



# Addressing the Compliance Challenges of Basel III: FRTB Modellability Rules

Managing and pooling data to generate increased  
modellability reports

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# Introduction

The modern financial landscape is becoming increasingly data-driven. As time progresses, regulators are prescribing more rigorous data accuracy, breadth, and retention requirements in both explicit and implicit ways. Regulatory frameworks such as Basel III are set to transform many aspects of how financial institutions operate. As effective data management will be able to address an almost infinite array of business needs, to concentrate focus this white-paper will tackle the FRTB or 'Minimum capital requirements for market risk' component within Basel III.

First context is established to how the rules came into existence and what issues the regulatory framework looks to address. Afterwards, TickSmith proposes a data management solution that meets and excels in addressing the FRTB requirements. At last, for firms to greatly reduce capital charges past what they can achieve using only their own data, TickSmith and DataVault Innovations proposes the option to implement a Data Pooling solution on a highly scalable Amazon Web Services (AWS) cloud solution.





# ***FRTB***

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## ***Overview***

Financial institutions across the world are preparing for 2023, when FRTB rules will fall into place. FRTB will drastically change both how trading desks are structured internally and how risk teams will operate. Anticipating firms have already made the decision to dismantle a portion of their trading desks, based on the belief that these desks will cease to be profitable after 2023. The major book of work for effective FRTB compliance comes from building a solid data management layer to serve as the foundation into other applications.

In 2010, members of the Basel Committee on Banking Supervision introduced the updated Basel III framework in response to the failures of American financial institutions during the 2007-08 financial crisis. As of March 2019, twenty seven member jurisdictions including Canada, the European Union, China, and the United States have enforced relevant risk-based capital rules<sup>1</sup>. Twenty one member jurisdictions have also come out with final rules for the revised framework<sup>2</sup>. The rules focus on strengthening the supervision and risk management of banks. Additionally, the rules will increase capital charge requirements and incentivize banks to use their data to better track continuity of prices.

The 2007-08 financial crisis occurred in part by complex bundled securities such as collateralized debt obligations being drastically mispriced by financial institutions. A multitude of factors contributed to how these tranching securities became mispriced and misrated. A few key factors include rating agencies allegedly misrepresenting the risks of mortgage-related securities<sup>3</sup>, the irresponsible underwriting of certain bundled securities<sup>4</sup>, and the cultural belief within the United States that mortgage-related debts were more secure investments than they actually were<sup>5</sup>.

# ***FRTB Overview***

It was evident that during the mid-2000s, many banking institutions in America and globally lacked a careful and standard method to accurately price and assess the risks of certain securities. Many institutions were also found to have insufficient capital charge requirements to weather the default of these debt securities.

The FRTB or 'Minimum capital requirements for market risk' published by the Basel Committee introduces new regulations in assessing market positions and risk. As of January 2020, all trading institutions must integrate the new FRTB rules into their security pricing methodology by January 1, 2022<sup>6</sup>. However, due to global market volatility concerns beginning in February 2020, regulators around the world have pushed back on this date once more. The Basel Committee's oversight body, the Group of Central Bank Governors and Heads of Supervision (GHOS), has delayed the FRTB implementation date to January 1, 2023<sup>7</sup>. Local regulators will also be providing updates to when the new implementation dates per region will be. In Canada, for example, the Office of the Superintendent of Financial Institutions is delaying the Basel III reforms until Q1 2023<sup>8</sup>.

One important component of these rules state that all trading desks must calculate minimum capital risk requirements using the Standardized Approach (STA)<sup>9</sup>. There is, however, a less capital-intensive calculation option banks may use as well called the Internal Models Approach (IMA) that may apply to specific desks. The series of steps to use IMA involves nominating a trading desk, passing an overall assessment by a supervisor, and proving the frequency of observable prices over history per risk factor. The methodology outlined in FRTB to prove the frequency of observable prices is also known as calculating the "modellability" of risk factors. The option to use IMA for assessment allows banks to significantly lower capital charges on their trading book. On May 2018 following the pre-finalized set of FRTB rules, *McKinsey & Company* published research in the *FRTB reloaded: Overhauling the trading-risk infrastructure* white paper stating:

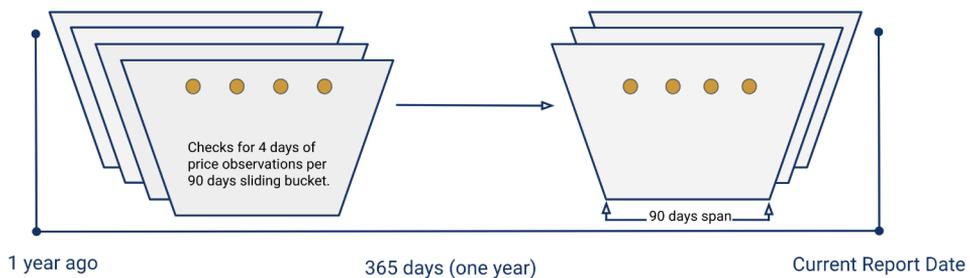
*Recent QIS and banks' internal analyses of FRTB's impact show that use of the IMA adds 50 percent to market risk RWAs, while STA adds 150 percent<sup>10</sup>.*

# FRTB Overview

The last step to use IMA involves calculating the risk factor eligibility test (RFET) otherwise known as determining the modellability of risk factors. The latest January 2019 finalized rules to the *Minimum capital requirements for market risk* document published by the Basel committee outlines:

*(1) The bank must identify for the risk factor at least 24 real price observations per year (measured over the period used to calibrate the current ES model, with no more than one real price observation per day to be included in this count). Moreover, over the previous 12 months there must be no 90-day period in which fewer than four real price observations are identified for the risk factor (with no more than one real price observation per day to be included in this count). The above criteria must be monitored on a monthly basis; or*

275 Buckets of 90 days means 275 checks



*(2) The bank must identify for the risk factor at least 100 “real” price observations over the previous 12 months (with no more than one “real” price observation per day to be included in this count).<sup>11</sup>*

# ***FRTB Overview***

Essentially, the first rule can be split into two components: a volume test and a frequency test. If both these tests are simultaneously met, modellability is achieved.

## **Rule I: Volume Test**

The rule 1 volume test checks for a minimum 24 days of price observations within the previous 12-month period.

## **Rule I: Frequency Test**

The rule 1 frequency test checks for a minimum of 4 days of price observations within any and all continuous 90-day periods within the previous 12-month period.

The second rule covers price observations with seasonality attributes. There is only a volume test that must be met for modellability to be achieved.

## **Rule II: Frequency Test**

The rule 2 frequency test checks for at least 100 days of price observations within the previous 12-month period.

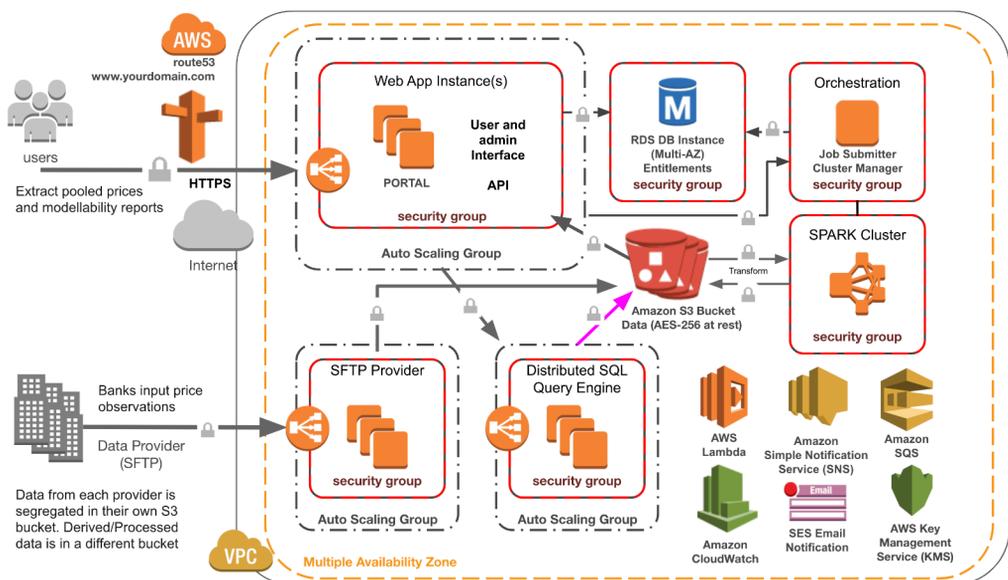
It is up to each firm to evaluate whether the lower capital charges from rigorous RFET calculations on price observations outweighs the implementation costs of the underlying technology used to organize data and compute this. NMRFs are built on a foundation of heavy data-driven models with millions of inputs. It is to be noted that as a result of global technological innovation in data management, it is likely that future regulators in the capital market space will only increase data governance and retention requirements. In fact, the introduction of MiFID II and FRTB rules along with more general regulations such as GDPR in recent years hints at the trend going in this direction. Therefore organizing data on an enterprise-wide level, cleaning the data, and combining it from disparate legacy systems to be able to effectively use data for multiple purposes is recommended regardless.



# Data Distribution & Modelling Analytics on the Cloud for FRTB

TickSmith GOLD - an acronym for *Gather, Organize, Leverage, and Distribute* - meets the industry standard for both internal and external data distribution, complete with monitoring tools and comprehensive entitlements. GOLD is able to store, normalize and run calculations on gigabytes to multi-petabytes of financial market data. This platform is ideal for processing and analyzing the large magnitudes of sensitive data required for Basel III compliance. Using a breadth of AWS technologies, GOLD runs on Amazon Simple Storage Service (Amazon S3) and Amazon Elastic Compute Cloud capabilities to autoscale processing tasks, efficiently handling any volume of data. Other AWS tools the platform is built on include, but are not limited to, Amazon Athena, Amazon CloudWatch, Amazon Simple Queue Service (Amazon SQS), and AWS Key Management Service (AWS KMS) to create and manage cryptographic keys.

Example Architecture Diagram for the Data Pooling Product



# ***Data Distribution & Modellability Analytics on the Cloud for FRTB***

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The GOLD Platform specializes in data cataloguing within Capital Markets and is also built as a generic product to handle the ingestion, organization, and normalization of semi-structured datasets, including alternative and over-the-counter data. Enterprise firms that have to work with disparate datasets from an array of siloed departments can easily do so using one central data management platform. Complete with ETL, data store, and data distribution capabilities, GOLD provides both the back-end data plumbing as well as a front-end interface where users can click and download straight from a portal.

The platform can process the private data your firm has on-hand, as well as partner with data vendors who are supplying feeds necessary for FRTB. This includes both the actual price observations datasets as well as metadata sets.

# Data Distribution & Modelling Analytics on the Cloud for FRTB

## Public Portal

GOLD provides a public portal to query, download, and run calculations on both raw as well as normalized data. Generated reports can be displayed for the public or made exportable for regulators. All this data is also available through APIs.

Product	Exchange	Category	Symbol	FOI	Cost
<input checked="" type="checkbox"/> Eurodollar Options	XCME	INTEREST RATES	GE	OPT	\$275 - \$16,500
<input type="checkbox"/> Eurodollar Futures	XCME	INTEREST RATES	GE	FUT	\$275 - \$16,500
<input type="checkbox"/> Eurodollar 1yr MC Options	XCME	INTEREST RATES	GE0	OPT	\$275 - \$16,500
<input type="checkbox"/> 5-Year T-Note Futures	XCBT	INTEREST RATES	ZF	FUT	\$275 - \$16,500
<input type="checkbox"/> 10-Year T-Note Futures	XCBT	INTEREST RATES	ZN	FUT	\$275 - \$16,500
<input type="checkbox"/> Eurodollar 2yr MC Options	XCME	INTEREST RATES	GE2	OPT	\$275 - \$16,500
<input type="checkbox"/> E-mini S&P 500 Futures	XCME	EQUITY INDEX	ES	FUT	\$275 - \$16,500
<input type="checkbox"/> Crude Oil Options	XNYM	ENERGY	LO	OPT	\$275 - \$16,500
<input type="checkbox"/> 10-Year T-Note Options	XCBT	INTEREST RATES	OZN	OPT	\$275 - \$16,500
<input type="checkbox"/> 2-Year T-Note Futures	XCBT	INTEREST RATES	ZT	FUT	\$275 - \$16,500

*Example Public Interface: The CME Group's entire data store of historical market data is handled by TickSmith GOLD*

## Public Portal

For firm-sensitive data, GOLD can categorize and store massive amounts of data with granular access entitlements for compliance or internal documentation purposes. Processing tasks can be performed to generate derived datasets that can be fed back into the platform. All this data is made available via the portal or programmatic APIs.

*Example Private Interface: Private bond trade data organized on the portal*

Execution Date	Execution Time	Settlement Date	Transaction Type	Counterparty Type	Customer
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...
20190926	...	...	...	...	...

# Data Distribution & Modellability Analytics on the Cloud for FRTB

## Modellability Reports

By loading a firm's private pricing data per asset class which can include trades and committed quotes as well as security master sets, the platform will give users the ability to self-define risk factors and process their own modellability reports. GOLD can automate the generation of reports that would otherwise take intensive human capital to produce with conventional database management systems.

*Example simple modellability report for bond data bucketed on the instrument-level*

	View Observations	Download Observations	Sliding Frequency & Volume Test	100 Days Volume Test	Losing Sliding Frequency & Volume...
216	<a href="#">View Observations</a>	<a href="#">Download Observations</a>	True	True	2020-04-22
217	<a href="#">View Observations</a>	<a href="#">Download Observations</a>	True	False	2020-04-23
218	<a href="#">View Observations</a>	<a href="#">Download Observations</a>	True	False	2020-04-23
219	<a href="#">View Observations</a>	<a href="#">Download Observations</a>	True	False	2020-04-23
220	<a href="#">View Observations</a>	<a href="#">Download Observations</a>	True	False	2020-04-23
221	<a href="#">View Observations</a>	<a href="#">Download Observations</a>	True	True	2020-04-23
222	<a href="#">View Observations</a>	<a href="#">Download Observations</a>	True	False	2020-04-23

*Example custom modellability report filters for user-defined bucketed overnight interest rate swap data*

**Modellability Report - OIS**

Bank:

Term to Maturity:  (0-3 years, 3-7 years, 7+)

Currency:   Only show modellable

Report Date:

# Data Distribution & Modellability

## Analytics on the Cloud for FRTB

### Data Configurations

Firms using TickSmith GOLD are able to assign validations and transformations from the ETL process, essentially being able to normalize their own data on the platform according to their data models themselves through configuration files. This way, the GOLD Software Platform gives its users the tools to organize their data themselves. Additionally after setup, users are able to associate advanced configuration files to define their own risk-factor mappings and process their own data in a self-serve manner.

#### A Conditional Required field with a Regex Validation

In this example, there is one field which is specified as conditional required based on the value of another field. By combining our ConditionalOnFieldValueValidation with a NotNullValidation and a RegexValidation, a user could ensure that when the field "trans\_type" is equal to 1 or 2, that our field "orig\_trade\_id" is not null, and that it begins with 8 digits representing the date followed by up to 22 additional characters.

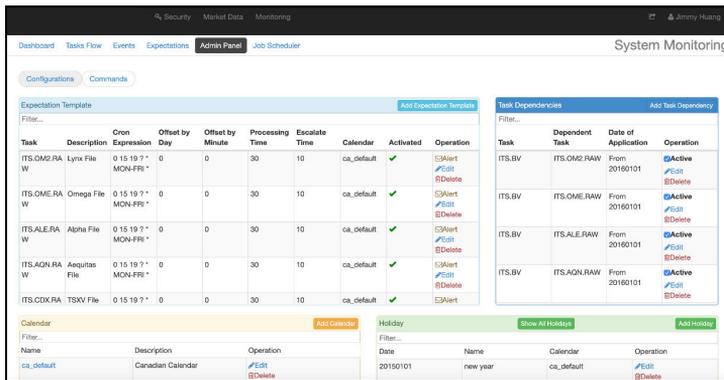
```
{
  "inputName": "orig_trade_id",
  "fieldPipeline": [
    {
      "type": "ConditionalOnFieldValueValidation",
      "nonCriticalError": true,
      "conditions": {
        {
          "regex": "1|2",
          "fieldDependency": {
            "useOriginal": true,
            "fieldName": "trans_type"
          }
        }
      }
    },
    {
      "type": "NotNullValidation",
      "nonCriticalError": true
    },
    {
      "type": "RegexValidation",
      "nonCriticalError": true,
      "inputFormats": [
        "[0-9]{8}.(0,22)"
      ]
    }
  ]
},
```

*Example data configuration file  
for validating data content*

### Data Monitoring

The monitor is configured with expectations of tasks to be completed by a certain time including the ingestion of data or the processing of downstream files. If a task fails or is not completed by that configured time the monitor can start an escalation process with specific market calendar support. The monitor has a web dashboard where administrators can see the latest events, the expected events, and the events that have triggered an alert. Admin accounts also have access to all the event logs.

# Data Distribution & Modellability Analytics on the Cloud for FRTB



Example monitor admin panel to set up expectation for files

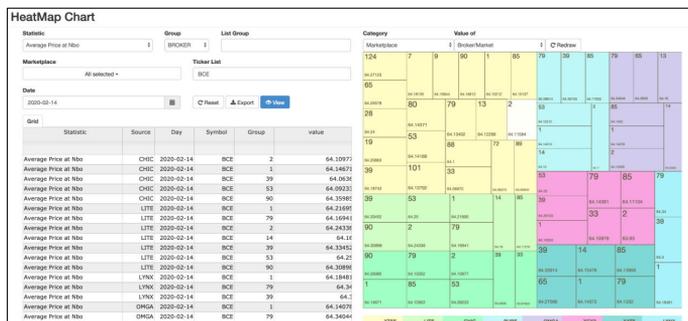
## Entitlements/Security

TickSmith GOLD is a data management platform that does not own any data. The data that GOLD manages sits in the client's AWS environment and they retain complete ownership and control of it. GOLD allows proprietary information to sit only with the client. Additionally, for the data pooling use-case, data is encrypted at-rest and in-flight with groups and roles-based entitlements. Entitlements on granular data content can be distinguished by tables, files, and, even on a row-by-row basis.

## Data Visualization

TickSmith offers a variety of data visualization options depending on the type of data being visualized. Examples include, but are not limited to, web interface views to processed time series data, rollup data, heatmap charts, and line charts representing analytics with file export options. Any additional third-party data visualization tools can be easily integrated into the platform as well (such as Tableau, Matlab, etc.).

Example heatmap chart representation of analytics



# Improving FRTB Modellability through Data Pooling & Anonymization

DataVault Innovations' Data Pooling product built using GOLD is able to take in private price observation data including trades and committed quotes from multiple banks into a secure data platform. The product leverages data from different sources to produce pooled reports that increases the number of modellable risk factor definitions back to each participant bank and works with data from all asset classes internationally

*Pooled, normalized, and anonymized bond price observations from multiple firms to feed risk applications*

**Pooled Price Observations**

Report Date: 2/7/2020 | Observation Date Time: All time

Quantity Range: [ ] | Price Range: [ ]

Reset All Filters | View (10,000 max) | Export

Number of rows : 10000

	Security Short Name	Observation Date	Observation Time	Quantity	Currency	Price	Observation Type
499	BC PROV CA/5.4 DEB 20350618 UNSEC	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
500	BC PROV CA/5.4 DEB 20350618 UNSEC	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
501	BC PROV CA/5.4 DEB 20350618 UNSEC	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
502	BC PROV CA/5.4 DEB 20350618 UNSEC	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
503	BC PROV CA/5.4 DEB 20350618 UNSEC	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
504	BC PROV CA/5.4 DEB 20350618 UNSEC	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
505	BC PROV CA/5.4 DEB 20350618 UNSEC	20190208	Anonymized	Anonymized	CAD	Anonymized	TRADE
506	BC PROV CA/5.7 PMT IN KIND DEB	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
507	BC PROV CA/5.7 PMT IN KIND DEB	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
508	BC PROV CA/5.7 PMT IN KIND DEB	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
509	BC PROV CA/5.7 PMT IN KIND DEB	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE
510	BC PROV CA/5.7 PMT IN KIND DEB	20190207	Anonymized	Anonymized	CAD	Anonymized	TRADE

# ***Improving FRTB Modellability through Data Pooling & Anonymization***

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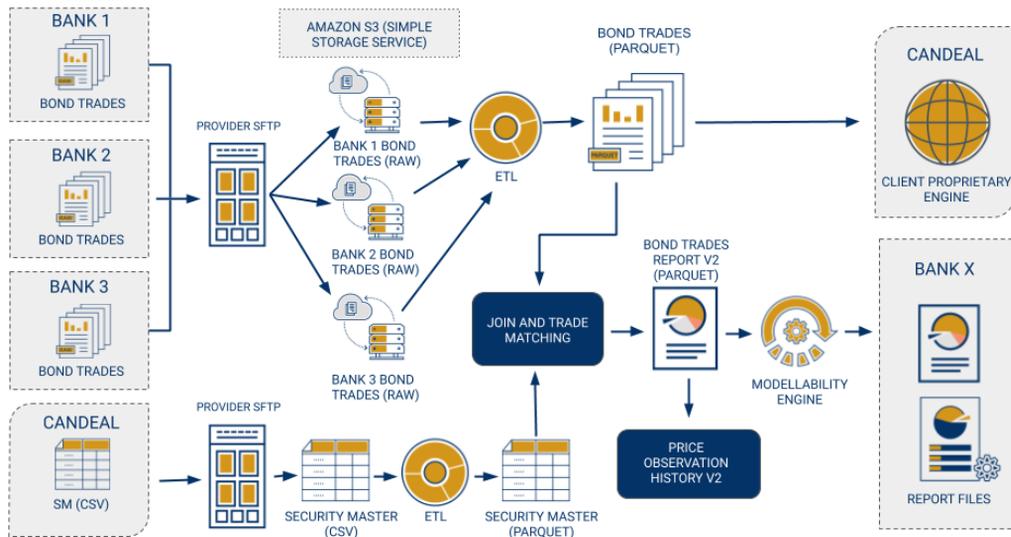
CanDeal and the six largest banks in Canada formed a service known as DataVault Innovations that configured TickSmith's technology to generate pooled modellability reports in the world's first production-grade data pool for FRTB. The platform leverages big data technologies such as Apache Spark to process the data and massively parallel processing query engines to filter and extract data. When the efficacy of the data pool is analyzed for the bond asset class, every participating bank has been able to prove that their number of modellable instruments and risk factors have consistently increased by several times over. This allows market risk teams within the banks to use the Internal Models Approach for wider sets of instruments and massively reduce their capital fees. Using the Internal Models Approach can mean the difference between being able to keep certain trading desks profitable and having to restructure.

Participating banks using the Data Pooling product consist of *BMO Nesbitt Burns Inc.*, *CIBC World Markets*, *National Bank Financial Inc.*, *RBC Capital Markets*, *Scotia Capital*, and *TD Securities*. First, the price observation data that comes from the different banks are segregated and then the data is anonymized to comply with information security requirements. Private information such as bank identifier and counterparty identifier are redacted. After the data is pooled, modellability calculations are run on the pooled set and modellability reports are delivered back to each participant. Throughout this process, data is encrypted at-rest and in-flight ensuring complete data protection.

TickSmith GOLD has proven to be the industry standard platform capable of working with any asset class from simple data products to the most complex ones including, but not limited to, equity data, futures, options, all types of bonds (including corporates, government, etc.), repurchase agreements (Repos), and all types of interest rate derivatives (including OIS, basis, swaptions, etc.).

# Improving FRTB Modellability through Data Pooling & Anonymization

Example Data Flow Diagram for the Data Pooling Product

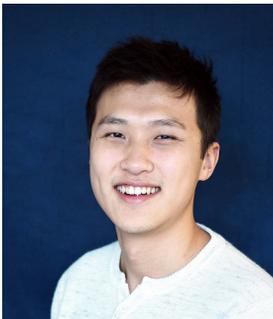


TickSmith GOLD provides advanced and easy user-customizable configurations for data validation and normalization tasks. If price observation data is received in different file formats with unstandardized content from multiple sources, the platform automatically monitors, validates, transforms, and organizes data coming in to combine with a security master set, thereby producing a fully enhanced and clean data pool. After anonymization, each participant can also extract pooled data they have entitlements to in order to build internal applications on top. Having this fully open and secure platform as well as the ability to feed data into other downstream systems gives clients both security as well as flexibility to work with their own proprietary data as they please.

Additional advantages to the Data Pool Solution is that each firm's data is already structured and easily accessible via APIs or as files so each participant can feed their own proprietary pricing data into other internal processes as well as to different departments with distinct entitlements. Amazon Simple Storage Service (Amazon S3) allows the platform to store data in segregated locations to meet information security requirements while at the same time maintaining high resiliency and granular entitlement accesses. Firms are able to monetize their own data by easily packaging it into data products for sale or by being able to make data-driven business decisions.

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## About the Author

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Jimmy Huang, the Data Pooling lead at TickSmith began collaborating with CanDeal 3 years ago on this innovative concept to pool data from the top 6 Canadian banks for FRTB purposes. He's been onsite from the beginning of the project as the big data expertise but through interacting with every participating bank on a biweekly basis for these years, he was able to fundamentally understand their collective needs. TickSmith's secure data pool with modellability report generation is currently in production with the six Canadian banks.



## About TickSmith

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We combine cutting-edge technology and a deep knowledge in Capital Markets. Our scalable and modular GOLD software platform is crucial in today's data-driven economy. GOLD— an acronym for gather, organize, leverage and distribute— is a robust end-to-end data management and analytics solution optimized for the cloud.

Financial enterprises accumulate massive amounts of data that is scattered all over the place and key insights are lost in the mountains of data. Our GOLD Platform securely processes thousands of data sets, productizes data flows, automates management, enrichment & delivery and enables petabytes of data.



CANDEAL

## **About DataVault Innovations**

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DataVault Innovations is a CanDeal data business. It works closely with the market to ensure more efficient regulatory compliance and to democratize access to pricing and security master data. Its shareholders include BMO Nesbitt Burns, CIBC World Markets, National Bank Financial, RBC Capital Markets, Scotia Capital, and TD Securities.



## About Amazon Web Services

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For 14 years, Amazon Web Services has been the world's most comprehensive and broadly adopted cloud platform. AWS offers over 175 fully featured services for compute, storage, databases, networking, analytics, robotics, machine learning and artificial intelligence (AI), Internet of Things (IoT), mobile, security, hybrid, virtual and augmented reality (VR and AR), media, and application development, deployment, and management from 76 Availability Zones (AZs) within 24 geographic regions, with announced plans for nine more Availability Zones and three more AWS Regions in Indonesia, Japan, and Spain. Millions of customers—including the fastest-growing startups, largest enterprises, and leading government agencies—trust AWS to power their infrastructure, become more agile, and lower costs. To learn more about AWS, visit [aws.amazon.com](https://aws.amazon.com).