journey with MathWorks
➢ Today, more time spent processing data than building models.
➢ Automation: finding data, generating reports, recoding models
➢ High cost of incorrect data assumptions causing models to be rejected by regulator.
➢ Need to iterate rapidly.
Mission: *Improve the pace, transparency and reproducibility of the model development and review processes through user-friendly tools that encourage a consistent approach.*

**What are the pain points?**
- Pace of building and reviewing models
- Ability to reproduce results
- Consistency of modeling approaches

**What is the solution?**
- MATLAB toolbox for risk modelling at HSBC
- Functions, apps, demos, and documentation
- Supports all stages of the workflow
- Leverages MATLAB toolboxes
- Target users: risk modellers and analysts
- Aims: improve pace, transparency, accuracy, reproducibility, consistency
Global Risk Model Execution Environment (MEE/wREN)

- Includes MATLAB Production Server in HSBC’s production environment
- APIs and conventions for calling models
- Infrastructure to connect directly to production data sources
- Runs legacy models and models built using MDE
Model Execution Environment (MEE/wREN)
GRA in a SLIDE

FROM THIS 

TO THIS

Poor Quality Models
Regulatory Scrutiny
High Cost
Inconsistency
Frustrated Users

SDLC Vendor Driven

Inconsistent runtimes

Expensive Vendors
Black-box technology

Data Federated at the Centre
Model Objects
External Cloud with access to tooling
Choice of aligned runtimes

Discovery
GRA as Service

getData
Model Execution

Data Madness
FROM THIS TO THIS

Reduced Cycle Time
Access to Tooling
Freedom to Analyse
Consistency
Lineage & Tractability
Low Cost

Agile/DevOps Focused
What Else?
Cloud Adoption
Cloud Adoption
Benefits of using cloud

• **Analytics requires significant compute power** yet this demand is not always **consistent**. Cloud allows compute power on-demand which we can use for a finite period and then demise.

• Cloud greatly increases the **speed that we can acquire additional compute power** (hours versus months under the traditional model of ordering our own servers) and **lower cost** (we only pay for what we use rather than idle time).

• Both **analytics and reporting processes can benefit from leveraging the cloud-based tools**. These are **typically cheaper** than our existing tools.

• Additionally, analytics and reporting can both benefit from the **additional security offered by the cloud** over our existing infrastructure and **improved collaboration** across legal entities and geographical boundaries.
Cloud Adoption
What are the use cases for cloud within Global Risk Analytics?

- Elastic Compute
- Cloud Based Reporting
- Collaborating with FinTechs & Academics
- Rebuilding Analytical Models
- Machine Learning
Cloud Adoption
Where are we now and what’s next?

• Since December 2016, we have:
  ✓ Completed the initial batch of proof of concepts:
    ✓ **Rebuilding risk reports** using dummy data on Google and MS Azure cloud.
    ✓ **Testing elastic compute** for RAVEN CR on AWS and Google using dummy data
    ✓ **De-sensitising production data** so that it can be shared with academics
    ✓ **Creating scalable cloud environments** to run analytics using MATLAB
  ✓ Set-up a **production environment in AWS Cloud with unmasked production data and MATLAB** for both Economic Capital (Op Risk) and Economic Capital (Credit – UK).

• Our **focus for H2 2017 is:**
  • Providing cloud environments to our **Innovation Champions** to run **proof of concepts**.
  • ** Scaling up production migrations** to cloud.
  • This will mean providing both our **business and IT colleagues** across Global Risk with **appropriate training** to use AWS and Google.