The complete guide to extracting bond data from Eikon (as far as I know)

This guide is written after one year's worth of experience with Eikon. Therefore, there is much I do not know about the program, but I have spent hundreds of hours of extracting the data of a hundred thousand bonds. In my experience, the official Eikon guides are insufficient as they do not deal with practical problems, and internet has few answers as this is expensive professional software. There is little knowledge about Eikon at NTNU, and the helper in the econ library is inexperienced with the program. Therefore, I hope this guide serves as a practical guide on using the program. However, I do assume that you, the reader, have seen the program before reading this document.

Along with this document, there are a set of supplementary files which may be provided upon request. The supplementary documents are:

- Extractions:
  - Announcement_Clean_price_OrgID_extraction.xlsx (extracts columns that needs to be appended to the list of bonds from Eikon)
  - Bond_rating_extraction.xlsx (Extracts credit ratings for bonds.)
  - Company_ESG_ratings.xlsx (Extracts historical ESG-ratings for issuers)
  - Company_market_data_extraction.xlsx (Extracts the market data of companies given PermIDs.)
  - Company_financials_extraction.xlsx (Extracts the financial data of companies given PermIDs.)
  - Gov_bond_extraction.xlsx (Extracts daily yields of government bonds)
  - Time_series_extraction.xlsx (Extracts time series data given a list of RICs or ISINs.)
  - TRBC_section_extraction.xlsx (Extracts industry sector information for bonds.)
- Data:
  - Bonds_fixed_data.csv (Contains all information regarding bonds)
  - Bonds_return_data.csv (Contains the daily price percentage returns)
  - Company_annual_data.csv (Contains annual financial and market data for issuers)
- Python:
  - Excel_to_csv.py (Merges the excel sheets into a single csv file.)
  - Price_to_return_data.py (Converts the bond price data to bond return data.)
- Other:
  - Bond_rating_numerical_conversion.xlsx (Maps credit ratings to numbers.)
  - Bond_rating_priority_list.xlsx (Decides which rating measure to use.)
  - External_Reviews.xlsx (List of all issuers in our study, and whether they are externally reviewed)
  - Green_bond_issuer_information.xlsx
  - Green_bond_yield_spread_computation.xlsx

Before we begin, I recommend you have English Excel. This means the functions, dates, and decimal point are in English. You can check if this is the case by checking whether the function =SUM() works (it is =SUMMER() in Norwegian), dates are written 20/07/21, and the decimal point is ".". This is best practice for Excel use in general, and you may experience trouble otherwise.

1. The tools

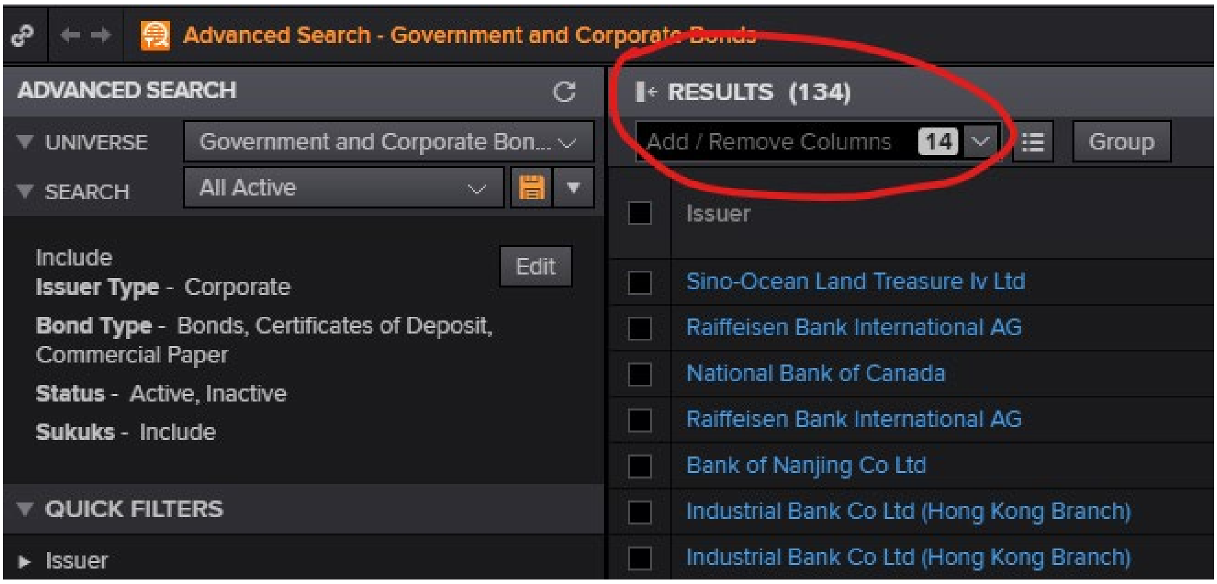
Eikon has multiple built in tools. In the following subsections I will briefly describe some of the tools along with tips and tricks for using them. More extensive guides and documentation can be found online, but fortunately, the tools are intuitive to use.

1.1 Advanced Search

"Advanced search – Government and Corporate bonds" is a useful tool to find and extract bond data. To find it, search for "Advanced search" in the left search field in the Eikon bar at the top of your screen.

Eikon limits the excel extraction to the top 4,000 rows, based on the order you have sorted the data on (so beware of the sorting). To extract more than 4,000 bonds, you need to limit the search to below 4,000 bonds and then concatenate the exports into a single file. A useful way to limit the results is to use the filter TICKER and extract for only a few companies at a time (if an issuer has more than 4,000 bonds (such as General Motors) you will need to filter using issuance date or similar).

Tip: A useful tip when extracting bonds is to first unselect all columns, and then select all. This ensures that the columns maintain the same order across all selections for concatenation. The menu for column selection can be found by clicking on the drop-down menu highlighted in the image below. At the top of the column menu, there is a "select all" option which you need to click before you can unselect all with the same button.



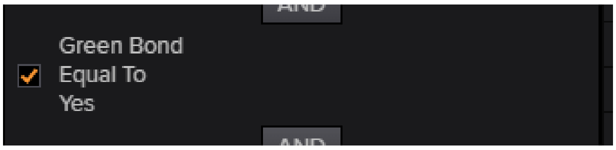
UNIVERSE: Government and Corporate Bon...

SEARCH: All Active

Include
Issuer Type - Corporate
Bond Type - Bonds, Certificates of Deposit, Commercial Paper
Status - Active, Inactive
Sukuks - Include

Issuer
Sino-Ocean Land Treasure Iv Ltd
Raiffeisen Bank International AG
National Bank of Canada
Raiffeisen Bank International AG
Bank of Nanjing Co Ltd
Industrial Bank Co Ltd (Hong Kong Branch)
Industrial Bank Co Ltd (Hong Kong Branch)

Green bonds: There is a filter for green bonds. (We have contacted Eikon to ask how they classify bonds as green, they just responded that they follow industry standards)



☑ Green Bond
Equal To
Yes

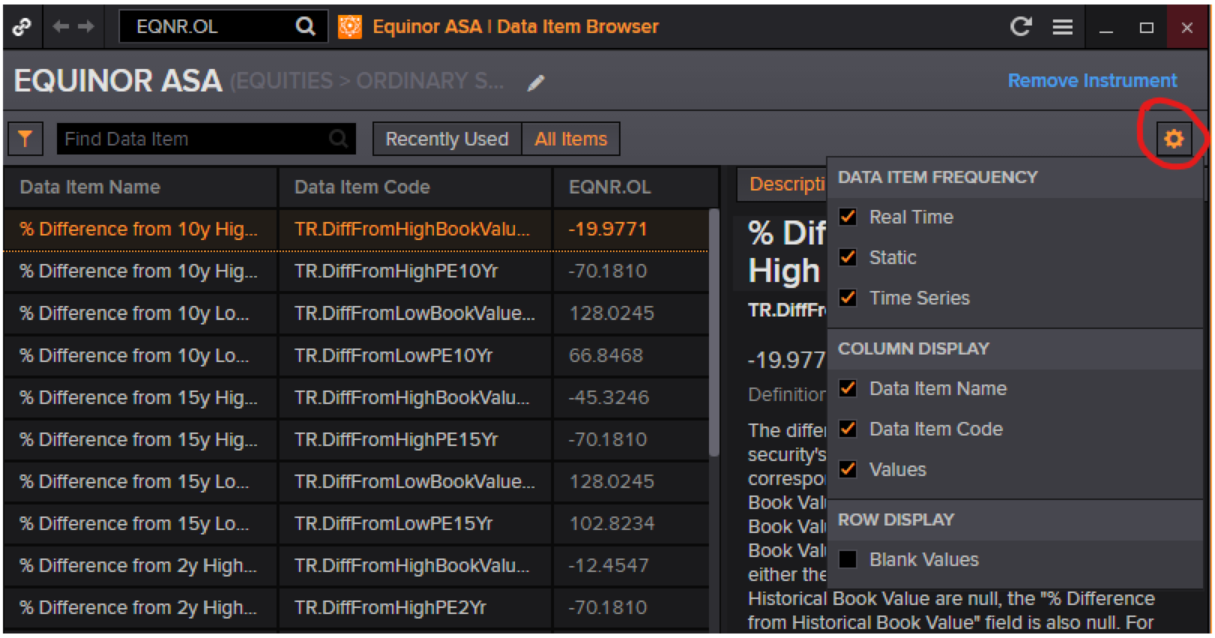
Social, sustainable, and sustainability-linked bonds: Eikon does not currently classify social, sustainable, or sustainability-linked bonds (as of July 2021). This makes these bonds difficult to work with. A potential work-around is to get ISINs from other sources such as the Climate Bonds Initiative (but this costs 2,000 USD).

Is there a way to do advanced search in Excel? It appears not. Eikon contains some legacy features that did something similar, but I would not recommend using them as they are less intuitive and may not work as intended.

1.2 Data Item Browser

The Data item browser is a tool to browse data items (the term *data item* is used by Eikon for a type of information regarding an instrument). To find the data item browser, search for it in the top left search field. If entering an instrument, you can see what all available data items for it are. This is useful to explore what data is available for that instrument and how the data is represented. Then use the Formula builder to extract that data item using its Data Item Code.

Tip: To more easily find what you are searching for use the options in the right corner. Displaying blank values can be useful as it may not be blank for other relevant instruments. In the bottom you can sort for relevance and A-Z. In my experience Eikon may not share your perception of relevance, so A-Z can be useful.



Data Item Name	Data Item Code	EQNR.OL
% Difference from 10y Hig...	TR.DiffFromHighBookValu...	-19.9771
% Difference from 10y Hig...	TR.DiffFromHighPE10Yr	-70.1810
% Difference from 10y Lo...	TR.DiffFromLowBookValue...	128.0245
% Difference from 10y Lo...	TR.DiffFromLowPE10Yr	66.8468
% Difference from 15y Hig...	TR.DiffFromHighBookValu...	-45.3246
% Difference from 15y Hig...	TR.DiffFromHighPE15Yr	-70.1810
% Difference from 15y Lo...	TR.DiffFromLowBookValue...	128.0245
% Difference from 15y Lo...	TR.DiffFromLowPE15Yr	102.8234
% Difference from 2y High...	TR.DiffFromHighBookValu...	-12.4547
% Difference from 2y High...	TR.DiffFromHighPE2Yr	-70.1810

% Dif
High
TR.DiffFr
-19.977
Definition
The differ
security's
correspo
Book Val
Book Val
Book Val
either the
Historical Book Value are null, the "% Difference from Historical Book Value" field is also null. For

DATA ITEM FREQUENCY
☑ Real Time
☑ Static
☑ Time Series

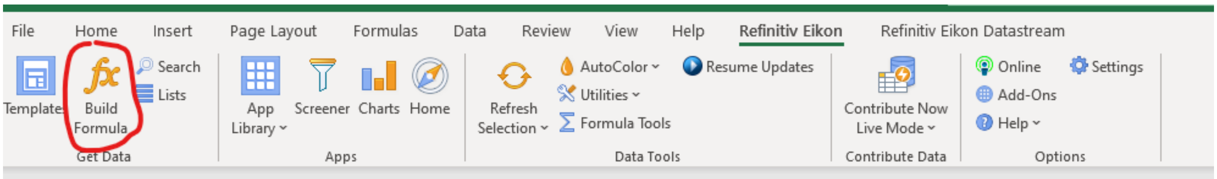
COLUMN DISPLAY
☑ Data Item Name
☑ Data Item Code
☑ Values

ROW DISPLAY
☐ Blank Values

1.3 Formula Builder

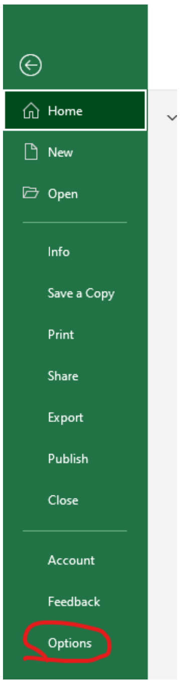
To extract data on bonds and issuers, one should use the formula builder tool in Excel. There are thousands of different data items, although this may require quite a lot of searching and navigating to find useful data items.

The Formula builder can be found in the Refinitiv Eikon tab in Excel as seen below.

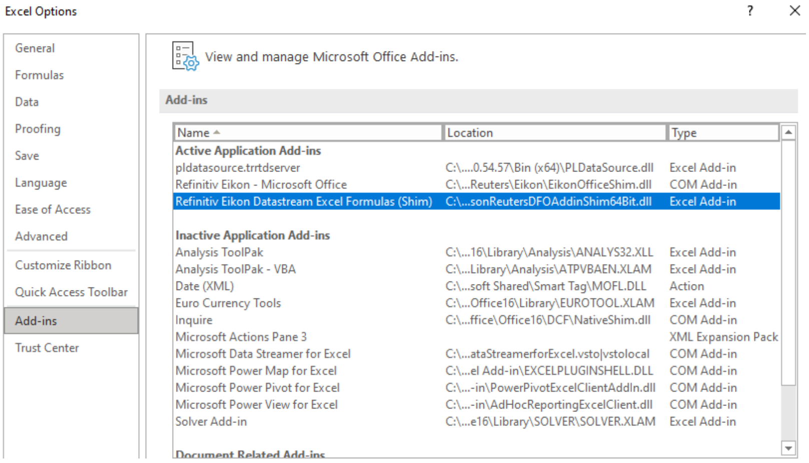


Note: You may need to enable the add-in pane in Excel. The NTNU library has a detailed tutorial on this, but the quick version is the following:

Go to File -> Options as seen below.



In Excel options, go to the Add-ins menu as seen below

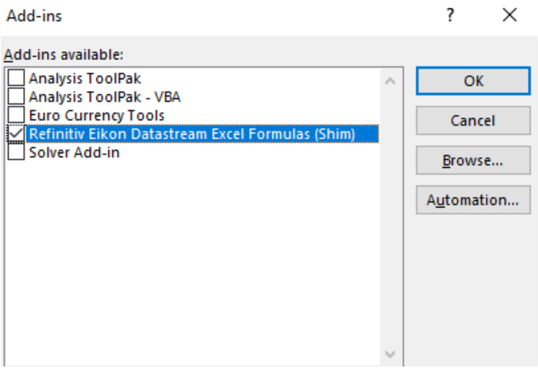


View and manage Microsoft Office Add-ins.

Add-ins

Name	Location	Type
Active Application Add-ins		
pldatasource.trrtdserver	C:\....0.54.57\Bin (x64)\PLDataSource.dll	Excel Add-in
Refinitiv Eikon - Microsoft Office	C:\...Reuters\Eikon\EikonOfficeShim.dll	COM Add-in
Refinitiv Eikon Datastream Excel Formulas (Shim)	C:\...sonReutersDFOAddinShim64Bit.dll	Excel Add-in
Inactive Application Add-ins		
Analysis ToolPak	C:\...16\Library\Analysis\ANALYS32.XLL	Excel Add-in
Analysis ToolPak - VBA	C:\...Library\Analysis\ATPVBAEN.XLAM	Excel Add-in
Date (XML)	C:\...soft Shared\Smart Tag\MOFL.DLL	Action
Euro Currency Tools	C:\...Office16\Library\EUROTOOL.XLAM	Excel Add-in
Inquire	C:\...ffice\Office16\DCF\NativeShim.dll	COM Add-in
Microsoft Actions Pane 3		XML Expansion Pack
Microsoft Data Streamer for Excel	C:\...ataStreamerforExcel.vsto|vstolocal	COM Add-in
Microsoft Power Map for Excel	C:\...el Add-in\EXCELPLUGINSHELL.DLL	COM Add-in
Microsoft Power Pivot for Excel	C:\...-in\PowerPivotExcelClientAddIn.dll	COM Add-in
Microsoft Power View for Excel	C:\...-in\AdHocReportingExcelClient.dll	COM Add-in
Solver Add-in	C:\...e16\Library\SOLVER\SOLVER.XLAM	Excel Add-in
Document Related Add-ins		

You may need to go to the "Manage Excel Add-ins" in the bottom of the Add-ins menu and ensure that the Eikon box is checked as seen below.



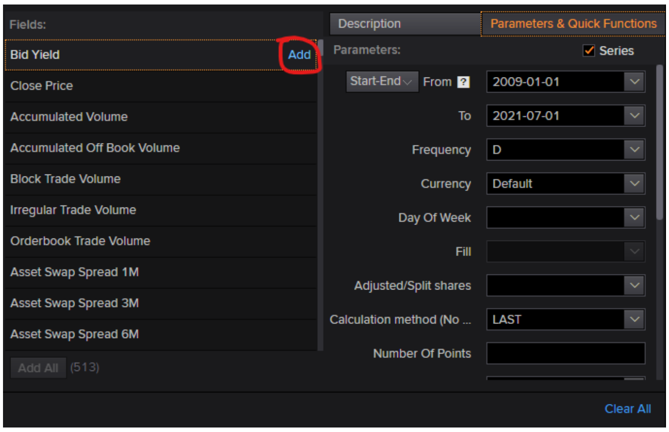
Add-ins available:

- ☐ Analysis ToolPak
- ☐ Analysis ToolPak - VBA
- ☐ Euro Currency Tools
- ☑ Refinitiv Eikon Datastream Excel Formulas (Shim)
- ☐ Solver Add-in

Tip: Always use the Formula builder when extracting data on bonds or companies, especially if you are extracting for multiple entities at once.

Tip: The limit for instruments is 7,500. If you need to extract more than that, I recommend splitting the extraction into multiple sheets.

Tip: Remember that the configuration of data items is done on an item-by-item basis which needs to be configured before “adding” the item in the Formula Builder. Click on the item first, then go to “Parameters & Quick Functions” to configure the data item. Finally, remember to click the Add button seen in the image below. This button is only visible if you hover your cursor over the relevant data item.



Fields:
- Bid Yield
- Close Price
- Accumulated Volume
- Accumulated Off Book Volume
- Block Trade Volume
- Irregular Trade Volume
- Orderbook Trade Volume
- Asset Swap Spread 1M
- Asset Swap Spread 3M
- Asset Swap Spread 6M

(513)

Parameters: ☑ Series

Start-End From 2009-01-01

To 2021-07-01

Frequency D

Currency Default

Day Of Week

Fill

Adjusted/Split shares

Calculation method (No ... LAST

Number Of Points

Tip: To edit a formula with the Formula builder, select the cell and click the Formula Builder. It will now open with the settings from the existing formula. However, this will not work if your formula is built dynamically (i.e. data items or configurations are stored in another referenced cell).

Important tip: When using Eikon in Excel, you create a formula that connects to Eikon’s servers to insert data into Excel cells. However, if your connection is broken to Eikon (by disconnecting from Eikon or opening the file without Eikon on the computer), Excel may delete the content of all cells filled by Eikon. This can be solved by reconnecting to Eikon, but if the extraction is large, this can be problematic as the extraction may crash Excel. To avoid this potential catastrophe, always comment out your formulas when not in use, this way the Eikon add-in will not touch any cells. To comment out formulas, I recommend adding an apostrophe in front of the equal sign, i.e. ‘=TR(…) or ‘=RHistory(…).

Important tip: The Eikon Excel add-in will always clean the content of cells before inserting a table on top of it. This means it potentially can overwrite other data which could be problematic if you underestimate the width or length of the table inserted. Therefore, always avoid having other data below or to the right when inserting a table. The greater potential hazard, however, is that Eikon is not properly deleting existing data. Say that you insert a time series table of 1000 rows, and then alter the formula to only get 500 rows. Eikon will not always delete the bottom 500 rows. This means you risk having 500 rows of trash data included in your table (this is not always obvious either as you rarely know the length of a table before inserting it). I faced this problem when extracting bond time series data as I reused the Excel sheets to extract new data, and it did not properly delete the previous data table. Therefore, always manually clean the cells before inserting a data table (by selecting the top leftmost cell of area to clean and holding shift+ctrl and pressing the down and right arrow keys before pressing delete).

Tip: You may want to extract the content to from Excel to a csv-file. To do so, either place the desired table in cell A1 on the first sheet of an Excel book and save as a csv-file, or if you have multiple tables (such as in our thesis where we needed to join 40+ tables) use Python or similar to extract the tables automatically (a description with code is included in the section on how to exactly replicate our data extraction. If using the provided time series extraction sheet, you may also use the Python code provided).

The formula builder has two different tabs, one for fixed time data, and one for time series data. However, the fixed time data can be used for time series data as well. The differentiation originates from Refinitiv Eikon being a merger of Thomson Reuters' software with Refinitiv's software. Therefore, there is a lot of legacy formulas and data items, and you may struggle to find guidance online as Refinitiv was established in 2018 and took over Eikon from Thomson Reuters.

Section 4 explains more thoroughly how to use the Formula builder for fixed time and time series data.

2. The identifiers

Identifiers are unique codes to refer to an instrument, and because Eikon is a mess, there are many alternative ID types for the same instrument. Some ID types are often missing, such as the RIC which primarily exists for exchange listed instruments (active bonds, exchange listed companies)

2.1 Bonds

Bonds have two usable types of identifiers (there are a few more, but they are not needed).

ISIN: ISIN identification is the industry standard for identifying bonds. Almost all bonds have ISINs, and most financial databases use them.

Preferred RIC: Reuters Instrument Code is an identifier invented by Thomson Reuters and is not accepted outside of its ecosystem. Therefore, if using RICs, other people using other tools may struggle to identify the bond. However, there are benefits to using RICs. The main benefit is that some bonds lack ISINs but do have RICs (and in some occasions, the ISIN exists, but using it returns no data when using the RIC does).

If you have a list of mixed ISINs and RICs, the data extraction will assume that all codes are RICs and fail to retrieve data for the ISINs.

Issuer (bond issuer identification): This is a weird Thomson Reuters invention. For all bonds, there is a field containing the Issuer ticker. However, this is not the ticker used for companies, so you cannot use this ticker to find information regarding the issuer. If you want that you must use the ISIN or RIC of the bond and use the TR.OrganizationID in Formula builder in Excel to get the issuer PermID. If you only have the Issuer Ticker and need the Issuer's PermID, your best bet is to use advanced search and filter on Issuer Tickers to get bond RIC / ISINs. Then use TR.OrganizationID on the bond RIC / ISIN to get the issuer's PermID.

To get Issuer Ticker from a company PermID, use TR.IssuerTickerCode. Sometimes it returns NULL even though the company has an Issuer Ticker. To find the Issuer Ticker then, you must use Advanced search and search for the issuer name and find a bond and read off the "ISSUER" column.

2.2 Companies

RIC: Exchange listed companies do also have RICs. It is usually structured as its tickers with a suffix. E.g., EQNR.OL. This ticker, however, cannot be used to find the company's issued bonds, and is therefore rarely used.

PermID: For non-listed issuers, however, only the PermID is usually available. E.g., 4297539200. I therefore recommend to always use the PermID for companies.

Note: There are multiple other organization IDs, but companies are often missing these, while PermID is never missing. These other IDs could look similar, so if you are using a new command, ensure that it is returning PermID and not another long number. You may also risk that other IDs cannot be used as instruments (input) in Excel.

Tip: You may have unlisted issuers with listed parent companies. Then the parent company data could be of importance to you. To get the Parent PermID, use the TR.UltimateParentId on either the bond ISIN/RIC or the unlisted parent PermID.

2.3 Other

Other instruments such as indices do also have RICs. One useful example is treasury bills which all have the form US30YT=RR where US is the country (Germany: DE, France: FR, Great Britain: GB, China: CN, Japan: JP, Hong Kong: HK, Singapore: SG, Norway: NO, Sweden: SE, Denmark: DK, South Korea: KR, New Zealand: NZ, Russia: RU, Australia: AU, India: IN, Canada: CA, Mexico: MX, Switzerland: CH) 30 is the year (20,10,7,5,3,2, and 1 are also available)

3. Extracting data

3.1 Fixed time data

To extract fixed (or time series data), use the =TR(…) function in Excel. There is no need to memorize the arguments for the function as one mostly uses the Formula builder.

Tip: You may run into the problem of non-time series data changing over time (such as a company's ESG rating). Hence, you need to be careful of these time-dependent "fixed" variables. You can set up the extraction like the following code.

=@TR(*List_of_Company_PermIDs*,"TR.TRESGScore","Period=FY0 Frq=CY SDate=2009-01-01 EDate=2021-05-01 CH=Fd RH=IN;date NULL=NA",*Output_Cell*)

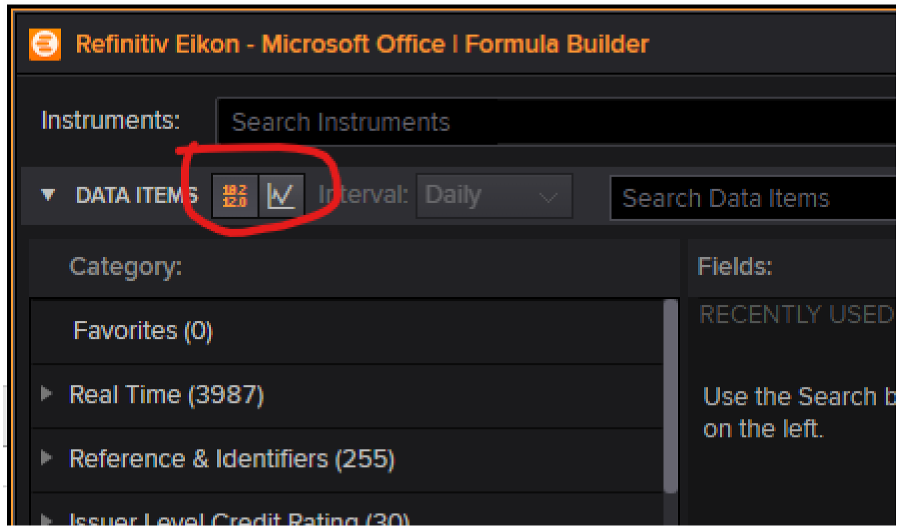
Tip: There may be multiple data items that provide the same type of information, such as credit rating. These need not yield the same results, so it is recommended to fetch all data items and structure the data either as an average of the non-missing values, or as a priority list of the available data. This can be done in Excel through nested IF sentences (=IF(condition, value if true, value if false))

3.2 Time series data (price etc.)

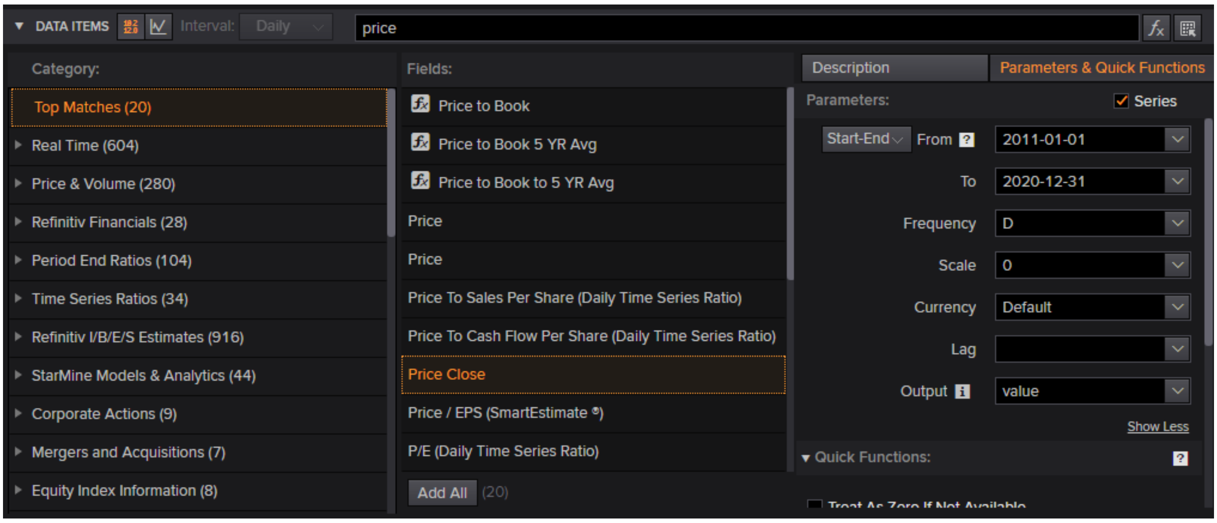
Extracting time series data is more complicated in EIKON than fixed time data.

You have two categories of time series data with different Excel functions with different arguments. You have the Thomson Reuters extraction function that start with =TR(…), and the Refinitiv historical data function =RHistory(…). The EIKON classifies =RHistory(…) as the time series function, but =TR(…) can also be used to get the non-time series data items over a period (i.e. time series data).

The two functions are separated by two different panes in the Formula builder. See the image below for the location. The left pane is =TR() while the right one is =RHistory().



To get time series data on TR() you must select a field where time series data is possible and check for Series information as seen below.


DATA ITEMS
Interval: Daily
price
Category:
Top Matches (20)
Real Time (604)
Price & Volume (280)
Refinitiv Financials (28)
Period End Ratios (104)
Time Series Ratios (34)
Refinitiv I/B/E/S Estimates (916)
StarMine Models & Analytics (44)
Corporate Actions (9)
Mergers and Acquisitions (7)
Equity Index Information (8)
Fields:
Price to Book
Price to Book 5 YR Avg
Price to Book to 5 YR Avg
Price
Price
Price To Sales Per Share (Daily Time Series Ratio)
Price To Cash Flow Per Share (Daily Time Series Ratio)
Price Close
Price / EPS (SmartEstimate ®)
P/E (Daily Time Series Ratio)
Add All (20)
Description
Parameters & Quick Functions
Parameters:
Show Less
Quick Functions:
Treat As Zero If Not Available

☑ Series

Start-End From 2011-01-01

To 2020-12-31

Frequency D

Scale 0

Currency Default

Lag

Output value

For RHistory, the formula builder is often broken so here is an example function:

=@RHistory(*Input array*, *Semicolon separated datafields*, *Configuration parameters*, *Do not know what this is for and is left empty*, *TSREPEAT:NO CH:Column_header*, *Output cell*)

=@RHistory(B10:B1009, MID_PRICE.Close;MID_PRICE.Timestamp, START:2009-01-01 END:2021-02-10 INTERVAL:1D CODE:ISIN, , TSREPEAT:NO CH:Fd, F9)

Notice that the field is Datatype.attribute, in this case Close price and timestamp. Separate these with semicolons. On the start and end dates, however, only spaces are used as separators. The

CODE:ISIN is required if bond ISINs are used, but if RICs are used, the entire field can be dropped (or alternatively CODE:RIC). The reason the RHistory function is much worse than TR is because it is old, but it still works best for mass time series such as bond prices.

Tip: If you are using bond prices, remember that there is a difference between dirty and clean prices (adjusting for accrued interests). To figure out if a bond has a clean price, use the field TR.FiPriceAccruedInterestFlag.

Tip: if you can alter the output setup and with columns and rows, how missing values should be treated, sorting, and which headers to include on the Layout menu in the bottom left corner.

4. Useful data items

For =TR(…) functions, some useful data items are

Results:

TR.Revenue

TR.OperatingIncome

TR.TotalOperatingExpense

TR.OperatingMarginPercent

TR.GrossMargin

TR.NetProfitMargin

TR.EffectiveTaxRate

TR.EBITDA

TR.DepreciationAmort

Balance sheet:

TR.TotalCurrentAssets

TR.TotalAssetsReported

TR.TotalDebt

TR.TotalLongTermDebt

TR.TotalLiabilities

TR.TotalEquity

TR.PropertyPlantEquipmentTotalNet

TR.Cash

TR.CashandEquivalents

Cash flow:

TR.CashFlow

Other:

TR.FiPriceAccruedInterestFlag (dirty or clean price)

TR.AnnouncementDate (gives the bond announcement date, which could be useful for event studies on bond announcements)

TR.IssuerTickerCode (gives Bond issuer TICKER from company RIC/PermID, but does not always work)

TR.TRBCIndustry (most specific, gives the company's Thomson Reuters Business Category industry)

TR.TRBCIndustryGroup (more specific, gives the company's Thomson Reuters Business Category industry group)

TR.TRBCBusinessSector (less specific, gives the company's Thomson Reuters Business Category business sector)

TR.TRBCEconomicSector (least specific, gives the company's Thomson Reuters Business Category economic sector)

TRBCIndustry is a subset of TRBCIndustryGroup, which is a subset of TRBCBusinessSector, which is a subset of TRBCEconomicSector.

TR.GR.Rating (Eikon Bond rating)

TR.IssuerRating (Issuer credit rating (works on bonds too))

TR.FiFitchsRating (Bond rating from Fitch)

TR.FiIssuerFitchLongRating (Issuer rating from Fitch (works on bonds too))

TR.FiMoodysRating (Bond rating from Moody's)

TR.TRESGScore (ESG Score 0 to 100) (This type of score exists for E, S, and G separately too)

TR.TRESGScoreGrade (ESG Letter grade D- to A+) (This type of score exists for E, S, and G separately too)

5. Other useful functions

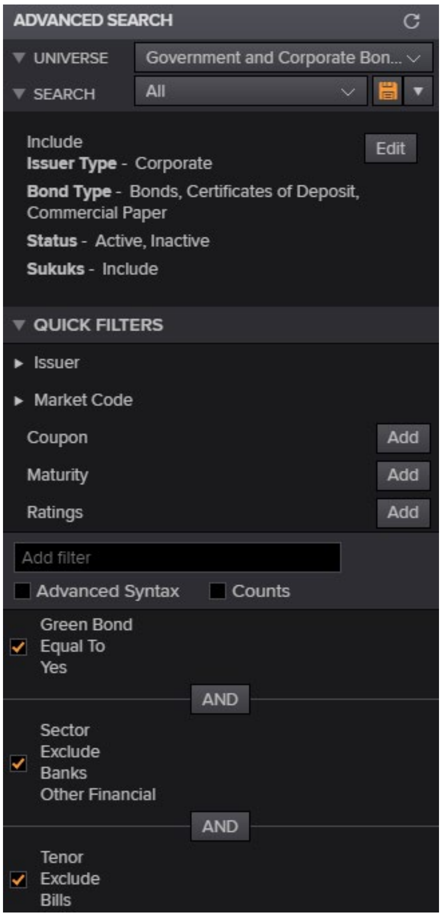
There exists a bunch of other Eikon functions in Excel, but these are rarely useful. However, one this function is useful for extracting peer information:

=@TR("Peers(#1)","TR.PrimaryInstrument",,,PermID) fetches peer companies for a company by providing its PermID.

6. Exact methodology for the green halo debt effect study

6.1 Extracting the bonds

First, we use Advanced search to find all non-financial corporate green bonds issued using the settings seen below.



ADVANCED SEARCH

UNIVERSE Government and Corporate Bon...

SEARCH All

Include
Issuer Type - Corporate
Bond Type - Bonds, Certificates of Deposit, Commercial Paper
Status - Active, Inactive
Sukuks - Include

QUICK FILTERS

☑ Green Bond Equal To Yes

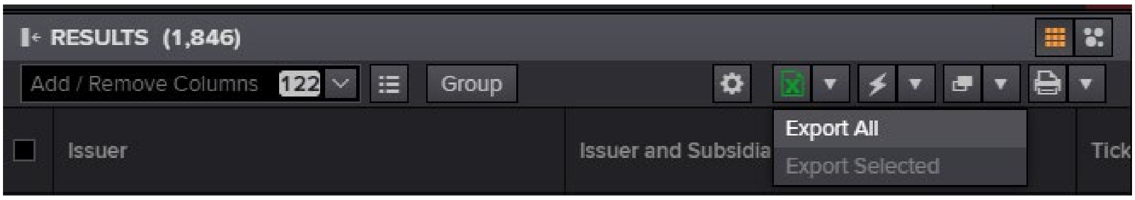
AND

☑ Sector Exclude Banks Other Financial

AND

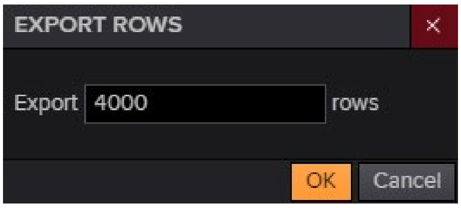
☑ Tenor Exclude Bills

We then export all the bonds to an Excel file by selecting the drop-down menu next to the green icon as seen below.



RESULTS (1,846)

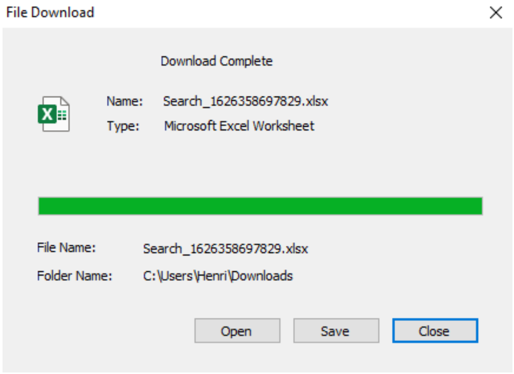
Then select 4000 rows in the pop-up menu that opens. 4000 is the upper limit on extraction. At the time of our extraction, there were around 2000 green bonds, if this is replicated later, the number may exceed 4000, and the extraction will need to be split by using issue dates (i.e., pre-2020, and post-2020).



EXPORT ROWS

Export 4000 rows

Then save the exported file.



File Download

Download Complete

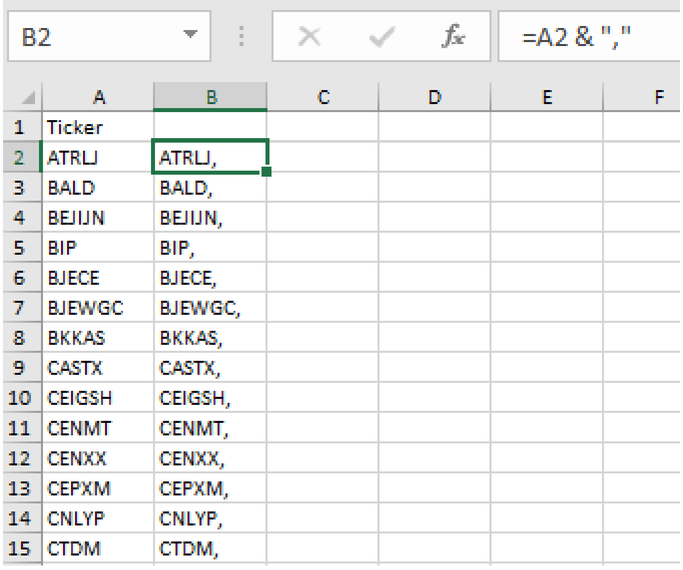
Name: Search_1626358697829.xlsx

Type: Microsoft Excel Worksheet

File Name: Search_1626358697829.xlsx

Folder Name: C:\Users\Henri\Downloads

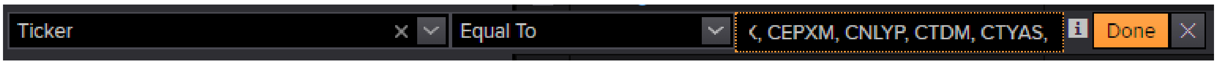
Then open the exported Excel file and select all Issuer Tickers, then remove all duplicates to get a list of unique Issuer Tickers. Then create a new column that adds a comma to each of the cells as seen below.



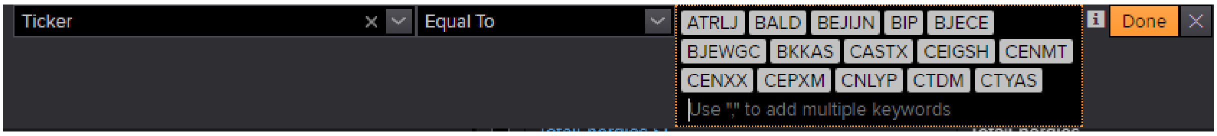
B2 =A2 & ","

	A	B	C	D	E	F
1	Ticker					
2	ATRLJ	ATRLJ,				
3	BALD	BALD,				
4	BEJIJN	BEJIJN,				
5	BIP	BIP,				
6	BJECE	BJECE,				
7	BJEWGC	BJEWGC,				
8	BKKAS	BKKAS,				
9	CASTX	CASTX,				
10	CEIGSH	CEIGSH,				
11	CENMT	CENMT,				
12	CENXX	CENXX,				
13	CEPXM	CEPXM,				
14	CNLYP	CNLYP,				
15	CTDM	CTDM,				

Then return to the Advanced Search. Remove the green bond filter and add a Ticker filter copying and pasting 10-30 of the entries from the comma-added excel column. An example is seen below.



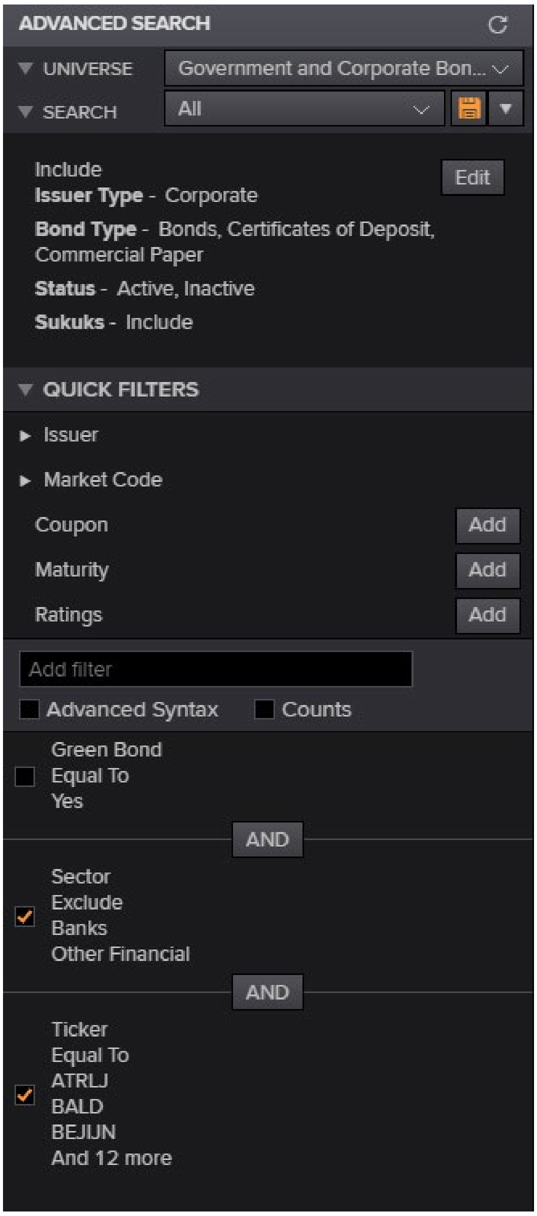
Ticker | Equal To | ‹, CEPXM, CNLYP, CTDM, CTYAS,



Ticker | Equal To | ATRLJ BALD BEJIJN BIP BJECE BJEWGC BKKAS CASTX CEIGSH CENMT CENXX CEPXM CNLYP CTDM CTYAS

Use "," to add multiple keywords

Tip: Mark 10-30 rows in the comma-appended excel column and copy them. Paste them directly in the Ticker filter in the Advanced search. Then simply press Enter.



ADVANCED SEARCH

UNIVERSE Government and Corporate Bon...

SEARCH All

Include
Issuer Type - Corporate
Bond Type - Bonds, Certificates of Deposit, Commercial Paper
Status - Active, Inactive
Sukuks - Include

QUICK FILTERS

- Issuer
- Market Code

Coupon

Maturity

Ratings

Add filter

□ Advanced Syntax □ Counts

□ Green Bond
Equal To
Yes

AND

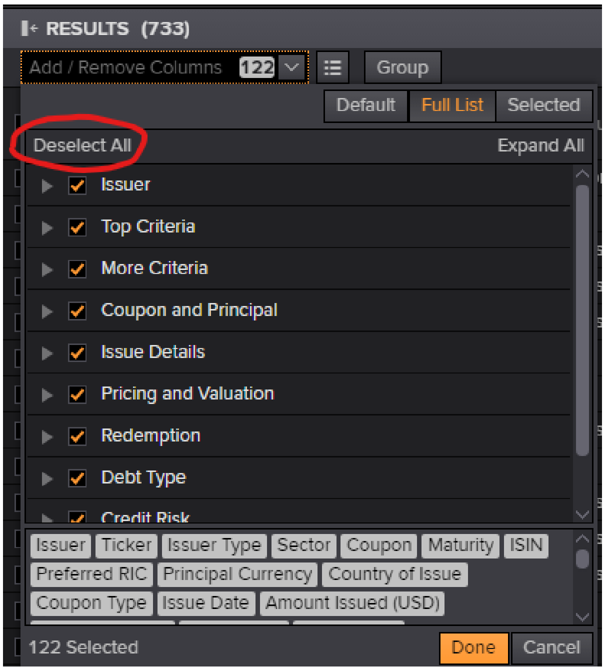
☑ Sector
Exclude
Banks
Other Financial

AND

☑ Ticker
Equal To
ATRLJ
BALD
BEJIJN
And 12 more

If the number of results is more than 4000 bonds, then click on the added filter to modify it, and start removing tickers from the end until your result contains fewer than 4000 bonds.

Export these <4000 rows to excel, but before exporting, ensure that you open the “Add / Remove Columns” and deselect all columns and then selecting all columns. This ensures that the column order is the same for all exported files making it easier to manually join them. (You need not deselect/select between every export, only the first one.)



Repeat this extraction with the 10-30 next tickers on the list until you are through the entire list.

To merge the exported Excel files of bond data, either open the excel books manually and paste them into a single file or use automated tools, such as Python with Pandas. As this is quick to do manually, I suggest doing this manually.

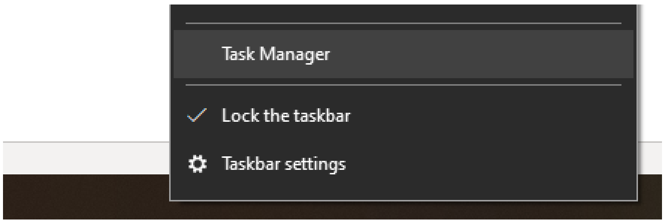
6.2 Extracting the bond time series data

If your data set contains both ISINs and RICs, you must first separate these into two groups as the Formula builder cannot handle a mix of data types.

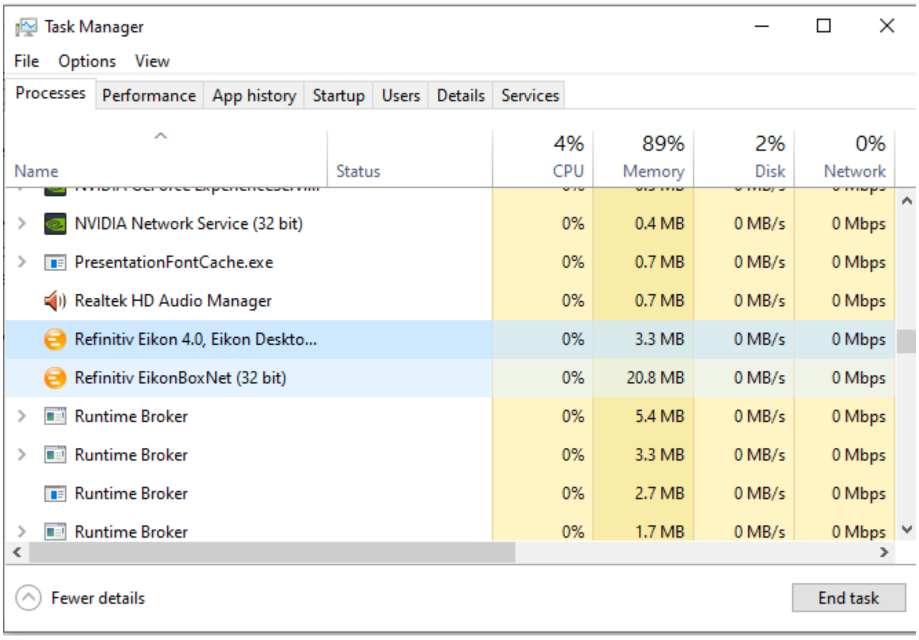
We used close mid-price for our study which is the average of buy and sell prices in the market at close. Extracting this can be done with the following Excel formula =@RHistory(B10:B1009, MID_PRICE.Close;MID_PRICE.Timestamp, START:2009-01-01 END:2021-02-10 INTERVAL:1D CODE:ISIN, , TSREPEAT:NO CH:Fd, F9)

where B10:1009 contains ISINs, and F9 is the output cell. I strongly discourage expanding the ISIN list beyond 1000 bonds as the extraction already is slow.

Tip: Extracting 1000 bonds can take 10+ minutes, depending on the time of day, Internet connection, and computer. If the extraction takes much more time than that, you likely are not getting your results. Retry with fewer ISINs, but before doing so, close Excel and Eikon. To properly close Eikon, you must also open the Task Manager in Windows and stop Eikon data fetching processes. Open the Task Manager by right clicking on the Windows task bar and selecting it as seen in the image below.



Then select *More details* if not already selected. Find all Refinitiv Eikon processes running and click *End task*.



Name	Status	4% CPU	89% Memory	2% Disk	0% Network
NVIDIA Network Service (32 bit)		0%	0.4 MB	0 MB/s	0 Mbps
PresentationFontCache.exe		0%	0.7 MB	0 MB/s	0 Mbps
Realtek HD Audio Manager		0%	0.7 MB	0 MB/s	0 Mbps
Refinitiv Eikon 4.0, Eikon Deskto...		0%	3.3 MB	0 MB/s	0 Mbps
Refinitiv EikonBoxNet (32 bit)		0%	20.8 MB	0 MB/s	0 Mbps
Runtime Broker		0%	5.4 MB	0 MB/s	0 Mbps
Runtime Broker		0%	3.3 MB	0 MB/s	0 Mbps
Runtime Broker		0%	2.7 MB	0 MB/s	0 Mbps
Runtime Broker		0%	1.7 MB	0 MB/s	0 Mbps

Repeat the extraction of 500-1000 bonds until you have extracted all bond time series data. It is preferable to extract on different sheets in the same Excel document. The Excel extraction sheet used will be provided along with this document.

Tip: To avoid Excel from crashing when opening it, select “pause updates” on the Refinitiv Eikon Excel tab as seen below. Updates should generally be on pause unless your sheet is using real time data.

Tip: To avoid Excel from crashing when extracting data, you should comment out (by inserting an apostrophe in front of the equal sign, i.e. ‘=RHistory(…) or ‘=TR(…)) the Eikon formulas not in use, then uncomment 2-5 formulas at once. In the Excel book I created for bond time series data extraction, there can be 40+ sheets, so I only uncomment the formulas when needed, and at most 5 at a time.

6.3 Merging the data extractions

As the rows (representing dates) do not correctly correspond between the extractions due to bond data availability, one must merge the sheets with Python or similar (I tried using Excel index-match, but it takes too long).

My Python code is included below, where I merge the extracted RICs and ISINs at once. Just enter the file names and the number of Excel sheets containing bond data. The file assumes the usage of my Excel extraction framework.

```
import pandas as pd
import numpy as np
import openpyxl

RIC_file = "GB-Issuer RIC TS extraction.xlsx"
RIC_sheets = 11

ISIN_file = "GB-Issuer ISIN TS extraction.xlsx"
ISIN_sheets = 25
```

```
ExportDF = pd.read_excel(RIC_file, sheet_name=3, header=3, index_col=0,
usecols='F:ALR', engine='openpyxl')

ExportDF.drop(ExportDF.head(6).index, inplace=True)
print(ExportDF)

ColumnSelector = pd.read_excel("GB-Issuer Column Selector.xlsx",
engine='openpyxl')

for i in range(2,RIC_sheets+1):
    Excel_extraction = pd.read_excel(RIC_file, sheet_name=i+2, header=3,
index_col=0, usecols='F:ALR', engine='openpyxl')
    Excel_extraction.drop(Excel_extraction.head(6).index, inplace=True)
    ExportDF = pd.concat([ExportDF.stack(),
Excel_extraction.stack()]).unstack()
    print(ExportDF)

for i in range(1,ISIN_sheets+1):
    Excel_extraction = pd.read_excel(ISIN_file, sheet_name=i+2, header=3,
index_col=0, usecols='F:ALR', engine='openpyxl')
    Excel_extraction.drop(Excel_extraction.head(6).index, inplace=True)
    ExportDF = pd.concat([ExportDF.stack(),
Excel_extraction.stack()]).unstack()
    print(ExportDF)

ExportDF.to_csv("GB-Issuer TS.csv")
print("Success!")
```

(The code extracts from two different files, one for RICs and one for ISINs. To avoid overlaps of ISINs and RICs (i.e. two identical time series with different names), there is a column selector file.

6.4 Converting price data to return data

Eikon RHistory does not have a defined bond return data (=TR(…) has this kind of functionality, but it is lacklustre). Therefore, we must convert bond prices to bond returns. This is complicated by bonds not having price data for every date. We therefore defined bond returns as the change in price from last time the bond had price data. For example, if a bond had a price of 100 three days earlier, but no price data for the two days following, and now has a price of 102, we define the return as 2%.

My python code for converting bond prices to returns is included below. Note that we first run a for-loop where we remove outliers, that is bonds that have lost 95% of their value, gained 2000%, or where the price is above 5x average levels or below 0.2x. This is because Eikon can return erroneous data, and we experienced some cases where bonds had unrealistic returns. We also remove “default prices” with this.

```
import pandas as pd
import numpy as np

TSData = pd.read_csv("GB-issuers TS sorted.csv",index_col=0)

npTSData = TSData.to_numpy()
returnMatrix = np.ndarray(shape=npTSData.shape)

rows = len(npTSData[:,0])
```

```
# THE FOLLOWING FOR-LOOP IS FOR DATA CLEANING AND NOT FOR PRICE-TO-RETURN
CONVERSION
for column in range(0, len(npTSData[0,:])):
    TSaverage = np.average(npTSData[:,column])
    first_date = None
    for date in range(rows-1,0,-1):
        if not np.isnan(npTSData[date,column]):
            if npTSData[date,column] <= 0 or npTSData[date,column] < 0.2 *
TSaverage or npTSData[date,column] > 5 * TSaverage:
                npTSData[date, column] = np.NaN
            elif first_date == None:
                first_date = npTSData[date,column]
            else:
                if npTSData[date,column] < 0.05 * first_date or
npTSData[date,column] > 20 * first_date:


# THIS IS THE FOR-LOOP THAT CONVERTS PRICES TO RETURNS
for column in range(0, len(npTSData[0,:])):
    for date in range(0, rows):
        if not np.isnan(npTSData[date,column]):
            match = False
            for prevcell in range(date+1, rows):
                if not np.isnan(npTSData[prevcell,column]):
                    returnMatrix[date,column] = (npTSData[date,column]-
npTSData[prevcell,column])/npTSData[prevcell,column]
                    match = True
                    break
            if not match:
                returnMatrix[date, column] = np.NaN
        else:
            returnMatrix[date,column] = np.NaN

returnDataframe = pd.DataFrame(returnMatrix,index=TSData.index,
columns=TSData.columns)

returnDataframe.to_csv("GB-issuer Returns.csv")
```

Note: you may experience that the csv-file produced is not sorted by dates either after converting to returns or when merging the data. It is very important that the order of the data is descending dates (from newest to oldest) at all times because the return computation, and AABSR-computation both assume that the data is in this order. Fix the order with this function:

```
TSData = pd.read_csv("GB-issuer Returns.csv ",index_col=0)
TSData.index = pd.to_datetime(TSData.index, errors="coerce")
TSData = TSData.sort_index(ascending=False)
TSData.to_csv("GB-issuer Returns sorted.csv")
```

6.5 Extracting issuer data

When extracting data regarding companies, the approach varies depending on the data type required. We extracted both market price data (such as stock price) and annual report data. These require separate extraction methodology. We also extract data from both the issuer and the ultimate parent of the issuer. The Excel sheets used is provided along with this document. Company_financials_extraction.xlsx contains sheets with extracted financial data and Company_market_data_extraction.xlsx contains market data.

The used fields not from annual reports were:

Market Capitalization:

```
=@TR(B10:B1009,"TR.CompanyMarketCap","Frq=Y SDate=2008-12-31 EDate=2020-12-31 CH=Fd RH=IN;date SORTD=date NULL=BLANK",G6)
```

where B10:B1009 is the list of company PermIDs and G6 is the output cell.

Return on Assets:

```
=@TR(B10:B1009,"TR.ROATotalAssetsPercent","SDate=2008-12-31 EDate=2021-03-10 Frq=CY UPDFRQ=SNAP CH=Fd RH=IN;periodenddate NULL=BLANK",G6)
```

where B10:B1009 is the list of company PermIDs and G6 is the output cell.

Weighted average cost of capital:

```
=@TR(B10:B1009,"TR.WACC","Frq=Y SDate=2008-12-31 EDate=2021-03-10 CH=Fd RH=IN;date SORTD=date NULL=BLANK",G6)
```

where B10:B1009 is the list of company PermIDs and G6 is the output cell.

Annual stock return formula:

```
=@TR(B10:B1009,"PERCENT_CHG(TR.PriceClose(SDate=2008-12-31 EDate=2020-12-31 Frq=AY), lag=-1AY)","SDate=2008-12-31 EDate=2020-12-31 Frq=AY CH=Fd RH=IN;date NULL=BLANK",G6)
```

where B10:B1009 is the list of company PermIDs and G6 is the output cell.

Annual report data:

```
=@TR(B10:B1009, “TR.Revenue;TR.OperatingIncome;TR.TotalOperatingExpense;TR.OperatingMarginPercent;TR.GrossMargin;TR.NetProfitMargin;TR.EffectiveTaxRate;TR.TaxOthIncTot;TR.TotalCurrentAssets;TR.TotalAssetsReported;TR.TotalDebt;TR.TotalLongTermDebt;TR.TotalLiabilities;TR.TotalEquity;TR.PropertyPlantEquipmentTotalNet;TR.Cash;TR.CashandEquivalents;TR.CashFlow;TR.EBITDA;TR.DepreciationAmort”, "Period=FY0 Frq=CY SDate=2009-01-01 EDate=2021-03-10 Curn=USD UPDFRQ=SNAP CH=Fd RH=IN;periodenddate NULL=BLANK",G6)
```

where B10:B1009 is the list of company PermIDs and G6 is the output cell.
IMPORTANT: This formula may break in excel because it has a too long text string. You solve this by placing the data items (the long string) in a separate cell and refer to it in the formula (i.e., put the string without brackets in A1, and write A1 in this formula)

After extracting these data items, we merge them together into a single sheet by using index-match on the years for the items that are not annual report information.

6.6 Peer company creation

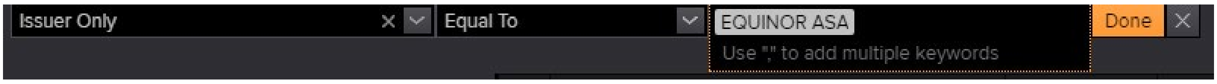
For our study we needed peer companies for our green bond issuers. To do so, we first started with automatic peer creation. This gives the peers EIKON lists as peers (you can find them if you search for a company in the EIKON bar and select the “Peers and Valuation” menu). This however is only available for public and larger companies, so peer creation involves manual peer selection as well.

To extract peers automatically, use this function:

=@TR("Peers(#1)","TR.PrimaryInstrument",,,PermID) fetches peer companies for a company by providing its PermID and returns the peers’ RICs as a list below the formula.

For each of the green bond issuers, you must use this function, take the top 20 peers, and then aggregate the peers to a single list by joining the peer lists (I did this manually, and a quick way to do so is to select the top row, hold the shift+ctrl keys and press the down key on your keyboard. Then hold shift while dragging the entire list into the neighbouring list. This will insert it into the list while shifting the existing items downwards. This is fine as the order of peers is not important)

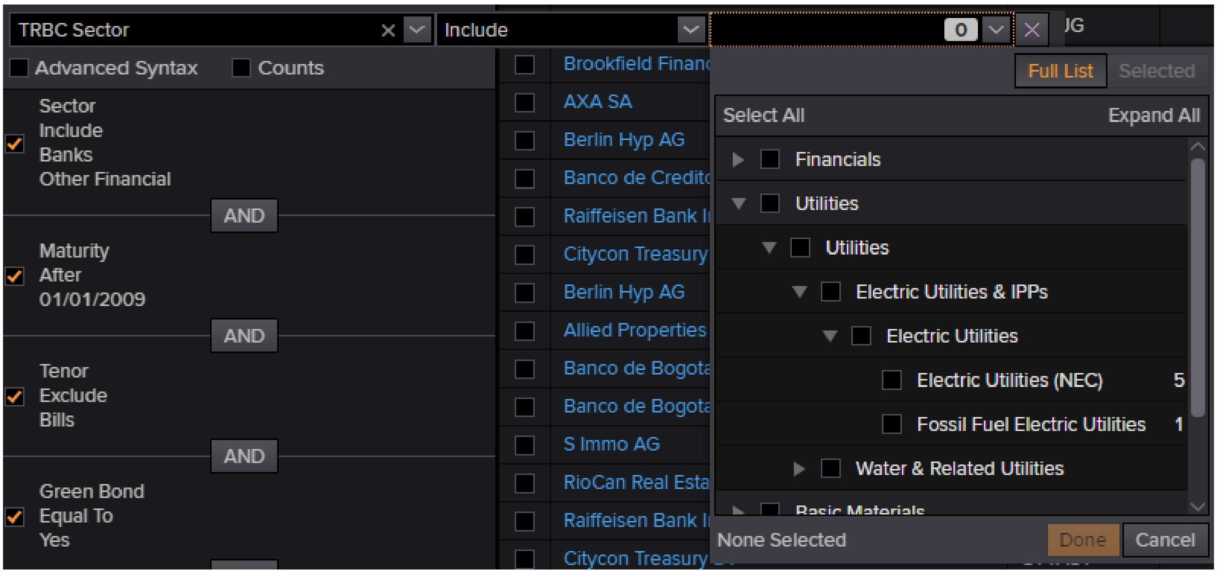
Unfortunately, the peer creation gives company RICs, so we need to convert those to bond issuer Tickers to get their bonds. To do so, we use the TR.IssuerTickerCode. This function will give correct tickers but will sometimes fail to return a ticker even though this always exists for a bond issuer. In that case, you must manually go to the Advanced search and filter bonds on “Issuer Only” or “Issuer and Subsidiaries,” and enter the company RIC (or PermID) to enable the filter. Then read of the Ticker column and manually add it to the list of bond issuer tickers.


Issuer Only ✕ | Equal To | EQUINOR ASA
Use "," to add multiple keywords

Our study uses the TRBC Sector to categorize peers. This means that if EIKON finds peers that are in separate TRBC sectors (TRBCIndustry or TRBCIndustryGroup or TRBCBusinessSector or TRBCEconomicSector), we will not use it as a peer for that company, but it is then designated as a peer for other companies in its TRBC sector. This allows us to have a clear division of industries.

After having manually created the peers per industry, we manually added more peers to the slimmest industries to ensure that each had at least 10 companies. To do so, we used the Advanced search to filter for “TRBC Sector” and find the appropriate industry, and manually select issuers (with their Bond Issuer Tickers) from the bonds that appear. As we were using a regional breakdown, we ensured that the geography of the peer company matched our data set for that sector.

Important: As can be seen below, the “TRBC Sector” filter has five levels. The four highest levels are the ones we have described previously (the lowest is TRBC Activity, but this is not useful). If you are extracting peers for a TRBCIndustry, ensure that you are on the correct level, and only select the one TRBCIndustry.



TRBC Sector ✕ | Include | 0

□ Advanced Syntax □ Counts

☑ Sector Include Banks Other Financial

AND

☑ Maturity After 01/01/2009

AND

☑ Tenor Exclude Bills

AND

☑ Green Bond Equal To Yes

□ Brookfield Financ
□ AXA SA
□ Berlin Hyp AG
□ Banco de Credito
□ Raiffeisen Bank I
□ Citycon Treasury
□ Berlin Hyp AG
□ Allied Properties
□ Banco de Bogota
□ Banco de Bogota
□ S Immo AG
□ RioCan Real Esta
□ Raiffeisen Bank I
□ Citycon Treasury

- □ Financials
- □ Utilities
  - □ Utilities
    - □ Electric Utilities & IPPs
      - □ Electric Utilities
        - □ Electric Utilities (NEC) 5
        - □ Fossil Fuel Electric Utilities 1
    - □ Water & Related Utilities
- □ Basic Materials

None Selected

(Ignore the other filters applied in the image, when extracting peers, you should not enable other filters)

Having created a list of peer bond issuer tickers, we repeated the bond extraction process we did for the green bond issuers.

6.7 Credit ratings

Bond credit ratings are a bit tricky to extract as there are multiple credit rating agencies, and they operate with different non-numerical ratings scores. Therefore, to extract credit ratings, I made an Excel book (Bond_rating_extraction.xlsx) that extracts all the different ratings. This is then manually fed to Bond_rating_numerical_conversion.xlsx which translates the ratings to numbers between in the range [0,7]. Then, a third book Bond_priority_list.xlsx decides which of the ratings to use.

6.8 ESG ratings

As the ESG ratings change over time, we do a time series extraction of annual ESG letter grades. A sheet to do this is included Company_ESG_extraction.xlsx. The extraction formula is as follows:

=@TR($B$4:$B$2399,"TR.TRESGScore;TR.TRESGScoreGrade;TR.TRESGCScore;TR.EnergyUseTotal;TR.AnalyticEnergyUse;TR.AnalyticWaterUse;TR.CO2EmissionTotal;TR.WasteTotal;TR.TRESGCScore;TR.TRESGCScoreGrade;TR.EnvironmentPillarScoreGrade;TR.EnvironmentPillarScore"&";TR.GovernancePillarScore;TR.SocialPillarScore;TR.GovernancePillarScoreGrade;TR.SocialPillarScoreGrade","Period=FY0 Frq=CY SDate=2009-01-01 EDate=2021-05-01 CH=Fd RH=IN;date NULL=NA",E3)

In some cases, a company may have an ESG rating one year but not the following. To handle this, we use the most recent ESG available before the missing data point.

6.9 External reviews

Eikon does not have functionality to determine if issuers have externally reviewed green bond frameworks. Therefore, you have two options. The first is to purchase this information from Climate Bonds Initiative (for 2,000 USD), or check this the manual way.

As the green bond framework is produced for investors and potential investors, the framework is usually published on the issuer's website (often under investor relations) and can be manually searched up. However, exotic issuers, such as Chinese companies, may not have English website or it may be impossible to find their website. Therefore, an option is to search for the bond, and hope Climate Bonds Initiative has included it in its newsletter (CBI has occasionally created posts once a month listing all green bonds issued that month, and whether the bonds are externally reviewed).

The reviewers (Sustainalytics, Cicero, Vigeo Eiris, ISS, S&P, KPMG, R&I, Deloitte, CBI, Sitawi, DNV GL, Lianhe Equator, JCRA, RFU, LEED, CCX) do sometimes publish their reviews.

Extracting the external reviews can be painful and may require a lot of googling.

6.10 The data merger

This far I have described multiple data extractions (such as ratings, ESG, company financials and market data, clean price, announcement dates, sectors, and external reviews), conversions from either non-numerical values or from absolutes to returns, and more. Our Python code requires three files, so this data must be merged into those three files. The files are:

1. The fundamental data file. This is the merged exported file from Eikon (Advanced search). We also add some additional columns: Issuer PermID, Ultimate Parent PermID, Bond announcement date, Clean price flag, BondID (either an ISIN or a RIC), Rating, External reviews, TRBC sectors, (and most recently issuance yield spread for greeniums). The added columns are done using INDEX-MATCH, which is a method to search for the correct row in the table of items to add it to the main-table (google it for instructions on how to use it).
2. The time series data file. This is one large table with BondIDs as headers, dates as index, and the cells are populated with bond return data.
3. Annual company information. This file has the data items as column headers and PermID+Year as a joint index. To get this into one file, one must merge the market data extractions into the company financials file through index match (matching on both year and company)

In the Data folder provided, I have included examples of these three files.

If you are in the position of partially or completely replicating this methodology, I wish you the best of luck!

Henrik Giske Fosse