

# Migrating from Numerix CrossAsset XL to CAIL

Value Proposition

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# 1. Numerix CrossAsset – Why Migrate CAXL to CAIL?

Numerix CrossAsset is a powerful library of methods and models for quantitative finance. A very common way to apply the vast library functionalities is via CrossAsset XL (CAXL), i.e. via an add-in for Microsoft Excel. Even though this is quick and easy to set up, this solution does have significant disadvantages in a productive system and when performing automated calculations. The newly developed CrossAsset Integration Layer (CAIL) provides a different way to interface with CrossAsset and alleviates these disadvantages.

## 1.1. Typical Issues with Pricing Platforms Based on Numerix CrossAsset XL

By applying CrossAsset XL (CAXL) to interface with Numerix CrossAsset the library objects (static data, market data, methods, models etc.) are defined within the cells of an Excel spreadsheet using key-value-pairs and are subsequently consigned by invoking Excel formulae. This set-up has several downsides as outlined below.

- **Flexibility constraints by mixing trade data, models and reports**  
Models, calibration instruments and market data, for example interest rate curves and volatility, are typically hard-linked via object-IDs. This does not offer any level of flexibility regarding adaptation of discounting methods or of underlying models. In its simplest level of abstraction, when a trade is to be priced using a differing discounting method, the entire workbook is duplicated and new IDs for the discount and forward curves are created.
- **Audit compliance issues**  
Changes to the workbooks are retrospectively often extremely difficult to comprehend. There are insufficient safety checks determining that only the declared changes were made, as is the case for most applications running via Excel.
- **Maintainability constraints**  
IT departments are usually not in the position to monitor the entire depth of the processes generated by Numerix CrossAsset XL. The code is often maintained by the corresponding business departments. Any errors made are therefore difficult to be recognised by IT. As the code commonly has been developed over time and often not in a modular fashion, it becomes equally difficult to both maintain and further develop.
- **No clear boundaries between business departments and IT**  
As a result of code being maintained by the respective business departments, there is often no clear distinction between the role of that department and that of IT.
- **Transparency handicaps**  
Overviews of the portfolio, as well as the models and methods used, must be manually generated/ maintained and are therefore time-consuming and prone to errors.
- **Not properly versioned input data with multiple references**  
Unclearly defined and multiple referenced data objects can lead to unstable calculation and modelling results.
- **Efforts for calculation increase as complexity of workbooks expand**  
Due to the set-up in Excel, multi-threading on a server with multiple cores is not easily obtained.
- **Significant manual efforts commonly go hand in hand with high operational risk**  
Adjustments (e.g. the implementation of a new sensitivity) require changes in workbooks for a great number of trades.

## 1.2. Benefits of Migrating from Numerix CAXL to CAIL

The new pricing platform Numerix CrossAsset Integration Layer (CAIL) is the latest development from Numerix. It is available for .Net, C++ and Java environments and facilitates the easy development of application with CrossAsset SDK. With CAIL it is possible to encapsulate several objects from the CrossAsset library within one template, e.g. a common financial product. Furthermore, custom input parameters and output reports may be defined. These abstract templates are accompanied with so-called instances, which contain the trade specific information. The definition of templates and setup of instances is carried out most simply via the Numerix Template Studio software, which provides a sophisticated

GUI for such tasks. Following this methodology, it is possible to configure, test and debug complicated CrossAsset structures without the need for Excel and CrossAsset XL (CAXL). The templates and instances are all managed in one repository, i.e. a collection of text files in a certain folder structure. Additionally, Numerix CAIL provides the Numerix Scripting Language (NXSL) as well as an advanced settings and policy framework. This architecture allows complex custom interrelations to be realised effortlessly and consistently over an entire portfolio, such as changing the discounting approach in a multi curve setup. Migrating an existing Numerix portfolio from CrossAsset XL to the new Numerix software solution CrossAsset Integration Layer provides our clients with numerous benefits ranging from potential savings (e.g. lower maintenance costs) to reduced operational risk, while simultaneously enhancing the daily valuation by a more flexible and sophisticated pricing framework (e.g. advanced adaptability to integrated OIS discounting or more flexible models w.r.t. negative interest rates). Together with Numerix, DEVnet provides a unique set of solutions to migrate an existing Numerix portfolio from CAXL to CAIL and at the same time solve valuation issues and audit findings, as well as make necessary market adjustments.

- **Flexibility**

Many aspects of the valuation approach can easily be amended or extended for the whole portfolio. Resulting outputs are changed globally via adjustments to the corresponding scripts. Changes to outputs on an individual workbook basis are no longer required.

- **Audit compliance**

Through revision control in Subversion all changes can easily be tracked. This is further enhanced as a result of the simple text file system underlying CAIL.

- **Maintainability**

With CAIL it is much easier as with preceding architectures to delegate error messages to a job scheduler and thus leaves the IT department in a better position to resume responsibility for monitoring the process. The pricing environment is no longer based on an Excel based cluster.

- **Segmentation between business and IT departments**

The business departments are no longer required to perform software development.

- **Transparency**

The level of abstraction allows to quickly gain a broad overview of the whole system while still providing complete access to the details if necessary. The text file nature of the whole repository makes it simple to search for specific information.

- **Encapsulated, versioned and controlled data**

Custom made software is provided by DEVnet to collect, preserve and analyse any given data set – a.k.a. data forensic and analytics – with the goal to migrate it to an encapsulated, versioned and controlled but also audit safe environment.

- **Improve valuation performance by usage of multi-threading**

CAIL allows to set up multi-threading on servers with multiple cores in an easy fashion as to increase calculation performance (time wise as well as accuracy wise).

- **Mitigated operational risk due to tested and signed off changes in a controlled environment**

The business departments do not require user rights for the production environment. All tasks can be completed within a development environment. Changes made in the production environment can be made per checkout from Subversion.

### 1.3. DEVnet Services to Facilitate the Migration from CAXL to CAIL

DEVnet provides a unique set of tools, experience, and know-how to facilitate entire portfolio migrations from CAXL to CAIL. This includes an in-depth knowledge of common but also highly structured securities in order to fully analyse and specify all components and dependencies from a financial engineering perspective, as well as all the necessary market and configuration data.

DEVnet also offers the essential IT expertise to migrate existing CAXL set-ups, which are embedded in specific IT landscapes and environments with many dependencies to other systems, to CAIL which enables a more structured and efficient overall architecture. DEVnet's capabilities are accompanied by custom-built tools and applications to support the migration process and also effectively reduce time to market.

## 2. Specific Issues and Custom Solutions

Numerix solutions in general and CrossAsset in particular are widely used in the financial industry, i.a. investment and universal banks, government and development banks, asset managers, hedge funds, insurances, auditors and advisories, etc. Usually, there are different business units and departments that have various dependencies with and interests in single components of a Numerix based solution, e.g. when migrating existing components to a new system.

### 2.1. Client Groups and Business Units

Within a corporation, different departments and business units have individual interests and specific concerns with regards to the usage of the particular Numerix platform. For example, Valuation and Quant departments often encounter issues that are opposite or even unrelated to concerns of other departments such as IT, Market Data or Risk. Only a holistic solution combined with a bespoke integration and individual interfaces can meet and satisfy such diverse requirements. In contrast to Excel based approaches such as Numerix CAXL, Numerix CAIL together with DEVnet's unique set of tools, experience, and know-how can provide the means to deliver such integrated but also individualised solutions.

### 2.2. Department and Business Unit Specific Issues

In the following sections, we would like to outline common requirements and issues encountered by different business departments.

#### 2.2.1. Common Business and Valuation Department Requirements and Issues

- Change costs need to be minimised. Consistent portfolio wide amendments are difficult and time consuming to realise in a CAXL set-up, e.g. adjusting all interest rate models to handle negative interest rates.
- Securities often need to be discounted with different discounting methods. Consequently, a sophisticated multi-curve pricing approach is required for the entire portfolio valuation. It is usually quite cumbersome to manage multi-curve frameworks with CAXL based approaches.
- Extending but also maintaining a portfolio is work and cost intensive. An Excel based tool cluster usually intensifies this problem.
- Excel or CAXL based interfaces to Front, Middle or Back Office systems are frequently not synchronised or standardised.
- With CAXL the segregation of duties between Business and IT is often difficult to define, especially if business logic is maintained by IT and/ or VBA code is necessary to process the daily valuation.
- Operational risk must be minimised, especially regarding the daily valuation processes.
- The integration using Excel (CAXL) imposes limitations to the amount of calculations that may be performed. Going beyond these limitations, e.g. estimating numerical errors for the whole portfolio, is cumbersome and can lead to instabilities.

#### 2.2.2. Common IT Issues

- Monitoring and logging a productive valuation process can be cumbersome, especially when interfacing to an Excel based and clustered environment.
- With CAXL the segregation of duties between Business and IT is often difficult to define, especially if business logic is maintained by IT and/ or VBA code is applied to process the daily valuation.

- Reducing maintenance costs can be challenging in an Excel based and clustered environment.

### 2.2.3. Common Compliance Issues

- Excel based implementations, such as CAXL or End User Computations (EUCs), are complicated to include in a release cycle. For compliance as well as auditory reasons, it is important to track what changes were implemented at the respective point in time.

### 2.2.4. Common Market Data Issues

- Validated market data needs to be available and checked on a daily basis. Excel based approaches are usually error-prone, need manual adjustments and have high maintenance costs.
- Checks that are run to visualise and validate market quotes are often set up in Excel. These tools are End User Computations (EUCs). Basel III as well as Solvency II include regulations concerning the usage and the riskiness of EUCs and requires banks and insurances to account for that risk by accumulating a corresponding risk reserve.
- In order for validated market data to be consumed by Numerix or other systems, the quality of the market data has to be guaranteed by eliminating any suspicious market quotes by means of detailed validity checks. Market data elements require certain standards on structural set-ups and conventions. CAXL does not provide out of the box tools to automate and version the required market data.

## 2.3. Common Risk Issues

High operational risk due to significant manual efforts: Adjustments (e.g. the implementation of a new sensitivity) require changes in CAXL workbooks for a great number of trades.

### 2.3.1. Manual steps within a CAXL framework together with insufficiently controlled market data can lead to unreliable valuation results.

- An entire portfolio valuation usually needs to be completed in a specific timeframe, i.e. over-night., This imposes restrictions on the calculation time of each trade. In order to meet the given timelines, the valuation quality may have to be decreased for specific trades.

### 2.3.2. Possible Solutions and Benefits for IT Departments

- Numerix CAIL enables easier change management due to simplified knowledge transfer as well as effort and risk mitigation through a cleaner architecture for batch runs
- Monitoring and controlling of the entire batch run is possible
- Numerix CAIL is independent of any MS Office version
- Clearer separation from IT and Business responsibilities as well as more flexible, quicker and less expensive maintenance

### 2.3.3. Possible Solutions and Benefits for the Compliance Departments

- Numerix CAIL is a text-file based application. Hence, the introduction into a release cycle can be easily maintained and could thus reduce the efforts for the compliance department and increase the audit safeness.

### 2.3.4. Possible Solutions and Benefits for Market Data Departments

- The CAIL market data repository provides a far more advanced, replicable and safe way to store market data and create reproducible valuations.
- CAIL provides the functionality to validate market quotes within the system. This can reduce the costs for EUC-risks on the market data side.

- Encapsulated, versioned and controlled data: Together with Numerix, DEVnet provides solutions to collect, preserve and analyse any given data set – a.k.a. data forensic and analytics – with the goal to migrate it to an encapsulated, versioned and controlled but also audit safe environment.

### 2.3.5. Possible Solutions and Benefits for Risk Departments

- Operational risk is easily minimised by migrating from a clustered Excel environment to a more streamlined, stable and integrated CAIL environment.
- Risk mitigation by CAIL through the ability to monitor and control entire batch runs.
- Multi-threading as well as the easy implementation of different models allows for a decrease in operational and modelling risk when conducting non-generic stress tests for a sub-portfolio.

## 3. Further Details on Numerix CrossAsset – CAXL & CAIL

Numerix CrossAsset is based on a powerful library of methods and models for quantitative finance. Models for all asset classes like interest rates, foreign exchange, credit, inflation, commodities and equities are available in this library. Advanced methods for building hybrid models by combining component models are available. The calibration to market data and calculation of risk figures like sensitivities and stress-testing results are also provided by the library. A payoff scripting language for describing the payoff structure of derivatives is integrated into the library. This scripting language provides an integrated and straightforward solution to customise specific deals and models, e.g. special payoffs of range accruals or power reverse dual-currency notes.

### 3.1. Numerix CrossAsset XL (CAXL)

There are several ways to interact with the Numerix CrossAsset valuation library. The most direct way to call methods from the model library is to use **Numerix CrossAsset XL (CAXL)**, a plug-in for Microsoft Excel. Objects from the Numerix CrossAsset model library are defined by a set of cells in a spreadsheet. These cells comprise header-value pairs, which are passed as parameters to a function provided by CAXL which in turn invokes the CrossAsset library. Excel based solutions are perfect tools for front office systems, e.g. for pre-trade price discovery or for testing trading strategies. However, CAXL is used in many banks in the context of risk management and reporting of P&L, sensitivities, and stress-test results. The setup of CAXL in a risk management environment is usually to have a set of Excel workbooks which describe a portfolio of trades. Market data is often supplied by a separate Excel workbook which contains market data elements and is updated at least once a day. Sensitivity and stress-testing reports can be set up in separate workbooks or be contained in the trade workbooks. The easiest way to export data from Excel workbooks into another system is usually via CSV files.

A set of Excel workbooks can be automatically calculated via the .NET framework, VBA macros, Visual Basic Script, Python and many other languages and frameworks via specific APIs. Usually a job scheduler is needed for automating a CAXL based batch run.

### 3.2. Numerix CrossAsset Integration Layer (CAIL)

Another way to interface with the Numerix CrossAsset model library is the **CrossAsset Integration Layer (CAIL)**. CAIL is an API which is based on a repository. This repository contains templates usually in the form of text files. Templates combine one or more objects from the Numerix CrossAsset model library with a set of input parameters and outputs, based on the specific requirements. Templates may be defined for trades, models, market data elements and portfolio wide reports. A calculation in CAIL usually starts with the instantiation of a trade template by specifying all required input parameters. Additional templates, e.g. a model template and market data elements, are linked to the trade template via look-up rules. Market data and fixing histories can be provided to CAIL via unified CSV files, which contain simple key – value pairs. Numerix Template Studio facilitates the creation and testing of new templates and instantiation files with a efficient GUI.